GRADE 11

Physical Sciences

Teacher Toolkit: CAPS Planner and Tracker

2019 TERM 4

CONTENTS

A. ABOUT THE TRACKER AND RESOURCES

1. Your quick guide to using this planner and tracker

What is the NECT and where do I fit in?

What you do matters! What you do every day as a teacher can change the life-chances of every child that you teach. The NECT supports teachers by providing CAPS planners and trackers so that teachers can plan to cover the curriculum, track progress, and seek help when they are falling behind.

But who will help me?

The NECT will work with your school management team (SMT) and assist them to have supportive and professional conversations with you about curriculum coverage that will be orientated to identifying and solving problems.

I have looked at the planner and tracker. It goes too fast!

The CAPS planner and tracker is an expanded ATP. It helps you pace yourself as if you were able to cover everything in the ATP/CAPS. When you fall behind because time has been lost, or because the learners are progressing slowly, you need to confidently discuss this with your teaching team without feeling blamed. The pace of coverage will be determined by the pace of learning. That is why coverage must be tracked by the teacher and the SMT.

How do I use the planner and tracker?

See the "**Quick 5-step Guide to Using the CAPS Planners and Trackers**" on the opposite page.

QUICK 5-STEP GUIDE TO USING THE CAPS PLANNERS AND TRACKERS

1. Find the textbook that YOU are using.

2. Use the planning page each week to plan your teaching for the week. It will help you link the CAPS content and skills to relevant material in the textbook, the teacher's guide, and other materials such as the DBE workbook.

3. Keep a record of the date when you were able to complete the topic. It may be different from the date you planned, and for different classes. Write this date in the column on the right for your records.

4. At the end of the week, reflect and check if you are up to date. Make notes in the blank space.

5. Be ready to have a professional and supportive curriculum coverage conversation with your HoD (or subject or phase head).

The CAPS planners and trackers also provide guidelines for assessment with samples, and may also have enrichment and remedial suggestions. Read the introduction pages carefully for a full explanation.

2. Purpose of the tracker

The Curriculum and Assessment Planner and Tracker is a tool to support you in your role as a professional teacher. Its main purpose is to help you keep pace with the time requirements and the content coverage of the CAPS by providing the details of what should be taught each day of the term; and of when formal assessments should be done. Each of the sessions for Physical Sciences in Grade 11 is linked to the approved sets of Learner's Books and Teacher's Guides on the National Catalogue, as well as the ***Everything Science*** Learner's Book (Siyavula) which has been distributed to schools by the Department of Basic Education as an additional resource. You can download it from www.everythingscience.co.za.

The tracker provides a programme of work that should be covered each day of the term and a space for reflection of work done for each of the LTSMs on the National Catalogue. By following the programme in the tracker for the Learner's Book you are using, you will cover the curriculum in the allocated time, and complete the formal assessment programme. By noting the date when each session is completed, you can assess whether or not you are on track. If you are not, strategise with your head of department (HOD) and colleagues to determine the best way in which to make up time to ensure that all the content prescribed for the term is completed. In addition, the tracker encourages you to reflect on what parts of your lessons were effective, and which parts of your lessons can be strengthened. These reflections can be shared with colleagues. In this way, the tracker encourages continuous improvement in practice.

This tracker should be kept and filed at the end of the term.

3. Links to the CAPS

The Grade 11 Physical Sciences tracker is based on the requirements prescribed by the Department of Basic Education's Curriculum and Assessment Policy Statement (CAPS) for Physical Sciences in the Further Education and Training (FET) band. The CAPS prescribes four hours per week for Physical Sciences. The work set out in the tracker for each day is linked directly to the topics and subtopics given in the CAPS, with the specified amount of time is allocated to each topic. It gives the page number in the CAPS document of the topics and subtopics being addressed in each session. This enables you to refer to the curriculum document directly should you wish to do so.

4. Links to approved LTSMs

There is a tracker for each set of Learner's Books and Teacher's Guides of the approved books on the National Catalogue. The tracker aligns the CAPS requirements with the content set out in the approved Learner's Books and Teacher's Guides. You must refer to the tracker for the book that is used by learners at your school. If you have copies of other Learner's Books, you can also refer to these trackers to give you ideas for teaching the same content in a different way. However, ensure that you cover the content systematically. For each set of LTSMs in the tracker, links are given to the relevant pages in both the Learner's Book and Teacher's Guide to make it easier for teachers to access the correct resources. Links to the ***Everything Science*** materials have been inserted in the trackers for all Learner's Books.

In addition, further suggestions for extension, enrichment, and/or homework exercises have been made. We recommend that you always have an extra activity available for those learners who complete their work earlier than others.

Each tracker is based on the latest print editions of the three approved LTSMs. Take note that page numbers may differ slightly from other print runs of the same Learner's Book. If the page numbers in your edition are not exactly the same as those given in the tracker, you should use the activity/exercise numbers given in the tracker to guide you to the correct pages. These should only differ by a page or two from those given in the tracker.

5. Managing time allocated in the tracker

The tracker provides a suggested plan for 16 one-hour sessions, organised into four sessions per week. Depending on your school's timetable, you may use two of these sessions in one double period. You might also need to adjust the work prescribed for a session to meet other demands of your timetable. However, the content that needs to be covered in a week, should always be covered in a week. If for some reason you do not complete the work set for the week, you need to find a way to get back on track.

The breakdown of work to be done each week corresponds to the annual teaching plan and programme of assessment drawn up by the Department of Education; however, the tracker gives a more detailed outline of what should be taught each day.

The tracker has been planned for a fourth term of nine weeks. Four weeks are allocated for covering the set curriculum. Week 5 is for catching up any work not done in this time and Week 6 has been allocated for revision. This leaves Weeks 7–9 for the end-

of-year examinations. If you use this tracker in a fourth term of a different length or if your school sets aside a different amount of time for the final examination, you should adjust the programme accordingly. Always check this at the start of the term.

Homework has been allocated for most sessions. For learners to benefit from these activities, it is necessary to provide feedback on the homework. Do this at the beginning of the next lesson or at the end of a topic. Learners who do not complete their written work in time can complete the activity for homework. If some learners complete their work well ahead of schedule, consider providing them with enrichment activities. We have provided some examples of enrichment activities in this tracker. If some learners do not complete their written work in time, they can complete the enrichment activity for homework. If for any reason you miss a lesson, or find that you need to spend more time than planned on some aspect of the work, find a way to get back on track so that the curriculum for the term is covered as required.

6. Links to assessment

The tracker indicates where in the series of lessons the CAPS assessment activities/tasks/practical activities should be done. This varies slightly from Learner's Book to Learner's Book, but is always in line with the CAPS specifications. We suggest that you discuss testing times with your colleagues who teach other subjects. In this way you can avoid having learners write several tests on the same day in a single week.

For the informal assessment tasks, you may want to use a variety of assessment methods, including peer assessment, self assessment and spot marking.

Further information about assessment is provided in sections B3, C3 and 5 of this document.

7. Resource list

The tracker suggests resources that you could use for certain lessons. In addition, suggestions for alternative equipment and resources have been made. Learners need to **interact** with learning material as much as possible, therefore every attempt has been made to allow for such interaction.

8. Columns in the tracker

The following columns can be found in the tracker for each set of LTSMs:

1. Session number
2. Relevant CAPS page number
3. CAPS concepts, practical activities and assessment tasks
4. Learner's Book page number
5. Learner's Book activity/task
6. Teacher's Guide page number
7. ***Everything Science*** Learner's Book page number
8. ***Everything Science*** Teacher's Guide page number
9. Date completed – this needs to be filled in each day and there are columns for each of the classes you teach.

9. Weekly reflection

The tracker provides a space to record reflections on a weekly basis. This weekly reflection provides you with a record for the next time you implement the same lesson, and also forms the basis for collegial conversations with your head of department (HOD) and colleagues. It should be shared both informally and at regular departmental meetings. Together with your HOD and colleagues, think of ways of improving your lessons and in turn your learners' work. If for some reason not all the work for the week has been covered, strategise with your HOD and colleagues as to how best to catch up so that the curriculum is covered.

You are encouraged to reflect on your lessons daily – thinking about what went well, or did not go so well in each, and how better to help learners grasp the content being taught. Briefly jot down your reflection by following the prompts in the tracker. When reflecting, you could think about things such as:

- Was my preparation for the lesson adequate? For example: Did I have all the necessary resources? Had I thought through the content so that I understood it fully and could teach it effectively?
- Did the purpose of the lesson succeed? For example: Did the learners reach a good understanding of the key concepts for the day? Could the learners use the language expected from them? Could the learners write what was expected from them?
- Did the learners cope with the work set for the day? For example: Did they finish the classwork? Was their classwork done to an adequate standard? Did I assign any homework?
- What can I do to support learners who did not manage the work, or to extend those who completed the work easily?
- What might I change next time I teach this same content? Will I try a different approach?

B. TERM PLANNING

Before you consider weekly and daily plans which are set out in the tracker, think about the term as a whole.

1. Check the term focus

Take note of the focus for the term. The CAPS document provides clear details regarding the focus for Grade 11:

Term 4 – *Chemistry:* Chemical change
Chemical systems

Overview of Term 4 topics

Redox reactions

In Term 3, you defined an acid as a proton donor and a base as a proton acceptor. In Term 4, we study redox reactions. In this case we define oxidation as a loss of electrons and reduction as a gain of electrons. Learners find it difficult to remember this definition. For this reason, it is useful to teach them memory tools like the mnemonics OIL (Oxidation Is a Loss of electrons) and RIG (Reduction Is a Gain of electrons). Notice oxidation and reduction occur at the same time. In the process there is a transfer of electrons from one atom to another. We can write these as individual half-reactions and combine them to show the overall reaction.

The second important concept learners need to grasp is the idea of an *oxidation number*. The oxidation number gives an indication of how electron-rich or -poor an atom in a compound is. We know that overall a molecule will be neutral, so the oxidation numbers of the atoms present add up to zero. However, the atoms in the molecule will have a tendency to attract or repel electrons. For example, in the hydrogen sulphide molecule, H_2S, the oxidation number of sulfur is –2. This tells us that sulfur in this molecule is electron-rich and has the ability to donate electrons when it reacts. Notice that sulfur does not have the same oxidation number in all molecules. In sulphur trioxide, SO_3, its oxidation number is +6. This tells us that in this molecule sulfur is electron-poor and tends to gain electrons in a reaction. It is important that learners learn the rules for assigning oxidation numbers and that they practice this procedure. In a reaction, we can easily tell if there is a change in oxidation number of atoms belonging to a particular element. We call this type of reaction a *redox reaction*.

The value of an oxidation number is not the only information a learner will need to determine if an atom is likely be part of a redox reaction. This is especially true for all pure elements. These have an oxidation number of zero. They have the same number of electrons and protons so are neutral. The idea of electron-rich and electron-poor do not seem to apply to them. However, this does not mean they are all have stable electron configurations. For example, the atoms of sodium metal have an oxidation number of zero, but like other Group 1 metals, they have a single valence electron. The single valence electron is not strongly attracted to the nucleus of the sodium atom, i.e it has a low first ionisation energy. This means that sodium atoms will always donate one electron each when reacting with other atoms and so can be considered as a source of electrons similar to electron-rich atoms found in molecules.

Another very important concept is that of oxidising agents and reducing agents. Atoms that are electron-rich (i.e have more negative oxidation numbers) have the ability to donate electrons to other atoms that are electron-poor (i.e have more positive oxidation numbers). In this process, the more electron-rich atoms can force an electron-poor atom to gain electrons. This means that the electron-poor atom gains electrons and is reduced. The electron-rich atom has caused reduction to occur. So we call the electron-rich atom the *reducing agent*. In the process of causing the electron-poor atom to gain electrons, the reducing agent loses electrons and so undergoes oxidation. What caused the process of oxidation? The electron-poor atom took the electrons from the electron-rich atom. So the electron-poor atom is the *oxidising agent*. You can teach your learners the mnemonics OAT (Oxidising Agent Takes electrons) and RAD (Reducing Agent Donates electrons).

This topic is not only about learning rules and procedures. Redox chemistry is extremely useful and is happening all around us. By allowing learners to do informal practical investigations involving redox reactions, they will remember the reactions and should recall the definitions and relationships. In Grade 12, learners will revisit redox chemistry when studying electrochemistry. It is therefore important that they have a good foundation in this topic.

You can show learners how to balance chemical equations using oxidation numbers too. This method helps especially for reactions that don't balance easily by inspection. In Grade 12, they will use the table of half-reactions to write balanced chemical equations. If you have time, you could show them this method even though it is not required for Grade 11 learners.

Chemical systems

The topic of *Exploiting the lithosphere* makes Chemistry relevant to learners and

explores history and environmental and social issues. Some teachers may be reluctant to teach this section and rather just give learners a self-study project. This is not an advisable approach. The topic lends itself to many opportunities for revision that learners will miss if they are not guided by a teacher. For example, when looking at gold mining, you could ask learners to draw a free-body diagram of a mine cage moving down a shaft. You could also use this context to revise Newton's Second Law. The extraction of valuable ores from rocks requires acids. This gives a moment to revise the definition and reactions of acids. In the extraction of gold, you can show your learners that the cyanide reaction is an example of a redox reaction. Ask them to assign oxidation numbers.

It is also very important to contextualise this topic in the local community. Many learners will know relatives who have gone to work in the mines. Encourage your learners to do interviews and share first-hand experiences of mining. There are also many articles that can be found in newspapers that deal with the health and safety of miners.

According to the CAPS, all learners need to study gold, but they can also choose other minerals (particularly those that are mined in the community) as a comparison. The Learner's Books all deal with iron and calcium carbonate, but the CAPS is clear that other examples of mining can be studied, especially if they are part of the community. For example, a school near Richards Bay could study titanium mining. Wherever possible, enhance the theory by doing some practical investigations.

Revision

It is extremely important to structure a revision programme for your learners. Although you want them to revise all the topics studied during the year, there may not be time to cover all of them in class. You will need to consider your learners' areas of strength and weakness, as well as how you have managed to keep pace. If you feel you rushed a topic, you should have time to revise this more slowly before the exams. Do not try to do too much in one lesson. Rather, select a topic and explore it more fully. It is particularly important to look at topics that are examined in Grade 12. If your learners have a good understanding of these, it will help them succeed in the final examinations.

2. Prepare resources

This stage in your preparation is vital. The prescribed Learner's Books provide both information and activities. The Teacher's Guides also provide valuable information as teaching guidelines. When you are planning, you need to be familiar with the information in the Learner's Book your learners will be using. This will ensure that you do not need to either read from the Learner's Book or ask your learners to copy down notes from the chalkboard or projector.

Teaching Physical Sciences should not be based on reading and discussing the Learner's Book. Learners need activities, demonstrations, problem solving opportunities and active debates. This all takes careful planning and preparation of resources.

Resources can range from everyday objects like a marble or a ball, to more scientific apparatus like a ticker timer, or even digital resources like a short video clip or simulation. Whatever resource you select as the focus of the lesson, make sure you think carefully about the questions you will ask learners to think about and discuss. You may plan these discussions in pairs or small groups. Through observation, reflection and discussion you will engage learners in helping them construct their own knowledge. It is important to challenge this knowledge and at times disagree with them even if they are correct. You can also present a common misconception and encourage them to be critical of the proposed idea.

Problem solving and application of knowledge are very important in Physical Sciences. Your learners will need to practise exam-type questions; the Learner's Books all give worked examples. There are also end-of-chapter or unit questions, exam practice and additional worksheets. These have been referenced in the tracker for each book and are included as homework activities. However, in some cases the Learner's Book may not have enough questions and we have referred you to additional activities from the ***Everything Science*** Learner's Book. If your learners don't have a copy, they can access these questions online from www.everythingscience.co.za. The Learner's Books can also be downloaded or print copies can be ordered from a supplier referred to on the same site. There is a huge database of questions that will be very useful for learners to work through both for remediation, revision and extension. Not all the activities are referenced in the tracker. If you identify that your learners are struggling in a particular section, select questions that are relevant to them.

A list of resources for the term appears below in case you want to collect these well in advance. You will find it worthwhile to collect these well in advance and leave them in a box or something similar. This way, you will avoid a last-minute rush. Remember that some materials are used on several different occasions, so keep laboratory equipment safe and well cleaned. Depending on how quickly your learners complete a section, and on what activities you choose, you may find that you are still on a certain week

when the following week's requirements are listed. Continue normally and check with the CAPS document to find out what you still need.

3. Plan for required assessment tasks

The CAPS requirements for formal assessment in Term 4 are two 3-hour end-of-year examinations. Most of the Learner's Books and/or Teacher's Guides provide examples of CAPS-compliant formal assessment tasks, including practical investigations, revision activities and a sample control test.

Where the LTSMs used at your school have the examination papers in the Learner's Book, they cannot be used because the learners will be able to prepare for them in advance. They are, however, useful for revision and informal assessment. Exemplar examination papers are provided in Section F *Assessment Resources* of this tracker.

No formal practical assessment is required in Term 4 but it is essential that informal practical work continue. Practical skills are assessed in the final examinations, too.

Please note: The DBE occasionally makes changes to the assessment requirements published in the CAPS. If any changes are made after this document is printed, you will need to adjust the assessment programme provided here and in the trackers accordingly.

Table 1: FORMAL ASSESSMENT TASKS INCLUDED IN EACH SET OF APPROVED LTSMs FOR TERM 4

Name of book	Examination
Study and Master Physical Sciences	**Week 6** Not provided in book Exemplar examination papers provided in Section F
Platinum Physical Sciences	**Week 6** Not provided in book Exemplar examination papers provided in Section F
Successful Physical Sciences	**Week 6** **Paper 1** LB pp. 339–343 (for practice/informal assessment) Memo: TG pp. 269–272 **Paper 2** LB pp. 343–349 (for practice/informal assessment) Memo: TG pp. 273–277 Exemplar examination papers provided in Section F

C. DAILY LESSON PLANNING AND PREPARATION

The tracker provides details of the content (in hour sessions) that you need to teach to your class. However, to deliver the lessons successfully, you must do the necessary preparation yourself. This entails a number of key steps that range from ensuring that you have a good understanding of the term focus through to checking the detailed preparation of resources needed for each lesson. Physical Sciences requires a range of resources, from printed material to typical science apparatus, such as test tubes, or household items including food items.

1. Check your own knowledge of the content

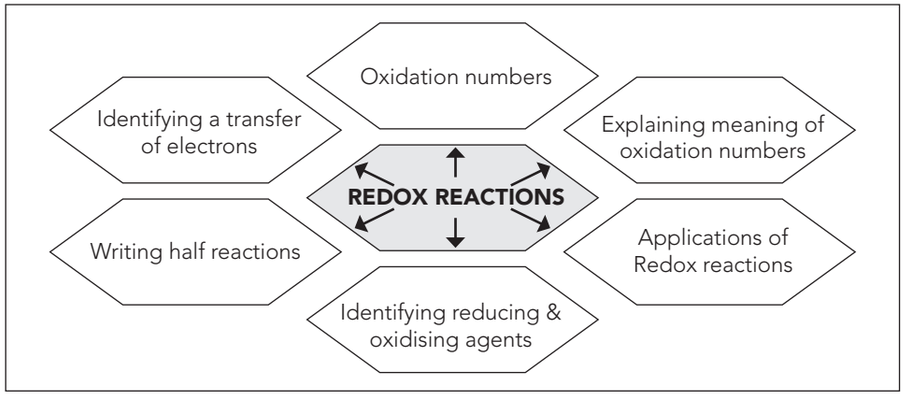
However well you know your work, it is easy to make small mistakes when in a classroom with learners asking questions. Always read through the content that you are going to cover to ensure that you are very familiar with the work. If possible, also do additional reading from other sources. Refer to Section E *Additional Information and Enrichment Activities* of this document where additional information about many of the topics for the term and some common errors – not always made explicit in the Learner's Books or Teacher's Guides – are addressed.

2. Prepare the conceptual framework for the lesson topic

When preparing the content to be taught, think carefully about how the concepts are organised in a conceptual framework; how to help learners develop this framework for themselves; what possible questions learners might ask; and difficulties learners might have and how to address these.

One way of preparing the content is to summarise it using a tool like a mind map, as shown in Figure 1. When you introduce a topic, learners will benefit from seeing the big picture and a concept map is a useful way to present this. It is also a useful way of showing learners how the class is progressing. At the end of the topic encourage your learners to make their own summaries in words and/or pictures. In this way, they will interact with concepts, and this in turn will promote deep learning.

Figure 1: MIND MAP OF KEY CONCEPTS ASSOCIATED WITH REDOX REACTIONS



While you prepare the conceptual framework, it is important to think about what prior knowledge learners should have and to have a clear idea of where and when they will need to draw on the concepts taught in earlier grades. It is also very important for you to have a clear idea of where and when learners will need to draw on the concepts taught in the Grade 11 lessons. For this purpose, it is vital that you are familiar with the Grade 12 Examination Guides for Physical Sciences, as many of the topics taught in Grade 11 are examined in the final Grade 12 exam.

In your preparation, think carefully about the types of questions learners will ask. You may want to pre-empt some of these questions by asking open-ended questions to arouse learners' curiosity and to engage them in the process of learning. It is also a good idea to leave a question unanswered for a short time and let the lesson activities suggest a possible answer. If the question is still unanswered, then you should provide the necessary help. Doing this will provide good opportunities for you to correct any wrong ideas or misconceptions.

3. Baseline assessment and remediation of misconceptions

Baseline assessment should take place at the beginning of each new topic. This enables you to establish what learners already know and to pick up any possible misconceptions. Some of the most common misconceptions have been addressed in relation to the relevant CAPS content in Section E *Additional Information and Enrichment Activities* of this document. Baseline assessment can take many forms – such as a quick question and answer session; or a paper and pencil activity. Once a gap in understanding or a misconception has been identified (e.g. some people think that when you kick a ball, it continues to move forward because of the force of the kick), address these misconceptions before moving on to teaching the new work for the term. In this context the word remediation refers to overcoming the learners' wrong ideas.

You need to make your learners aware that the end of year examinations are extremely important. They will use their results when applying to study tertiary institutions. It is also an important second step towards the preparing learners to write the matric examination. It is crucial that learners develop good study skills and exam technique. It is even more important that they learn from their mistakes. One of the ways you can assist learners is to identify areas of strength and weakness. In Section F, an example of an analysis sheet has been provided. You could use these tables to analyse trends for a class or grade or to highlight an individual learner's performance. Feedback and a detailed review of the mid-year examinations is essential to preparing your learners for future success. You may need to allocate time out of the normal allocation to address some of the common errors and to provide support and remediation particularly for the weaker learners.

4. Learner activities

Think about the tasks that learners need to complete in each lesson because it is important that they do something constructive. On rare occasions they may copy something from the chalkboard or another medium, but this should not be the sole focus of the lesson. Some examples of activities they can do in each lesson include, answering questions by writing the answers (the CAPS encourages writing); completing translation activities by converting a drawing to a description, or a table to a graph. You set the stage for the learner activities by giving explanations about different concepts, asking questions, setting problem-solving activities, or giving clear instructions about what learners need to do.

In Section E *Additional Information and Enrichment Activities* of this document, you will find ideas for activities linked to several CAPS topics beyond the scope of those given in many of the LTSMs. Refer to this resource when preparing your lessons. In some instances, a more appropriate practical activity than the one in the Learner's Book has been included for your use.

Ensure that you have enough chalk or markers. Where instructions in the Learner's

Book that you are using are not clear, use the chalkboard (or whatever media you use in your classroom) to draw or write instructions about what the learners need to do in order to complete the prescribed activity. Chalkboards are also useful for the writing down and explaining of new vocabulary.

Always allow time in your lessons to review learners' work and to give formative feedback on any assessment that has been done. Ensure that during peer or self-assessment you have a list of possible answers.

5. Informal assessment

In addition to specifying the number and nature of the formal assessment tasks, the CAPS suggests that there should also be ongoing informal assessment each term. Learners can do a variety of informal assessment tasks, both in class and for homework, and many of the Learner's Book activities are useful for this purpose. Informal assessment tasks do not have to be marked by the teacher. You can allow learners to mark their own or each other's work. You should consider taking in about five or six pieces of work from time to time to help you assess progress informally and to keep learners attentive. Also change your review techniques from time to time.

While learners do not always need marks for their work, they do need feedback. You need to know which concepts they understood and which one they did not. This will enable you to correct and support their learning. Record any marks that are awarded or key comments for your own interest.

6. Learners with special needs

People are not all the same. Learners will attend the Physical Science classes with different needs, styles of learning and also with a variety of alternative ideas about scientific phenomena. It is challenging for a teacher to accommodate all these differences, but it is important that you consider these differences during your preparation.

For different learning styles, you can use a variety of teaching methods. These include whole-class teaching, peer interaction, small-group learning, writing activities, drawing and mind-mapping activities, presentations, debates and role play. Wherever possible, encourage reading, writing and speaking skills.

There is a large amount of additional information to help you in the Teacher's Guides. The Learner's Books also provide additional suggestions. Additional to this, the DBE has published some excellent materials to support you in working with learners with learning barriers. Two such publications are:

- Directorate Inclusive Education, Department of Basic Education (2011) *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements.* Pretoria. www.education.gov.za, www.thutong.doe.gov.za/InclusiveEducation
- Directorate Inclusive Education, Department of Basic Education (2010) *Guidelines for inclusive teaching and learning. Education White Paper 6. Special needs education: Building an inclusive education and training system.* Pretoria. www.education.gov.za, www.thutong.doe.gov.za/InclusiveEducation

7. Enrichment

In certain tasks, learners will work at different speeds. For those learners who complete their work earlier than others, refer to enrichment or extension activities in the Teacher's Guide, those suggested in Section E *Additional Information and Enrichment Activities* or provided in Section G *Additional Worksheet* of this document.

8. Homework

It is essential for Grade 11 learners to do homework every day. Examine the tracker and decide what sorts of tasks are appropriate for homework each week. Allow a few minutes at the end of each lesson to provide homework instructions. Homework can be a useful consolidation exercise and need not take learners very long. If well planned in advance, learners can sometimes be given a longer homework exercise to be handed in within a week. This arrangement allows for flexibility.

If homework tasks are allocated, it is essential to allow a few minutes at the start of the following lesson to review the previous day's homework.

9. Practical work

Practical work must be integrated with theory to strengthen the concepts being taught. This may take the form of simple practical demonstrations or an experiment or practical investigation

In Term 4, learners are not required to do any formal practical assessment, as the required work for this purpose should have been be completed in Term 3. However,

it is important to continue doing informal practical work to support the development of conceptual understanding. The skills of doing practical work need to be revised regularly too as these are usually examined in the end of year examinations.

For learners to achieve the most from their experience of practical work, you need to be extremely well prepared. Think carefully and plan how to accommodate all learners in doing practical activities. In most schools, there may be a limited amount of equipment. This means that you may need to give groups of learners the opportunity to complete the practical work after school hours. If equipment is limited, one solution is to set up different stations with different equipment. Learners rotate from one station to the next in order to complete a series of experiments.

Learners also need to be well prepared for any practical work. In the trackers, you will see that learners are required to review the investigations for homework on the day before they are required to do the investigation. You could ask them to complete pre-practical questions.

Safety is critical whenever doing practical work. Please ensure you discuss safety rules with your learners regularly. Refer to the websites below that deal with laboratory safety:

- International chemical safety cards: www.inchem.org/pages/icsc.html
- Merck safety data sheets: www.merckmillipore.com/ZA/en/support/safety/safety-data-sheets/lvmb.qB.TzsAAAFCXd4Xr74u,nav
- School chemistry laboratory safety guide: www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf

To conduct a successful practical activity, the following procedures are suggested:

- Before the practical session, check that the materials are the correct ones so that no mistakes occur.
- Talk through the activity with learners or get them to read the descriptions from the Learner's Book before they come to a practical class.
- Stop from time to time to emphasise certain points. For example, **remember to use safety glasses and not to look directly at burning magnesium**.
- Let learners sometimes work in their chosen groups of friends and change the groups on other occasions.
- Keep a watchful eye on the activity and walk around looking at what learners are doing. This teaching strategy provides you with the opportunity to assess their skills of working with apparatus.
- Drawing the experimental set-up on the chalkboard or another medium helps learners to focus.
- Ensure that books and bags are safely stowed away from the practical work area.
- Enforce a strict rule of **no tasting**. There should be no eating of any kind in the laboratory or classroom where investigations are conducted.
- Ensure that work areas are clean both before and after the practical activity.
- Encourage learners to wear plastic aprons and safety glasses and insist on closed shoes wherever possible.
- Insist on the correct labelling of all tubes and bottles.
- Set a good example by following correct procedures at all times.
- Insist that learners tidy their workplaces when they have finished.
- Have a supply of tap water at hand in case of accidental acid spills. Do not attempt to neutralise acids and bases on a learner or yourself. Simply wash with plenty of water.
- Have a fire extinguisher handy and know how to use it.
- Keep a supply of gauze and plasters in a simple first aid box. A plastic container works well.

D. TRACKERS FOR EACH SET OF APPROVED LTSMs

This section maps out how you should use your Physical Sciences Learner's Book and Teacher's Guide in a way that enables you to cover the curriculum sequentially and in a well-paced manner, aligning with the CAPS for meaningful teaching.

The following components are provided in the columns of the tracker:

1. Lesson number
2. CAPS concepts, practical activities, assessment tasks and page reference number
3. Learner's Book page number
4. Learner's Book activity/task
5. Teacher's Guide page number
6. *Everything Science* Learner's Book page number
7. *Everything Science* Teacher's Guide page number
8. Completion date

In addition, a list of resources for each session and enrichment ideas are provided.

Weekly reflection

The tracker provides space for you to jot down both successes and ideas for a different approach in future years. This reflection should be based on the daily sessions you have taught during the week.

Share your ideas with colleagues and with your HOD. Discuss aspects that went well and aspects that did not go as well as you expected.

- Did the learners grasp the main concepts of the lesson?
- Was my content preparation adequate?
- Did I have all the correct resources in sufficient numbers?
- Did the learners interact with the learning material provided?
- Did learners ask and answer questions relating to the concept?
- Did the learners finish their work in time?
- Was there enough work to keep learners busy for the allocated time?
- What quality of homework did learners produce?

Put your thoughts in writing by briefly jotting down your reflections each week but **think** about your lessons daily.

The prompts for reflection in the tracker are as follows:

- *What went well?*
- *What did not go well?*
- *What did the learners find difficult or easy to understand or do?*
- *What will you do to support or extend learners?*
- *What will you change next time? Why?*
- *Did you complete all the work set for the week?*
- *If not, how will you get back on track?*

The reflection should be based on the daily lessons you have taught each week. It will provide you with a record for the next time you implement the same lesson, and also forms the basis for collegial conversations with your HOD and peers.

Explanation of abbreviations and symbols used in the trackers

A	Answer
Act.	Activity
CA	Class activity
Demo.	Demonstration
ES	*Everything Science*
Ex.	Exercise
Exp.	Experiment
HOD	Head of Department
IA	Informal assessment
Inv.	Investigation
LB	Learner's Book
No.	Number
PA	Practical activity
PT	Periodic table
p.	Page
pp.	Pages
Q.	Question
S #	Hour session
TG	Teacher's Guide
TYS	Test Yourself (*Study and Master*)
WS	Worksheet
#	Examined in Grade 12

1. *Study and Master Physical Sciences* (Cambridge University Press)

Study and Master Physical Sciences Week 1: Redox reactions												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1	**Redox reactions** • Determine the oxidation number from a chemical formula and electronegativities • Explain the meaning of 'oxidation number' • Assign oxidation numbers to atoms in various molecules like H_2O, CH_4, CO_2, H_2O_2, HOCℓ by using oxidation number guidelines or rules • Use rules of oxidation to assign oxidation numbers to atoms in a variety of molecules and ions • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation–reduction reactions as involving electron transfer	93–94	277–283	283 TYS 8 1 a–h	D99							
	Homework			283 TYS 8 2 a–i	D99	464 Ex. 13.8 1–2	464 Ex. 13.8 1–2					
2	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation–reduction reactions as involving electron transfer	93	283–284	284 PA Exp. 1	D99–D101							
	Homework: Complete report on Exp. 1; prepare for Exp. 2			284 PA Exp. 284–285 PA Exp. 2	D99–D102	457–460	457–460					
3	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation–reduction reactions as involving electron transfer	93–94	284–285	284–285 PA Exp. 2	D101–D102							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
4	**Redox reactions** • Describe oxidation–reduction reactions as always involving changes in oxidation number	93		285–286	D102–D103							
	Homework: Complete report for Exp. 3 (Displacement of metals and non-metals); prepare for Part B			286–287	D102–D104	455 13.7 1–3	335–339					

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Study and Master Physical Sciences Week 2: Redox reactions and exploiting the lithosphere

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1	**Redox reactions** • Describe oxidation–reduction reactions as always involving changes in oxidation number	93	287	287 PA 1 & 2	D103–D104	461–467						
	Homework: Complete report for Part B			287 PA 1 & 2	D103–D104	464 Ex. 13.8 3 a–d	341–343					
2	**Redox reactions** Revision	93–94	288–290	289 Unit 3 1–4	D106							
	Homework: Revision; extension activity			289 Unit 3 5–7 288 Act. 15	D106 D104–D106	468 Ex. 13.9 10–13	346–350					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
3	**Mining and mineral processing** • Give a brief history of humankind across the ages: – Link their technology and the materials they used to their tools and their weapons – Refer to evidence of these activities in South Africa	95	292–295			470–477						
	Homework			320 Act. 8	D115–D116	477 1–6						
4	**Mining and mineral processing** • Describe the Earth's crust as a source of the materials humans use • What is available? (The abundance of the elements on Earth) • Where is it found? (The uneven distribution of elements across the atmosphere, the hydrosphere, the biosphere and the lithosphere) • How is it found? (Seldom as elements, inevitably as minerals) • How are the precious materials recovered? (The need to mine and process the minerals, separating them from their surroundings and processing them to recover the metals or other precious material – use terms like resources, reserves, ore, ore body)	96	295–298			477–479						
	Homework			320 Act. 8	D115–D116	461–467						

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Study and Master Physical Sciences Week 3: Exploiting the lithosphere												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** • Describe the recovery of gold referring to: – Why it is worth mining – The location of the major mining activity in South Africa	97	306–309	315 Act. 6 1–2	D113	480–482						
	Homework			309–310 Case Study		482 Ex. 14.1 1 a–e	353					
2	**Mining and mineral processing** • The major steps in the process: – Deep-level underground mining – Separation of the ore from other rock – The need to crush the ore-bearing rock – Separating the finely divided gold metal in the ore by dissolving in a sodium cyanide oxygen mixture (oxidation) – simple reaction equation – The recovery of the gold by precipitation (Zn) (reduction) – simple reaction equation – This method is outdated, mines now use activated carbon – Smelting	97	311–314	315 Act. 6 3–4	D114							
	Homework			315 Act. 6 5 a–f	D114	482 Ex. 14.1 1 a–e	353					
3	**Mining and mineral processing** • Give the major steps in the process of mining if you have chosen one of the other mining activities	97	303	303 Act. 3	D109–D111	485						
	Homework			303 Act. 3	D109–D111							
4	**Mining and mineral processing** • Describe the environmental impact of – Mining operations – Mineral recovery plants • Discuss old mining methods and the impact on the environment of such methods, e.g. Mapungubwe	97	316			483–485						
	Homework: Prepare for a class debate			320 Act. 7	D114							

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Study and Master Physical Sciences Week 4: Exploiting the lithosphere												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** • Describe the consequences of the current large-scale burning of fossil fuels, and why many scientists and climatologists are predicting global warming	97	317–320	320 Act. 7	D114							
	Homework			320 Act. 8	D115–D116	484–485						
2	**Mining and mineral processing** • Give the major steps in the process of mining if you have chosen one of the other mining activities (iron)	97	298–302	PA 299–302 Act. 2	D108–D109	485–486						
	Homework: Complete report on Practical Activity			PA 299–302 Act. 2	D108–D109							
3	**Mining and mineral processing** Extension: Calcium carbonate		303–305	303–305	D111–D113							
	Homework: Complete report on Practical Activity			PA 299–302 Act. 2	D108–D109							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
4	**Mining and mineral processing** Revision and extension		322–323	322–323 1–5	D117							
	Homework: Examination preparation			323 6–13	D117	487 Ex. 14.2 1–2	353–354					

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?

What will you change next time? Why?

HOD: **Date:**

Study and Master Physical Sciences Week 5: Catch up and consolidation – plan your week												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1												
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Study and Master Physical Sciences Week 6: Examination preparation												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1												
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Study and Master Physical Sciences Weeks 7–9: End-of-year examinations	
Reflect on the year	
Think about and make a note of: 1. Did you find that using the tracker helped you to plan your work so that you met the CAPS requirements? In what ways did it help, and how can you make better use of it next year?	4. What concepts and skills did learners struggle with? How can you help your group next year understand these concepts and develop these skills better?
2. Were you able to fulfill the requirements of the curriculum for this year? What helped or prevented you from doing this?	5. What needs to be communicated to the teacher who will teach this group of learners next year?
3. What concepts and skills did learners grasp well this year? What good practice could you use again next year?	6. What have you learnt this year about your own teaching practice? How can you develop your practice?
HOD:	**Date:**

2. *Platinum Physical Sciences* (Maskew Miller Longman)

Platinum Physical Sciences Week 1: Redox reactions												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1	**Redox reactions** • Determine the oxidation number from a chemical formula and electronegativities • Explain the meaning of 'oxidation number' • Assign oxidation numbers to atoms in various molecules like H_2O, CH_4, CO_2, H_2O_2, HOCℓ by using oxidation number guidelines or rules • Use rules of oxidation to assign oxidation numbers to atoms in a variety of molecules and ions	93	250–252 262	252 Ex. 14.1 1–4 263 Ex. 14.7 1–7	145–146 153							
	Homework			252 Ex. 14.1 5–9 263 Ex. 14.7 8–14	146 153	464 Ex. 13.8 1–2	464 Ex. 13.8 1–2					
2	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation reduction reactions as involving electron transfer • Describe oxidation–reduction reactions as always involving changes in oxidation number • Balance redox reaction equations by using oxidation numbers via the ion–electron method		253	253 Ex. 14.2 1–3	146							
	Homework			253 Ex. 14.3 1–2	147	457–460	457–460					
3	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation reduction reactions as involving electron transfer • Describe oxidation–reduction reactions as always involving changes in oxidation number • Balance redox reaction equations by using oxidation numbers via the ion–electron method											

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
	Homework: Prepare for practical investigations			254–259	147–152	455 13.7 1–3	455 13.7 1–3					
4	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation reduction reactions as involving electron transfer		254–259	254 Exp. 14.1 Exp. 14.2 Exp. 14.3	147–152							
	Homework			Ex. 14.4 Ex. 14.5	147–152	455 13.7 1–3	335–339					

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Week 2: Redox reactions and exploiting the lithosphere

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1	**Redox reactions** • Balance redox reaction equations by using oxidation numbers via the ion–electron method	94	260–261	261 Ex. 14.6 1–2		461–467						
	Homework			263 1–6	154–155	464 Ex. 13.8 3 a–d	341–343					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
2	**Mining and mineral processing** • Give a brief history of humankind across the ages: – Link their technology and the materials they used to their tools and their weapons – Refer to evidence of these activities in South Africa	95	270	270 Act. 15.1 1–3	159							
	Homework			267–268 7–8	157	468 Ex. 13.9 10–13	346–350					
3	**Mining and mineral processing** • Describe the Earth's crust as a source of the materials humans use • What is available? (The abundance of the elements on Earth)		271–272	271 Ex. 15.1 272 Act. 15.2	159	470–477						
	Homework			272 Ex. 15.2	159–160	477 1–6						
4	**Mining and mineral processing** • Where is it found? (The uneven distribution of elements across the atmosphere, the hydrosphere, the biosphere and the lithosphere) • How is it found? (Seldom as elements, inevitably as minerals) • How are the precious materials recovered? (The need to mine and process the minerals and separating them from their surroundings and processing them to recover the metals or other precious material – use terms like resources, reserves, ore, ore body)	96	272	272 Ex. 15.2	159–160	477–479						
	Homework					461–467						

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Week 3: Exploiting the lithosphere												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** • Describe the **recovery of gold** referring to – Why it is worth mining – The location of the major mining activity in South Africa	97	273–274	274 Act. 15.3 1–2	161	480–482						
	Homework			274 Act. 15.3 3	161	482 Ex. 14.1 1 a–e	353					
2.	**Mining and mineral processing** • The major steps in the process: deep level underground mining – Separation of the ore from other rock – The need to crush the ore bearing rock – Separating the finely divided gold metal in the ore by dissolving in a sodium cyanide oxygen mixture (oxidation) – simple reaction equation – The recovery of the gold by precipitation (Zn) (reduction) – simple reaction equation – This method is outdated, mines now use activated carbon – Smelting		274–275	275 Act. 15.4 2	161							
	Homework			275 Act. 15.4 1, 3	161							
3	**Mining and mineral processing** • Give the major steps in the process of mining if you have chosen one of the other mining activities	97	275–278	276 PA Exp. 15.1	162							
	Homework			278 Act. 15.5	163	482 Ex. 14.1 1 a–e	353					
4	**Mining and mineral processing** • Describe the consequences of the current large-scale burning of fossil fuels, and why many scientists and climatologists are predicting global warming		279–280 285–288	288 Exp. 15.5	167	485						
	Homework			286 Act. 15.8	165–166	483–485						

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Week 4: Exploiting the lithosphere												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** Give the major steps in the process of mining if you have chosen one of the other mining activities	97		278 Act. 15.5	163	484–485						
	Homework: Prepare for class debate			284 Act. 15.7	165							
2	**Mining and mineral processing** Discuss old mining methods and the impact on the environment of such methods	97		284 Act. 15.7	165	485–486						
	Homework: Examination preparation			291–292 1–4	169–170	487 Ex. 14.2 1–2	353–354					
3	**Mining and mineral processing** Extension: Calcium carbonate		280–283	281 PA Exp. 15.2 Exp. 15.3 Exp. 15.4	163 163–164 164							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
	Homework: Complete report on Practical Activity			283 Act. 15.6	164							
4	**Mining and mineral processing** Revision and extension			289 1–4	168							
	Homework: Complete examination preparation			291–292 1–4	169–170	487 Ex. 14.2 1–2	353–354					

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Week 5: Catch up and consolidation – plan your week												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	Term 4 Revision/Target Worksheets											
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Week 6: Examination preparation												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1												
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Platinum Physical Sciences Weeks 7–9: End-of-year examinations	
Reflect on the year	
Think about and make a note of: 1. Did you find that using the tracker helped you to plan your work so that you met the CAPS requirements? In what ways did it help, and how can you make better use of it next year?	4. What concepts and skills did learners struggle with? How can you help your group next year understand these concepts and develop these skills better?
2. Were you able to fulfill the requirements of the curriculum for this year? What helped or prevented you from doing this?	5. What needs to be communicated to the teacher who will teach this group of learners next year?
3. What concepts and skills did learners grasp well this year? What good practice could you use again next year?	6. What have you learnt this year about your own teaching practice? How can you develop your practice?
HOD:	**Date:**

3. *Successful Physical Sciences* (Oxford)

Successful Physical Sciences Week 1: Redox reactions												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation–reduction reactions as involving electron transfer	93	276–278	277 Act. 1 1.1–1.3 2.1–2.2	237							
	Homework			277 Act. 1 1.4–1.7 2.2–2.4	237	464 Ex. 13.8 1–2	340					
2	**Redox reactions** • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation–reduction reactions as involving electron transfer	93	279–280	PA Exp. 2–4	238							
	Homework			280 Act. 5 1–4		457–460						
3	**Redox reactions** • Determine the oxidation number from a chemical formula and electronegativities • Explain the meaning of 'oxidation number' • Assign oxidation numbers to atoms in various molecules like H_2O, CH_4, CO_2, H_2O_2, HOCℓ by using oxidation number guidelines or rules • Use rules of oxidation to assign oxidation numbers to atoms in a variety of molecules and ions	93–94	281–283	283 Act. 1 1.10 Act. 2 1.1–1.3	239–240							
	Homework			283 Act. 1 11.21 Act. 2 2.1–2.6	239–240	455 13.7 1–3	335–339					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
4	**Redox reactions** Describe oxidation–reduction reactions as always involving changes in oxidation number	93	284–285	284 Act. 3 1–4 PA 285 Exp. 4 & 5	240 240–241							
	Homework			284 Act. 3 1–4	240	455 13.7 1–3	335–339					

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Science Week 2: Redox reactions and exploiting the lithosphere

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1	**Redox reactions** • Balance redox reaction equations by using oxidation numbers via the ion–electron method	93	286–288	288 Act. 1 1.1–1.3 2.1–2.3	241–242	461–467						
	Homework			288 Act. 1 1.4–1.6 2.4–2.6	241–242	464 Ex. 13.8 3 a–d	341–343					
2	**Redox reactions** Revision and extension	93–94	291–292	291–292 1–3	245							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
	Homework			292 4–7	245	468 Ex. 13.9 10–13	346–350					
3	**Mining and mineral processing** • Give a brief history of humankind across the ages: – Link their technology and the materials they used to their tools and their weapons – Refer to evidence of these activities in South Africa	95	293–299	299 Act. 1 1.1–1.2	246	470–477						
	Homework			299 Act. 1 2	246	477 1–6						
4	**Mining and mineral processing** • Describe the Earth's crust as a source of the materials humans use • What is available? (The abundance of the elements on Earth) • Where is it found? (The uneven distribution of elements across the atmosphere, the hydrosphere, the biosphere and the lithosphere) • How is it found? (Seldom as elements, inevitably as minerals) • How are the precious materials recovered? (The need to mine and process the minerals and separating them from their surroundings and processing them to recover the metals or other precious material – use terms like resources, reserves, ore, ore body)	96	300–303	303 Act. 1 1–2	247	477–479						
	Homework			303 Act. 2 1–2	247	477–479						

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Sciences Week 3: Exploiting the lithosphere												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** • Describe the **recovery of gold** referring to: – Why it is worth mining – The location of the major mining activity in South Africa	97	307–308	307 Act. 1	249	480–482						
	Homework			307 Act. 1	249	482 Ex. 14.1 1 a–e	353					
2	**Mining and mineral processing** • The major steps in the process: – Deep-level underground mining – Separation of the ore from other rock – The need to crush the ore bearing rock – Separating the finely divided gold metal in the ore by dissolving in a sodium cyanide oxygen mixture (oxidation) – simple reaction equation – The recovery of the gold by precipitation (Zn) (reduction) – simple reaction equation – This method is outdated, mines now use activated carbon – Smelting	97	309–310	310 Act. 1	250							
	Homework			292 4–7	245	482 Ex. 14.1 1 a–e	353					
3	**Mining and mineral processing** • Give the major steps in the process of mining if you have chosen one of the other mining activities	97	304–306	304 Act. 2 1–2 PA 306 Exp. 3	248 249	485						
	Homework			304 Act. 1 1–2	248							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
4	**Mining and mineral processing**. Describe the environmental impact of: • Mining operations • Mineral recovery plants	97	314–316	316 Act. 1 1	252	483–485						
	Homework			316 Act. 1 2	252							

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Sciences **Week 4: Exploiting the lithosphere**												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1	**Mining and mineral processing** • Discuss old mining methods and the impact on the environment of such methods, e.g. Mapungubwe	97	317–318	318 Act. 2 1–2	252							
	Homework			318 Act. 2 1–2	252	484–485						

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB	TG					
2	**Mining and mineral processing** • Describe the consequences of the current large scale burning of fossil fuels, and why many scientists and climatologists are predicting global warming	97	319	319 Act. 3 1–2		485–486						
	Homework			321 1–3	253							
3	**Mining and mineral processing** Extension: Calcium carbonate		311–313	PA 2 & 3 312–313	250–251							
	Homework			312 Act. 1 1–3	250							
4	**Mining and mineral processing** Revision and extension			321 4–5	253							
	Homework: Examination preparation			322–323		487 Ex. 14.2 1–2	353–354					

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Sciences Week 5: Catch up and consolidation – plan your week												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB	**TG**	**Date completed**				
1												
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection	
Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Sciences Week 6: Examination preparation												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB	TG	Date completed				
1												
	Homework											
2												
	Homework											
3												
	Homework											
4												
	Homework											

Reflection

Think about and make a note of: What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you cover all the work set for the week? If not, how will you get back on track?	What will you change next time? Why?
	HOD: **Date:**

Successful Physical Sciences Weeks 7–9: End-of-year examinations	
Reflect on the year	
Think about and make a note of: 1. Did you find that using the tracker helped you to plan your work so that you met the CAPS requirements? In what ways did it help, and how can you make better use of it next year? 2. Were you able to fulfill the requirements of the curriculum for this year? What helped or prevented you from doing this? 3. What concepts and skills did learners grasp well this year? What good practice could you use again next year?	4. What concepts and skills did learners struggle with? How can you help your group next year understand these concepts and develop these skills better? 5. What needs to be communicated to the teacher who will teach this group of learners next year? 6. What have you learnt this year about your own teaching practice? How can you develop your practice?
HOD:	**Date:**

E. ADDITIONAL INFORMATION AND ENRICHMENT IDEAS

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment ideas
Redox reactions	
Redox reactions • Determine the oxidation number from a chemical formula and electronegativities • Identify a reduction–oxidation reaction and apply the correct terminology to describe all the processes • Describe oxidation-reduction reactions as involving electron transfer • Describe oxidation-reduction reactions as always involving changes in oxidation number • Balance redox reaction equations by using oxidation numbers via the ion-electron method • Explain the meaning of 'oxidation number' • Assign oxidation numbers to atoms in various molecules like H_2O, CH_4, CO_2, H_2O_2, HOCℓ by using oxidation number guidelines or rules • Use rules of oxidation to assign oxidation numbers to atoms in a variety of molecules and ions	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical–sciences/grade–11/chemical–change–types–reactions–redox–reactions The process of rusting is very evident in coastal areas. You could set up an investigation on rusting and the prevention of rusting. Place identical iron nails in test tubes and control conditions: Test tube 1 – sealed after warming the test tube and nail (dry air) Test tube 2 – exposed to air Test tube 3 – add a few drops of water and seal Test tube 4 – add a few drops of salt water/sea water and seal Allow learners to suggest other possibilities to test. Ask learners to observe over time. Encourage them to take photos to make comparisons. Additional experiments/Demonstrations: 1. Add iron nail or steel wool to solution of copper (II) sulphate 2. Make a small ornament shaped like a tree using copper wire. Place the ornament into a solution of silver nitrate and allow learners to observe a silver tree forming in the solution.
Exploiting the lithosphere	
Mining and mineral processing • Give a brief history of humankind across the ages: – Link their technology and the materials they used to their tools and their weapons – Refer to evidence of these activities in South Africa • Describe the Earth's crust as a source of the materials humans use • What is available? (The abundance of the elements on Earth) • Where is it found? (The uneven distribution of elements across the atmosphere, the hydrosphere, the biosphere and the lithosphere) • How is it found? (Seldom as elements, inevitably as minerals) • How are the precious materials recovered? (The need to mine and process the minerals and separating them from their surroundings and processing them to recover the metals or other precious material – use terms like resources, reserves, ore, ore body)	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical–sciences/grade–11/chemical–systems–exploiting–lithosphere Refer to Grade 8 and 9 Natural Sciences Learner's Book and Teacher's Guide. You could also speak to your colleagues who teach Geography and look at their Grade 10 and 11 Geography Learner's Book and Teacher's Guide for information about mining and visual material to enrich your learners' understanding of mining and the processes involved. Ask learners to conduct interviews with community members who have worked on mines.

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment ideas
Exploiting the lithosphere	
Mining and mineral processing • Describe the recovery of gold referring to: – Why it is worth mining – The location of the major mining activity in South Africa • The major steps in the process: – Deep-level underground mining – Separation of the ore from other rock – The need to crush the ore bearing rock – Separating the finely divided gold metal in the ore by dissolving in a sodium cyanide oxygen mixture (oxidation) – simple reaction equation – The recovery of the gold by precipitation (Zn) (reduction) – simple reaction equation – This method is outdated, mines now use activated carbon – Smelting	Speak to your colleagues who teach History and share resources especially related to the history of gold mining. You may find relevant information at a local museum too. Visit the Chamber of Mines website: http://www.chamberofmines.org.za/sa–mining/gold See same site for bursary applications and information on the mining of other metals and minerals. See also http://www.mintek.co.za/corporate–profile/hr–training–bee–and–academic–support/bursaries/ Encourage learners to enter the MinQuiz Competition run by Mintek. See previous questions at http://www.mintek.co.za/2016/04/19/minquiz–2016/
Mining and mineral processing • Discuss old mining methods and the impact on the environment of such methods, e.g. Mapungubwe • Give the major steps in the process of mining if you have chosen one of the other mining activities • Describe the environmental impact of: – Mining operations – Mineral recovery plants • Describe the consequences of the current large scale burning of fossil fuels; and why many scientists and climatologists are predicting global warming	Demonstrate the extraction of copper from copper carbonate using a Bunsen burner, a carbon block and a blow pipe. Look for local mining activities to give context to this topic. See http://www.thisisgold.co.za/facts–and–figures/resources for up to date facts and figures on gold mining. Also short videos on gold and the impact of gold on society. See case studies at: http://www.greenpeace.org/africa/en/campaigns/Climate–change/coal–testimonies/ Watch short video: https://vimeo.com/99675319

F. ASSESSMENT RESOURCES

1. Sample item analysis sheet

SUGGESTED ITEM ANALYSIS RECORD SHEET FOR FORMAL ASSESSMENT

PHYSICS WRITTEN EXAMINATION												
		Questions										
		1	2	3	4	5	6	7	8	9	10	Total
		Multiple choice	Force vectors	Motion and friction	Newton's laws	Universal gravitation	Refraction	Diffraction	Electrostatics	Electromagnetism	Electric circuits and electric energy	
Marks		20	20	10	18	12	21	6	15	12	16	150
Learner name	Learner surname											

SUGGESTED ITEM ANALYSIS RECORD SHEET FOR FORMAL ASSESSMENT

CHEMISTRY WRITTEN EXAMINATION											
		Questions									
		1	2	3	4	5	6	7	8	9	Total
		Multiple choice	Molecular shapes	Bond energy	Intermolecular forces	Mole concept	Chemical change	Acids – bases	Gas laws	Mining	
Marks		20	20	10	10	12	30	16	18	14	150
Learner name	Learner surname										

2. Physical Sciences Grade 11: End-of-Year Physics Examination

INSTRUCTIONS AND INFORMATION

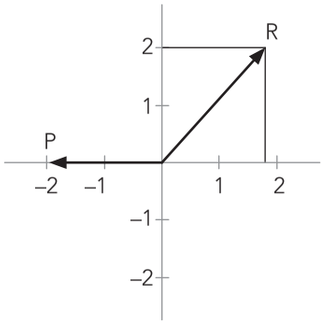
1. This question paper consists of 10 questions. Answer ALL the questions.
2. Write your full name and surname in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK.
3. Answer Question 1 and Question 9.1 on the attached ANSWER SHEET and the other questions in the ANSWER BOOK.
4. Data sheets are attached for your use.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Number your answers correctly according to the numbering system used in this question paper.
8. Wherever motivations, discussions, etc. are required, be brief.

Question 1

Multiple choice questions

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and make a cross (X) in the block (A–D) next to the question number (1.1–1.10) on the ATTACHED ANSWER SHEET.

1.1 The diagram below shows force P and R measured in newtons.



The resultant of vectors R and P is …

A 0 N

B 4 N to the right and 2 N down

C 2 N up

D 2 N down (2)

1.2 Frictional force …

A is opposite to the direction of motion of an object and acts perpendicular to the surface the object is in contact with.

B is in the same direction as the motion of an object and acts parallel to the surface the object is in contact with.

C is in the same direction as gravitational force.

D opposes the motion of an object and acts parallel to the surface the object is in contact with. (2)

1.3 Two forces of magnitudes 8 N and 6 N are added to each other.
Which of the following values cannot be a resultant of these two forces?

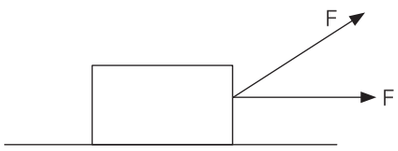
A 2 N

B 3 N

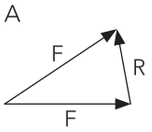
C 14 N

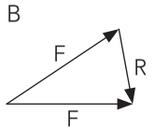
D 16 N (2)

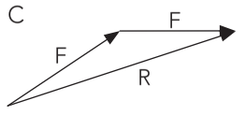
1.4 A crate is pulled along a smooth frictionless surface by two forces, each with a magnitude **F**, as shown in the diagram.

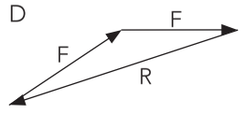


Which vector diagram correctly shows how the resultant force **R** on the crate can be determined?

A 

B 

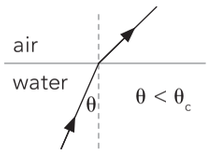
C 

D 

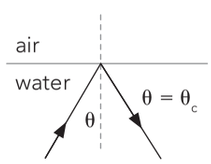
(2)

1.5 Which of the following diagrams represents TOTAL INTERNAL REFLECTION?
(θ_c is the critical angle)

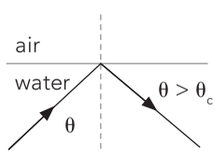
A



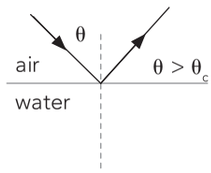
B



C



D



(2)

1.6 A ray of light passing from glass into ice is refracted away from the normal.
The refractive indices of the two substances compare as follows:

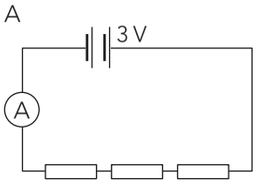
A glass > ice
B ice > glass
C glass = ice
D too little information to know (2)

1.7 The electric field experienced by a point charge is 800 $N.C^{-1}$ at a distance of 30 cm from the centre of the sphere. The charge carried by the sphere is …

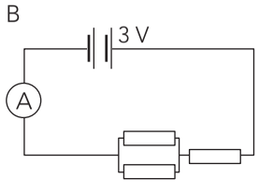
A 26,7 nC
B 375 nC
C 8 nC
D 4 nC (2)

1.8 A learner is provided with three identical resistors to insert in any manner in a circuit.
Which ONE of the following circuit diagrams will allow the largest current through the ammeter?

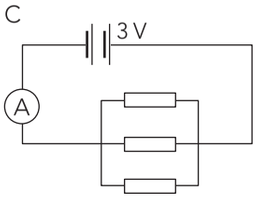
A



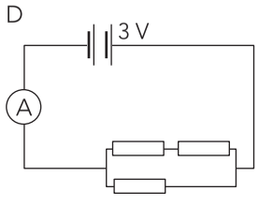
B



C



D



(2)

1.9 The magnitude of the electrostatic force between two identically charged spheres is given as F_0. If the charge on each sphere is doubled, while the distance between them is halved, the new electrostatic force between the spheres will be …

A $16\ F_0$
B $4\ F_0$
C F_0
D $0{,}5\ F_0$ (2)

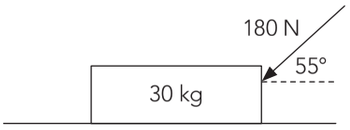
1.10 Which of the following words or phrases is equivalent to 'the work done per unit charge'?

A energy
B potential difference
C power
D current (2)

10 × (2) = **[20]**

Question 2

2.1 A force of 180 N is acting on a block at 55° to the horizontal as shown in the diagram. The block remains stationary.

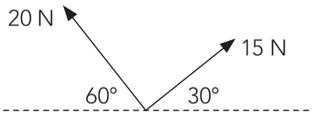


2.1.1 CONSTRUCT a vector diagram to determine the x- and y-components of the force. (Use a scale of 3 N : 1 mm) (7)

2.1.2 Use your answer from Question 2.1.1 to calculate the normal force. (3)

2.2 Define the term: 'resultant vector'. (2)

2.3 Two forces act on a point as indicated in the diagram below.



2.3.1 CALCULATE the magnitude of the resultant force. A vector diagram MUST accompany your calculations. (3)

2.3.2 CALCULATE the angle of the resultant force clockwise from the positive y-axis. (2)

2.4 What is meant by a CLOSED vector diagram and what conclusion can be made from such a diagram? (3)

[20]

Question 3

A sled travelling at 6 $m.s^{-1}$ enters a stretch of snow as indicated in the diagram. The coefficient of kinetic friction is 6×10^{-2}.

3.1 Draw a free-body diagram to show all forces that act on the sled. (NAME ALL FORCES) (3)

3.2 Calculate:

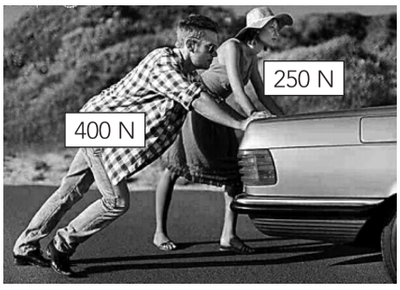
3.2.1 The magnitude of the acceleration of the sled. (4)

3.2.2 The distance travelled by the sled before stopping. (3)

[10]

Question 4

4.1 Douglie and Bulie are pushing a car with a mass of 2 000 kg on a rough horizontal surface which has a frictional force of 500 N. Douglie applies a horizontal force of 400 N to the right and Bulie applies a horizontal force of 250 N in the same direction.



Frictional force = 500 N

4.1.1 Draw a free-body diagram to show the **horizontal** forces acting on the car. (3)

4.1.2 Calculate the magnitude and direction of the acceleration of the car. (4)

4.1.3 If the road has a slight incline of 5°, calculate the component of the car's weight parallel to the incline. (2)

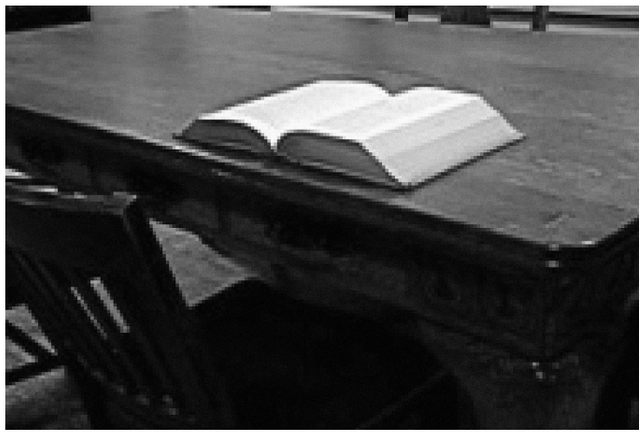
4.1.4 What will the motion of the car be on the incline, if Douglie and Bulie are applying the same force parallel to the incline as they were before? Only write STATIONARY, ACCELERATE UP the incline, ACCELERATE DOWN the incline, MOVE AT A CONSTANT VELOCITY UP the incline OR MOVE WITH A CONSTANT VELOCITY DOWN the incline. (1)

4.2 The 'Arrive Alive' campaign always warns passengers and drivers to wear seatbelts when getting into vehicles to ensure their safety during accidents.

4.2.1 What is inertia? (1)

4.2.2 Explain, using relevant laws of physics, how a seatbelt works when a vehicle suddenly slows down in an accident. (2)

4.3 A book is resting on a table as shown below.



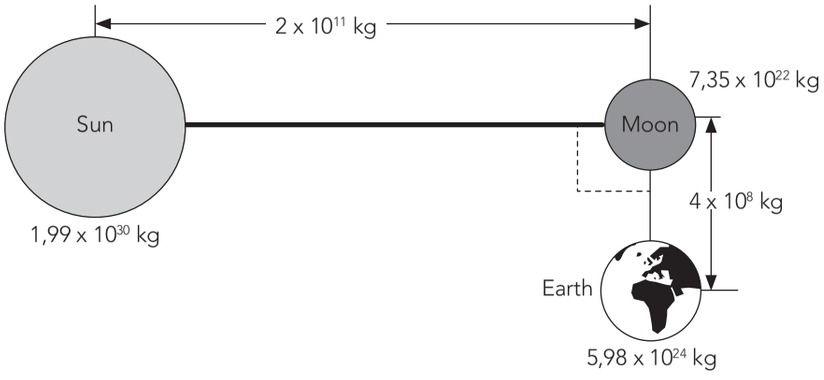
4.3.1 State Newton's third law of motion. (2)

4.3.2 Draw a diagram to show the action–reaction pairs that act ON THE DESK. Label each force clearly. (3)

[18]

Question 5

Consider the diagram below. The diagram is not drawn to scale.



Calculate the following:

5.1 The magnitude of the gravitational force between the **Earth and Sun** at the position indicated in the diagram. (5)

5.2 The acceleration due to gravity on the **Moon** if the radius of the Moon is 1,6 × 106 m. (4)

5.3 The weight of a 50 g object on **Earth.** (3)

[12]

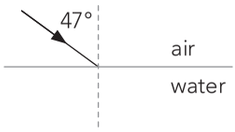
Question 6

A light ray strikes an air–water surface at an angle of 47° with respect to the normal.
Refractive index for air = 1,00 and refractive index for water = 1,33

6.1 Define the term refraction. (2)

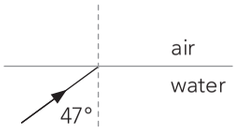
6.2 Calculate the angle of refraction when the direction of a light ray is as follows:

6.2.1 From air to water.



(4)

6.2.2 From water to air.



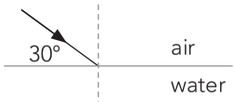
(3)

6.3 Calculate the speed of light in water. (3)

6.4 Show that the critical angle of water is 48,75°. (3)

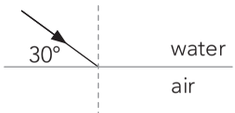
6.5 Complete and label the following diagrams fully. (Diagrams not drawn to scale):

6.5.1



(2)

6.5.2



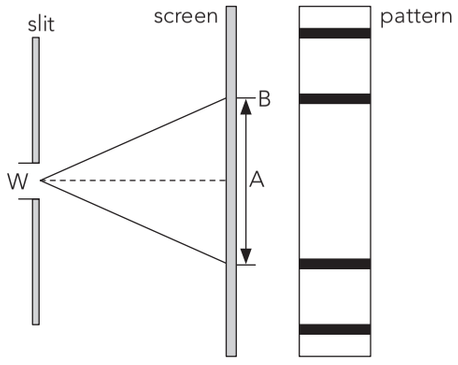
(2)

6.6 Give TWO advantages of using optic fibres in telecommunication. (2)

[21]

Question 7

Monochromatic light with a wavelength of 760 nm passes through a slit 8×10^{-8} m wide and a diffraction pattern is observed on a screen as shown in the diagram below.



7.1 Define the term 'diffraction'. (2)

7.2 Write down suitable labels for A and B. (2)

7.3 Which part of the pattern (A or B) is the result of constructive interference? (1)

7.4 How will the broadness of A differ if light with a wavelength of 900 nm is used?
Write down only BROADER, NARROWER, or REMAIN THE SAME. (1)

[6]

Question 8

A small carbon graphite-coated polystyrene bead A has been charged to –2 pC.

8.1 Calculate the magnitude of the electric field strength a distance of 3 cm from the centre of the polystyrene bead A. (3)

Another polystyrene bead B is placed 3 cm to the right of the centre of polystyrene bead A, and charged to –1 pC.

8.2 State Coulomb's Law. (2)

8.3 Calculate the force experienced by polystyrene bead A. (3)

8.4 Draw a diagram to represent the net/resultant magnetic field of the polystyrene beads A and B. (3)

An additional polystyrene bead C is placed between bead A and bead B and charged to +0,5 pC.

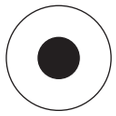
8.5 Calculate the distance from bead A at which the resultant force on the bead C is zero. (4)

[15]

Question 9

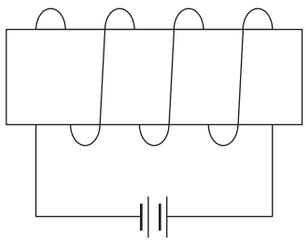
9.1 Copy the following diagrams in your answer book and show the shape and direction of the magnetic field due to the current in each case.

9.1.1 Top view of current-carrying conductor.



(3)

9.1.2 A solenoid.



(3)

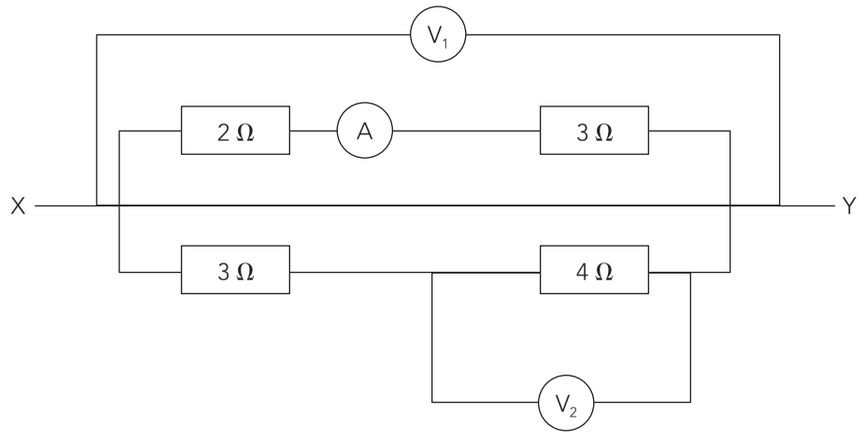
9.2 A solenoid with 450 turns has a cross-sectional area of 176 cm^2. It is positioned perpendicular to a uniform magnetic field of 0,72 T.

9.2.1 Calculate the flux through the solenoid. (3)

9.2.2 Calculate the induced *emf* across the solenoid when the solenoid is pulled out of the magnetic field in 0,22 s. (3)

[12]

Question 10



10.1 A number of meters and resistors are connected as shown in the diagram above.
A 3,0 V battery is connected to the terminals X and Y.
Assume the battery has no internal resistance.

10.1.1 Determine the reading on V_1. (1)

10.1.2 Calculate the reading on A. (3)

10.1.3 Calculate the reading on V_2. (5)

10.2 A washing machine is labelled: 220 V; 2600 W. The washing machine operates as rated.

10.2.1 Calculate the resistance of the washing machine's motor. (4)

10.2.2 Calculate the cost of using the washing machine for 90 minutes if electricity costs R1,14 per kWh. (3)

[16]

TIME: 3 HOURS

TOTAL: 150 MARKS

END OF PAPER

Physical Sciences Grade 11: End-of-Year Physics Examination

ANSWER SHEET

NAME: _____

Question 1

Multiple choice questions

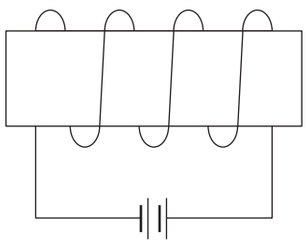
1.1	A	B	C	D	
1.2	A	B	C	D	
1.3	A	B	C	D	
1.4	A	B	C	D	
1.5	A	B	C	D	
1.6	A	B	C	D	
1.7	A	B	C	D	
1.8	A	B	C	D	
1.9	A	B	C	D	
1.10	A	B	C	D	
				TOTAL	

Question 9

9.1.1 Top view of current-carrying conductor

(3)

9.1.2 A solenoid



(3)

DATA SHEET

GRADE 11 TERM 4

Table 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Coulomb's constant	k	$9{,}0 \times 10^9$ N.m^2.C^{-2}
Acceleration due to gravity on earth	g	9,8 m.s^{-2}

Table 2: FORMULAE

MOTION

$v_f = v_i + a\Delta t$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$
$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = v_i\Delta t + \frac{1}{2}a(\Delta t)^2$

FORCE

$F_{net} = ma$	$w = F_g = mg$	$F_f^{max} = \mu F_N$

ELECTROSTATICS

$F = \frac{kQ_1Q_2}{r^2}$ ($k = 9{,}0 \times 10^9$ N.m^2.C^{-2})	$E = \frac{F}{q}$
$E = \frac{k.Q}{r^2}$ ($k = 9{,}0 \times 10^9$ N.m^2.C^{-2})	$E = \frac{V}{d}$

ELECTROMAGNETISM

$\varepsilon = -\frac{N.\Delta\Phi}{\Delta t}$	$\Phi = B.A.\cos\theta$

CURRENT ELECTRICITY

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$	$R_T = r_1 + r_2 + r_3 \ldots$
$W = Vq$	$P = \frac{W}{\Delta t}$
$W = VI\Delta t$	$W = VI\Delta t$
$W = I^2R\Delta t$	$W = I^2R\Delta t$
$W = \frac{V^2\Delta t}{R}$	$W = \frac{V^2\Delta t}{R}$

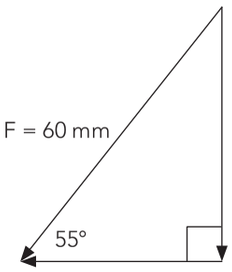
3. Physical Sciences Grade 11: End-of-Year Physics Examination Memorandum

Question 1

1.1	C ✓✓	1.2	D ✓✓	1.3	D ✓✓	1.4	C ✓✓	1.5	C ✓✓	
1.6	A ✓✓	1.7	C ✓✓	1.8	C ✓✓	1.9	A ✓✓	1.10	B ✓✓	10 × (2) = **[20]**

Question 2

2.1 2.1.1



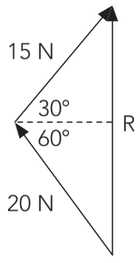
F = 60 mm ✓
Angle = 55° ✓
X = 34 mm ✓ (accept 33–35 mm)
Horizontal force = 102 N ✓(accept 99–105 N) left
Y = 49 mm ✓ (accept 48–50mm)
Vertical Force =147 N ✓ (accept 144–150 N) down ✓ (7)

Alternative if a calculation was done instead of a construction (Max 4 marks):
Right-angled triangle with information shown ✓
All 3 arrows correct ✓
Horizontal force: FX = 180 cos 55° = 103,24 N ✓
Vertical force: FY = 180 sin 55° = 147,45 N ✓

2.1.2 $w = mg$ = 30(9,8) ✓ = 294 N ✓
normal force = 294 + 147 = 441 N ✓ (3)

2.2 A single vector P with the same effect as a number of vectors acting together on an object. ✓ (2)

2.3 2.3.1 $R^2 = (20^2 + 15^2)$
R = 25 N ✓✓



✓ for correct vector diagram (3)

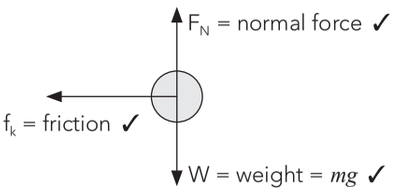
2.3.2 tan A = $\frac{15}{20}$
A = 36,87° ✓
Hence angle is 6,87° ✓ (clockwise from the positive y-axis) (2)

2.4 When three or more vectors drawn head to tail ✓ form a closed figure, ✓ their resultant is zero or they are in equilibrium/balanced. ✓ (3)

[20]

Question 3

3.1



(3)

3.2 3.2.1 The kinetic frictional force is the only force acting on the sled in the x direction and opposes the motion of the sled so the net force is given by:
$F_{net} = ma$ ✓ OR $\mu_k mg$ ✓ $= ma$
$\mu_k g = a$
6×10^{-2} ✓ × 9,8 ✓ = a (substitution)
a = 0,588 m.s^{-2} ✓ (4)

3.2.2 $vf^2 = vi^2 + 2a\Delta x$ ✓

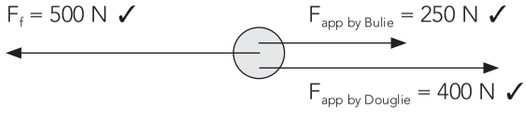
$0^2 = 6^2 + 2\,(-0{,}588)\Delta x$ ✓ (the sled decelerates)

$\Delta x = 30{,}61$ m ✓ (3)

[10]

Question 4

4.1 4.1.1 $F_f = 500$ N ✓ $F_{app\ by\ Bulie} = 250$ N ✓



$F_{app\ by\ Douglie} = 400$ N ✓ (3)

4.1.2 $F_{net} = ma = 400 + 250 + (-500)$ ✓ $= 2\,000\,a$ ✓

$150 = 2\,000 \times a$

$a = 0{,}075$ m.s^{-2} ✓ to the right ✓ (4)

4.1.3 $F_g// = F_g \sin\theta = mg \sin\theta$ ✓

$= 2\,000\,(9{,}8) \sin 5° = 1\,708{,}25$ N ✓ (2)

4.1.4 ACCELERATE DOWN the incline ✓ (1)

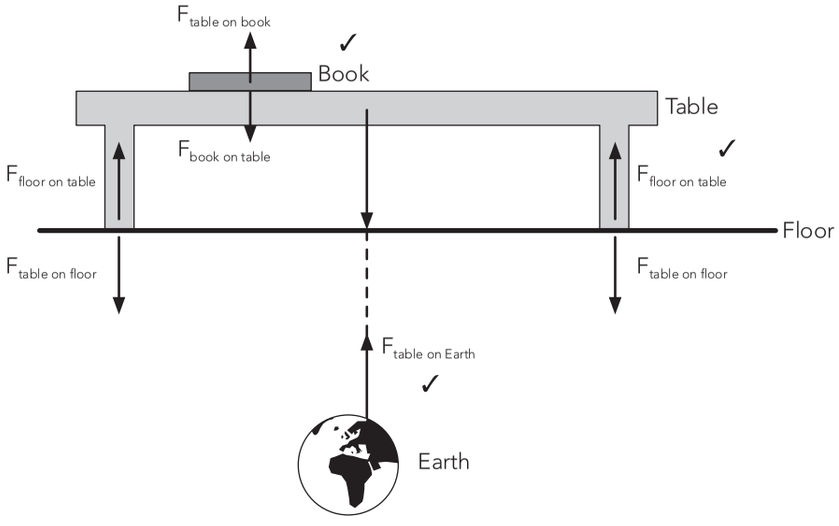
4.2 4.2.1 Inertia is the tendency of an object to resist change. ✓ (1)

4.2.2 A person will keep on moving forward in a straight line at constant velocity unless acted on by a resultant force. ✓ The seatbelt acts as a net force ✓ which hold you safely in the seat. (2)

4.3. 4.3.1 Newton's third law of motion states that when object A exerts a force on object B, object B simultaneously exerts an oppositely directed force of equal magnitude on object B. ✓✓ (2)

4.3.2 Three pairs of forces:

Upwards		Downwards
Force of table on Earth	–	Force of Earth on table
Force of floor on table	–	Force of table on floor
Force of table on book	–	Force of book on table



Note: All pairs must be of equal length but opposite in direction. Forces do not need to touch. (3)

[18]

Question 5

5.1 $F_{sun\ on\ earth} = \frac{G.M_{sun}.M_{moon}}{d^2}$ ✓

$= \frac{6{,}67 \times 10^{-11}.(1{,}99 \times 10^{30}).(5{,}98 \times 10^{24})}{(2 \times 10^{11})^2 \checkmark + (4 \times 10^{8})^2}$ ✓

$= 1{,}98 \times 10^{22}$ N ✓ (5)

5.2 $g_{moon} = \frac{M_{moon}}{d^2}$ ✓

$= \frac{6{,}67 \times 10^{-11}.(7{,}5 \times 10^{2})}{(1{,}6 \times 10^{6})^2}$ ✓

$= 1{,}92$ m.s^{-2} ✓ (4)

5.3 $W = mg$ ✓ $= 50 \times 10^{-3} \times 9{,}8$ ✓ $= 0{,}49$ N ✓ (3)

[12]

Question 6

6.1 Refraction is the change in speed ✓ when a wave moves from one medium to a different medium. ✓ (2)

6.2 6.2.1 $n_1 \sin \theta_1 = n_2 \sin \theta_2$ ✓

$1{,}00 \times \sin 47° ✓ = 1{,}33 \sin \theta^2$ ✓

$\sin \theta^2 = 0{,}55$

$\theta^2 = 33{,}36°$ ✓ (4)

6.2.2 $n_1 \sin \theta_1 = n_2 \sin \theta_2$

$1{,}33 \sin 47° ✓ = 1{,}00 \sin \theta^2$ ✓

$\theta^2 = 76{,}58°$ ✓ (3)

6.3 $n = \frac{c}{v}$ ✓

$1{,}33 = \frac{3 \times 10^8}{v}$ ✓

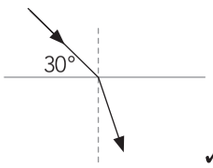
$v = 2{,}26 \times 10^8 \text{ m.s}^{-1}$ ✓ (3)

6.4 $n_1 \sin \theta_1 = n_2 \sin \theta_2$

$1{,}33 \sin \theta_1 ✓ = 1{,}00 \sin 90°$ ✓

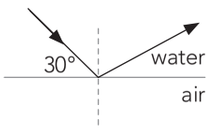
$\theta_1 = 48{,}75°$ ✓ (3)

6.5 6.5.1



✓✓ (2)

6.5.2



✓✓ (2)

6.6 Fibre optics allows for faster transmission of data than through copper cables ✓

Optic fibres allow for streaming of video/video conferencing ✓

Optic fibres are not affected by lightning ✓

Optic fibres are usually not stolen as often as copper cables ✓

(Any two) (2)

[21]

Question 7

7.1 Diffraction – The bending ✓ of a wavefront around the edges ✓ of an obstacle. (2)

7.2 A – Central bright broad band ✓

B – dark band ✓ (2)

7.3 A ✓ (1)

7.4 Broader ✓ (1)

[6]

Question 8

8.1 $E_A = \frac{kQ}{r^2}$ ✓

$= \frac{(9 \times 10^9)(-2 \times 10^{-12})}{(0{,}03)^2}$

$= \text{NC}^{-1}$ ✓ (3)

8.2 **Coulomb's law**: The force between two charges is directly proportional to the product of the charges ✓ and inversely proportional to the distance between the charges squared. ✓ (2)

8.3 $F = \frac{kq_1q_2}{r^2}$ ✓

$= \frac{(9 \times 10^9)(-2 \times 10^{-12})(-1 \times 10^{-12})}{(0{,}03)^2}$ ✓

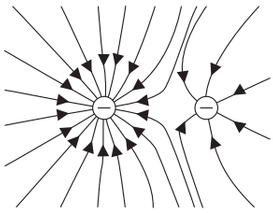
$= 2 \times 10^{-11} \text{ N}$ ✓

OR $F = E.q$ ✓

$= (20)(-1 \times 10^{-12})$ ✓

$= 2 \times 10^{-11} \text{ N}$ ✓ (3)

8.4



Shape ✓
Direction ✓
Greater density of lines around bead A ✓

(3)

8.5 let x = distance from bead A

$\frac{kq_Aq_C}{x^2} = \frac{kq_Bq_C}{(0,03-x)^2}$ ✓✓

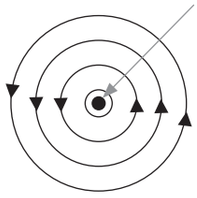
$\frac{(-2 \times 10^{12})}{x^2} = \frac{(-1 \times 10^{12})}{(0,03-x)^2}$ ✓ [square root both sides]

x = 0,0175 m ✓ (4)

[15]

Question 9

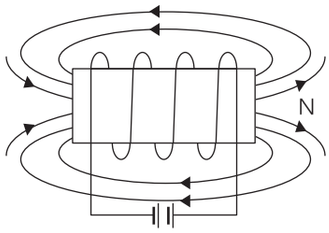
9.1 9.1.1



Current direction: Out of the page ✓
Circular magnetic field ✓
Direction of the field is anti-clockwise ✓

(3)

9.1.2



Shape of magnetic field – like a bar magnet ✓
North pole on the right – closest to the positive terminal ✓
Direction of magnetic field from North to South ✓

(3)

9.2 9.2.1 Φ = BA cos θ ✓

= 0,72(0,0176) cos 0° ✓

= 0,013 Wb ✓ (0,012672 Wb) (3)

9.2.2 $\varepsilon = -\frac{N.\Delta\Phi}{\Delta t}$ ✓

$= \frac{-450(1-0,013)}{0,22}$ ✓

= 26,59 V ✓ (3)

[12]

Question 10

10.1 10.1.1 3 V ✓ (1)

10.1.2 $I = \frac{V}{R}$ ✓ $= \frac{3}{5}$ ✓ = 0,6 A ✓ (3)

10.1.3 $I = \frac{V}{R}$ ✓ $= \frac{3}{7}$ ✓ = 0,43 A ✓

$V_2 = I.R$ ✓ = 0,43 × 4 = 1,72 V ✓ (5)

10.2 10.2.1 $P = \frac{V^2}{R}$ ✓

2 600 ✓ $= \frac{220^2}{R}$ ✓

R = 18,62 Ω ✓ (4)

10.2.2 Cost = (2,6 × 1,5) ✓ × 1,14 ✓ = R4,45 ✓ (3)

[16]

TOTAL: 150 MARKS

4. Cognitive Analysis for Physical Sciences Grade 11: End-of-Year Physics Examination

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Mechanics	Waves, sound and light	Electricity and magnetism	
Marks	**22**	**53**	**60**	**15**	**68**	**32**	**50**	**150**
Actual	20	54	61	15	68	33	49	150
Question 1								**20**
1.1			2		2			2
1.2		2			2			2
1.3				2	2			2
1.4		2			2			2
1.5	2					2		2
1.6		2				2		2
1.7			2				2	2
1.8		2					2	2
1.9			2				2	2
1.10	2						2	2
Question 2								**20**
2.1.1		4	3		7			7
2.1.2			3		3			3
2.2	2				2			2
2.3.1		3			3			3
2.3.2			2		2			2
2.4	2		1		3			3
Question 3								**10**
3.1	1	2			3			3
3.2.1			4		4			4
3.2.2			3		3			3
Question 4								**18**
4.1.1	3				3			3
4.1.2		4			4			4
4.1.3		2			2			2
4.1.4		1			1			1
4.2.1		1			1			1
4.2.2		2			2			2
4.3.1		2			2			2
4.3.2		3			3			3

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Mechanics	Waves, sound and light	Electricity and magnetism	
Question 5								**12**
5.1		3	2		5			5
5.2		2	2		4			4
5.3			3		3			3
Question 6								**21**
6.1	2					2		2
6.2.1			4			4		4
6.2.2			3			3		3
6.3				3		3		3
6.4		3				3		3
6.5.1			2			2		2
6.5.2		2				2		2
6.6	2					2		2
Question 7								**6**
7.1	2					2		2
7.2		2				2		2
7.3			1			1		1
7.4				1		1		1

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Mechanics	Waves, sound and light	Electricity and magnetism	
Question 8								**15**
8.1			3				3	3
8.2	2						2	2
8.3			3				3	3
8.4		3					3	3
8.5				4			4	4
Question 9								**12**
9.1.1		3					3	3
9.1.2		3					3	3
9.2.1			3				3	3
9.2.2			3				3	3
Question 10								**16**
10.1.1		1					1	1
10.1.2			3				3	3
10.1.3				5			5	5
10.2.1			4				4	4
10.2.2			3				3	3

5. Physical Sciences Grade 11: End-of-Year Chemistry Examination

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 8 questions. Answer ALL the questions.
2. Write your full name and surname in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK.
3. Answer Question 1 on the attached ANSWER SHEET and the other questions in the ANSWER BOOK.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. For calculations, unless otherwise stated, give your final answer correct to two decimal places.
7. Data sheets are attached for your use.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

Question 1

Multiple choice questions

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and make a cross (X) in the block (A–D) next to the question number (1.1–1.10) on the ATTACHED ANSWER SHEET.

1.1 Which of the following compounds is composed of polar molecules?

A $NaCl$

B CCl_4

C NH_3

D Cl_2 (2)

1.2 On your Periodic Table no electronegativity values are given for the noble gases. The reason for this is:

A They are gases at room temperature.

B They do not bond with other atoms in general.

C They do not form polar molecules.

D They are noble gases which means that they do not need numbers. (2)

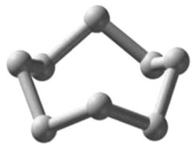
1.3 Water can undergo autoprotolysis to form hydronium ions (H_3O^+) and hydroxide ions (OH^-). The respective shapes of these compounds are as follows:

	H_2O	H_3O^+	OH^-
A	angular	pyramidal	linear
B	angular	angular	angular
C	angular	trigonal planar	linear
D	pyramidal	tetrahedral	angular

(2)

1.4 Sulfur is found in nature as small yellow crystals. The crystals are formed by packing molecules of sulfur together. Sulfur molecules have the formula S_8. The structure showing the bonding in a sulfur molecule is shown.

Structure of sulfur



The type of solid to which the crystal lattice of sulfur belongs is:

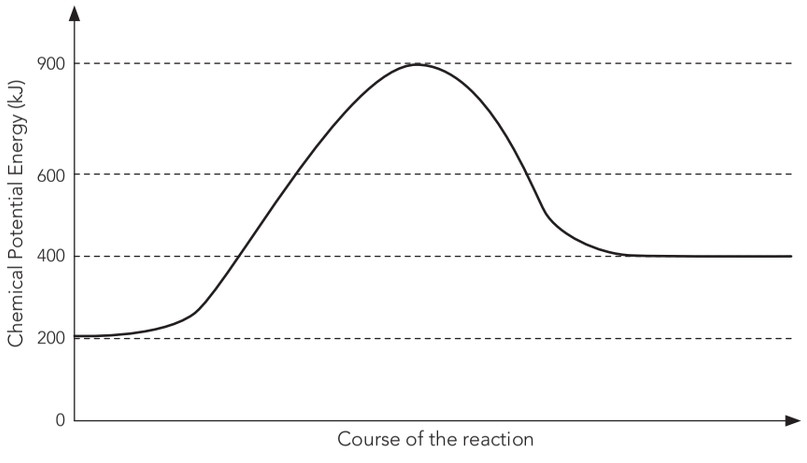
A network atomic

B ionic

C metallic

D molecular (2)

1.5 The graph below shows the change of potential energy during the course of a chemical reaction:



The values for the activation energy (EA) and the heat of the reaction (ΔH) are:

	E_A (kJ)	ΔH (kJ)
A	900	400
B	700	+200
C	700	–200
D	500	400

(2)

1.6 Which of the following represents the same number of oxygen atoms as there are in 8 g of oxygen gas?

A $6{,}02 \times 10^{23}$ atoms of carbon

B 0,5 mol of copper atoms

C $1{,}51 \times 10^{22}$ gold atoms

D 0,25 mol of helium atoms (2)

1.7 Hydrogen is a fuel which can explode when ignited together with oxygen.
The following balanced equation represents this reaction.

$2\,H_2\,(g) + O_2\,(g) \rightarrow 2\,H_2O\,(g)$; $\Delta H < 0$

In the experiment above, an intrepid scientist ignited 2 dm^3 of hydrogen gas with excess oxygen in a balloon. The reaction was carried out at room temperature. Which of the following statements regarding this experiment is correct?

A 1,4 g of oxygen was used and 1,6 g of water formed as product.

B 1 dm^3 of oxygen was used and 2 dm^3 of water formed as a product.

C 0,089 moles of hydrogen reacted.

D 1 dm3 of oxygen was used and 3 dm^3 of water was formed. (2)

1.8 Which of the following solutions can be considered to be a strong acid?

A A 0,01 $mol.dm^{-3}$ HCℓ solution

B A 1 $mol.dm^{-3}$ CH_3COOH (acetic acid) solution

C A 0,01 $mol.dm^{-3}$ NH_3 solution

D A 1 $mol.dm^{-3}$ NaOH solution (2)

1.9 What is the oxidation number of iron in the following compound: Fe_2O_3?

A –2 B +2 C +3 D +6 (2)

1.10 In an electrolytic cell water decomposes to form hydrogen and oxygen at the cathode and anode respectively.

The equation for the reaction is:

$2\,H_2O\,(g) \rightarrow 2\,H_2\,(g) + O_2\,(g)$

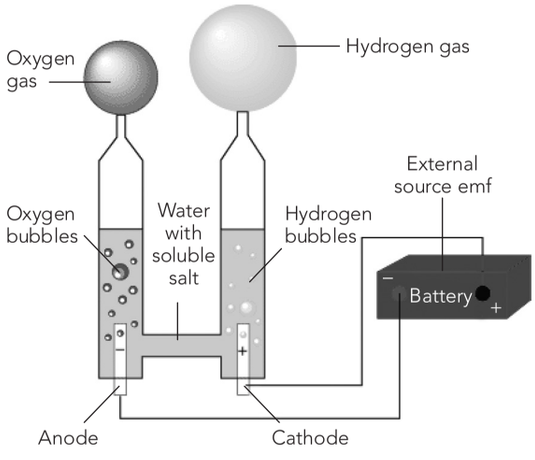
Which one of the following statements is true?

A Oxygen gas is reduced and gains electrons.

B Hydrogen gas is reduced and gains electrons.

C Water undergoes oxidation at the anode.

D This is not an example of a redox reaction.



(2)

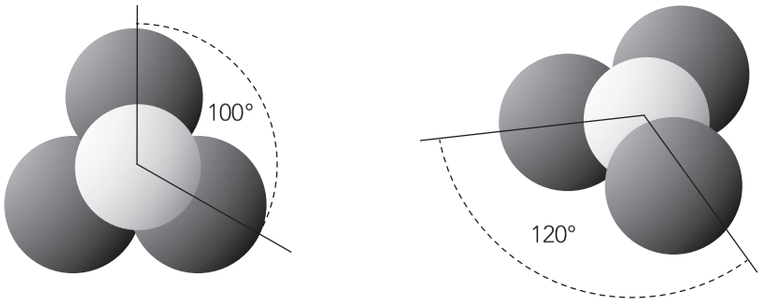
10 × (2) = **[20]**

Question 2

Phosphorus trichloride is a colourless liquid that is used in many applications including insecticides, herbicides and flame retarders.

Boron trichloride is a colourless gas that is used in the purification and refining of metals such as aluminium and copper.

The diagram below shows the bond angles of the two compounds.



Phosphorus trichloride	Boron trichloride
Bond angle: 100°	Bond angle: 120°
	Shape: Trigonal planar

2.1 Using a Lewis structure show how the atoms of chlorine and phosphorus are bonded in a molecule of $PC\ell_3$. (4)

2.2 Use the terms IONIC; COVALENT; NON-POLAR and/or POLAR to compare $PC\ell_3$ and $BC\ell_3$ with regard to:

2.2.1 The nature of the bonds between the atoms. (Hint: Use the electronegativity number difference to help you) (4)

2.2.2 The polarity of the molecule. (2)

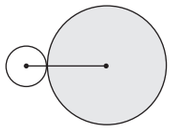
2.3 Use your knowledge of the valence-shell electron-pair repulsion theory (VSEPR) to explain the difference in the bond angles of $PC\ell_3$ and $BC\ell_3$. (8)

2.4 Name the shape of the $PC\ell_3$ molecule. (2)

[20]

Question 3

In molecular geometry, bond length or bond distance is the average distance between nuclei of two bonded atoms in a molecule.



Refer to the table below that shows the bond lengths and bond energies for different bonds.

Bond	Bond length (pm)	Bond energy (kJ/mol)
C – C	154	347
C – N	147	305
N – N	145	163
N = N	123	418
C = N	128	615
C = C	134	611
C ≡ C	120	837
N ≡ N	110	946
C ≡ N	116	891

3.1 What is meant by the term 'bond energy'? (2)

3.2 Give a reason for the different bond lengths for bonds formed between carbon atoms. (2)

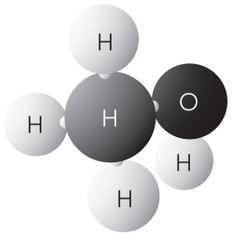
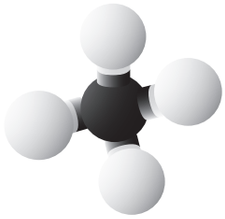
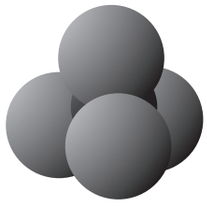
3.3 Rearrange the data in the table in ascending or descending order of bond length for each the different types of bond, i.e carbon to carbon, carbon to nitrogen, and nitrogen to nitrogen. **Complete this question in the table on the ANSWER SHEET.** (3)

3.4 A learner states that the bond energy is directly proportional to the bond length. How can you deduce from the data whether this statement is true or not? (3)

[10]

Question 4

Consider the following three compounds:

			
Substance	*Methanol*	*Methane*	*Tetrachloromethane*
Formula	CH_3OH	CH_4	CCl_4
Phase at room temperature	liquid	gas	liquid
Molar mass	32,04 g.mol^{-1}	16,04 g.mol^{-1}	153,82 g.mol^{-1}
Boiling point	64,07 °C	–164 °C	76,72 °C

4.1 Identify the intermolecular forces found in methane gas. (1)

4.2 Explain how these forces are formed. (2)

4.3 By identifying and comparing the intermolecular forces, provide a detailed explanation for:

4.3.1 The difference in boiling points of methane and tetrachloromethane. (3)

4.3.2 The fact that methanol is miscible (dissolves) in water, but tetrachloromethane is not. (4)

[10]

Question 5

Ammonium nitrate (NH_4NO_3) is a compound used extensively in the production of fertilisers.
If you have 240 g of pure ammonium nitrate, calculate:

5.1 The number of moles of ammonium nitrate present. (4)

5.2 The number of moles of nitrogen atoms present. (3)

5.3 The number of moles of nitrogen gas that were used to produce the 240 g of ammonium nitrate. Assume that all nitrogen used as a reactant forms the product. You do not need to refer to a balanced chemical equation. (2)

5.4 The volume of nitrogen gas used for the production of the 240 g of ammonium nitrate at STP, assuming that all of the nitrogen gas reacted to completion. (3)

[12]

Question 6

The Contact Process is the industrial process for the production of **sulfuric acid** (H_2SO_4).
It consists of the three steps shown below.

Step 1: The combustion of sulfur:

$S\ (s) + O_2\ (g) \rightarrow SO_2\ (g)$

Step 2: The reaction of sulfur dioxide with oxygen in the presence of a catalyst:

$2\ SO_2\ (g) + O_2\ (g) \xrightarrow{\text{catalyst}} 2\ SO_3\ (g)$

Step 3: The addition of water to SO_3:

$SO_3\ (g) + H_2O\ (\ell) \rightarrow H_2SO_4\ (\ell)$

6.1 2 000 g of sulfur is burnt in excess oxygen.

6.1.1 Calculate the mass of sulfur dioxide that will be produced from this quantity of sulfur. (4)

6.1.2 Predict what volume of sulfur dioxide will be produced at STP. (3)

6.1.3 In reality, Step 2 is run at 450°C. If 2 000 dm^3 of sulfur dioxide reacts with 2 000 dm^3 of oxygen, determine the volume of sulfur trioxide that should form at this temperature. (2)

6.1.4 An industrial chemist finds that the mass of sulfuric acid that is produced at the end of the process is less than predicted. He suspects industrial sabotage. To test the quality of the sulfur powder that is being used, he sets up a simulation of the entire process in his laboratory using 100% pure oxygen gas at STP. Assume that all of the reactions run to completion. He uses 48 g of sulfur, which is burnt in an excess of pure oxygen gas. At the end of the third step, he isolates and determines the mass of sulfuric acid produced and finds it to be 115 g. Determine the percentage purity of the sulfur that was used. (6)

6.2 Sulfur dioxide is one of the few gases that is both acidic and a reducing gas.

6.2.1 Define what is meant by a reduction reaction. (2)

6.2.2 Consider Step 2 in the Contact Process. Use oxidation numbers (show values) to identify the oxidising and reducing agents. (4)

6.2.3 Explain why sulfur dioxide is called a reducing gas. (2)

6.3 Sulfur dioxide gas reacts with hydrogen sulfide gas (H_2S) in the presence of water to form sulfur and water as shown in the following chemical equation:

$$SO^2 + 2\ H_2S \rightarrow 3\ S + 2\ H_20$$

Use oxidation numbers to write down:

6.3.1 The oxidation half-reaction. (3)

6.3.2 The reduction half-reaction. (3)

6.3.3 The chemical formula of the oxidising agent. (1)

[30]

Question 7

When SO^7 dissolves in water it produces sulfurous acid (H_2SO_3):

$$SO_2\ (g) + H_2O\ (\ell) \rightarrow H_2SO_3\ (aq)$$

Sulfurous acid then ionises in water according to the following two equations:

$$H_2SO_3\ (aq) + H_2O\ (\ell) \rightarrow H_SO_3^-\ (aq) + H_3O^+\ (\ell)\ \ldots\ldots\ldots\ (A)$$

$$HSO_3^-\ (aq) + H_2O\ (\ell) \rightarrow SO_3^{2-}\ (aq) + H_3O+\ (\ell)\ \ldots\ldots\ldots\ (B)$$

7.1 Give the Lowrey–Bronsted definition of an acid. (2)

7.2 Study equation A. Is this an acid–base reaction or a redox reaction? (2)

7.3 Explain your answer to Question 7.2. (2)

7.4 Identify the acid and its conjugate base in equation B. (4)

7.5 Write down the chemical formula of an amphoteric substance formed when sulfur dioxide dissolves in water. (2)

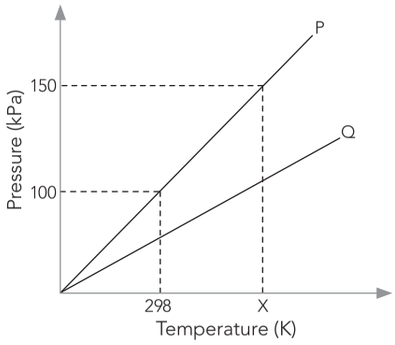
7.6 Explain your answer to Question 7.5. (4)

[16]

Question 8

8.1 Explain what is meant by the term *temperature of a gas*. (1)

8.2 Two learners investigate the relationship between the temperature and the pressure of an enclosed gas. The learners use different samples of the same gas in two identical containers of fixed volumes. Graph P and Graph Q below represent the results obtained by the learners.



8.2.1 State Guy Lussac's law in words. (2)

8.2.2 Use the law in Question 8.2.1 to determine the value of temperature **X**, shown on the graph, in °C. (4)

8.2.3 Explain, using the relevant formulae, why graph **Q** has a smaller gradient than graph **P**. (4)

8.3 A certain gas with a mass of 2,2 g occupies a volume of 0,831 dm^3 at 27 °C and pressure 150 kPa.

8.3.1 Calculate the molar mass of the gas. Assume that the gas behaves like an ideal gas. (6)

8.3.2 Write down the MOLECULAR FORMULA or NAME of the gas in Question 8.3.1. (1)

[18]

Question 9

Mining has been the main driving force behind the history and development of South Africa. Diamond and gold production may now be well down from their peaks, though South Africa is still number 5 in gold. It is the world's largest producer of chrome, manganese, platinum and vanadium, as well as the world's third largest coal exporter. In 2012, South Africa overtook India to become the world's third biggest iron ore supplier to China, the world's largest consumer of iron ore.

9.1 Choose from the list below the mining activity that you have studied and then answer the questions that follow.

gold; iron; phosphate; coal; diamonds; copper; platinum; zinc; chromium; asbestos; manganese

9.1.1 What is the location of the major mining activity in South Africa that you studied? (2)

9.1.2 What type of mining is used to recover the selected mineral? (2)

9.2 Mining has advantages and disadvantages.

9.2.1 Give TWO reasons why the mining industry is so important to the South African economy. (2)

9.2.2 Write down TWO negative impacts that mining has on the environment. (4)

9.3 A large deposit of a precious metal is discovered in South Africa.
Write down TWO factors that have to be considered before developing the site for mining. (4)

[14]

TIME: 3 HOURS

TOTAL: 150 MARKS

END OF PAPER

Physical Sciences Grade 11: End-of-Year Chemistry Examination

ANSWER SHEET

NAME: _____

Question 1

Multiple choice questions

1.1	A	B	C	D	
1.2	A	B	C	D	
1.3	A	B	C	D	
1.4	A	B	C	D	
1.5	A	B	C	D	
1.6	A	B	C	D	
1.7	A	B	C	D	
1.8	A	B	C	D	
1.9	A	B	C	D	
1.10	A	B	C	D	
				TOTAL	

Question 3.3

Bond	Bond length (pm)	Bond energy (kJ/mol)

DATA SHEET

GRADE 11 TERM 4

Table 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Standard pressure	p^{θ}	$1{,}01 \times 10^5$ Pa
Molar gas volume at STP	V^m	22,4 $dm^3.mol^{-1}$
Standard temperature	T^{θ}	273 K
Avogadro's constant	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

Table 2: FORMULAE

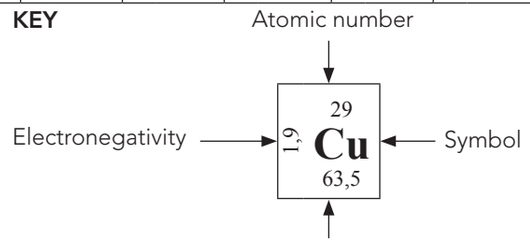
$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$	
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$	$n = \frac{N}{N_m}$
$c = \frac{n}{V}$	$c = \frac{m}{MV}$	

Table 3: PERIODIC TABLE OF THE ELEMENTS

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 **H** 1																	2 **He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	10 **Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	18 **Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	36 **Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	54 **Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	86 **Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

58 **Ce** 140	59 **Pr** 141	60 **Nd** 144	61 **Pm**	62 **Sm** 150	63 **Eu** 152	64 **Gd** 157	65 **Tb** 159	66 **Dy** 163	67 **Ho** 165	68 **Er** 167	69 **Tm** 169	70 **Yb** 173	71 **Lu** 175
90 **Th** 232	91 **Pa**	92 **U** 238	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**

KEY



6. Physical Sciences Grade 11: End-of-Year Chemistry Examination Memorandum

Question 1

1.1 C ✓✓ 1.2 B ✓✓ 1.3 A ✓✓ 1.4 D ✓✓ 1.5 B ✓✓

1.6 B ✓✓ 1.7 B ✓✓ 1.8 A ✓✓ 1.9 C ✓✓ 1.10 C ✓✓ 10 × (2) = **[20]**

Question 2

2.1 

✓ lone pair on P
✓✓ 3 bonding pairs
✓ correct valence electrons on Cℓ (4)

2.2 2.2.1 PCl_3: ENND = EN (Cl) – EN (P) = 3,0 – 2,1 = 0,9 ✓
Polar covalent bonds ✓
BCl_3: bonds ENND = EN (Cl) – EN (B) = 3,0 – 2,0 = 1,0 ✓
Polar covalent bonds ✓ (4)

2.2.2 PCl_3: polar molecule/dipole ✓ BCl_3: non–polar ✓ (2)

2.3 In PCl_3 there are 4 electron regions ✓ with one lone pair ✓
The repulsion ✓ between the lone pair and the bonding pairs is greater than between the bonding pairs ✓ causing the bonding pairs to move closer together. ✓
In BCl_3 the molecule is symmetrical ✓ with 3 electron regions ✓
The repulsion is equal ✓ and the bond angles are equal. ✓ (8)

2.4 pyramidal ✓✓ (2)

[20]

Question 3

3.1 It is the energy released when new bonds are formed or the energy required to break the bonds between two atoms. ✓✓ (2)

3.2 Carbon has the ability to form multiple bonds ✓
Multiple bonds have a shorter bond length. ✓ (2)

3.3

Bond	Bond length (pm)	Bond energy (kJ/mol)
C – C	154	347
C = C	134	611
C ≡ C	120	837
C – N	147	305
C = N	128	615
C ≡ N	116	891
N – N	145	163
N = N	123	418
N ≡ N	110	946

✓✓✓ data must be arranged in ascending or descending order of bond length; like with like (3)

3.4 The ratio between the bond length and bond energy for each bond type should be constant ✓✓ which it is not. They are not directly proportional. ✓ (3)

[10]

Question 4

4.1 London's forces (induced dipole–induced dipole) ✓ (1)

4.2 Although the molecules are non-polar, collisions cause a temporary shift in the electrons resulting in temporary/momentary P dipoles forming in the molecules. A force of attraction will form between the negative pole of one molecules and the positive pole of another molecule. ✓ (2)

4.3 4.3.1 Both molecules have weak London's forces between the molecules. ✓
$CC\ell_4$ has a greater molecular mass and thus a greater electron density than methane. This causes the intermolecular forces to be stronger ✓ More energy is needed to break these forces when boiling. ✓ (3)

4.3.2 Both methanol and water have strong hydrogen bonds between the molecules. ✓
Since they are of the same strength, methanol can take the place of other water molecules and fit between them. ✓
$CC\ell_4$ has weak London's forces between its non-polar molecules. ✓ Water is a polar molecule and there are hydrogen bonds between the molecules. The intermolecular forces are not of the same strength or nature and thus the two liquids are immiscible. ✓ (4)

[10]

Question 5

5.1 $n(NH_4NO_3) = \frac{m}{M}$ ✓ $= \frac{240}{80}$ ✓✓ $= 3$ ✓ (4)

5.2 In one molecule of ammonium nitrate there are 2 atoms of nitrogen ✓
So in 3 mol × 2 atoms per molecule = 6 mol of nitrogen atoms ✓✓ (3)

5.3 6 moles of nitrogen atoms require 3 moles N_2 ✓✓ (2)

5.4 volume = $0 \times Vm = 3 \times 22,4$ ✓ = 67,2 ✓ dm^3 ✓ (3)

[12]

Question 6

6.1 6.1.1 $n(S) = \frac{m}{M} = \frac{2\,000}{32}$ ✓ = 62,5 mol ✓
$\therefore n(SO_2) = 62,5$
$m(SO_2)$ – 62,5 x 64 ✓ = 4 000 g (4)

6.1.2 volume (SO_2) = 62,5 x 22,4 ✓ = 1 400 dm^3 ✓ (3)

6.1.3 $n(SO_2)$: $n(SO_3)$ = 1:1
2 000 dm^3 SO_3 should form ✓✓ (2)

6.1.4 $n(S) = \frac{48}{32}$ ✓ = 1,5 ✓
$\therefore n(H_2SO_4) = 1,5$ ✓
$\therefore m(H_2SO_4) = 1,5 \times 98$ ✓ = 147 g ✓
$\therefore$ % purity = $\frac{\text{actual mass}}{\text{theoretial mass}}$ x 100 = $\frac{115}{147}$ ✓ x 100 = 78,23% ✓
OR actual $n(H_2SO_4) = \frac{115}{98}$ ✓✓ = 1,17 ✓
$\therefore$ % purity = $\frac{1,17}{1,5}$ ✓✓ x 100 = 78% ✓ (6)

6.2 6.2.1 The gain of electrons ✓ (2)

6.2.2 $2\ SO_2 + O_2 \rightarrow 2\ SO_3$
ON(S) = +4 ON(O) = 0 ✓ ON(S) = +6 ON(O) = –2 ✓
The ON of oxygen has decreased. It has been reduced and so is the oxidising agent. ✓
The oxidation number of sulphur has increased. It has been oxidised and is thus a reducing agent. ✓ (4)

6.2.3 In this reaction the sulphur of sulfur dioxide is the reducing agent ✓ because it donates electrons. ✓ (2)

6.3 6.3.1 $SO_2 + 2\ H_2S \rightarrow 3\ S + 2\ H_2O$
ON(S) = +4 ON(S) = –2 ON(S) = 0 ✓✓
$H_2S \rightarrow S + 2\ H^+ + 2e–$ (loss of 2 electrons hence oxidation) ✓
OR $2\ H_2S \rightarrow 2\ S + 4\ H^+ + 4e^-$ ✓ (3)

6.3.2 ON(S) in SO_2 from +4 to 0 (gain of 4 e^-) ✓✓
$SO_2 + 4e^- \rightarrow S$ ✓ (3)

6.3.3 SO_2 ✓ (1)

[30]

Question 7

7.1 An acid is a proton donor ✓✓ (2)

7.2 An acid–base reaction ✓✓ (2)

7.3 HSO_3^- (aq) + H_2O (ℓ) → SO_3^{2-} (aq) + H_3O^+ (ℓ) …….. (B)
There is change in oxidation number of any atom ✓✓
OR HSO_3^- (aq) loses a hydrogen ion to become SO_3^{2-} (aq) ✓✓ (2)

7.4 Acid: HSO_3^- (aq) ✓✓ Conjugate base: SO_3^{2-} (aq) ✓✓ (4)

7.5 HSO_3^- (aq) ✓ ✓ (2)

7.6 HSO_3^- (aq) can either lose a hydrogen ion to form HSO_3^{2-} when it acts as an acid ✓ (Reaction B ✓)
HSO_3^- (aq) can gain a hydrogen ion to form HSO_3 when it acts as a base ✓ (reverse reaction A ✓)
Hence it can be either an acid or a base and so is amphoteric. (4)

[16]

Question 8

8.1 Temperature of a gas is a measure of the average kinetic energy of the gas molecules. ✓ (1)

8.2 8.2.1 The pressure (of a fixed mass of gas) is directly proportional to the temperature ✓ at constant volume. ✓ (2)

8.2.2 $\frac{p_1}{T_1} = \frac{p_2}{T_2}$ ✓
$\frac{100}{298} = \frac{150}{T_2}$ ✓
T_2 = 447 K
= 174 °C ✓ (4)

8.2.3 Gradient = $\frac{p}{T}$ ✓
From $pV = nRT$ ✓
$\frac{p}{T} = \frac{nR}{V}$
For constant V, $\frac{p}{T} \propto n$ ✓
For graph Q: Smaller gradient implies smaller number of moles and thus smaller mass of gas. ✓ (4)

8.3 8.3.1 $pV = nRT$ ✓
(150 × 103) ✓ (0,831 × 10^{-3}) ✓ = ($\frac{2,2}{M}$) ✓ (8,31)(300) ✓
$\therefore M$ = 44 g·mol^{-1} ✓ (6)

8.3.2 CO_2 ✓ OR carbon dioxide ✓
OR C_3H_8 ✓ OR propane ✓ (1)

[18]

Question 9

9.1 9.1.1 Gold: Witwatersrand and Northern Free State ✓✓ (only need one correct location)
Iron: Northern Cape (Sishen) and Thabazimbi, Limpopo ✓✓
Phosphate: Phalaborwa; Mpumalanga ✓✓
Coal: Witbank; Waterberg; Highveld; Ermelo; Utrecht ✓✓
Diamond: Kimberley and Orange River Basin ✓✓
Copper: Mpumalanga, Northern Cape, Northwest ✓✓
Platinum: Rustenburg (Marikana mine) ✓✓
Zinc: Northern Cape ✓✓
Chromium: Rustenburg ✓✓
Asbestos: Northern Cape ✓✓
Manganese: Mpumalanga; Northern Cape ✓✓ (2)

9.1.2 Select the method used for the chosen mineral:
Deep-level undergound mining ✓✓
OR Open-cast mining ✓✓ (2)

9.2 9.2.1 Two of the following reasons:
Creates jobs and innovation ✓
A lot of money can be generated from mineral resources ✓
Economy of the country grows and strengthened by international trade. ✓ (2)

9.2.2 Any two factors:

Destruction of natural ecosystem. ✓✓

Moving of people from areas where they have lived for a long time. ✓✓

Miners work under terrible conditions for relatively low wages. ✓✓

Labour unrest can negatively affect the economy of the country. ✓✓

Mining can make the surrounding land unstable and unsafe to build on. ✓✓

Pollution as a result of energy needed for the extraction of the metal. ✓✓

The destruction of the surrounding landscape. ✓✓

Endangers people's lives who work on mines. ✓✓

Cause of poor health in communities around mines. ✓✓ (4)

9.3 Any two factors:

Size of the ore body. ✓✓

Amount of mineral in the ore ✓✓

What minerals are present in the ore ✓✓

Depth at which the mineral is located influences the mine cost. ✓✓

Mining expertise available. ✓✓

Price of mineral compared to the cost of mining. ✓✓

Infrastructure available. ✓✓ (housing for employees, roads, water, electricity, school, hospitals)

Cost of establishing infrastructure. ✓✓ (4)

[14]

7. Cognitive Analysis for Physical Sciences Grade 11: End-of-Year Chemistry Examination

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Matter and materials	Chemical change	Chemical systems	
Marks	**22**	**60**	**53**	**15**	**60**	**70**	**20**	**150**
Actual	22	60	53	15	66	70	14	150
Question 1								**20**
1.1	2				2			2
1.2		2			2			2
1.3				2	2			2
1.4			2		2			2
1.5		2				2		2
1.6				2		2		2
1.7			2			2		2
1.8	2					2		2
1.9		2				2		2
1.10	2					2		2
Question 2								**20**
2.1	2	2			4			4
2.2.1		2	2		4			4
2.2.2			2		2			2
2.3			4	4	8			8
2.4		2			2			2
Question 3								**10**
3.1	2				2			2
3.2		2			2			2
3.3			3		3			3
3.4				3	3			3
Question 4								**10**
4.1	1				1			1
4.2		2			2			2
4.3.1			3		3			3
4.3.2			4		4			4
Question 5								**12**
5.1		2	2			4		4
5.2		1	2			3		3
5.3				2		2		2
5.4		3				3		3
Question 6								**30**
6.1.1		4				4		4
6.1.2		3				3		3
6.1.3				2		2		2
6.1.4		3	3			6		6
6.2.1	2					2		2
6.2.2		2	2			4		4
6.2.3		2				2		2
6.3.1			3			3		3
6.3.2			3			3		3

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Matter and materials	Chemical change	Chemical systems	
6.3.3		1				1		1
Question 7								**16**
7.1	2					2		2
7.2			2			2		2
7.3			2			2		2
7.4		4				4		4
7.5		2				2		2
7.6			4			4		4
Question 8								**18**
8.1	1				1			1
8.2.1	2				2			2

Question	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Matter and materials	Chemical change	Chemical systems	
8.2.2		2	2		4			4
8.2.3		2	2		4			4
8.3.1		3	3		6			6
8.3.2			1		1			1
Question 9								**14**
9.1.1	2						2	2
9.1.2	2						2	2
9.2.1		2					2	2
9.2.2		4					4	4
9.3.		4					4	4