"We are all connected to each other biologically. To the earth chemically. To the rest of the universe atomically."

-Neil Degrasse Tyson

NATURAL SCIENCES

LESSON PLAN
GRADE 8 TERM 4

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 and to help the DBE reach the NDP goals.

The NECT has successfully brought together groups of relevant people so that we can work collaboratively 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 embedding process.

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 & Technology 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 resource pack 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 4 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.

e. ***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.

f. ***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.

3. 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 resource pack, 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 routine.

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 resource for 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 RESOURCE PACK.** 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 resource papers 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 Routine

Train your learners to know and anticipate the routine of Natural Sciences lessons. You will soon see that a good knowledge of this routine 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 routine:

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
These lesson plans have been designed against the stipulated CAPS requirements with topics being allocated for the time prescribed by CAPS. (Remember that some slight changes have been incorporated to accommodate time for revision, tests and examinations).			

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	1
		(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 each – 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 checklist questions used effectively?		
16.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

PROGRAMME ORIENTATION

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 checklist 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:
The Solar System
Term 4, Weeks 1A – 3C

A. TOPIC OVERVIEW

Term 4, Weeks 1a – 3c

- This topic runs for 3 weeks.
- It is presented over 9 x 1 hour 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

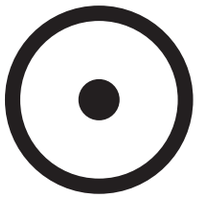
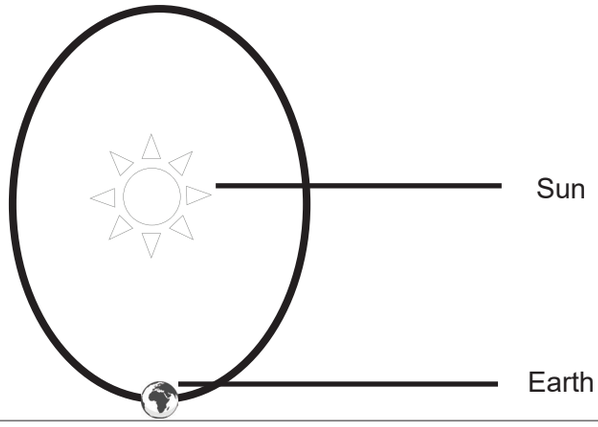
B. SEQUENTIAL TABLE

GRADE 8 & 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Relationship of the Sun to the Earth • Solar energy and the • Earth's seasons • Solar energy and life on Earth • Stored solar energy	• The Sun • Objects around the Sun • Earth's position in the solar system	• The Earth as a system

C. SCIENTIFIC AND TECHNOLOGICAL VOCABULARY

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

	TERM	EXPLANATION
1.	nuclear fusion	This is the process where nuclei join together to form a new nucleus and energy is released.

2.	core	The core is the centre of an object. In these lessons, we will talk about the core of the Sun. 
3.	fusion	To fuse is to combine or mix or join together.
4.	orbit	An orbit is the oval shaped pathway or journey that the planet takes to move around the Sun. 
5.	terrestrial planets	Terrestrial planets are planets that have solid rocky surfaces. These are Mercury, Venus, Earth and Mars.
6.	gas planets	Gas planets are planets that are mainly made of gas with small cores of rocky materials. These planets are Jupiter, Saturn, Uranus, and Neptune.

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Our Sun gives us light, heat and energy. It may seem that energy comes from other sources such as gasoline and electricity but the ultimate source of energy for the Earth is nothing else but the Sun. Without the Sun, life on Earth would not exist. It would be so cold that no living thing would be able to survive and our planet would be completely frozen.

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 4, Week 1, Lesson A
Lesson Title: How the Sun emits light and heat energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The Sun
CAPS Page Number	53

Lesson Objectives

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

- explain how the Sun emits light and heat energy
- describe the structure of the Sun
- relate the types of reactions that occur in the Sun

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Poster	

C CLASSROOM MANAGEMENT

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

> Which is the closest star to Earth?

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 Sun is the closest star to the Earth.*

D ACCESSING INFORMATION

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

> HOW DOES THE Sun RELEASE ENERGY?
>
> 1. The Sun is made up of hydrogen gas (+ 71%) and helium gas (+ 27%) with a tiny amount of other gases.
> 2. The temperature on the Sun's surface is about 5500 C, while at the core it is + 15 million C.
> 3. The centre (core) is so hot that nuclear reactions which change atoms from one element to another happen.
> 4. This is called nuclear fusion.
> 5. This nuclear fusion reaction releases energy from the Sun's core.
> 6. The energy eventually reaches the Sun's surface. The Sun's energy then spreads out into the solar system in the form of heat and light which eventually reaches the Earth.

2. Explain the information to the learners as follows:
   a. Our solar system includes the Sun and all the objects that orbit around the Sun.
   b. In this lesson, we will learn that a variety of objects are in orbit around the Sun: eight planets, dwarf planets, asteroids, Kuiper Belt objects and comets. We will focus on the planets, dwarf planets, asteroids, Kuiper Belt objects and comets in later lessons.
   c. Today we will focus on how the Sun releases energy into our solar system.

d. The way in which nuclear energy is produced is different from the way a fire burns. A fire burns by means of a chemical reaction and oxygen is needed. There is no oxygen in the Sun.

e. The nuclear reactions in the Sun is caused by extremely high pressure in its core.

f. The pressure creates such high temperatures that hydrogen atoms fuse to form helium gas atoms, releasing energy.

g. This energy reaches the surface of the Sun from its core and eventually reaches the Earth.

3. Instruct the learners to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. What reaction releases energy from the Sun's core?

b. Which two kinds of energy are released by the Sun?

Answers to the checkpoint questions are as follows:

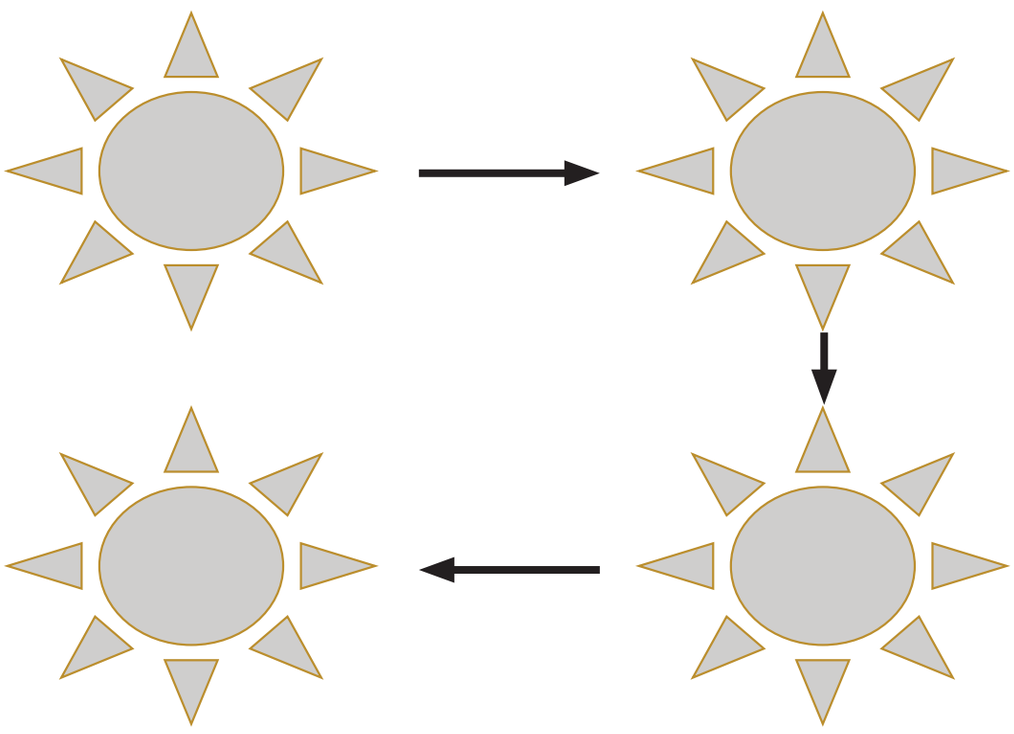
c. Nuclear fusion

d. Heat and light

E CONCEPTUAL DEVELOPMENT

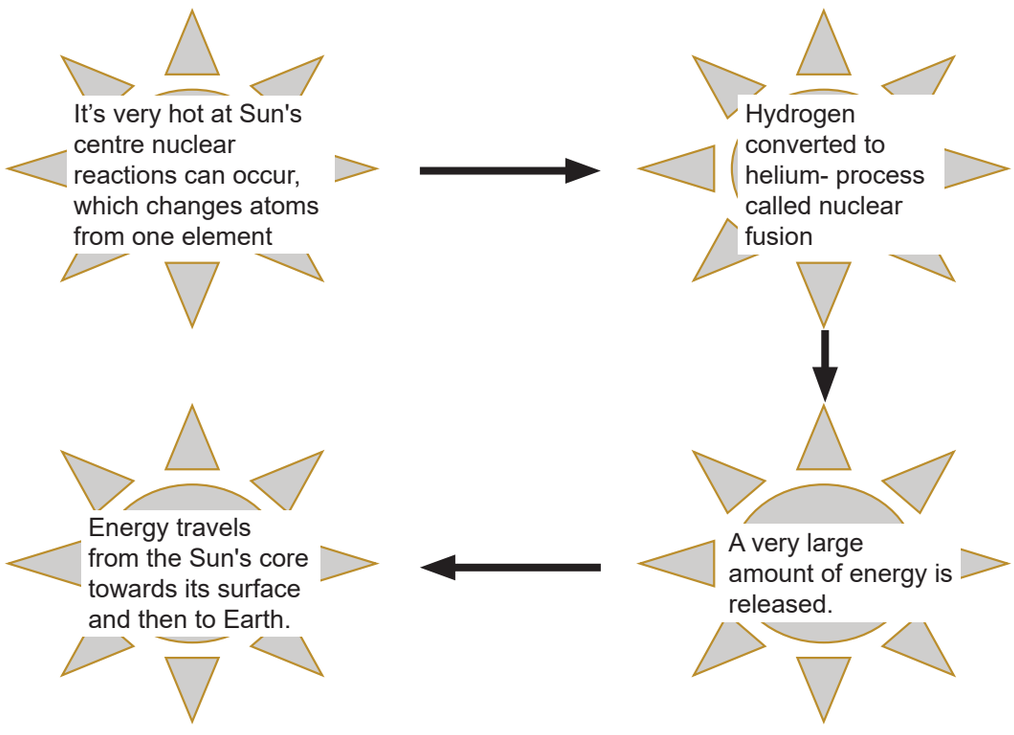
1. Write the instruction and draw the following onto the chalkboard:

Using the flowchart below, describe how energy is formed in the Sun and then released from the Sun to Earth.



2. Tell the learners that in this lesson they:
   a. Should work in pairs to complete this activity.
   b. Must draw the four Suns into their workbook as shown on the chalkboard.
   c. Need to take a few minutes to read through the information that they have just written down from the chalkboard and discuss this information with their partner.
3. Learners must now work together quietly to fill in their flowchart, to show how energy is formed and then released to the Earth. The learners may use colour pencils to make the drawing attractive.
4. Learners should eventually have a flowchart with four steps.
5. Give learners some time to complete this task in their workbook.
6. Even though learners are working in pairs, they must each fill in their own flowchart.
7. Once the class is done with this task, ask one learner to come to the chalkboard and fill in each of the blocks with the help of the class and the teachers' answers.
8. Ask the learners to check their work and make any corrections necessary.
9. Complete the example of the board fully and allow learners to copy down the information that they do not have.
10. Write the model answer onto the chalkboard:

<u>Describe how energy is formed and then released from the Sun to Earth</u>



11. Show learners Resource 1 to help you explain how the Sun emits light.

Checkpoint 2

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

a. What is nuclear fusion?
b. What is the temperature at the Sun's surface?

Answers to the checkpoint questions are as follows:

a. When nuclei are fused together to form a new nucleus.
b. The temperature at the Sun's surface is about 5500 ℃, while at the core it is + 15 million ℃.

11. 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
Spot on Natural Science	The Solar System	148-149
Top Class Natural Science	The Solar System	140
Platinum Natural Science	The Solar System	192-193
Successful Natural Science	The Solar System	162-163
Via Afrika Natural Science	The Solar System	146-147
Sasol Inzalo Natural Science Bk B	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	125 - 127
Top class Natural Sciences	The Solar System	140
Solutions for all Natural Sciences	The Solar System	195 - 196

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.universetoday.com/75803/how-does-the-Sun-produce-energy [How the Sun produces energy]

1 B

Term 4, Week 1, Lesson B
Lesson Title: Our solar system
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Objects around the Sun
CAPS Page Number	53

Lesson Objectives

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

- identify the eight planets in our solar system
- show where they are in relation to the Sun
- differentiate between terrestrial planets and gaseous planets

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Model of our solar system	Resource 2 and 3
	Poster of our solar system
	A4 Plain 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:

> Name the eight planets in our solar system, starting with the one closest to the Sun.

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.

> *Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune*

C CLASSROOM MANAGEMENT

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

> THE SOLAR SYSTEM
>
> 1. The Sun is the largest object in our solar system. Due to the Sun's massive size, its large gravitational pull causes the planets and other objects in the solar system to orbit around it.
> 2. There are eight planets along with their moons that **orbit** the Sun.
> 3. The four planets closest to the Sun are Mercury, Venus, Earth and Mars. These are called **terrestrial planets** because they have solid rocky surfaces.
> 4. The **gas planets or** gas giants, Jupiter, Saturn, Uranus, and Neptune are further away from the Sun. They are much larger than the terrestrial planets and are mainly made up of gas with small cores of rocky materials.

2. Explain to the learners that eight planets along with their moons, dwarf planets and many smaller objects like asteroids, Kuiper belt objects and comets orbit the Sun.
11. Show learners Resource 3 which indicates the Asteroid Belt and the Kuiper Belt.
12. Tell the learners that they will learn more about all the other objects, other than the planets, later in the term.

4. Tell the learners the following:
    a. Scientist discovered that there are 8 planets that revolve around the Sun. These are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
    b. Working in pairs, the learners must take a few minutes to find a way to remember the order of these planets for example: My Very Eager Monkey Jumped Straight Up Neptune.
    c. Planets are different from the Sun because they do not produce their own energy.
    d. The planets are only visible to us because they reflect the Sun's light.
5. Tell the learners that there are terrestrial and gas planets.
6. Explain to the learners that terrestrial planets all have the following:
    a. a metal core
    b. a rocky mantle
    c. a thin outer crust
    d. a thin atmosphere
7. The Earth's atmosphere is unique in the solar system because it contains lots of oxygen which is necessary to sustain life on Earth.
8. Explain to the learners that gas planets are different because:
    a. they are mostly made of hydrogen and helium gases
    b. they are much less dense than the rocky terrestrial planets.
9. Give the learners some time to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. Why can the planets orbit around the Sun?
b. Why are four planets closest to the Sun called terrestrial planets?

Answers to the checkpoint questions are as follows:

a. The planets can orbit around the Sun because of the Sun's massive gravitational pull.
b. These are called terrestrial planets because they have solid rocky surfaces.

E CONCEPTUAL DEVELOPMENT

1. Complete the following activity with the learners:

   a. Take the learners outside and ask:
   b. For nine volunteers.
   c. For one of these volunteers to be the Sun.
   d. The other eight volunteers to be one of the planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
   e. The learner who is the Sun should stand in the center of the circle. Now ask each learner who is a planet to stand where they think they should stand depending on how far they think they should be from the Sun.
   f. Give one learner who is not a planet or the Sun, Resource 1 and ask that learner to move the planets (learners) into the correct place.
   g. Ask learners to come back into the class.

2. Hand out one A4 blank unlined paper to each learner.
3. Each learner must now sketch the Sun and 8 planets according to where they would be found in relation to the Sun.
4. They may use the poster and Resource 1 to help them.
5. Once they are done they need to complete the following activity. (Write the activity on the chalkboard)

Table showing differences between terrestrial and gas planets	
Terrestrial planets	**Gas planets**

6. Write the model answer onto the chalkboard:

Terrestrial planets	***Gas planets***
Mercury, Venus, Earth, Mars	*Jupiter, Saturn, Uranus and Neptune.*
Have a metal core, a rocky mantle, a thin outer crust and a thin atmosphere	*Mostly made of hydrogen and helium gases and are much less dense than the rocky terrestrial planets.*

Checkpoint 2

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

a. Which planet is closest to the Sun?
b. What do you notice about the size of the planets as they get further away from the Sun?

Answers to the checkpoint questions are as follows:

a. Mercury
b. The planets closest to the Sun are smaller than the ones further away.

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
Spot on Natural Science	The Solar System	150-151
Top Class Natural Science	The Solar System	141-142
Platinum Natural Science	The Solar System	194-195
Successful Natural Science	The Solar System	164-168
Via Afrika Natural Science	The Solar System	148-149
Sasol Inzalo Natural Science Bk B	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	128
Top class Natural Sciences	The Solar System	141
Solutions for all Natural Sciences	The Solar System	196 - 197

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.universetoday.com/75803/how-does-the-Sun-produce-energy [How the Sun produces energy]
2. https://www.space.com/16080-solar-system-planets.html [Information about the solar system]

1 C

Term 4, Week 1, Lesson C
Lesson Title: Features of the terrestrial planets
lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Objects around the Sun
CAPS Page Number	53

Lesson Objectives

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

- identify terrestrial planets
- name the features of terrestrial planets: diameter, distance from the Sun, number of moons, composition, surface temperature, time to orbit the Sun

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting	✓	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
Model of our solar system	Resource 2
Poster of our solar system	

C CLASSROOM MANAGEMENT

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

> Name the four terrestrial planets, starting with the one closest to the Sun.

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.

> *Mercury, Venus, Earth, Mars*

D ACCESSING INFORMATION

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

THE TERRESTRIAL PLANETS

1. The four planets closest to the Sun are Mercury, Venus, Earth and Mars.
2. These are called terrestrial planets because they have solid rocky surfaces.
3. They all have a metal core, a rocky mantle and a thin outer crust.
4. They also have a thin atmosphere (Mercury has an extremely thin atmosphere).
5. The Earth's atmosphere is unique in the solar system because it contains abundant oxygen, which is necessary to sustain life on Earth.

Table showing the features of the terrestrial planets

Name of Planet	**Size/ Diameter**	**Distance from Sun (millions of km)**	**Number of Moons**	**Surface temperature**	**Day length (Rotation on its own axis)**	**Year length (Revolution around the Sun)**
Mercury	4 800 km	58	0	-180 °C to 427 °C	59 days	88 days
Venus	12 100 km	108	0	471°C	243 days	225 days
Earth	12 756 km	150	1	-88°C to 58°C	23h56min	365 days
Mars	6 794 km	228	2	-87°C to 0°C	24h31min	687 days

2. Tell the learners that you will only be discussing the terrestrial planets in this lesson.
3. Read through each point on the chalkboard slowly and underline key words like solid rocky surface, metal core and rocky mantle.
4. Explain the following to the learners:
    a. The four terrestrial planets are very small compared to the gas planets.
    b. The closer the planet is to the Sun the warmer it is.
    c. Although Venus is not the closest to the Sun it has the highest surface temperature. This is because it has a dense atmosphere made of carbon dioxide that traps the solar energy.
    d. The further away from the Sun a planet is, the longer it takes to orbit the Sun.
    e. Mars is often called the red planet because it has iron in its soil and strong winds blow this red soil into the atmosphere.
5. Tell the learners to remember these facts because in the next few lessons they will be making a model of our solar system.
6. Show learners Resource 2 to help you explain how this information.
7. Ask learners to collect old newspaper or any other paper and bring it to class during the week.
8. Give learners some time to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. Which terrestrial planet has the largest diameter?
b. If you had to spend a day on another terrestrial planet, other than Earth, which planet would you choose and why?

Answers to the checkpoint questions are as follows:

a. Earth
b. Mars. It is most like Earth in terms of temperature. The other two have extreme temperatures which would make staying alive very difficult.

E CONCEPTUAL DEVELOPMENT

1. Write the following questions onto the chalkboard:

THE TERRESTRIAL PLANETS

1. Order the rocky planets from the smallest to the largest.
2. Order the rocky planets from the coldest to the hottest.
3. Which rocky planet has the most number of moons?
4. Which two rocky planets do not have moons?
5. Which is the hottest rocky planet?
6. Imagine you won a 5-day trip to any of the planets.

6.1 Write a paragraph explaining which planet you would like to visit and why.

6.2 Also write what you would need to take with you to this planet. Use the information in the table and your own knowledge to answer this question.

2. Tell the learners to do the following:
   a. Copy the questions into their workbooks.
   b. Work quietly to answer the questions by using the information they copied from the chalkboard at the beginning of the lesson.
3. Give learners some time to complete this task in their workbooks.
4. Tell the learners that once they are done they should find a partner that is also done and compare answers.
5. Write the model answers onto the chalkboard:

1. *Mercury, Mars, Venus, Earth*
2. *Mercury, Mars, Earth, Venus*
3. *Mars*
4. *Mercury and Venus*
5. *Venus*
6. *Mars*

6.1 Answers here will vary but learners should choose Mars for the following reasons: Mars is close to Earth so the trip would not take too long. The temperature on Mars and Earth are quite similar so you can survive. Mars is not too big so you can see most of it in 5 days .

6.2 Take own food and water as there is nothing on Mars. Must take oxygen tanks because there is no oxygen on Mars. Some form of shelter and transport. A suit that will ensure that you will not float away as there is no gravity on Mars.

Checkpoint 2

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

a. Calculate the approximate distance between Earth and Mars.
b. Which planet is less than half as far from the Sun as the Earth?

Answers to the checkpoint questions are as follows:

a. 228-150 = 78 million kilometres
b. Mercury

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
Spot on Natural Science	The Solar System	151-153
Top Class Natural Science	The Solar System	143-144
Platinum Natural Science	The Solar System	201-202
Successful Natural Science	The Solar System	168-169
Via Afrika Natural Science	The Solar System	148-149
Sasol Inzalo Natural Science Bk B	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	129 - 134
Top class Natural Sciences	The Solar System	141
Solutions for all Natural Sciences	The Solar System	198

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.space.com/16080-solar-system-planets.html [The solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of Planets]

2 A

Term 4, Week 2, Lesson A
Lesson Title: The gas giants
lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Objects around the Sun
CAPS Page Number	53

Lesson Objectives

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

- identify the gas giants
- name the features of gas giants: diameter, distance from the Sun, number of moons, composition, surface temperature, time to orbit the Sun

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Model of our solar system	Resource 2
	Poster of our solar system

E CONCEPTUAL DEVELOPMENT

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

Name the four gas planets starting with the one closest to the Sun.

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.

Jupiter, Saturn, Uranus, Neptune

D ACCESSING INFORMATION

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

THE GAS GIANTS

1. The **gas giants**, Jupiter, Saturn, Uranus, and Neptune are further away from the Sun than the terrestrial planets.
2. These planets are much larger than the terrestrial planets and are mainly made of gas with small cores of rocky materials.
3. Saturn has visible rings around it made of small, solid particles and ice crystals.
4. Uranus is the only planet that spins on its side.

Table showing features of the gas giants

Name of Planet	**Size/ Diameter**	**Distance from Sun (millions of km)**	**Number of Moons**	**Surface temperature**	**Day length (Complete Rotation on its own axis)**	**Year length (Revolution around the Sun)**
Jupiter	143 200 km	778	67	-148 °C	9h55	12 years
Saturn	120 000 km	1427	63	-178 °C	10h42min	29 years
Uranus	51 800 km	2871	27	-200 °C	17h12min	84 years
Neptune	49 528 km	4498	13	-210 °C	16h6min	165 years

2. Tell the learners that you will only be discussing the gas planets in this lesson.
3. Read through each point on the chalkboard slowly and underline key words like further away, larger and made of gas.

4. Explain the following to the learners:
    a. The four gas planets are very large compared to the terrestrial planets.
    b. The further away the planet is from the Sun the colder it is. Point to Neptune and show that it is 4498 million kilometers away from the Sun and has a temperature of -210 °C, which is extremely cold.
    c. The further away from the Sun the planet is, the longer it takes for the planet to orbit the Sun. Point this out for Neptune which is furthest away. Now point out that Jupiter is only 778 million kilometers away from the Sun and takes 12 Earth years to orbit the Sun.
5. Like the other gas planets, Saturn's thick atmosphere is made of mostly hydrogen and helium. Saturn has visible rings around it that are made of small, solid particles and ice crystals.
6. Uranus is the only planet that spins on its side.
7. Show the learners Resource 2 to demonstrate this.
8. Tell learners to remember these facts because in the next few lessons they will be making a model of the solar system.
9. Ask learners to collect old newspaper or any other paper and bring to class during the week.
10. Give learners some time to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. Which gas planet has the largest diameter?
b. Which gas planet spins the fastest on its own axis? How do you know this?

Answers to the checkpoint questions are as follows:

a. Jupiter.
b. Jupiter. A complete rotation takes 9h55.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard:

THE GAS PLANETS

1. Order the gas planets from the smallest to the largest.
2. Order the gas planets from the coldest to the hottest.
3. Which gas planet has the most number of moons?
4. How long does it take for Jupiter to orbit the Sun once?
5. Which gas planet spins the fastest on its own axis?
6. Arrange the gas planets in terms of their distances from the Sun starting from the one closest to the Sun.

7.1 What is the general relationship between the distance from the Sun and the temperature of the planet?

7.2 Why do you think this relationship is like it is?

2. Tell the learners to do the following:
   a. Copy the questions into their workbooks.
   b. Work quietly to answer the questions by using the information they copied from the chalkboard at the beginning of the lesson.
3. Give learners some time to complete this task in their workbooks.
4. Tell the learners that once they are done they should find a partner that is also done and compare answers.
5. Write the model answers onto the chalkboard:

1. Neptune, Uranus, Saturn, Jupiter

2. Uranus, Neptune, Saturn, Jupiter

3. Jupiter

4. 12 years

5. Jupiter

6. Neptune, Uranus, Saturn, Jupiter

7.1 The further away from the Sun that the planet is, the colder it is.

7.2 The Sun's energy takes a longer time to reach the planet and there is a lot of space in between that may absorb some of the energy.

Checkpoint 2

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

a. What do you notice about the relationship between the distance from the Sun and the time it takes for the planet to rotate around the Sun?

b. Explain the relationship you mentioned in (a).

Answers to the checkpoint questions are as follows:

a. The further away from the Sun that a planet is, the longer it takes.

b. The planet will take a longer time to orbit the Sun because it has further to travel.

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
Spot on Natural Science	The Solar System	151-153
Top Class Natural Science	The Solar System	143-145
Platinum Natural Science	The Solar System	194-195
Oxford Successful Natural Science	The Solar System	164-166
Via Afrika Natural Science	The Solar System	154-155
Sasol Inzalo Natural Science	The Solar System	157-166
Step-by-step Natural Sciences	The Solar System	137 - 138
Top class Natural Sciences	The Solar System	144 - 145
Solutions for all Natural Sciences	The Solar System	202 - 204

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.space.com/16080-solar-system-planets.html [Information about the solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of planets]

2 B

Term 4, Week 2, Lesson B
Lesson Title: Make a model of our solar system: Part 1
lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Make a model of the solar system
CAPS Page Number	53

Lesson Objectives

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

- make a model of our solar system
- replicate the different sizes of the eight planets (relatively)
- place each planet in their correct location in our solar system

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Polystyrene ball of various sizes	All-purpose cake flour
Model of our solar system	Containers or bowls
Poster of Solar System	Water
	Scrap paper, newspaper
	Poster of our solar system
	Resource 2

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 the main **visible** difference that you see when looking at the 8 planets in our solar system

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 first 4 planets are much smaller than the second 4 planets.

D ACCESSING INFORMATION

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

The planets are all very recognizable as they all look fairly different from one another in terms of size, colour and special characteristics.

Descriptions of the eight planets:

1. Mercury – The surface looks like the moon with plains and craters.
2. Venus – The surface has many volcanoes. It shines brightly.
3. Earth – Is called the blue planet with oceans covering about 70% of its surface.
4. Mars – This planet is called the red planet.
5. Jupiter – This planet is almost twice as heavy as the total mass of all the other planets in our solar system. It is almost as bright as Venus.
6. Saturn – This planet has beautiful rings surrounding it.
7. Uranus – Looks like the other gas planets but looks green and rotates on its side.
8. Neptune – Looks like the other gas planets but looks blue.

2. Read the description of each planet out loud.
3. Ask the learners if they would like to add to the descriptions. If they do, add this to the description.

Checkpoint 1

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

a. How many planets are there in our solar system?
b. Which is the biggest planet in our solar system?

Answers to the checkpoint questions are as follows:

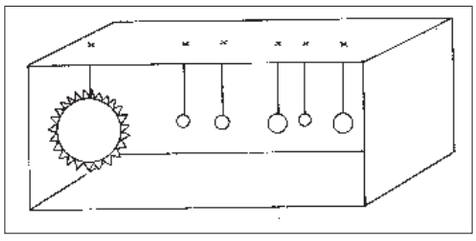
a. There are 8 planets in our solar system.
b. Jupiter

E CONCEPTUAL DEVELOPMENT

1. To do this activity, you will need the following:
    - plastic packets
    - newspapers
    - glue
    - tape
    - colouring pencils, paint or kokis
    - scissors
    - wool or string
    - cardboard box
2. Ensure you have these materials prepared before the lesson starts.
3. Tell the learners that they are going to be making a model.
4. 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.
2. We will be making a model of the solar system in a box.
3. Make sure that you do the following:
    - include the sun and all of the planets
    - show the planets the size of the plantes in relation to each other



4. Each person in the class must participate in the investigation and complete the answers to the written activities in their workbooks.
5. We will need the following materials and equipment to do the investigation:
    - plastic packets
    - newspapers
    - glue
    - tape
    - colouring pencils, paint or kokis
    - scissors
    - wool or string
    - cardboard box
6. You will need to work in a group to complete the task.

5. Read through the practical task with the learners.
6. Remind the learners that they must try to make the model to scale.
7. Tell the learners that they may refer to resource 2.

Practical set-up (Do this before the lesson)

1. Make sure that the materials are available.
2. Ask learners to bring materials a few weeks in advance.
3. Ensure that you have an area to work in.

8. Divide the learners into groups.
9. Ask a member of each group to collect their materials for the investigation.
10. Explain the following to the learners:
    - They must work as a group.
    - They must use the time wisely.
    - By the end of the lesson the planets should be made.
    - The planets and sun must be to scale. They can use the measurements below.
11. Ask them if they have any questions.
12. Write the following onto the chalkboard (always try to do this before the lesson starts):

Measurements for making planets

Planet	**Actual diameter in relation to the sun**	**Diameter you can use**
Mercury	0,3mm	1cm
Venus	0,8mm	2,4cm
Earth	0,9mm	2,7cm
Mars	0,4mm	1,2cm
Jupiter	10,2mm	6,5cm
Saturn	8,3mm	5cm
Uranus	3,3mm	3,3cm
Neptune	3,2mm	3,1cm

13. Once they have completed their models they can answer the task questions.
14. Write the following onto the chalkboard (always try to do this before the lesson starts):

Questions: (20 marks)

1. Name the largest planet. (1)
2. Name the smallest planet. (1)
3. Which planet is closest to the sun? (1)
4. Which planet is furtherest from the sun? (1)
5. How does the size of earth compare to the other planets?(2)
6. What was something interesting you learnt whilst making this project? (1)
7. The other marks will be allocated to the model. (13)

14. Read through the questions with the learners.
15. Discuss the questions with the learners.
16. Ask the learners to copy the questions into their books.
17. Tell the learners they have 10 minutes to answer these questions in their workbooks.
18. Supervise the learners whilst they complete the task and answer any questions they may have.
19. Collect books for assessment.

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
Spot on Natural Science	The Solar System	150-154
Top Class Natural Science	The Solar System	140-144
Platinum Natural Science	The Solar System	200-202
Successful Natural Science	The Solar System	168-169
Via Afrika Natural Science	The Solar System	148-154
Sasol Inzalo Natural Science Bk B	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	137 - 138
Top class Natural Sciences	The Solar System	144 - 145
Solutions for all Natural Sciences	The Solar System	202 - 204

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.space.com/16080-solar-system-planets.html [Information about the solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of planets]

2 C

Term 4, Week 2, Lesson C
Lesson Title: Make a model of our solar system Part 2
lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Model of the solar system
CAPS Page Number	53

Lesson Objectives

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

- make a model of our solar system
- replicate the different sizes of the eight planets (relatively)
- place each planet in their correct location in the solar system

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Polystyrene ball of various sizes	Koki / paint / crayons / pastels / colouring in pencils
Model of our solar system	Sticks
	Poster of our solar system
	Resource 2

C CLASSROOM MANAGEMENT

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

> Name the smallest planet and the largest planet.

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 smallest planet is Mercury and the largest planet is Jupiter.*

D ACCESSING INFORMATION

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

> 1. Arrange the planets from the one closest to the Sun to the one furthest from the Sun.
> 2. Describe each planet so that it will help you when you are decorating your paper mache planet.

2. Give learners some time to copy the questions into their workbooks.
3. Tell the learners to answer the 2 questions on the board as a group. They need to refer to their notes from the previous lessons, look at the poster of the solar system and use Resource 2 to do this.
4. Write the model answer on the board and ask the learners to correct their answers:

> *Mercury – The surface looks like the moon with planes and craters.*
> *Venus – The surface has many volcanoes. It shines brightly.*
> *Earth – Called the blue planet with oceans covering + 70% of its surface.*
> *Mars – This planet is called the red planet.*
> *Jupiter – This planet is almost twice as heavy as the total mass of all the other planets in our solar system. It is almost as bright as Venus.*
> *Saturn – This planet has beautiful rings surrounding it.*
> *Uranus – Looks like the other gas planets but looks green and rotates on its side.*
> *Neptune – Looks like the other gas planets but looks blue.*

E CONCEPTUAL DEVELOPMENT

1. Tell the learners do the following:
    b. Bring in the balls that they made the day before into the class.
    c. Use the information in your textbook and the model answers on the chalkboard to decorate the planets using Koki / paint / crayons / pastels /coloured pencils.
    d. Pierce a hole and put a stick through each planet so that it is easier to hold.
    e. Arrange your planets according to how they are found in our solar system.
    f. Tie a piece of string to the stick on each planet.
    g. Attach each planet to a big, long stick in the correct order starting with the Sun.
2. Each group must come to the front of the class and using their model, tell the class the following:
    a. Which ball is the Sun.
    b. Name each planet.
    c. Why the planet is decorated in the way that it is. For example, Mars is red because it is called the red planet.

Checkpoint 1

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

a. What did you find difficult about making the model?
b. Why was this difficult and how did you overcome this problem?

Answers to the checkpoint questions are as follows:

a. Answers will vary.
b. Answers will vary.

3. 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
Spot on Natural Science	The Solar System	150-154
Top Class Natural Science	The Solar System	140-144
Platinum Natural Science	The Solar System	200-202
Oxford Successful Natural Science	The Solar System	168-169
Via Afrika Natural Science	The Solar System	148-154
Sasol Inzalo Natural Science	The Solar System	144-146

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
Spot on Natural Science	The Solar System	150-154
Top Class Natural Science	The Solar System	140-144
Platinum Natural Science	The Solar System	200-202
Successful Natural Science	The Solar System	168-169
Via Afrika Natural Science	The Solar System	148-154
Sasol Inzalo Natural Science Bk B	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	129 - 134
Top class Natural Sciences	The Solar System	141
Solutions for all Natural Sciences	The Solar System	197 - 198

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.space.com/16080-solar-system-planets.html [Information about the solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of planets]

3 A

Term 4, Week 3, Lesson A

Lesson Title: Comparison between terrestrial and gas planets

lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Comparison between terrestrial and gas planets
CAPS Page Number	53

Lesson Objectives

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

- name the terrestrial and gas planets
- differentiate between the features of the planets
- draw a bar graph to show the differences in the temperatures between the planets

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Graph paper	Lined 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:

> Although Venus is further away from the Sun than Mercury, it has a higher surface temperature. How is this possible?

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.

> *Although Venus is not the closest to the Sun it has the highest surface temperature. This is because it has a dense atmosphere made of carbon dioxide that traps the solar energy.*

D ACCESSING INFORMATION

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

> THE PLANETS
>
> Using the information from the previous lessons, draw a table to show the following:
>
> 1. The number of moons that each planet has.
> 2. The surface temperature of each planet.
> 3. The distance of each planet from the Sun.
>
> When drawing the table remember the rules for drawing a table which are as follows:
>
> 1. Every table must have a complete heading.
> 2. Every column must have a suitable heading.
> 3. No units in the body of the table.
> 4. Use a ruler to draw the table.
> 5. Work neatly and accurately.

2. Tell the learners that they should do the following:
   a. Draw a table with a complete heading.
   b. They need to have 4 columns, one for the name of the planet, one for the number of moons, one for the surface temperature and one for the distance of planet from the Sun.
3. Give learners some time to complete this activity.
4. Write the model answer onto the chalkboard:

Table showing the number of moons, surface temperature and distance from the Sun for each planet

Name of planet	Number of moons	Surface temperature (°C)	Distance from Sun (millions of kms)
Mercury	0	-180 °C to 427 °C	58
Venus	0	471 °C	108
Earth	1	-88 °C to 58 °C	150
Mars	2	-87 °C to 0 °C	228
Jupiter	67	-148 °C	778
Saturn	63	-178 °C	1427
Uranus	27	-200 °C	2871
Mars	13	-210 °C	4498

5. Once learners have completed drawing the table they need to swap books and take out a pencil.
6. Tell the learners to use a pencil to mark their partner's work. Learners must do this quietly and slowly and must listen to your instructions carefully.
7. Tell the learners to put a tick next to the following:
   a. One mark for the heading of the table.
   b. Four marks for each of the column headings.
   c. Four marks for each row. It is important that the correct number of moons, surface temperature and distance from the Sun is written next to each planet.
   d. One mark if no units are in the body of the table.
   e. One mark for drawing a neat table.
8. Tell the learners that the total is 35 and they need to add the number of ticks and write a mark out of 35 for their partner.
9. The learners should now return the books to the owner.
10. The marks may be recorded as a short assessment.

Checkpoint 1

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

a. Which planet has the most moons?
b. What can you say in general about the number of moons that the two types of planets have?

Answers to the checkpoint questions are as follows:

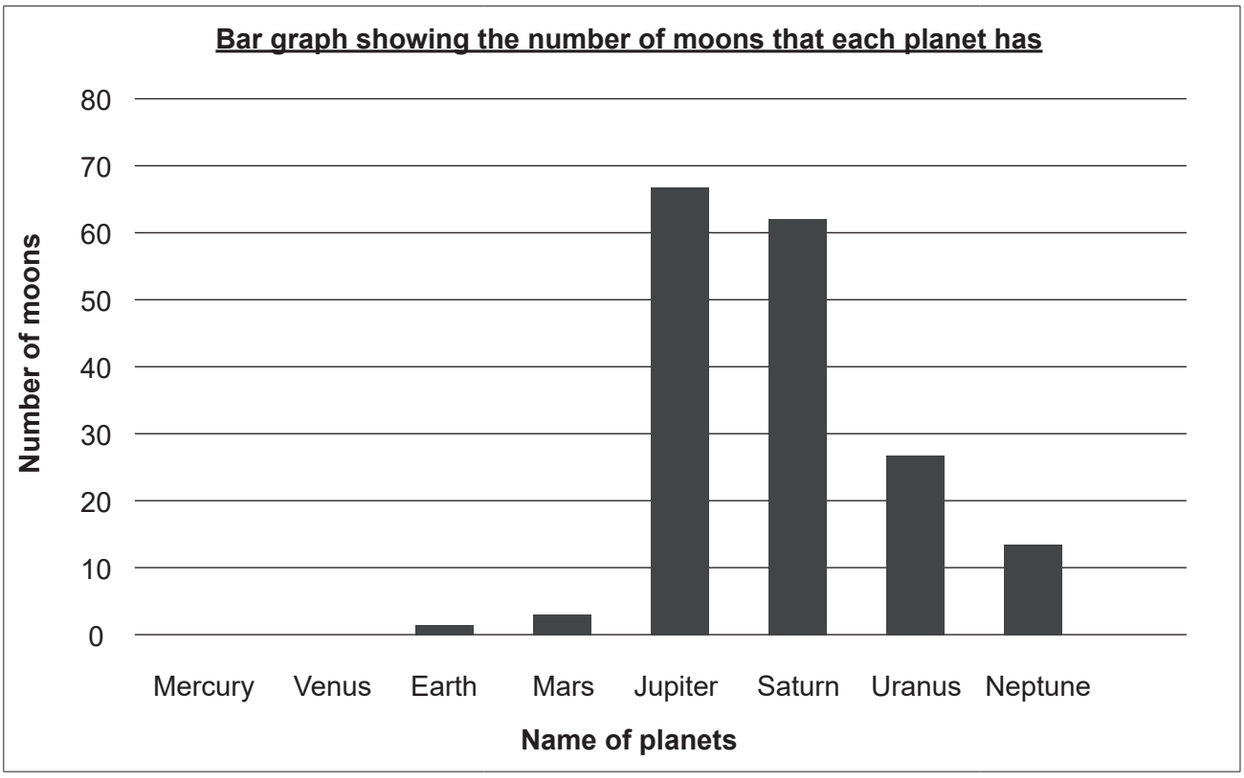
a. Jupiter
b. The gas planets have more moons than the terrestrial planets.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard:

> a. Use the table to draw a bar graph to show the number of moons that each planet has.
> b. Draw a bar graph.
> c. The bar graph must have a complete heading.
> d. The independent variable must be on the x-axis and the dependent variable must be on the Y-axis.
> e. Use a correct scale.

2. Provide instructions for this task to the learners as follows:
3. Give learners some time to complete this task in their workbooks.
4. Write the model answer on the chalkboard:



Checkpoint 2

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

a. Which planet has the most moons?
b. Why is the Earth's moon important to us?

Answers to the checkpoint questions are as follows:

a. Jupiter.
b. It controls the tides.

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
Spot on Natural Science	The Solar System	151-154
Top Class Natural Science	The Solar System	140-145
Platinum Natural Science	The Solar System	194-196
Oxford Successful Natural Science	The Solar System	164-169
Via Afrika Natural Science	The Solar System	148-155
Sasol Inzalo Natural Science	The Solar System	157-166
Step-by-step Natural Sciences	The Solar System	129 - 131
Top class Natural Sciences	The Solar System	144
Solutions for all Natural Sciences	The Solar System	197 - 198

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.space.com/16080-solar-system-planets.html [Information about the solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of planets]

3 B

Term 4, Week 3, Lesson B
Lesson Title: The Kuiper belt, Oort cloud, Asteroid belt and comets
lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Objects around the Sun
CAPS Page Number	53

Lesson Objectives

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

- identify objects around the Sun
- differentiate between asteroid, meteoroid, meteor, comet, dwarf planets and meteorites
- describe what makes up the Kuiper belt, Oort cloud, Asteroid belt and comets
- locate the Kuiper belt, Oort cloud and Asteroid belt

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook showing the Kuiper belt, Oort cloud, Asteroid belt and comets	Resource 3
Poster of our solar system showing the Kuiper belt, Oort cloud, Asteroid belt and comets	

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 name 3 celestial bodies you can find in our solar system?

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.

> *Choose from: star (Sun), planets, moons, satellites, comets, meteors, meteorites, dwarf planets*

D ACCESSING INFORMATION

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

> FOUND IN OUR SOLAR SYSTEM
>
> 1. **Dwarf planets** are planets that are not able to keep their path clear of other objects. Pluto was considered a planet but is now seen as a dwarf planet along with Eris, Ceres and Makemake.
> 2. **Asteroids** are smaller rocky objects made of stony or metallic material. They are smaller than dwarf planets. Most asteroids orbit the Sun and are found in the asteroid belt. The asteroid belt is an area between Mars and Jupiter.
> 3. **Meteoroids** are small solid objects in space much smaller than an asteroid. When a meteoroid enters the Earth's atmosphere it starts to burn up and is then called a **meteor**. When the meteor crashes to the ground it is called a **meteorite**.
> 4. **Comets** are lumps of frozen gas that can be as small as 200 meters or as large as 50 kilometers. Comets are found in the Kuiper Belt as well as in the **Oort Cloud**.
> 5. The **Kuiper belt** is a region of space filled with trillions of small objects that lie in the outer reaches of the solar system, past the orbit of Neptune.
> 6. The Oort Cloud is thought to be a huge cloud of icy objects at the very edge of our solar system, even further away than the Kuiper belt.
> 7. Gravity is the force that keeps all these objects in their stable predictable orbits around the Sun.

2. Tell the learners that you will be discovering more about our solar system. Explain that we have spent the last few lessons finding out about the Sun and the planets but there are other smaller objects in our solar system that need to be studied as well.
3. Ask a learner to read through each point on the chalkboard slowly.
4. Explain to the learners that dwarf planets are objects that orbit the Sun, just like the planets. However, they are smaller than planets. Due to their small size, they are unable to meet the official definition of a planet. One dwarf planet used to be classified as a planet but was reclassified as a dwarf planet. This planet was Pluto.

5. Explain to the learners that asteroids are small rocky objects that are believed to be left over from the formation of our solar system 4.6 billion years ago. Asteroids range in size from tens of meters across to several hundred kilometers across and come in many shapes. Most asteroids are found in the asteroid belt, which lies between the orbits of Mars and Jupiter.
6. Tell the learners that the Kuiper belt is a region of space filled with trillions of small objects that lies in the outer layer of the solar system, past the orbit of Neptune. This belt is like the closer asteroid belt, except that the objects are not made of rock, but rather of frozen ice.
7. Show the learners Resource 2 which shows the Asteroid belt and Kuiper belt, to help explain this.
8. Explain to learners that comets are icy, dusty objects, orbiting around the Sun at great distances. Comets are found in the Kuiper Belt and in the Oort Cloud. Comets that come into the inner solar system do not live forever. The Sun's heat melts comets.
9. Finally, explain that the Oort Cloud is thought to be a huge cloud of icy objects at the very edge of our solar system.
10. Give the learners some time to copy the information from the chalkboard into their workbooks.

Checkpoint 1

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

a. Name one dwarf planet.
b. What are comets made up of?

Answers to the checkpoint questions are as follows:

a. Pluto, Eris, Ceres or Makemake.
b. Frozen gas.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard:

1. a. Find the drawing of the solar system that you did in the second lesson of this section.
   b. Using a pencil, colouring pencils or pens add the following to your drawing:
      - The Asteroid belt
      - The Kuiper belt
      - The Oort Cloud
2. Draw a flow diagram to show what happens to a meteoroid when it enters the Earth's atmosphere. You can use diagrams or just words.
3. Draw this table in your workbook and fill in the missing information:

Other solar system objects	Location	Composition

2. Ask the learners to look in their notes for the sketch that they had to do of our solar system in Lesson 1B.
3. Give learners some time to complete the above activity in their exercise books.
4. Discuss the model answers with the learners.

1. Refer to the poster.
2. Meteoroids → meteor → meteorite

Other solar system objects	Location	Composition
Asteroid	Mostly found in asteroid belt which is between the orbits of Mars and Jupiter	Lumps of stony or metallic material
Comet	Comes from the Kuiper belt and Oort Cloud	Ammonia, ice, dry ice, water, dirt, rocks
Meteoroid	Just outside the Earth's atmosphere	Small pieces of rock

Checkpoint 2

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

a. Will comets from the Kuiper belt or Oort Cloud take longer to complete an orbit?
b. Give a reason for your answer.

Answers to the checkpoint questions are as follows:

a. Comets from the Oort Cloud will take longer to complete an orbit.
b. The Oort Cloud is much further away from the Sun and this will mean that the comet will take a much longer time to complete an orbit around the Sun.

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
Spot on Natural Science	The Solar System	150-151
Top Class Natural Science	The Solar System	141-142
Platinum Natural Science	The Solar System	196-199
Oxford Successful Natural Science	The Solar System	166-167
Via Afrika Natural Science	The Solar System	149-150
Sasol Inzalo Natural Science	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	132
Top class Natural Sciences	The Solar System	142
Solutions for all Natural Sciences	The Solar System	200 - 201

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.space.com/16080-solar-system-planets.html [Information about the solar system]
2. http://www.theplanetstoday.com/the_planets.html [Features of planets]

3 C

Term 4, Week 3, Lesson C
Lesson Title: Third planet from the Sun
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Earth
CAPS Page Number	53

Lesson Objectives

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

- know that the Earth is the third planet from the Sun
- give reasons why the Earth is the only planet that is known to support life

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbooks	Resources 4, 5, 7, 16, 17, and 18

C CLASSROOM MANAGEMENT

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

> Where would you find the Asteroid belt and the Kuiper belt?

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 asteroid belt is found between Mars and Jupiter and the Kuiper belt is found just past Neptune.*

D ACCESSING INFORMATION

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

> LIFE ON EARTH
>
> Earth is believed to be the only planet to support life. The conditions necessary to support life are:
>
> 1. Temperature:
>
>   The Earth's distance from the Sun provides the ideal temperature range to support life, which is between 71 °C and -90 °C.
> 2. Water:
>
>   Water can be a solid, liquid or gas in the Earth's temperature range. Earth is the only planet that has water in a liquid form and the Earth is covered with 76% water.
> 3. Sunlight:
>
>   Sunlight provides energy to sustain food chains on Earth. Plants manufacture food using the Sun's energy. Plants are then eaten by animals and the energy is transferred through the food chain.
> 4. Oxygen:
>
>   Earth is the only planet in our solar system that has oxygen in its atmosphere. Oxygen is released when plants make food or photosynthesise.

2. Ask a learner to read the information on the chalkboard.
3. Show the learners Resource 4 and 5 showing the Earth, its hemispheres and the equator.
4. Explain to the learners how life began on Earth by saying the following:
   a. Scientists do not know exactly how life began on Earth, but they estimate that the early ancestor of modern bacteria was alive on Earth 3.5 billion years ago.
   b. The early Earth's atmosphere had almost no oxygen. Instead, it was composed mainly of carbon dioxide, nitrogen and water vapour with some methane and ammonia.

c. Carbon dioxide and water vapour were pumped into the atmosphere during volcanic eruptions, which caused the atmosphere to change over time.
d. Eventually the water vapour in the atmosphere condensed to form rain, forming the first oceans.
e. Eventually living organisms (bacteria) appeared in the oceans.
f. These simple organisms used Sunlight, water and carbon dioxide in the oceans to produce sugars and oxygen.

4. Ask the learners to get into a group of 3 or 4 learners and discuss how they think the Earth formed.
5. Provide each learner with a copy of Resources 16, 17 and 18 which has information about the Big Bang Theory and the creation story.
6. After a few minutes ask them to share with the class their answers. Many learners will talk about the Bible and God. Listen to all arguments and close by saying that there are different beliefs and we must all respect every person's opinions. Allow for a lot of time for this debate as it is an important discussion to have and a chance for the learner voices to be heard.
7. Give learners some time to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. Which gas is necessary for life on Earth?
b. Name one other thing that Earth has that makes it suitable for life.

Answers to the checkpoint questions are as follows:

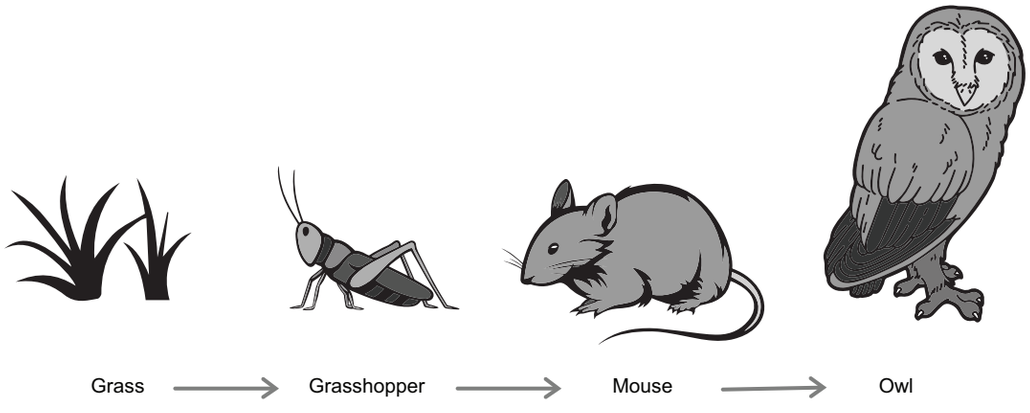
a. Oxygen
b. Choose from: water, ideal temperature, Sunlight

E CONCEPTUAL DEVELOPMENT

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

> 1. Draw a simple food chain that you would find in one of our national parks or reserves. Use only words and not pictures.
> 2. Which of the organisms is the producer?
> 3. Why is this organism so important?
> 4. Deforestation occurs when people cut down trees.
>   a. Why do you think that the trees are cut down?
>   b. What will happen if we do not stop cutting down trees?
> 5. Name four conditions that are needed for organism to survive and for each of them, explain why this condition is needed.

1. Read and discuss each statement with the learners:
   a. Number 1:
      - Tell learners what a National Park is. Then tell the learners the names of some of the biggest parks in South Africa: The Kruger National Park, Pilanesburg Nature Reserve, St Lucia, etc.
      - Explain that when drawing the food chain only use words like 'lion' as you do not have to draw a lion. You should draw arrows to show the flow of energy. Draw this example on the board to show the learners this example:



   b. Number 2: Tell the learners that they need to only draw three things in their food chain always starting with a producer.
   c. Number 3: Explain that a producer is a plant or tree or shrub that is able to manufacture their own food. It is usually green and at the beginning of a food chain.
   d. Number 4: Tell the learners that deforestation means to cut down many trees.
   e. Number 5: Tell the learners to refer to the notes in the first part of this lesson on the conditions necessary to support life.
3. Give the learners some time to complete this task in their workbooks.
4. Write the model answers onto the chalkboard and discuss these with the learners.

1. *Tree/ plant/ shrub/bush → giraffe / rat /zebra / buck → lion / leopard / jackal*
2. *Tree/ plant/ shrub/bush*
3. *These are the only organisms that can manufacture its own food.*
4. *a. They may want to use the space for agriculture, to build homes, schools etc.*
   b. Trees are extremely important as they provide shelter/homes for other organisms.
   They also provide food for all other organisms.
   They produce oxygen which is necessary to sustain life on Earth.
5. *a.Temperature: If it were too hot water would evaporate and if it were too cold the water would freeze. We need water as a liquid to drink.*
   b. Water: Organisms are made up of mostly water.
   c. Sunlight: Sunlight provides energy to sustain food chains on Earth. Plants manufacture food using the Sun's energy. Plants are then eaten by animals and the energy is transferred through the food chain. Sunlight also warms the Earth.
   *d. Oxygen: Oxygen is needed for **respiration** which is the process whereby organisms break down food to release energy.*

5. Once learners have completed the task, discuss the answers with the learners.

Checkpoint 2

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

a. List the four conditions required to sustain life on Earth.
b. Give an example of a 'producer' in the food chain.

Answers to the checkpoint questions are as follows:

a. Temperature, water, Sunlight and oxygen
b. Grass, trees, bushes.

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
Spot on Natural Science	The Solar System	155
Top Class Natural Science	The Solar System	145-146
Platinum Natural Science	The Solar System	204-205
Oxford Successful Natural Science	The Solar System	170-171
Via Afrika Natural Science	The Solar System	157-159
Sasol Inzalo Natural Science	The Solar System	144-146
Step-by-step Natural Sciences	The Solar System	135
Top class Natural Sciences	The Solar System	143
Solutions for all Natural Sciences	The Solar System	206

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.thestudentroom.co.uk/ [Conditions necessary for life on Earth]

4 A

Term 4, Week 4, Lesson A
Lesson Title: Revision:The solar system
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The solar system
CAPS Page Number	53

Lesson Objectives

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

- explain how much they understand about our solar system
- correct any misconceptions they may have about what is beyond our solar system

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbooks	

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 the difference between a star and a planet?

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.

Planets do not produce their own energy but stars do.

D ACCESSING INFORMATION

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

REVISION: THE SOLAR SYSTEM

Question 1

1.1. Put the planets in the correct order, starting with the planet closest to the Sun: Jupiter, Earth, Mars, Venus, Saturn, Uranus, Mercury, Neptune

1.2. Which of the eight planets is the smallest?

1.3. Other than size, what is the main difference between a planet and a star?

Question 2

2.1. Complete the table below to show differences between the Kuiper Belt and the Oort Cloud:

Kuiper Belt	**Oort Cloud**

2.2. What is the difference between the four inner planets and the four outer planets?

2.3. What are the differences between asteroids and comets?

Question 3

In the table below, name the four conditions that are needed for life on Earth and then explain why the condition is needed.

	Condition needed for life	**Why is this condition needed**
1.		
2.		
3.		
4.		

2. Give learners some time to answer these questions in their workbooks.
3. Tell the learners that they need to answer all the questions quietly.
4. Once learners are complete with the revision exercise, read each of the questions out loud and then ask learners to contribute their answers.
5. Write the model answers on the chalkboard as you do this:

Question 1

1.1. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

1.2. Mercury

1.3. Planets do not produce their own energy but stars do.

Question 2

Kuiper Belt	***Oort Cloud***
1. Found past the orbit of Neptune.	*1. The Oort Cloud is thought to be a huge cloud of icy objects at the very edge of our solar system.*
2. Region of space filled with trillions of small objects.	*2. Cloud of icy objects*

2.3. Asteroids are lumps of stony or metallic material. Comets are lumps of frozen gas that can be as small as 200 meters or as large as 50 kilometres.

Question 3

	Condition needed for life	***Why is this condition needed***
1.	*Temperature*	*If it was too hot, water would evaporate and if it was too cold the water would freeze. We would freeze if it was too cold or burn up if it was too hot.*
2.	*Water*	*Organisms are made up of mostly water. Water is also needed for drinking. Many organisms live in water.*
3.	*Sunlight*	*Sunlight provides energy to sustain food chains on Earth. Plants manufacture food using the Sun's energy. Plants are then eaten by animals and the energy is transferred through the food chain. Sunlight also warms the Earth.*
4.	*Oxygen*	*Oxygen is needed for respiration which is the process whereby organisms break down food to release energy.*

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

E 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
Spot on Natural Science	Beyond the solar system	148-157
Top Class Natural Science	Beyond the solar system	140-146
Platinum Natural Science	Beyond the solar system	192-209
Oxford Successful Natural Science	Beyond the solar system	162-171
Via Afrika Natural Science	Beyond the solar system	146-159
Sasol Inzalo Natural Science Bk B	Beyond the solar system	144-183
Step-by-step Natural Sciences	Beyond the solar system	135
Top class Natural Sciences	Beyond the solar system	145
Solutions for all Natural Sciences	Beyond the solar system	206

F ADDITIONAL ACTIVITIES / READING

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

TOPIC OVERVIEW:
Beyond the solar system
Term 4, Weeks 4B – 6C

A. TOPIC OVERVIEW

Term 4, Weeks 4b – 6c

- This topic runs for 3 weeks.
- It is presented over 9 x 1 hour 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

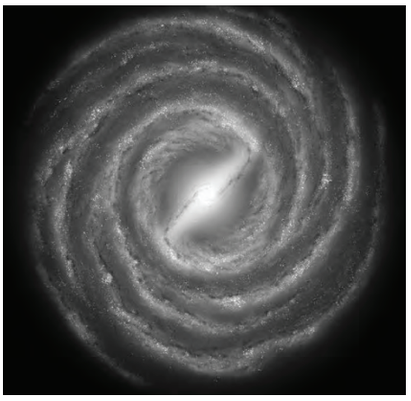
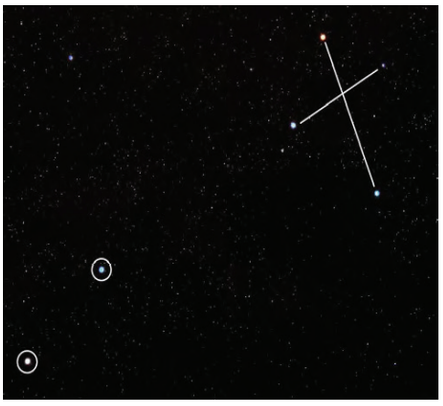
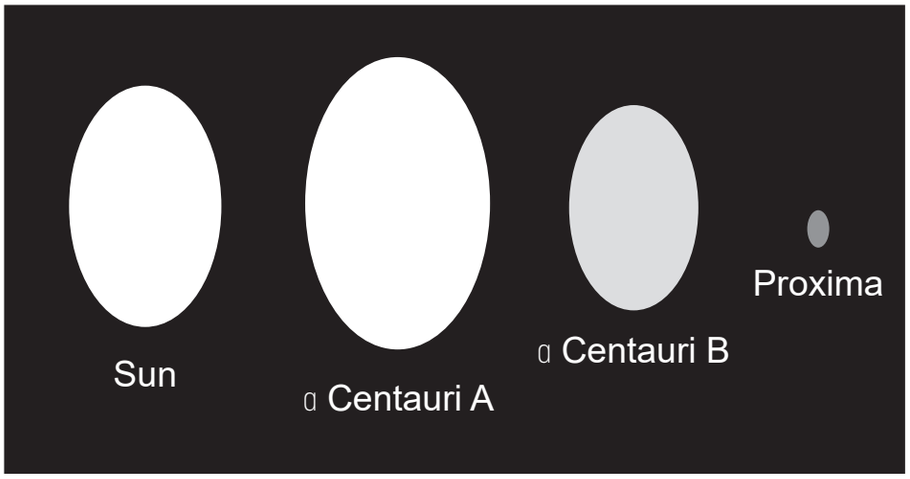
LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 8 & 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Relationship of the Sun to the Earth • Solar energy and the • Earth's seasons • Solar energy and life on Earth • Stored solar energy	• Beyond the solar system • The Milky Way galaxy • Our nearest star • Light years, light hours and light minutes • Beyond the Milky Way • galaxy	• Birth, life and death of stars

C. SCIENTIFIC VOCABULARY

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

	TERM	EXPLANATION
1.	galaxy	A collection of billions of stars, space dust and gas, held together by gravity. 
2.	astronomer	A scientist who studies the stars, planets and other objects. Galileo was an astronomer who invented the telescope.
3.	constellation	A group of stars that, when viewed from Earth, form a pattern in the sky. The ones that are famous are Orion's belt and The Southern Cross. 
4.	Alpha Centauri	The name of our closest easily visible star after the Sun. 

5.	Sundial	A Sundial is a device that tells the time of day by the position of the Sun in the sky. It consists of a flat plate (the dial) and a gnomon (can be a rod, wire, stick) which casts a shadow onto the dial.
6.	supercluster	Many galaxy groups are found in galaxy clusters and many of these are found in big groups called superclusters.

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Understanding of the Milky Way is important to think about space travel. Also, the study of stars is an interesting hobby as well as a potential career for astronomers and astrologers.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

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

4 B

Term 4, Week 4, Lesson B
Lesson Title: The Milky Way
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The Milky Way
CAPS Page Number	54

Lesson Objectives

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

- name the galaxy our Solar System is in
- define that a galaxy is a collection of stars held together by their mutual gravity
- explain stars in terms of the Milky Way galaxy and the Sun's place within it
- recall different stories about constellations

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

TOPIC: Beyond the solar system

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Stories of how the Milky Way was formed	Resources 8 and 9

C CLASSROOM MANAGEMENT

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

Which is the closest star to Earth?

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 Sun is the closest star to the Earth.

D ACCESSING INFORMATION

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

THE MILKY WAY GALAXY

1. Our **galaxy** is called the Milky Way because it looks like spilt milk.
2. Most of the stars of the Milky Way are not visible from the Earth.
3. **Astronomers** have determined that our galaxy is spiral-shaped.
4. The Milky Way looks like a huge whirlpool around a central bulge.
5. It has four main spiral arms.
6. The centre of the Milky Way looks like a black hole.
7. The Sun is only one of the billion or more stars in our galaxy.
8. All the stars in this galaxy are revolving around the centre of the galaxy. Just as the Earth travels around the Sun, the Sun and our entire solar system is travelling around the centre of the Milky Way galaxy.
9. Even though we are travelling incredibly fast years it takes the Sun about 225 million years to complete one orbit around the galaxy centre.

2. Tell the learners that the universe consists of millions of galaxies of which the Milky Way is one. Within each galaxy there are many solar systems. Our solar system is in the Milky Way.
3. Show the learners Resource 9 which shows what the milky looks like.
4. Tell the learners that the Milky Way looks like milk that was spilt. There are many stories told by our ancestors about how the Milky Way was formed.

4. Ask the learners if they know any stories told by their parents or grandparents about how the Milky Way was formed.
5. Let these learners share their stories with the class.
6. Using Resource 8, read the various stories about how The Milky Way was formed.
7. Tell the learners to copy the information written 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 name of our galaxy?
b. What is the general shape of our galaxy?

Answers to the checkpoint questions are as follows:

a. The Milky Way.
b. It has a spiral shape.

E CONCEPTUAL DEVELOPMENT

1. Ask the learners to get into a group of 3 or 4 learners.
2. Tell the learners that they will work together to write a story to tell their children how the Milky Way was formed.
3. Tell the learners that their story must follow these criteria:
   a. The story must have an interesting title.
   b. The story must describe the Milky Way.
   c. The story must tell us how the Milky Way was formed.
   d. There must be at least one drawing in the story.
   e. It must not be longer than 2 pages, including the drawings.
4. Ask the learners to start and tell them that they will have to read out their story to the class at the end of the lesson.
5. Once the learners have completed their stories, each group must come to the front of the class and read their story to the class.
6. When all stories are read, ask the class to vote for the best story.
7. Take each story and pin it up or stick it to the wall of the class.

Checkpoint 2

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

a. Can we see all the stars in our galaxy?

b. How many main spiral arms does our galaxy have?

Answers to the checkpoint questions are as follows:

a. No we cannot.

b. It has four main spiral arms.

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
Spot on	Beyond the solar system	157-159
Top Class	Beyond the solar system	147
Platinum	Beyond the solar system	209-210
Oxford	Beyond the solar system	162-163
Via Afrika	Beyond the solar system	160-161
Sasol Inzalo Natural Science Bk B	Beyond the solar system	144-183
Step-by-step Natural Sciences	Beyond the solar system	136
Top class Natural Sciences	Beyond the solar system	145 - 146
Solutions for all Natural Sciences	Beyond the solar system	206 - 207

G ADDITIONAL ACTIVITIES / READING

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

3. https://solarsystem.nasa.gov/planets/beyond/basic [Information about a solar system]
4. https://www.windows2universe.org/the_universe/Constellations/south_constellations.html [Constellations]
5. http://www.comfychair.org/~cmbell/myth/myth.html [Stories and Folk Tales about constellations]

4 C

Term 4, Week 4, Lesson C
Lesson Title: Drawing the Milky Way
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Beyond the solar system
CAPS Page Number	54

Lesson Objectives

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

- draw our galaxy
- locate where our Sun is in the galaxy

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Food colouring or ink or paint	Textbook showing pictures of the Milky Way
Container of water. Container should be transparent so a drinking glass will be good.	
Spoon or fork or stick	
Resource 9	

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 shape is our galaxy?

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.

> *It is a spiral shape.*

D ACCESSING INFORMATION

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

> THE MILKY WAY AND OUR SOLAR SYSTEM
>
> 1. The Milky Way galaxy consists of a thick bulge of stars in the middle with four bright spiral arms.
> 2. Our Sun is located towards the edge of the Milky Way galaxy in one of the spiral arms.

2. Give learners some time to write the above information from the chalkboard into their workbooks.
3. Tell the learners to close their eyes and imagine the Milky Way as you describe it. Tell the learners that they need to pay attention as they will need to draw the Milky Way in this lesson.
4. Read the description very slowly.

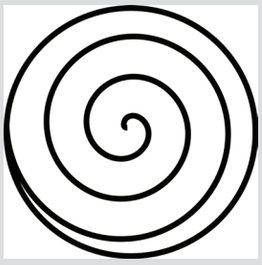
5. Describe the Milky Way as follows:
    a. The central part of the galaxy is orange because the stars found at the center of the galaxy tend to be older and cooler than the young hot blue stars.
    b. Scientists think that there are five major spiral arms in our galaxy. These are the Norma Arm, the Scutum-Crux Arm, the Sagittarius Arm, the Perseus Arm and the Cygnus Arm. The spiral goes from the center and forms in an anti-clockwise direction.
    c. The spirals are blue-ish in colour and are filled with dust, gas and hot young stars.
    d. Our Sun is located in a small spiral arm called the Orion (or Local) Arm which lies between the Sagittarius Arm and the Perseus Arm. Our Sun is about halfway out from the center of the galaxy.

Checkpoint 1

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

a. Why is the centre of the galaxy orange and the outer part blue?
b. Sketch a spiral shape in your book.

Answers to the checkpoint questions are as follows:

a. The central part of the galaxy is orange because the stars found at the centre of the galaxy
b. 

E CONCEPTUAL DEVELOPMENT

1. Do the following activity with the learners:

    a. Ask learners to get into groups of 3 or 4 for this part of the lesson.
    b. Tell one learner to come to the front of the class and get a container 75% filled with water, a fork or spoon, and a tiny drop of ink or food colouring or paint.
    c. Learners must now do the activity to observe the pattern of the Milky Way.
    d. Tell the learners to do the following:
        - Place the container with the water in the middle of the table.
        - One learner must stir the water vigorously with the fork in a circular motion.
        - Once the water is turning like a whirlpool remove the fork or spoon.
        - Another learner must quickly drop a few drops of ink or food colouring or paint into the middle of the water.

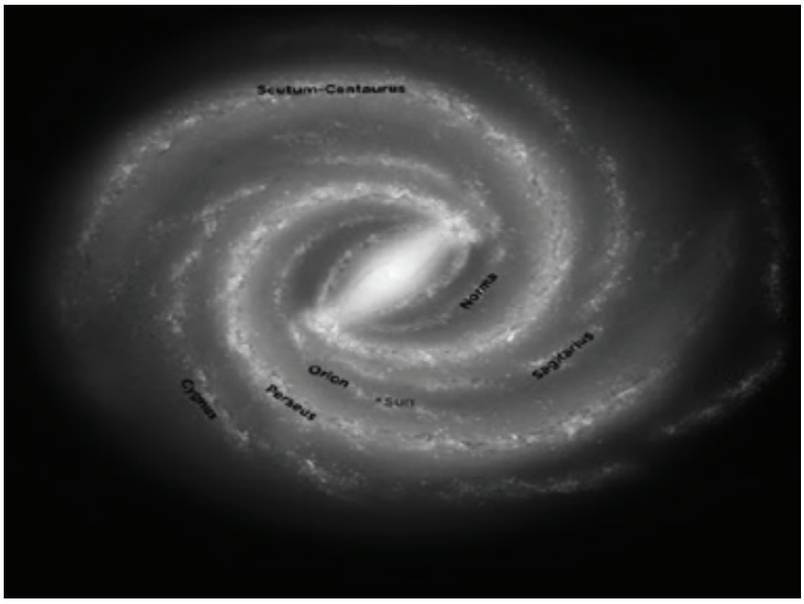
- Observe the speed of the swirling in the middle of the container and towards the edge.
- Look at the pattern that forms.

2. Read the following to the learners:

In your workbook draw the Milky Way. Be creative but accurate. Remember the following:

a. The central part of the galaxy is orange because the stars found at the center of the galaxy tend to be older and cooler than the young hot blue stars.
b. There are five major spiral arms in our galaxy. These are the Norma Arm which is closest to the centre, the Scutum-Crux Arm, the Sagittarius Arm, the Perseus Arm and the Cygnus Arm which is the outside arm of the spiral. The spiral goes from the centre and forms in an anti-clockwise direction.
c. The spirals are bluish in colour and are filled with dust and gas and hot young stars.
d. Our Sun is located in a small spiral arm called the Orion (or Local) Arm which lies between the Sagittarius Arm and the Perseus Arm. Our Sun is about halfway out from the centre of the galaxy.
e. Label your drawing.

3. Draw the model answer on the chalkboard:



The Sun's position in the Milky Way

Checkpoint 2

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

a. How many spiral arms does the Milky Way have?

b. Where is the Sun in our galaxy?

Answers to the checkpoint questions are as follows:

a. 5

b. The Sun is at the centre of our solar system but it is not in the centre of our galaxy. Our Sun is located in one of the spiral arms, towards the edge of the Milky Way galaxy.

4. 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
Spot on Natural Science	Beyond the solar system	158-159
Top Class Natural Science	Beyond the solar system	148
Platinum Natural Science	Beyond the solar system	211-212
Oxford Successful Natural Science	Beyond the solar system	170-175
Via Afrika Natural Science	Beyond the solar system	160-162
Sasol Inzalo Natural Science Bk B	Beyond the solar system	189-190
Step-by-step Natural Sciences	Beyond the solar system	140 - 141
Top class Natural Sciences	Beyond the solar system	147 - 148
Solutions for all Natural Sciences	Beyond the solar system	212 - 214

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://solarsystem.nasa.gov/planets/beyond/basic [Beyond the solar system]
2. https://www.windows2universe.org/the_universe/Constellations/south_constellations.html [Constellations in the Southern Hemisphere]

5 A

Term 4, Week 5, Lesson A
Lesson Title: Our nearest star
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The Sun
CAPS Page Number	54

Lesson Objectives

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

- recall that the Sun is our closest star
- name the star called Alpha Centauri as the nearest easily visible star to the Sun
- write the large numbers associated with space distances

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook showing pictures of the constellation	Resources 10, 11, 12

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 keeps the stars of our galaxy from drifting away from each other?

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.

They are held together by their pull of gravity on each other.

D ACCESSING INFORMATION

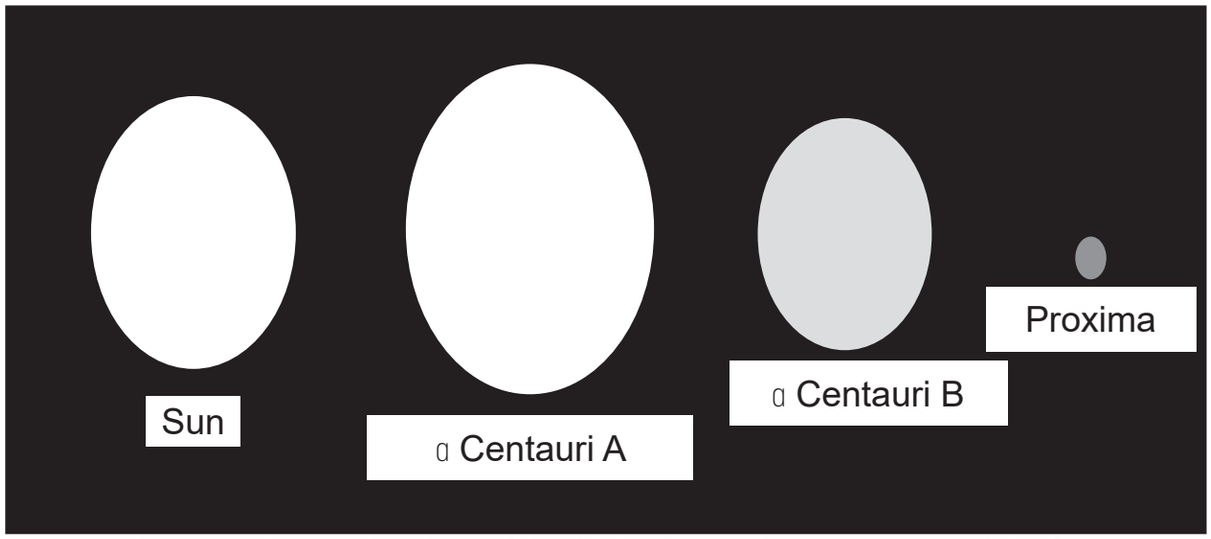
1. Write the following table onto the chalkboard (always try to do this before the lesson starts):

CONSTELLATIONS

1. A constellation is a group of stars that, when viewed from Earth, form a pattern in the sky. One famous constellation that is visible, even from big cities in South Africa, is the Southern Cross. This is shown below.
2. The two bright stars at the bottom left pointing towards the cross are called the pointers.

The Pointers (circled) and the Southern Cross

3. The brightest of the Pointers looks slightly orange if you look closely. This star is called **Alpha Centauri** and is our closest easily visible star after the Sun.



A comparison of the sizes of the Alpha Centauri star system and the Sun.

3. The Sun is our closest star, and is 150 million kilometers from Earth.
4. Proxima Centauri, the closest star to our own Sun, is about 40 trillion km away from the Earth. Alpha Centauri A and B are slightly farther away, at 42 trillion km away from us.

2. Give learners some time to copy the information written on the chalkboard into their workbooks.
3. Show the learners Resources 10, 11 and 12 to help explain the information on the blackboard.
4. Tell the learners the following:
   a. The Sun is our closest star, and is only 150 million kilometers from Earth.
   b. A constellation is a group of stars that, when viewed from Earth, form a pattern in the sky. One famous constellation that is visible, even from big cities in South Africa, is the Southern Cross. The two bright stars at the bottom left pointing towards the cross are called the pointers.
   c. The brightest of the Pointers looks slightly orange if you look at it at night. This star is called Alpha Centauri and is our closest easily visible star after the Sun. Point to the one on the left which is near the edge of the page. Ask learners to label this pointer in their drawing.
   d. Alpha Centauri is actually part of a triple star system which is where three stars are in orbit around each other.
   e. The two main stars of the system are called Alpha Centauri A and Alpha Centauri B. They orbit close together.
   f. A smaller, fainter star, called Proxima Centauri, orbits much further out.
   g. If you were to look at Alpha Centauri through a small telescope, instead of one star you would be able to make out the two separate stars Alpha Centauri A and B next to each other.
   h. Proxima Centauri is much dimmer and further away from the other two so you would not see this one with the other two.

Checkpoint 1

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

a. Name the star that is closest to the Earth, other than the Sun.

b. Alpha Centauri is part of a system of three stars but if you look through a telescope you will only be able to see two. Why is this case?

Answers to the checkpoint questions are as follows:

a. Alpha Centauri

b. Proxima Centauri is much fainter and further away from the other two so you would not see this one with the other two.

E CONCEPTUAL DEVELOPMENT

1. Explain the following to the learners:
   a. Different animals, modes of transport and objects travel at different speeds and therefore take different lengths of times to travel from one place to another.
   b. The formula for calculating the time taken for something to move from one place to another is: $time = \frac{distance}{speed}$
2. Write the following on the chalkboard and give the learners time to copy the information into their workbooks.

In words	In number format
one hundred	
one thousand	
one million	
one billion	
one trillion	

3. Tell the learners to complete the table by filling in the second column in number format.
4. Ask the learners to work quietly and accurately to complete the activity.
5. Write the model answer on the chalkboard:

In words	In number format
one hundred	*100*
one thousand	*1 000*
one million	*1 000 000*
one billion	*1 000 000 000*
one trillion	*1000 000 000 000*

Checkpoint 2

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

a. How would you write a billion?

b. What is the formula for calculating distance?

Answers to the checkpoint questions are as follows:

a. 1 000 000 000

b. distance = time X speed

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
Spot on	Beyond the solar system	160
Top Class	Beyond the solar system	148
Platinum	Beyond the solar system	214-215
Oxford Successful	Beyond the solar system	177
Via Afrika	Beyond the solar system	162-163
Sasol Inzalo Natural Science Bk B	Beyond the solar system	189-190
Step-by-step Natural Sciences	Beyond the solar system	142
Top class Natural Sciences	Beyond the solar system	148
Solutions for all Natural Sciences	Beyond the solar system	212 - 214

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://solarsystem.nasa.gov/planets/beyond/basic [Beyond the solar system]
2. https://starchild.gsfc.nasa.gov/docs/StarChild/questions/question19.html [Light years and how it is used]

5 B

Term 4, Week 5, Lesson B
Lesson Title: Light years, light hours
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Light years, light hours
CAPS Page Number	54

Lesson Objectives

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

- explain the concepts: light year, light hour, light minute
- draw a graph comparing distances of the planets from the Sun in light years

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbooks	Information in lesson plans

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 a constellation?

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 constellation is a group of stars that, when viewed from Earth, form a pattern in the sky.

D ACCESSING INFORMATION

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

LIGHT YEARS, LIGHT HOURS, LIGHT MINUTES

1. People use light years to measure distances to stars and other objects beyond the solar system.
2. Alpha *Centauri* is 42 trillion km away.
3. A light year is the distance that light travels in one year.
4. A light hour is the distance that light travels in one hour.
5. A light minute is the distance that light travels in one minute.
6. a. Our solar system has a diameter of about 13 light hours.
   b. The Earth is about 8 light minutes away from the Sun
7. Looking at it in another way:

- 1 light second = light travels 300 000 km
- 1 light minute = light travels 18 million km
- 1 light hour = light travels 1,1 billion km
- 1 light day = light travels 25 billion km
- 1 light year = light travels 9,5 Trillion km

2. Give learners some time to copy the information written on the chalkboard into their workbooks.

3. Tell the learners the following:
   a. **Astronomers** use units called **light years** to measure the distances between stars and galaxies.
   b. One light year is almost 10 trillion kilometres.
   c. Light years, light hours and light minutes measure distances.
   d. If you measure the distance to a light source in light travel time, you can work out how long the light took to reach you.
   e. Light that is emitted from an object one light year away from you, takes one year to reach your eyes. Similarly, light that is emitted from an object one light hour away, takes one hour to reach your eyes.
   f. Light travels at about 1080 million km/h (kilometres per hour)
   g. Light takes 8 minutes to travel from the Sun to the Earth.
4. Ask the learners how long it takes from the time they press a light switch on until the room fills with light. (They will say immediately, or a second)
5. Tell the learners that light travels so fast, that if they were standing a metre away from the lamp it would take only three billionths of a second for the light from the lamp to reach their eyes.

Checkpoint 1

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

a. How far is *Alpha Centauri* from the Earth?
b. If the Sun were to turn off now, how long will it take before the Earth is in complete darkness?

Answers to the checkpoint questions are as follows:

a. *Alpha Centauri* is 42 trillion km away.
b. 8 minutes.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

Planet	Distance from the Sun (million km)	Distance from the Sun in light hours or minutes
Mercury	57.9	3.2 light minutes
Venus	108.2	6.0 light minutes
Earth	149.6	8.3 light minutes
Mars	227.9	12.7 light minutes
Jupiter	778.6	43.3 light minutes

Saturn	1433.5	1.3 light hours
Uranus	2872.5	2.7 light hours
Neptune	4495.1	4.2 light hours

a. Which planet is the furthest from the Sun?

b. Which planet is closest to the Sun?

c. What is the distance in light minutes between the Sun and the Earth?

Draw a line graph to show the distance from the planets and the Sun in light minutes. Only plot value for Mercury, Venus, Earth, Mars and Jupiter.

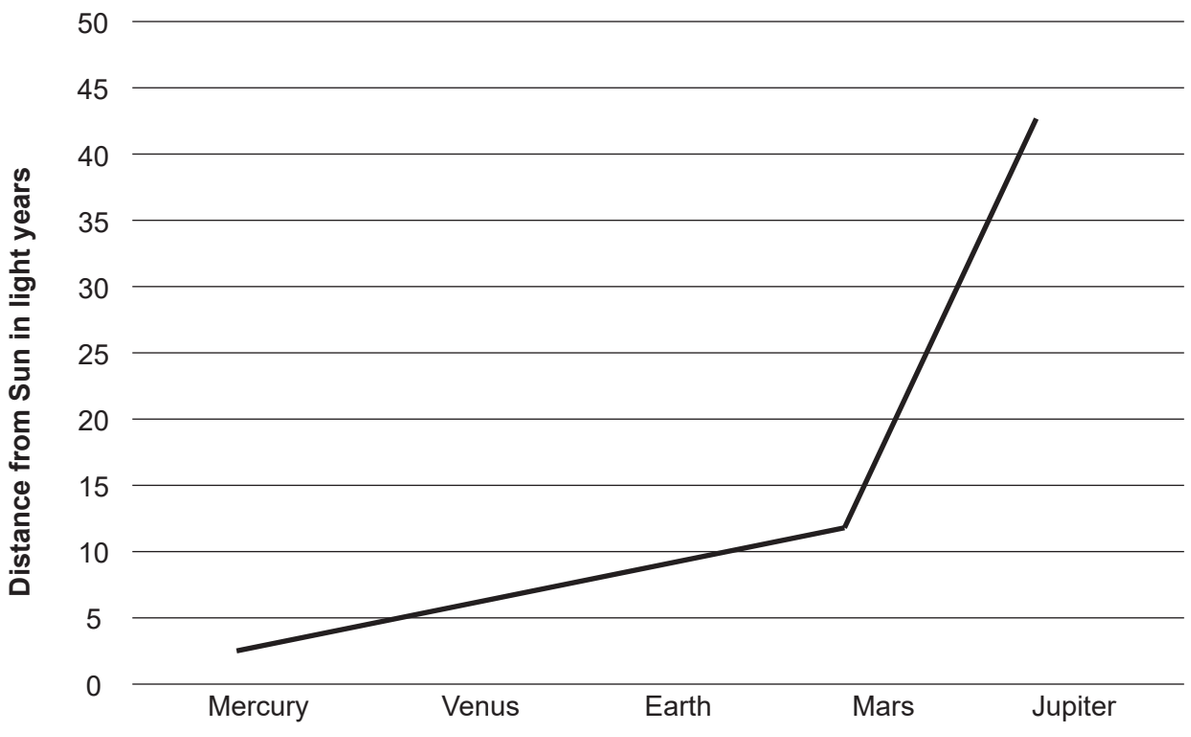
2. Tell the learners to do the following:
   a. They do not have to copy the questions in their workbooks as this will take a long time.
   b. Answer the questions written on the chalkboard in their workbooks.
   c. The table shows the distance that each planet lies from the Sun in kilometers (km) and then in light hours or light minutes.
   d. Work quietly to answer the questions by using the information they copied from the chalkboard at the beginning of the lesson.
3. Give learners some time to complete this task in their workbook.
4. Write the model answers onto the chalkboard:

a. Neptune

b. Mercury

c. 8.3 light minutes

Line graph showing the distance between the planets and the Sun in light years



Checkpoint 2

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

a. How many spiral arms does the Milky Way have?

b. Where is the Sun in our galaxy?

Answers to the checkpoint questions are as follows:

a. 5

b. The Sun is at the centre of our solar system but it is not in the centre of our galaxy. Our Sun is in one of the spiral arms, towards the edge of the Milky Way galaxy.

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
Spot on	Beyond the solar system	160-161
Top Class	Beyond the solar system	149-151
Platinum	Beyond the solar system	216-217
Oxford Successful	Beyond the solar system	178-179
Via Afrika	Beyond the solar system	164-165
Sasol Inzalo Natural Science Bk B	Beyond the solar system	194-196
Step-by-step Natural Sciences	Beyond the solar system	143
Top class Natural Sciences	Beyond the solar system	148
Solutions for all Natural Sciences	Beyond the solar system	215 - 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://solarsystem.nasa.gov/planets/beyond/basic [Beyond the solar system]
2. https://starchild.gsfc.nasa.gov/docs/StarChild/questions/question19.html [Light years and how it is used]

5 C

Term 4, Week 5, Lesson C
Lesson Title: Making a Sundial
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Making a Sundial
CAPS Page Number	54

Lesson Objectives

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

- make a Sundial
- tell the time using a Sundial

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook	Lesson plan with information
Watches	Wall clock
Crayons or colour pens	Resources 13, 14 and 15
Paper plate or a piece of blank A4 paper	
Sharpened pencil	
Plastic straw or stick	
Ruler	

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 units used by astronomers used to measure the distances between stars in the galaxies?

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.

> *Astronomers use units called **light years** to measure the distances between stars in the galaxies.*

D ACCESSING INFORMATION

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

> SunDIALS
>
> 1. A Sundial is a device that tells the time of day by the position of the Sun in the sky.
> 2. It consists of a flat plate (the dial) and a gnomon (which can be a rod, wire or stick) which casts a shadow onto the dial.
> 3. As the Sun appears to move across the sky, the shadow lines up with different hour lines which are marked on the dial to indicate the time of day.

2. Show the learners Resource 13 and 14 which show examples of Sundials.

3. Hold the wall clock up so that every learner can see it clearly.
4. Change the time on the clock to different times and ask learners to put up their hand when they know what time it is.
5. Use the following times:
   a. 3:30
   b. 12:15
   c. 6:00
   d. 4:45
   e. 9:20
6. Give learners some time to copy the information written on the chalkboard into their workbooks.
7. Explain to the learners that years ago, before the invention of clocks and watches. people used a Sundial to tell the time of day.

Checkpoint 1

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

a. What is a Sundial?
b. Why do we say that the Sun 'appears' to move?

Answers to the checkpoint questions are as follows:

a. A Sundial is a device that tells the time of day by the position of the Sun in the sky.
b. The Sun does not move, rather the Earth moves around the Sun.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

HOW TO MAKE A SunDIAL

1. Prepare a Paper Plate or an A4 blank paper
   - Start this project on a Sunny day just before noon.
   - Use the pencil to poke a hole through the very centre of the paper plate or A4 paper .
   - Write the number 12 on the edge of the plate with a crayon.
   - Write the number 6 on the opposite side of the plate.
   - Using a ruler as a guide, draw a line from 12 to 6. Make sure that you go right through the centre where you made the hole.
   - The plate is now divided into 2 halves.
   - Divide each half into 2 so that you now have 4 equal parts.
   - Write the numbers 3 and 9 on the edge of those parts.
   - Using a ruler as a guide, draw a line from 3 to 9. Make sure that you go right through the centre where you made the hole.

- The plate or paper should start to look like the face of a clock.
- Continue to divide each part so that you eventually have 12 equal pieces.
- Take your colour pen or pencil and write the numbers 1 to 12 on the edges.
- Try to be as accurate and creative as possible.
- Poke the straw through the hole.
- Keep this paper plate with you.

2. Take the plate or paper with you. When it is 12 o'clock take the plate or paper, and place it on the ground so that the shadow of the straw falls along the line to the number 12.
3. Fasten the plate or paper to the ground. Predict where you think that the shadow of the straw will be pointing in one hour. (It should be at 1 at 1 o'clock)
4. Continue each hour predicting the position and then checking and marking the actual position and time on the edge of the plate.

2. Explain this task to the learners as follows:
   a. Follow the instructions that are written on the chalkboard to make the Sundial.
   b. Be creative and accurate.
3. Explain to the learners that they will have to do the following:
   a. When it is 12 o'clock take the plate or paper and place it on the ground so that the shadow of the straw falls along the line to the number 12.
   b. Fasten the plate or paper to the ground.
   c. Predict where they think that the shadow of the straw will be pointing in one hour. (It should be at 1 at 1 o'clock)
   d. Continue each hour predicting the position and then checking and marking the actual position and time on the edge of the plate or paper.
4. Show the learners Resource 15 which shows a homemade Sundial.
5. The learners' Sundials should look like this:

6. Ask the learners the following questions:
    a. How many parts was the Sundial divided into? (12)
    b. Why was it divided into that number of parts? (*There are 12 hours in the day and 12 hours in the night)*

Checkpoint 2

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

a. How many hours are there in a day?
b. How many minutes in an hour?

Answers to the checkpoint questions are as follows:

a. 24 hours
b. 60 minutes

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
Spot on	Beyond the solar system	
Top Class	Beyond the solar system	
Platinum	Beyond the solar system	
Oxford Successful	Beyond the solar system	
Via Afrika	Beyond the solar system	
Sasol Inzalo Natural Science Bk B	Beyond the solar system	
Step-by-step Natural Sciences	Beyond the solar system	144 - 145
Top class Natural Sciences	Beyond the solar system	149 - 150
Solutions for all Natural Sciences	Beyond the solar system	217 - 219

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.nwf.org/kids/family-fun/crafts/Sundial.aspx [How to make a Sundial]

6 A

Term 4, Week 6, Lesson A
Lesson Title: How our Universe was formed.
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Beyond the Milky Way galaxy
CAPS Page Number	54

Lesson Objectives

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

- explain that the Milky Way is only one of many galaxies in our universe
- recall that the size of the observable universe is estimated to be about 28 billion light years
- describe different beliefs of how the universe was formed

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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, 17 and 18

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 the name of our galaxy?

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 Milky Way.*

D ACCESSING INFORMATION

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

> THE UNIVERSE
>
> 1. Our galaxy, the Milky Way, is only one out of a total of about 100 to 200 billion galaxies that astronomers estimate to be in the universe.
> 2. As well as stars, galaxies contain large amounts of gas and dust.
> 3. According to the Big Bang Theory, the universe was once extremely hot, closely packed matter that suddenly started expanding.
> 4. It spread rapidly to form the present universe and it is still expanding.
> 5. The universe is about 14 billion years old.

1. Explain this information to the learners as follows:
   a. Our galaxy, the Milky Way, is only one out of a total of about 100 to 200 billion galaxies that astronomers estimate to be in the universe. That's more than 10 times the total number of people on Earth.
   b. As well as stars, galaxies contain large amounts of gas and dust.
   c. The galaxies are all moving away at great speeds. This means the universe keeps getting bigger.
3. Ask the learners if they remember learning about the Big Bang Theory in previous lesson. Give them some time to answer and share their thoughts about this theory.

4. Tell the learners that:
   a. According to the Big Bang Theory, the universe was once extremely hot, closely packed matter that suddenly started expanding.
   b. It spread rapidly to form the present universe and it is still expanding.
   c. The universe is about 14 billion years old.
5. Ask the learners how they think the universe began and was formed. (Once again, they may talk about the Bible and God. Allow for this and encourage debate.)
6. Give learners some time to copy the information written on the chalkboard into their workbooks.

Checkpoint 1

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

a. How old do scientists think the universe is?
b. How did the universe form?

Answers to the checkpoint questions are as follows:

a. The universe is about 14 billion years old.
b. The Big Bang Theory or God created the Earth in 7 days.

E CONCEPTUAL DEVELOPMENT

1. Tell the learners that the next part of the lesson will involve a dramatization of how the Universe was formed.
2. Have the learners do the following activity:

Ask the learners to do the following:

a. Form 4 groups.
b. Two groups will be called the 'Big Bang Theory' and two groups will be called the 'Bible' group.
c. The two 'Big Bang Theory' groups will to go to one part of the classroom and the 'Bible' group will to go to the other part of the classroom.
d. Give the 'Big Bang Theory' groups Resource 16 and 17 and the 'Bible' group Resource 18.
e. Ask one person from each of the groups to read the information to the group while the others listen carefully.
f. The groups must now separate and find a space far away from the others to dramatize or create a play about how the Universe was formed.

Checkpoint 2

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

a. As well as stars, what else does the galaxies contain?

b. Does the size of the universe stay the same?

Answers to the checkpoint questions are as follows:

a. Galaxies contain large amounts of gas and dust.

b. No it keeps getting bigger and bigger.

3. Tell the learners the following:

   a. They will have until the rest of the lesson to prepare and that they will act out their play in the next lesson.

   b. The play must not be longer than 5 minutes.

   c. 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
Spot on	Beyond the solar system	162-163
Top Class	Beyond the solar system	150
Platinum	Beyond the solar system	220-222
Oxford Successful	Beyond the solar system	180-181
Via Afrika	Beyond the solar system	166-167
Sasol Inzalo Natural Science Bk B	Beyond the solar system	200-204
Step-by-step Natural Sciences	Beyond the solar system	144 - 145
Top class Natural Sciences	Beyond the solar system	149 -150
Solutions for all Natural Sciences	Beyond the solar system	217 - 219

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://solarsystem.nasa.gov/planets/beyond/indepth [Beyond the Milky Way galaxy]

6 B

Term 4, Week 6, Lesson B
Lesson Title: Earth's place in the universe
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Where does Earth fit in the universe?
CAPS Page Number	54

Lesson Objectives

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

- differentiate between the scientific beliefs of how the Universe was formed and the religious beliefs of how the Universe was formed
- explain that there are many other galaxies and that they have various shapes and sizes

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook	

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 do galaxies contain?

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.

> *As well as stars, galaxies contain large amounts of gas and dust.*

D ACCESSING INFORMATION

1. Tell the learners the following:
   a. They will be performing their plays.
   b. They will only have 5 minutes per play.
3. Allow the learners to perform their plays and after the plays are done ask the learners if they have any questions and answer them.
4. Write the following onto the chalkboard (always try to do this before the lesson starts):

> SHAPES AND SIZES OF GALAXIES
>
> 1. Galaxies come in a variety of shapes and sizes.
> 2. There are five main types of galaxies:
>   - Spiral
>   - Barred spiral
>   - Elliptical
>   - Lenticular
>   - Irregular
> 3. The Milky Way is an average-sized spiral galaxy: it is 100 000 light years across and contains around 200 billion stars.
> 4. Small galaxies may contain only a few million stars, while large galaxies can have several trillion stars.

5. Our closest galaxy neighbor is called the Andromeda galaxy which is 2.5 million light years away from the Milky Way.
6. Most galaxies are found gathered together in gigantic galaxy neighbourhoods, called **galaxy groups**.
7. **Galaxy clusters** are even larger, spanning tens of millions of light years, and can contain hundreds or even thousands of galaxies.
8. Many clusters of galaxies come together to form **superclusters** of galaxies.
9. Gravity holds the galaxies in groups, clusters and superclusters together.

4. Explain this information to the learners as follows:
   a. Galaxies come in a variety of shapes and sizes.
   b. The Milky Way is an average-sized spiral galaxy: it is 100 000 light years across and contains around 200 billion stars.
   c. Our galaxy, the Milky Way, is only one out of a total of about 100 to 200 billion galaxies that astronomers estimate to be in the universe. That's more than 10 times the total number of people on Earth.
   d. Small galaxies may contain only a few million stars, while large galaxies can have several trillion stars.
   e. Our closest galaxy neighbor is called the Andromeda galaxy. Andromeda is 2.5 million light years away from the Milky Way and if you wanted to travel to Andromeda and could travel as fast as light, it would still take you 2.5 million years to get there.
5. Explain to the learners how the Earth fits into our galaxy by telling them the following:
   a. The Earth is found in our solar system. Our solar system is in a galaxy known as the Milky Way.
   b. Most galaxies are found gathered together in gigantic galaxy neighbourhoods, called galaxy groups. Our Milky Way is found in a group of galaxies called The Local Group.
   c. Many galaxy groups are found in galaxy clusters and many of these are found in superclusters.
   d. Gravity holds the superclusters together.
6. Give learners some time to copy the information written 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 name of our closest galaxy neighbour?
b. Why do the galaxies not drift away from each other?

Answers to the checkpoint questions are as follows:

a. Our closest galaxy neighbor is called the Andromeda galaxy.
b. They are held together by gravity.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

Activity

1. Name the 5 types of galaxy shapes.
2. If Andromeda is 2.5 million light years away from the Milky Way, how far is this in kilometers?
3. Draw and label a flowchart to show how the Earth fits into the Universe. Use colour pencils to make your flowchart as beautiful as possible.

2. Give learners some time to complete the above activity in their workbooks.
3. Tell the learners that they will need to:
   a. Refer to their notes from the previous days to answer these questions.
   b. Be as creative as possible to answer question 3.
3. Tell the learners that once they are done they should find a partner that is also done and compare answers.
4. Write the model answers on the chalkboard:

1. *Spiral, Barred spiral, Elliptical, Lenticular, Irregular*
2. *1 light year = 9,5 Trillion km*

   5million light years = 9.5 trillion X 2.5 million

   = 23.75 000 000 000 000 000 000
3. ***Earth*** → ***solar system*** → ***Milky Way*** → ***The Local Group*** → ***galaxy clusters*** → ***super cluster*** → ***universe***

Checkpoint 2

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

a. Is a galaxy cluster or a supercluster bigger?
b. Explain your answer in (a)?

Answers to the checkpoint questions are as follows:

a. Supercluster.
b. Many galaxy groups are found in galaxy clusters and many of these are found in superclusters. So, a supercluster is made up of many galaxy clusters.

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
Spot on	Beyond the solar system	162-163
Top Class	Beyond the solar system	150
Platinum	Beyond the solar system	220-222
Oxford Successful	Beyond the solar system	180-181
Via Afrika	Beyond the solar system	166-167
Sasol Inzalo Natural Science Bk B	Beyond the solar system	212-216
Step-by-step Natural Sciences	Beyond the solar system	145 - 146
Top class Natural Sciences	Beyond the solar system	150
Solutions for all Natural Sciences	Beyond the solar system	219

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.space.com › Science & Astronomy [The Big Bang Theory]
2. https://answersingenesis.org/age-of-the-earth/how-old-is-the-earth/ [How the Earth was created according to the Bible]

6 C

Term 4, Week 6, Lesson C
Lesson Title: Beyond the solar system
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Beyond the milky way galaxy
CAPS Page Number	54

Lesson Objectives

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

- recognize how much they understand about what is beyond the solar system
- learn fun facts about what is beyond the solar system
- correct any misconceptions they may have about what is beyond our Solar system

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook	

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 lies beyond our solar system?

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.

Our galaxy, other galaxies, the universe.

D ACCESSING INFORMATION

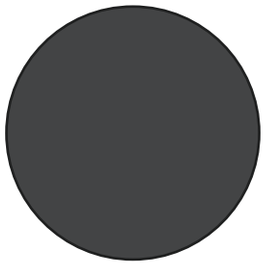
1. Write the following table onto the chalkboard (always try to do this before the lesson starts):

BEYOND OUR MILKY WAY GALAXY: SOME INTERESTING FACTS

1. Expanding Universe:
   Edwin Hubble discovered that the Universe is expanding (growing bigger and bigger).
2. Billions and Billions:
   There are at least a hundred billion galaxies in the Universe. A galaxy is full of stars: Our Sun is just one of at least a hundred billion stars in our own Milky Way galaxy, and each of those stars could have their own planetary system just like we have our solar system. Our closest galaxy neighbour is called the Andromeda Galaxy which is 2.5 million light years away from the Milky Way.
3. Many Galaxies:
   A space telescope, observed a tiny patch of sky (one-tenth the diameter of the moon) and found approximately 10,000 galaxies, of all sizes, shapes and colours.
4. Life out there:
   Scientists are searching for life on other planets. For life to exist we need oxygen, Sunlight, water, and the correct temperature.
5. Black Holes:
   Black holes are not empty spaces in the Universe. A black hole is a great amount of matter packed into a very small area, which results in a gravitational pull so strong that nothing can escape.

2. Give the learners time to read through the information. There is no need to copy this information into their workbooks.
3. Divide the learners into 5 groups.
4. Each group must be allocated one fun fact and a blank A4 page.
5. Tell the learners that people have different ways of learning. Some children learn by listening to the teacher while others are visual learners, so they need to see pictures, writing or symbols to learn. For this reason, each group needs to create a picture to illustrate (show) their fun fact. For example, fun fact 5 could look like this:

NO ESCAPE!!!!!



A black hole: a small area packed
with a lot of matter. Nothing can escape.

6. Give the learners some time to complete the activity.
7. Once they are done they can stick their fun fact poster onto the wall and everyone can have a look at it.
8. Give the learners some time to draw each poster that was created by the groups.

Checkpoint 1

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

a. Who discovered that the Universe is expanding (growing bigger and bigger).
b. What is a black hole?

Answers to the checkpoint questions are as follows:

a. Edwin Hubble
b. A black hole is a great amount of matter packed into a very small area, which results in a gravitational pull so strong that nothing can escape.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

THINKING ABOUT SPACE

Fill in the blanks.

1. _____ discovered that the Universe is expanding.
2. There are at least a hundred billion _____ in the Universe.
3. A galaxy is full of stars. The name of a very important star in our galaxy is the _____.
4. The name of our galaxy is the _____.
5. Our closest galaxy neighbour is called the _____ Galaxy which is 2.5 million light years away from the Milky Way.
6. In order for life to exist we need _____, _____, _____ and the correct _____.
7. Black holes are not empty spaces in the Universe. A black hole is a great amount of _____ packed into a very small area. The _____ is so strong that nothing can escape.

2. Tell the learners to answer the questions in their workbooks.
3. Tell the learners that they will need to look through their notes to remind themselves of their previous knowledge.
4. Give the learners time to complete the task.
5. Write the model answers on the chalkboard:

1. *Edwin Hubble discovered that the Universe is expanding.*
2. *There are at least a hundred billion galaxies in the Universe.*
3. *A galaxy is full of stars. The name of a very important star in our galaxy is the Sun.*
4. *The name of our galaxy is the Milky Way.*
5. *Our closest galaxy neighbour is called the Andromeda Galaxy which is 2.5 million light years away from the Milky Way.*
6. *In order for life to exist we need oxygen, water, Sunlight and the correct temperature.*
7. *Black holes are not empty spaces in the Universe. A black hole is a great amount of matter packed into a very small area. The gravitational pull is so strong that nothing can escape.*

Checkpoint 2

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

a. What is the name of our closest galaxy neighbour and how far away from the Milky Way is it?
b. What is the name of our galaxy?

Answers to the checkpoint questions are as follows:

a. Andromeda Galaxy.
b. The Milky Way.

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
Spot on	Beyond the solar system	158-166
Top Class	Beyond the solar system	147-151
Platinum	Beyond the solar system	210-225
Oxford Successful	Beyond the solar system	160-168
Via Afrika	Beyond the solar system	172-187
Sasol Inzalo Natural Science Bk B	Beyond the solar system	187-207
Step-by-step Natural Sciences	Beyond the solar system	147
Top class Natural Sciences	Beyond the solar system	151
Solutions for all Natural Sciences	Beyond the solar system	219 - 221

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://solarsystem.nasa.gov/planets/beyond/needtoknow [Fun facts: Beyond the solar system]

TOPIC OVERVIEW:
Looking into Space
Term 4, Weeks 7A – 8C

A. TOPIC OVERVIEW

Term 4, Weeks 7a – 8c

- This topic runs for 2 weeks.
- It is presented over 6 X 1 hour 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

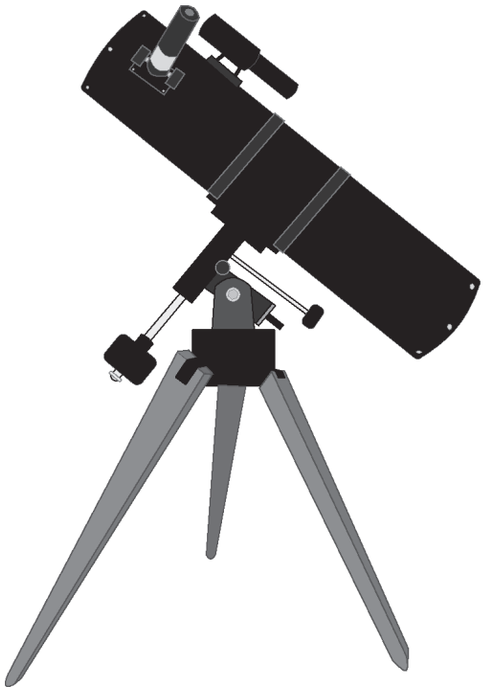
B. SEQUENTIAL TABLE

GRADE 8 & 7	GRADE 8	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Historical development of astronomy • Early indigenous • knowledge • Modern developments	• Early viewing of space • Telescopes	• The Earth as a system

C. SCIENTIFIC VOCABULARY

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

	TERM	EXPLANATION
1.	optical telescopes	A device that gathers and focus light mainly from visible part of electromagnetic spectrum to magnify images.

2.	A Newtonian reflector	Reflects the light to an eyepiece on the side of the telescope tube. This design is often used for amateur telescopes because having the eyepiece on the side of the tube makes the telescope easy to use. 
3.	A Cassegrain reflector	Reflects light through a small hole in the primary mirror. This kind of telescope is often used for large professional telescopes as it allows heavy detectors to be placed at the bottom of the telescope. This makes them easy to reach for repairs and also means that the weight of the detectors does not affect the telescope tube.

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

Understanding of the Milky Way is important to think about space travel. Also, the study of stars is an interesting hobby as well as a potential career for astronomers and astrologers.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

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

7 A

Term 4, Week 7, Lesson A
Lesson Title: Constellations
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Constellations
CAPS Page Number	55

Lesson Objectives

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

- explain that stars can be arranged in different constellations
- recall that different cultures have identified and named certain constellations
- identify that some constellations have stories linked to them.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Worksheets with constellations	
Videos showing constellations	

C CLASSROOM MANAGEMENT

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

Name the 5 types of galaxy shapes.

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.

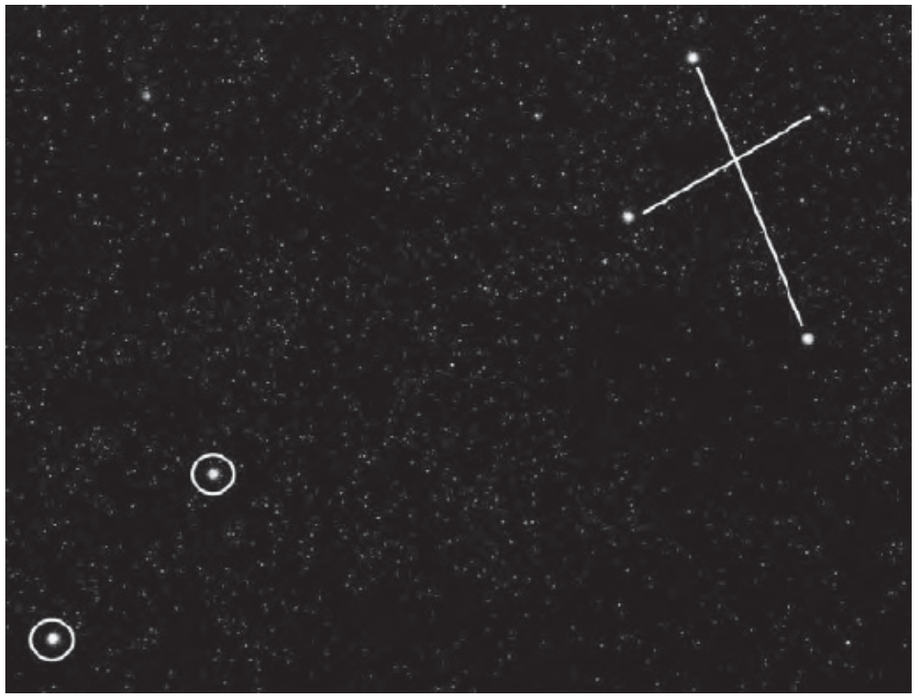
Spiral, Barred spiral, Elliptical, Lenticular and Irregular.

D ACCESSING INFORMATION

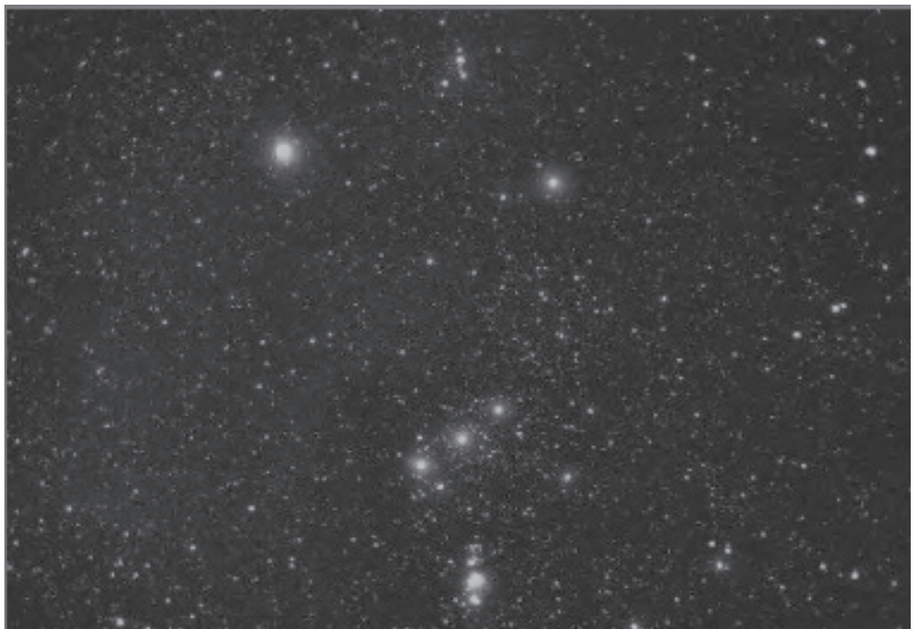
1. Write and draw the following onto the chalkboard (always try to do this before the lesson starts).
2. When drawing the constellations just draw the very visible stars and not the tiny stars in the background.

CONSTELLATIONS

a. A constellation is a group of stars arranged in a recognizable pattern.
b. In dark conditions, away from city lights, thousands of stars are visible in the sky at night.
c. In historical times, people used the movement of the stars and planets to mark the passage of time.
d. Early cultures used to associate the stars with animals or gods and told stories, which were passed on from generation to generation.
e. Early civilizations studied the stars and we have learnt valuable information from Babylonian, Egyptian, Greek and Roman civilizations.
f. The sky has been divided into 88 constellations.
g. Twelve of the constellations (the signs of the zodiac) join up with one another in a circle around the Earth.
h. The constellations that are visible depend on where you are on Earth. We live in the southern hemisphere so we can see the Southern Cross, Orion and Pavo the Peacock.
i. The Southern Cross is the smallest constellation and was used by travelers to find their way when they were lost.



The Southern Cross



Orion's Belt

1. Explain the following information to the learners: (Show the learners Resource 10 to help explain this).
   a. In dark conditions away from city lights, thousands of stars are visible in the
   b. night sky.
   c. Early cultures around the world noted the movement of the stars and planets across the sky and used this to mark the passage of time.
   d. People often grouped the stars they saw into patterns called constellations.

e. Twelve constellations, the signs of the zodiac, join up with one another in a circle around the Earth.

f. The stars that are visible depend upon your location on Earth and also the time of year.

g. The southern sky, which we see from South Africa, is full of beautiful stars and many constellations are visible in the sky including the Southern Cross, Orion and Pavo the Peacock.

2. Ask the learners to share with the class, any stories they may have been told about the constellations.
3. Using Resource 8 read through the African stories about the constellations.
4. Ask the learners if they have heard of the zodiac signs for example, Taurus and Gemini? Explain to them that these are called the star signs and astrologers used them to describe people.
5. Give learners some time to copy the information from the chalkboard into their workbooks.

Checkpoint 1

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

a. What did people in ancient times use the stars for?

b. Name a constellation that we can see from the southern hemisphere.

Answers to the checkpoint questions are as follows:

a. They used the movement of the stars and planets to mark the passage of time.

b. The Southern Cross, Orion and Pavo the Peacock.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard.

Activity

a. What is a constellation?

b. Which civilisations left us records of their knowledge of astronomy?

c. Give 3 examples of constellations.

d. Which is the smallest constellation and why is this constellation so important?

e. Name 2 activities or events that early people linked to the annual appearance of a particular constellation.

f. Draw one of the signs of the Zodiac. (Put up Resource 6 to help the learners).

2. Read through the questions on the chalkboard with the learners.
3. Have the learners answer the questions in their workbooks.

Checkpoint 2

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

a. What is a person who studies the stars called?
b. Why do we see different constellations at different times of the year?

Answers to the checkpoint questions are as follows:

a. Astronomer.
b. The Earth is constantly moving around the Sun so it looks as though the stars are moving.

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
Spot on	Looking into space	164-165
Top Class	Looking into space	152
Platinum	Looking into space	223-224
Oxford Successful	Looking into space	182-185
Via Afrika	Looking into space	168-170
Sasol Inzalo Natural Science Bk B	Looking into space	200-204
Step-by-step Natural Sciences	Looking into space	148 - 153
Top class Natural Sciences	Looking into space	152
Solutions for all Natural Sciences	Looking into space	222 - 230

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.windows2universe.org/the_universe/Constellations/south_constellations.html [Constellations]

7 B

Term 4, Week 7, Lesson B
Lesson Title: Telescopes and magnification
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Early viewing of space
CAPS Page Number	55

Lesson Objectives

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

- explain what a telescope is
- name types of telescopes

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Telescope	
Textbook with information on telescopes	

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 see all the stars in the sky with your eyes? Why not?

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.

> *No. They are too far away.*

D ACCESSING INFORMATION

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

> TELESCOPES
>
> 1. In 1609 Galileo Galilei used the first telescope that made objects seem 30 times closer.
> 2. There are different types of telescopes including:
>   a. Optical telescopes which receive light and focus it by refraction (using lenses) or reflection (using mirrors) such as SALT (Southern Africa Large Telescope), and the Hubble Space telescope.
>   b. Radio telescopes that receive radio waves and focus them by reflection (typically using a metal receiving dish) such as the SKA (Square Kilometer Array).
> 3. Optical telescopes are telescope that collect light given off from distant objects and focuses that light so that we can see the object.
> 4. For an optical telescope to work well there must be:
>   a. Little or no light from people or buildings nearby.
>   b. A climate with mainly clear skies at night.
>   c. Clean air with little pollution or smoke.
>   d. High altitude so that the air is thin.
> 5. Magnification is how many times bigger an object looks compared to the actual object.

2. Explain the following information to the learners:
    a. We cannot visit distant stars or galaxies to study them directly as they are so far away. Instead astronomers study stars and galaxies by analyzing the visible light, radio waves and electromagnetic radiation that they receive from them.
    b. Human eyes can see very far. Andromeda Galaxy which is 2.5 million light-years away and is visible to the naked eye. However, we cannot see any detail and it appears as only a tiny smudge on the sky.
    c. Light is emitted from stars and galaxies and travels in a straight line in all directions. When you look at a star, you only see the light rays that hit your eye.
    d. The further away a star is, the more the starlight is spread out and so less of the total light from the star reaches your eye. This makes distant objects faint and difficult to see clearly. If we had huge eyes we would be able to see distant objects more clearly because our eyes would gather more of their light.
3. Tell the learners that there are 2 types of optical telescope. These are:
    a. Refracting telescopes which use lenses to collect and focus the light from distant objects and
    b. Reflecting telescopes which use mirrors to collect and focus the light from distant objects.
4. Ask the learners if they have every used a telescope, magnifying glass or binoculars. If they say yes, ask them what they noticed. (They should say whatever they were looking at looked much bigger and that they could see more detail.)
5. Tell the learners that a telescope magnifies the size of an object. Magnification is how many times bigger an object looks compared to the actual object.
6. Give learners some time to copy the information from the chalkboard into their workbooks.

Checkpoint 1

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

a. Name the 2 types of telescopes.
b. What does SKA stand for?

Answers to the checkpoint questions are as follows:

a. Refracting telescopes and Reflecting telescopes.
b. Square Kilometre Array telescope.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard.

Activity

1. Fill in the table below:

Can see with the naked eye	**Yes/No**
ant	
virus	
potato	
stars	
bacteria	

2. Who invented the first telescope?
3. When did he invent the telescope?
4. a. Name the 2 types of telescopes.
   b. What is the difference between these telescopes?

2. Read through the questions on the chalkboard with the learners.
3. Tell the learners to complete the answers in their workbooks.
4. Write the model answers on the chalkboard:

1. Can see with the naked eye	***Yes/No***
ant	*Yes*
virus	*No*
potato	*Yes*
stars	*Yes*
bacteria	*No*

2. Galileo Galilei

3. 1609

4. There are two types of optical telescope:

a. Refracting telescopes use lenses to collect and focus the light from distant objects.

b. Reflecting telescopes use mirrors to collect and focus the light from distant objects.

Checkpoint 2

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

a. What is a person who studies the stars called?

b. Why do we see different constellations at different times of the year?

Answers to the checkpoint questions are as follows:

a. An astronomer.

b. The Earth is constantly moving around the Sun so it looks as though the stars are moving.

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
Spot on	Looking into space	164-165
Top Class	Looking into space	152
Platinum	Looking into space	223-224
Oxford Successful	Looking into space	182-185
Via Afrika	Looking into space	168-170
Sasol Inzalo Natural Science Bk B	Looking into space	200-204
Step-by-step Natural Sciences	Looking into space	149 - 153
Top class Natural Sciences	Looking into space	153 - 154
Solutions for all Natural Sciences	Looking into space	222 - 230

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://van.physics.illinois.edu/qa/listing.php?id=2078 [How telescopes work]
2. https://www.windows2universe.org/the_universe/Constellations/south_constellations.html [Constellations]

7 C

Term 4, Week 7, Lesson C
Lesson Title: Refracting telescopes
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Early viewing of space
CAPS Page Number	55

Lesson Objectives

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

- Understand that there are two types of optical telescopes
- Understand how the refracting telescope works

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Telescope	Resource 19 and 20
Textbook with information of telescopes	

C CLASSROOM MANAGEMENT

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

> Name the two types of telescopes.

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.

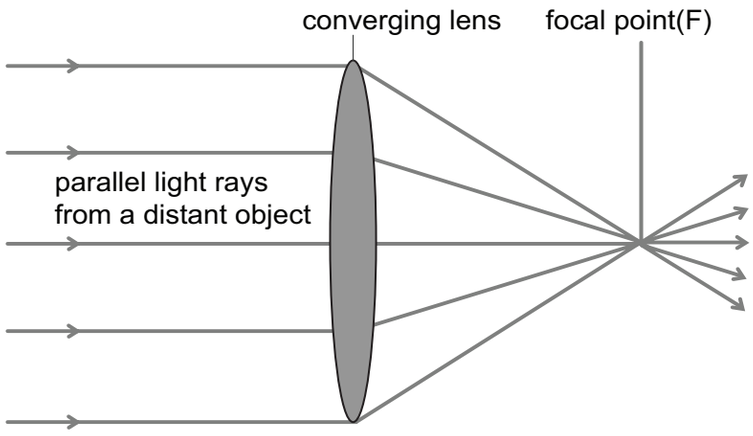
> *Reflecting and refracting telescopes.*

D ACCESSING INFORMATION

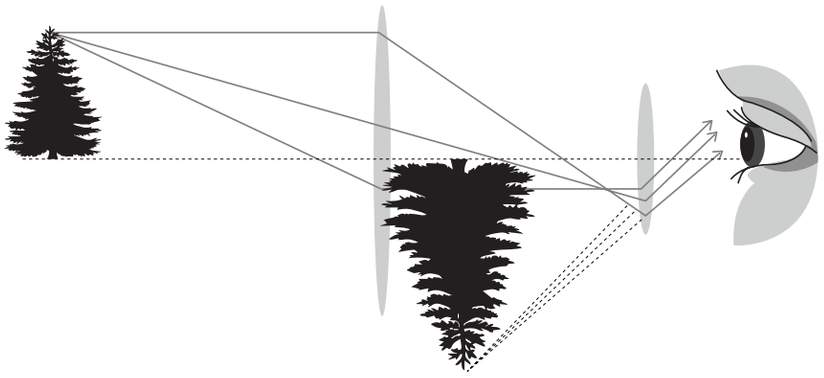
1. Write the following table onto the chalkboard (always try to do this before the lesson starts):

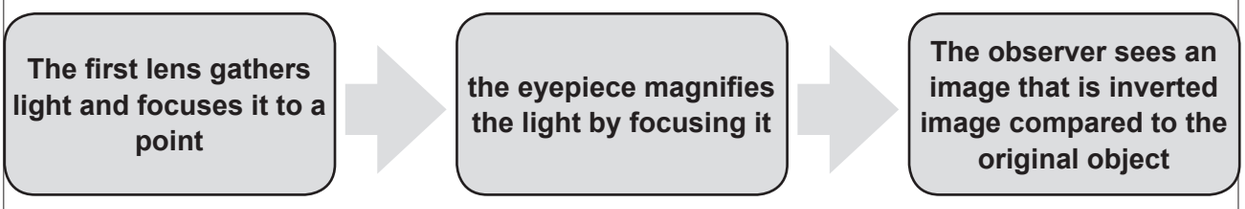
REFRACTING TELESCOPES

1. Refracting telescopes use a converging (convex) lens to collect and bend the light rays inwards to the focal point (also called the focus) of the telescope. The light collecting lens is called the objective lens.



2. Once light is brought to a focus, it is then magnified by another lens called the eyepiece lens.





2. Explain to the learners that they will be learning about refracting telescopes in this lesson and reflection telescopes in the next lesson.
3. Explain the following information about the refracting telescope:
4. Refracting telescopes use a converging (convex) lens to collect and bend the light rays inwards to the focal point (also called the focus) of the telescope. The light collecting lens is called the objective lens.
5. Show the learners Resource 19 to explain this.
6. Point to the convex lens. Ask them to put the palms of their hand together and then make a little space between them. Tell them that this is roughly the shape of a convex lens.
7. Trace the path of the light with your finger, from the object, through the lens to the focus point.
8. Now point to the next drawing.
9. Show the learners that once the light is brought to a focus, it is then magnified by another lens called the eyepiece lens.
10. The telescope objective lens collects and focuses the light from a distant tree forming a real inverted image of the tree. The eyepiece lens, like a magnifying glass, then enlarges the image collected by the objective lens, producing a larger, virtual image.
11. This image is what we see when we look through the telescope.
12. Show the learners Resource 20 to explain this.
13. Give learners some time to copy the information and pictures into their workbooks.

Checkpoint 1

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

a. Draw a convex lens.

b. What is the light collecting lens called?

Answers to the checkpoint questions are as follows:

a. 

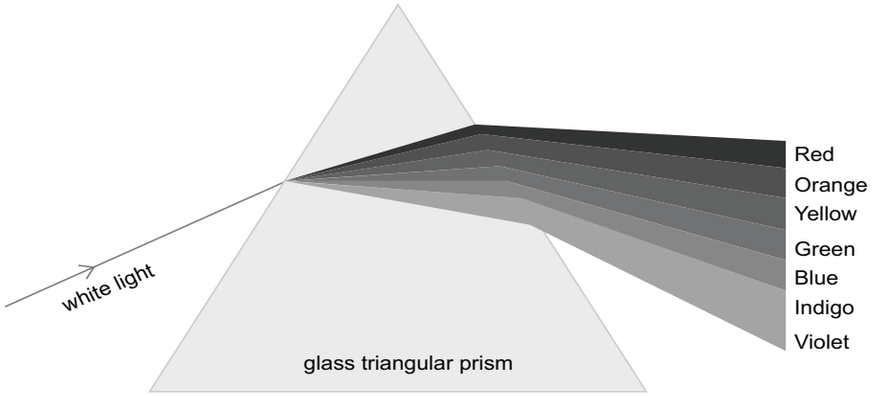
b. The light collecting lens is called the objective lens.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

Activity

1. What kind of lenses are the objective lens and the eyepiece lens?
2. What do each of these lenses do?
3. Draw the triangular prism as shown below which shows how light is refracted (bent) and splits into the colours of the rainbow when it comes through the other side of the prism:



a. Which colour is refracted the most?

b. Which colour is refracted the least?

2. Explain to the learners that:

a. lenses are shaped to bend light by a certain amount. Look at the drawing of the prism and notice what happens when white light goes through the prism: it is refracted (bent) and splits into the colours of the rainbow when it comes through the other side of the prism

b. white light is a mixture of all the colours of the rainbow. Different colours are refracted by different amounts as they travel through the prism so the white light is split into its different colours.

3. Give learners some time to complete this task in their workbooks.
4. When the learners are done, ask them to compare their answers with a partner.
5. Write the correct answers on the chalkboard and ask the learners to correct their work.

1. *Convex lenses*
2. *The light collecting lens is called the objective lens. The eyepiece lens, like a magnifying glass, then enlarges the image collected by the objective lens, producing a larger image.*
3. *Drawing of a prism*
   a. *Violet*
   b. *Red*

6. Ask the learners to work in groups of 3 or 4 to answer the following questions. Write the questions onto the chalkboard. (answers are in italics):

a. What are the colours of the rainbow? *(red, orange, yellow, green, blue, indigo and violet)*
b. Try to make up a rhyme ort sentence to remember the colours of the rainbow in order. *(Answers will vary here)*

Checkpoint 2

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

a. What are the colours of the rainbow?
b. Why are refraction telescope images blurry?

Answers to the checkpoint questions are as follows:

a. Red, orange, yellow, green, blue, indigo and violet
b. Lenses are shaped to bend light by a certain amount. However, the different colours that make up white light bend by slightly different amounts. This means that different colours come to a focus at slightly different distances from the objective lens. Each colour will produce its own image and they will be slightly misaligned with each other resulting in a slightly blurry image.

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
Spot on Natural Science	Looking into space	174-175
Top Class Natural Science	Looking into space	155-157
Platinum Natural Science	Looking into space	234
Oxford Successful Natural Science	Looking into space	186-187
Via Afrika Natural Science	Looking into space	176-177
Sasol Inzalo Natural Science	Looking into space	218-222
Step-by-step Natural Sciences	Looking into space	154 - 156
Top class Natural Sciences	Looking into space	155 - 159
Solutions for all Natural Sciences	Looking into space	231 - 236

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://van.physics.illinois.edu/qa/listing.php?id=2078 [Telescopes]

8 A

Term 4, Week 8, Lesson A
Lesson Title: Reflecting telescopes and radio telescopes
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The reflecting telescopes and radio telescopes
CAPS Page Number	55

Lesson Objectives

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

- explain how the reflecting telescope works
- explain that radio telescopes gather information from radio waves

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Telescope	Resources 22 and 23
Textbook with information of telescopes	

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 the main feature of a refracting telescope?

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.

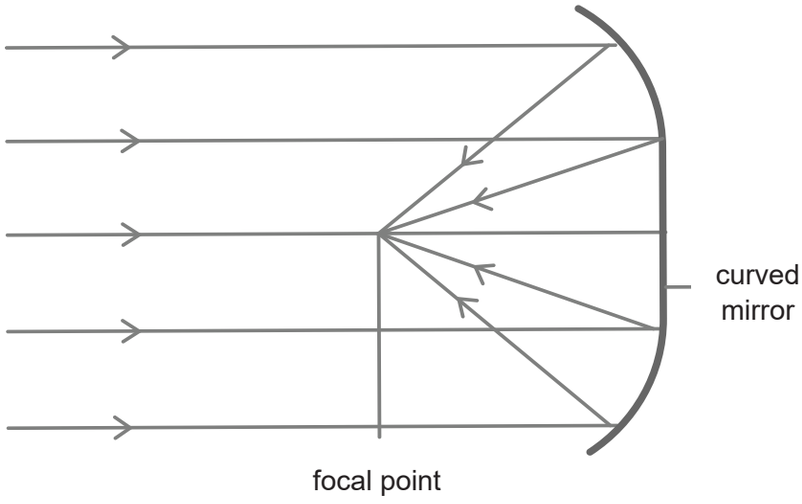
> *Refracting telescopes use a converging (convex) lens to collect and bend the light rays inwards to the focal point (also called the focus) of the telescope.*

D ACCESSING INFORMATION

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

REFLECTING TELESCOPES

1. In the 1680s, Isaac Newton invented the reflecting telescope. Reflecting telescopes use a curved, primary mirror to collect light from distant objects and reflect it to a focus.



How a reflecting telescope works

2. The advantages of a reflecting telescope include:
    a. The glass of the mirror does not have to be perfect throughout, only the surface has to be perfect.
    b. The mirror can be supported across the whole of its back so it won't sag.
    c. Making large mirrors is easier and cheaper than making big lenses.
    d. They do not suffer from blurring.
3. Optical telescopes on the ground do however have some disadvantages:
    a. They can only be used at night.
    b. They cannot be used in bad weather (rain, cloud, snow etc).
4. The largest telescopes in the world today are reflecting telescopes. An example of a well-known reflector telescope is called the Southern African Large Telescope (SALT) which in a small town in the Karoo called Sutherland.
5. Radio telescopes were invented later than the optical telescope.

2. Explain to the learners that they will be discussing reflecting telescope this lesson.
3. Explain the following information about the reflecting telescope:
    a. In the 1680s, Isaac Newton invented the reflecting telescope.
    b. Reflecting telescopes use a curved, primary mirror to collect light from distant objects and reflect it to a focus.
4. There are many different types of reflecting telescopes. A prime focus reflector is the simplest type of reflector telescope. In this design, a recording structure is placed at the focal point to see the focused image.
5. More complex designs of reflecting telescopes use a secondary small mirror to reflect the light towards the eyepiece lens.
    - A **Newtonian reflector** reflects the light to an eyepiece on the side of the telescope tube.
    - A **Cassegrain reflector** reflects light through a small hole in the primary mirror.
6. The largest telescopes in the world today are reflecting telescopes.
7. Show the learners Resource 22 and 23 which shows examples of telescopes.
8. Give learners some time to copy the information from the chalkboard into their workbooks.

Checkpoint 1

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

a. What is the simplest type of reflector telescope?
b. Name a more complex reflector telescope.

Answers to the checkpoint questions are as follows:

a. A prime focus reflector is the simplest type of reflector telescope.
b. Newtonian reflector and Cassegrain reflector

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard.

Activity

1. What is a telescope?
2. List 2 disadvantages and 2 disadvantages of a reflecting telescope.
3. What type of telescope:
   a. Receives light through a large lens.
   b. Includes a mirror that reflects incoming light.
   c. Receives radio waves from the universe?
4. a. Name an example of a well-known reflecting telescope in South Africa.
   b. Where would you find this telescope?
5. How is a radio telescope different from a reflector and refracting telescope?
6. What is the SKA and where do we find it?

2. Read through the questions with the learners.
3. Tell the learners to answer the questions in their workbooks.
4. Write the model answers on the chalkboard:

1. *A telescope is an optical instrument designed to make distant objects appear nearer.*
2. *The advantages of a reflecting telescope include:*
   a. *The glass of the mirror does not have to be perfect throughout, only the surface must be perfect.*
   b. *The mirror can be supported across the whole of its back so it won't sag.*
   c. *Making large mirrors is easier and cheaper than making big lenses.*
   d. *They do not suffer from blurring.*

   Disadvantages of reflecting telescopes disadvantages:
   a. *They can only be used at night.*
   b. *They cannot be used in bad weather (rain, cloud, snow etc).*
3. a. *Refracting telescope*
   b. *Reflecting telescope*
   c. *Radio telescope*
4. a. *Southern African Large Telescope (SALT).*
   b. *In a town called Sutherland in the Karoo.*
5. *These radio telescopes are larger than optical telescopes and look like satellite dishes.*
6. *The SKA is a radio telescope. SKA stands for Square Kilometre Array telescope. It is in the Karoo in South Africa.*

Checkpoint 2

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

a. Name a telescope that has made South Africa famous.
b. What type of telescope is the SKA?

Answers to the checkpoint questions are as follows:

a. Southern African Large Telescope (SALT).
b. A radio telescope.

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
Spot on	Looking into space	174-175
Top Class	Looking into space	155-157
Platinum	Looking into space	234
Oxford Successful	Looking into space	186-187
Via Afrika	Looking into space	176-177
Sasol Inzalo Natural Science Bk B	Looking into space	218-222
Step-by-step Natural Sciences	Looking into space	154 - 156
Top class Natural Sciences	Looking into space	160
Solutions for all Natural Sciences	Looking into space	231 - 236

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://van.physics.illinois.edu/qa/listing.php?id=2078 [How telescopes work]
2. https://www.salt.ac.za/ [Information on the SALT telescope]

8 B

Term 4, Week 8, Lesson B
Lesson Title: SALT
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Telescope
CAPS Page Number	55

Lesson Objectives

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

- design a brochure to convince scientists and stargazers to visit Sutherland in the Karoo
- explain the importance of the Southern Africa Large Telescope

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Lesson plan with notes and drawings	Textbook
	Resource 21

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 does SALT stand for?

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.

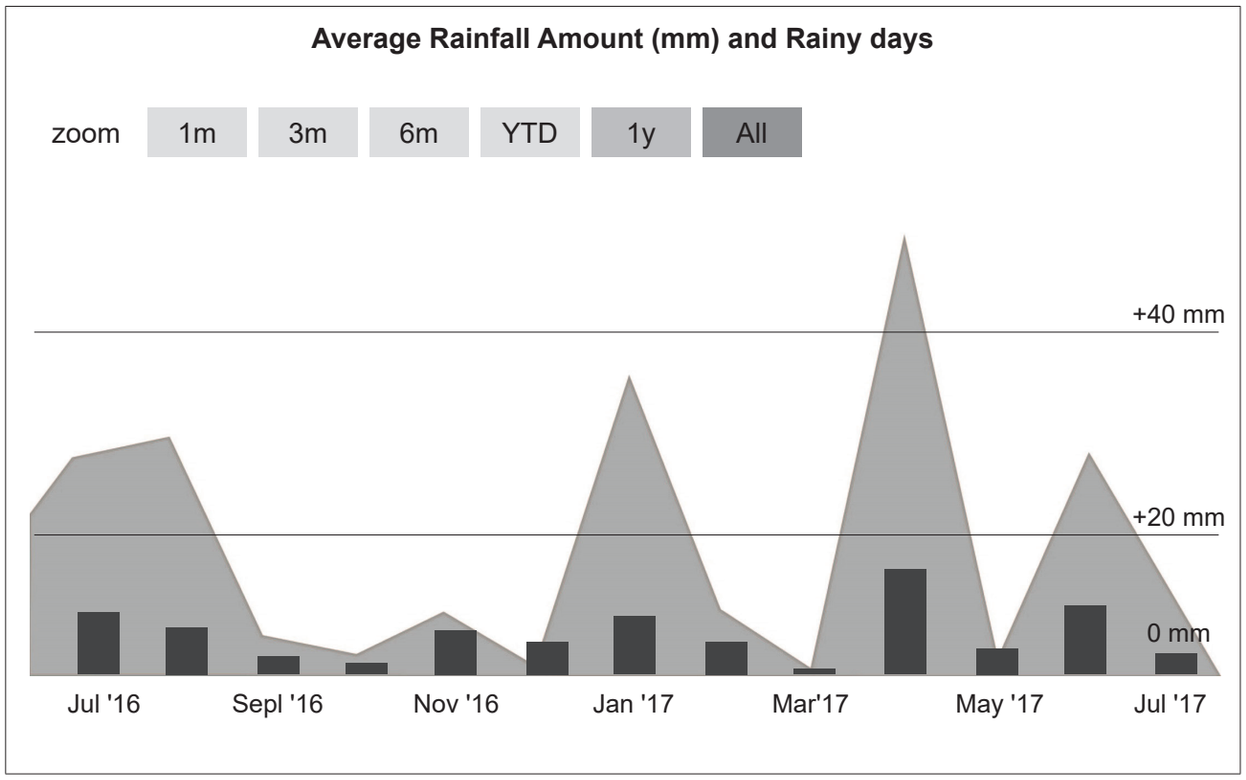
Southern African Large Telescope (SALT)

D ACCESSING INFORMATION

1. Write the following information onto the chalkboard.
2. Using Resource 21 draw the graph on the chalkboard (always try to do this before the lesson starts):

THE SOUTHERN AFRICAN LARGE TELESCOPE IN SUTHERLAND

1. The Southern African Large Telescope (SALT), is the largest telescope in the Southern Hemisphere, with a mirror measuring 11.1 by 9.8 metres.
2. The telescope is located at the South African Astronomical Observatory near Sutherland, in South Africa which is 1,798 metres above sea level.
3. This is the perfect town for star gazing because Sutherland is a small, rural town in the Karoo, in the Northern Cape. So there is not much pollution in the atmosphere.
4. The town has many old buildings, a museum, art galleries and numerous beautiful hiking trails that people visit other than SALT.
5. Sutherland gets extremely cold in winter with temperatures reaching below -20 0C.
6. Sutherland also has high rainfall as seen in the graph below:



3. Ask learners to discuss, in pairs the following:

a. What is the main reason that people visit Sutherland?
b. Name some exciting and interesting activities people could do while in a small town like Sutherland.
c. Suggest different types of jobs and businesses the people in Sutherland could have to make money and a living. Suggest at least 2 different jobs or businesses.
d. The minimum and maximum rainfall in Sutherland.

4. Discuss answers with the learners. Their answers could include the following:

a. To look at the stars through the Southern African Large Telescope.
b. Hiking, visiting art galleries, museums.
c. Some of the businesses and jobs could include:

Restaurants and coffee shops which will need cooks, waiters, cleaners, managers, bookkeepers

Bed and breakfasts or guesthouses or hotels which will need also need cooks, waiters, cleaners, managers, bookkeepers

Supermarkets which will need a manager, people to stock the shelves, cashiers

Banks which will need tellers and customer service people

Garages and service stations which will need mechanics, people to fill the tanks

Tour guides to take people to SALT, on hiking trails and other places in the town

Art galleries/ African craft shops which will need artists, sales people, cashiers.

d. Minimum is + 2mm and a maximum of + 55mm

Checkpoint 1

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

a. What does SALT stand for?

b. What is the main reason that people would visit Sutherland?

Answers to the checkpoint questions are as follows:

a. Southern African Large Telescope.

E CONCEPTUAL DEVELOPMENT

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

Activity

1. Using the information from the graph, draw a table to show the amount of rainfall from July 2016 to July 2017.

2.1 What is the maximum amount of rainfall that Sutherland experiences?

2.2 Which month has the maximum amount of rainfall?

2.3 What is the minimum amount of rainfall that Sutherland experiences?

2.4 Which month has the minimum amount of rainfall?

3. Explain why you think SALT was built in the town of Sutherland, in the Karoo.

2. Tell the learners that they will work in groups of 3 or 4 for this activity.
3. Hand out Resources 21 to the groups.
4. Every learner must write the answers in their workbook even though they are working in groups.
5. Once the activity is complete do the following:
   - A: ask a learner to draw the table on the chalkboard.
   - B: ask one learner for the answers and write the model answers on the chalkboard.
   - C: discuss this answer with all the learners and when a good point is mentioned, write the answer on the chalkboard.

1.

Month and year	***Amount of rainfall (mm)***
July 2016	*12*
August 2016	*9*
September 2016	*3*
October 2016	*2*
November 2016	*10*
December 2016	*9*

January 2017	*11*
February 2017	*8*
March 2017	*1*
April 2017	*14*
May 2017	*7*
June 2017	*13*
July 2017	*3*

2.1 14 mm

2.2 April 2017

2.3 1 mm

2.4 March 2017

3. Sutherland is good location for SALT because:

- *Rural town so not much light pollution that could interfere with viewing the stars.*
- *Does not have industries / factories so little to no pollution.*
- *Rural so not many people live here so not too many vehicles so less air and noise pollution.*
- *Very high up (1,798 metres) so unobstructed view of the skies.*
- *Any other suitable answer.*

Checkpoint 2

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

a. How big is the mirror of the SALT?

b. Which desert is Sutherland situated in?

Answers to the checkpoint questions are as follows:

a. It measures 11.1 by 9.8 metres.

b. The Karoo.

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:

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Spot on	Looking into space	174-175
Top Class	Looking into space	155-157
Platinum	Looking into space	234
Oxford Successful	Looking into space	186-187
Via Afrika	Looking into space	176-177
Sasol Inzalo Natural Science Bk B	Looking into space	218-222
Step-by-step Natural Sciences	Looking into space	154 - 156
Top class Natural Sciences	Looking into space	160
Solutions for all Natural Sciences	Looking into space	231 - 236

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://van.physics.illinois.edu/qa/listing.php?id=2078 [How telescopes work]
2. https://www.salt.ac.za/ [Information on the SALT telescope]

8 C

Term 4, Week 8, Lesson C
Lesson Title: Summing up space
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Looking into space
CAPS Page Number	55

Lesson Objectives

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

- see what they still need to revise for the Planet Earth and Beyond
- take note of what they do not understand

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	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. Predicting		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
Textbook	

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 were the three main sub-topics of this term?

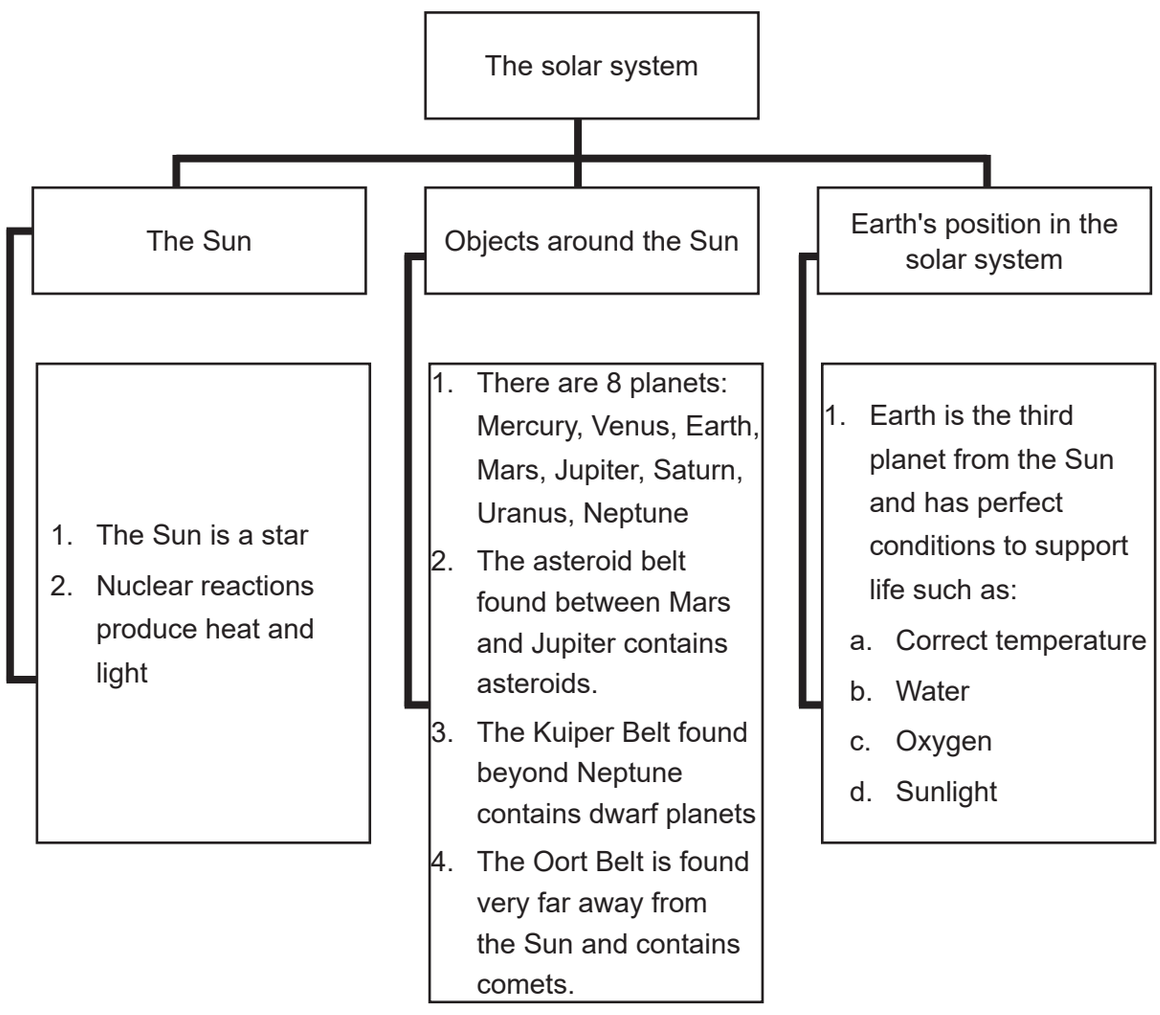
3. Learners should enter the classroom and answer the question in their workbooks.
4. Discuss the answer with the learners.
5. Write the model answer onto the chalkboard.

> *The solar system, beyond the solar system and looking into space.*

D ACCESSING INFORMATION

1. Draw the following flow chart onto the chalkboard and fill in the labels (always try to do this before the lesson starts):

CONCEPT MAP FOR THE SOLAR SYSTEM



2. Explain to the learners that the diagram on the board is a concept map.
3. Tell them the following about concept maps:
   a. It is designed to help summarize all the information that was studied in a section.
   b. It allows us to put a lot of information onto one page so that you can see where everything fits in.
   c. It is a good tool to use for studying.
4. Give the learners time to copy the concept map from the chalkboard into their workbooks.

Checkpoint 1

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

a. What are the main sections under the heading: Beyond the solar system?
b. What are the main sections under the heading: Looking into space?

Answers to the checkpoint questions are as follows:

a. The Milky Way galaxy; our nearest star; light years, light hours and light minutes and beyond the Milky Way galaxy.
b. Early viewing of space and telescopes.

E CONCEPTUAL DEVELOPMENT

1. Write the following flow chart onto the chalkboard.

Activity 1

Draw a concept map for:

a. Beyond the solar system and
b. Looking into space

2. Ask the learners to work in pairs to create 2 concept maps: one for ‘Beyond the solar system’ and another for ‘Looking into space’.
3. Tell them that even though they are working in pairs, each person must have their own concept map in their workbook.
4. Tell them that to create a good and useful concept map they should work together and do the following:
   a. Decide what the main subheadings are under ‘Beyond the solar system’.
   b. Decide what important information needs to be included in these subheadings.
5. The learners should then follow the same process for: ‘Looking into space’.
6. Write the model answer on the chalkboard:

There are no right and wrong answers here. A concept map is a revision tool for learners so they must draw one that will make sense to them.

Checkpoint 2

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

a. Where is the asteroid belt found?

b. Where is the Oort belt found?

Answers to the checkpoint questions are as follows:

a. The asteroid belt is found between Mars and Jupiter contains asteroids.

b. The Oort Belt is found very far away from the Sun and contains comets.

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
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Sasol Inzalo Natural Science Bk B	Looking into space	207-247
Step-by-step Natural Sciences	Looking into space	158
Top class Natural Sciences	Looking into space	161
Solutions for all Natural Sciences	Looking into space	238 - 239

G ADDITIONAL ACTIVITIES / READING

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

NATURAL SCIENCES

ASSESSMENT
GRADE 8 TERM 4

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.

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. ***Poject***

      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 ASSESSMENT

Grade 8					
Programme of Formal Assessment					
Formal Assessments	**TERM 1**	**TERM 2**	**TERM 3**	**TERM 4**	**TOTAL % FOR THE YEAR**
School-based assessments	Test 1 [35 marks] Practical task/ investigation 1 [20 marks]	Test 2 [35 marks] Practical task/ investigation 2 [20 marks]	Test 3 [35 marks] Practical task/ investigation 3 [20 marks]	Practical task/ investigation 4 [20 marks] Project [30 marks]	40%
Exams [60 minutes]		Exam 1 on work from terms 1 and 2 [70 marks]		Exam 2 on work from terms 3 and 4 [70 marks]	60%
Number of formal assessments	2	3	2	3	Total: 100%

Refer to CAPS on the processes for converting marks to percentages and to the 7-point scale.

In this section of the booklet, you will find your science assessments for this term.

There are two assessments included:

A Practical Activity

The activity completed is drawn from one of the lessons in the lesson plans. The rubric or memorandum attached in this pack will assist you with assessing the task completed by the learners.

An Exam

The exam included will need to be copied onto the chalkboard for learners to complete. There is also an exam memorandum included to assist you with marking the learners completed test scripts.

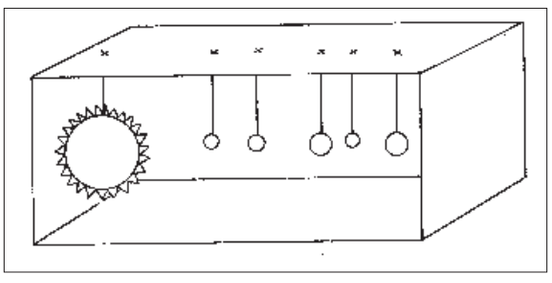
All of the assessments are aligned to CAPS requirements and the marks allocated for each assessment are as stipulated in CAPS.

Natural Sciences
Grade 8
Practical Task
Term 4

20 marks
Time allocation: 90 minutes (15 minutes preparation, 75 minutes task time)

NOTE TO THE TEACHER:

1. This practical activity will be completed as part of Section E of lesson 2B.
2. This practical will take place during the lesson after the teaching component in Section D, "Accessing Information".
3. The first 15 minutes will be used to teach section D and prepare learners for the practical task.
4. The next 60 minutes will be used to complete the practical activity as outlined in Section E.
5. The last 15 minutes will be to answer the questions.
6. The instructions and content of the practical task should be written on the chalkboard, before the lesson for the learners.
7. The memo for assessing the practical task is provided.
8. The learners will be working as a class and will need the following to complete the tasks:
    - plastic packets
    - newspapers
    - glue
    - tape
    - colouring pencils, paint or kokis
    - scissors
    - wool or string
    - cardboard box
9. Ensure that all the materials have been collected before the practical lesson. This may take a few weeks. Allow enough time for this.
10. The learners should answer questions with some guidance. Use the memo to guide you.
11. Below is a diagram to show you the model. You can draw this on the board.



Grade 8

Natural Sciences

Term 4

Practical Task

Memorandum

(See Section E of Lesson 2B For Instructions And Questions)

CAPS Topic	Question	Expected answer/outcome	Marks
Solar system	1	Jupiter ✓	1
Solar system	2	Mercury ✓	1
Solar system	3	Mercury ✓	1
Solar system	4	Neptune ✓	1
Solar system	5	Earth is bigger than some of the rocky planets ✓ but much smaller than the gas planets. ✓	2
Solar system	6	Accept different answers ✓	1
Solar system	7	• 1 mark for each planet – 8 marks ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ • 1 mark for the sun ✓ • 2 mark for arranging the planets in the correct position ✓ ✓ • 2 mark for making the model to scale ✓ ✓	13
			TOTAL: 20

Grade 8
Natural Sciences
Term 4
Exam

70 Marks
90 Minutes

NOTE TO THE TEACHER:

If possible, photocopy this exam for each learner. If this is not possible, write the exam 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. Which planet in our solar system is closest to the sun?

a. Neptune

b. Mercury

c. Earth

d. Saturn.

You have answered correctly if you have circled Ⓑ

GRADE 8 ASSESSMENT – EXAM TERM 4

SECTION A: Energy and Change

QUESTION 1: MULTIPLE CHOICE [6]

1.1. In a series circuit, which wire is the best conductor?

a. Steel wire
b. Nichrome
c. Plastic wire
d. Lead

1.2. An opaque object is …

a. An object that allows light to pass through it.
b. An object that sometimes allows light to pass through it.
c. An object that does not allow light to pass through it.
d. An object that does not allow coloured light to pass through it.

1.3. What can be used to break white light into the spectrum of colours?

a. A circular prism.
b. A square prism.
c. A rectangular prism.
d. A triangular prism.

1.4. The definition of friction is …

a. When people fight.
b. The force that resists the movement between two objects.
c. When two objects attract each other.
d. The force that repels the movement between two objects.

1.5. When more resistors are connected in parallel …

a. The resistance decreases.
b. The resistance increases.
c. The resistance stays the same.
d. There is no resistance.

1.6. A translucent object …

a. Does not allow light to pass through it.
b. Allows light to partially pass through it.
c. Allows all light to pass through it.
d. Only allows white light through it.

QUESTION 2: True or False [5]

Write true or false next to the following statements:

2.1. Electrons move from one object to another through friction.

_____

2.2. An electrical circuit is a system used for the transfer of heat energy.

_____

2.3. In a series circuit the current is the same everywhere.

_____

2.4. Copper has a very low resistance to electric current.

_____

2.5. The separation of charges is called current electricity.

_____

QUESTION 3: [6]

Write one or two words that mean the same as the sentence:

3.1. Something that is not moving.

_____

3.2. Very thin thread or wire in a bulb.

_____

3.3. The splitting of white light into different colours.

_____

3.4. Opposition to the flow of electrical current.

_____

3.5. A material that does not allow a charge to flow through it.

_____

3.6. To push away from something.

_____

QUESTION 4: [12]

Answer the questions below.

4.1. Explain the difference between an open and a closed circuit. (4)

_____

_____

_____

4.2. How does resistance affect the flow of an electrical current? (4)

_____

_____

4.3. What does LED stand for? _____ (1)

4.4. When a prism was placed on white paper and a beam of light shone through the slit in the cardboard, several colours showed up on the paper. Name these seven colours. (1)

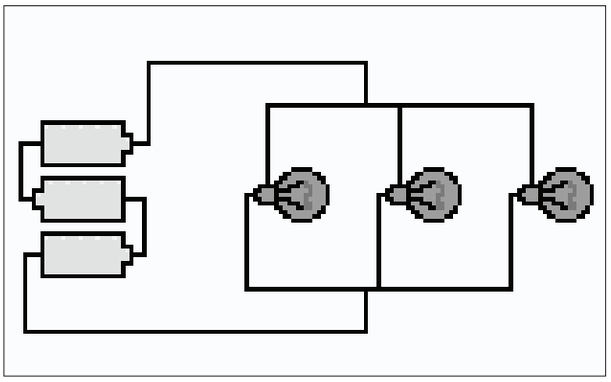
_____

4.5. Write a definition for photoreceptors. (2)

_____

QUESTION 5 [6]

5.1. Use the correct symbols to draw the circuit diagram from the drawing below.



GRADE 8 ASSESSMENT – EXAM TERM 4

SECTION B: Planet Earth and Beyond

QUESTION 1: MULTIPLE CHOICE [6]

Read each question and circle the letter that shows the correct answer.

1.1. The sun releases:

a. Light energy and heat energy.

b. Sound energy and light energy.

c. Heat energy and movement energy.

d. Sound energy and movement energy.

1.2. Choose the statement that is true of our solar system.

a. The moon is the largest object in our solar system.

b. Jupiter is the largest object in our solar system.

c. The sun is the largest object in our solar system.

d. The sun and moon are the largest objects in our solar system.

1.3. The conditions to support life are:

a. Temperature, water, sunlight and oxygen.

b. Water, CO2, sunlight.

c. Temperature, oxygen, water and chlorophyll.

d. Oxygen, plants and chlorophyll.

1.4. An astronomer is:

a. A person that can see the future.

b. A person who studies astrology.

c. A scientist that tells fortunes.

d. A scientist who studies the stars.

1.5. Choose the fact that is false when describing a dwarf planet.

a. Not able to keep their path clear of other objects.

b. Objects that orbit the sun.

c. Smaller than planets.

d. Bigger than planets.

1.6. The name of our galaxy is …..

a. Orion

b. Milky Way

c. Alpha Cetauri

d. Proxima

QUESTION 2 [5]

Write one word that means the same as the sentence:

2.1. A collection of stars, spacedust and gas, held together by gravity.

_____

2.2. Lumps of frozen gas.

_____

2.3. The centre of an object.

_____

2.4. Small rocky objects made of stony or metallic material.

_____

2.5. To combine, mix or join together.

_____

QUESTION 3 [6]

3.1. Draw a food chain that has a producer, a herbivore, an omnivore and a carnivore from a Savannah ecosystem. Remember to give your food chain a heading. (Remember write the words. Do not draw picture

Heading: _____

QUESTION 4 [11]

Answer the questions below.

4.1. What releases energy from the sun's core? _____ (2)

4.2. What is the difference between terrestrial planets and gas planets?(6)

Terrestrial Planets	Gas Planets

4.3. Name the 3 layers of the rocky planets. (3)

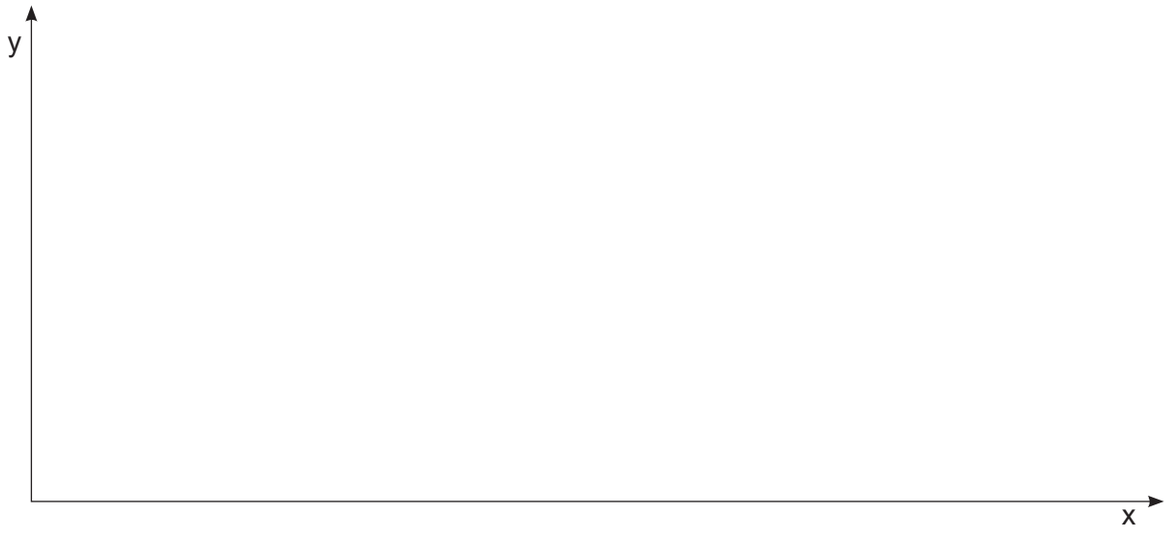
_____ _____ _____

QUESTION 5 [7]

5.1. Use the information below to draw a bar graph to represent the planets and their number of moons.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Number of moons	0	0	1	2	67	63	27	13

Remember to label the X and Y axis. Give your graph a heading.

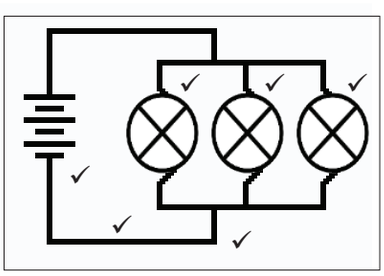


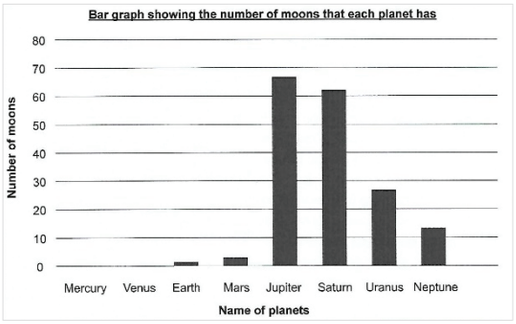
TOTAL: 70

Grade 8
Natural Sciences
Term 4
Exam

Memorandum

CAPS Topic	Questions	Expected answer(s)	Marks
PART A: Energy and Change			
	1		
Series and parallel circuits	1.1	B ✓	1
Visible light	1.2	C ✓	1
Visible light	1.3	D ✓	1
Static electricity	1.4	B ✓	1
Series and parallel circuits	1.5	A ✓	1
Visible light	1.6	B ✓	1
	2		
Static electricity	2.1	True ✓	1
Energy transfer	2.2	False ✓	1
Series and parallel circuits	2.3	True ✓	1
Series and parallel circuits	2.4	True ✓	1
Static electricity	2.5	False ✓	1
	3		
Static electricity	3.1	Static ✓	1
Energy transfer	3.2	Filament ✓	1
Visible light	3.3	Dispersion ✓	1
Series and parallel circuits	3.4	Resistance ✓	1
Static electricity	3.5	Isolator ✓	1
Static electricity	3.6	Repel ✓	1
	4		
Energy transfer	4.1	An open circuit allows electricity to pass through and a closed circuit does not allow electricity to pass through. ✓ ✓ ✓ ✓	4
Energy transfer	4.2	The higher the resistance, the lower the current and the lower the resistance, the higher the current. ✓ ✓ ✓ ✓	4
Series and parallel	4.3	Light-emitting diode ✓	1
Visible light	4.4	Violet, indigo, blue, green, yellow, orange and red ✓	1
Visible light	4.5	Cells in the eye that are sensitive to light ✓ ✓	2

CAPS Topic	Questions	Expected answer(s)	Marks
	5		
Series and parallel	5.1		6
PART B: Earth and Beyond			
	1		
The solar system	1.1	A ✓	1
The solar system	1.2	C ✓	1
The solar system	1.3	A ✓	1
Beyond the solar system	1.4	D ✓	1
The solar system	1.5	D ✓	1
Beyond the solar system	1.6	B ✓	1
	2		
The solar system	2.1	Galaxy ✓	1
The solar system	2.2	Comets ✓	1
The solar system	2.3	Core ✓	1
The solar system	2.4	Asteroids ✓	1
The solar system	2.5	Fusion ✓	1
	3		
The solar system	3.1	Accept different answers: eg: Grass ✓ ➔ butterfly ✓ ➔ bird ✓ ➔ fox ✓ <u>Food chain from a Savannah</u> ✓ (plus one mark for arrows) ✓	6
	4		
The solar system	4.1	Nuclear fusion ✓ ✓	2
The solar system	4.2	Terrestrial planets – metal core, rocky mantle, thin outer crust, thin atmosphere ✓ ✓ ✓ Gas planets – Mostly made of hydrogen and helium, less dense than rocky planets. ✓ ✓ ✓	6
The solar system	4.3	Core, mantle and crust ✓ ✓ ✓	3

CAPS Topic	Questions	Expected answer(s)	Marks
	5		
The solar system		 Award marks as follows: Heading ✓ labelling of x-axis ✓ labelling of y-axis ✓ accuracy of graph ✓ ✓ ✓ ✓	7