Interesting Science fact #5

A teaspoonful of neutron star would weigh 6 billion tons.

NATURAL SCIENCES

LESSON PLAN

GRADE 8 TERM 2

A MESSAGE FROM THE NECT

NATIONAL EDUCATION COLLABORATION TRUST (NECT)

Dear Teachers

This learning programme and training is provided by the National Education Collaboration Trust (NECT) on behalf of the Department of Basic Education (DBE)! We hope that this programme provides you with additional skills, methodologies and content knowledge that you can use to teach your learners more effectively.

What is NECT?

In 2012 our government launched the National Development Plan (NDP) as a way to eliminate poverty and reduce inequality by the year 2030. Improving education is an important goal in the NDP which states that **90% of learners will pass Maths, Science and languages with at least 50% by 2030**. This is a very ambitious goal for the DBE to achieve on its own, so the NECT was established in 2015 to assist in improving education.

The NECT has successfully brought together groups of people interested in education to work together to improve education. These groups include the teacher unions, businesses, religious groups, trusts, foundations and NGOs.

What are the learning programmes?

One of the programmes that the NECT implements on behalf of the DBE is the 'District Development Programme'. This programme works directly with district officials, principals, teachers, parents and learners; you are all part of this programme!

The programme began in 2015 with a small group of schools called the **Fresh Start Schools (FSS)**. Curriculum **learning programmes** were developed for **Maths, Science and Language** teachers in FSS who received training and support on their implementation. The FSS teachers remain part of the programme, and we encourage them to mentor and share their experience with other teachers.

The FSS helped the DBE trial the NECT learning programmes so that they could be improved and used by many more teachers. NECT has already begun this scale-up process in its Universalisation Programme and in its Provincialisation Programme.

Everyone using the learning programmes comes from one of these groups; but you are now brought together in the spirit of collaboration that defines the manner in which the NECT works. Teachers with more experience using the learning programmes will deepen their knowledge and understanding, while some teachers will be experiencing the learning programmes for the first time.

Let's work together constructively in the spirit of collaboration so that we can help South Africa eliminate poverty and improve education!

www.nect.org.za

CONTENTS

PROGRAMME ORIENTATION

Welcome to the NECT Natural Sciences learning programme! This CAPS compliant programme consists of:

- A full set of lesson plans for the term (3 X 1 hour lessons per week)
- A Resourcepack with images to support the lesson plans
- A full colour poster
- An outline of the assessment requirements for the term
- A tracker to help you monitor your progress

Lesson Plan Structure

1. Term 1 lesson plans are structured to run for 8 weeks.
2. Each week, there are three lessons, of the following notional time:

   3 x 1 hour

   This time allocation of 3 hours per week is CAPS aligned.

Lesson Plan Contents

1. The lesson plan starts with a **CONTENTS PAGE** that lists all the topics for the term, together with a breakdown of the lessons for that topic. You will notice that lessons are named by the week and lesson number, for example, Week 8 Lesson 8C.

2. Every topic begins with a 2 - 4 page **TOPIC OVERVIEW**. The topic overview pages are grey, making them easy to identify. The topic overview can be used to introduce the topic to learners. The topic overview includes:

   a. A ***general introduction*** to the topic that states how long the topic runs for, the value of the topic in the final exam and the number of lessons in the topic.

   b. A table showing the ***position of the topic*** in the term.

   c. A ***sequential table*** that shows the prior knowledge required for this topic, the current knowledge and skills that will be covered, and how this topic will be built on in future years. Use this table to give learners an informal quiz to test their prior knowledge. If learners are clearly lacking in the knowledge and skills required, you may need to take a lesson to cover some of the essential content and skills. It is also useful to see what you are preparing learners for next, by closely examining the 'looking forward' column.

   d. A glossary of ***scientific vocabulary***, together with an explanation of each word or phrase. It is a good idea to display these words and their definitions somewhere in the classroom, for the duration of the topic. It is also a good idea to allow learners some time to copy down these words into their personal dictionaries or science exercise books. You must explicitly teach the words and their meanings as and when you encounter these words in the topic. A good way to teach learners new vocabulary is to use 'PATS':

- POINT – if the word is a noun, point at the object or at a picture of the object as you say the word.
- ACT – if the word is a verb, try to act out or gesture to explain the meaning of the word, as you say it.
- TELL – if the word has a more abstract meaning, then tell the learners the meaning of the word. You may need to code switch at this point, but also try to provide a simple English explanation.
- SAY – say the word in a sentence to reinforce the meaning.

a. ***Understanding the uses / value of science****.* It is very important to give learners a sense of how science applies to their daily lives, and of the value that science adds to their lives. Hold a brief discussion on this point when introducing the topic, and invite learners to elaborate on the uses and value that this topic will have to their lives.

b. ***Personal reflection****.* At the end of every topic, come back to the topic overview, and complete this table. In particular, it is important to note your challenges and ideas for future improvement, so that you can improve your teaching the next year.

1. After the topic overview, you will find the **INDIVIDUAL LESSONS.** Every lesson is structured in exactly the same way. This helps you and the learners to anticipate what is coming next, so that you can focus on the content and skills. Together with the title, each lesson plan includes the following:

a. ***Policy and Outcomes****.* This provides you with the CAPS reference, and an overview of the skills that will be covered in the lesson. You can immediately see the science process skills that will be covered, and whether they are lower middle or higher order skills.

b. ***Possible Resources****.* Here, you will see the resources that you should ideally have for the lesson. If you need to use the poster or pages from the Resourcepack, this will be listed here. There is also a space for improvised resources, and you are invited to add your own ideas here.

c. ***Classroom Management****.* Every lesson starts in the same way. Before the lesson, you must write a question that relates to the previous lesson on the chalkboard. Train your learners to come in to the classroom, to take out their exercise books, and to immediately try to answer this question. This links your lesson to the previous lesson, and it effectively settles your learners.

Once learners have had a few minutes to answer, read the question and discuss the answer. You may want to offer a small reward to the learner who answers first, or best. Get your learners used to this roucane.

Next, make sure that you are ready to begin your lesson, have all your resources ready, have notes written up on the chalkboard, and be fully prepared to start. Remember, learners will get restless and misbehave if you do not keep them busy and focussed.

d. ***Accessing Information****.* This section contains the key content that you need to share with learners. Generally, it involves sharing some new information that is written on the chalkboard, explaining this information, and allowing learners some time to copy the information into their exercise books. Train learners to do this quickly and efficiently. Learners must anticipate this part of the lesson, and must have their books, pens, pencils and rulers ready.

Explain to learners that this is an important Resourcefor them, because these are the notes they will revise when preparing for tests and exams.

Checkpoint 1*.* Straight after 'Accessing Information', you will find two checkpoint questions. These questions help you to check that learners understand the new content thus far.

e. ***Conceptual Development****.* At this point, learners will have to complete an activity to think about and apply their new knowledge, or to learn a new skill. This is the most challenging part of the lesson. Make sure that you fully understand what is required, and give learners clear instructions.

Checkpoint 2*.* Straight after 'Conceptual Development, you will find two checkpoint questions. These questions help you to check that learners understand the new concepts and skills that they have engaged with.

f. ***Reference Points for Further Development****.* This is a useful table that lists the relevant sections in each approved textbook. You may choose to do a textbook activity with learners in addition to the lesson plan activity, or even in place of the lesson plan activity. You may also want to give learners an additional activity to do for homework.

g. ***Additional Activities / Reading****.* This is the final section of the lesson plan. This section provides you with web links related to the topic. Try to get into the habit of visiTing these links as part of your lesson preparation. As a teacher, it is always a good idea to be more informed than your learners.

4. At the end of the week, make sure that you turn to the **TRACKER,** and make note of your progress. This helps you to monitor your pacing and curriculum coverage. If you fall behind, make a plan to catch up.

5. **POSTER AND ResourcePACK.** You will have seen that the *Possible Resource*s ection in the lesson plan will let you know which resources you will need to use in a lesson.

   Please note that you will only be given these resources once. It is important for you to manage and store these resources properly. Do this by:

   - Writing your name on all resources
   - Sticking Resources onto cardboard or paper
   - Laminating all resources, or covering them in contact paper
   - Filing the Resourcepapers in plastic sleeves once you have completed a topic

   Have a dedicated wall or notice board in your classroom for Natural Sciences.

   - Use this space to display the resources for the topic
   - Display the vocabulary words and meaning here, as well as the resources
   - Try to make this an attractive and interesTing space
   - Display learners' work on this wall – this gives learners a sense of ownership and pride

6. **ASSESSMENT.** At the end of the lesson plans, you will find the CAPS assessment requirements for the term. You should refer to your prescribed textbooks and departmental resources for examples of the relevant assessments.

Lesson Plan Roucane

Train your learners to know and anticipate the roucane of Natural Sciences lessons. You will soon see that a good knowledge of this roucane will improve time-on-task and general classroom discipline and that you will manage to work at a quicker pace.

Remember, every Natural Sciences lesson follows this roucane:

1. **Classroom Management**: settle learners by having two questions written on the chalkboard. Learners take out their exercise books and pens, and immediately answer the questions. Discuss the answers to the questions, and reward the successful learner.
2. **Accessing Information:** have key information written on the chalkboard. Explain this to learners. Allow learners to copy this information into their books.
3. **Checkpoint 1:** ask learners at least two questions to check their understanding.
4. **Conceptual Development:** complete an activity to apply new knowledge or skills.
5. **Checkpoint 2:** ask learners at least two questions to check their understanding.
6. **Reference Points for Further Development:** links to textbook activities – you may choose to use these activities as additional classwork activities, or as homework activities.
7. **Tracker:** fill in your tracker at the end of the lessons to track your progress.

PROGRAMME ORIENTATION

A vehicle to implement CAPS

Teaching Natural Sciences can be exciTing and rewarding. These lesson plans have been designed to guide you to implement the CAPS policy in a way that makes the teaching and learning experience rewarding for both the teacher and the learners.

To support the policy's fundamentals of teaching Natural Sciences, these lesson plans use the CAPS content as a basis and:

- provide a variety of teaching techniques and approaches
- promote enjoyment and curiosity
- highlight the relationship between Natural Science and other subjects
- where appropriate, draw on and emphasise cultural contexts and indigenous knowledge systems
- show the relationship between science, learners, their societies and their environments
- aim to prepare learners for economic activity and self-expression

Content and Time Allocation

These lessons plans have been developed to comply with CAPS in respect of both content and time allocation. In developing these lesson plans, consideration of the realities of teachers was taken and to this end, some simple adjustments were made, without deviaTing from policy, to make the teaching of these lesson plans more achievable. The kinds of adjustments made include using some of the practical tasks in the lesson plans for assessment purposes; and building in time for revision and exams during terms 2 and 4.

CAPS assigns one knowledge strand to form the basis of content in each term. These strands are as follows:

- Term 1: ***Life and Living***
- Term 2: ***Matter and Materials***
- Term 3: ***Energy and Change***
- Term 4: ***Planet Earth and Beyond***

The distribution of these strands across the year is summarised in the table below:

Grade 8			
Term 1	**Term 2**	**Term 3**	**Term 4**
NS Strand	**NS Strand**	**NS Strand**	**NS Strand**
Life and Living	**Matter and Materials**	**Energy and Change**	**Planet Earth and Beyond**
Photosynthesis and respiration Interactions and interdependence within the environment Micro-organisms	Atoms Particle model of matter Chemical reactions	Static electricity Energy transfer in electrical systems Series and parallel circuits Visible light	The Solar System Beyond the Solar System Looking into space

PROGRAMME ORIENTATION

The time allocation by topic is summarised in the table below.

Remember that one week equates to 3 hours or three lessons of 1 hour each.

	GRADE 7		GRADE 8		GRADE 9	
TERM	**Topic**	**Time in weeks**	**Topic**	**Time in weeks**	**Topic**	**Time in weeks**
Term 1: Life and Living	• The biosphere	1	• Photosynthesis and respiration	2	• Cells as the basic units of life	2
	• Biodiversity	3½	• Interactions and interdependence within the environment	5	• Systems in the human body	2
	• Sexual Reproduction	3½			• Human Reproduction	2
	• Variation	1	• Micro-organism	2	• Circulatory and respiratory systems	1½
					• Digestive system	1½
		(9 wks)		(9 wks)		(9 wks)
Term 2: Matter and Materials	• Properties of materials	2	• Atoms	2	• Compounds	1
	• SeparaTing mixtures	2	• Particle model of matter	5	• Chemical reactions	1
	• Acids, bases and neutrals	2	• Chemical reactions	1	• Reactions of metals with oxygen	1½
	• Introduction to the periodic table of the elements	2			• Reactions of non-metals with oxygen	1
					• Acids, bases and pH value	1
					• Reactions of acids with bases (I)	½
					• Reactions of acids with bases (II)	1
					• Reactions of acids with bases (III)	½
					• Reactions of acids with metals	1½
		(8 wks)		(8 wks)		(8 wks)

Term 3: Energy and Change	• Sources of energy • Potential and Kinetic energy • Heat transfer • Insulation and energy saving • Energy transfer to surroundings • The national electricity supply system	1 2 2 2 1 1	• Static electricity • Energy transfer in electrical systems • Series and parallel circuits • Visible light	1 3 2 3	• Forces • Electric cells as energy systems • Resistance • Series and parallel circuits • Safety with electricity • Energy and the national electricity grid • Cost of electrical power	2 ½ 1 2 ½ 1 2
		(9 wks)		(9wks)		(9 wks)
Term 4: Planet Earth and Beyond	• Relationship of the Sun and the Earth • Relationship of the Moon and the Earth • Historical development of astronomy	4 2 2	• The Solar System • Beyond the Solar System • Looking into space	3 3 2	• The Earth as a system • The Lithosphere • Mining of mineral resources • Atmosphere • Birth, life and death of stars	1 2 2 2 1
		(8 wks)		(8 wks)		(8 wks)
TOTALS	34 weeks		34 weeks		34 weeks	

REFLECTing ON THE LESSONS THAT YOU TEACH

It is important to reflect on your teaching. Through reflection, we become aware of what is working and what is not, what we need to change and what we do not. Reflecting on your use of these lesson plans will also help you use them more effectively and efficiently.

These lesson plans have been designed to help you deliver the content and skills associated with CAPS. For this reason, it is very important that you stick to the format and flow of the lessons. CAPS requires a lot of content and skills to be covered – this makes preparation and following the lesson structure very important.

Use the tool below to help you reflect on the lessons that you teach. You do not need to use this for every lesson that you teach – but it is a good idea to use it a few times when you start to use these lessons. This way, you can make sure that you are on track and that you and your learners are getting the most out of the lessons.

LESSON REFLECTION TOOL			
Preparation			
1.	What preparation was done?		
2.	Was preparation sufficient?		
3.	What could have been done better?		
4.	Were all of the necessary resources available?		
Classroom Management			
		Yes	**No**
5.	Was the question written on the board?		
6.	Was the answer written on the board?		
7.	Was the answer discussed with the learners in a meaningful way?		
8.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

Accessing Information			
		Yes	**No**
9.	Was the text and/ or diagrams written on the chalkboard before the lesson started?		
10.	Was the work on the board neat and easy for the learners to read?		
11.	Was the explanation on the content easy to follow?		
12.	Was the information on the board used effectively to help with the explanations?		
13.	Was any new vocabulary taught effectively? (in context and using strategies like PATS)		
14.	Were the learners actively engaged? (asked questions, asked for their opinions and to give ideas or suggestions)		
15.	Were the checkpoint questions used effectively?		
16.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

Conceptual Development			
		Yes	**No**
17.	Was the information taught in the 'Accessing Information' part of the lesson used to foreground the activity?		
18.	Were clear instructions given for the conceptual development activity?		
19.	Were the outcomes/answers to the activities explained to the learners?		
20.	Could the learners ask questions and were explanations given?		
21.	Was a model answer supplied to the learners? (written or drawn on the board)		
21.	Were the checkpoint questions used effectively?		
22.	At the end of the lesson, were the learners asked if they had questions or if they needed any explanations?		
23.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

TOPIC OVERVIEW:

Atoms

Term 2, Weeks 1A – 2C

A. TOPIC OVERVIEW

Term 2, Weeks 1a – 2c

- This topic runs for 2 weeks.
- It is presented over 6 lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• A mixture is made up of two or more substances with different physical properties • The physical properties of the materials in a mixture determine the separation method • The Periodic Table is a classification system for the elements which make up matter and materials • The Periodic Table was devised by Mendeleev. He arranged the elements according to their properties • Each element has its own name, symbol, atomic number and position on the Periodic Table.	• All matter is made up of atoms • An element is made up of atoms of the same kind and cannot be broken down • The nucleus consist of positively charged protons and neutral neutrons • Negatively charged electrons move around the nucleus • Atoms react chemically to form molecules • A compound consists of atoms of different elements bonded together in a fixed ratio	• The elements can be classified into metals, non-metals and semi-metals • Each element on the Periodic Table has an atomic number, mass number, name and symbol • A formula is a ratio of the symbols of the elements and number of atoms for each symbol in a compound • No atoms are lost or gained in a reaction; they are simply rearranged

	• When elements and compounds are mixed, they form mixtures • Mixtures are separated by physical means	

C. SCIENTIFIC VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	atom	An atom is the smallest particle of matter that can exist on its own.
2.	nucleus	A nucleus is the central region of an atom.
3.	element	An element consists of atoms of only one kind.
4.	diatomic molecule	It is a molecule that consists of two atoms of the same kind.
5.	compound	A compound consists of atoms of two or more different elements chemically bonded together.
6.	pure substance	A pure substance consists of atoms or molecules of the same kind.
7.	chemical bond	A chemical bond is the force that holds atoms together in a molecule.
8.	electrolysis	Electrolysis is the decomposition of a compound when an electrical current is passed through a solution of the compound.
9.	mixture	A mixture is formed when two or more different elements or compounds are mixed
10.	physical means	Separation by physical means is the manual separation by hand or apparatus
11.	indivisible	Unable to be divided or cut up
12.	Noble gases	Six gases that occur naturally as atoms

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Learners will understand that all matter consists of atoms and that atoms of different elements combine chemically to form compounds. In addition, they will learn that elements and compounds are pure substances because they only consist of one type of atom or molecule. However, when different elements and compounds are mixed, they form a mixture.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

1 A

Term 2, Week 1, Lesson A
Lesson Title: Atoms - Building blocks of matter
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Atoms
CAPS Page Number	40

Lesson Objectives

By the end of the lesson, learners will be able to:

- describe matter
- explain what an atom is
- describe the atoms of an element
- explain why atoms differ.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information		6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 1: Periodic Table	
Beads/ dried lentils/ dried peas/ glue/ paper plate	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

> Can you give an example of matter found in the classroom?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

> *Desk/ chair/ book case/ pencil case/ pencil/ pen/ ruler*

D ACCESSING INFORMATION

1. Write the following onto the chalkboard. Always try to do this before the lesson starts.

> ATOMS - THE BUILDING BLOCKS
>
> 1. Everything in the Universe is made up of matter.
> 2. Matter is everything that has mass and occupies space.
> 3. All matter is made up of tiny particles called atoms.
> 4. An atom is the smallest particle of matter that can exist on its own.
> 5. Atoms cannot be created or destroyed.
> 6. Not all atoms are the same.
> 7. Anything that is made up of only one kind of atom is called an element.
> 8. The atoms of some elements exist individually.
> 9. The atoms of some elements combine to form diatomic molecules.

2. Explain this to the learners as follows:
   a. All the objects that we see, the food that we eat, the air that we breathe and even our own bodies, are all examples of matter.
   b. Matter is the name given to anything that has mass and takes up space.

c. **Atoms** are the building blocks of matter.
d. Atoms are very small and cannot be seen with the naked eye.
e. Single atoms are too small to see with your eyes.
f. Atoms are **indivisible** and cannot be created or destroyed.
g. Although everything is made of atoms, not all atoms are the same.
h. Atoms of the same element have the same chemical properties and mass.
i. Atoms of **elements** can be found individually or in pairs as diatomic molecules.Read through the information written on the chalkboard with the learners.

3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is matter?
b. What are the smallest building blocks of matter?

Answers to the checkpoint questions are as follows:

a. Matter is everything that has mass and occupies space.
b. Atoms

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. Matter is everything that we can see, living or non-living.
   b. Although surfaces of objects look smooth, they are all made up of particles called atoms.
   c. We cannot see these atoms because they are too small.
   d. We can only see atoms when there are enough of them together in one place and if we have a microscope.
   e. A single grain of salt contains about 1 000 000 000 000 000 000 (a trillion) atoms.
   f. The word 'atom' means indivisible, which means that an atom cannot be cut into smaller pieces.
2. Use the Periodic Table from the Resource Pack to explain the following to the learners:
   a. Atoms of one element are different from atoms of another element.
   b. When we look at the Periodic Table, copper atoms (point to the symbol Cu) are different from zinc atoms (point to the symbol Zn) because they have different chemical properties and masses.

c. However, all copper atoms are exactly the same. They have the same properties and mass.

d. The atoms of the Noble Gases exist individually (point to the symbols in the last column: helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe) and radon (Rn).

e. The atoms of other elements, such as hydrogen (H), oxygen (O) and nitrogen (N), combine to form diatomic molecules.

3. Draw and write the following on the chalkboard (always try to do this before the lesson starts):

TASK

Use the beads/ dried lentils/ dried peas, glue and paper plate that the teacher gave you to make the following two-dimensional model. Your teacher will tell you which model to make. Tick it off.

Atoms of the element helium (He)	
Diatomic molecules of the element oxygen (O)	

1. Write the heading of your model at the top of the plate.
2. Glue the beads/ lentils/ peas onto the plate so that your model is correct.
3. Present your model to the class.

4. Tell the learners that models are made specially of things that we cannot see. We can then understand them better.

a. Hand out 10 beads/ dried lentils/ dried peas, glue and a paper plate to each learner.

b. One half of the class must make a two-dimensional model of the atoms of the element helium.

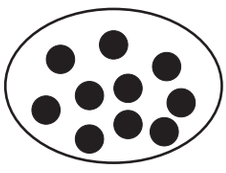
c. They must stick the beads/ lentils/ peas onto the plate so that they represent helium atoms.

d. The other half of the class has to make a two-dimensional model of the atoms of the element oxygen.

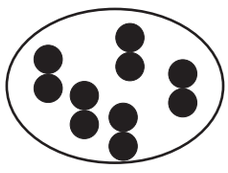
e. They must stick the beads/ lentils/ peas onto the plate so that they represent diatomic molecules of oxygen.

5. Give the learners enough time to make the models.
6. Let each learner stand up and show his/her model to the class.
7. The two models should look as follows (but not identical):

8.



Atoms of helium



Diatomic molecules of oxygen

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Are all the atoms the same?

b. What are two identical atoms called that exist together?

Answers to the checkpoint questions are as follows:

a. No, the atoms of different elements are different.

b. Diatomic molecule

8. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Atoms	64
Top Class Natural Sciences	Atoms	68-69
Via Africa Natural Sciences	Atoms	64-65
Solutions for All Natural Science	Atoms	84
Spot on Natural Sciences	Atoms	50-51
Platinum Natural Sciences	Atoms	72-73
Step-by-step	Atoms	46
Natural Sciences	Atoms	68-69
Sasol Inzalo Bk A	Atoms	120-125

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. www.understandingnano.com/what-is-buckyball-c60.html [A bucky ball - C60]

1 B

Term 2, Week 1, Lesson B
Lesson Title: Sub-atomic particles
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Protons, neutrons and electrons
CAPS Page Number	40

Lesson Objectives

By the end of the lesson, learners will be able to:

- list the three sub-atomic particles of an atom
- describe the position of each sub-atomic particle in the atom
- name the charge of each sub-atomic particle in the atom
- explain what a neutral atom is.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 2: Atomic structure of a carbon atom	
Beads/ dried lentils/ dried peas, glue, paper plate/ cardboard, coloured koki pens	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is matter made of?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Matter is made of atoms.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

SUB-ATOMIC PARTICLES

1. An atom is made up of smaller sub-atomic particles, namely protons, neutrons and electrons.
2. The protons and neutrons are situated in the nucleus of the atom.
3. The nucleus is at the centre of the atom.
4. The electrons move around the atom.
5. The protons are positively charged.
6. The neutrons are neutral and have no charge.
7. The electrons are negatively charged.
8. A neutral atom has the same number of positive and negative charges.

2. Explain this to the learners as follows:
    a. The sub-atomic particles in an atom are protons, neutrons and electrons.
    b. The protons and neutrons are found in the nucleus of the atom.
    c. The electrons move around the nucleus.
    d. The protons have a positive charge and the neutrons are neutral.
    e. The electrons are negatively charged.
    f. The neutral atom has the same number of protons and electrons.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What are the two sub-atomic particles that are found in the nucleus of the atom?
b. What is the charge of an electron?

Answers to the checkpoint questions are as follows:

a. Protons and neutrons
b. Negative

E CONCEPTUAL DEVELOPMENT

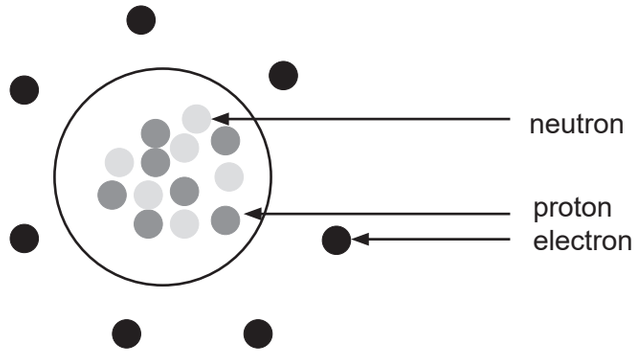
1. Explain the following to the learners:
    a. How do we know what an atom looks like when we cannot see it, even with the strongest microscope? Scientists have developed a model of the atom based on the results of experiments that they did on the behaviour of atoms.
    b. An atom consists of protons, neutrons and electrons. They cannot exist on their own.
    c. The positively charged particles, called protons, and electrically neutral particles called neutrons, are tightly packed in the nucleus. The nucleus has an overall positive charge. Protons and neutrons together are called nucleons.
    d. The nucleus is a positively charged sphere in the centre of the atom. It consists of positively charged protons and neutral neutrons.
    e. The electrons move at very high speeds in orbits around the nucleus. They form an electron cloud that is much larger than the nucleus.
    f. Atoms are neutral because the number of negatively charged electrons is equal to the number of positively charged protons. The overall charge of an atom is zero.
    g. The simplest atom is a hydrogen atom. It has only one proton, one electron and no neutrons.
    h. A carbon atom has six protons, six neutrons and six electrons. Show the learners the carbon atom on Resource 2.

2. Ask the learners to make a basic model of a nitrogen atom with seven protons, seven neutrons and seven electrons. They should use beads/ dried lentils/ dried peas, glue and a paper plate to make a model of the nitrogen atom. The beads, lentils or peas should be coloured in different colours for the protons (e.g. red), neutrons (e.g. yellow) and electrons (e.g. blue). They should be pasted in the right position and correctly labelled.

TASK

Use the beads/ lentils/ peas, glue and paper plate that the teacher gave you to make a model of a nitrogen atom. A nitrogen atom has seven protons, seven neutrons and seven electrons. Each type of sub-atomic particle should be a different colour.
Label each sub-atomic particle.

3. Give the learners enough time to make the models.
4. Let each learner stand up and show his/her model to the class.
5. The model should look similar to the model below (but not identical):



Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is the overall charge of the nucleus of an atom?
b. How many electrons does a neutral atom with 17 protons have?

Answers to the checkpoint questions are as follows:

a. Positive
b. 17 electrons

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Atoms	66-67
Top Class Natural Sciences	Atoms	69-70
Via Africa Natural Sciences	Atoms	65-69
Solutions for All Natural Science	Atoms	85
Spot on Natural Sciences	Atoms	50-51
Platinum Natural Sciences	Atoms	74-77
Step-by-step	Atoms	47-49
Natural Sciences	Atoms	68-69
Sasol Inzalo Bk A	Atoms	120-25

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.khanacademy.org/rutherfords-gold-foil-experiment (11min 23sec) [Rutherford's gold foil experiment]
2. https://www.learner.org/courses/physics/glossary/definition.html_plum_pudding [Plum pudding model]
3. https://www.britannica.com/science/Bohr-atomic-model [Bohr's atomic model]

1 C

Term 2, Week 1, Lesson C
Lesson Title: Elements
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Elements
CAPS Page Number	41

Lesson Objectives

By the end of the lesson, learners will be able to:

- define an element
- list the names and symbols of the first 20 elements in the Periodic Table
- explain how the atoms of all the elements are different.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 1: Periodic Table	
Resource 2: The atomic structure of a carbon atom	
Resource 3: The atomic structure of a helium atom	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why do we say that atoms are neutral?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Atoms have the same number of positive protons and negative electrons.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard and copy the diagram onto the chalkboard as well. Always try to do this before the lesson starts.

ELEMENTS

1. An element is made up of only one kind of atom.
2. Elements cannot be broken down into simpler substances.
3. There are 118 known elements and they are listed in the Periodic Table.
4. The elements are arranged in the Periodic Table in order of their atomic number.
5. The atomic number of an element is the number of protons that an atom has in its nucleus.
6. Each element has its own name, symbol and unique properties.
7. Some elements consist of single atoms while other elements consist of diatomic molecules.
8. A molecule is two or more atoms that are bonded together to form a unit.
9. A diatomic molecule consists of two identical atoms.
10. Atoms of different elements are different. They have different numbers of protons, neutrons and electrons.

2. Explain this to the learners as follows:
    a. Although everything is made of atoms, not all atoms are the same.
    b. The atoms of the same element are all identical but atoms of different elements are different.
    c. Elements cannot be broken down into simpler substances or changed into another element by chemical methods.
    d. Each element has its own particular name, symbol and properties.
    e. There are 118 known elements and they are listed in the Periodic Table.
    f. When an element consists of single atoms, we call them the atoms of the element.
    g. When an element consists of diatomic molecules, we call them molecules of the element.
    h. The atoms of different elements have different numbers of protons, neutrons and electrons. Show the learners Resource 2 and Resource 3. Ask them what the difference is between a carbon atom and a helium atom. *(Answer: A carbon atom has six protons, six neutrons and six electrons. A helium atom has two protons, three neutrons and two electrons.)*
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What does an element look like on the atomic level?
b. Which table summarises in an orderly way all the elements known to us?

Answers to the checkpoint questions are as follows:

a. The atoms of an element look all the same.
b. The Periodic Table.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. All the atoms of a specific element are identical. For example, the element sulfur consists only of sulfur atoms.
   b. Even when an element consists of diatomic molecules, the atoms of the molecules are still identical. For example, the atoms of the diatomic molecules of chlorine are both chlorine atoms.
   c. There are seven diatomic molecules: nitrogen (N_2), hydrogen (H_2), oxygen (O_2), fluorine (F_2), chlorine (Cl_2), iodine (I_2) and bromine (Br_2).
   d. Each element has its own particular symbol and own unique properties. For example, the symbol for sulfur is S and sulfur is a yellow, non-metal powder.
   e. Scientists all over the world use the same symbols for the elements that are listed in the Periodic Table.
   f. You might think that because there are so many materials in the world there must be millions of different elements. However, all materials are made up of only a small number of elements.
   g. There are 118 known elements of which 93 elements occur naturally, while 25 elements are made by scientists in laboratories.
   h. Elements are arranged in the Periodic Table according to their atomic numbers, which are the number of protons in the nucleus.
   i. The first element is hydrogen because a hydrogen atom has one proton in its nucleus. The second element is helium because a helium atom has two protons in its nucleus. Using this system, we can go on listing the elements.
2. Draw the following table on the chalkboard (always try to do this before the lesson starts). Show the learners Resource 1. Ask them to complete the table for the first 20 elements by using the Periodic Table.

TASK

Copy the table on the chalkboard in your book. Use the Periodic Table to complete the table for the first 20 elements.

Name of element	Symbol of element	Number of protons in the nucleus of an atom

3. Give the learners enough time to complete the table.
4. Give each learner the opportunity to go to the chalkboard and write down an element.
5. Make sure the tables of the learners are correct and complete. The correct table is shown below:

Name of element	Symbol of element	Number of protons in the nucleus of an atom
Hydrogen	H	1
Helium	He	2
Lithium	Li	3
Beryllium	Be	4
Boron	B	5
Carbon	C	6
Nitrogen	N	7
Oxygen	O	8
Fluorine	F	9
Neon	Ne	10
Sodium	Na	11
Magnesium	Mg	12
Aluminium	Al	13
Silicon	Si	14
Phosphorus	P	15
Sulfur	S	16
Chlorine	Cl	17
Argon	Ar	18
Potassium	K	19
Calcium	Ca	20

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How are the atoms of one element different from the atoms of another element?
a. How many protons and electrons does a neutral magnesium element have?

Answers to the checkpoint questions are as follows:

a. Atoms of different elements have different numbers of protons, neutrons and electrons.
b. 12 protons and 12 electrons

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Atoms	68-69
Top Class Natural Sciences	Atoms	71
Via Africa Natural Sciences	Atoms	69-70
Solutions for All Natural Science	Atoms	87
Spot on Natural Sciences	Atoms	54-55
Platinum Natural Sciences	Atoms	81-82
Step-by-step	Atoms	53
Natural Sciences	Atoms	70-73
Sasol Inzalo Bk A	Atoms	127-128

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.ptable.com/ [Dynamic Periodic Table]

2 A

Term 2, Week 2, Lesson A
Lesson Title: Compounds
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Compounds
CAPS Page Number	41

Lesson Objectives

By the end of the lesson, learners will be able to:

- define a compound
- explain how a compound is formed
- define a molecule
- explain how a compound can be decomposed.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 4: Water molecules	
Resource 5: Electrolysis of copper chloride	
Copper(II) chloride powder, water, glass beaker, two conducting wires, two carbon electrodes or pencil leads, 3-9V cell or battery, cardbard	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are the symbols for the elements potassium and aluminium?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The symbol for potassium is K and the symbol for aluminium is Al.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

COMPOUNDS

1. A **compound** is a material that consists of atoms of two or more different elements that are chemically bonded together.
2. The atoms in a given compound are always combined in a fixed ratio to form molecules.
3. A molecule is the smallest part of a compound and consists of two or more different atoms that are bonded together.
4. A compound consists of molecules of the same type.
5. A **chemical bond** is the force that holds atoms together in a compound.
6. The properties of a compound are different from the properties of the elements that it is made of.

7. Compounds can be broken down into their original elements by heating or electrolysis.
8. Electrolysis is the process where an electrical current is passed through a solution of a compound.

2. Explain this to the learners as follows:
    a. A compound is formed when atoms of different elements are joined together in a fixed ratio during a chemical reaction.
    b. The smallest part of a compound is a molecule. The molecule of a compound consists of atoms of two or more elements.
    c. The atoms are held together in the molecule of a compound by chemical bonds. A chemical bond is a strong force of attraction that holds the atoms together.
    d. A compound can be separated into its constituent elements by chemical means only, such as heat or electricity.
    e. When we pass an electrical current through a solution of a compound, the compound can be decomposed into the elements that formed the compound. This process is called electrolysis.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. How are the atoms held together in a molecule?
b. What do we call molecules of the same type?

Answers to the checkpoint questions are as follows:

a. The atoms are held together by chemical bonds.
b. A compound.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. A compound is formed by a chemical reaction of two or more different elements. An example is water (H_2O).
   b. Show the learners Resource 4 and tell them that the diagram shows a model of water molecules. The circles represent the different atoms.
   c. Water molecules are very small. In one water drop there are millions of water molecules. Water molecules are too small to see with the naked eye.
   d. When hydrogen atoms (H) combine chemically with oxygen atoms (O) they form water molecules (H_2O). The elements hydrogen and oxygen react to form the compound water.
   e. Each water molecule consists of two hydrogen atoms and one oxygen atom. The hydrogen atoms and oxygen atoms combine in a fixed ratio of 2:1.
   f. The hydrogen and oxygen atoms are held together by a chemical bond, which is represented by the black line between them.
   g. Water has different properties to oxygen and hydrogen. For instance, water is a liquid that we can drink whereas oxygen is a gas that we inhale.
2. Also explain the following to the learners:
   a. If elements can combine to form a compound, a compound can be broken up into its elements again.
   b. This is called the decomposition of a compound.
   c. A compound can be decomposed by electrolysis where we use an electrical current to split up the compound into the elements it is made of.
   d. Water can be decomposed into hydrogen and oxygen by means of electrolysis.
   e. Thermal decomposition takes place when heat is used to break up a compound into the elements it is made of.
   f. When mercury oxide (HgO) is heated it will be decomposed into mercury and oxygen.
3. Do the following experiment as a demonstration. Look at Resource 5 and prepare the set-up for the electrolysis of copper chloride before the class starts.
   a. Make a solution of copper chloride in the glass beaker by dissolving one teaspoon of copper chloride in 250 ml of water. Place a piece of cardboard on top of the beaker.
   b. Connect the positive terminal of the battery to the one carbon electrode by using a connecting wire. Connect the negative terminal of the battery to the other carbon electrode using the other connecting wire.
   c. When you are ready to do the demonstration, move the apparatus to the front of the class. You can ask the learners to sit closer so that they can see properly.
   d. Tell the learners that you are going to conduct an experiment to show the decomposition of copper chloride (CuCl2). Explain the set up to the learners.

e. Before you insert both the electrodes in the copper chloride solution, ask the learners what elements they expect to see? (Answer: copper metal and chlorine gas) Tell them to observe closely what is happening at each electrode.

f. After one minute you can take out the electrodes. Show both electrodes to the learners and let a few smell the electrodes and solution.

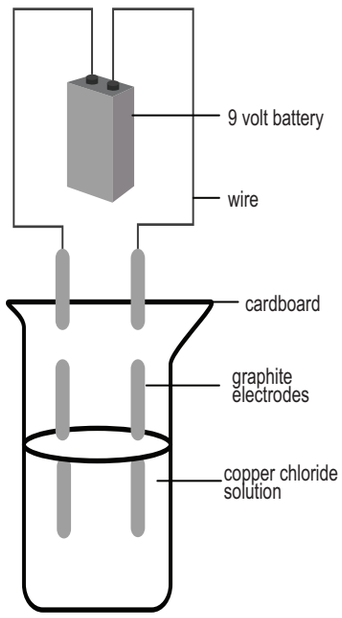
g. Write the following questions on the chalkboard (always try to do this before the lesson starts). Also show them Resource 5. They should draw the apparatus.

EXPERIMENT

The teacher will show you an experiment where copper chloride is decomposed. Observe carefully what is happening at each electrode and answer the following questions. First draw the set-up for the experiment and use correct labels.

1. What did you observe at the one electrode?
2. What element was formed at this electrode?
3. What did you observe at the other electrode?
4. What element was formed at this electrode?
5. What are the two elements that copper chloride was decomposed to?

4. Give the learners enough time to copy the questions from the chalkboard and answer the questions.
5. The answers to the questions are below:



1. *The electrode has turned brown.*
2. *Copper metal*
3. *Bubbles that smell like chlorine pool cleaner.*
4. *Chlorine gas*
5. *Copper chloride was decomposed to form copper and chlorine.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What atoms are water molecules made of?
b. How can a compound be decomposed into its elements?

Answers to the checkpoint questions are as follows:

a. Hydrogen atoms and oxygen atoms.
b. By using an electrical current or heat.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Atoms	70
Top Class Natural Sciences	Atoms	72-75
Via Africa Natural Sciences	Atoms	70-73
Solutions for All Natural Science	Atoms	89-90
Spot on Natural Sciences	Atoms	56-57
Platinum Natural Sciences	Atoms	83-86
Step-by-step	Atoms	55-57
Natural Sciences	Atoms	74-80
Sasol Inzalo Bk A	Atoms	132-142

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=_Y1alDuXm6A (1min 12sec) [Decomposition of mercury(II) oxide]
2. https://www.youtube.com/watch?v=STsz0QZnCVU (1min 25sec) [Decomposition of potassium permanganate]

2 B

Term 2, Week 2, Lesson B
Lesson Title: Pure substances
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Pure substances
CAPS Page Number	41

Lesson Objectives

By the end of the lesson, learners will be able to:

- define a pure substance
- list pure substances.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 6: Silicon crystal structure	
Resource 7: Table salt (sodium chloride), crystal	
Beads/ dried lentils/ dried peas, table salt, Prestik, glass of water	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How is a compound different from an element?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

An element consists of atoms that are of the same type and a compound consists of molecules that are of the same type.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

PURE SUBSTANCES

1. A **pure substance** consists of only one kind of atom or molecule.
2. Elements and compounds are pure substances.
3. A pure substance cannot be seen with the naked eye.
4. The atoms or molecules that a substance consists of determine whether a substance is pure.

2. Explain this to the learners as follows:
   a. A substance is pure when it consists of only one type of atom or one type of molecule.
   b. There are only two classes of pure substances, namely elements and compounds.
   c. All the other substances are not considered pure substances.
   d. Substances may look pure but we can only know whether they are pure when we look at the particles that they consist of.

3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What substances are pure substances?
b. When is a substance a pure substance?

Answers to the checkpoint questions are as follows:

a. Elements and compounds
b. A substance is a pure substance when the substance consists of only one kind of atom or molecule.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. When people talk about pure substances they usually mean substances without impurities.
   b. Look at the glass of water. Do you think the water is pure? *(Answer: If the water is clear the learners might say yes. However tap water is not pure because on a microscopic level there might be other atoms and molecules in the water as well.)*
   c. The water in the glass is only pure when there are only water molecules in the water.
   d. Show the learners Resource 6. This is an example of a pure substance. It is a crystal of the element silicon where all the atoms are silicon atoms.
   e. Show the learners a salt pot with salt. Then show them Resource 7. It shows the microscopic model of a table of salt crystal. The chemical name for table salt is sodium chloride.
   f. Table salt is a compound that is made of sodium atoms (the small circles) and chlorine atoms (the big circles). They react in the ratio 1:1. For every one sodium atom, there is one chlorine atom.
   g. Table salt is a pure substance because it only consists of sodium chloride molecules.
2. Hand out the beads/ dried lentils/ dried peas and ask the learners to complete the following task. They are required to build models of the given pure substances. Draw an example of each atom or molecule on the chalkboard (always try to do this before the lesson starts). They can use Prestik to stick 'atoms' together. They should re-use the beads/lentils/peas for the next pure substance. Learners can make the particles of different colours to represent the different elements

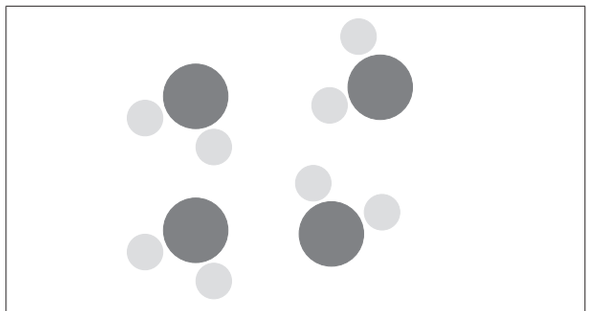
TASK

Use the beads/ lentils/ peas and the Prestik that the teacher gave you to make the following models of pure substances. Re-use the beads/ lentils/ peas for each model.

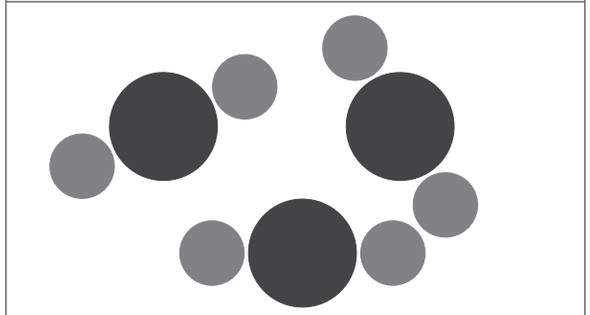
		
Water molecule	Carbon dioxide molecule	Hydrogen molecule

1. Water (H_2O)
2. Carbon dioxide (CO_2) gas
3. Hydrogen (H_2) gas

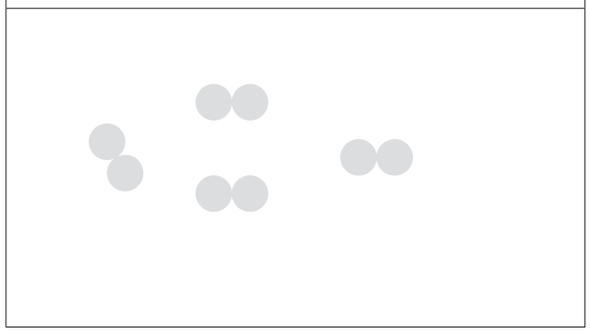
3. Give the learners enough time to copy the questions from the chalkboard and then build the models.
4. Below are examples of what the pure substances might look like. Let each learner present his or her models to the class.

1. 

Water Molecules

2. 

Carbon dioxide Molecules

3. 

Hydogen Molecules

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why is copper a pure substance?
b. When do we consider a glass of water a pure substance?

Answers to the checkpoint questions are as follows:

a. Copper consists only of copper atoms.
b. When the water consists of water molecules only

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Atoms	68
Top Class Natural Sciences	Atoms	70
Via Africa Natural Sciences	Atoms	69
Solutions for All Natural Science	Atoms	87
Spot on Natural Sciences	Atoms	54
Platinum Natural Sciences	Atoms	79-80
Step-by-step	Atoms	52
Natural Sciences	Atoms	70
Sasol Inzalo Bk A	Atoms	127-128

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.bbc.co.uk/education/guides/zypv34j/revision [Pure and impure chemical substances]
2. https://www.youtube.com/watch?v=Ze0kG4yeFS0 (8min 36sec) [What are pure substances?]

2 C

Term 2, Week 2, Lesson C
Lesson Title: Mixtures and separation of mixtures
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Mixtures of elements and compounds
CAPS Page Number	41

Lesson Objectives

By the end of the lesson, learners will be able to:

- define a mixture
- give examples of mixtures
- distinguish between mixtures and pure substances
- describe methods of separation of mixtures.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 8: Elements, compounds and mixtures	
Examples of mixtures: peanuts and raisins, sugar and water, sand and water, oil and vinegar, tea sieve/ strainer, filtration paper	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

When is a substance pure?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

A substance is pure when it consists of only one type of atom or molecule.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

MIXTURES

1. A mixture consists of two or more substances that are mixed together, but not chemically combined, to form a new substance.
2. A mixture has the combined properties of the substances that form the mixture.
3. Elements and compounds are mixed together to form mixtures.
4. The amounts of substances can vary in a mixture.
5. In some mixtures we can recognise the different substances that make up the mixture.
6. In some mixtures it is not possible to see the different substances that make up the mixture.

SEPARATION OF MIXTURES

7. A mixture can be separated into separate substances by **physical means**.
8. Separation by physical means is separation manually by hand or with apparatus.

9. Separation techniques are:
    a. Hand sorting
    b. Filtration and sieving
    c. Evaporation and crystallisation
    d. Decanting
    e. Distillation
    f. Chromatography.
10. Mixtures are separated according to the properties of the substances that make up the mixture.

2. Explain this to the learners as follows:
    a. Elements and compounds are often found mixed together.
    b. None of the substances in a mixture are chemically bonded together and the amount of each substance can vary in the mixture.
    c. When substances are mixed, they do not form a new substance. The properties of the mixture are a combination of the properties of the substances that are mixed.
    d. Sometimes the different substances that are mixed can be distinguished. However, in some mixtures the different substances in the mixture cannot be identified.
    e. Substances in a mixture can be separated by using separation techniques, such as hand sorting, filtration, sieving, decanting, evaporation, crystallisation, distillation and chromatography.
    f. The properties of the substances in the mixture will determine the separation technique that is used.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a characteristic of a mixture?
b. Can you give one separation technique for mixtures?

Answers to the checkpoint questions are as follows:

a. The substances in a mixture do not bond chemically and can be mixed in different amounts.
b. Filtration/ sieving/ decanting/ evaporation/ crystallisation/ distillation/ chromatography/ hand sorting

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
    a. There are not many pure substances in our everyday lives. Most of the substances around us are mixtures of elements and compounds.
    b. Examples of mixtures include the air that we breathe (oxygen, nitrogen, carbon dioxide), fizzy drinks (cold drink and carbon dioxide [bubbles]) and steel (iron and carbon).
    c. Mix water and sugar in a glass. The sugar and water did not react chemically to form a new substance. The sugar molecules mixed with the water molecules by moving in between the water molecules.
    d. The sugar water mixture still has the properties of the water because it can be poured into another glass. The mixture also has the properties of the sugar because it tastes sweet.
    e. We can have any proportion of water and sugar. When we add more sugar to the water, we still have a sugar water mixture.
    f. We cannot see the sugar in the mixture but we know that it is there.
    g. Make a mixture of water and sand. When we mix sand and water we can see the sand in the water.
2. Also explain to learners the different separation techniques. Have the mixtures and apparatus ready.
    a. When an element or compound in a mixture is needed in its pure form, it can be separated from the mixture.
    b. The separation methods that we use are different depending on the substances that are mixed.
    c. Show the mixture of peanuts and raisins. When the particles are big enough, we can use hand sorting to separate the particles. Ask one of the learners to separate the peanuts and raisins.
    d. Filtration or sieving can be used to separate the sand and water in the sand water mixture because the sand is visible. Let a learner pour the sand water through a tea sieve/ strainer or filtration paper. The water will move through the sieve or filter paper while the sand will stay behind.
    e. To separate the sugar from the water in the sugar water mixture, the mixture can be left in the sun so that the water can evaporate. The sugar crystals will be left behind in the container.
    f. Mix oil and vinegar in a bottle. The oil and vinegar can be separated by decanting because the oil floats on top of the vinegar. Ask a learner to pour the oil into another container.

3. For question 1, show the learners Resource 8 and cover the labels below the containers. Name the containers A, B, C and D. They are required to identify the element, compound and mixture. For question 2, draw a table on the chalkboard with the headings Compounds and Mixtures (always try to do this before the lesson starts). The learners have to write down the characteristics of the compounds and mixtures to show the differences between them. You could either revise compounds or learners could refer to the section on compounds in their books.

TASK

1. Look at the page that the teacher will show you and identify the substances as elements, compounds and mixtures.
2. Copy the table from the chalkboard and write down the differences between mixtures and compounds (pure substance).

Compounds	**Mixtures**

4. *Give the learners enough time to copy the table from the chalkboard and complete it.*
5. *Give learners the opportunity to write an entry on the chalkboard. Answers are given below:*
   1. *A - element*
      B - compound
      C - mixture
      D - mixture
   2.

Compounds	***Mixtures***
Proportions of substances in a compound are fixed.	*Proportions of substances in a mixture can vary.*
We cannot separate the parts by physical methods.	*We can separate the parts by physical methods.*
The properties of a compound differ from the properties of the elements that form the compound.	*The components of the mixture keep their individual properties.*
When a compound forms, there is a chemical change and a new substance is formed.	*When a mixture is made, there is no chemical change and no new substance is formed.*
Energy is needed to separate a compound into its elements.	*No energy is needed to separate a mixture.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Name the differences in the separation of compounds and mixtures.
b. Why can we not separate sugar and water in a sugar water mixture by filtration or sieving?

Answers to the checkpoint questions are as follows:

a. The elements of a compound are separated by adding energy, such as heat or electricity, while the substances that are in a mixture can be separated by physical separation techniques. (See the table for other differences.)
b. The sugar is not visible in the mixture and will move with the water through the sieve or filter paper.

7. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Top Class Natural Sciences	Atoms	76
Via Africa Natural Sciences	Atoms	75
Solutions for All Natural Science	Atoms	93-95
Spot on Natural Sciences	Atoms	58
Platinum Natural Sciences	Atoms	87
Step-by-step	Atoms	59
Natural Sciences	Atoms	81
Sasol Inzalo Bk A	Atoms	142-145
Sasol Inzalo Bk A	Skeletons as structures	16

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.slideshare.net/NichitaGLM/separation-methods-46690642 [Separation methods]

TOPIC OVERVIEW:
Particle model of matter
Term 2, Weeks 3A – 7C

A. TOPIC OVERVIEW

- This topic runs for 5 weeks.
- It is presented over 15 lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• N/A	• The particle model of matter is used to explain that all matter is made up of particles • Particles are arranged differently in a solid, liquid or gas • Diffusion is a process in which liquid and gas particles move from a high concentration area to a lower concentration area • Heating and cooling cause a material to change state • The density of a material is the amount of mass for a given volume of the material • Solids, liquids and gases expand when heated and contract when cooled	• N/A

	• A gas exerts a pressure because of the collisions of the particles with each other and against the sides of the container	

C. SCIENTIFIC VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	model	A model is a visual representation of something that we cannot see.
2.	solid	A substance is a solid when it has a fixed shape that cannot be changed.
3.	liquid	A substance is a liquid when it can be poured and takes on the shape of a container.
4.	gas	A gas is a substance that fill any space and cannot be seen (there are exceptions).
5.	diffusion	Diffusion is a process in which particles in liquids and gases move from a highly-concentrated to a lower concentration area of those particles.
6.	heating	Heating occurs when energy is added to a substance and there is a rise in temperature.
7.	cooling	Cooling occurs when energy is removed from a substance and there is a fall in temperature.
8.	density	Density is the the amount of mass for a given volume of the material.
9.	pressure	Pressure is the force that gas particles exert on the walls of a container and other particles by colliding with the walls and the particles.
10.	macroscopic	What we can see with the naked eye and experience with our senses
11.	microscopic	What we cannot see with the unaided eye

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Learners will understand that the particle model of matter helps us to understand how the particles are arranged in solids, liquids, or gases, as well as how diffusion takes place. Learner will also be able to use the particle model of matter to explain changes of states, expansion and contraction of materials and pressure

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

3 A

Term 2, Week 3, Lesson A
Lesson Title: The particle model of matter
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The concept of the particle model of matter
CAPS Page Number	42

Lesson Objectives

By the end of the lesson, learners will be able to:

- define the particle model of matter
- list the principles of the particle model of matter
- explain the particle model of matter
- draw a model to represent the particles of a substance.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Particle model of matter

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 9: Particle model of matter	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How is a mixture of elements different from a compound?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

In a mixture the elements are mixed while in a compound the elements have reacted to form a new substance.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

PARTICLE MODEL OF MATTER

1. A **model** is used to explain the behaviour of particles because particles are too small to see.
2. Atoms and molecules are referred to as particles in the particle model of matter. We represent these particles as circles.

THE PARTICLE MODEL OF MATTER STATES:

3. All matter is made up of particles.
4. The particles are continuously moving.
5. The particles have spaces between them.
6. The particles exert forces on each other.

2. Explain this to the learners as follows:
    a. The particle model of matter is a scientific model that we use to explain the properties and behaviour of matter.
    b. We refer to an atom or a molecule as a particle in the particle model of matter.
    c. The particles are represented as circles. Show the learners Resource 9.
    d. The particles that make up matter are always moving.
    e. There are forces between the particles.
    f. There are spaces between the particles of a substance.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is the particle model of matter?
b. What are the particles that are mentioned in the particle model of matter?

Answers to the checkpoint questions are as follows:

a. It is a model to help us understand the behaviour of particles of matter that are too small for us to see.
b. Atoms and molecules.

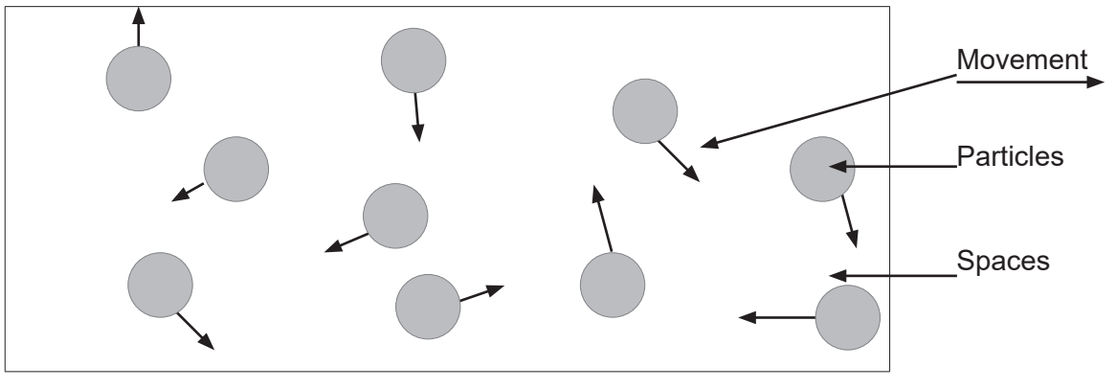
E CONCEPTUAL DEVELOPMENT

1. Use Resource 9 to explain the following to the learners:
    a. All substances, such as air, water, wood, metal and plastic, are made up of tiny particles, which are atoms and molecules.
    b. These particles are so small that we cannot see them, even when we use a microscope. We say that they are **microscopic**.
    c. The particle model of matter is a representation of the particles that we cannot see. Atoms and molecules are not really circles but circles are easier to draw.
    d. The particles are constantly moving.
    e. The energy that the particles have is known as kinetic energy or movement energy. How fast or slow the particles move depends on the amount of energy they have.
    f. The spaces between the particles are empty. There is nothing in the spaces, not even air, because air is actually made up of oxygen and nitrogen particles.
    g. There are forces of attraction between the particles.
8. Tell the learners to do the following activity. Each learner should have a lead pencil that they can use to draw the circles for the particles.

TASK

Draw a square in your book. Use a lid to draw ten circles inside the square. These circles represent the particles of a substance. Indicate the four principles of the particle model of matter in your drawing.

3. Give the learners enough time to complete the task.
4. Let each learner stand up and show their particle model to the rest of the class.
5. A possible answer is shown below:



Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is between the particles in a substance?
b. What is the energy called that the particles have due to their movement?

Answers to the checkpoint questions are as follows:

a. Nothing, not even air.
b. Kinetic energy.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	74
Top Class Natural Sciences	Particle model of matter	78-79
Via Africa Natural Sciences	Particle model of matter	76
Solutions for All Natural Science	Particle model of matter	97
Spot on Natural Sciences	Particle model of matter	61-63
Platinum Natural Sciences	Particle model of matter	89-91
Step-by-step	Particle model of matter	60
Natural Sciences	Particle model of matter	87-91
Sasol Inzalo Bk A	Particle model of matter	152-154

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=ziwuz0w2ZaM (4min 49sec) [The particle model of matter]

3 B

Term 2, Week 3, Lesson B
Lesson Title: States of matter: Solids
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The concept of the particle model of matter
CAPS Page Number	42

Lesson Objectives

By the end of the lesson, learners will be able to:

- list the macroscopic properties of a solid
- describe the microscopic properties of a solid in terms of the particle model of matter
- explain the macroscopic properties of a solid in terms of its microscopic properties
- apply the particle model of matter to draw a solid.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 7: Table salt (sodium chloride) crystal	
Resource 10: Salt crystal	
Examples of solids	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are the principles of the particle model of matter?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

All matter consists of particles that are constantly moving and exerting forces on one another. There are spaces between the particles.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

MACROSCOPIC PROPERTIES OF A SOLID

1. Matter can exist in a **solid** state.
2. A solid has a definite shape. It can be hard, soft or powdery.
3. A solid occupies a definite space.
4. Solids cannot be compressed.

MICROSCOPIC PROPERTIES OF A SOLID

1. The particles of a solid are closely packed and arranged in an orderly way.
2. There are strong forces between the particles in a solid.
3. The particles of a solid vibrate about fixed points in one place.
4. There are small spaces between the particles.

2. Show the learners the different examples of solids, as well as Resource 7. Explain this to the learners as follows:
   a. Solids have a definite shape and volume.
   b. It is not possible to compress most solids.
   c. The particles of a solid are packed closely together and arranged in an organised pattern. Each particle is the same distance away from the other particles.
   d. The particles of a solid do not move around freely, but vibrate around fixed positions with small spaces between them.
   e. The particles are held together by strong forces of attraction between them.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What can you say about the shape of a solid?
b. How do the particles of a solid move?

Answers to the checkpoint questions are as follows:

a. A solid has a definite shape.
b. They do not move around but vibrate in one place.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners. Show the learners Resource 7 and Resource 10.
   a. Salt is a compound and consists of sodium atoms and chlorine atoms.
   b. Let us explain the macroscopic properties of a solid by looking at the microscopic properties of the particles. We will use a salt crystal as an example.
   c. The salt crystal is hard because the particles are very closely packed together.
   d. The crystal is rigid and has a fixed shape because the particles are packed in an orderly arrangement and there are strong forces of attraction between the particles.
   e. The shape of the salt crystal will remain the same even when we apply force with our hands.
   f. The salt crystal cannot be compressed because there are small spaces between the particles.
   g. Even though we cannot see or feel it, the particles of the crystal are vibrating but they have low kinetic energy.
2. Tell the learners to do the following activity. Each learner should have a lid that they can use to draw the circles for the particles.

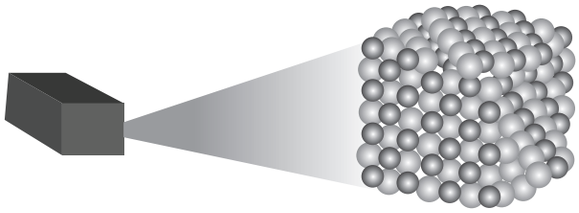
TASK

Complete the following task in your workbook.

1. Choose any solid object.
2. Draw the solid and list the properties that you can see.
3. Use the particle model of matter to draw the particles of the solid.
4. List the microscopic properties of the object.

3. Give the learners enough time to complete the task.
4. Let each learner stand up and show his or her particle model to the rest of the class.
5. A possible answer is given below using a brick:

1. A brick



2. A brick has the definite shape of a rectangular prism. The shape of the brick is rigid and cannot be changed. The brick has a definite volume that one can calculate. The brick cannot be compressed and will break if you hit it with a hammer.

3. See the diagram.

4. The particles are closely packed with small spaces between them. The particles are also packed in an orderly way and can only vibrate in one place. There are strong forces of attraction between the particles.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why does a solid object have a definite shape?

b. Why is a solid not compressible?

Answers to the checkpoint questions are as follows:

a. The particles are packed in an orderly way.

b. There are very small spaces between the particles.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	74
Top Class Natural Sciences	Particle model of matter	79
Via Africa Natural Sciences	Particle model of matter	77
Solutions for All Natural Science	Particle model of matter	98
Spot on Natural Sciences	Particle model of matter	64
Platinum Natural Sciences	Particle model of matter	92
Step-by-step	Particle model of matter	60
Natural Sciences	Particle model of matter	93
Sasol Inzalo Bk A	Particle model of matter	156

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=Fx5IUVC4UkU (1min 38sec) [Solids, liquids and gases]

3 C

Term 2, Week 3, Lesson C
Lesson Title:States of matter: Liquids
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The concept of the particle model of matter
CAPS Page Number	42

Lesson Objectives

By the end of the lesson, learners will be able to:

- list the macroscopic properties of a liquid
- describe the microscopic properties of a liquid in terms of the particle model of matter
- explain the macroscopic properties of a liquid in terms of its microscopic properties
- compare liquids and solids.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 11: Liquid state	
Containers of different shapes, water	
Examples of liquids (e.g. milk, tea, oil)	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How are the particles of a solid arranged?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The particles of a solid are arranged in an orderly way with small spaces between them.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

MACROSCOPIC PROPERTIES OF A LIQUID

1. Matter can exist in a **liquid** state.
2. Liquids are runny. Some liquids are more runny than others.
3. A liquid has a definite **volume**.
4. A liquid takes the shape of its container.
5. Liquids are not easily compressible.

MICROSCOPIC PROPERTIES OF A LIQUID

In a liquid the particles:

6. are loosely arranged but are still in contact.
7. are constantly moving and sliding past each other in all directions.
8. have weaker forces between them.
9. have small spaces between them.

2. Show the learners the different examples of liquids. Explain this to the learners as follows:
    a. Liquids can flow and can be poured from one container to another.
    b. Liquids do not have a definite shape but do have a definite volume. They take on the shape of the container they are in.
    c. Weak forces exist between liquid particles but the forces are still strong enough to keep the particles in contact with each other.
    d. Liquid particles do not have fixed positions but move freely around.
    e. The liquid particles slip and slide past each other.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a property of a liquid?
b. How do the particles of a liquid move?

Answers to the checkpoint questions are as follows:

a. A liquid is runny and can flow. A liquid takes on the shape of the container it is in.
b. The particles slide over each other in all directions.

E CONCEPTUAL DEVELOPMENT

1. Show the learners Resource 11 and pour water into various containers with different shapes. Then explain the following to the learners:
    a. A liquid is not rigid and can flow easily. This means that a liquid can also take on the shape of the container it is in.
    b. The reason is that the forces between the particles are weak and the particles have more energy to move around in all directions. Therefore, the particles are not orderly arranged in an orderly way.
    c. A liquid has a fixed volume because the forces between the particles are still strong enough to keep the particles in contact with each other.
    d. The spaces between the particles are very small, which means that liquids are not easily compressed.
2. Write the following paragraph on the chalkboard (always try to do this before the lesson starts). It deals with the differences between solids and liquids. Tell the learners to copy the paragraph in their books and fill in the missing words. Let the learners refer back to solids in their workbooks.

TASK

Write the following paragraph in your workbook and fill in the missing words.

The particles in _____ are still close together but are arranged more loosely. Particles of solids are arranged in a more _____pattern. Particles can move _____ in a liquid and _____ over each other in _____ directions. The forces of attraction are _____ in solids than liquids. The spaces between liquid particles are still small, although the spaces are _____ than in a solid. Liquid particles have _____ kinetic energy than that of solids.

3. Give the learners enough time to complete the task.
4. Give the answers to the learners. The answers are given below:

The particles in a liquid are still close together but are arranged more loosely. Particles of solids are arranged in a more orderly pattern. Particles can move faster in a liquid and slide over each other in all directions. The forces of attraction are stronger in solids than liquids. The spaces between liquid particles are still small, although the spaces are larger than in a solid. Liquid particles have more kinetic energy than particles of solids.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why are liquids runny?
b. Does a liquid have a fixed volume or a fixed shape?

Answers to the checkpoint questions are as follows:

a. The liquid particles are able to move more freely and slide over each other.
b. A liquid has a fixed volume but takes on the shape of the container it is in.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	74
Top Class Natural Sciences	Particle model of matter	80
Via Africa Natural Sciences	Particle model of matter	77
Solutions for All Natural Science	Particle model of matter	98
Spot on Natural Sciences	Particle model of matter	64
Platinum Natural Sciences	Particle model of matter	92
Step-by-step	Particle model of matter	61
Natural Sciences	Particle model of matter	93-94
Sasol Inzalo Bk A	Particle model of matter	157

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=HCPXILOPcso (2min 59sec) [Solids, liquids and gases]

4 A

Term 2, Week 4, Lesson A
Lesson Title: States of matter: Gases
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The concept of the particle model of matter
CAPS Page Number	42

Lesson Objectives

By the end of the lesson, learners will be able to:

- list the macroscopic properties of a gas
- describe the microscopic properties of a gas in terms of the particle model of matter
- explain the macroscopic properties of a gas in terms of its microscopic properties

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing		7. Raising Questions	✓	12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 12: Chlorine gas	
Balloon, empty plastic bottle with lid	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How do the particles of a liquid move?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The particles slide over one another in all directions and do not have a fixed position.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

MACROSCOPIC PROPERTIES OF A GAS

1. Matter can exist in a gaseous state.
2. Most gases are colourless and not visible.
3. A gas has no definite shape or volume and will fill all the available space.
4. A gas can be compressed into a smaller space.

MICROSCOPIC PROPERTIES OF A GAS

In a gas the particles:

1. have no particular arrangement.
2. move very fast in straight lines until they collide with another particle of the walls of the container.
3. have extremely weak forces between them.
4. have very big spaces between them.

2. Show the learners the different examples of gases. Explain this to the learners as follows:
    a. Most gases are not visible but there are a few that are coloured and that we can see. For example, chlorine gas is green. Show the learners Resource 12.
    b. A gas has no definite shape but it spreads out to fill the available space.
    c. A gas is compressible.
    d. The particles of a gas are constantly moving freely in all directions.
    e. Gas particles move in straight lines until they collide with other gas particles. Then they change direction and move in a straight line again.
    f. The particles of a gas are far apart from one another.
    g. Very weak forces of attraction exist between the particles.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. How are the particles in the gas state arranged?
b. Why are gases compressible?

Answers to the checkpoint questions are as follows:

a. Gas particles have no specific arrangement.
b. There are big spaces between gas particles so they are able to move closer together.

E CONCEPTUAL DEVELOPMENT

1. Have all the resources available. Explain the following to the learners:
    a. Show the learners the empty plastic bottle. Tell them that there is a gas inside but because certain gases are colourless we cannot see them.
    b. Blow up the balloon but keep the opening closed with your finger. Inside the balloon is a certain volume of gas. It may seem as if it has a definite volume and shape. However, when we let the gas out of the balloon it will spread out and fill the available space in the room.
    c. The reason for this is that gas particles move at fast speeds in all directions. The forces between the particles are too small to keep them together.
    d. Blow up the balloon again. Tie the end of the balloon. When you apply a force to this balloon, gas is compressed. This occurs because of the big spaces between the particles.
2. Take the learners outside and let them do the following role-play to demonstrate the movement and arrangement of particles in solid, liquid and gas states.

TASK

Do the following role-play.

1. Each learner represents a particle.
2. To represent a solid, learners should:
   - stand in straight rows and columns to form an orderly grid.
   - touch one another lightly at the side, in front and at the back.
   - move slightly to all sides (vibrating) but remain in one position.
3. To represent a liquid, learners should:
   - move freely in a gliding way but still touch the other learners.
4. To represent a gas, learners should
   - walk very fast in any direction.
   - keep spaces between them without touching other learners.
   - change direction as soon as they touch another learner and then move in a straight line in a new direction.

3. Give the learners enough time to complete the task.
4. This activity can be used as revision for all three states of matter. After the role-play to demonstrate each state, tell the learners to describe the behaviour of the particles according to the particle model of matter.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why do gases not have a fixed shape?
b. Why are there such big spaces between gas particles?

Answers to the checkpoint questions are as follows:

a. Gas particles move very fast and spread out to fill any space.
b. The forces of attraction between the particles are very weak.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	74
Top Class Natural Sciences	Particle model of matter	80
Via Africa Natural Sciences	Particle model of matter	77
Solutions for All Natural Science	Particle model of matter	98
Spot on Natural Sciences	Particle model of matter	64
Platinum Natural Sciences	Particle model of matter	92
Step-by-step	Particle model of matter	61
Natural Sciences	Particle model of matter	94
Sasol Inzalo Bk A	Particle model of matter	158

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=Xz2GZ6Wo9Wk (1min 20sec) [Coloured gases]
2. https://www.youtube.com/watch?v=o2qM4o8e_Vo (4min 16sec) [States of matter]

4 B

Term 2, Week 4, Lesson B
Lesson Title: Diffusion
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The concept of the particle model of matter
CAPS Page Number	43

Lesson Objectives

By the end of the lesson, learners will be able to:

- define diffusion
- give examples of diffusion
- explain diffusion in terms of the particle model of matter
- compare diffusion in liquids and gases.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 13: Diffusion in a liquid	
Resource 14: Diffusion in a gas	
Deodorant spray can, glass of water, potassium permanganate crystal, food colouring	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

> In what way do the particles of liquids and the particles of gases behave in a similar way?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

> *Liquid particles and gas particles are able to move freely.*

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

> DIFFUSION
>
> 1. **Diffusion** is a process in which the particles move from a highly concentrated area to an area with a lower concentration of those particles.
> 2. Diffusion only takes place in liquids and gases.
> 3. **Concentration** refers to the number of particles in a certain area. A high concentration contains many particles and a low concentration contains fewer particles.
> 4. Diffusion is faster in gases than in liquids.
> 5. Gas particles move more quickly and at greater speeds and, therefore, they will move more quickly from a high concentration area to a low concentration area.
> 6. The speed at which particles diffuse depends on the size of the particles, the state of the particles and the temperature of the particles.

2. Explain this to the learners as follows:
    a. Diffusion is a process in which the particles in liquids and gases move from a place where there are many particles to a place where there are fewer particles.
    b. Diffusion occurs only in gases and in liquids.
    c. The particle model of matter explains diffusion.
    d. Diffusion occurs because particles of matter are in continuous motion.
    e. Diffusion takes place faster in gases than in liquids because the particles in a gas move more quickly than the particles in a liquid.
    f. The rate at which particles diffuse depends on the size of the particles, the state of the particles and the temperature of the particles.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is diffusion?
b. Do liquid particles or gas particles diffuse faster?

Answers to the checkpoint questions are as follows:

a. Diffusion is the movement of particles from an area of many particles to an area of fewer particles.
b. Gas particles

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. Spray deodorant in the front of the class and ask the learners to stand up when they smell the deodorant.
   b. When the deodorant particles leave the can, they move randomly, colliding with each other, and spreading through the room.
   c. The area around the can has a high concentration of deodorant particles because there are many particles. In the rest of the classroom the concentration of deodorant particles is very low.
   d. Drop a potassium permanganate crystal in the water. Let the learners observe how the purple colour diffuses through the water. It will take a while for all the water to turn purple. (Alternatively use a few drops of food colouring.)
   e. Show the learners Resource 13 and explain how the potassium permanganate particles spread out in the water.
   f. Different substances diffuse at different rates.
   g. Diffusion is faster in gases than in liquids because gas particles have greater kinetic energy. They also move more quickly and the particles are further apart. This makes it easier for particles to move from one point to another. As a result, the gas particles will spread out quickly to fill the space evenly.
   h. A particle in a liquid is constantly colliding with other particles because the particles are so close together. The particle cannot travel very far because it is sent in different directions and eventually moves to the lower concentration of particles.
2. Show the learners Resource 14 and ask them to refer to the diagram to answer the following questions in their workbooks.

TASK

Look at the diagram of hydrogen gas (H_2) and oxygen gas (O_2). They are in two chambers that are connected. Answer the following questions in your workbook.

1. What happened when the stopcock or tap was opened?
2. What do we call this process?
3. Why did this process take place?
4. Which gas diffused faster? How do you know this?
5. Why do you think the gas in Number 3 diffused faster?
6. When did the process stop?

3. Give the learners enough time to complete the task.
4. Give the answers to the learners. They are provided below:

1. *The gases in the two chambers moved from the one chamber to the other.*
2. *Diffusion*
3. *In the one chamber there was a high concentration of hydrogen gas and in the other chamber there was a high concentration of oxygen gas.*
4. *The hydrogen gas diffused faster, because there are more hydrogen particles in the oxygen chamber than oxygen particles in the hydrogen chamber in the second diagram.*
5. *The hydrogen particles are smaller than the oxygen particles and will move faster.*
6. *When the concentration of the gases is the same in both chambers.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why do gases diffuse more quickly than liquids?
b. When will the process of diffusion stop?

Answers to the checkpoint questions are as follows:

a. Gases diffuse more quickly than liquids because the particles of gases have more space to move in and they also have more energy, so they move faster.
b. Diffusion will stop when the concentration of particles is the same everywhere.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	77
Top Class Natural Sciences	Particle model of matter	81-82
Via Africa Natural Sciences	Particle model of matter	78-79
Solutions for All Natural Science	Particle model of matter	99-100
Spot on Natural Sciences	Particle model of matter	68
Platinum Natural Sciences	Particle model of matter	94-95
Step-by-step	Particle model of matter	64
Natural Sciences	Particle model of matter	94-95
Sasol Inzalo Bk A	Particle model of matter	160-167

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=_oLPBnhOCjM (4min 01sec) [Diffusion of gases]

4 C

Term 2, Week 4, Lesson C
Lesson Title: Change of state: Heating
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Change of state
CAPS Page Number	43

Lesson Objectives

By the end of the lesson, learners will be able to:

- describe what happens when a solid or liquid is heated
- explain melting in terms of the particle model of matter
- explain boiling in terms of the particle model of matter
- distinguish between boiling and evaporation.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions	✓	12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 15: Change of state	
Ice cubes, glass jar, thermometer, source of heat (bunsen burner)	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What property must particles have to be able to diffuse?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The particles have to be able to move freely and randomly.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CHANGE OF STATE

1. When a substance is **heated**, it gains energy and the temperature of the substance increases.
2. When a solid is heated, it changes to a liquid state.
3. When a solid changes to a liquid, we call it melting.
4. When the particles of the solid gain energy, they overcome the strong forces of attraction and move more freely.
5. When a liquid is heated, it changes to the gas state.
6. When a liquid changes to a gas, we call the process evaporation or boiling.
7. The liquid particles gain more energy, they overcome the forces of attraction, and are able to move faster and further apart from one another.
8. The amount of matter stays the same during a change of state.

2. Show the learners Resource 15. Explain this to the learners as follows:
    a. Heating a substance can cause the substance to change state.
    b. When a solid is heated, it can change to a liquid state. We say the solid melts.
    c. According to the particle model of matter, the particles of a solid start to vibrate more vigorously when they receive energy. These vibrations overcome the forces of attraction and the particles break away and start to move past each other. This causes the solid to melt.
    d. If we keep on heating the liquid, it will start to evaporate and change to the gas state.
    e. The liquid particles will gain more energy, move even faster and overcome most of the forces of attraction. The particles will move even further apart and escape to the gas state.
    f. The amount of a substance remains the same during a change of state.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What happens when a substance is heated?
b. What do we call the change of state from a solid to a liquid?

Answers to the checkpoint questions are as follows:

a. The substance changes state.
b. Melting

E CONCEPTUAL DEVELOPMENT

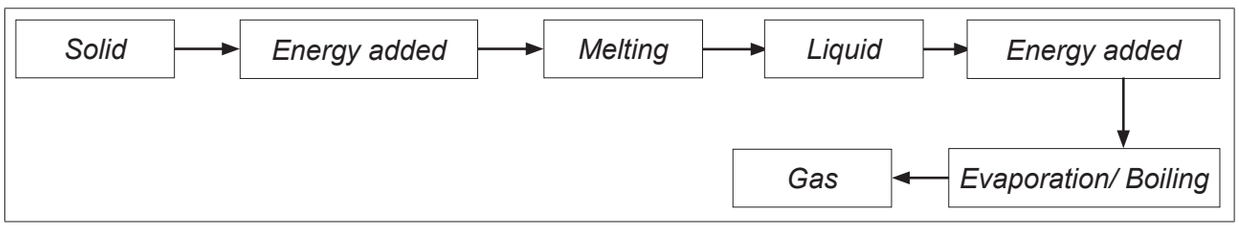
1. Explain the following to the learners:
   a. Fill a glass jar with ice cubes and take the temperature with the thermometer. It should be close to 0° C.
   b. Tell the learners that temperature indicates how hot or how cold a substance is and is measured in degrees Celsius (°C).
   c. If you have a heat source, heat the ice cubes and let the learners observe how the ice cubes melt and change to a liquid (water). Alternatively, put the ice cubes in the sun and make the same observation.
   d. As the water particles of the ice obtain energy, they start to vibrate more vigorously until they have overcome the strong forces of attraction. At the melting point, the particles start to slide over each other and move more freely.
   e. Take the temperature when all the ice has melted. The temperature should be higher than 0 °C.
   f. When you leave the liquid water in the sun, the water will evaporate until all the liquid water has changed to the gas state.
   g. The Sun only provides heat energy for the water particles close to the surface of the liquid. These particles will move faster and further apart from each other until they escape to the gas state.
   h. Evaporation is a slow process because not all the particles receive the same energy at the same time to change state. Evaporation takes place at any temperature.
   i. When you heat the water, it will boil and change to the gas state, which is called steam. Take the temperature when the water boils. It should be close to 100 °C.
   j. When the water is boiled, all the particles in the liquid obtain enough energy to overcome the forces of attraction and leave the liquid. This is a rapid process. Water can only boil at a definite temperature, namely 100 °C.
2. Ask the learners to complete the following task in their workbooks.

TASK

Use the following words to draw a flow diagram of the changes of states from a solid to a gas

Liquid	Gas	Evaporation/ Boiling	Solid
Energy added	Energy added	Melting	

3. Give the learners enough time to complete the task.
4. Draw the correct flow diagram on the chalkboard:



Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How are evaporation and boiling similar?
b. What is the difference between evaporation and boiling?

Answers to the checkpoint questions are as follows:

a. During evaporation and boiling a liquid changes to a gas.
b. Evaporation is a slow change of state whereas boiling is a rapid change of state.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	78
Top Class Natural Sciences	Particle model of matter	83-84
Via Africa Natural Sciences	Particle model of matter	80-81
Solutions for All Natural Science	Particle model of matter	101
Spot on Natural Sciences	Particle model of matter	71-73
Platinum Natural Sciences	Particle model of matter	96
Step-by-step	Particle model of matter	65
Natural Sciences	Particle model of matter	95-96
Sasol Inzalo Bk A	Particle model of matter	167-170

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.studyladder.com/games/activity/changing-states-27807 [Changing states: Interactive activity lessons]

5 A

Term 2, Week 5, Lesson A
Lesson Title: Change of state: Cooling
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Change of state
CAPS Page Number	43

Lesson Objectives

By the end of the lesson, learners will be able to:

- describe what happens when a gas or liquid is cooled
- explain condensation in terms of the particle model of matter
- explain freezing/ solidification in terms of the particle model of matter.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 15: Change of state	
Resource 16: Coke can with water droplets	
Resource 17: Change of state: Summary	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is needed for a substance to melt?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The substance must be heated and energy has to be added.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CHANGE OF STATE

1. When a substance is cooled, heat is taken away and the temperature of the substance decreases.
2. When a gas is cooled, it changes to the liquid state. We call it condensation.
3. The particles of the gas lose energy. They move less energetically and closer to each other.
4. When a liquid is cooled, it changes to a solid state. We call this change of state freezing or solidification.
5. The liquid particles lose energy and move even closer together, until they only vibrate in one place.
6. The amount of matter stays the same during a change in state and the particles do not change.
7. Gas → *Energy is removed* → Liquid → *Energy is removed* → Solid

Condensation

Freezing/ Solidification

2. Show the learners Resource 15. Explain this to the learners as follows:
   a. Taking heat away from a substance can cause the substance to change state.

   When heat is taken away from a gas it condenses to form a liquid.

   The gas particles have less energy and move closer to the other particles until they touch and form a liquid.

   If we cool a liquid, it will change to a solid state. We call this process freezing or solidification.

   The liquid particles lose more energy and move even closer to each other. This happens to the point where the particles are so close together that they cannot move freely anymore. They remain in one place and are only able to vibrate.

   The amount of a substance remains the same during a state change and the particles do not change.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What happens when a gas is cooled?
b. What do we call the change in state when a liquid changes to a solid?

Answers to the checkpoint questions are as follows:

a. It changes to a liquid.
b. Freezing or solidification

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners. Show the learners Resource 16.
   a. Do you notice the little droplets of water that are on the outside of the cold can of Coke? They are formed by condensation.
   b. Where do these droplets come from? (Give the learners time to give answers.)
   Answer: Water vapour (water in the gas state) in the air condenses and forms liquid water droplets on the can.
   c. When the gas particles of water in the air come into contact with the cold Coke can, they lose energy. The particles have less kinetic energy, so they move more slowly. This means that the forces of attraction are able to pull them closer together. The spaces between them decrease and eventually the particles touch and form a liquid. The particles are still able to move freely.

d. Should we put the can of Coke in the freezer, the water droplets will freeze. In the freezer the particles lose energy and have less energy to move around. The forces of attraction pull them closer together and they settle into a fixed pattern. The particles can no longer move past each other so they vibrate in fixed positions. The spaces between the particles decrease until they are packed close together in a solid.

e. The water particles did not change during the change of state. The gas particles of water are the same as the liquid particles of water and are also the same as the solid particles of water.

2. Ask the learners to complete the following task in their workbooks. Show them Resource 17. This is a summary of the changes of state when energy is added or removed. Write the paragraph on the chalkboard (always try to do this before the lesson starts).

TASK

Look at the diagram that the teacher is showing you. Copy the paragraph from the chalkboard into your workbook and fill in the missing words.

When a solid is heated, its _____ increases and it _____. The solid changes to a _____. When a liquid is _____, its energy decreases and it _____. The liquid changes to a _____. A _____ changes to a liquid when it is cooled. This is called _____. The energy of the particles _____. During evaporation a _____ changes to a _____, as the temperature is _____. The energy of the particles _____.

3. Give the learners enough time to complete the task.
4. Give the answers to the learners. The answers are given below:

Model Answer

When a solid is heated, its energy increases and it melts. The solid changes to a liquid. When a liquid is cooled, its energy decreases and it solidifies/ freezes. The liquid changes to a solid. A gas changes to a liquid when it is cooled. This is called condensation. The energy of the particles decreases. During evaporation a liquid changes to a gas, as the temperature is increased. The energy of the particles increases.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What do we call the process where water droplets form on the outside of a cold can of Coke?

b. What change of state will happen when a liquid is put in a freezer?

Answers to the checkpoint questions are as follows:

a. Condensation.

b. The liquid will change to a solid.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	78
Top Class Natural Sciences	Particle model of matter	84-85
Via Africa Natural Sciences	Particle model of matter	80-81
Solutions for All Natural Science	Particle model of matter	102
Spot on Natural Sciences	Particle model of matter	71-73
Platinum Natural Sciences	Particle model of matter	96-97
Step-by-step	Particle model of matter	65
Natural Sciences	Particle model of matter	96-97
Sasol Inzalo Bk A	Particle model of matter	170-173

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=mjBiHCk2V2A (1min 21sec) [Condensation: How it works]
2. https://www.lifepersona.com › Chemistry [Examples of solidification]

5 B

Term 2, Week 5, Lesson B
Lesson Title: Density: Mass and volume
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Change of state
CAPS Page Number	43

Lesson Objectives

By the end of the lesson, learners will be able to:

- define density
- explain density in terms of mass and volume
- calculate the density of an object.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	
4. Measuring	✓	9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Identical plastic/ paper cups, cooking oil, water, milk, vinegar, golden syrup, measuring jug, kitchen scale, four objects with the same mass	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How can materials be made to change their state?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Materials need to obtain energy or lose energy to change state.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

DENSITY

1. The density of a material describes the amount of mass in a given volume of that material.
2. Density is a property of matter.
3. Mass is a measure of the amount of matter that an object is made of. It is measured in grams (g) or kilograms (kg).
4. There are a thousand grams in one kilogram (1000 g = 1 kg).
5. Volume is the amount of space an object occupies. It is measured in millilitres (ml) or litres (l).
6. There are a thousand millimetres in 1 litre (1000 ml in 1 l) and 1 millimetre is equal to 1 cubic centimetre (1 ml = 1 cm^3).
7. Mass and volume are physical quantities of a material. This means that we can observe and measure them.

8. The formula for density is the mass per unit of volume:
   $p = \frac{m}{V}$ where,
   p is the symbol for density and the unit is g/ml or g.cm³
   m is the symbol for mass and the unit is g
   V is the symbol for volume and the unit is ml or cm³.

2. Explain this to the learners as follows:
   a. Density is a measure of how much mass of a material fits into a given volume.
   b. Density is a property of all matter and every material has a specific density.
   c. The mass of an object is how much matter the object has and it is measured in grams or kilograms.
   d. The volume of an object is the space that the object occupies and is measured in millilitres or litres.
   e. The formula for density is $p = \frac{m}{V}$
   f. The unit for density is g/ml or g/cm³.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

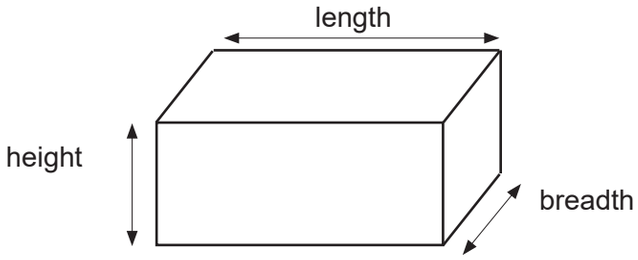
a. What is the relationship between density, mass and volume?
b. What is the unit of mass?

Answers to the checkpoint questions are as follows:

a. Density is the mass that can fit into a certain volume.
b. The unit of mass is grams (g) or kilograms (kg).

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
   a. We can think of density as the lightness or heaviness of objects of the same size.
   b. Density depends on the mass and volume of a substance.
   c. Mass, volume and density are physical properties of objects and we can use these to describe objects.
   d. The greater mass an object has, the more matter it has. When we measure the mass of a small object, we measure the mass in grams. When we measure the mass of a big object, we measure the mass in kilograms.
   e. When we have two copper rods, each with mass of 350 g, then the two rods will have exactly the same amount of copper atoms.
   f. We can determine the volume of a regular shape by using the formula for volume:
   Volume = length x breadth x height

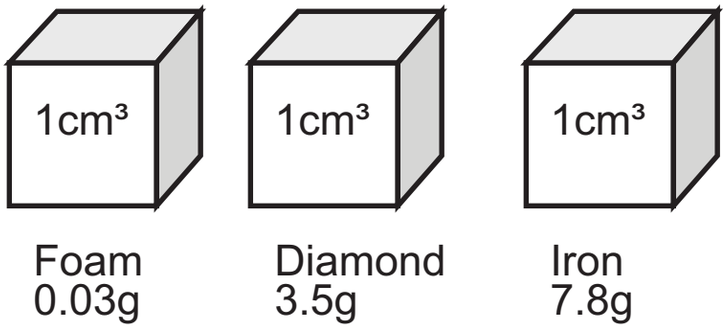


2. Also explain the following to the learners. Have the required objects nearby.
   a. If you have different objects with the same volume, the object with the highest mass will have the greatest density.
   b. Fill four cups with the same amount or pour 250 ml of the following liquids into the cups: cooking oil, water, vinegar, golden syrup, milk or whatever is available. Let a learner pick up each of the cups and compare their masses. Alternatively, the mass of each cup can be measured with the kitchen scale. Let the learners arrange them in order of increasing density.

      [Answer: Oil, water, vinegar, milk, golden syrup]
   c. When we have different objects with the same mass, they will have different sizes (volumes) because their densities are different.
   d. Find four objects with the same mass. Let a learner order them from the smallest to the largest. The smallest object will have the highest density and the biggest object will have the smallest density. For instance, iron, wood and sponge, with the same mass, will have different sizes. The sponge will be the biggest, then the wood and the iron will be the smallest.
3. Ask the learners to complete the following task in their workbooks. Write and draw the following diagram on the chalkboard (always try to do this before the lesson starts).

TASK

1. Look at the diagram and answer the questions that follow.

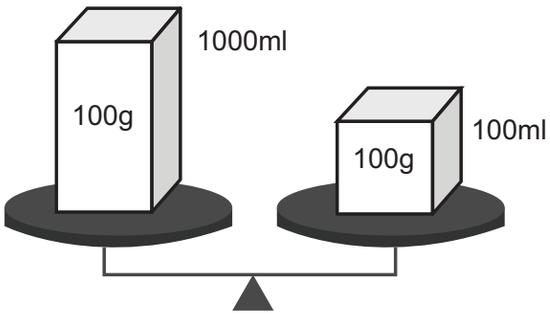


1.1 Which block do you think will have the highest density? Why do you say so?

1.2 Calculate the density of each block.

1.3 Put the blocks in order of increasing density.

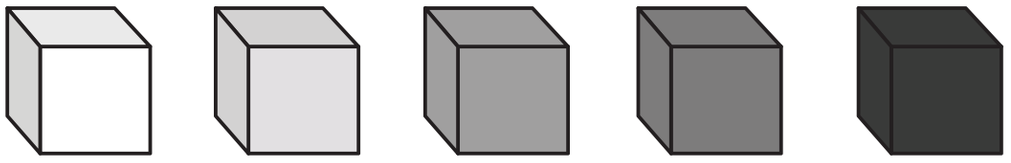
2.



2.1 Which block do you think will have the lowest density? Why do you say so?

2.2 Calculate the density of each block.

3. Look at the diagram and answer the questions that follow.



Water
Density = 1

Sea Water
Density = 1.1

Rock
Density = 3

Iron
Density = 8

Mercury
Density = 13.6

3.1 Which block do you think will be the heaviest? Why do you say so?

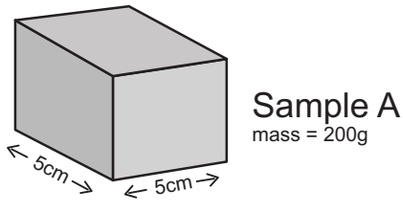
3.2 If the volume of each block is 15 ml, determine the mass of each block to see whether your answer in question 3.1 was correct.

4. Look at sample A, B and C of a material.

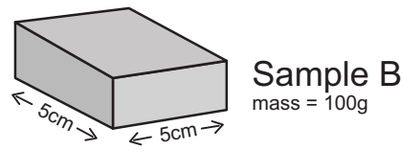
4.1 Which sample do you think will have the lowest density?

4.2 Calculate the density of each sample.

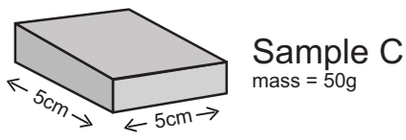
4.3 What conclusion can you draw from the densities in 4.2?



Sample A
mass = 200g



Sample B
mass = 100g



Sample C
mass = 50g

3. Give the learners enough time to complete the task.
4. Give the answers to the learners.

1. *Answer*

   1.1. *The iron because it is heavier than the other blocks.*

   1.2. $\rho(\text{foam}) = \frac{m}{V} = \frac{0,03}{1} = 0,03\,g/cm^3$

   $\rho(\text{diamond}) = \frac{m}{V} = \frac{3,5}{1} = 3,5\,g/cm^3$ $\rho(\text{iron}) = \frac{m}{V} = \frac{7,8}{1} = 7,8\,g/cm^3$

   1.3. *foam, diamond, iron*

2. *Answer*

   2.1. *The 1000 ml block because there is less mass per volume.*

   2.2. $\rho(1000\ ml) = \frac{m}{V} = \frac{100}{1000} = 0,1\,g/ml$

   $\rho(100\ ml) = \frac{m}{V} = \frac{100}{100} = 1\,g/ml$

3. *Answer*

   3.1. *The learners might answer iron because it is the heaviest. However, the same amount of mercury is heavier than iron.*

   3.2. *m (water) = p x V = 1 x 15 = 15 g*

   m (sea water) = p x V = 1,1 x 15 = 16,5 g
   m (rock) = p x V = 3 x 15 = 45 g
   m (iron) = p x V = 8 x 15 = 120 g
   m (mercury) = p x V = 13,6 x 15 = 204 g

4. *Answer*

   4.1. *Many learners might choose sample A.*

   4.2. *Volume of sample A = length x breadth x height = 5 x 4 x 5 = 100 cm3*

   $\rho(\text{sample A}) = \frac{m}{V} = \frac{200}{100} = 2\,g/cm^3$

   Volume of sample B = length x breadth x height = 5 x 4 x 5 = 100 cm3

   $\rho(\text{sample B}) = \frac{m}{V} = \frac{100}{50} = 2\,g/cm^3$

   Volume of sample C = length x breadth x height = 5 x 1 x 5 = 25 cm3

   $\rho(\text{sample C}) = \frac{m}{V} = \frac{50}{25} = 2\,g/cm^3$

   4.3. *The density of a material is always the same no matter what the size of the object is.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How does mass affect density when the volumes of objects remain the same?
b. How does volume affect density when the masses of objects remain the same?

Answers to the checkpoint questions are as follows:

a. The heavier an object the higher its density will be.
b. The bigger the volume of an object the lower its density will be.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	78
Top Class Natural Sciences	Particle model of matter	86
Via Africa Natural Sciences	Particle model of matter	81-82
Solutions for All Natural Science	Particle model of matter	104
Spot on Natural Sciences	Particle model of matter	76
Platinum Natural Sciences	Particle model of matter	98-99
Step-by-step	Particle model of matter	66-67
Natural Sciences	Particle model of matter	97
Sasol Inzalo Bk A	Particle model of matter	175-177

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=7tVebi3TSsg (8min 56sec) [Density practice problems]
2. http://www.psyclops.com/tools/technotes/materials/density.html [Densities of materials]

5 C

Term 2, Week 5, Lesson C
Lesson Title: Density: States of matter
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Density, mass and volume
CAPS Page Number	43

Lesson Objectives

By the end of the lesson, learners will be able to:

- order the states of matter according to their densities
- explain the density of solids, liquids and gases in terms of the particle model of matter
- compare the states of water in relation to density.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 18: Density and states of matter	
Resource 19: Different states of water molecules	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are the two physical properties of a material that we need to determine its density?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

We need its mass and volume.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CHANGE OF STATE

1. The density of a material depends on the state that it is in.
2. Solids, liquids and gases have different densities because of the distances between their particles.
3. The closer together the particles are, the greater the mass of that substance in a given volume, and the higher the density.
4. A solid has a high density because its particles are tightly packed with little spaces between them.
5. A solid cannot be compressed because of its high density.
6. There is little difference between the density of a solid and the liquid state of a material. The particles of a liquid still stay closely packed together although they can move more freely.
7. In general, gases are less dense than liquids and solids. The particles of gases are far apart and the spaces between them are big.
8. The order of density from least dense to most dense is usually gas, liquid and solid.

2. Explain this to the learners as follows:
    a. The state that a substance is in affects its density.
    b. When a substance is in the solid state, it has a high density because its particles are closely packed together in a certain volume.
    c. A solid cannot be compressed because of its high density.
    d. There is little difference between the density of a substance in the liquid state and the solid state.
    e. Although the particles of a liquid are able to move freely, they are still in close contact, with little spaces between them.
    f. Like solids, liquids cannot be easily compressed.
    g. The density of gases is the lowest because the gas particles are further apart than the particles of solids and liquids. The gas particles have much kinetic energy and move quickly in all directions.
    h. There are large spaces between gas particles and therefore gas particles can be compressed.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. Which state of matter has the lowest density?
b. Which state of matter has the biggest mass for a given volume?

Answers to the checkpoint questions are as follows:

a. Gas state
b. Solid state

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners. Show the learners Resource 18.
    a. In general, gases are less dense than liquids and liquids are less dense than solids.
    b. The reason that different states of matter have different densities is easily explained using the particle model of matter.
    c. The particles of solids are tightly and orderly packed in a certain space. No particles can be added to the arrangement. Each particle has a certain mass, so solids have the maximum mass per volume of the substance.

d. Particles in a solid are tightly packed and cannot be squeezed closer together into a smaller volume. This explains why solid material cannot be compressed.

e. Liquids are also very dense. The density of a liquid is almost the same as the density of the solid state of the same substance. This is because their particles are close together, even though they are not in fixed positions. Liquid particles slide over each other.

f. Most liquids cannot be compressed into smaller volumes. The spaces between them are too small.

g. Gases are not very dense at all because of the large spaces between the gas particles. Particles of a gas are spaced far apart with no particular arrangement.

h. In the same way as solids or liquids, gases have much less matter and therefore less mass.

i. Gases can easily be compressed because of the small number of particles in a large volume.

2. Ask the learners to complete the following task in their workbooks. Show them Resource 19. This is a conceptual/ thinking activity in which the learners have to compare the three states of water.

TASK

Look at the page that the teacher is showing you and answer the following questions.

Which state of water:

1. contains the greatest number of particles?
2. contains the smallest number of particles?
3. has the highest mass?
4. has the lowest mass?
5. has the highest density? Why do you say so?
6. has the lowest density? Why do you say so?
7. What is your conclusion?
8. Why does ice float on liquid water?

3. Give the learners enough time to complete the task.
4. Give the answers to the learners. The answers are given below:

MODEL ANSWER

1. *The liquid state*
2. *The gas state*
3. *The liquid state*
4. *The gas state*
5. *The liquid state because it has the biggest mass for a given volume*
6. *The gas state because it has the smallest mass for a given volume*
7. *The solid state of water does not have the highest density as is expected. Water is an exception where its liquid state is denser than its solid state.*
8. *Ice is solid water. Because it is less dense than liquid water, it will float on top of the liquid water.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Which state of water has the biggest spaces between the water molecules?
b. What is the order of the states of water from least dense to most dense?

Answers to the checkpoint questions are as follows:

a. The gas state of water
b. Gas, solid, liquid

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	81-82
Top Class Natural Sciences	Particle model of matter	87
Via Africa Natural Sciences	Particle model of matter	83
Solutions for All Natural Science	Particle model of matter	105
Spot on Natural Sciences	Particle model of matter	78
Platinum Natural Sciences	Particle model of matter	100
Step-by-step	Particle model of matter	66
Natural Sciences	Particle model of matter	97
Sasol Inzalo Bk A	Particle model of matter	177-178

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=dHJmOH38agY (1min 51sec) [Solids, liquids and gases of water molecules]

6 A

Term 2, Week 6, Lesson A
Lesson Title: Density: Different materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Density of different materials
CAPS Page Number	44

Lesson Objectives

By the end of the lesson, learners will be able to:

- explain why different materials have different densities
- list the factors that affect the density of a material
- investigate the densities of different materials.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 7: Table salt (sodium chloride) crystal	
Resource 20: Table sugar (sucrose) molecule	
Resource 19: Different states of water molecules	
Resource 21: Cooking oil (propenal) molecule	
Sugar, salt, identical plastic cups, kitchen scale, measuring cup, water, cooking oil, plastic bottle, cap from cool drink bottle (soda cap)	
Plastic bottles, golden syrup, full-cream milk, dishwashing liquid, water, food colouring, vegetable oil, methylated spirits/ rubbing spirits, plastic beads, iron nail, popcorn kernel, cherry tomato, seeds or nuts	Materials from home

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why is a liquid denser than a gas?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The liquid particles are closely arranged with little spaces between them. Gas particles move further away from each other and there are large spaces between them.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

DENSITY: DIFFERENT MATERIALS

1. Different materials have different densities.
2. The density of a material depends on the kind of particles it is made of and the way in which they are packed in the solid or liquid state.
3. When a material is made up of big particles, they will have a high mass.
4. A material with small particles will have a smaller mass.
5. It is easy to fit many particles of some materials into a small space. The particles of other materials might be too big and fewer will be able to fit into a certain space.
6. A material that has a lower density floats on a liquid with a higher density.
7. Less dense liquids float on top of denser liquids.

2. Explain this to the learners as follows:
   a. Some materials have a low density and some have a high density.
   b. The individual particles making up one material may have different masses, compared to the individual particles making up another material.
   c. The way in which particles are packed in a solid or liquid determines the size of the spaces between the particles, and the density of the solid or liquid.
   d. A material with a lower density will float on a liquid with a higher density. However, a material with a higher density than the liquid it is in, will sink.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What are the two factors that influence the density of a material?
b. When will a solid float on a liquid?

Answers to the checkpoint questions are as follows:

a. The type of particles that the material is made of and the spaces between the particles
b. A solid will float on a liquid when its density is less than the density of the liquid.

E CONCEPTUAL DEVELOPMENT

1. This activity will be done in groups.
2. To do this activity, each group will need the following:
    - two small glass jars
    - one large glass jar
    - a container of water
    - a cup of cooking oil
    - a tablespoon of salt
    - A tablespoon of sugar
    - a quarter cup of methylated spirits
    - a quarter cup syrup
    - a quarter cup dishwashing liquid
    - a quarter cup amasi or milk
    - an iron nail, coin or key
    - a seed, peanut, dried bean
    - a piece of polystyrene (can be broken from a polystyrene tray)
3. Ensure that you have these materials prepared for each group before the lesson starts.
4. Tell the learners that they are going to be doing an investigation where they will be looking at the density of different materials.
5. Divide the learners into groups of six.
6. Write the following onto the chalkboard (always try to do this before the lesson starts):

PRACTICAL TASK

1. This practical task will be done in groups of 6.
2. Each group will be doing tasks to investigate density.
3. Each person in the group must participate in the investigation and complete the answers to the written activities in their workbooks.
4. Each group will need the following materials and equipment to do the investigation:
    - two small glass jars
    - one large glass jar
    - a container of water
    - a cup of cooking oil
    - a tablespoon of salt
    - A tablespoon of sugar
    - a quarter cup of methylated spirits
    - a quarter cup syrup
    - a quarter cup dishwashing liquid
    - a quarter cup amasi or milk
    - an iron nail, coin or key

- a seed, peanut, dried bean
- a piece of polystyrene

7. Read through the practical task with the learners.
8. Remind the learners that different materials will have different densities.
9. Tell the learners that today they are going to be conducting a practical task where they will be investigating the density of some solids and some liquids.
10. Have each group collect the equipment they will need (as listed on the board) for the task.
11. Write the following "Investigation method" onto the chalkboard:

METHOD

a. Pour the sugar into one of the small glass jars.
b. Pour the salt into the second small glass jar.
c. Pour a quarter cup of water into the big jar.
d. Pour a quarter cup of oil into the same jar as the water.

12. Read through the method with the learners.
13. Ask them if they have any questions.
14. Tell the learners they have 5 minutes to complete this task.
15. Supervise the learners whilst they complete the task and answer any questions that they may have.
16. After 5 minutes call the learners back to attention.
17. Tell the learners that they are now going to work together as a group to investigate density.
18. The following will need to be written on the chalkboard:

Task 1 (7 marks)

Look at the jars of salt and sugar first.

1. Which have the bigger crystals – the sugar or the salt?
2. Which of the two is more dense?
3. If you were to fill the jars, which jar would have the most particles, the sugar jar or the salt jar?
4. Give a reason for your answer.

Now look at the jar of oil and water.

1. What do you observe when looking at the jar?
2. Why is the oil floating on top of the water?
3. Which liquids molecules are more tightly packed together?

19. Read through task 1 with the learners.
20. Ask them if they have any questions.
21. Tell the learners they have 10 minutes to complete task 1 and to answer the questions in their workbooks

22. Supervise the learners whilst they complete the task and answer any questions that they may have.
23. After 15 minutes call the learners back to attention.
24. Tell the learners that they are now going to work together, as a group, to make a density column.
25. The following will need to be written on the chalkboard:

METHOD

a. You are going to pour equal amounts (a quarter cup or agreed measure) of each liquid into the large glass jar.
b. Start by pouring the syrup into the large glass jar.
c. Next pour the amasi (or milk) into the large glass jar.
d. Now pour the dishwashing liquid into the same jar.
e. Now pour a quarter cup of water into the jar.
f. Next pour a quarter cup of cooking oil into the jar.
g. Lastly add the methylated spirits.
h. Allow the jar to stand for a few minutes for the layers to form.
i. Now carefully drop the nail, the seed and the polystyrene into the jar.

26. Read through the method with the learners.
27. Ask them if they have any questions.
28. Tell the learners they have 8 minutes to complete this task.
29. Supervise the learners whilst they complete the task and answer any questions that they may have.
30. After 8 minutes call the learners back to attention.
31. The following will need to be written onto the chalkboard:

Task 2 (13 marks)

Looking at the large jar of liquid, answer the following:

1. Why have the liquids separated into layers?
2. How many layers can you see?
3. Which is the most dense liquid?
4. Which is the least dense liquid?
5. Which liquid has settled closest to the middle?
6. Which objects have dropped under the water layer?
7. What does this tell you about those objects?
8. Are any objects above the water layer?
9. What does that tell you about that object?
10. A variable is somehing you can change in an investigation. What variable did you keep the same in this investigation?
11. Which variable did you change in this activity?
12. Pour some more water into the jar. Allow it to settle for 2 minutes. What do you notice has happened?

32. Read through task 2 with the learners.
33. Ask the learners if they have any questions and answer as necessary.
34. Tell the learners they have 10 minutes to complete the written answers in their workbooks.
35. Supervise the learners as they complete the task and answer any questions they may have.
36. After 10 minutes call the learners to attention and have learners hand in their workbooks for assessment.
37. Learners must then tidy up investigation areas and hand back equipment.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	82-83
Top Class Natural Sciences	Particle model of matter	87-89
Via Africa Natural Sciences	Particle model of matter	83
Solutions for All Natural Science	Particle model of matter	105-109
Spot on Natural Sciences	Particle model of matter	78
Platinum Natural Sciences	Particle model of matter	102-105
Step-by-step	Particle model of matter	66
Natural Sciences	Particle model of matter	97
Sasol Inzalo Bk A	Particle model of matter	180-189

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=GzdRGOuNIFg (6min 04sec) [Density]
2. https://www.youtube.com/watch?v=B3kodeQnQvU (4min 0sec) [7-layer density - cool science experiment]

6 B

Term 2, Week 6, Lesson B
Lesson Title: Expansion of materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Expansion and contraction of materials
CAPS Page Number	44

Lesson Objectives

By the end of the lesson, learners will be able to:

- describe what happens to a material when it expands
- explain expansion in terms of the particle model of matter
- explain the difference between expansion and change of state.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 22: Expansion joint on bridge	
Resource 23: Hot iron rod	
Resource 24: Thermometers with different temperatures	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why does oil float on water?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Oil is less dense than water because there are more spaces between the oil particles.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

EXPANSION OF MATERIALS

1. Only when sufficient heat energy is added to a material will the material change state.
2. In general, solids, liquids and gases tend to expand when heated.
3. Expansion is an increase in the size of an object when the temperature is increased.
4. When a material is heated, the particles move faster and push further apart. The spaces between the particles get bigger and the material expands.
5. When a material expands, the size and number of particles do not change.

2. Explain this to the learners as follows:
   a. When a material is heated, it can either change state or expand.
   b. Sometimes materials become slightly larger when they are heated. We say they expand.
   c. The particles of solids, liquids and gases are in a constant state of motion.
   d. As a material is heated, the movement of the particles increases and they move further apart. Therefore the material expands.

e. The size and number of particles do not increase. Only the spaces between the particles increase.

3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What happens to a material when it is heated?
b. How do the particles change when a material expands?

Answers to the checkpoint questions are as follows:

a. The material expands.
b. The spaces between the particles increase, but the size and number of the particles stay the same.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
   a. Sometimes, when a material is heated, the heat energy is not sufficient for the material to change state. Instead, the material increases in size. We say the material expands.
   b. When we heat an iron rod in a fire, the rod expands but does not melt. The melting point of iron is 1 538 °C. Only when the fire has heated the iron rod to 1 528 °C will the iron start to melt. Show the learners Resource 23.
   c. The iron particles are vibrating in one place. When these particles gain energy, they vibrate more and move slightly further apart from each other to allow them to vibrate more.
   d. The forces of attraction between the particles can no longer hold them together as strongly.
   e. Although the iron particles still keep their orderly arrangement, the spaces between them increase.
   f. The iron particles do not change and the number of particles remains the same. Only the spaces between them change.
   g. The concrete and tar that roads are made of also expand when heated by the Sun. Therefore, expansion joints are put in the roads to allow for the roads to expand. Show the learners Resource 22. What will happen when expansion joints are not put in the ro ads?

   (Answer: The concrete or tar will expand but, because there is no space to expand, the concrete or tar particles will push each other upwards and the road surface will become uneven and may crack.)

TASK

1. Some solids expand more than others. Look at the table below.

Material	**How far a 100 m length of material will expand when the temperature is increased by 100 °C**
Brass	19 mm
Iron	12 mm
Steel	11 mm
Concrete	11 mm
Ordinary glass	11 mm
Ovenproof glass	3,5 mm

1.1. Which material expands the most?

1.2. Which material expands the least?

1.3. What is the best material to reinforce concrete with? Why do you say so?

1.4. A person used brass frames for the windows in his or her house but the glass keeps on falling out.

1.4.1. Why do you think this happens?

1.4.2. How can he or she solve this problem?

2. Look at the picture of four identical thermometers A, B, C and D on Resource 24. The liquid inside the thermometers is coloured ethanol, which has a boiling point of 78 °C.

2.1. Which thermometer shows the lowest temperature? What is the reading?

2.2. What does this reading tell you about the freezing point of the ethanol in the thermometer?

2.3. What is the difference in temperature between thermometers B and C?

2.4. In which thermometer are the spaces between the particles the largest?

2.5. Which thermometer has the most particles?

2.6. Why can we not use an ethanol thermometer to measure the boiling point of water, which is 100 °C?

3. Give the learners enough time to complete the task.
4. Give the answers to the learners.

1. Answer

1.1. The brass

1.2. The ovenproof glass

1.3. Steel is the best material to reinforce concrete with because it expands at the same rate as the concrete.

1.4. Answer

14.1. When the brass and glass are heated by the Sun, the brass expands more than the glass and therefore the glass falls out.

1.4.2. One can use steel for the frames because the steel and glass expand at the same rate.

2. Answer

2.1. Thermometer A. The reading is -18 °C.

2.2. The freezing point of the ethanol is lower than -18 °C, otherwise the liquid ethanol would have changed to a solid.

2.3. 23 - 7 = 16 °C

2.4. In thermometer D, because the ethanol expanded the most in this thermometer

2.5. All the thermometers have the same number of particles.

2.6. The boiling point of ethanol is 78 °C. At 100 °C the ethanol will be in a gas state and no reading will be possible.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Where do we find the concept of expansion in our everyday lives?
b. Do all materials expand the same?

Answers to the checkpoint questions are as follows:

a. Expansion joints, thermometers
b. No, different materials will expand differently.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	90-92
Via Africa Natural Sciences	Particle model of matter	86-87
Solutions for All Natural Science	Particle model of matter	110-112
Spot on Natural Sciences	Particle model of matter	82-83
Platinum Natural Sciences	Particle model of matter	106-109
Step-by-step	Particle model of matter	70-71
Natural Sciences	Particle model of matter	100-101
Sasol Inzalo Bk A	Particle model of matter	189-195

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=ne8oPFTM_AU (1min 06sec) [Ball and ring experiment]
2. https://www.youtube.com/watch?v=LmN8bybyQY8 (5min 52sec) [Examples of expansion]

6 C

Term 2, Week 6, Lesson C
Lesson Title: Contraction of materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Expansion and contraction of materials
CAPS Page Number	44

Lesson Objectives

By the end of the lesson, learners will be able to:

- describe what happens to a material when it contracts
- explain contraction in terms of the particle model of matter
- give examples of contraction in everyday life.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 22: Expansion joint on bridge	
Resource 24: Thermometers with different temperatures	
Boiling water, measuring jug	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why does a material expand when it is heated?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The particles of the material move more and the spaces between the particles increase.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CONTRACTION OF MATERIALS

1. Materials contract when they are cooled.
2. Contraction is a decrease in the size of an object when the temperature is decreased.
3. When a material is cooled, the particles move less and, as they move closer to each other, the space between them gets smaller.
4. When a material contracts, the size and number of particles does not change.
5. When materials contract, no state change takes place.

2. Explain this to the learners as follows:
   a. When a material is cooled, it contracts. The material becomes slightly smaller.
   b. The particles of solids, liquids and gases are in a constant state of motion.
   c. As a material is cooled, the movement of the particles decreases and they move closer together. Therefore the material contracts.
   d. The size and number of particles do not increase. Only the spaces between the particles decrease while the forces of attraction between the particles increase.

e. No change of state takes place during contraction. During contraction a material is not cooled enough for the particles to move too close to each other to start a change of state.

3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What happens to a material when it is cooled?
b. How does the particles change when a material contracts?

Answers to the checkpoint questions are as follows:

a. The material contracts.
b. The spaces between the particles decrease and they move closer together.

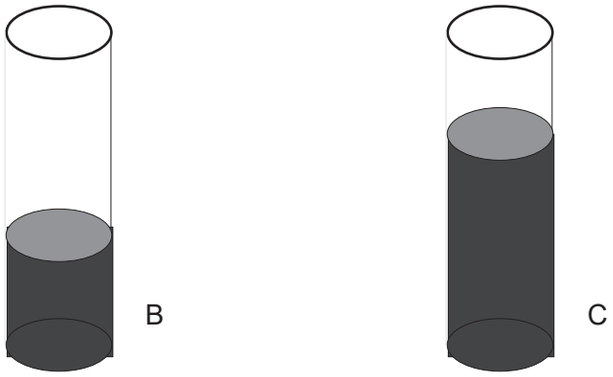
E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
   a. When a material loses energy, it decreases in size. We say the material contracts.
   b. When materials lose energy, such as when hot liquid water cools down, the movement of the particles slows down because they lose kinetic energy. This happens even in solids, although the solids still keep their orderly arrangement of particles and only move or vibrate less in the same place.
   c. Fill a measuring jug up to a certain level with boiling water. Write down the measurement on the chalkboard. Let the water cool and take the reading again. Ask the learners what they observe. *(Answer: The volume of water should decrease.)*
   d. The water particles do not have enough energy to slide energetically. The forces of attraction become stronger and the particles move closer together.
   e. Expansion joints in roads and bridges also have to compensate for the contraction of the concrete during cold nights or wintertime. Show learners Resource 22.
   f. A thermometer works on the principle of expansion and contraction. When a thermometer is put in cold water, the liquid in the thermometer will contract and drop in the tube of the thermometer.
2. Ask the learners to complete the following task in their workbooks. Show the learners Resource 24.

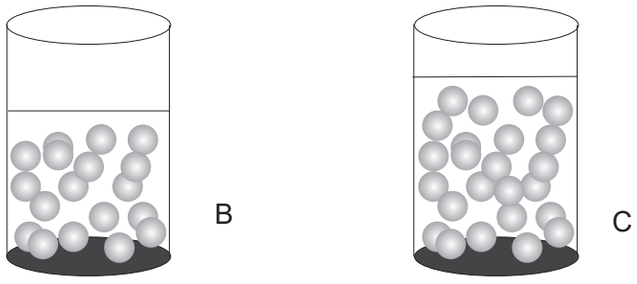
TASK

Look at the thermometers that the teacher is showing you. The same thermometer is used to measure the temperatures of different liquids. The different temperatures are shown in A, B, C and D.

- Draw the particles of the liquid in thermometers B and C.
- Simply draw the column of the thermometer.
- Represent the particles as circles. You can use bottle caps to make the circles.
- Remember, the particles of a liquid are not arranged in an orderly way and they touch each other.



3. Give the learners enough time to complete the task.
4. Let each learner stand up and show his/her diagram. Make sure that the number of particles in each thermometer stayed the same.



Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What happens to the volume of a liquid when it is cooled down?
b. Why does the liquid in a thermometer contract when put in cold water?

Answers to the checkpoint questions are as follows:

a. The volume of the liquid will decrease.
b. The particles lose energy, and move less and more closely to each other. The spaces between the particles decrease.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	90-92
Via Africa Natural Sciences	Particle model of matter	86-87
Solutions for All Natural Science	Particle model of matter	110-112
Spot on Natural Sciences	Particle model of matter	82-83
Platinum Natural Sciences	Particle model of matter	106-109
Step-by-step	Particle model of matter	70-71
Natural Sciences	Particle model of matter	100-101
Sasol Inzalo Bk A	Particle model of matter	189-195

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=ne8oPFTM_AU (1min 06sec) [Ball and ring experiment]
2. https://www.youtube.com/watch?v=LmN8bybyQY8 (5min 52sec) [Examples of expansion]

7 A

Term 2, Week 7, Lesson A
Lesson Title: Pressure of gases
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Pressure
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- define pressure
- apply the particle model of matter to explain pressure in gases
- describe the factors that influence the pressure of a gas.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	
3. Comparing	✓	8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 25: Gas particles in a closed container	
Tennis balls	Any other small balls
Aerosol cans, such as deodorant, hair spray, spray paint	Fire extinguisher

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Should a substance be heated or cooled for contraction to take place?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

A substance should be cooled for contraction to take place.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

PRESSURE

1. **Pressure** is an important property of a gas.
2. Pressure is the force that gas particles in a closed container exert on the sides of the container and other particles
3. Gases exert pressure in all directions.
4. Gases do not possess a definite shape or volume because the gas particles are free to move in any direction, until they collide with each other or an object.
5. Gas particles inside a closed container move around very quickly and collide more frequently with each other and the sides of the container.
6. The factors that influence the pressure of a gas are:
   a. the number of gas particles
   b. the temperature of the gas
   c. the volume of the container.

2. Show the learners Resource 25. Explain this to the learners as follows:
    a. Pressure is an important property of gas.
    b. A gas in a closed container exerts a pressure, because of the collisions of the particles with each other and against the container sides.
    c. Pressure is a measure of the force on a particular area.
    d. Every time a particle collides with the sides of a container, it exerts a **force** on that area.
    e. When there are more gas particles in a container, they collide more frequently with the sides of the container and this leads to a high pressure.
    f. When the temperature of gas particles is high, they move faster and collide more frequently with the sides of the container. This results in a high pressure.
    g. When the container is small, the gas particles do not have a lot of space to move in and they collide more with the sides of the container. The result is a high pressure.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is pressure?
b. What factors influence the pressure of a gas?

Answers to the checkpoint questions are as follows:

a. It is the force that gas particles exert on the sides of a container.
b. The factors that influence the pressure of a gas are: volume of the container, the temperature and the number of particles.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners. Have the tennis balls ready to explain the concept of pressure. If necessary, take the learners outside to demonstrate pressure using the tennis balls.
    a. Pressure is an important property of a gas.
    b. It is important to know what the pressure is in a car's tyres. Any aerosol can is filled with a gas that is under high pressure.
    c. Pressure really means the force that gas particles exert on a certain area of a surface.
    d. We know that gases do not possess a definite shape or volume. The reason for this is that gas particles move freely in a straight line. They can also move in all directions. They only change direction when they collide against each other and the sides of a container.

f. When gas particles hit a surface, they apply a force to it. This is what we call gas pressure.
g. Let learners throw the tennis balls at a wall. The wall then experiences a force and pressure exerted by the tennis balls.
h. More gas particles cause more collisions and therefore a high pressure is created.
i. Let the learners aim at a certain area on a wall and throw all the tennis balls at once at that area. The wall then experiences high pressure.
j. When a gas is at a high temperature the particles move at very high speeds, because they have more kinetic energy.
k. When learners throw the tennis balls at high speeds, the wall experiences increased pressure.

2. Ask the learners to complete the following task in their workbooks. First, explain and demonstrate the following:
   a. Show the learners examples of aerosol cans. Explain to learners that a fire extinguisher is made to contain gas under pressure.
   b. An aerosol can contain very small droplets of a liquid substance that is sealed with a gas in the container under pressure. The droplets are released with the gas as a spray through a valve or nozzle.
   c. Explain to the learners that the pressure of the gas inside an aerosol is very high. The high pressure is responsible for the release of the gas when the nozzle is operated.
   d. Read the part of the labels to the learners where the high pressure is mentioned.

TASK

Look at the aerosol cans that the teacher is showing you and answer the following questions in your workbook.

1. What is an aerosol can?
2. Give three examples of aerosol cans.
3. What does the label state regarding the pressure of the gas inside the container?
4. Why do the labels of many aerosol cans state, "Protect from sunlight and do not expose to temperatures exceeding 50 °C"?

3. Give the learners enough time to complete the task.
4. Give the answers to the learners.
5. Model Answer

1. *An aerosol can contains very small droplets of a liquid substance that is sealed in a metal container under pressure with a gas. The droplets are released with the gas as a spray through a valve or nozzle.*
2. *Answers will vary: deodorants, hair spray, paint spray, oven cleaner, 'spray-and-cook' aerosols.*

3. *A typical statement regarding pressure on a can is "Pressurised container" or "Container under pressure".*
4. *When a can is put in a warm place, the temperature and pressure of the gas inside the can will be high and the aerosol container may explode.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What happens when many gas particles collide with the surface of an object?
b. Will a gas on a cold day exert a high or a low pressure on a surface?

Answers to the checkpoint questions are as follows:

a. All the gas particles together will exert a great force on the surface and the pressure will be high.
b. The gas will exert a low pressure on a surface.The main joints are the shoulder, elbow, wrist, hip, knee, ankle.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	92-94
Via Africa Natural Sciences	Particle model of matter	88-89
Solutions for All Natural Science	Particle model of matter	112-116
Spot on Natural Sciences	Particle model of matter	84-86
Platinum Natural Sciences	Particle model of matter	110-114
Step-by-step	Particle model of matter	72
Natural Sciences	Particle model of matter	101-106
Sasol Inzalo Bk A	Particle model of matter	196-203

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=LVYLgm-TIRs (2min 09sec) [Aerosols]
2. https://www.youtube.com/watch?v=jmQ8FWnM0fA (4min 29sec) [Air pressure]

7 B

Term 2, Week 7, Lesson B
Lesson Title: Increasing pressure on gases
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Pressure
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- explain an increase in pressure in terms of the particle model of matter
- describe the ways in which the pressure of a gas can be increased
- apply an increase in pressure to everyday situations.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 26: Pressure and temperature	
Resource 27: Pressure and volume	
Resource 28: Pressure and number of particles	
Resource 29: Syringe	
Balloons, syringes	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is pressure in gases?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Pressure is the force that gas particles exert on a certain area.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

INCREASE IN PRESSURE

1. Pressure is the force that gas particles exert on the container it is in.
2. The force that gas particles exert while colliding against the sides of a container causes a pressure inside the container.
3. There are three ways to increase the pressure of a gas in a container:
   a. A decrease in the volume of a gas
   b. An increase in the number of gas particles
   c. An increase in the temperature of the gas.
4. In each case more collisions of the gas particles occur, which leads to an increase in pressure.

2. Explain this to the learners as follows:
    a. An increase in pressure occurs when there are more collisions of the gas particles with each other and the sides of the container. The reason for this is that the particles exert a greater force on the sides of the container.
    b. When more particles are put in a container, they will collide more often with the sides of a container. This will increase the pressure.
    c. When the temperature of a gas is increased, the particles have more energy and move faster. They collide more with each other and the sides of a container, and so increase the pressure.
    d. When the volume of a container is made smaller, the gas particles do not have enough space to move in and collide more frequently with each other and the sides of the container. The result is an increase in pressure.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What can we do to increase the pressure of a gas?
b. What can we do to increase the pressure of a gas?

Answers to the checkpoint questions are as follows:

a. We can decrease the volume of the gas.
b. We can increase the temperature of the gas or the amount of gas particles.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
    a. Show the learners Resource 26. The flask contains an enclosed gas that is submerged in water. The thermometer measures the temperature of the water. A pressure gauge is fitted on top of the flask and it measures the pressure of the gas in kilopascals (kPa).
    b. When the water is heated, the thermometer will rise and measure a higher temperature. The pressure gauge will show an increase in the pressure of the gas. What do you think the reading on the gauge will be? *[Answer: Any reading between 70 kPa and 100 kPa.]*
    c. If the gas is heated, the particles move faster as they gain more kinetic energy. They then collide with the inside of the container more often and with more force. This causes an increase in pressure.

d. When an aerosol can is heated, pressure builds up inside the can up to a point where the can might explode.

e. Show the learners Resource 27. When the volume of a gas in a piston is decreased, the pressure gauge, which is connected to the piston, will show an increase in pressure. Can you give the gauge reading for the large volume and the small volume? *[Answer: For the large volume the pressure is 20 kPa, and for the small volume the pressure is 130 kPa.]*

f. When a gas is squeezed into a smaller volume, the particles have less space to move. The gas particles will collide more often with each other and with the inside of the container.

g. When you pump a bicycle tyre, you increase the pressure and the volume of the tyre will increase.

h. Show the learners Resource 28. The person is trying to increase the pressure in the soccer ball by pumping more air into the ball.

i. More particles inside the ball mean more collisions with the inside of the ball and more collisions lead to a higher pressure. The ball will expand because the gas particles exert forces on the inside of the ball.

2. Ask the learners to complete the following investigation in their workbooks. They should work in groups. Hand out a balloon and syringe to each group. Tell the learners that the movable part of a syringe is called the plunger. Show them Resource 29.

INVESTIGATION

1. Blow up the balloon until it is the size of a mango. Do not tie a knot at the end. Keep the balloon closed by pressing the end with your fingers.
   a. What happened when you blew up the balloon?
   b. How can you increase the gas pressure in the balloon?
   c. How can you increase the amount of gas particles in the balloon?
   d. Try to blow up the balloon until it is the size of a melon but not bursting. Why does it become difficult to blow up the balloon now?
   e. What happens when the balloon pops? (Do not attempt to do this. It is dangerous.)
   f. What do you conclude from the investigation?
2. Take the syringe.
   a. Pull the plunger of the syringe out until the black stopper is at a certain number. Do not pull out the plunger completely. Use your finger to close the small opening of the syringe.
   b. Do you think there is gas pressure inside the syringe? Why do you say so?
   c. Keeping your finger at the opening of the syringe, push the plunger in until it cannot go any further. Record the number at which the stopper of the plunger is now.

d. Why can you not push the plunger any further?
e. Let each member of your group repeat steps 2.1 and 2.3.
f. What do you conclude from the investigation?

3. Give the learners enough time to complete the investigation.
4. Discuss the answers with the learners.
5. Model Answer

1. Answer

a. The balloon is filled with gas and becomes bigger.
b. You can increase the gas particles in the balloon.
c. You can blow up the balloon further.
d. The bigger the balloon, the higher the pressure in the balloon.
e. The pressure in the balloon becomes too high. The particles exert such a great force against the inside of the balloon that the balloon bursts.
f. The pressure in the balloon is increased when more gas particles are blown into the balloon. More gas particles exert a greater force on the inside of the balloon and the balloon becomes bigger.

2. Answer

a. Let the learners record the number to which they pulled out the syringe, for example, 2,5 ml as on Resource 29.
b. Yes, there is a pressure inside the syringe because there are gas particles in the syringe that collide with each other and the inside of the syringe.
c. A reading might be 1 ml.
d. There is a high pressure in the syringe, which is pushing against the stopper of the plunger and preventing it from moving any further.
e. Let each learner obtain two readings.
f. When the plunger is pushed in, the volume in the syringe becomes smaller. The particles collide more with the inside of the syringe and the pressure increases.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How can you increase the pressure in an aerosol can?
b. How can you increase the pressure in a car tyre?

Answers to the checkpoint questions are as follows:

a. You can heat the can.
b. You can add gas particles by pumping air into the tyre.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	92-94
Via Africa Natural Sciences	Particle model of matter	88-89
Solutions for All Natural Science	Particle model of matter	112-116
Spot on Natural Sciences	Particle model of matter	84-86
Platinum Natural Sciences	Particle model of matter	110-114
Step-by-step	Particle model of matter	72
Natural Sciences	Particle model of matter	101-106
Sasol Inzalo Bk A	Particle model of matter	196-203

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=t-Iz414g-ro (1min 05sec) [Gas volume and pressure]
2. https://www.stevespanglerscience.com › Home › Experiments (0min 59sec) [Air pressure can crusher]

7 C

Term 2, Week 7, Lesson C
Lesson Title: Decreasing pressure on gases
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Pressure
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- explain a decrease in pressure in terms of the particle model of matter
- describe the ways in which the pressure of a gas can be decreased
- apply a decrease in pressure to everyday situations.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	✓
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 26: Pressure and temperature	
Resource 27: Pressure and volume	
Resource 30: Bicycle with flat tyre	
Empty plastic bottle with lid	
Balloon, big glass bowl or beaker, ice water	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How can the pressure of a gas in a container be increased?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Gas pressure can be increased by increasing the number of gas particles, increasing the temperature or decreasing the volume.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

DECREASE IN PRESSURE

1. Pressure is the force that gas particles exert on the container it is in.
2. The force that gas particles exert while colliding against the sides of a container causes a pressure inside the container.
3. There are three ways to decrease the pressure of a gas in a container:
   a. An increase in the volume of a gas
   b. A decrease in the number of gas particles
   c. A decrease in the temperature of the gas.
4. In each case more collisions of the gas particles occur, which leads to an increase in pressure.

2. Explain this to the learners as follows:
    a. A decrease in pressure occurs when there are fewer collisions of the gas particles with each other and the sides of the container. The reason for this is that the particles exert a smaller force on the sides of the container.
    b. When particles are removed from a container, they will collide less frequently with the sides of a container. This will decrease the pressure.
    c. When the temperature of a gas is decreased, the particles have less energy and move more slowly. They collide less frequently with the sides of a container and decrease the pressure.
    d. When the volume of a container is increased, the gas particles have enough space to move freely and collide less frequently with each other and the sides of the container. The result is a decrease in pressure.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What must we do to decrease the pressure of a gas?
b. What must we do to increase the pressure of a gas?

Answers to the checkpoint questions are as follows:

a. We can decrease the number of gas particles or temperature of the gas.
b. We can increase the volume of the gas.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
    a. Show the learners Resource 26. The flask contains an enclosed gas that is submerged in water. The thermometer measures the temperature of the water. A pressure gauge is fitted on top of the flask and measures the pressure of the gas in kilopascals (kPa).
    b. When ice cubes are put in the water, the thermometer will drop and measure a lower temperature. The pressure gauge will show a decrease in the pressure of the gas. What do you think the reading on the gauge will be? *[Answer: Any reading between 10 kPa and 50 kPa.]*
    c. If the gas is cooled the particles move more slowly as they lose kinetic energy. This means they will collide less often with the inside of the container and with less force. This causes a decrease in pressure.

d. Remove the lid from the plastic bottle and put it aside. Close the bottle and put it in a freezer. The bottle will collapse in on itself. When the gas in the bottle has been cooled, the pressure decreased. The force of the gas particles on the inside of the bottle decreased.

e. Show the learners Resource 27. When the volume of a gas in a piston is increased, the pressure gauge, which is connected to the piston, will show a decrease in pressure. Can you give the gauge reading for the large volume and the small volume? [Answer: For the large volume the pressure is 20 kPa and for the small volume the pressure is 130 kPa.]

f. When the volume of a container with gas is increased, the particles have more space to move. The gas particles will collide less often with each other and with the inside of the container.

g. When air is let out of a balloon, the pressure inside the balloon decreases and the volume of the balloon decreases.

h. When air is let out of a balloon, there are fewer gas particles inside the balloon.

i. Fewer particles inside the balloon means fewer collisions with the inside of the balloon. This results in a lower pressure. The balloon will contract because the force that the gas particles exert on the inside of the balloon is less. Ask the learners to complete the following investigation in their workbooks. They should work in groups. Hand out a balloon and syringe to each group. Tell the learners that the movable part of a syringe is called the plunger. Show them Resource 29.

2. Ask the learners to complete the following task in their workbooks.

a. First, do the demonstration and then let them answer question 1. Blow up the balloon and fill the bowl with ice water. Put the balloon in the ice water for one minute, turning it so that it cools evenly.

b. Show the learners Resource 30 for question 2.

TASK

1. Answer the following questions about the balloon investigation.
   a. What did you observe when the balloon was put in the ice water?
   b. What happened to the pressure in the balloon?
   c. Using the particle model of matter, can you give a reason as to why the pressure changed?
2. Look at the picture that the teacher is showing you and answer the following questions:
   a. How do you think the tyre of the bicycle became flat?
   b. What happened to the pressure of the gas inside the tyre?
   c. How did the pressure of the tyre change?

3. Give the learners enough time to complete the task.
4. Discuss the answers with the learners.

MODEL ANSWER

1. *Answer*
   a. *The balloon became smaller and shrank.*
   b. *The pressure in the balloon decreased.*
   c. *When the temperature of the gas decreased, the particles moved less often. Therefore, they collided less often and with less force against the sides of the balloon.*
2. *Answer*
   a. *The bicycle might have received a puncture from a sharp object, such as a thorn or nail.*
   b. *The pressure inside the tyre decreased.*
   c. *The pressure of the tyre changed because there were not enough particles moving around inside. A flat tyre resulted as there were not enough collisions between the gas particles and the inside wall of the tyre. The result was that the inside wall was not pushed outwards strongly enough.*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How can you decrease the pressure in a plastic bottle?
b. How can you decrease the pressure in a bicycle tyre?

Answers to the checkpoint questions are as follows:

a. You can cool the plastic bottle in the freezer.
b. You can make a hole in the tyre so that the gas particles can escape or you can open the tyre's valve to let air out.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	92-94
Via Africa Natural Sciences	Particle model of matter	88-89
Solutions for All Natural Science	Particle model of matter	112-116
Spot on Natural Sciences	Particle model of matter	84-86
Platinum Natural Sciences	Particle model of matter	110-114
Step-by-step	Particle model of matter	72
Natural Sciences	Particle model of matter	101-106
Sasol Inzalo Bk A	Particle model of matter	196-203

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.stevespanglerscience.com › Home › Experiments (0min 59sec) [Air pressure can crush]

TOPIC OVERVIEW:
Chemical reactions
Term 2, Weeks 8A – 8C

A. TOPIC OVERVIEW

- This topic runs for 1 weeks.
- It is presented over 3 lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• N/A	• Substances can react with each other to form products with different properties • The substances that react with one another are called reactants • The substances that are produced are called products • In reactions, re-arrangement of the atoms takes place • During a chemical reaction, chemical bonds of the reactants break and new bonds form to produce products • Indigenous knowledge includes useful chemical reactions, such as fementation	• Some metals react with oxygen during burning • Rusting is a slow chemical reaction of iron metal with oxygen and moisture to form iron oxide • Non-metals react with oxygen to form non-metal oxide • Acids and bases react together. We call this a neutralisation reaction • When metals react with oxygen, they tend to form oxides • When metals react with water they tend to form metal hydroxides

		• Acids react with metal carbonates to form salt, water and carbon dioxide

C. SCIENTIFIC VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	physical change	A physical change occurs when the physical properties of a material change but the material does not lose its identity.
2.	chemical change	A chemical change occurs when materials react to form a new material with different properties to the initial materials.
3.	reactant	A reactant is a substance that takes part in a chemical reaction and undergoes change.
4.	product	A product is a substance that is produced after a chemical reaction has taken place
5.	chemical reaction	A chemical reaction occurs when substances react to form new substances
6.	chemical equation	A chemical equation is a symbolic method that is used to represent chemical reactions.
7.	base	The main part of the substance
8.	chemical bond	A force that holds atoms together
9.	combustion reaction	A chemical reaction that takes place when a fuel reacts with oxygen to produce energy
10.	electrolysis	Electrolysis is the process of passing an electric current through a substance in order to produce chemical changes in the substance.
11.	diatomic (molecule)	A molecule that is composed of two atoms
12.	fermentation	Fermentation is a chemical reaction in which alcohol is produced from sugars.
13.	neutralisation reaction	A neutralisation reaction takes place when an acid and a base react to neutralise each other.
14.	base	A substance with a soapy feel and bitter taste
15.	acid	A substance with a stingy taste and a corrosive feel

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Learners will learn about chemical reactions in which reactants react to form products with different properties. A chemical equation can be used to represent a chemical reaction. They will also understand that the bonds of the reactants are broken and new bonds are formed, which are the products. Lastly, they will learn about useful chemical reactions, such as fermentation and combustion.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

8 A

Term 2, Week 8, Lesson A
Lesson Title: Introducing chemical reactions
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Reactants and products
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- distinguish between a physical and chemical change
- define a chemical reaction
- identify the reactants and products of a chemical reaction
- write a chemical equation for a chemical reaction.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 5: Electrolysis of copper chloride	
Resource 19: Different states of water molecules	
Resource 31: Modelling clay	
Resource 32: Fireworks	
Bicarbonate of soda, vinegar	
Iron filings, sulfur, glass test tube, candle, matches	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How can the pressure of a gas in a container be decreased?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

Gas pressure can be decreased by decreasing the number of gas particles, decreasing the temperature or increasing the volume of the container.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CHEMICAL REACTIONS

1. A **physical change** occurs when the physical properties of a material change but the material does not lose its identity.
2. A **chemical change** occurs when materials react to form a new material with different properties to the initial materials.
3. A physical change is easily reversible while a chemical change is not easily reversible.
4. During a **chemical reaction** substances react to form new substances with different chemical properties.
5. The **reactants** are the substances that take part in a chemical reaction and are changed.

6. In a chemical reaction the substances that are produced are called the **products**.
7. Reactants and products have different chemical properties.
8. Chemical reactions can be represented by using **chemical equations**.
9. Reactants → Products
10. There are many signs that indicate that a chemical reaction has taken place. They include a colour change, fizzing or a gain or release of energy.

2. Explain this to the learners as follows:
   a. A physical change does not cause any change in the chemical composition of a substance. It is easily reversible. Show the learners Resource 31. Modeling clay is an example of a physical change
   b. During a chemical change, substances react to form completely new and different substances, which have different properties to the substances that reacted together. It is not easily reversible. Show the learners Resource 32. Fireworks is an example of a chemical change.
   c. A chemical reaction causes a chemical change because substances react to form new substances with different properties.
   d. Reactants are the elements and compounds that participate in a chemical reaction and react with each other.
   e. Products are the elements and compounds that are formed as a result of a chemical reaction. The properties of products are different from the properties of the reactants.
   f. We can represent chemical reactions using equations. The reactants are always placed on the left-hand side of the arrow. The products are placed on the right-hand side of the arrow.
   g. A chemical reaction can easily be observed. Add vinegar to bicarbonate of soda and ask the learners what they observe.
   [Answer: The bicarbonate of soda starts to fizz, which indicates that the vinegar is reacting with the bicarbonate of soda and a gas (carbon dioxide) is released.]
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a difference between physical change and chemical change?
b. What do we call the substances that react during a chemical reaction?

Answers to the checkpoint questions are as follows:

a. During a physical change no new substances are formed while a chemical change results in new substances with new properties.
b. Reactants.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
   a. When we change the state of a substance or its density, we are causing a physical change. Expansion and contraction are also examples of physical change.
   b. During a physical change the chemical properties of the substances does not change. This means that no new substances are formed. The atoms or molecules stay exactly the same. Show the learners Resource 19. Do you notice any change in the molecules of water?

      [Answer: No. Each state contains water molecules.]
   c. When a chemical reaction takes place, reactants are changed into new substances called products.
   d. **Electrolysis** is an example of a chemical change. During electrolysis an electric current is passed through a substance in order to produce chemical changes in the substance. So, during electrolysis copper chloride is decomposed into copper and chlorine gas. The copper chloride is a blue powder that dissolves in water, while the copper is a brown metal and chlorine is a yellow gas. New substances have been formed.
   d. The reactant is the copper chloride solution and the products are the copper metal and chlorine gas.
   e. We can write the chemical reaction as a chemical equation.
      Word equation: copper chloride → copper + chlorine
      Symbol equation: $CuCl_2 \rightarrow Cu + Cl_2$
   f. A chemical equation is different from a mathematical equation. Let us consider the reaction between magnesium and oxygen to produce magnesium oxide,

      $$2Mg + O_2 \rightarrow 2MgO$$

      The plus sign in the chemical equation indicates that the reactants, magnesium and oxygen, are reacting together and the arrow indicates that the product magnesium oxide is the result.
2. Ask the learners to complete the following task in their workbooks. Before the learners do question 3, you will have to demonstrate the reaction of iron with sulfur.
   a. Mix a teaspoon of iron filings with a teaspoon of sulfur in a test tube.
   b. Ask the learners to answer questions 3.1 and 3.2.
   c. Light the candle and heat the test tube evenly with the candle. Let the learners observe what happens.
   d. Ask the learners to answer questions 3.3 and 3.4.

TASK

1. Identify the following as physical change or chemical change:
   a. Melting butter
   b. Crushing ice
   c. Electrolysis of water
   d. Cutting paper
   e. Burning wood
   f. Rusting of an iron gate.
2. Identify the reactants and the products in the following chemical reactions:
   a. Hydrogen gas and oxygen gas react to form water.
   b. A chemical reaction occurs when you test for carbon dioxide by blowing through a straw into clear limewater. The limewater becomes milky because of the formation of carbon carbonate in the water.
3. Look at the demonstration that the teacher did with the iron (Fe) and sulfur (S). Now answer the following questions:
   a. Is the mixing of the iron and sulfur a physical change or a chemical change?
   b. Did the properties of the iron and sulfur stay the same or did they change?
   c. A chemical change occurred when the mixture was heated and iron sulfide (FeS) was formed. What proof is there that a chemical reaction took place?
   d. Write a chemical equation for the reaction.

3. Give the learners enough time to complete the task.
4. Model answers

1. Identify the following as physical change or chemical change:
   a. Physical change
   b. Physical change
   c. Chemical change
   d. Physical change
   e. Chemical change
   f. Chemical change
2. Identify the reactants and the products in the following chemical reactions:
   a. Hydrogen gas and oxygen as are the reactants and the water is the product.
   b. The carbon dioxide and the limewater are the reactants and the calcium carbonate and water are the products.

3. Look at the demonstration that the teacher did with the iron (Fe) and sulfur (S). Now answer the following questions:
   a. A physical change
   b. The properties of the sulfur and iron stayed the same. One can still see the iron and yellow sulfur.
   c. There was a colour change and a new substance was formed.
   d. $Fe + S \rightarrow FeS$

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is the evaporation of water a physical or a chemical change?
b. Does a chemical reaction take place when milk turns sour?

Answers to the checkpoint questions are as follows:

a. It is a physical change.
b. Yes, and a new substance is formed.

5. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Particle model of matter	86-87
Top Class Natural Sciences	Particle model of matter	92-94
Via Africa Natural Sciences	Particle model of matter	88-89
Solutions for All Natural Science	Particle model of matter	112-116
Spot on Natural Sciences	Particle model of matter	84-86
Platinum Natural Sciences	Particle model of matter	110-114
Step-by-step	Particle model of matter	72
Natural Sciences	Particle model of matter	101-106
Sasol Inzalo Bk A	Particle model of matter	196-203

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=0Bt6RPP2ANI (13min 10sec) [The 10 most amazing chemical reactions]

8 B

Term 2, Week 8, Lesson B
Lesson Title: Mechanism of chemical reactions
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Reactants and products
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- understand that atoms are conserved in a chemical reaction
- explain how atoms are rearranged in a chemical reaction to form new bonds
- use a model to represent a chemical reaction.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 33: The synthesis of water	
Resource 34: The decomposition of mercury(II) oxide	
Resource 35: The synthesis of ammonia	
Beads, dried peas, beans	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

> Is the boiling of water a physical change or a chemical change?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

> *Physical change.*

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

> THE MECHANISM OF CHEMICAL REACTIONS
>
> 1. Everything around us is made up of tiny particles called atoms.
> 2. Atoms are joined together in a chemical reaction with a force that is called a **chemical bond.**
> 3. During a chemical reaction atoms are conserved. This means that atoms are not created or destroyed. They are just rearranged.
> 4. When reactants react with each other, bonds are broken and new bonds are formed.
> 5. Energy, such as heat energy or electrical energy, is needed to break the bonds of the reactants.

2. Explain this to the learners as follows:
   a. Atoms are the building blocks of all matter.
   b. Atoms can combine in various ways to form many compounds.
   c. Atoms are kept together in a molecule by a strong attraction force called a chemical bond.

d. Atoms cannot be created or destroyed. They are conserved during a chemical reaction.
e. During a chemical reaction, the bonds between the atoms of the reactants are broken and new bonds are formed to produce the products.
f. Energy is needed to break the bonds between atoms.

3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What does it mean when we say that atoms are conserved in a chemical reaction?
b. What do we call the force between atoms in a bond?

Answers to the checkpoint questions are as follows:

a. Atoms are not created or destroyed in the chemical reaction.
b. A chemical bond.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners. Show the learners Resource 31.
   a. Hydrogen gas and oxygen gas are elements that consist of **diatomic** (composed of two atoms) molecules.
   b. When energy is added to the mixture of hydrogen gas and oxygen gas, the bonds between the hydrogen atoms and oxygen atoms in the diatomic molecules will be broken.
   c. The hydrogen atoms and oxygen atoms will rearrange themselves and new bonds will be formed between two hydrogen atoms and one oxygen atom to form a water molecule. We say that the compound water has been formed.
   d. The hydrogen atoms and oxygen atoms are held together by a chemical bond.
   e. The hydrogen and oxygen atoms that appear on the left-hand side also appear on the right-hand side. They are just rearranged.
   f. The number of hydrogen atoms and oxygen atoms has been conserved.

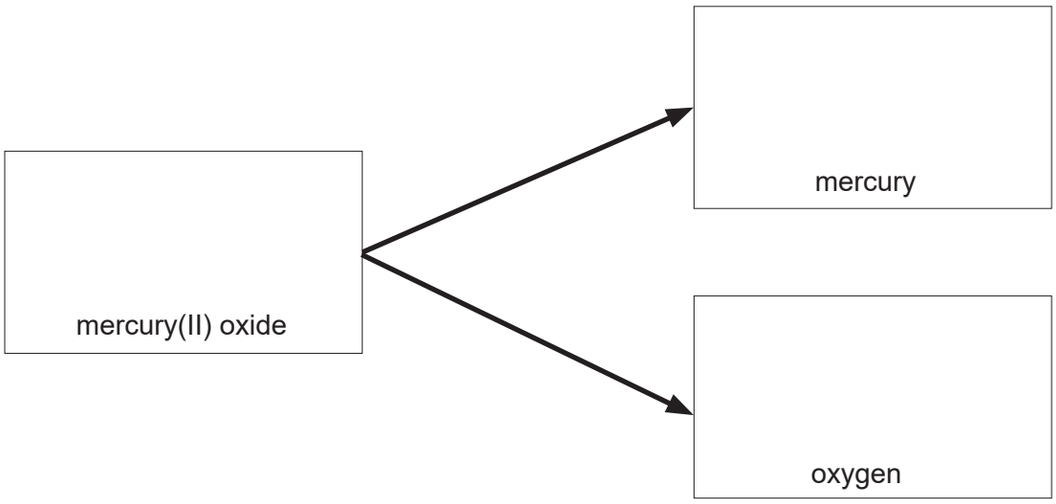
Element atoms	Number of atoms in reactants	Number of atoms in products
Hydrogen (H)	4	4
Oxygen (O)	2	2

   g. The number and type of molecules have not been conserved. On the left-hand side there are three molecules, which are hydrogen and oxygen molecules, while on the right-hand side there are two molecules, which are water molecules.

2. Ask the learners to complete the following task in their workbooks. Hand out the beads, dried peas or beans to the learners. They should have two types of particles, such as peas and beans, to show the different atoms in the reactions. Show the learners Resource 34 for question 1 and Resource 35 for question 2.

TASK

1. The page that the teacher is showing you is an experiment to decompose mercury(II) oxide (HgO) into its elements, mercury (Hg) and oxygen (O_2) gas. When the mercury(II) oxide is heated, mercury drops are formed on the inside of the test tube and oxygen gas is collected in the test tube over water. Draw the following boxes and use the beads/ dried peas/ beans to show how the bonds between the atoms are broken and how they are rearranged to form the products. Make sure that the atoms are conserved.



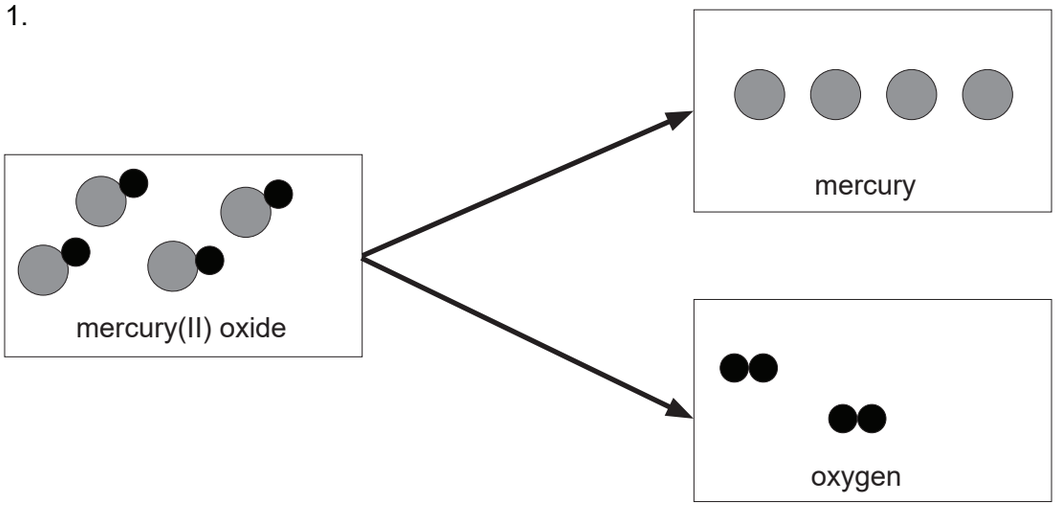
2. Look at the diagram that the teacher is showing you. Hydrogen gas reacts with nitrogen gas to form ammonia molecules. Complete the following table to prove that the number and type of atoms are conserved in the chemical reaction. The grey circles are the nitrogen atoms and the white circles are the hydrogen atoms

Element atoms	Number of atoms in reactants	Number of atoms in products
Hydrogen (H)		
Oxygen (O)		

3. Give the learners enough time to complete the task.
4. Let the learners show their arrangement of the atoms in question 1 to the rest of the class. They could make the atoms and molecules in any ratio according to the example below.

5. Model Answers

1.



2.

Element atoms	*Number of atoms in reactants*	*Number of atoms in products*
Hydrogen (H)	*18*	*18*
Oxygen (O)	*6*	*6*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is not conserved during a chemical reaction?

b. How are new bonds formed to produce the products?

Answers to the checkpoint questions are as follows:

a. The type and number of molecules are not conserved.

b. The atoms rearrange themselves and form new bonds.

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Chemical reactions	91
Top Class Natural Sciences	Chemical reactions	97
Via Africa Natural Sciences	Chemical reactions	92
Solutions for All Natural Science	Chemical reactions	119-120
Spot on Natural Sciences	Chemical reactions	89
Platinum Natural Sciences	Chemical reactions	116-118, 120
Step-by-step	Chemical reactions	73-74
Natural Sciences	Chemical reactions	109
Sasol Inzalo Bk A	Chemical reactions	113

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=_OUHaz3pFII (19min 22sec) [Particle diagrams of reaction types]

8 C

Term 2, Week 8, Lesson C
Lesson Title: Applications of chemical reactions
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Reactants and products
CAPS Page Number	45

Lesson Objectives

By the end of the lesson, learners will be able to:

- list useful chemical reactions in everyday life
- explain fermentation, neutralisation and combustion
- investigate a neutralisation reaction.

Specific Aims	1. DOING SCIENCE	✓
	2. UNDERSTANDING + CONNECTING IDEAS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicing		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing	✓	14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	✓

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 36: Strawberry wine fermentation	
Resource 37: Egg without a shell	
Resource 38: Reaction of bicarbonate of soda and vinegar	
Resource 39: Burning ethanol	
Resource 40: Magnesium burning in air	
Raw eggs, vinegar, beaker	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is conserved during a chemical reaction?

3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

The number and type of atoms are conserved during a chemical reaction.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CHEMICAL REACTIONS

1. Chemical reactions are useful.
2. A **neutralisation reaction** is the reaction between an **acid** and a **base**. The acid and base neutralise each other.
3. A **fermentation reaction** takes place when the reaction between sugar and yeast produces alcohol and carbon dioxide.
4. Yeast is a micro-organism.
5. A **combustion reaction** takes place when a fuel burns in oxygen. The fuel reacts with the oxygen.
6. The products of a combustion reaction with a fuel are always carbon dioxide and water.
7. A combustion reaction releases a lot of energy.
8. Substances, such as metals and non-metals, can also burn in oxygen. The product is called a metal oxide or non-metal oxide.

2. Explain this to the learners as follows:
    a. Useful chemical reactions happen around us all the time.
    b. When an acid and a base react, they neutralise each other. We call the reaction a neutralisation reaction.
    c. During a fermentation process, a micro-organism, yeast, reacts with sugar to produce an alcohol and carbon dioxide.
    d. When a fuel burns, it reacts with the oxygen in the air. The products are carbon dioxide and water. We say the fuel combusts in oxygen.
    e. During a combustion reaction, a lot of energy is released.
    f. When a metal or non-metal reacts with oxygen, a metal oxide or non-metal oxide is formed.
3. Read through the information written on the chalkboard with the learners.
4. Ask the learners if they have any questions.
5. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What do we call the type of reaction where yeast and sugar is involved?
b. What do we call the type of reaction where a fuel reacts with oxygen?

Answers to the checkpoint questions are as follows:

a. Fermentation
b. Combustion reaction

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners.
    a. During fermentation, yeast, which is a micro-organism, breaks down sugar. Alcohol and carbon dioxide are formed. Show the learners Resource 36. The bubbles on top of the strawberry wine are the carbon dioxide that is formed.
    b. The word equation for fermentation is:
    sugar (glucose) + yeast $\rightarrow$ ethanol (alcohol) + carbon dioxide
    c. In Xhosa, umqombothi is a beer made from maize, yeast and water while Mahewu is a traditional Zulu fermented drink prepared from soft mielie meal porridge. Grapes are fermented to make wine.
    d. A base can be used to neutralise stomach acid during a neutralisation reaction. Stomach acid is hydrochloric acid (HCl).
    e. ENO is a fizzy tablet that contains a base, called sodium carbonate (Na_2CO_3), which a person can take to neutralise stomach acid. Milk of Magnesia also contains a base, magnesium hydroxide ($Mg(OH)_2$, which can neutralise the hydrochloric acid in the stomach.

f. The reaction of bicarbonate of soda and vinegar is a neutralisation reaction. Carbon dioxide is one of the products. Show the learners Resource 38. The bubbles are the carbon dioxide gas.

g. Ethanol is a fuel that burns in oxygen. The products of the combustion reaction are carbon dioxide and water. Cars are being made that can run on ethanol instead of petrol. Show the learners Resource 39.

h. The word equation for a combustion reaction is:
fuel + oxygen → carbon dioxide + water

i. When a magnesium ribbon is placed in a flame, the magnesium starts to burn. It reacts with the oxygen in the air and magnesium oxide is formed. Show the learners Resource 40.

2. Ask the learners to complete the following investigation in their workbooks. This is group work. Hand out one raw egg, beaker and 250 ml vinegar to each group. You can show the learners Resource 37, if the experiment takes too long.

INVESTIGATION

In this activity you will dissolve an eggshell during a chemical reaction. The chemical reaction is:
calcium carbonate (eggshell) + acetic acid (vinegar) → calcium acetate + carbon dioxide + water

What you need:

a raw egg

250 ml vinegar

a beaker.

What you have to do:

Put the egg in a beaker with vinegar and make sure that the egg is completely covered. Leave the egg overnight or for a day or two.

Answer the following questions:

a. What do you observe after a few minutes?

b. Name the gas that is formed.

c. What do you observe after a day or two?

d. Is it correct to say that the eggshell dissolved in the vinegar?

e. What type of reaction is this?

f. Can you name the reactants of the reaction?

g. Can you name the products of the reaction?

3. Give the learners enough time to complete the task.
4. Give the answers to the learners.
5. Model answers

a. Little bubbles formed on the eggshell.

b. Carbon dioxide

c. The egg did not have a shell anymore.

d. No. The eggshell reacted with the vinegar during a chemical reaction and new substances (products) were formed.

e. It is a neutralisation reaction.

f. Calcium carbonate and acetic acid

g. Calcium acetate, carbon dioxide and water

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is the word equation for fermentation?
b. What are the products of a combustion reaction?

Answers to the checkpoint questions are as follows:

a. sugar (glucose) + yeast → ethanol (alcohol) + carbon dioxide
b. Carbon dioxide and water

6. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Successful Natural Sciences	Chemical reactions	93-95
Top Class Natural Sciences	Chemical reactions	97-98
Via Africa Natural Sciences	Chemical reactions	92-93
Solutions for All Natural Science	Chemical reactions	121-122
Spot on Natural Sciences	Chemical reactions	93-95
Platinum Natural Sciences	Chemical reactions	118-119
Step-by-step	Chemical reactions	74-75
Natural Sciences	Chemical reactions	112-116
Sasol Inzalo Bk A	Chemical reactions	214-216

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=VOY7o_pvkhU (5min 07sec) [Baking soda and vinegar bottle rocket]
2. https://www.youtube.com/watch?v=nmRSQQuaJNk (2min 48sec) [Baking soda and vinegar volcano]
3. https://www.youtube.com/watch?v=5MDH92VxPEQ (1 min 57sec) [Steel wool burning in air]

NATURAL SCIENCES

ASSESSMENT

GRADE 8 TERM 2

GRADE 8 ASSESSMENT

- This section presents the CAPS assessment requirements for this grade for this term.
- See your prescribed textbooks for examples of the required assessments.
- An example of a practical task and an exam have been included. See your textbook and departmental resources for policy compliant tests.

CAPS Assessment

Assessment is a continuous planned process that involves identifying, gathering, interpreting and diagnosing information about the performance of learners.

Assessment involves generating and collecting evidence of learner achievement and progress, and using this information to understand and provide assistance to the learner during the process of teaching and learning.

Assessment should be both *formal* and *informal*:

a. ***Informal Assessment*** involves regular checking of learners' class work and practical tasks; asking questions; discussions; informal classroom interactions; and giving constructive feedback. Informal assessment marks do not need to be recorded, but the teacher can make notes for future reference.

b. ***Formal Assessment*** provides teachers with a systematic way of evaluating how well learners are progressing. Formal Assessment consists of selected assessment tasks. These tasks are stipulated by CAPS and the marks need to be recorded. These tasks are done throughout the year, and include practical / investigations, project, tests and examinations.

   i. ***Tests and Examinations***

      The weighting of the marks should reflect the time allocated to each section in the curriculum content. Tests and exams should consist of a range of questions that cover different cognitive levels: recall; understanding; application; evaluation; analysis; and synthesis. CAPS aligned tests and examinations, with accompanying memoranda, are provided with these lesson plans.

   ii. ***Practical / investigation tasks***

      Practical / investigation tasks give learners the opportunity to demonstrate knowledge, skills and understanding. They form part of the activities included in these lesson plans. Each term, one practical / investigation task has been selected for assessment. A rubric is provided to conduct the assessment.

   iii. ***Project***

      Projects give learners the opportunity to demonstrate knowledge, skills, understanding and application. The project can be given in any term but must be recorded for term 4 assessment.

A minimum mark allocation is prescribed in CAPS for, practical / investigation projects, tests and examinations for each grade. These are summarised, by grade, in the table below:

Grade 8							
Programme of Formal Assessment							
	Term 1		**Term 2**		**Term 3**		**Term 4**
Form of Assessment	Practical task/ Investigation	Test	Practical task/ Investigation	Examination	Project	Test	Examination
Tools of Assessment	Rubric/memo/ checklist	Memo	Rubric/memo/ checklist	Memo	Rubric/memo/ checklist	Memo	Memo
Minimum Marks	**20**	**60**	**20**	**90**	**30**	**60**	**90**
Maximum Time Allocation	Dependent on nature of the task and context	90 minutes	Dependent on nature of the task and context	120 minutes	Dependent on nature of the task and context	90 minutes	120 minutes
Content and skills focus	Term 1	Term 1	Term 1	Terms 1 & 2	Any content for the year	Term 3	Terms 3 & 4
No. of Tasks	**2**		**2**		**2**		**1**

PRACTICAL TASK - INTRODUCTION

NS
GRADE 8
PRACTICAL TASK
TERM 2

20 MARKS

Time allocation: 60 minutes (20 minutes preparation, 40 minutes task time)

NOTE TO THE TEACHER

1. This practical activity will be completed as part of Section E of lesson 6A.
2. This practical will take place during the lesson after the teaching component in Section D, “Accessing Information”.
3. The first 20 minutes will be used to teach section D and prepare learners for the practical task.
4. The next 40 minutes will be used to complete the practical activity as outlined in Section E.
5. The instructions and content of the practical task should be written on the chalkboard for the learners.
6. This task will be done in groups of 6.
7. Each group will need the following in order to complete the investigation:
   - two small glass jars
   - one large glass jar
   - a container of water
   - a cup of cooking oil
   - a tablespoon of salt
   - A tablespoon of sugar
   - a quarter cup of methylated spirits
   - a quarter cup syrup
   - a quarter cup dishwashing liquid
   - a quarter cup amasi or milk
   - an iron nail, coin or key
   - a seed, peanut, dried bean
   - a piece of polystyrene (can be broken from a polystyrene tray)
8. Ensure that you have all the materials ready and prepared for the learners before the lesson begins.
9. The memorandum for assessing the practical task is provided.
10. The learners should complete the drawings with a sharp pencil and the written answers should be completed in pen.

PRACTICAL – MEMORANDUM

NS
GRADE 8
PRACTICAL TASK
TERM 2

20 MARKS

(see Section E of Lesson 6A for instructions and questions)

Topic	Task	Expected answer/outcome	Marks
	1		
Particle model of matter	1.1	The sugar ✓	1
Particle model of matter	1.2	The salt ✓	1
Particle model of matter	1.3	The salt ✓	1
Particle model of matter	1.4	The spaces between the salt crystals are smaller and so more of them will fit into the jar. ✓	1
Particle model of matter	1.5	The oil is floating on top of the water. ✓	1
Particle model of matter	1.6	The oil is less dense than the water. ✓	1
Particle model of matter	1.7	The water ✓	1
	2		
Particle model of matter	2.1	They are of different densities. ✓	1
Particle model of matter	2.2	Six ✓	1
Particle model of matter	2.3	Syrup ✓	1
Particle model of matter	2.4	Methylated spirits ✓	1
Particle model of matter	2.5	Answer will vary ✓	1
Particle model of matter	2.6	Nail and possibly seed (depending on size) ✓	1
Particle model of matter	2.7	It is more dense than the water ✓	1
Particle model of matter	2.8	Polystyrene ✓	1
Particle model of matter	2.9	It is less dense than the water ✓	1
Particle model of matter	2.10	The quantity of each liquid ✓	1
Particle model of matter	2.11	The objects dropped into the liquid ✓	1
Particle model of matter	2.12	The water eventually settles into the water layer and the water layer gets wider. ✓	2
		TOTAL	**20**

GRADE 8 ASSESSMENT

TERM EXAM

NS
GRADE 8
EXAM
TERM 2

90 MARKS
120 MINUTES

NOTE TO THE TEACHER:

If possible, photocopy this test for each learner. If this is not possible, write the test on the chalkboard.

INSTRUCTIONS TO THE LEARNERS

1. Answer all questions in blue or black ink.
2. Read each question carefully before answering it.
3. Pay attention to the mark allocations.
4. Plan your time carefully.
5. Write your answers in the spaces provided.
6. Write neatly.

Practice Question

Read the question and circle the letter that shows the correct answer.

1.1 An example of a simple sugar?

A. rocks
B. plants
C. soil
D. water

You have answered correctly if you have circled (B)

GRADE 8 ASSESSMENT

NS
GRADE 8
TERM 2
EXAM

90 MARKS

PART 1: Life and Living

Question 1: Multiple choice [4]

Read each question and circle the letter that shows the correct answer.

1.1 Which one of these is NOT an abiotic factor of the environment?

A. Air.
B. Soil.
C. Water.
D. Animals

1.2 Which of these statements is false?

A. All ecosystems are large.
B. An ecosystem is a self-sufficient system.
C. Different ecosystems are linked to each other.
D. Ecosystems can be water systems or terrestrial systems.

1.3 Which of these statements is true?

A. Primary consumers eat secondary consumers in the food chain.
B. Lions are an example of a primary consumer.
C. Giraffes and zebras are examples of primary consumers.
D. Tertiary consumers eat plants.

1.4 Which one of these is not an example of a decomposer?

A. Mushrooms.
B. Earthworms.
C. Maggots.
D. Scavengers.

Question 2: Match the columns **[4]**

Instructions:

- Match the sentences in COLUMN A with the words in COLUMN B.
- Draw a line to join the sentence in COLUMN A with the correct word in COLUMN B. Do this as shown in the example below.

COLUMN A		COLUMN B
example	Animals that feed on plants only	A. Insectivore
2.1.	An animal that feeds on other animals that have died	B. Scavenger
2.2.	Animals that hunt and catch their prey.	C. Omnivore
2.3.	Eats insects like ants, beetles and grasshoppers.	D. Predators
2.4.	An animal that eats both plants and other animals.	E. Herbivore

Question 3 **[8]**

Complete the following sentences using words in the block below:

energy, glucose, oxygen, oxidised, exhale, inhale, water, carbon-dioxide, blood, air

Rewrite the sentences and underline your answers.

3.1 Living organisms obtain _____from the food that is stored in plants.

3.2 Respiration is the process where energy is released when _____ is broken down in the presence of oxygen.

3.3 The by-products of respiration in humans are _____ and _____.

3.4 A human will _____ oxygen for the process of respiration, and then _____ carbon-dioxide.

3.5 During respiration, oxygen in the _____ is exchanged with the carbon dioxide in the _____.

3.6 The process of respiration is a chemical reaction where glucose is _____ to release energy. (1)

3.7 Glucose + _____→Energy + carbon dioxide + water.

Question 4 **[4]**

Write the word that is being described in the sentence.

Only write the answer.

4.1 Process whereby green plants make their own food using energy from the Sun.

_____

4.2 The green pigment in the cells of plants that absorbs radiant energy.

_____

4.3 The substance known as the chemical compound H_20.

_____

4.4 Gas released by plants during photosynthesis.

_____

Question 5 **[4]**

"Different food chains in an ecosystem are interconnected to form a food web."

5.1 Use the following food chains to draw a food web:

leaves→worm→lizard→bird

leaves→snail→bird→snake

leaves→rabbit→snake

leaves→worm→spider→lizard

Question 6 **[4]**

"Natural and human disturbances can cause a disruption in an ecosystem."

6.1 Name two natural factors that can cause a disturbance in an ecosystem.

_____

_____

6.2 Name two human factors that can cause a disturbance in an ecosystem.

_____

_____

Question 7 **[8]**

Read the following statement:

"Adaption is the change in the structural, functional and behavioural characteristics of an organism, enabling it to adjust to changing conditions within an environment.

7.1. Why do plants and animal adapt to their environments?

_____

7.2. Explain, using the camel as an example,the differences between structural adaption, behavioral adaption and functional adaption.

_____

_____

7.3. How are water plants and desert plants adapted differently to their environments?

_____

_____

7.4. What happens to a species if they are unable to adapt to changes in their environment quickly enough?

_____

_____

Question 8 **[5]**

State whether the following statements are True or False:

8.1. All micro-organisms are consumers. _____

8.2. We measure micro-organisms in micrometres. _____

8.3. Bacteria are the smallest of the micro-organisms._____

8.4. HIV is a disease caused by a virus, which is a micro-organism. _____

8.5. Micro-organisms differ in size and function on different trophic levels._____

Question 9 **[4]**

9.1 Using what you have learnt and the words in the box below, write 4 sentences showing how micro-orhanisms can be useful to man.

fermentation, cheese, vaccines, decomposer, protista, feeding cycle, yeast, antibodies

_____

_____

_____

_____

_____

PART 2: Matter and Materials

Question 10: Multiple choice **[4]**

Read each question and circle the letter that shows the correct answer.

10.1 Which one of these is NOT cause a chemical change in a substance?

A. Melting butter.
B. Electrolysis of water.
C. Burning wood.
D. Rusting of an iron gate.

10.2 Which of these statements is false?

A. Everything around us is made up of tiny particles called atoms.
B. Atoms are joined together by a chemical bond.
C. During a chemical reaction, atoms are destroyed.
D. During a chemical reaction, atoms are conserved or rearranged.

10.3 Which of these statements is true?

A. Expansion of materials occurs when the temperature is decreased.
B. Only solids and gases expand when heated.
C. When a material expands, the size of the particles changes.
D. When a material is heated, the particles move faster and push further apart.

10.4 Which one of these is not a method of separating a mixture

A. Microscope.
B. Chromatography.
C. Filtration.
D. Distillation.

Question 11: Match the columns **[4]**

Instructions:

- Match the sentences in COLUMN A with the words in COLUMN B.
- Draw a line to join the sentence in COLUMN A with the correct word in COLUMN B. Do this as shown in the example below.

COLUMN A		COLUMN B
example	The force that holds atoms together in a molecule.	A. Diatomic molecule
11.1	Smallest particle of matter that can exist on its own.	B. Atom
11.2	Molecule that consists of two atoms of the same kind.	C. Nucleus
11.3	Consists of atoms of only one kind.	D. Element
11.4	The central region of an atom.	E. Chemical bond

Question 12 **[6]**

Complete the following sentences using words in the block below:

nucleus, electrons, protons, nucleus, sub-atomic, neutral

Rewrite the sentences and underline your answers.

12.1 An atom is made up of smaller _____ particles, namely protons neutrons and electrons.

12.2 The protons and neutrons are found in the _____ of the atom.

12.3 The _____ move around the atom.

12.4 The _____ are positively charged.

12.5 The _____ are negatively charged.

12.6 The neutrons are _____ and have no charge.

Question 13 **[5]**

Write the word that is being described in the sentence.

Only write the answer.

13.1 The amount of mass for a given volume of material.

_____

13.2 The force that gas particles exert on the walls of a container.

_____

13.3 The process in which particles in liquids and gasses move from an area of high concentration to an area of low concentration.

_____

13.4 A substance that takes part in a chemical reaction and undergoes change.

_____

13.5 The reaction that takes place when a fuel reacts with oxygen to produce energy.

_____

Question 14 **[5]**

14.1 Using what you have learnt and the words in the box below, explain how hydrogen gas and oxygen gas bond to form water.

elements, diatomic, atoms, molecules, Hydrogen(H), Oxygen (O), bonds, energy, rearrange, compound, water, H_2O

_____

_____

_____

_____

_____

_____

_____

_____

Question 15 **[4]**

"Umqombothi is a fermented beer made from maize, yeast and water."

15.1. Explain what happens during fermentation.

_____

_____

_____

15.2. Write a word equation for fermentation:

_____

Question 16 **[5]**

A bottle of milk is put in the freezer.

16.1 Why will the milk change state once it is put in the freezer?

_____

16.2 Give one word to name this change of state.

_____

16.3 Using what you know about the particle model of matter, explain how the milk particles changed in terms of the movement of particles.

_____

_____

16.4 Using what you know about the particle model of matter, explain how the milk particles changed in terms of the arrangement of the particles.

_____

_____

16.5 Using what you know about the particle model of matter, explain how the milk particles changed in terms of the spaces between the particles.

_____

_____

Question 17 **[6]**

When wood burns, the carbon (C) in the wood, reacts with the oxygen (O_2) in the air to form carbon dioxide ($C0_2$)

17.1 Write a chemical equation for the reaction.

_____

17.2 Show how the atoms are conserved during the reaction

_____

_____

17.3. Explain how the atoms were rearranged to form a new substance.

_____

_____

Question 18 **[6]**

State whether the following are True or False:

18.1. Energy is needed to break the bonds of the reactants during chemical reactions. _____.

18.2. Reactants are the elements and compounds that participate in a chemical reaction and react with each other. _____.

18.3. In a chemical reaction, the substances that are produced are called the properties. _____.

18.4. A neutralization reaction happens when two acids are combined. _____

18.5. Gases exert pressure in all directions. _____

18.6. Pressure is an important property of liquids. _____

18.7. Solids contract when they are cooled. _____

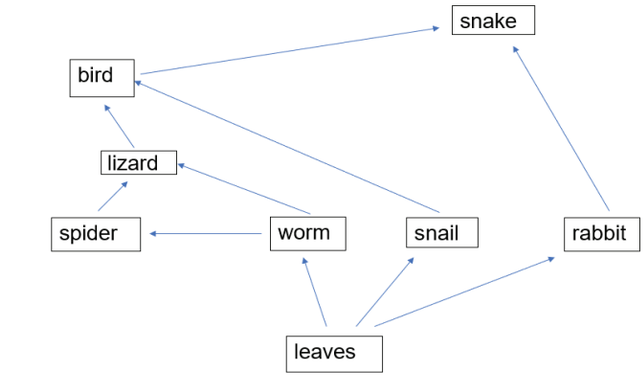
TOTAL: [90]

TERM 2 EXAM – MEMORANDUM

NS
GRADE 8
MEMORANDUM
TERM 2

90 MARKS

Caps Topic	Questions	Expected answer(s)	Marks
PART 1: Life and the Living			
	1		
	1.1	D✓	1
	1.2	A✓	1
	1.3	C✓	1
	1.4	D✓	1
	2		
	2.1	B✓	1
	2.2	D✓	1
	2.3	A✓	1
	2.4	C✓	1
	3		
	3.1	energy✓	1
	3.2	glucose✓	1
	3.3	carbon-dioxide✓ water✓	½ x 2 =1
	3.4	inhale✓ exhale✓	½ x 2 =1
	3.5	air✓ blood✓	2
	3.6	oxidised✓	1
	3.7	oxygen✓	1
	4		
	4.1	photosynthesis✓	1
	4.2	chlorophyll✓	1
	4.3	water✓	1
	4.4	oxygen✓	1

	5		
	5		4
	6		
	6.1	(Any 2) • Fires✓ • Floods✓ • Droughts✓ • Tsunami✓ • Volcanic activity✓ • Extreme temperature changes✓	2
	6.2	(Any 2) • Poaching and hunting✓ • Pollution✓ • Farming✓ • Deforestation✓ • Mining✓	2
	7		
	7.1	In order to ensure survival in a changing environment	1
	7.2	• Structural adaptions are special features of the body adapted for the environment.✓ • In a camel: closed nostrils, long eyelashes, wide feet✓ • Behavioural adaptions are how a living organism behaves in its environment.✓ • In a camel: A camel knows to drink a lot of water when it is available.✓ • Functional adaptions are how the body of the organism works in its environment.✓ • In a camel: The hump of the camel is to store water✓	4

	7.3	Water plants are flat so that they can float on water and have breathing pores on the top of their leaves.✓ Desert plants store water in their thick and fleshy leaves and have thorns for protection from animals✓	2
	7.4	They become extinct✓	1
	8		
	8.1	False✓	1
	8.2	True✓	1
	8.3	False✓	1
	8.4	True✓	1
	8.5	True✓	1
	9		
	9	Any 4 • In an eco-system. Bacteria and fungi act as decomposers✓ • Bacteria are used to make wine, beer and yoghurt.✓ • Some cheese need moulds to help them ripen.✓ • Yeast is used to help bread rise.✓ • Penicillin is used as an antibiotic to kill bacteria.✓ • A vaccine contains small amounts of bacteria or virus and are used to fight disease.✓	4

GRADE 8 ASSESSMENT

Caps Topic	Questions	Expected answer(s)	Marks
PART 8: Matter and Materials			
	10		
Particle model of matter	10.1	A✓	1
Particle model of matter	10.2	C✓	1
Particle model of matter	10.3	D✓	1
Particle model of matter	10.4	A✓	1
	11		
Atoms	11.1	B✓	1
Atoms	11.2	A✓	1
Atoms	11.3	D✓	1
Atoms	11.4	C✓	1
	12		
Atoms	12.1	sub-atomic✓	1
Atoms	12.2	nucleus✓	1
Atoms	12.3	electrons✓	1
Atoms	12.4	protons✓	1
Atoms	12.5	electrons✓	1
Atoms	12.6	neutral✓	1
	13		
Particle model of matter	13.1	density✓	1
Particle model of matter	13.2	pressure✓	1
Particle model of matter	13.3	diffusion✓	1
Particle model of matter	13.4	reactant✓	1
Particle model of matter	13.5	Combustion reaction✓	1

	14		
Particle model of matter	14	It takes two molecules of the diatomic gas hydrogen (H)✓ and one molecule of the diatomic gas oxygen (O)✓ to form water (H_2O)✓ When energy is added to the mixture of hydrogen gas and oxygen gas✓ The hydrogen atoms and oxygen atoms will rearrange themselves✓ And bond chemically✓ To form water-H_2O✓	5
	15		
Chemical reactions	15.1	During fermentation, yeast breaks down sugar. Alcohol and carbon dioxide are formed.✓	1
Chemical reactions	15.2	sugar (glucose) + yeast →ethanol (alcohol) + carbon dioxide✓✓✓	3
	16		
Particle model of matter	16.1	Energy is being removed from the milk as it cools✓	1
Particle model of matter	16.2	Freezing✓	1
Particle model of matter	16.3	The particles slow down/less movement of particles✓	1
Particle model of matter	16.4	The particles are arranged in a more orderly way✓	1
Particle model of matter	16.5	The spaces between the particles are very small✓	1
	17		
Chemical reactions	17.1	$C + O_2 \rightarrow CO_2$✓✓	2
Chemical reactions	17.2	There is one C (carbon) atom in the reactant and one C (carbon) atom in the product✓ There are two O (oxygen) atoms in the reactant and two O (oxygen) atoms in the product.✓	2
Chemical reactions	17.3	The bonds between the carbon atoms and the oxygen atoms were broken.✓ A new bond was formed by chemical reaction to form CO_2.✓	2

	18		
Particle model of matter	18.1	True✓	1
Chemical reactions	18.2	True✓	1
Chemical reactions	18.3	False✓	1
Chemical reactions	18.4	True✓	1
Particle model of matter	18.5	False✓	1
Particle model of matter	18.6	True✓	1
			TOTAL 90