GRADE 11

Physical Sciences

Teacher Toolkit: CAPS Planner and Tracker

2019 TERM 3

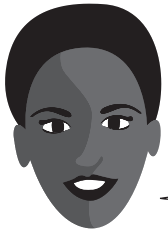
CONTENTS

A. ABOUT THE PLANNER AND TRACKER

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.

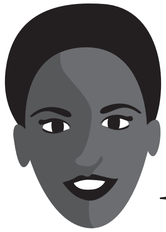


But who will help me?

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 32 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 third term of 11 weeks. Eight weeks are allocated for covering the set curriculum. Week 9 is for catching up any work not done in this time. This leaves Weeks 10 and 11 for you to give your learners the required control test and to do remediation work with them. During this time, you will also need to make sure that the formal assessment of practical work has been completed.

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

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 content, concepts and skills for the day
4. Learner's Book page number
5. Learner activity number
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 1 – Physics: Mechanics
Chemistry: Matter and materials

Term 2 – Physics: Waves, sound and light
Geometrical optics
2D and 3D wavefronts
Chemistry: Matter and materials
Ideal gases and thermal properties
Chemical change
Quantitative aspects of chemical change

Term 3 – *Chemistry:* Chemical change
***Physics:* Electricity and magnetism**

Term 4 – Chemistry: Chemical change and chemical systems

Overview of Term 3 Topics

Electrostatics

This is a topic that usually fascinates learners, especially if simple experiments are done. These may include charging a Perspex ruler or a glass rod by rubbing them with different types of cloth. This is best done on a dry day. Most schools will not have access to a Van de Graaff generator but it you can show learners a video clip of one in action. It provides a hair-raising experience which can be shocking! Many of these experiments are done in the lower grades but it is worthwhile repeating these as demonstrations so that you can probe learners' understanding of the concepts.

One of the most important concepts that needs to be developed is the concept of a field. In terms of electrostatics this is a three-dimensional space that surrounds any charged object. When another charged object enters this region it will experience a force. The force may be an attractive force if the charged objects are oppositely charged (i.e. one positive and one negative) or a force of repulsion if they have the same charges (i.e. both positively charged or both negatively charged). You need to draw your learners' attention to the fact that there are strong similarities between an electrostatic field, a magnetic field and a gravitational field.

The emphasis in Grade 11 is on quantifying the strength of the electrostatic field that surrounds different charged objects. We begin by introducing Coulomb's Law which is used to calculate the force of attraction or repulsion between charged objects. Mathematically, the equation is similar to the equation used to describe Newton's Law of Universal Gravitation. It is particularly important to emphasise the inverse square relationship between the electrostatic force and the distance between the centres of the charges. Your learners need to be familiar with the fact that if you increase the distance by a certain factor then the force will decrease by the square of that factor. Questions based on this relationship are often asked in examinations. It can save learners time too, as they do not have to repeat calculations where calculator errors can give them an incorrect answer. An example has been included in Worksheet 1 (see Section G of this tracker).

Coulomb's Law also provides an opportunity to revise and forces and force vectors in this new context. It is recommended that learners draw labelled free body diagrams. They need to apply Newton's Third Law as well. It is particularly important that learners use subscripts to identify the forces. For example, if two charged objects A and B are brought close to each other then the force on object A should be labelled as F_{BA} and the force on object B should be labelled as F_{AB}.

In order to provide a more concrete picture of an electrostatic field, we draw diagrams of field lines. Learners need to draw neat diagrams with a sharp pencil. Field lines always leave a surface at 90° to the surface and never cross each other. When field lines are close together the field is strong; when they are far apart the field is weaker. We determine the direction of the field line by introducing a small positive test charge into the region around a charged object. We ask the question, 'In which direction will the electrostatic force act on the test charge?' We indicate the direction using an arrow on the field line.

The use of a test charge gives rise to a vector quantity called electric field strength, E, which is defined as the force per unit charge at a point in the field: $E = \frac{F}{q}$. The charge q in this equation is usually the test charge and the electric field is produced by another charge. When we combine this defining equation with Coulomb's Law, we get the equation $E = \frac{k.Q}{r^2}$. The Q in this equation is the charge that is producing the field at a distance from itself. Many learners confuse these two equations. Spend time on clarifying the differences between them and stress the difference in q (the charge experiencing the force) and Q (the charge producing the electric field).

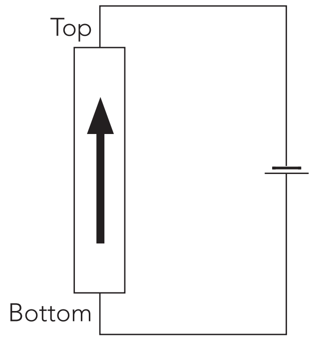
When teaching electrostatics, you could consider introducing terminology that is usually used in the context of electromagnetism. For example, a charged Perspex ruler will cause a stream of water to bend. There is no contact between the ruler and the stream of water. We can say the electric field has induced a change in direction of the stream of water. The word induced is not common but is crucial in understanding Faraday's Law.

Electromagnetism

The discovery of the link between magnetism and current electricity changed the world and is probably responsible for the explosion of technology that is part of our daily lives. Studying this topic gives us the opportunity to inspire learners to ask questions and make discoveries of their own. One role model from this field is Michael Faraday. Faraday was born into a very poor family and had no formal education. He had to go to work when he was still very young. He worked as an apprentice to a book binder and taught himself to read. At the time scientists all belonged to the wealthy classes and science was not accessible to ordinary people. Michael Faraday changed that. He developed an interest in science through reading and volunteered to be a laboratory assistant to a famous scientist who was trying to use magnets to generate electricity. But it was Michael Faraday who discovered that if you move a magnet through a coil of wire you can induce a potential difference across the ends of the coil. He went on to use this principle to develop electric motors and generators. Michael Faraday is also famous because he shared his discoveries with ordinary people by giving public lectures on science.

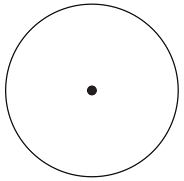
This topic requires learners to develop a mental picture of the interaction between a magnetic field and a current. These interactions happen at 90° to each other so it is not easy to draw them on a flat piece of paper. To help us we use symbols. However, the key to developing a good conceptual understanding is to be explicit about where the viewer is observing the interaction from. Learners need to become comfortable with changing their point of view. Figures 1–5 illustrate this idea.

FIGURE 1: DIAGRAM OF A STRAIGHT CURRENT-CARRYING CONDUCTOR (SIDE VIEW)



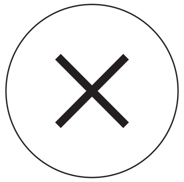
In the side view of the conductor (Figure 1), the current is moving from the bottom of the page to the top of the page. The direction of the current is given by an arrow.

FIGURE 2: DIAGRAM OF A STRAIGHT CURRENT-CARRYING CONDUCTOR (TOP VIEW)



In the top view of the conductor (Figure 2), the current is moving towards the viewer (out of the page) and this symbolised with a dot in the middle of the conductor.

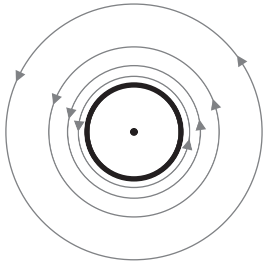
FIGURE 3: DIAGRAM OF A STRAIGHT CURRENT-CARRYING CONDUCTOR (BOTTOM VIEW)



In the bottom view of the conductor (Figure 3), the current is moving away from the viewer (into the page) and this is symbolised with a cross.

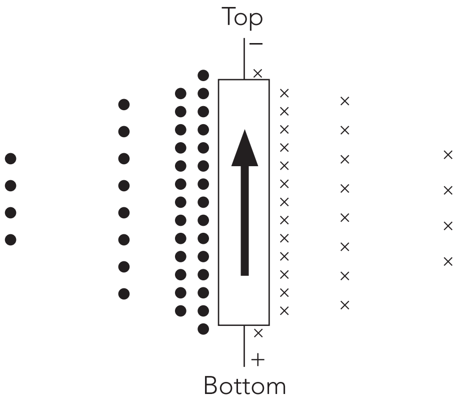
The crucial step in using these different views comes when you combine the current and the associated magnetic field. This link was first discovered by Ørsted. He found that a magnetic field formed around the conducting wire and that it was perpendicular to the direction of current. The magnetic field is strongest close to the conductor but becomes weaker further away. The magnetic field is illustrated by concentric circles and the direction of the field by arrows (Figure 4).

FIGURE 4: DIAGRAM OF A STRAIGHT CURRENT-CARRYING CONDUCTOR (TOP VIEW) SHOWING MAGNETIC FIELD



So what would the side view look like? The diagram in Figure 5 shows the magnetic field lines as dots and crosses. The dots show the direction of the field out of the page and the crosses represent the magnetic field direction into the page. This diagram shows that the magnetic field lines are closer together nearer the conductor and farther apart at a greater distance from the conductor.

FIGURE 5: DIAGRAM OF A STRAIGHT CURRENT-CARRYING CONDUCTOR (SIDE VIEW) SHOWING MAGNETIC FIELD



The diagram is also critical in developing the concept of magnetic flux. Initially you could ask learners to count the number of dots or crosses in a square close to the conductor. Next you could move the square away from the conductor and the number of dots and crosses passing through the square would decrease. This exercise links the idea of a magnetic field passing through an area that is perpendicular to the field and so defines the term magnetic flux.

One can then look at magnetic flux for a loop or a solenoid while exploring the idea that a moving charge (current) produces a magnetic field. Learners should be able to understand that the magnetic flux inside a solenoid is much higher than outside the coil.

The next step is to explore the converse relationship that Faraday discovered. Here we look at how a moving magnet field can induce an electromagnetic field (emf) across the ends of a conductor. The relationship is summarised in the equation for Faraday's Law $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ where N is the number of turns in the coil and Φ is the magnetic flux. This is best demonstrated by moving a magnet into a coil connected to a galvanometer. We say the moving magnet induces an emf across the ends of the conducting wires. When these wires are connected to form a closed circuit, current will pass through the wire. The direction of the current changes when the direction of the movement of the magnet changes. The factors that affect the size of the induced emf may also be explored, including the strength of the magnet and the number of turns in the coil. Learners will also discover that the faster the magnet moves, the greater the induced emf. This evidence can be used to explain the phrase 'rate of change' which is found in the statement of Faraday's Law.

Electric circuits

The relationship between emf (potential difference) and current is explored in this topic. One of the crucial activities in this section of work is to verify Ohm's Law. It is important to link these topics, as your learners could be asked to combine Faraday's Law and Ohm's Law in order to calculate resistance of a coil or the magnitude of the induced current in a coil.

Electric circuits are not new to learners. However, it is important to revise the definitions of potential difference, emf, current and resistance with them. They should also be reminded about series and parallel connections. Drawing and interpreting circuit diagrams is also crucial.

Ohm's Law is a very powerful tool in solving circuit problems. Investigating the relationship between current passing through a conductor and the potential difference across its ends will allow learners to develop their practical skills. They will also need to tabulate data, plot graphs and refine their understanding of what 'directly proportional' means.

Learners need to be given lots of opportunity to solve circuit problems. They need to be comfortable dealing with combinations of resistors in parallel and in series. They need to start with identifying which resistors are in series and which are in parallel. They can usually work out the equivalent resistance of the branched resistors. They should also identify where the current is the same (in the series section of the circuit) and where potential difference (voltmeter readings) are the same (branched sections). By applying Ohm's Law, most unknowns can then be calculated. It is important to recognise that there are often different ways to solve circuit problems. Learners should learn to solve these problems in different ways, so that they can check their answers in exams.

Electric circuits are examined in the final Grade 12 Physics papers. Examiners' reports over the years indicate that many learners struggle with questions in this section. However, a good understanding of the basic concepts and a clear strategy for dealing with circuits will ensure learners do well in this section.

Energy and chemical change

The concepts developed in this section of Chemistry will be developed and examined in Grade 12. The terminology used must be learnt. The most important aspect in this section is drawing and interpreting graphs of energy profiles. These graphs indicate why not all reactions are spontaneous and illustrate the difference between endothermic and exothermic reactions.

The concept of a catalyst is also very important, particularly in biochemistry and industrial chemistry. Catalysts are chemical substances that participate in chemical reactions without being used up. They may be changed during the reaction but this change is not permanent. The same mass of catalyst present at the start of a reaction will be present at the end. Catalysts lower the activation energy of a reaction, often by providing a surface for reactant molecules to join together and form new products. Reactions involving catalysts are easy to demonstrate and some involve chemicals available in most pharmacies or supermarkets. An example is 'elephant toothpaste', in which a catalyst such as potassium iodide, manganese dioxide, dried yeast or even chicken liver is added to hydrogen peroxide, thus releasing a large volume of oxygen. By adding a small amount of liquid dishwashing detergent to the hydrogen peroxide, the oxygen is captured in a mass of small bubbles. Learners will not forget the effect of a catalyst easily after watching this demonstration. For more information, see https://sciencebob.com/fantastic-foamy-fountain/

In Term 2, your learners completed the verification of Snell's Law as a Physics project. In Term 3, they will need to investigate endothermic and exothermic reactions as part of the formal practical assessment as a Chemistry project. The results of one of these projects needs to be recorded for reporting purposes. Guidelines for managing projects are given in the CAPS and in the teacher guides. You may also want to encourage learners to enter regional science fairs. For more details and guidelines on managing projects contact Eskom Expo for Young Scientists (www.exposcience.co.za).

Acids and bases

Acids and bases is another topic that learners will have investigated in earlier grades. They also did stoichiometric calculations that involved acid–base reactions in Term 2. Acids and bases are referred to in everyday conversation, so learners should be familiar with the basic concepts, but there is more to learn. In Grade 11, learners define an acid as a proton donor (hydrogen ion donor) and a base as a proton acceptor. An acid–base reaction therefore involves a transfer of hydrogen ions. Learners are also formally introduced to titrations.

One of the most fascinating things about acid–base reactions is that you can observe a colour change in the solution by using an indicator when doing a titration. An indicator is a chemical that has a distinct colour in an acidic solution and a different colour in a basic solution. So when they add a base to an acidic solution in a titration, learners will observe a distinct colour change as the base neutralises the acid. What is most interesting is that these colour changes can be reversed. If an acid is added to a basic solution, the indicator's colour will return to the original colour. This demonstrates the concept of a reversible reaction.

Reversible reactions are important in many different contexts, including biochemistry and industrial chemistry. In the context of acid–base reactions we look at reversible reactions by pairing the acid and its conjugate base and the base and its conjugate acid. Many learners get confused by this concept, possibly because the word conjugate is not familiar to them. To help them you need to explain that the acid and its conjugate base differ by a hydrogen ion. The conjugate base acts as a base by accepting a hydrogen ion to reform the acid. In a similar way, the base and the conjugate acid also differ by a hydrogen ion.

Once learners have grasped these theoretical concepts, they need to apply them by exploring various acid–base reactions and then using them to prepare salts.

This section needs to include a lot of practical work and so preparation is critical. You can conduct most of the required investigations even if you do not have laboratory glassware. By doing practical work you will stimulate learners' interest and help them to apply the theory. This is particularly important when preparing salts. You can ask learners to write balanced chemical equations for each of the activities they complete. If you make it a requirement that learners must submit the chemical equations before doing the practicals they will be more motivated to get the chemical equations correct. You will also be able to identify learners or groups of learners who need remediation.

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 formal assessment tasks

The CAPS requirements for formal assessment in Term 3 are a project (practical assessment) and an end-of-term test. The project specified for Term 3 is either a physics or a chemistry project. The physics project is based on work done in Term 2, and if it was done there, the mark must be recorded for Term 3 practical work. Projects have not been allocated class time in the trackers as it is expected that learners will do them in their own time. 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 test in the Learner's Book, this test cannot be used because the learners will be able to prepare for it in advance, but it is useful for revision and informal assessment. An exemplar test is provided in Section F Assessment Resources of this tracker.

Table 1 gives an overview of the practical task/investigations/project and control test provided in each of the LTSMs, and where they are scheduled in each tracker. This will help you in your preparation.

TABLE 1: FORMAL ASSESSMENT TASKS INCLUDED IN EACH APPROVED SET OF LTSMs FOR TERM 3

Name of book	Formal practical assessment	Control test
Study and Master Physical Sciences	**Mark from work done in Term 2 Week 2: Project: Verify and apply Snell's Law** LB p. 145; TG D51–D52 **OR** **Week 6: Project: Exothermic and endothermic reactions** LB pp. 252–254; TG D89–D91	**Week 10:** Control test TG B19–B20 Memo in TG B21–B22 Exemplar test provided in Section F
Platinum Physical Sciences	**Mark from work done in Term 2 Week 2: Project: Verify and apply Snell's Law** LB p. 110; TG pp. 66–68 **OR** **Week 6: Project: Exothermic and endothermic reactions** LB pp. 229–231; TG pp. 130–134	**Week 10:** Test 3 in Control Test Book pp. 10–13 Memo in TG pp. 24–25 Exemplar test provided in Section F
Successful Physical Sciences	**Mark from work done in Term 2 Week 2: Project: Verify and apply Snell's Law** LB p. 137; TG pp. 117–119 **OR** **Week 6: Project: Exothermic and endothermic reactions** LB pp. 252–253; TG pp. 224–227	**Week 10:** Exemplar test given in LB pp. 329–333 (useful for practice, not for formal assessment) On CD in TG Memo in TG pp. 259–262 Exemplar test provided in Section F

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.

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

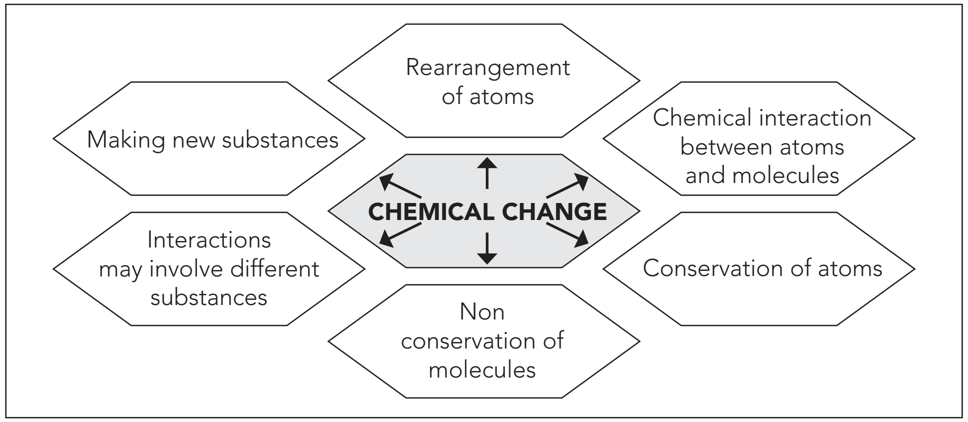
However well you know your work, it is easy to make small mistakes when in a classroom with learners asking questions. Always read through the content that you are going to cover to ensure that you are very familiar with the work. If possible, also do additional reading from other sources. Refer to Section E *Additional Information and Enrichment Activities* of this tracker 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 6. 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 6: MIND MAP OF KEY CONCEPTS ASSOCIATED WITH CHEMICAL CHANGE



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.

The mid-year examination for Grade 11 learners is the first step in 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 is 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, the teacher 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* and Section G Additional Worksheet of this tracker.

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. Some of these practical activities will be done as part of formal assessment and others can be done as part of informal assessment. Learners are also required to complete one project on either Physics or Chemistry this term. This gives a total of three formal assessments in practical work in Physical Sciences for the year. It is also recommended that learners do a minimum of four experiments for informal assessment (two Chemistry and two Physics experiments). This gives a total of seven assessments in practical work in Physical Sciences for the year. Learners need to understand and experience that practical work in science distinguishes this discipline from other knowledge areas.

In Term 3, learners are required to investigate exothermic and endothermic reactions as a project. In order to prepare learners for this formal assessment, it is important to give them opportunities to complete other informal Physics and Chemistry investigations. The marks for either the verification of Snell's Law or the investigation of exothermic and endothermic reactions need to be recorded.

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 formal or informal 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.merck-chemicals.com/msds-search/
- School chemistry laboratory safety guide: www.cdc.gov/niosh/docs/2007–107/pdfs/2007–107.pdf
- WCED laboratory safety guidelines: www.curriculum.wcape.school.za/site/52/pol/view/

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
p.	Page
pp.	Pages
PA	Practical activity
PT	Periodic table
Q.	Question
S #	Hour session
TG	Teacher's Guide
WS	Worksheet
TYS	Test Yourself (*Study and Master*)
#	Examined in Grade 12

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

Study and Master Physical Sciences **Week 1: Electrostatics**

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Review and remediation:** Mid-year Examinations											
	Homework: Selected questions from Mid-Year Exam or from Exemplar Papers in Term 2 Tracker				B15–B18							
2	**Coulomb's Law** • State Coulomb's Law, which can be represented mathematically as $F = \frac{kQ_1Q_2}{r^2}$ • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D)	84	204–208	WS 1 Q. 1.1–1.2	D76	194–199	256–257					
	Homework			WS 1 Q. 2.1–2.3		199–201 Ex. 5.1 1–13	257–258					
3	**Coulomb's Law** • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D) and two dimensions (2D)	84	208–209	WS 1 Q. 2.4		201–206						
	Homework			WS1 Q. 3 and 4		205 Ex. 5.2 1–2	258–260					
4	**Electric field** • Describe an electric field as a region of space in which an electric charge experiences a force • The direction of the electric field at a point is the direction that a positive test charge (+1C) would move if placed at that point • Draw electric field lines for various configurations of charges	85	209–211	TYS 1 1–2	D77	328–335						
	Homework			TYS 1 3	D77	342 9.2 4a and b	266					

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: Electrostatics and electromagnetism												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Electric field** • Define the magnitude of the electric field at a point as the force per unit charge $E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is $F = q.E$ • Calculate the electric field at a point due to a number of point charges, using the equation $E = \frac{kQ}{r^2}$ • to determine the contribution to the field due to each charge	85	211–214	214 TYS 2 1 WS1 5	D77	335–340 Ex. 9.2 1–2	263–264					
2	**Electric field** • Calculate the electric field at a point due to a number of point charges, using the equation: $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	85		243 4–6	D85–D86							
	Homework			243 3a–c, 7–9	D85–D87	342–343 Ex. 9.3 5–8	267–268					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
3	**Magnetic field associated with current-carrying wires** • Provide evidence for the existence of a magnetic field (B) near a current-carrying wire • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire • Draw the magnetic field lines around – a straight current-carrying wire	86	215–216	WS1 Q. 7.1		346–350 348 Act. 1 349 Act. 2 1–6						
	Homework			WS1 Q. 7.2		349 Act. 2 6–12 355 Ex. 10.1 1–2	270–271					
4	**Magnetic field associated with current-carrying wires** • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a current-carrying loop (single) of wire – a solenoid Draw the magnetic field lines around: – a current-carrying loop (single) of wire – a solenoid • Discuss qualitatively the environmental impact of overhead electrical cables	86	216–218	218 PA Act. 1	D78–79	350–351						
	Homework			WS1 Q. 7.3		356 Ex. 10.1 3–4	271–272					

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: Electromagnetism

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Faraday's Law** • State Faraday's Law • Use words and pictures to describe what happens when a bar magnet is pushed into or pulled out of a solenoid connected to a galvanometer • Use the Right Hand Rule to determine the direction of the induced current in a solenoid when the north or south pole of a magnet is inserted or pulled out	87	219–222	219–220 PA Act. 2	D79–D80	357–362						
	Homework: Prepare for informal practical assessment on Faraday's Law			219–220 PA Act. 2	D79–D80							
2	**Faraday's Law** • State Faraday's Law • Use words and pictures to describe what happens when a bar magnet is pushed into or pulled out of a solenoid connected to a galvanometer • Use the Right Hand Rule to determine the direction of the induced current in a solenoid when the north or south pole of a magnet is inserted or pulled out	87	219–222	219–220 PA Act. 2	D79–D80	357–362						
	Homework: Complete report on practical activity			222 TYS 3 1a-f	D80	367–368 Ex. 10.2 1–2	272–273					
3	**Faraday's Law** • Know that for a loop of area A in the presence of a uniform magnetic field B, the magnetic flux (Φ) passing through the loop is defined as: $\Phi = BA \cos \theta$ where θ is the angle between the magnetic field B and the normal to the loop of area A • Know that the induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux • Calculate the induced emf and induced current for situations involving a changing magnetic field using the equation for Faraday's Law: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ where $\Phi = BA \cos \theta$ is the magnetic flux	87	222–226	226 TYS4 1–2	D80	357–362						
	Homework			226 TYS4 3–4	D80	369 Ex. 10.3 1–4	276–277					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
4	**Electromagnetism** Consolidation, remediation and revision			246 10–13	D87–D88	369 Ex. 10.3 5–9	278–279					
	Homework			244 3d–e 247 14–15	D85 D88	369 Ex. 10.3 1–4	276–277					

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: Electromagnetism and electric circuits												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Ohm's Law** • Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit • State the difference between Ohmic and non-Ohmic conductors and give an example of each	88	227–231	230–231 PA Act. 3		372–375	282					
	Homework: Prepare for Ohm's Law investigation		227–231	230–231 PA Act. 3		375 Ex. 11.1 1a–e	283–284					
	Ohm's Law – Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit	88	227–231	230–231 PA Act. 3		373–375 376–378						
	Homework: Complete report on Ohm's Law investigation		227–231	230–231 PA Act. 3		373–375 376–378						

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
2	**Ohm's Law** Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ for series and parallel circuits	88	232–235	234 Act. 4 1a–c	D83	376–383 Ex. 11.2 1–3	284–285					
	Homework:			234 Act. 4 2	D83	382–383 Ex. 11.3 1–5	287–289					
3	**Ohm's Law** Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ for series and parallel circuits	88	232–235	234 Act. 4 3	D83	383–397 393 Ex. 11.4 1–6	290–294					
	Homework			234 Act. 4 4	D83	397 Ex. 11.5 1–4	296–301					
4	**Electric circuits** Revision, consolidation and remediation			247 16	D88							
	Homework			244 3f 247 17	D88							

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: Power, energy												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Power, energy** • Define power as the rate at which electrical energy is converted in an electric circuit and is measured in watts (W) • Know that electrical power dissipated in a device is equal to the product of the potential difference across the device and current flowing through it: $P = IV$ • Know that power can also be given by $P = I^2R$ or $P = \frac{V^2}{R}$ • Solve circuit problems involving the concept of power	89	236–240	240 TYS 5 1a–c	D84	399–407						
	Homework: Prepare for practical investigation			238–239 Act. 5	D83–D84	407 Ex. 11.6 1–4	301–307					
2	**Power, energy** • Define power as the rate at which electrical energy is converted in an electric circuit and is measured in watts (W) • Know that electrical power dissipated in a device is equal to the product of the potential difference across the device and current flowing through it: $P = IV$ • Know that power can also be given by $P = I^2R$ or $P = \frac{V^2}{R}$ • Solve circuit problems involving the concept of power			238–239 Act. 5 Q. 1–4	D83–D84							
	Homework: Complete questions for practical investigation			238–239 Act. 5 Q. 1–4 240 TYS 5 Q. 2	D83–D84 D84–D85							
3	**Power, energy** • Know that the electrical energy is given by $E = P.\Delta t$ • and is measured in joules (J) • Solve problems involving the concept of electrical energy • Know that the kilowatt hour (kWh) refers to the use of 1 kilowatt of electrical energy for 1 hour • Calculate the cost of electricity usage given the power specifications of the appliances used, as well as the duration if the cost of 1 kWh is given	89	240–242	242 TYS 6 Q. 1	D85	409–412						

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Date completed				
	Homework			242 TYS 6 Q. 1	D85	407 Ex. 11.6 5–6	307–310					
4	**Electricity and magnetism** Revision, consolidation and remediation (Informal assessment: Class test)			243–247 WS3	D85–D88	413–414 Ex. 11.7 1–4	310–311					
	Homework			243–247 WS3	D85–D88	414–415 Ex. 11.7 5–9	311–315					

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: Energy and chemical change, types of reactions

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Class / Date completed				
1	**Energy changes in reactions related to bond energy changes** • Explain the concept of enthalpy and its relationship to heat of reaction • Define exothermic and endothermic reactions • Identify that bond breaking requires energy and that bond formation releases energy • Classify (with reason) the following reactions as exothermic or endothermic: respiration, photosynthesis, combustion of fuels	90	248–255	252–254 PA Act. 5	D89–D91	418–428 424 Ex. 12.1 1–2	318–319 319–320					
	Homework: Prepare for formal practical assessment (project)			252–254 PA Act. 5	D89–D91	428–429 Ex. 12.2 1–3	320–322					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed					
						LB pp.	TG pp.						
2	**Activation energy** • Define activation energy • Explain a reaction process in terms of energy change and relate this change to bond breaking and formation and to 'activated complex' • Draw freehand graphs of endothermic reactions and exothermic reactions (with activation energy)	91	255–258	256–257 Act. 6 1–9	D91	429–432 432 Ex. 12.3 1–2	323						
	Homework			256–257 Act. 6 1–9 258 TYS 4 1a–e	D91	433 Ex. 12.4 1–3	324						
3	**Activation energy** • Explain a reaction process in terms of energy change and relate this change to bond breaking and formation and to 'activated complex' • Draw freehand graphs of endothermic reactions and exothermic reactions (with activation energy)	91	258–259	258 Act. 7	D92								
	Homework: Prepare for formal practical assessment (project)			259 Act. 8 252–254 PA Act. 5	D92–D93 D89–D91	433 Ex. 12.4 4–6	325–327						
4.	**Investigate endothermic and exothermic reactions (project)**	91	252–254	252–254 PA Act. 5	D89–D91								
	Homework: Revision and extension			275 5–8	D93–D94								

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 7: Types of reactions

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Acid–base** • Use the acid–base theories of Arrhenius and Brønsted and Lowry to define acids and bases • Define an acid as an H^+ donor and a base as an H^+ acceptor in reactions	92	260–261	261 TYS 5 1	D93	438–441	330–331					
	Homework			261 TYS 5 2	D93	441–442 Ex. 13.1 1–2	331–332					
2	**Acid–base** • Identify conjugate acid/base pairs • Define an ampholyte • List common acids (including hydrochloric acid, nitric acid, sulfuric acid and acetic acid) and common bases (including sodium carbonate, sodium hydrogen carbonate and sodium hydroxide) by name and formula	92	262–264	262 TYS 6 1a–b	D93	442–443						
	Homework			262 TYS 6 1c–d	D93	443 Ex. 13.2 1–2	332–333					
3	**Acid–base** • Write the overall equation for simple acid–metal hydroxide, acid–metal oxide and acid–metal carbonate reactions and relate these to what happens at the macroscopic and microscopic level	92	264–267	266 TYS 7 1, 3	D93–D94	443–445, 447–450						
	Homework: Prepare for informal practical investigation on indicators			269–270 Act. 10	D94–D95	447 Ex. 13.3 1 448 Ex. 13.4 1 450 Ex. 13.5 1	334					
4	**Acid–base** • What is an indicator? • Look for some natural indicators	92	268–270	269–270 Act. 10	D94–D95	445–446						
	Homework: Complete report on indicators			269–270 Act. 10	D94–D95	467 Ex. 13.9 4–6	344–345					

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 8: Types of reactions												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Acid–base** • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92	271	267 PA Act. 9	D94	450–452						
	Homework: Complete report on titration			267 PA Act. 9	D94	452 Ex. 13.6 1–2	334					
2	**Acid–base** • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$			271 Act. 11	D95							
	Homework			266 TYS 7 2	D94	452 Ex. 13.6 3	334					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
3	**Acid–base** • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92	272–273	272 Act. 12	D96	450–452						
	Homework			273 Act. 13	D96	452 Ex. 13.6 4–6						
4	**Acid–base** Consolidation, revision and remediation	92	274–275	275 9–11	D98							
	Homework			274 1–4	D97	467–468 Ex. 13.9 7–9	345					

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 9: 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 pp.	TG pp.	Date completed				
1												
2												
3												
4												

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 10–11: Term 3 Control test, review of test and corrections	
End-of-term reflection	
Think about and make a note of: 1. Was the learners' performance during the term what you had expected and hoped for? Which learners need particular support with Physical Sciences in the next term? What strategy can you put in place for them to catch up with the class? Which learners would benefit from extension activities? What can you do to help them?	3. What ONE change should you make to your teaching practice to help you teach more effectively next term?
2. With which specific topics did the learners struggle the most? How can you adjust your teaching to improve their understanding of this section of the curriculum in the future?	4. Did you cover all the content as prescribed by the CAPS for the term? If not, what are the implications for your work on these topics in future? What plan will you make to get back **on track**?
HOD:	**Date:**

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

Platinum Physical Sciences Week 1: Electrostatics												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Review and remediation:** Mid-year Examinations											
	Homework: Selected questions from Mid-Year Exam or from exemplar papers in Term 2 Tracker				Control Test Book 6–9 21–23							
2	**Coulomb's Law** • State Coulomb's Law, which can be represented mathematically as: $F = \frac{kQ_1Q_2}{r^2}$ • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D)	84	188–191	188 Act. 9.1 1–3 189 Ex. 9.1 1–3 Ex. 9.2 1–2	106 106 107	318–326 Ex. 9.1 1–3	256–257					
	Homework			189 Ex. 9.1 4–7	107	326 Ex. 9.1 4–6	257–258					
3	**Coulomb's Law** • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D) and two dimensions (2D)	84	191–192	192 Ex. 9.3 1	107							
	Homework			192 Ex. 9.3 2	107	327 Ex. 9.1 7–12	258–263					
4	**Electric field** • Describe an electric field as a region of space in which an electric charge experiences a force • The direction of the electric field at a point is the direction that a positive test charge (+1C) would move if placed at that point • Draw electric field lines for various configurations of charges • Define the magnitude of the electric field at a point as the force per unit charge: $E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is: $F = qE$ • Calculate the electric field at a point due to a number of point charges, using the equation: $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	85	193–194	194 Ex. 9.4 1.1–1.2	108	328–335						

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Date completed				
	Homework			194 Ex. 9.4 2	108	342 Ex. 9.2 4a, b	266					

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: Electrostatics and electromagnetism

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Class				
								Date completed				
1	**Electric field** • Define the magnitude of the electric field at a point as the force per unit charge: $E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is: $F = qE$ • Calculate the electric field at a point due to a number of point charges, using the equation: $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	85	194–195	194 Ex. 9.5 1–2	108	335–340 Ex. 9.2 1–2	263–264					
	Homework			196 1–3	109	341–342 Ex. 9.3 1–3	265–266					
2	**Electric field** Revision, remediation and consolidation	85		196 4–6	109–110							
	Homework			196 7–9	110	342–343 Ex. 9.3 5–8	267–268					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
3	**Magnetic field associated with current-carrying wires** • Provide evidence for the existence of a magnetic field (B) near a current-carrying wire • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire • Draw the magnetic field lines around: – a straight current-carrying wire	86	197–198	198 PA 10.1	111–112	346–350 348 Act. 1 349 Act. 2 1–6						
	Homework: Prepare for project: Make an electromagnet			200 PA	112	349 Act. 2 6–12 355 Ex. 10.1 1–2	270–271					
4	**Magnetic field associated with current-carrying wires** • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire – a current-carrying loop (single) of wire – a solenoid • Draw the magnetic field lines around: – a straight current-carrying wire – a current-carrying loop (single) of wire – a solenoid • Discuss qualitatively the environmental impact of overhead electrical cables	86	199–200	200 PA		350–351						
	Homework			206 1.1–1.3	115	356 Ex. 10.1 3–4	271–272					

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: Electromagnetism

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Faraday's Law** • State Faraday's Law • Use words and pictures to describe what happens when a bar magnet is pushed into or pulled out of a solenoid connected to a galvanometer • Use the Right Hand Rule to determine the direction of the induced current in a solenoid when the north or south pole of a magnet is inserted or pulled out	87	201–202	201 PA Act. 10.2	113	357–362						
	Homework: Complete report on Act. 10.2			201 PA Act. 10.2	113	367–368 Ex. 10.2 1–4	272–274					
3	**Faraday's Law** • Know that for a loop of area A in the presence of a uniform magnetic field B, the magnetic flux (Φ) passing through the loop is defined as: $\Phi = BA \cos \theta$ where θ is the angle between the magnetic field B and the normal to the loop of area A • Know that the induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux	87	202–204	202 Ex. 10.1 1 203 Act. 10.3	113 114	363–367						
	Homework			202 Ex. 10.1 2–3	113–144	368 Ex. 10.2 5–7	274–276					
4	**Faraday's Law** • Calculate the induced emf and induced current for situations involving a changing magnetic field using the equation for Faraday's Law: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ where $\Phi = BA \cos \theta$ is the magnetic flux	87	203–205	204 Ex. 10.2 1–4 205 Ex. 10.3 1–2	114 115							
	Homework: Revision			207 2–4	115–116	369 Ex. 10.3 1–9	276–279					

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: Electromagnetism and electric circuits**												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
2	**Ohm's Law** • Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit	88	210–211, 208	208 PA Exp 1	117–119	372–375	282					
	Homework: Complete report on Ohm's Law experiment and prepare for Part 2 of practical investigation			211 Ex. 11.1 1–7	119	375 Ex. 11.1 1a–e	283–284					
3	**Ohm's Law** • State the difference between Ohmic and non-Ohmic conductors, and give an example of each • Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ • for series and parallel circuits	88	209–212	212 Ex. 11.2 1–4		376–383 Ex. 11.2 1–3	284–285					
	Homework			216 1.1–1.2	122	382–383 Ex. 11.3 1–5	287–289					
4	**Ohm's Law** • Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ • for series and parallel circuits	88		216 2–3	122	383–397 393 Ex. 11.4 1–6	290–294					
	Homework			222 8.1–8.4	127	397 Ex. 11.5 1–4	296–301					

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: Power, energy

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Class				
								Date completed				
1	**Power, energy** • Define power as the rate at which electrical energy is converted in an electric circuit and is measured in watts (W) • Know that electrical power dissipated in a device is equal to the product of the potential difference across the device and current flowing through it: $P = IV$ • Know that power can also be given by: $P = I^2R$ or $P = \frac{V^2}{R}$ • Solve circuit problems involving the concept of power	89	213–214	213–214 PA Ex. 11.2	120	399–407						
	Homework			214 Act. 11.1 1–4	120–121	407 Ex. 11.6 1–4	301–307					
2	**Power, energy** • Solve circuit problems involving the concept of power • Know that the electrical energy is given by: $E = Pt$ and is measured in joules (J) • Solve problems involving the concept of electrical energy • Know that the kilowatt hour (kWh) refers to the use of 1 kilowatt of electricity for 1 hour • Calculate the cost of electricity usage given the power specifications of the appliances used, as well as the duration if the cost of 1 kWh is given	89	214–216	214 Ex. 11.3 1–3 215 Act. 11.2 1–2	120 121	409–412						
3	**Homework**			217 4–7	122–123	407 Ex. 11.6 5–6	307–310					
4	**Electric circuits** Consolidation		218–22	219–221 1–5	124–126	413–414 Ex. 11.7 1–4	310–311					
	Homework			221 6, 7, 9	126–127	414–415 Ex. 11.7 5–9	311–315					

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: Energy and chemical change, types of reactions												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Energy changes in reactions related to bond energy changes** • Explain the concept of enthalpy and its relationship to heat of reaction • Define exothermic and endothermic reactions • Identify that bond breaking requires energy and that bond formation releases energy • Classify (with reason) the following reactions as exothermic or endothermic: respiration, photosynthesis, combustion of fuels	90	224–228	227 Ex. 12.1 1–2	128–129	418–428 424 Ex. 12.1 1–2	318–319 319–320					
	Homework: Prepare for formal practical assessment (project)			229 1–4 229–231	129 130–134	428–429 Ex. 12.2 1–3	320–322					
2	**Energy changes in reactions related to bond energy changes** • Classify (with reason) the following reactions as exothermic or endothermic: respiration, photosynthesis, combustion of fuels	90	232–233	233 PA Exp. 12.1	135	429–432 432 Ex. 12.3 1–2	323					
	Homework: Prepare for formal practical assessment (project)			233 Ex. 12.2 1–3 229–231	130–134	433 Ex. 12.4 1–6	324–327					
3	**Activation energy** • Define activation energy • Explain a reaction process in terms of energy change and relate this change to bond breaking and formation and to 'activated complex' • Draw freehand graphs of endothermic reactions and exothermic reactions (with activation energy)	91	234–236	234 Ex. 12.3 235 Act. 12.1 1–6	136 136							
	Homework: Prepare for formal practical assessment (project)			236 Ex. 12.4 1.1–1.2 229–231	136 130–134							
4	**Investigate endothermic and exothermic reactions (project)**			229–231	130–134							
	Homework: Revision			236 1–6	137–138							

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 7: Types of reactions												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Acid–base** • Use the acid–base theories of Arrhenius and Brønsted and Lowry to define acids and bases • Define an acid as an H^+ donor and a base as an H^+ acceptor in reaction • Define an ampholyte • List common acids (including hydrochloric acid, nitric acid, sulfuric acid and acetic acid) and common bases (including sodium carbonate, sodium hydrogen carbonate and sodium hydroxide) by name and formula	92	238–240, 242	249 1.1–1.5	139–140	438–441	330–331					
	Homework: Revision			236 1–6	137–138	441–442 Ex. 13.1 1–2	331–332					
2	**Acid–base** • Identify conjugate acid/base pairs • Define an ampholyte	92	240–242	249 Ex. 2.1–2.3	143	440–442 443 Ex. 13.2 1–2	332–333					
	Homework			249 Ex. 3.1–3.3	143	447 Ex. 13.3 1	334					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed
						LB pp.	TG pp.	
3	**Acid–base** • Write the overall equation for simple acid–metal hydroxide, acid–metal oxide and acid–metal carbonate reactions and relate these to what happens at the macroscopic and microscopic level	92	242–245	244 Ex. 13.1 1–3 245 Exp. 13.1	140 140–141	443–445, 447–450		
	Homework: Revision Prepare for informal practical investigation on indicators			249 4–5 246 Exp. 13.2	143 141	447 Ex. 13.3, 1 448 Ex. 13.4, 1 450 Ex. 13.5, 1	334	
4	**Acid–base** What is an indicator? Look for some natural indicators	92	244–246	246 Exp. 13.2	141	445–446		
	Homework: Complete report on natural indicators			246 Exp. 13.2	141	467 Ex. 13.9 4–6	344–345	

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 8: Types of reactions

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Acid–base** • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92	245–248	245 Exp. 13.1 247 Exp. 13.3 1–3	140–141 142	450–452						
	Homework			248 Act. 13.4 1–4	142	452 Ex. 13.6 1–3						
2	**Acid–base** • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92		247 Exp. 13.3 1–3	142	450–452						
	Homework			248 Act. 13.4 1–4	142	452 Ex. 13.6 4–6						
3	**Chemical change** Revision, consolidation, remediation		264–267	266 3.1–3.4	156							
	Homework			265– 266 1.1–1.6 2.1–2.6	156	467–468 Ex. 13.9 7–9	345					
4	**Chemical change** Revision, consolidation, remediation		264– 267	266 4, 5	156–157							

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 9: 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 pp.	**TG pp.**	**Date completed**				
1												
2												
3												
4												

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 10–11: Term 3 Control test, review of test and corrections	
End-of-term reflection	
Think about and make a note of: 1. Was the learners' performance during the term what you had expected and hoped for? Which learners need particular support with Physical Sciences in the next term? What strategy can you put in place for them to catch up with the class? Which learners would benefit from extension activities? What can you do to help them?	3. What ONE change should you make to your teaching practice to help you teach more effectively next term?
2. With which specific topics did the learners struggle the most? How can you adjust your teaching to improve their understanding of this section of the curriculum in the future?	4. Did you cover all the content as prescribed by the CAPS for the term? If not, what are the implications for your work on these topics in future? What plan will you make to get back **on track**?
HOD:	**Date:**

3. *Successful Physical Sciences* (Oxford University Press)

Successful Physical Sciences Week 1: Electrostatics												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Review and remediation:** Mid-year Examinations											
	Homework: Selected questions from Mid-year Exam or from Exemplar Papers in Term 2 Tracker			334–338	263–268							
2	**Coulomb's Law** • State Coulomb's Law, which can be represented mathematically as: $F = \frac{kQ_1Q_2}{r^2}$ • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D)	84	203–207	205 Act. 1 1–3	173–175	318–326 Ex. 9.1 1–3	256–257					
	Homework			209 Act. 1 1–4	175–176	326 Ex. 9.1 4–6	257–258					
3	**Coulomb's Law** • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D) and two dimensions (2D)	84	206–209	209 Act. 1 5–6	176–177							
	Homework			209 Act. 1 7–8	177–180	327 Ex. 9.1 7–12	258–263					
4	**Electric field** • Describe an electric field as a region of space in which an electric charge experiences a force • The direction of the electric field at a point is the direction that a positive test charge (+1C) would move if placed at that point • Draw electric field lines for various configurations of charges • Define the magnitude of the electric field at a point as the force per unit charge: $E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is: $F = qE$ • Calculate the electric field at a point due to a number of point charges, using the equation: $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	85	210–211	211 Act. 1 4–5	180–181	328–335						
	Homework			211 Act. 1 1–3	181	342 9–2 4a, b	266					

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 2: Electrostatics and electromagnetism												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Electric field** • Define the magnitude of the electric field at a point as the force per unit charge: $E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is: $F = qE$ • Calculate the electric field at a point due to a number of point charges, using the equation: $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	85	212–215	215 Act. 1 4–5	184–186	335–340 Ex. 9.2 1–2	263–264					
	Homework			215 Act. 1 1–3	182–184	341–342 Ex. 9.3 1–3	265–266					
2	**Electric field** Revision, remediation and consolidation	85	244–245	245 1–4	214–217							
	Homework			245 1–4	214–217	342–343 Ex. 9.3 5–8	267–268					
3	**Magnetic field associated with current-carrying wires** • Provide evidence for the existence of a magnetic field (B) near a current-carrying wire • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire • Draw the magnetic field lines around: – a straight current-carrying wire	86	216–217	216 Exp. 1	186–187	346–350 348 Act. 1 349 Act. 2 1–6						

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
	Homework			217 Act. 2 1, 2	187	349 Act. 2 6–12 355 Ex. 10.1 1–2	270–271					
4	**Magnetic field associated with current-carrying wires** • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire – a current-carrying loop (single) of wire – a solenoid • Draw the magnetic field lines around: – a straight current-carrying wire – a current-carrying loop (single) of wire – a solenoid • Discuss qualitatively the environmental impact of overhead electrical cables	86	218–219	217 Act. 1 1, 4	187–188	350–355						
				217 Act. 1 2, 3		356 Ex. 10.1 3–4	271–272					

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: Electromagnetism													
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**					
						LB pp.	**TG pp.**	**Date completed**					
1	**Faraday's Law** • State Faraday's Law • Use words and pictures to describe what happens when a bar magnet is pushed into or pulled out of a solenoid connected to a galvanometer • Use the Right Hand Rule to determine the direction of the induced current in a solenoid when the north or south pole of a magnet is inserted or pulled out	87	220–221	220 Exp. 1	188–189	357–362							
	Homework			221 Act. 2 1–3	189–190								
2	**Faraday's Law** • State Faraday's Law • Know that for a loop of area A in the presence of a uniform magnetic field B, the magnetic flux (Φ) passing through the loop is defined as: $\Phi = BA\cos\theta$ where θ is the angle between the magnetic field B and the normal to the loop of area A • Know that the induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux	87	222–223	223 Act. 2 4–5	190–191	357–362							
	Homework			223 Act. 2 1–4	190	367–368 Ex. 10.2 1–4	272–274						
3	**Faraday's Law** Calculate the induced emf and induced current for situations involving a changing magnetic field using the equation for Faraday's Law: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ where $\Phi = BA\cos\theta$ is the magnetic flux		224–225	225 Act. 1 1.1–1.3	191–192	363–367							
	Homework			225 Act. 1 2–3	192–193	368 Ex. 10.2 5–7	274–276						
4	**Electromagnetism** Review, remediation and consolidation		244–246	245–246 1–3	217	369 Ex. 10.3 1–4	276–277						
	Homework: Revision and extension			246 4–5	217–219	369 Ex. 10.3 5–9	278–279						

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: Electric circuits												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Ohm's Law** • Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit	88	226–228	226–228 Exp. 1 1	194	372–375	282					
	Homework: Complete questions on Exp. 1 and prepare for Exp. 2			226–228 Exp. 1 2	194–195	375 Ex. 11.1 1a–e	283–284					
2	**Ohm's Law** • Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit • State the difference between Ohmic and non-Ohmic conductors and give an example of each	88	229	229 Exp. 2	195–196	372–375	282					
	Homework: Complete report on Exp. 2			229 Exp. 2	195–196	375 Ex. 11.1 1a–e	283–284					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
3	**Ohm's Law** • State the difference between Ohmic and non-Ohmic conductors and give an example of each • Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ for series and parallel circuits	88	230–232	232 Act. 1 1–5	196–197	376–383 Ex. 11.2 1–3	284–285					
	Homework			232 Act. 1 6–10	197–201	382–383 Ex. 11.3 1–5	287–289					
4	**Ohm's Law** • Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ for series and parallel circuits	88	233–235	235 Act. 1 1–2	201–204	383–397 393 Ex. 11.4 1–6	290–294					
	Homework			235 Act. 1 3–5	204–207	397 Ex. 11.5 1–4	296–301					

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: Power, energy												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Power, energy** • Define power as the rate at which electrical energy is converted in an electric circuit and is measured in watts (W) • Know that electrical power dissipated in a device is equal to the product of the potential difference across the device and current flowing through it: $P = IV$ • Know that power can also be given by: $P = I^2R$ or $P = \frac{V^2}{R}$ • Solve circuit problems involving the concept of power	89	236–239	236 Exp 1	207–208	399–407						
	Homework			239 Act. 1 1–4	208–209	407 Ex. 11.6 1–4	301–307					
2	**Power, energy** • Solve circuit problems involving the concept of power • Know that the electrical energy is given by: $E = Pt$ • and is measured in joules (J) • Solve problems involving the concept of electrical energy	89	238–241	239 Act. 1 5–6 241 Act. 1 1–3	209–210 211	409–412						
	Homework			241 Act. 1 4–5	212	407 Ex. 11.6 5–6	307–310					
3	**Power, energy** • Know that the kilowatt hour (kWh) refers to the use of 1 kilowatt of electricity for 1 hour • Calculate the cost of electricity usage given the power specifications of the appliances used, as well as the duration if the cost of 1 kWh is given		242–243	243 Act. 1 2	213–214							
	Homework			243 Act. 1 1 and 3	213–214	407 Ex. 11.6 5–6	307–310					
4	**Electric circuits** Consolidation		244–246	246 1–2	219	413–414 Ex. 11.7 1–4	310–311					
	Homework			246 3–4	219–221	414–415 Ex. 11.7 5–9	311–315					

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: Energy and chemical change												
S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1	**Energy changes in reactions related to bond energy changes** • Explain the concept of enthalpy and its relationship to heat of reaction • Define exothermic and endothermic reactions • Identify that bond breaking requires energy and that bond formation releases energy • Classify (with reason) the following reactions as exothermic or endothermic: respiration, photosynthesis, combustion of fuels	90	248–253	248 Exp. 1 251 Act. 2 1–3	222–223	418–428 424 Ex. 12.1 1–2	318–319 319–320					
	Homework: Prepare for formal practical assessment (project)			251 Act. 2 4–5 252–253	223 224–227	428–429 Ex. 12.2 1–3	320–322					
2	**Energy changes in reactions related to bond energy changes** • Explain the concept of enthalpy and its relationship to heat of reaction		254–255	255 Act. 1 1.1–1.3	228							
	Homework: Prepare for formal practical assessment (project)			255 Act. 1 2–3 252–253	228 224–227							

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed				
						LB pp.	TG pp.					
3	**Activation energy** Define activation energy • Explain a reaction process in terms of energy change and relate this change to bond breaking and formation and to 'activated complex' • Draw freehand graphs of endothermic reactions and exothermic reactions (with activation energy)	91	256–258	258 Act. 1 3–4	229	429–432 432 Ex. 12.3 1–2	323					
	Homework: Prepare for formal practical assessment (project)			258 Act. 1 1–2 252–253	229 224–227	433 Ex. 12.4 1–6	324–327					
4	**Investigate endothermic and exothermic reactions (project)** • Alternative investigation	91		252–253 260 Act. 3	224–227 230–231							
	Homework: Complete project report Revision and extension			252–253 290 1–5	224–227 243							

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 7: Types of reactions												
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1	**Acid–base** • Use the acid–base theories of Arrhenius and Brønsted and Lowry to define acids and bases • Define an acid as an H^+ donor and a base as an H^+ acceptor in reaction • List common acids (including hydrochloric acid, nitric acid, sulfuric acid and acetic acid) and common bases (including sodium carbonate, sodium hydrogen carbonate and sodium hydroxide) by name and formula	92	261–265	265 Act. 1 1–10	231–233	438–440	330–331					
	Homework			265 Act. 1 11–19	233	441–442 Ex. 13.1 1–2	331–332					
2	**Acid–base** • Identify conjugate acid/base pairs • Define an ampholyte	92	266–267	266 Act. 2 1.1–1.7 267 Act. 3 1–3	233 234	440–442 443 Ex. 13.2 1–2	332–333					
	Homework			266 Act. 2 2–3 267 Act. 3 4–6	233–234 234	447 Ex. 13.3 1	334					
3	**Acid–base** • Write the overall equation for simple acid–metal hydroxide, acid–metal oxide and acid–metal carbonate reactions and relate these to what happens at the macroscopic and microscopic level	92	268–270	270 Act. 1 1–3	234	443–445, 447–450						
	Homework: Prepare for informal practical investigation on natural indicators			270 Act. 1 4–6	234	447 Ex. 13.3, 1 448 Ex. 13.4, 1 450 Ex. 13.5, 1	334					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Date completed				
4	**Acid–base** • What is an indicator? • Look for some natural indicators	92	273–275	274 Exp. 1	236	445–446						
	Homework: Complete report on natural indicators			291 6.1–6.4	244	467 Ex. 13.9 4–6	344–345					

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 8: Types of reactions

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science* LB pp.	*Everything Science* TG pp.	Class				
								Date completed				
1	**Acid-base** • Use acid-base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92	270–272	271 Exp. 2	235	450–452						
	Homework: Complete report on salt preparation Revision and extension			291 1–3	244	452 Ex. 13.6 1–3	334					
2	**Acid-base** • Use acid-base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	92	270–272	271 Exp. 2	235	450–452						
	Homework: Complete report on salt preparation Revision and extension			291 4–5	244	452 Ex. 13.6 4–6	335					

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Date completed					
						LB pp.	TG pp.						
3	**Acid-base** • Use acid-base reactions to produce and isolate salts, e.g. e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$ • Recommend Act. 3 as practical investigation as per teacher guide	92	270–272	271 Act. 3 1–3	235								
	Homework: Complete report on salt preparation			271 Act. 3 4–6	235	467–468 Ex. 13.9 7–9	345						
4	**Term 3 Consolidation** Revision and remediation			291 1–6	244	467–468 Ex. 13.9 7–9	343–345						

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 9: 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 pp.	TG pp.	Date completed				
1												
2												
3												
4												

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 10–11: Term 3 Control test, review of test and corrections	
End-of-term reflection	
Think about and make a note of: 1. Was the learners' performance during the term what you had expected and hoped for? Which learners need particular support with Physical Sciences in the next term? What strategy can you put in place for them to catch up with the class? Which learners would benefit from extension activities? What can you do to help them?	3. What ONE change should you make to your teaching practice to help you teach more effectively next term?
2. With which specific topics did the learners struggle the most? How can you adjust your teaching to improve their understanding of this section of the curriculum in the future?	4. Did you cover all the content as prescribed by the CAPS for the term? If not, what are the implications for your work on these topics in future? What plan will you make to get back **on track**?
HOD:	**Date:**

E. ADDITIONAL INFORMATION AND ENRICHMENT ACTIVITIES

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment activities
Weeks 1–2: Electrostatics	
Coulomb's Law • State Coulomb's Law, which can be represented mathematically as: $F = \frac{kQ_1Q_2}{r^2}$ • Solve problems using Coulomb's Law to calculate the force exerted on a charge by one or more charges in one dimension (1D) and two dimensions (2D)	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electrostatics Worksheet in Section G
Electric field • Describe an electric field as a region of space in which an electric charge experiences a force • The direction of the electric field at a point is the direction that a positive test charge (+1C) would move if placed at that point • Draw electric field lines for various configurations of charges • Define the magnitude of the electric field at a point as the force per unit charge$E = \frac{F}{q}$, E and F are vectors • Deduce that the force acting on a charge in an electric field is $F = q.E$ • Calculate the electric field at a point due to a number of point charges, using the equation $E = \frac{kQ}{r^2}$ to determine the contribution to the field due to each charge	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electrostatics **PHET Simulation: Charges and fields** http://phet.colorado.edu/sims/charges-and-fields/charges-and-fields_en.html Worksheet in Section G
Weeks 2–4: Electromagnetism	
Magnetic field associated with current-carrying wires • Provide evidence for the existence of a magnetic field (B) near a current-carrying wire • Use the Right Hand Rule to determine the magnetic field (B) associated with: – a straight current-carrying wire – a (single) current-carrying loop of wire – a solenoid • Draw the magnetic field lines around: – a straight current-carrying wire, – a (single) current-carrying loop of wire – a solenoid • Discuss qualitatively the environmental impact of overhead electrical cables	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electromagnetism Worksheet in Section G
Faraday's Law • State Faraday's Law • Use words and pictures to describe what happens when a bar magnet is pushed into or pulled out of a solenoid connected to a galvanometer • Use the Right Hand Rule to determine the direction of the induced current in a solenoid when the north or south pole of a magnet is inserted or pulled out • Know that for a loop of area A in the presence of a uniform magnetic field B, the magnetic flux (Φ) passing through the loop is defined as: $\Phi = BA \cos \theta$ where θ is the angle between the magnetic field B and the normal to the loop of area A • Know that the induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux • Calculate the induced emf and induced current for situations involving a changing magnetic field using the equation for Faraday's Law: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ where $\Phi = BA \cos \theta$ is the magnetic flux	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electromagnetism **PHET Simulation: Faraday's Law** http://phet.colorado.edu/en/simulation/legacy/faraday

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment activities
Weeks 4–5: Electric circuits	
Ohm's Law • Determine the relationship between current, voltage and resistance at constant temperature using a simple circuit • State the difference between Ohmic and non-Ohmic conductors, and give an example of each • Solve problems using the mathematical expression of Ohm's Law: $R = \frac{V}{I}$ for series and parallel circuits	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electric-circuits **PHET Simulations: Electric Circuits** http://phet.colorado.edu/en/simulation/legacy/circuit-construction-kit-dc
Power, energy • Define power as the rate at which electrical energy is converted in an electric circuit and is measured in watts (W) • Know that electrical power dissipated in a device is equal to the product of the potential difference across the device and current flowing through it: $P = IV$ • Know that power can also be given by: $P = I^2R$ or $P = \frac{V^2}{R}$ • Solve circuit problems involving the concept of power • Know that the electrical energy is given by: $E = Pt$ and is measured in joules (J) • Solve problems involving the concept of electrical energy • Know that the kilowatt hour (kWh) refers to the use of 1 kilowatt of electricity for 1 hour • Calculate the cost of electricity usage given the power specifications of the appliances used, as well as the duration, if the cost of 1 kWh is given	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/electricity-magnetism-electric-circuits
Week 6: Energy and chemical change	
Energy changes in reactions related to bond energy changes • Explain the concept of enthalpy and its relationship to heat of reaction • Define exothermic and endothermic reactions • Identify that bond breaking requires energy (endothermic) and that bond formation releases energy (exothermic) • Classify (with reason) the following reactions as exothermic or endothermic: respiration, photosynthesis, combustion of fuels	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/chemical-change-energy-and-chemical-change
Exothermic and endothermic reactions • State that $\Delta H > 0$ for endothermic reactions. • State that $\Delta H < 0$ for exothermic reactions • Draw freehand graphs of endothermic reactions and exothermic reactions (without activation energy)	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/chemical-change-energy-and-chemical-change
Activation energy • Define activation energy • Explain a reaction process in terms of energy change and relate this change to bond breaking and formation and to 'activated complex' • Draw freehand graphs of endothermic reactions and exothermic reactions (with activation energy)	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/chemical-change-energy-and-chemical-change

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment activities
Weeks 7–8: Types of reaction	
Acid–base • Use the acid–base theories of Arrhenius and Brønsted and Lowry to define acids and bases • Define an acid as an H+ donor and a base as an H+ acceptor in reactions • Identify conjugate acid/base pairs • Define an ampholyte • List common acids (including hydrochloric acid, nitric acid, sulfuric acid and acetic acid) and common bases (including sodium carbonate, sodium hydrogen carbonate and sodium hydroxide) by name and formula	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/chemical-change-types-reactions-acids-bases
Acid–base • Write the overall equation for simple acid–metal hydroxide, acid–metal oxide and acid–metal carbonate reactions and relate these to what happens at the macroscopic and microscopic level • What is an indicator? • Look for some natural indicators • Use acid–base reactions to produce and isolate salts, e.g. Na_2SO_4, $CuSO_4$ and $CaCO_3$	**Mindset Learn Videos:** http://learn.mindset.co.za/resources/physical-sciences/grade-11/chemical-change-types-reactions-acids-bases

F. ASSESSMENT RESOURCES

1. Sample item analysis sheets

PHYSICAL SCIENCES TERM 3 GRADE 11

SUGGESTED ITEM ANALYSIS RECORD SHEET FOR FORMAL ASSESSMENT

TERM 3 CONTROL TEST										
		Questions								
		1	2	3	4	5	6	7	8	Total
		Multiple choice	Electrostatics	Electromagnetism	Electric circuits	Electric circuits	Energy and chemical change	Acids and bases	Acids and bases	
	Marks	10	20	9	14	12	12	6	17	100
Learner name	Learner surname									

SUGGESTED ITEM ANALYSIS RECORD SHEET FOR FORMAL ASSESSMENT

PRACTICAL PROJECT								
		Questions						
		1	2	3	4	5	6	Total
		Pre-practical preparation	Setting up equipment Conducting experiment	Collection of data	Tabulation and calculations	Discussion of results	Conclusion	
	Marks							
Learner name	Learner surname							

2. Physical Sciences Grade 11: End-of-Term 3 Control Test

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 8 questions, a data sheet and a Periodic Table.
2. Make sure that your question paper is complete.
3. Read the questions carefully.
4. Write legibly and to set your work out neatly.
5. **Question 1** consists of 5 multiple-choice questions. There is only one correct answer to each question. Write only the letter (A–D) next to the question number, e.g. 1.2 A.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Make use the data sheet whenever necessary.
9. Answer **all** questions.
10. Show all working clearly in all calculations.
11. Where appropriate round up answers to **two** decimal places.

Question 1

Multiple choice questions

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A–D) next to the question number, e.g. 1.2 A.

1.1 Two spheres, A and B, have charges of +5 nC and –8 nC, respectively.

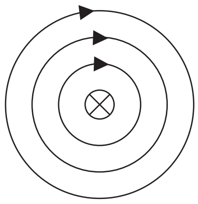
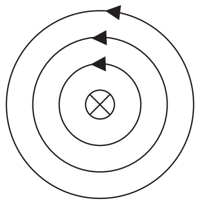
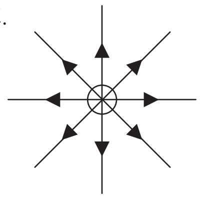
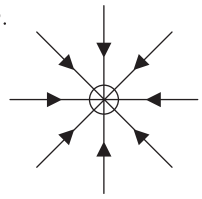
They are allowed to touch but then separate.

The charges (in nC) on the spheres after separation are …

	Sphere A	Sphere B
A	+5	–8
B	–3	–3
C	+1,5	+1,5
D	–1,5	–1,5

(2)

1.2 Which of the following diagrams correctly represents the magnetic field associated with a current-carrying conductor when the current flows into the plane of the page?

A. 
B. 
C. 
D. 

(2)

1.3 A current of 1,5 A passes through a light bulb will connected to a 12 V source.

How much energy is dissipated through the light bulb in 2,5 minutes?

A. 45 J

B. 45 W

A. 2,7 kJ

B. 2700 W (2)

1.4 In a given reversible reaction, the forward reaction is exothermic.

Which statement about the reverse reaction is true?

A. The reverse reaction is exothermic.

B. The energy released by the reverse reaction is equal to the activation energy of forward reaction.

C. The ΔH value for the reverse reaction is larger than that for the forward reaction.

D. The ΔH value for the reverse reaction is smaller than that for the forward reaction. (2)

1.5 For the reaction below, which are the Brønsted-Lowry bases?

$H_2O + H_2O \leftrightarrows OH^- + H_3O^+$

A. H_2O only

B. H_2O and H_3O^+

C. OH^- only

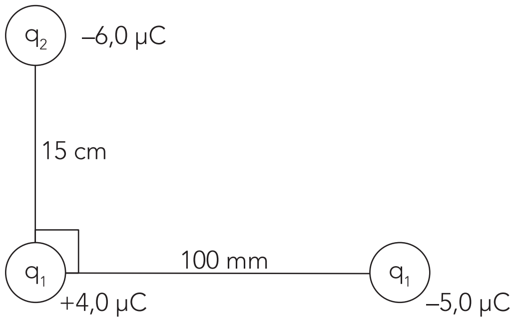
D. OH^- and H_2O (2)

(2) ×5 = **[10]**

Show all working in the following questions.

Question 2

Consider the diagram below, which shows three point charges q_1, q_2 and q_3 of charge +4,0 μC, –6,0 μC and –5,0 μC, respectively. The distance between q_1 and q_2 is 15 cm, and that between q_1 and q_3 is 100 mm. The diagram is not drawn to scale.



2.1 State Coulomb's Law. (2)

2.2 Draw a free-body diagram for all the electrostatic forces that act on q_1. (3)

2.3 Calculate the magnitude of the electrostatic force between q_1 and q_2. (4)

2.4 Calculate the net electrostatic force on q_1. (7)

2.5 Calculate the magnitude of the net electric field strength at the position of q_1. (4)

[20]

Question 3

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.

3.1 Calculate the flux through the solenoid. (4)

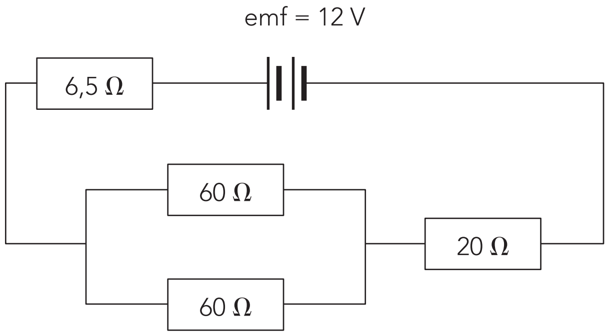
3.2 State Faraday's Law of electromagnetic induction. (2)

3.3 Calculate the induced emf if the solenoid is pulled out of the magnetic field in 0,22 s. (3)

[9]

Question 4

In the circuit represented below, two 60 Ω resistors connected to a 20 Ω resistor and a 6,5 Ω resistor as shown in the circuit diagram below. The battery has an emf of 12 V.



4.1 Explain what is meant by 'an emf of 12 V'. (3)

4.2 Calculate the following:

4.2.1 equivalent resistance of the two 60 Ω resistors. (3)

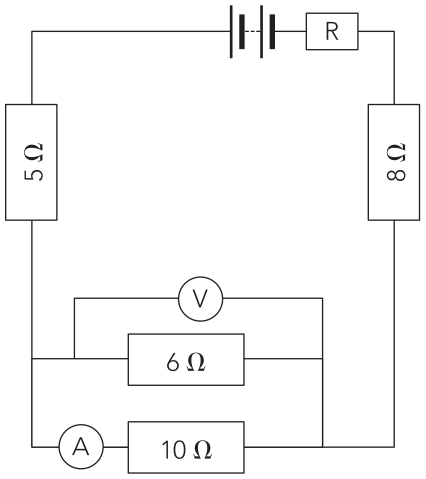
4.2.2 the current through the battery. (5)

4.2.3 the power dissipated by the 20 Ω resistor. (3)

[14]

Question 5

In the circuit represented below, a battery of emf 30 V is connected to an unknown resistor R and to a combination of resistors, as shown. Ignore the resistance of the ammeter and the connecting wires. The voltmeter has very high resistance.



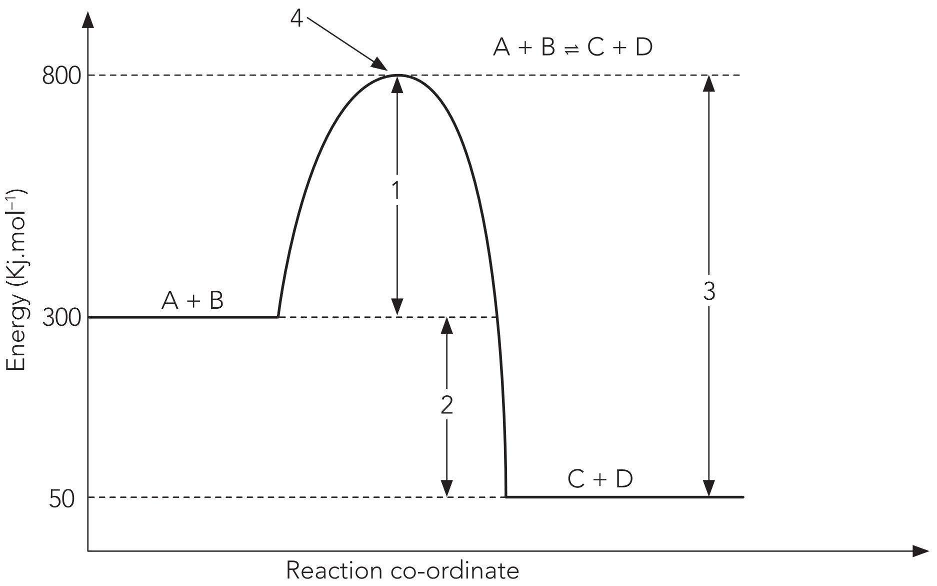
The current passing through the 10 Ω resistor is 0,6 A.

Calculate the resistance of R.

[12]

Question 6

The following energy profile diagram represents the energy changes that take place during a reversible reaction. The *x*-axis represents the reaction co-ordinate and the *y*-axis represents the energy of the reactants or products.



6.1 Provide names for labels 1 to 4. (4)

6.2 Calculate the activation energy for the forward reaction shown on the graph. (2)

6.3 Calculate the overall enthalpy of the forward reaction. (2)

6.4 Define a catalyst. (2)

6.5 Draw a sketch to show the effect of a catalyst. (2)

[12]

Question 7

Carbon dioxide is extremely soluble in water and forms a weak acid called carbonic acid found in all fizzy drinks. The chemical equations below represent the reversible reactions taking place in a glass of sparkling water.

I: CO_2 (g) + H_2O (ℓ) $\leftrightarrows$ H_2CO_3 (aq)

II: H_2CO_3 (aq) + H_2O (ℓ) $\leftrightarrows$ HCO_3^- (aq) + H_3O^+ (aq)

III: HCO_3^- (aq) + H_2O (ℓ) $\leftrightarrows$ CO_3^{2-} (aq) + H_3O^+ (aq)

7.1 Define an acid according to the Lowry-Brønsted theory. (2)

7.2 Identify the acid and its conjugate base for Reaction II. (2)

7.3 Write down the chemical formula of an ampholyte present in the sample of sparkling water. (2)

[6]

Question 8

8.1 What mass of NaOH(s) is needed to prepare 200 cm^3 of NaOH solution with a concentration of 0,4 $mol.dm^{-3}$? (2)

8.2 100 cm^3 of distilled water is added to the solution referred to in 8.1.

8.3 A standard solution of NaOH solution is used to determine the concentration of a sulphuric acid solution. The concentration of the sodium hydroxide solution is 0,25 $mol.dm^{-3}$.

Write a balanced chemical equation for this reaction. (4)

8.4 Calculate the concentration of the sulphuric acid if 25 cm^3 NaOH neutralises exactly 12,4 cm^3 of the acid. (7)

[17]

TOTAL MARKS: 100

TIME: 2 HOURS

END OF TEST

DATA SHEET

GRADE 11 TERM 3

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Coulomb's constant	k	$9{,}0 \times 10^{9}$ N.m^2.C^{-2}
Avogadro's constant	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE

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

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

ELECTRICAL CURRENTS

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

CHEMISTRY

$\frac{C_aV_a}{C_bV_b} = \frac{n_a}{n_b}$	$c = \frac{n}{V} = \frac{m}{MV}$
$c = \frac{m}{M} = \frac{V}{V_m} = \frac{N}{N_A}$	

TABLE 3: THE PERIODIC TABLE OF 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)
1 2,1 **H** 1																	2 **He** 4
3 1,0 **Li** 7	4 1,5 **Be** 9											5 2,0 **B** 11	6 2,5 **C** 12	7 3,0 **N** 14	8 3,5 **O** 16	9 4,0 **F** 19	10 **Ne** 20
11 0,9 **Na** 23	12 1,2 **Mg** 24											13 1,5 **Aℓ** 27	14 1,8 **Si** 28	15 2,1 **P** 31	16 2,5 **S** 32	17 3,0 **Cℓ** 35,5	18 **Ar** 40
19 0,8 **K** 39	20 1,0 **Ca** 40	21 1,3 **Sc** 45	22 1,5 **Ti** 48	23 1,6 **V** 51	24 1,6 **Cr** 52	25 1,5 **Mn** 55	26 1,8 **Fe** 56	27 1,8 **Co** 59	28 1,8 **Ni** 59	29 1,9 **Cu** 63,5	30 1,6 **Zn** 65	31 1,6 **Ga** 70	32 1,8 **Ge** 73	33 2,0 **As** 75	34 2,4 **Se** 79	35 2,8 **Br** 80	36 **Kr** 84
37 0,8 **Rb** 86	38 1,0 **Sr** 88	39 1,2 **Y** 89	40 1,4 **Zr** 91	41 **Nb** 92	42 1,8 **Mo** 96	43 1,9 **Tc**	44 2,2 **Ru** 101	45 2,2 **Rh** 103	46 2,2 **Pd** 106	47 1,9 **Ag** 108	48 1,7 **Cd** 112	49 1,7 **In** 115	50 1,8 **Sn** 119	51 1,9 **Sb** 122	52 2,1 **Te** 128	53 2,5 **I** 127	54 **Xe** 131
55 0,7 **Cs** 133	56 0,9 **Ba** 137	57 **La** 139	72 1,6 **Hf** 179	73 **Ta** 181	74 **W** 184	75 **Re** 186	76 **Os** 190	77 **Ir** 192	78 **Pt** 195	79 **Au** 197	80 **Hg** 201	81 1,8 **Tℓ** 204	82 1,8 **Pb** 207	83 1,9 **Bi** 209	84 2,0 **Po**	85 2,5 **At**	86 **Rn**
87 0,7 **Fr**	88 0,9 **Ra** 226	89 **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

Atomic number: 29

Electronegativity: 1,9

Symbol: **Cu**

Approximate relative atomic mass: 63,5

3. Physical Sciences Grade 11: End-of-Term 3 Control Test Memorandum

Question 1

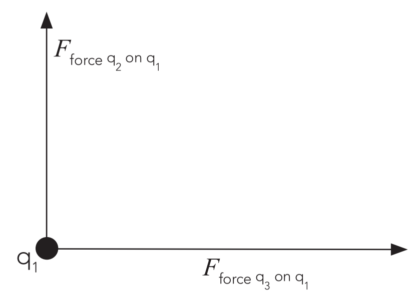
1.1 D ✓✓ 1.2 A ✓✓ 1.3 C ✓✓ 1.4 B ✓✓ 1.5 D ✓✓

5 × (2) = **[10]**

Question 2

2.1 The force of attraction or repulsion that two charged objects at rest exert on each other is directly proportional to the product of the charges and inversely proportional to the square of the distance between their centres. ✓✓ (2)

2.2



✓✓✓ (3)

2.3 $F_{q_2 \text{ on } q_1} = \frac{k.q_2q_1}{r^2}$ ✓

$= \frac{(9 \times 10^9)(4 \times 10^{-6})(6 \times 10^{-6})}{(00,15)^2}$ ✓✓

$= 9,6$ N ✓ (4)

2.4 $F_{q_3 \text{ on } q_1} = \frac{k.q_3q_1}{r^2}$ ✓

$= \frac{(9 \times 10^9)(4 \times 10^{-6})(5 \times 10^{-6})}{(00,10)^2}$ ✓✓

$= 18$ N ✓

$F_{net} = \sqrt{(F_{q_2 \text{ on } q_1})^2 + (F_{q_3 \text{ on } q_1})^2} = \sqrt{(9,6)^2 + (18)^2}$ ✓ (c.o.e.)

$= 20,4$ N ✓

$\tan\theta = \frac{9,6}{18} = 0,533$ ✓

$= 28,07°$

$F_{net} = 20,4$ N at an angle of 28,07° to the force of q_3 on q_1 ✓ (7)

2.5 $E = \frac{F_{net}}{Q}$ ✓ $= \frac{20,4}{4 \times 10^{-6}}$ ✓ $= 5,1 \times 10^6$ N.C^{-1} ✓ at an angle of 28,07° to $F_{\text{force } q_3 \text{ on } q_1}$ ✓ (4)

[20]

Question 3

3.1 $\Phi = B\perp A = BA\cos\theta$ ✓

$= (0,72)(176 \times 10^{-4})\cos 90°$ ✓✓

$= 0,013$ Wb ✓ or $1,27 \times 10^{-2}$ Wb (4)

3.2 Faraday's law states that the induced emf is directly proportional to the rate of change of magnetic flux. (2)

3.3 $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ ✓

$= \frac{-V \div 0,22 \times 10^{-2} \text{ V}}{0,22}$ ✓ (c.o.e. from 3.1)

$= -25,92$ ✓ (3)

[9]

Question 4

4.1 An emf of 12 V tells us that 12 J of energy ✓ is the total amount of energy transferred by the battery ✓ per coulomb of charge passing through it. ✓ (3)

4.2 $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$= \frac{1}{60} + \frac{1}{60}$ ✓

$R_{eq} = \frac{2}{60} = 30\ \Omega$ ✓ (3)

4.3 $R_T = 30 + 20 + 6{,}5 = 56{,}5\ \Omega$ ✓✓

$I_T = \frac{V_T}{R_T}$ ✓ $= \frac{12}{56{,}5}$ ✓ $= 0{,}21$ A ✓ (5)

4.4 $P = I^2.R$ ✓

$= (0{,}21)^2 \times 20$ ✓

$= 0{,}88$ W ✓ (3)

[14]

Question 5

$V_{10\ \Omega} = V_{6\ \Omega} = IR$ ✓

$= 0{,}6 \times 10$

$= 6$ V ✓

$I_{6\ \Omega} = \frac{V_{6\ \Omega}}{R_{6\ \Omega}} = \frac{6}{6} = 1$ A ✓

Total current = $I_1 + I_2$ ✓ $= 1 + 0{,}6 = 1{,}6$ A ✓

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{6} + \frac{1}{10} = 0{,}2667$

$R_p = 3{,}75\ \Omega$ ✓

$R_T = \frac{V_T}{I_T}$ ✓ $= \frac{30}{1{,}6}$ ✓ $= 18{,}75\ \Omega$

$R = R_T - (R_p + R_{5\ \Omega} + R_{8\ \Omega})$ ✓

$= 18{,}75 - (3{,}75 + 5 + 8)$ ✓

$= 2\ \Omega$ ✓

[12]

Question 6

6.1 1 – Activation Energy (EA) of the forward reaction ✓

2 – Enthalpy or Heat of Reaction (ΔH) ✓

3 – Activation Energy (EA) of the reverse reaction ✓

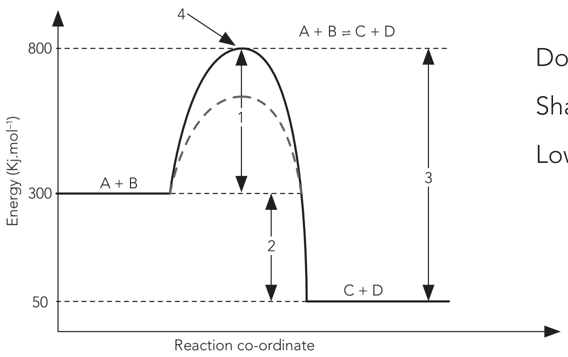
4 – Activation complex ✓ (4)

6.2 $E_A = 800 - 300 = 500$ kJ.mol^{-1} ✓✓ (2)

6.3 $\Delta H = 50 - 300 = -250$ kJ.mol^{-1} ✓✓ (2)

6.4 A catalyst is a chemical substance that takes part in a chemical reaction without being used up. ✓✓ (2)

6.5



Dotted line – effect of catalyst

Shape ✓

Lower Activation Energy ✓ (2)

[12]

Question 7

7.1 An acid is a proton donor ✓✓ (2)

7.2 H_2CO_3 (aq) ✓ and HCO_3^- (aq) ✓ (2)

7.3 HCO_3^- (aq) ✓✓ (2)

[6]

Question 8

8.1 m = CMV ✓ = (0,4)(40)(0,2) = 3,2 g ✓ (2)

8.2 $n = \frac{m}{M} = \frac{3,2}{40}$ = 0,08 mol ✓

$C = \frac{n}{V}$ ✓ $= \frac{0,08}{(0,2 + 0,1)}$ ✓ = 0,27 $mol.dm^{-3}$ ✓ 4)

8.3 2 NaOH ✓ + H_2SO_4 ✓ → Na_2SO_4 ✓ + 2 H_2O ✓ (B) (4)

8.4 $n_b = C_b \times V_b$

$= (0,25)(25 \times 10^{-3})$ ✓

$= 6,25 \times 10^{-3}$ mol ✓

From the balanced equation ratio of moles of base to acid is 2:1 ✓

$n_a = \frac{6,25 \times 10^{-3}}{2} = 3,125 \times 10^{-3}$ mol ✓

$C_a = \frac{n}{V}$ ✓

$= \frac{3,125 \times 10^{-0}}{12,4 \times 10^{-0}}$ ✓

$= 0,25$ $mol.dm^{-3}$ ✓ (7)

[17]

TOTAL MARKS: 100

4. Cognitive Analysis for Physical Sciences Grade 11: End-of-Term 3 Control Test

There are no guidelines for the weightings of content for the Grade 11 Term 3 Control Test. The target weightings given in the tables below for the Control Test are based on the weighting of time given to a topic. The actual marks allocated are fairly close to the targets but there were more questions assigned to Electric Circuits as this is a topic examined in Grade 12.

Level 1: Recall
Level 2: Comprehension
Level 3: Analysis, application
Level 4: Evaluation, synthesis

Question	1	2	3	4	Electrostatics	Electromagnetism	Electric circuits	Energy and chemical change	Acids and bases	
Marks required	**15**	**35**	**40**	**10**	**17**	**17**	**22**	**11**	**33**	**100**
Actual	15	35	40	10	22	11	28	14	25	100
Question 1										**10**
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
Question 2										**20**
2.1	2				2					2
2.2		3			3					3
2.3		4			4					4
2.4	2		5		7					7
2.5		4			4					4
Question 3										**9**
3.1		2	2			4				4
3.2	2					2				2
3.3		1	2			3				3

Question	1	2	3	4	Electrostatics	Electromagnetism	Electric circuits	Energy and chemical change	Acids and bases	
Question 4										**14**
4.1			3				3			3
4.2	3						3			3
4.3		2	3				5			5
4.4			3				3			3
Question 5										**12**
		4		8			12			12
Question 6										**12**
6.1		4						4		4
6.2			2					2		2
6.3		2						2		2
6.4	2							2		2
6.5			2					2		2
Question 7										**6**
7.1	2								2	2
7.2			2						2	2
7.3			2						2	2
Question 8										**17**
8.1		2	2						4	4
8.2			2	2					4	4
8.3		3							3	3
8.4			6						6	6
Marks required	15	35	40	10	17	17	22	11	33	100
Actual	**15**	**35**	**40**	**10**	**22**	**11**	**28**	**14**	**25**	**100**

G. ADDITIONAL WORKSHEET

1. Worksheet 1: Electrostatics and electromagnetism

Question 1

The electrostatic force between a point charge of –4 nC and another of +6 nC is found to be F N when the two point charges are 20 mm apart.

1.1 Use Coulomb's Law to calculate the value of F. (4)

1.2 Without further calculations, complete the table below:

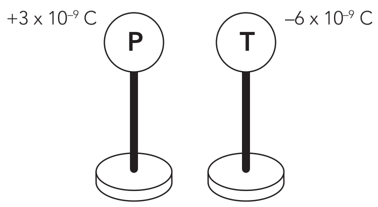
Force (N)	Charge 1 (nC)	Charge 2 (nC)	Distance (m)
F	–4	+6	20×10^{-3}
1,5 F	–4	$Q_2 = ?$	20×10^{-3}
$F_{new} = nF = ?$	–4	+6	1×10^{-2}
0,25 F	–4	+6	$r = ?$

(3)

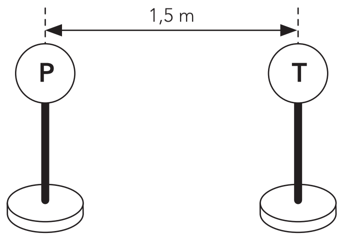
[7]

Question 2

Two metal spheres, P and T, on insulated stands, carry charges of $+3 \times 10^{-9}$ C and -6×10^{-9} C, respectively.



The spheres are allowed to touch each other and are then placed 1,5 m apart as shown below.



2.1 In which direction will electrons flow while spheres P and T are in contact? Write down only FROM P TO T or FROM T TO P. (1)

2.2 Calculate the net charge gained or lost by sphere P after the spheres have been in contact. (3)

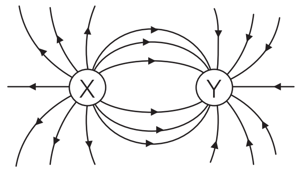
2.3 Calculate the number of electrons transferred during the process in Question 2.2.
A third sphere R, carrying a charge of -3×10^{-9} C, is now placed between P and T at a distance of 1 m from T. (2)

2.4 Calculate the net force experienced by sphere R as a result of its interaction with P and T. (6)

[12]

Question 3

3.1 The diagram below shows the electric field pattern due to two point charges X and Y.



Which ONE of the following represents the charge on X and Y respectively?

	POINT CHARGE X	POINT CHARGE Y
A.	Negative	Negative
B.	Positive	Positive
C.	Positive	Negative
D.	Negative	Positive

(2)

3.2 Two identical insulated spheres, each carrying a charge Q and separated by a distance r, exert an electrostatic force of magnitude F on each other. The distance between the spheres is now HALVED.

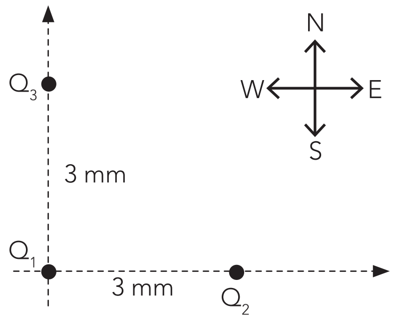
The magnitude of the force the spheres now exert on each other is:

A. $\frac{1}{2}F$
B. F
C. $2F$
D. $4F$ (2)

[4]

Question 4

Three small, identical metal spheres, Q_1, Q_2 and Q_3 are placed in a vacuum. Each sphere carries a charge of –4 μC. The spheres are arranged such that Q_2 and Q_3 are each 3 mm from Q_1 as shown in the diagram below.



4.1 State Coulomb's Law in words. (2)

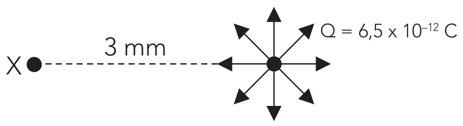
4.2 Draw a force diagram showing the electrostatic forces exerted on Q_1 by Q_2 and Q_3. (2)

4.3 Calculate the net force exerted on Q_1 by Q_2 and Q_3. (8)

[12]

Question 5

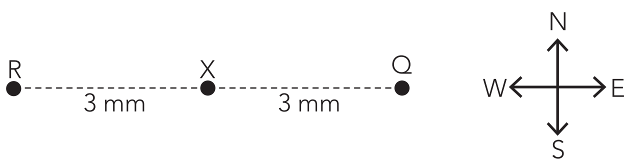
An isolated point charge Q is located in space as shown in the diagram below. Point charge Q contributes to an electric field as shown. Point X is located 3 mm away from point charge Q.



5.1 Define the term electric field at a point. (2)

5.2 Calculate the magnitude of the electric field at point X. (3)

5.3 Point charge R carrying a charge of $+6{,}5 \times 10^{-12}$ C is placed 3 mm away from point X as shown in the diagram below.

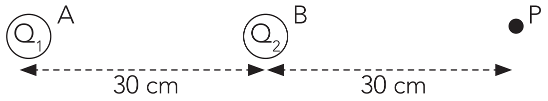


5.4 Calculate the net electric field at point X. (4)

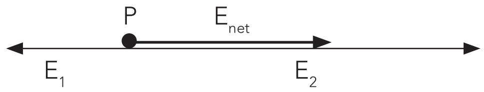
[9]

Question 6

Two identical conducting spheres A and B with charges Q_1 and Q_2, respectively, are placed in fixed positions along the same straight line as shown in the diagram below. Spheres A and B are placed 30 cm from each other. Point P is positioned 30 cm to the right of sphere B on the same straight line.



The charge on sphere B is positive. The net electric field E_{net} at point P as a result of the two charges Q_1 and Q_2 is toward the right as shown in the diagram below.



6.1 What is the sign of the charge on sphere A? Give a reason for your answer. (3)

6.2 The net electric field at point P is 1 600 $N.C^{-1}$ to the right and the charge on sphere B has a magnitude of +12 nC. Calculate the magnitude of the charge on sphere A. (7)

6.3 A proton is placed at point P without changing the charges and positions of spheres A and B.

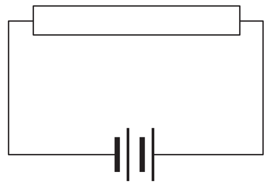
Calculate the net electrostatic force experienced by the proton. (4)

[14]

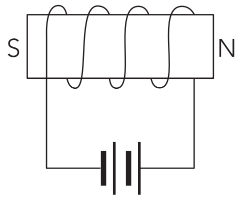
Question 7

Complete the following sketch diagrams, by clearly indicating the direction of the current and the direction of the associated magnetic field:

7.1 A conductor connected to a battery of two cells. (4)



7.2 A coil of wire connected to a battery of two cells. Also label the North and South poles. (4)



7.3 The view of the solenoid in 7.2 when looking from position Y. (4)

[12]

TOTAL: 70

2. Answers for Worksheet 1

Question 1

1.1 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9 \times 10^9)(4 \times 10^{-9})(6 \times 10^{-9})}{(20 \times 10^{-3})^2}$ ✓✓

$= 5,4 \times 10^{-4}$ N attraction ✓ (4)

1.2

Force (N)	Charge 1 (nC)	Charge 2 (nC)	Distance (m)
$F = 5,4 \times 10^{-4}$ N	–4	+6	20×10^{-3}
1,5 F	–4	$Q_2 = 6 \times 1,5 = 9$ ✓	20×10^{-3}
$F_{new} = nF = 4F = 2,16 \times 10^{-3}$ N ✓	–4	+6	1×10^{-2}
0,25 F	–4	+6	$r = 40 \times 10^{-3}$ ✓

(3)

[7]

Question 2

2.1 FROM T to P ✓ (1)

2.2 $Q = \frac{3 \times 10^{-9} + (-6 \times 10^{-9})}{2} = -1,5 \times 10^{-9}$ C ✓

ΔQP = QP(final) – QP(initial)

$= -1,5 \times 10^{-9} - 3 \times 10^{-9}$ ✓

$= -4,5 \times 10^{-9}$ C ✓ (3)

2.3 Number of electrons $= \frac{-4,5 \times 10^{-9}}{-1,6 \times 10^{-19}}$ ✓✓ $= 2,81 \times 10^{10}$ (2)

2.4 $F_{TR} = \frac{kQ_1Q_2}{r^2}$

$= \frac{(9 \times 10^9) + (1,5 \times 10^{-9})(3 \times 10^{-9})}{(1)^2}$ ✓

$= 4,05 \times 10^{-8}$ N to the left/towards P ✓

$F_{PR} = \frac{kQ_1Q_2}{r^2}$

$= \frac{(9 \times 10^9) + (1,5 \times 10^{-9})(3 \times 10^{-9})}{(0,5)^2}$ ✓

$= 1,62 \times 10^{-7}$ N to the right/towards T ✓

Let the direction to the right (towards T) be positive

$F_{net} = 1,62 \times 10^{-7} + (-4,05 \times 10^{-8})$ ✓

$= 1,22 \times 10^{-7}$ N to the right ✓ (6)

[12]

Question 3

3.1 C ✓✓ (2)

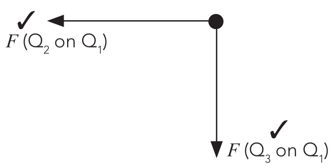
3.2 D ✓✓ (2)

[4]

Question 4

4.1 The magnitude of the electrostatic force exerted by one charge on another is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between their centres. ✓ (2)

4.2



(2)

4.3 $F_{(Q_2 \text{ on } Q_1)} = \frac{kQ_2Q_1}{r^2}$

$= \frac{(9 \times 10^9) + (4 \times 10^{-6})(4 \times 10^{-6})}{(3 \times 10^{-3})^2}$ ✓✓

$= 16\,000$ N left ✓

$F_{(Q_3 \text{ on } Q_1)} = \frac{kQ_3Q_1}{r^2}$ (for both equations)

$= \frac{(9 \times 10^9) + (4 \times 10^{-6})(4 \times 10^{-6})}{(3 \times 10^{-3})^2}$ ✓

$= 16\,000$ N downwards ✓

$F_{net} = 22\,627,42$ N ✓ at 45° south of west ✓ (8)

[12]

Question 5

5.1 The force ✓ per unit charge ✓ at that point. (2)

5.2 $E = \frac{kQ}{r^2}$ ✓

$= \frac{(9 \times 10^9) + (6,5 \times 10^{-12})}{(0,003)^2}$ ✓

$= 6,5 \times 10^3$ N.C^{-1} ✓ (3)

5.3 At point X:

$E_Q = 6,5 \times 10^3$ N.C^{-1} west ✓

$E = \frac{kQ}{r^2}$

$= \frac{(9 \times 10^9) + (6,5 \times 10^{-12})}{(0,003)^2}$

$= 6,5 \times 10^3$ N.C^{-1} east ✓

E_{net} = EQ + ER ✓

$= 6,5 \times 10^3 + (-6,5 \times 10^3)$

$= 0$ N.C^{-1} ✓ (4)

[9]

Question 6

6.1 Negative ✓

The direction of E_1 on the diagram is to the left ✓

This is opposite to that of E_2 which indicates the field for a positive charge ✓ (3)

6.2 $E_2 = \frac{kQ_2}{r^2}$ ✓

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

$= 1\,200$ N.C^{-1} to the right

$E_{net} = E_2 - E_1$ ✓

$1\,600 = 1\,200 - E_1$ ✓

$E_1 = -400$ N.C^{-1}

$E = \frac{kQ_1}{r^2}$

$-400 = \frac{(9 \times 10^9)Q_2}{(0,6)^2}$ ✓

$Q_2 = -1,60 \times 10^{-8}$ C ✓ (7)

6.3 $E = \frac{F}{q}$

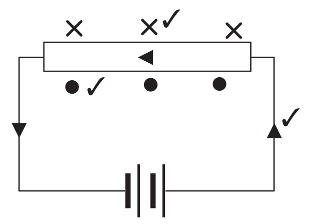
$1\,600$ ✓ $= \frac{F}{1,6 \times 10^{-19}}$

$F = 2,56 \times 10^{-16}$ N right ✓ (4)

[14]

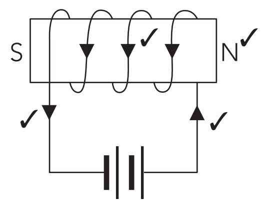
Question 7

7.1



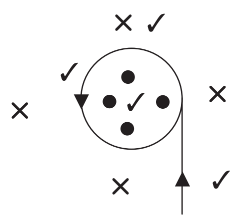
(4)

7.2



(4)

7.3



(4)

[12]

TOTAL: 70