GRADE 10

Physical Sciences

Teacher Toolkit: CAPS Planner and Tracker

2019 TERM 4

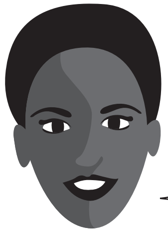
CONTENTS

A. ABOUT THE TRACKER AND RESOURCES

1. Your quick guide to using this planner and tracker

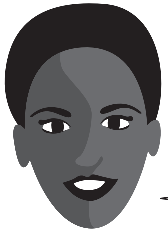
What is the NECT and where do I fit in?

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



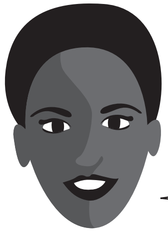
But who will help me?

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



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

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



How do I use the planner and tracker?

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

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

1. Find the textbook that YOU are using.
2. Use the planning page each week to plan your teaching for the week. It will help you link the CAPS content and skills to relevant material in the textbook, the teacher's guide, and other materials such as the DBE workbook.
3. Keep a record of the date when you were able to complete the topic. It may be different from the date you planned, and for different classes. Write this date in the column on the right for your records.
4. At the end of the week, reflect and check if you are up to date. Make notes in the blank space.
5. Be ready to have a professional and supportive curriculum coverage conversation with your HoD (or subject or phase head).

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

2. Purpose of the tracker

The Curriculum and Assessment Planner and Tracker is a tool to support you in your role as a professional teacher. Its main purpose is to help you keep pace with the time requirements and the content coverage of the CAPS by providing the details of what should be taught each day of the term; and of when formal assessments should be done. Each of the sessions for Physical Sciences in Grade 10 is linked to the approved sets of Learner's Books and Teacher's Guides on the National Catalogue, as well as the ***Everything Science*** textbook (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 10 Physical Sciences tracker is based on the requirements prescribed by the Department of Basic Education's Curriculum and Assessment Policy Statement (CAPS) for Physical Sciences in the Further Education and Training (FET) band. The CAPS prescribes four hours per week for Physical Sciences. The work set out in the tracker for each day is linked directly to the topics and subtopics given in the CAPS, with the specified amount of time is allocated to each topic. It gives the page number in the CAPS document of the topics and subtopics being addressed in each session. This enables you to refer to the curriculum document directly should you wish to do so.

4. Links to approved LTSMs

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

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

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

5. Managing time allocated in the tracker

The tracker provides a suggested plan for 16 one-hour sessions, organised into four 60-minute 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.

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. You may decide in certain cases that the suggested homework is too long. In these instances, you are free to choose which aspects of the homework the learners should complete. 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.

Please note:
This tracker has been designed for a fourth term of nine weeks. Four weeks are allocated for covering the set curriculum. Week 5 is for catching up on any work not done in this time and Week 6 has been allocated for revision. This leaves Weeks 7–9 for the end-of-year examinations. In weeks where you have time to catch up, consolidate and revise work, you should plan the work carefully to help learners with topics where they need most help, or where you were not able to cover the curriculum adequately in previous terms. Should you use this tracker in a fourth term of a different duration, or if your school's assessment period is of a different length, you will need to adjust your programme accordingly.

6. Links to assessment

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

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

Further information about assessment is given in Sections B3, C3 and 5 of this document.

7. Resource list

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

8. Columns in the tracker

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

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

9. Weekly reflection

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

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

- Was my preparation for the lesson adequate? For example: Did I have all the necessary resources? Had I thought through the content so that I understood it fully and could teach it effectively?
- Did the purpose of the lesson succeed? For example: Did the learners reach a good understanding of the key concepts for the day? Could the learners use the language expected from them? Could the learners write what was expected from them?
- Did the learners cope with the work set for the day? For example: Did they finish the classwork? Was their classwork done to an adequate standard? Did I assign any homework?

- What can I do to support learners who did not manage the work, or to extend those who completed the work easily?
- What might I change next time I teach this same content? Will I try a different approach?

B. TERM PLANNING

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

1. Check the term focus

Take note of the focus for the term. The CAPS document provides clear details regarding the focus for Grade 10:

Term 4 – ***Physics:***
(3 weeks)
Gravitational potential energy
Kinetic energy
Mechanical energy
Conservation of energy
Chemistry:
(2 weeks)
The hydrosphere
Its composition and interaction with other global systems

Overview of Term 4 topics

Physics

- Define gravitational potential energy of an object as the energy it has because of its position in the gravitational field relative to some reference point
- Define kinetic energy as the energy an object possesses as a result of its motion
- Define mechanical energy as the sum of the gravitational potential and kinetic energy
- State the law of the conservation of energy
- State that in the absence of air resistance, the mechanical energy of an object moving in the Earth's gravitational field is constant

The Physics topics for Term 4 lay the foundation for more complex concepts in later years. These topics also provide a finale for all previous work on energy. Energy conservation (in a closed system) is a vitally important concept in all the sciences. We also need to realise that on Earth, energy dissipated to space increases the entropy of the universe!

Physics is an intellectually demanding discipline and many students have difficulties learning to deal with it. Our instruction is often far less effective than we realise: recent investigations have revealed that many students, even when getting good marks, emerge from their basic Physics courses with significant scientific misconceptions, prescientific notions, poor problem-solving skills, and with an inability to apply what they learned. Students' acquired Physics knowledge is often nominal rather than functional.

Many people believe that Physics is abstract and boring. There is a general view that while physics is intellectually challenging and worthwhile as a mental exercise, it has little relevance to our everyday lives. We need to change these notions of Physics, and bring our learners to an understanding that much of what we do every day functions according to the laws of Physics (walking is a trivial yet important example). Indeed, changing attitudes is very similar to changing erroneous conceptual ideas. Changing ideas and attitudes requires a radical change in outdated teaching methods.

Teachers know that there is a need to move away from the teacher-dominated lecture method of teaching. We also know that many positive steps have been made in this direction (although there are times when teacher talk is necessary). One way of breaking the tedium of the lecture is to intersperse it with short, relevant demonstrations or short learner activities.

Solving Physics problems mathematically is a skill that must be learned and which requires practice. You should ensure that learners become able to solve problems with understanding and are not just copying solutions from each other or your solutions on the chalkboard or whiteboard. Think of Vygotsky's notion of the zone of proximal development and provide learners with problems incrementally.

Learners do not always make the connections that we think are obvious. They move from learning area to learning area in a day and Physical Science lessons may be 24 hours or more apart. There is no guarantee that on entering a Physics class, they are thinking about Physics! They need to be brought back to a previous discussion. When they are engaged in practical work, impress upon them that the activity is related to this or that concept. For example, they can be reminded that working with strings or springs is related to waves, and that music is related to frequency, amplitude and wavelength.

(Some of the comments above are adapted from Frederic Reif's Millikan Lecture 1994.)

Chemistry

- The hydrosphere consists of the Earth's water
- It is found as liquid water (both surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapour in the atmosphere
- Explain how the building of dams affects the lives of the people and the ecology in the region

The Chemistry topic for Term 4, the hydrosphere, provides useful scope for 'science in society' considerations. Remember, however, that it is the chemistry of water that is of prime importance in this module. For this reason, learners are required to test for chemical compounds in the water samples made available to them. These chemical compounds have been introduced to the learners previously, in the context of studying aqueous solutions. Now, there is opportunity to learn about the effect of these compounds on life and communities.

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 textbook your learners will be using. This will ensure that you do not need to either read from the textbook or ask your learners to copy down notes from the chalkboard or projector. If at all possible, try to obtain both the Learner's Books and Teacher's Guides of the publications which your school is **not** using. In this way, you will have a rich collection of resources.

Teaching Physical Sciences should not be based on reading and discussing the textbook. 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 textbooks 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*** textbook. 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. Otherwise resources are listed per week. You will find it worthwhile to collect these well in advance and leave them in a box or something similar. This 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.

Week 1:	Everyday materials like tennis balls, planks, bricks, string, toy cars to show potential energy; paper-and-pencil problem-solving activities (mathematical) for learners to practise
Week 2–3:	A length of plastic pipe approximately 20 mm in diameter, marble, masking tape, measuring tape; everyday materials like tennis balls, planks, bricks, string, toy cars to show potential and kinetic energy; paper-and-pencil problem-solving activities (mathematical) for learners to practise

Week 4: TETRA-test strips to test water (buy from pet shop for fish tanks), silver nitrate, microscope or magnifying glass, filter paper and funnel; newspaper and other articles about water, rivers and dams, especially in South Africa

3. Plan for required assessment tasks

In this term, the formal assessment requirements are a research project and an examination.

All of the Learner's Books and/or Teacher's Guides provide examples of a research project. None of them provides a formal examination paper. An exemplar examination paper is provided in Section F *Assessment Resources* of this tracker.

Table 1 gives an overview of where you can find the research project in each set of LTSMs, and in which week it should be done. This project, and informal assessment activities are shown in the trackers. The examination date will be scheduled by each school. You can use the common paper if one is set by the province, set your own or use the exemplar provided in this tracker.

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

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

Name of book	Formal research project	Examination
Study and Master Physical Sciences	**Week 4:** Research project on dam ecology; LB pp. 311–313; Act. 1; TG D 96	Not provided in LTSM Exemplar examination paper provided in Section F
Platinum Physical Sciences	**Week 4:** Research project on dam ecology; LB pp. 262–264; Act. 2; TG pp. 156–157	Not provided in LTSM Exemplar examination paper provided in Section F
Successful Physical Sciences	**Week 4:** Research project on dam ecology; LB pp. 258–260; Exp. 1; TG pp. 153–157	Not provided in LTSM Exemplar examination paper provided in Section F

C. DAILY LESSON PLANNING AND PREPARATION

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

1. Check your own knowledge of the content

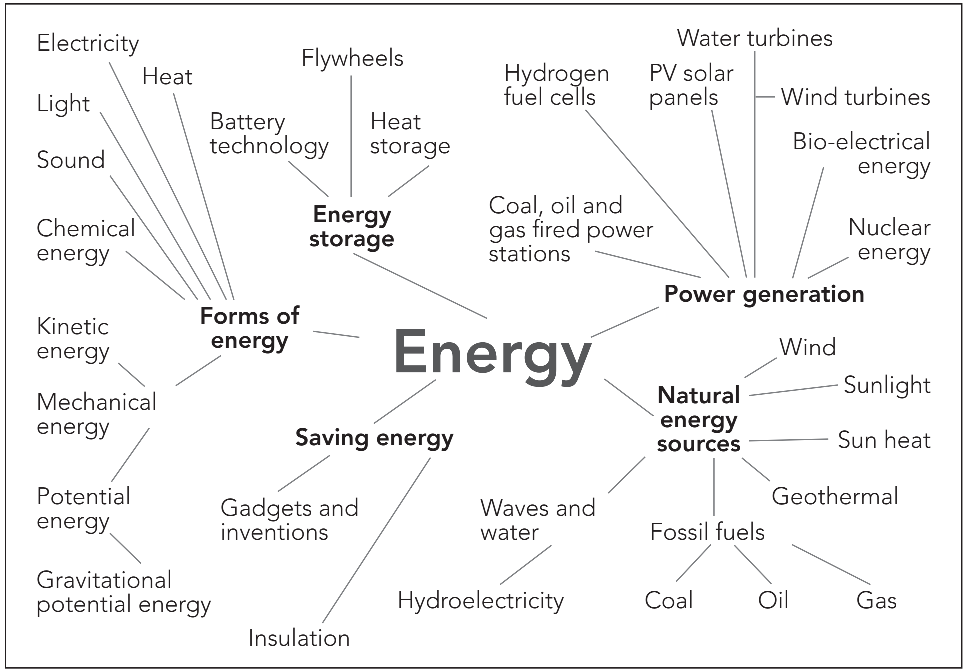
However well you know your work, it is easy to make small mistakes when in a classroom with learners asking questions. Always read through the content that you are going to cover to ensure that you are very familiar with the work. If possible, also do additional reading from other sources. Refer to Section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

2. Prepare the conceptual framework for the lesson topic

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

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

Figure 1: MIND MAP OF KEY CONCEPTS PERTAINING TO ENERGY



Source: https://www.google.co.za/search?q=energy+mind+map&biw=1024&bih=61&tbm=isch&imgil=bDKK4re8DrJe3M%253A%253BklZkw97

The mind map in Figure 1 is taken from a site on the internet. It makes mention of several energy concepts not included in this term's work, but included elsewhere. The concepts included in this term's work appear at the bottom left-hand side of the map, i.e. *kinetic energy, mechanical energy* and *gravitational potential energy*. It would help learners to examine the mind map and discuss the various concepts it contains. For example, they can discuss energy changes during chemical reactions; they can recall previous years' work on sound, light and electricity.

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 the Grade 8 and 9 lessons. 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. 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.

4. Learner activities

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

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

Ensure that you have enough chalk or markers. Where instructions in the Learner's Book that you are using are not clear, use the chalkboard (or whatever media you use in your classroom) to draw or write instructions about what the learners need to do in order to complete the prescribed activity. Chalkboards are also useful for writing down and explaining 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* or provided in Section G *Additional Worksheets* of this document.

8. Homework

It is essential for Grade 10 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 the 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. It may take the form of simple practical demonstrations or an experiment or practical investigation. Even though there is no formal assessment of practical work in Term 4, informal practical work should continue in this term. Learners need to understand and experience that practical work distinguishes science from other subjects.

Learners were required to investigate acceleration and velocity in the formal assessment for Physics in Term 3. You can ask them to recall these investigations when teaching about energy and motion. In this term, they do a small amount of additional practical work on mechanical (kinetic) energy transfer. They also do some practical work on water quality in the Chemistry section.

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 the day before they are required to do the investigation. You could ask them to complete pre-practical questions.

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

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

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

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

D. TRACKERS FOR EACH SET OF APPROVED LTSMs

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

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

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

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

Weekly reflection

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

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

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

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

The prompts for reflection in the tracker are as follows:

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

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

Explanation of abbreviations and symbols used in the trackers

A	Answer
Act.	Activity
CA	Class activity
Ch.	Chapter
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
PA	Practical activity
PD	Practical demonstration
PT	Periodic table
pp.	Pages
Q.	Question
S #	Hour session
TG	Teacher's Guide
TYS	Test Yourself
WS	Worksheet
#	Examined in Grade 12

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

Study and Master Physical Sciences Week 1: 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				
Gravitational potential energy		58										
1	• Define gravitational potential energy of an object as the energy it has because of its position in the gravitational field relative to some reference point	58	296		D90–D91	436–440	270–271 Ex. 22.1					
Homework: ES pp. 436–440												
2	• Determine the gravitational potential energy of an object using $E_p = mgh$	58	296–297	Example p. 297*	D90–D91	440–441	270–271 Ex. 22.1					
Homework: ES pp. 440–441												
Kinetic energy												
3	• Define kinetic energy as the energy an object possesses as a result of its motion	58	297		D90–D91	441–444	271–273 Ex. 22.2					
Homework: ES pp. 441–444												
4	Determine the kinetic energy of an object using $E_k = \frac{1}{2}mv^2$	58	297–298	Example p. 298*	D90–D91	444–446	271–273 Ex. 22.2					
Homework: ES pp. 444–446												

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: Mechanical 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				
Mechanical energy												
1	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	298	*	D90–D91	447–448	273–274 Ex. 22.3 (1)					
Homework: ES pp. 447–448												
2	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	298	*	D90–D91	449–450	273–274 Ex. 22.3 (2)					
Homework: ES pp. 449–450; Complete worksheet *												
Conservation of mechanical energy (in the absence of dissipative forces)		59										
3	• State the law of conservation of energy	59	298		D90–D91	450–451	273–274 Ex. 22.3 (3)					
Homework: ES pp. 450–451												
4	• State that in the absence of air resistance, the mechanical energy of an object moving in the Earth's gravitational field is constant (conserved)	59	298–299		D90–D91	451–452	274 Ex. 22.3 (4)					
Homework: ES pp. 451–452 Example 7												

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: Conservation of 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				
Conservation of mechanical energy (in the absence of dissipative forces)												
1	• Apply the principle of conservation of mechanical energy to various contexts, e.g. the motion of a pendulum bob	59	300–301	*	D90–D91	453–454	275–277 Ex. 22.3 (5)					
Homework: ES pp. 453–454 Example 8												
2	• Apply the principle of conservation of mechanical energy to various contexts, e.g. objects dropped down or thrown vertically upwards	59	300–301		D90–D91	454–455	275–277 Ex. 22.3 (4)					
Homework: Complete worksheet *												
3	• Apply the principle of conservation of mechanical energy to various contexts, e.g. roller coaster problems	59	302	Act. 1	D90–D91	455–456	277–281 End-of-ch. Ex.					
Homework: ES pp. 454–456 Example 9												
4	• Revise the principle of conservation of mechanical energy to various contexts, e.g. inclined plane problems	59	303	Act. 2	D90–D91	456–459	277–281 End-of-ch. Ex.					
Homework: LB p. 304 Assessment Task; ES pp. 456–458 Example 10 and p. 459 Ex. 22–23												

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: The hydrosphere

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**				
The hydrosphere												
	• The hydrosphere consists of the Earth's water • It is found as liquid water (both surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapour in the atmosphere	60										
1	**Its composition and interaction with other global systems** • Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere • Water moves through: air (atmosphere), rocks and soil (lithosphere), plants and animals (biosphere), dissolving and depositing, cooling and warming	60	305–311	Act. 1	D92–97	462–467	282					
Homework: Prepare for Activities 2 and 3 in LB pp. 312–314												
2	**Its composition and interaction with other global systems** • Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere	60	312–314	Act. 2 Act. 3	D92–97	466–467	282					
Homework: Complete scientific report for Act. 3												
3	• Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended experiment for informal assessment**	60	315–319	Act. 4	D92–97	467–468 469 Exp.	282					
Homework: Write up results of Act. 4												
4	• Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended project for formal assessment**	60	311–313	Act. 1	D96		282					
Homework: End-of-chapter exercises p. 471												

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

Study and Master Physical Sciences Week 5: Catch up and consolidation – plan your week

S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1												
Homework												
2												
Homework												
3												
Homework												
4												
Homework												

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

Study and Master Physical Sciences Week 6: Examination preparation

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1												
Homework												
2												
Homework												
3												
Homework												
4												
Homework												

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

Study and Master Physical Sciences Weeks 7–9: End-of-year examinations

Reflect on the year

Think about and make a note of:

1. Did you find that using the tracker helped you to plan your work so that you met the CAPS requirements? In what ways did it help, and how can you make better use of it next year?
2. Were you able to fulfil the requirements of the curriculum for this year? What helped or prevented you from doing this?
3. What concepts and skills did learners grasp well this year? What good practice could you use again next year?
4. What concepts and skills did learners struggle with? How can you help your group next year understand these concepts and develop these skills better?
5. What needs to be communicated to the teacher who will teach this group of learners next year?
6. What have you learnt this year about your own teaching practice? How can you develop your practice?

HOD:

Date:

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

Platinum Physical Sciences **Week 1: 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				
Gravitational potential energy		58										
1	• Define gravitational potential energy of an object as the energy it has because of its position in the gravitational field relative to some reference point	58	242–243		139 See ES	436–440	270–271 Ex. 22.1					
Homework: ES pp. 436–440												
2	• Determine the gravitational potential energy of an object using $E_{\text{p}} = mgh$	58	244	Act. 2	139 See ES	440–441	270–271 Ex. 22.1					
Homework: ES pp. 440–441												
Kinetic energy												
3	• Define kinetic energy as the energy an object possesses as a result of its motion	58	243	Act. 1	139 See ES	441–444	271–273 Ex. 22.2					
Homework: ES pp. 441–444												
4	• Determine the kinetic energy of an object using $E_{\text{k}} = \frac{1}{2}mv^2$	58	243		139 See ES	444–446	271–273 Ex. 22.2					
Homework: ES pp. 444–446												

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: Mechanical 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				
Mechanical energy												
1	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	244	*	138–139	447–448	273–274 Ex. 22.3 (1)					
Homework: ES pp. 447–448												
2	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	244	*	138–139	449–450	273–274 Ex. 22.3 (2)					
Homework: ES pp. 449–450; complete worksheet *												
Conservation of mechanical energy (in the absence of dissipative forces)		59										
3	• State the law of conservation of energy	59	244–245		138–139	450–451	273–274 Ex. 22.3 (3)					
Homework: ES pp. 450–451												
4	• State that in the absence of air resistance, the mechanical energy of an object moving in the Earth's gravitational field is constant (conserved)	59	245–246	Example 1	138–139	451–452	275 Ex. 22.3 (4)					
Homework: ES pp. 451–452 Example 7												

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: Conservation of 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				
Conservation of mechanical energy (in the absence of dissipative forces)												
1	• Apply the principle of conservation of mechanical energy to various contexts, e.g. objects dropped down or thrown vertically upwards, the motion of a pendulum bob	59	246	Example 2*	140	453–454	275–277 Ex. 22.3 (5)					
Homework: ES pp. 453–454 Example 8; LB p. 248 Q. 1												
2	• Apply the principle of conservation of mechanical energy to various contexts, e.g. objects dropped down or thrown vertically upwards	59	247		140–141	454–455	275–277 Ex. 22.3 (4)					
Homework: Complete worksheet *; LB p. 248–251 Q. 2												
3	• Apply the principle of conservation of mechanical energy to various contexts, e.g. roller coaster problems	59	247	Example 3	141–142	455–456	277–281 End-of-ch. Ex.					
Homework: ES pp. 454–456 Example 9; LB p. 250–251 Q. 3												
4	• Revise the principle of conservation of mechanical energy to various contexts, e.g. inclined plane problems	59	247		142	456–459	277–281 End-of-ch. Ex.					
Homework: ES pp. 456–458 Example 10 and p. 459 Ex. 22–3; LB p. 251 Q. 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 Week 4: The hydrosphere

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				
The hydrosphere												
	- The hydrosphere consists of the Earth's water - It is found as liquid water (both surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapour in the atmosphere	60										
1	**Its composition and interaction with other global systems** - Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere	60	253–255		150 Target worksheet A	467 468 School project	282					
Homework: LB p. 265 Q. 1												
2	- Explain how the building of dams affects the lives of the people and the ecology in the region	60	257	Act. 1	151–152	468 Project	282					
Homework: LB p. 265 Q. 2.1–2.4; Target worksheet B												
3	- Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended experiment for informal assessment**	60	258–262	Exp.1	152	471 End-of-ch. Ex.	282					
Homework: Complete write-up of Experiment 1; start LB p. 265 exam practice questions												
4	- Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended project for formal assessment**	60	262–264	Act. 2	156–157	466	282					
Homework: LB p. 265 Q. 2.5–2.6; complete LB p. 265 exam practice questions												

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

Platinum Physical Sciences Week 5: Catch up and consolidation – plan your week

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB act.	TG pp.	*Everything Science*		Class				
						LB pp.	TG pp.	Date completed				
1												
Homework												
2												
Homework												
3												
Homework												
4												
Homework												

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

Platinum Physical Sciences Week 6: Examination preparation

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												
Homework												
2												
Homework												
3												
Homework												
4												
Homework												

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

Platinum Physical Sciences Weeks 7–9: End-of-year examinations

Reflect on the year

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

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

Successful Physical Sciences Week 1: 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				
Gravitational potential energy		58										
1	• Define gravitational potential energy of an object as the energy it has because of its position in the gravitational field relative to some reference point	58	248–249	Example 1	159	436–440	270–271 Ex. 22.1					
Homework: ES pp. 436–440												
2	• Determine the gravitational potential energy of an object using $E_p = mgh$	58	249–250	Act. 1	159–160	440–441	270–271 Ex. 22.1					
Homework: ES pp. 440–441												
Kinetic energy												
3	• Define kinetic energy as the energy an object possesses as a result of its motion	58	250–251	Example 2	160–161	441–444	270–273 Ex. 22.2					
Homework: ES pp. 441–444												
4	• Determine the kinetic energy of an object using $E_k = \frac{1}{2}mv^2$	58	250–251		160–161	444–446	270–271 Ex. 22.2					
Homework: ES pp. 444–446												

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?s
	HOD: **Date:**

Successful Physical Sciences Week 2: Mechanical 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				
Mechanical energy												
1	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	251	Act. 2	162–163	447–448	273–274 Ex. 22.3 (1)					
Homework: ES pp. 447–448												
2	• Define mechanical energy as the sum of the gravitational potential and kinetic energy	58	251–252	Act. 2	163	449–450	273–274 Ex. 22.3 (2)					
Homework: ES pp. 449–450; complete worksheet *												
Conservation of mechanical energy (in the absence of dissipative forces)		59										
3	• State the law of conservation of energy	59	252		163	450–451	273–274 Ex. 22.3 (3)					
Homework: ES pp. 450–451												
4	• State that in the absence of air resistance, the mechanical energy of an object moving in the Earth's gravitational field is constant (conserved)	59	253–254	Prac. Dem. 1	163	451–452	274 Ex. 22.3 (4)					
Homework: ES pp. 451–452 Example 7												

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?s
	HOD: **Date:**

Successful Physical Sciences Week 3: Conservation of 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				
Conservation of mechanical energy (in the absence of dissipative forces)												
1	• Apply the principle of conservation of mechanical energy to various contexts, e.g. objects dropped down or thrown vertically upwards, the motion of a pendulum bob	59	254–255	Act. 2	163–167	453–454	275–277 Ex. 22.3 (5)					
Homework: ES pp. 453–454 Example 8												
2	• Apply the principle of conservation of mechanical energy to various contexts, e.g. objects dropped down or thrown vertically upwards	59	255–256		163–167	454–455	275–277 Ex. 22.3 (4)					
Homework: Complete worksheet *												
3	• Apply the principle of conservation of mechanical energy to various contexts, e.g. roller coaster problems	59	257	Act. 3	163–167	455–456	277–281 End-of-ch. Ex.					
Homework: ES pp. 454–456 Example 9												
4	• Revise the principle of conservation of mechanical energy to various contexts, e.g. inclined plane problems	59	259–260	Revision questions	168–174	456–459	277–281 End-of-ch. Ex.					
Homework: ES pp. 456–458 Example 10 and p. 459 Ex. 22–23												

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?s
	HOD: **Date:**

Successful Physical Sciences Week 4: The hydrosphere

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				
The hydrosphere												
	- The hydrosphere consists of the Earth's water - It is found as liquid water (both surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapour in the atmosphere	60										
1	**Its composition and interaction with other global systems** - Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere - Water moves through: air (atmosphere), rocks and soil (lithosphere), plants and animals (biosphere), dissolving and depositing, cooling and warming	60	261–264	Act. 1 175	464–465		283					
Homework: LB p. 271 The hydrosphere – Q. 1 & 2												
2	**Its composition and interaction with other global systems** - Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere	60	265–266	Act. 1	176	466	283					
Homework: LB p. 271 The hydrosphere – Q. 3 & 4												
3	- Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended project for formal assessment**	60	258–260	Exp. 1	153–157	467–468 School project	283					
Homework: LB p. 271 Human interaction – Q. 1 & 2												
4	- Explain how the building of dams affects the lives of the people and the ecology in the region **Recommended project for informal assessment**	60	269	Project 2, 3 or 4	177–178	469 Exp.	283					
Homework: Complete revision questions LB p. 271 OR Project 3 or 4; ES p. 471 End-of-chapter exercises												
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?s **HOD:**					**Date:**				

Successful Physical Sciences Week 5: Catch up and consolidation – plan your week

<table>
<tr><th rowspan="3">S #</th><th rowspan="3">CAPS concepts, practical activities and assessment tasks</th><th rowspan="3">CAPS pp.</th><th rowspan="3">LB pp.</th><th rowspan="3">LB act.</th><th rowspan="3">TG pp.</th><th colspan="2" rowspan="2">Everything Science</th><th colspan="5">Class</th></tr>
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<tr><th>LB pp.</th><th>TG pp.</th><th colspan="5">Date completed</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="13">Homework</td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="13">Homework</td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="13">Homework</td></tr>
<tr><th colspan="13">Reflection</th></tr>
<tr><td colspan="5" rowspan="2">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?</td><td colspan="8">What will you change next time? Why?</td></tr>
<tr><td colspan="5">HOD:</td><td colspan="3">Date:</td></tr>
</table>

Successful Physical Sciences Week 6: Examination preparation

S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB act.**	**TG pp.**	***Everything Science***		**Class**				
						LB pp.	**TG pp.**	**Date completed**				
1												
Homework												
2												
Homework												
3												
Homework												
4												
Homework												

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

Successful Physical Sciences Weeks 7–9: End-of-year examinations

Reflect on the year

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

E. ADDITIONAL INFORMATION AND ENRICHMENT ACTIVITIES

CAPS concepts, practical activities and assessment tasks	Additional information and enrichment activities
Introductory remarks regarding the energy concept	
Energy	Learners may have the following misconceptions about energy: • Energy is truly lost in many energy transformations/transfers • If energy is conserved, why are we running out of it? • Energy can be changed completely from one form to another (no energy losses) • An object at rest has no energy • The only type of potential energy is gravitational • Gravitational potential energy depends only on the height of an object • Doubling the speed of a moving object doubles the kinetic energy • Energy is a substance (it is difficult to imagine an 'amount' of an abstraction) A diagnostic test would reveal many of these wrong ideas. Encourage learners to understand that energy is a unifying theme in the sciences because both living and non-living things have energy. Absolute zero (–273 °C) is the point where an object has no energy. Refer to the concept map at this point and encourage discussion. Some educators prefer to discuss energy in terms of 'transfer' and others use the concept of 'transformation'. In a paper presented at the 2011 NARST Annual Conference, Orlando, FL, Cari F. Herrmann-Abell and George E. DeBoer isolated the main ideas subsumed by these concepts, including energy conservation: • **Transformation**: Energy can be transformed within a system (meaning that energy can take a number of **forms** such as heat, light, sound). • **Transfer:** Energy can be transferred from one object or system to another in different ways: by conduction, mechanically, electrically, or by electromagnetic radiation. • **Conservation**: Regardless of what happens within a system, the total amount of energy in the system remains the same unless energy is added to or released from the system.
Weeks 1 to 3: Energy transfer and conservation	
Gravitational potential energy; kinetic energy; energy conservation	Refer to the list of misconceptions above and check learners' understanding of the concepts. Note that although many learners can state the law of conservation of energy, they find it difficult to apply this law in certain scenarios. This lack of understanding will be revealed when learners experience difficulty solving energy problems.
Week 4: The hydrosphere	
Its composition and interaction with other global systems	During these weeks, a project about water quality is required. This can be done fairly quickly. However, if you find that you have extra time, you could encourage learners to spend this additional time on enriched project reading and research.

F. ASSESSMENT RESOURCES

1. Sample item analysis sheet

SUGGESTED ITEM ANALYSIS RECORD SHEET FOR FORMAL ASSESSMENT

Learner name	Learner surname	Portfolio mark	Physics Written examination					Chemistry Written examination							Total
			Questions					Questions							
			1	2	3	4	Total	1	2	3	4	5	6	Total	
MAX MARKS		100	20	34	31	65	150	20	19	42	33	21	15	150	400

INSTRUCTIONS AND INFORMATION

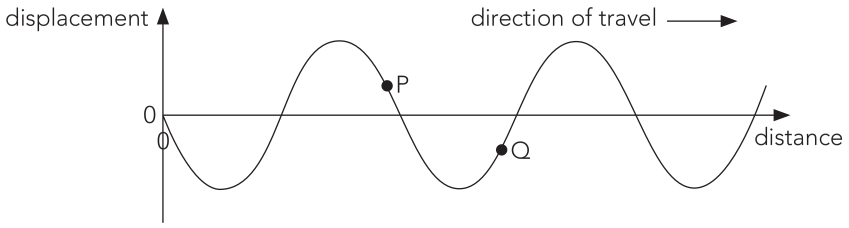
1. This paper consists of 4 questions, a data and formula sheet, and an answer sheet. Make sure that your question paper is complete.
2. **Write your name on the answer sheet.**
3. Read the questions carefully.
4. Make use of the data and formulae whenever necessary.
5. **Question 1** consists of 10 multiple choice questions. There is only one correct answer to each question. On the answer sheet, place a cross (X) over the letter (A, B, C or D) that corresponds with your choice of the correct answer.
6. **Start each question on a new page.**
7. Write legibly and set your work out neatly.
8. Answer **all** questions.
9. Show your working clearly in all calculations.
10. Round up answers to two decimal places where appropriate.
11. Units need not be included in the working of calculations, but appropriate units should be shown in the answer.

Question 1

Multiple choice questions

There is only one correct answer to each question. On the answer sheet, place a cross (X) over the letter (A, B, C or D) that corresponds with your choice of the correct answer.

1.1 A transverse wave travels along a rope. The graph shows the variation of displacement with distance along the rope at a certain time. The wave is travelling to the right.



In which direction are the points P and Q on the rope moving?

	Movement of P	**Movement of Q**
A	downwards	downwards
B	upwards	downwards
C	downwards	upwards
D	upwards	upwards

(2)

1.2 SABC broadcasts radio waves from its various stations. The radio wave transmitter sends a

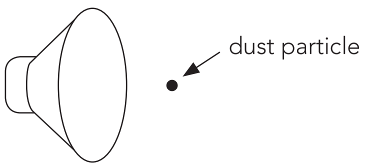
A longitudinal wave

B sound wave

C mechanical wave

D transverse wave (2)

1.3 A particle of dust is floating at rest 10 cm directly in front of a loudspeaker. The loudspeaker is not working. Then the loudspeaker emits a sound of frequency 10 Hz with a speed of 330 $m.s^{-1}$.



Which one of the following statements best describes the motion of the particle of dust when the loudspeaker emits the sound?

A The particle of dust remains at rest.

B The particle of dust moves vertically up and then down at 10 Hz maintaining its average position of 10 cm in front of the loudspeaker.

C The particle of dust moves horizontally forward and backward at 10 Hz maintaining its average position of 10 cm in front of the loudspeaker.

D The particle of dust moves at 330 $m.s^{-1}$ away from the loudspeaker while moving forwards and backwards at 10 Hz. (2)

1.4 The Earth's magnetic field runs through the earth from the magnetic south pole to the magnetic north pole. The north pole of a bar magnet is attracted to the magnetic north pole of the earth. This happens because

A The Earth's north pole is actually a magnetic south pole.

B The Earth's north pole is actually a magnetic north pole.

C The bar magnet's north pole is actually a magnetic south pole.

D Like magnetic poles repel each other. (2)

1.5 Which one of the following units is equivalent to the volt (V)?

A $A.C^{-1}$

B $J.C^{-1}$

C $A.s^{-1}$

D $J.A^{-1}$ (2)

1.6 Which one of the following quantities is a vector quantity?

A distance

B speed

C displacement

D kinetic energy (2)

1.7 Which of the following statements is/are TRUE about a vehicle travelling at a constant velocity?

I It must be travelling in a straight line.

II It travels at the same speed as the magnitude of its velocity.

III Its displacement increases by the same amount in each time interval.

A I only

B I and II only

C II and III only

D All the statements are true (2)

1.8 A ball is thrown up into the air to reach a maximum height of 4 m above a boy's hand. When the ball returns, the boy catches it in the same position as that from where it was launched into the air.

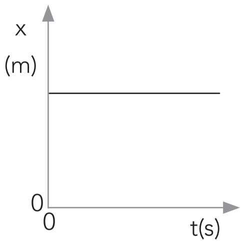
Which of the following values are BOTH correct for distance covered and the ball's displacement from the time it was launched to the time it was caught?

	Distance (m)	Displacement (m)
A	8	8
B	8	0
C	0	8
D	0	0

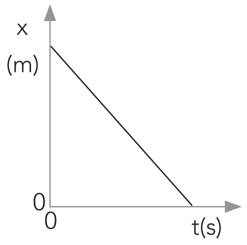
(2)

1.9 Which graph shows the variation of position versus time for an object moving with constant velocity towards you?

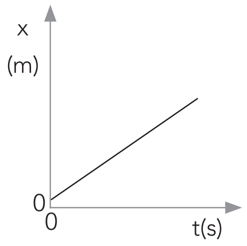
A



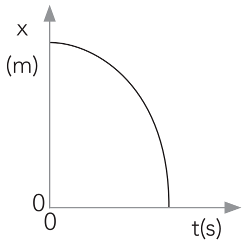
B



C



D



(2)

1.10 When a car (mass m) travels at velocity of **v**, its kinetic energy is **K**. What is its kinetic energy (in terms of **K**) when it travels at twice the velocity (that is, at a velocity of 2**v**)?

A $\frac{1}{4}$ **K**

B $\frac{1}{2}$ **K**

C 2 **K**

D 4 **K** (2)

10 × (2) = **[20]**

Question 2

2.1 A transverse wave with a wavelength of 60 mm is generated every 0,2 s in a ripple tank. A small cork, floating on the water, bobs up and down through a total vertical distance of 6 mm.

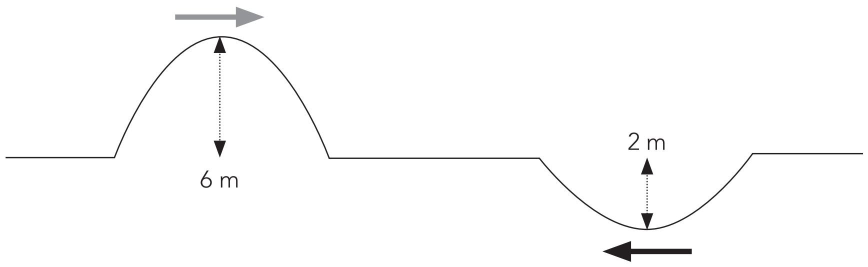
2.1.1 Define the amplitude of a wave. (2)

2.1.2 Calculate the amplitude of this wave. (2)

2.1.3 Calculate the frequency of the wave. (3)

2.1.4 Calculate the speed of the waves. (3)

2.2 A crest 6 m tall approaches a trough of depth 2 m travelling in the opposite direction in the ocean, as represented in the diagram below.



2.2.1 State the phenomenon that takes place when the crest and trough meet. (2)

2.2.2 Draw a diagram to show the pulse which results when the waves cross. (2)

2.3 A salvage ship sends a SONAR signal to the bottom of the ocean to determine the ocean depth. A return signal is received 3 s later. The speed of sound in sea water is 1 450 $m.s^{-1}$.

2.3.1 Name the phenomenon which causes the signal to return from the bottom of the ocean. (1)

2.3.2 Calculate the depth of the ocean at that point. (4)

2.4 You can tell how far away a thunderstorm is by measuring the time between a flash of lightning and hearing the clap of thunder. One evening you see a flash of lightning and 3 s later you hear the clap of thunder.

2.4.1 Explain why you see the flash of lightning first. (1)

2.4.2 Explain how thunder is produced. (3)

2.5 In 1969, Neil Armstrong was the first man to walk on the Moon. He spoke to the mission control centre in Houston, USA, using a radio telephone. He also kept in contact via radio telephone with his fellow astronaut Buzz Aldrin while they walked on the Moon's surface. The conditions on the Moon do not support life. There is no air, and therefore no oxygen, and no clouds in the lunar sky. The astronauts wore spacesuits to maintain a comfortable temperature and pressure on their bodies, and to protect them from high-energy electromagnetic radiation, such as ultraviolet, X-rays and gamma rays.

2.5.1 The radio frequency which Neil Armstrong used to contact Earth was 2 287,5 MHz. Calculate:

a) The wavelength of the radio waves (in m). (4)

b) The time (in s) it took for the radio signal to reach the Earth, given that the distance of the Moon from the Earth is $3,84 \times 10^8$ m. (3)

2.5.2 Explain why Buzz and Neil had to use a radio telephone to speak to one another, because they would not have heard a sound if they tried to communicate by shouting at each other. (2)

2.5.3 Gamma rays are the highest energy type of electromagnetic radiation.

a) Give one use of gamma radiation. (1)

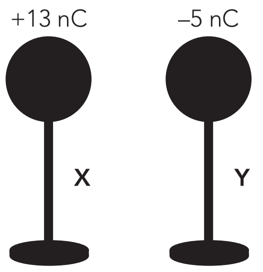
b) Give one danger of gamma radiation. (1)

[34]

Question 3

3.1 **X** and **Y** are two identical metal spheres mounted on insulated stands.

X has a charge of +13 nC and **Y** has a charge of –5 nC.



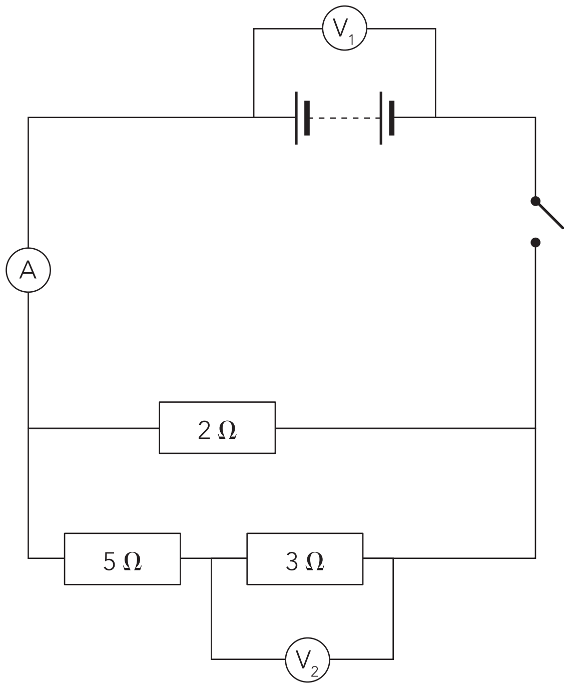
3.1.1 Determine how many more electrons than protons there are on **Y**, the –5 nC charge. (4)

3.1.2 Will the electrostatic force between the spheres be one of **attraction** or of **repulsion**? (1)

3.1.3 The spheres are brought together and touch each other; then they are separated. Determine the charge (in nC) on sphere **X** after it has separated from sphere **Y**. (3)

3.1.4 State the principle which you used to calculate the charge on sphere **X** in 3.1.3. (2)

3.2 Consider the electric circuit shown below.



3.2.1 Define potential difference. (2)

3.2.2 Calculate the effective resistance of the circuit. (4)

3.2.3 When the switch is closed, the reading on voltmeter V_1 is 9,6 V. Calculate the following:

a) The potential difference across the 2 W resistor (1)

b) The reading on V_2 (4)

3.3 A current of 2,0 A passes through a resistor of 15 W for 3 minutes.

3.3.1 Define electric current. (2)

3.3.2 Calculate the amount of charge which passes through the resistor. (4)

3.3.3 Calculate the amount of energy transferred to the resistor in 3 minutes. (4)

[31]

Question 4

4.1 A hiker has walked 7 km North and then 4 km West from the town. He has fallen and is badly injured. He does not know his geographical location, but sends a distress message for help, telling the rescue station the route he followed.

You are at the rescue station in the town where he began his hike and you are asked to plot the quickest way to reach the hiker by helicopter.

4.1.1 Draw a labelled vector diagram which can help you find the hiker's displacement. (3)

4.1.2 Determine the hiker's displacement from the town. (5)

4.1.3 Explain the difference between the hiker's displacement and his distance from the town. (4)

4.2 A car (mass 1 000 kg) accelerates uniformly along a straight horizontal road moving from rest to a speed of 40 $m.s^{-1}$ over a distance of 600 m.

4.2.1 Define the term acceleration. (2)

4.2.2 What is the displacement of the car during this motion? (2)

4.2.3 Does the car exceed the speed limit of 120 $km.h^{-1}$? Show your reasoning. (3)

4.2.4 Determine the magnitude of the acceleration of the car. (4)

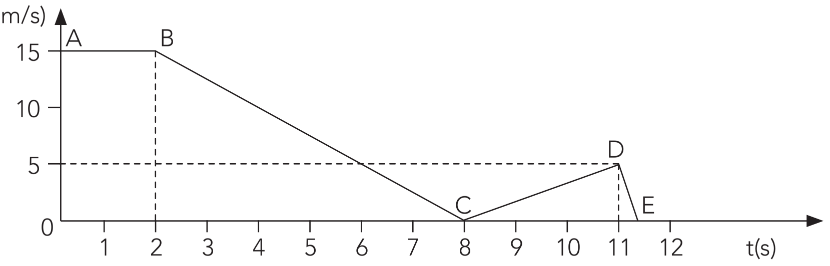
4.2.5 For how long (in s) does the car accelerate? (4)

4.2.6 Draw a neat sketch graph of **displacement–time** for the motion of this car for this period of time. Label the axes with the relevant values which you have been given and which you have calculated. (4)

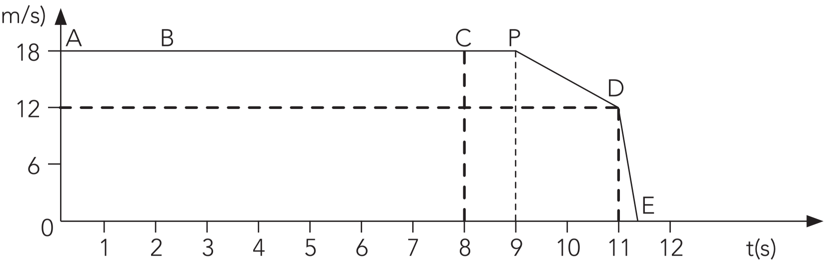
4.2.7 Calculate the kinetic energy gained by the car during this motion. (4)

4.3 Study the velocity–time graphs shown below. The first graph shows the motion of a car and the second graph shows the motion of a motorcycle as they both approach and collide at an intersection.

CAR

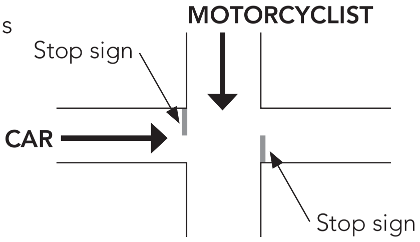


MOTORCYCLIST



The diagram alongside shows the intersection, which has a stop street for the car and right of way (no stop street) for the motorcyclist.

The motorcyclist says that the car did not stop at the stop sign.



The driver of the car claims that the motorcyclist was more than 80 m from the intersection when he drove his car into the intersection. The motorcyclist was going too fast.

Using these facts and accusations, you are going to decide which person was at fault.

4.3.1 Describe the motion of the car from

- a) A to B (1)
- b) B to C (2)
- c) C to D (1)
- d) D to E (1)

4.3.2 Did the car stop at the stop street? Use evidence from the graph of the car's motion to answer this question. (2)

4.3.3 Calculate the acceleration of the car from 2 s to 8 s. (4)

4.3.4 Calculate the distance travelled by the motorcyclist during the time 8 s to 11 s (that is, from the time when the car entered the intersection to the time that they collided). (4)

4.3.5 From the evidence and calculations which you have performed, who was at fault for this accident? Was it the driver of the car, the motorcyclist, or were both of them in the wrong? Justify your answer briefly. (2)

4.4 A 20 kg rock falls vertically from rest off a cliff into the sea. The cliff is 12 m high. Ignore any effects of air resistance.

4.4.1 Define gravitational potential energy. (2)

4.4.2 Calculate the gravitational potential energy of the rock relative to sea level. (4)

4.4.3 State the law of conservation of mechanical energy. (2)

4.4.4 Calculate the velocity of the rock when it hits the sea. (5)

[65]

TOTAL MARKS: 150

TIME: 2 HOURS

END OF TEST

ANSWER SHEET

NAME: ____

Question 1

Multiple choice questions

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

DATA SHEET

GRADE 10 TERM 4

Table 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Approximate magnitude of acceleration due to gravity	G	9,8 m·s^{-2}
Speed of light in a vacuum	C	3,0 × 10^{8} m·s^{-1}
Speed of sound in air	V	330 m·s^{-1}
Magnitude of charge on electron	E	1,6 × 10^{-19} C

Table 2: FORMULAE

MOTION

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

ENERGY AND POWER

$E_p = mgh$	$E_k = \frac{1}{2}mv^2$	$P = \frac{W}{t}$

ELECTRIC CIRCUITS

$I = \frac{Q}{t}$	$V = \frac{W}{Q}$
$R_T = R_1 + R_2 + \ldots$	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$W = Pt$	$P = VI = I^2R = \frac{V_2}{I}$

WAVES, LIGHT AND SOUND

$c = f\lambda$	$f = \frac{1}{T}$

3. Physical Sciences Grade 10: End-of-Year Physics Examination Memorandum

Question 1

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

Question 2

2.1 2.1.1 The amplitude of a wave is the maximum displacement of a particle from its rest position. ✓✓ (2)

2.1.2 Amplitude or A = $\frac{1}{2}$(0,006) ✓ (method)

= 0,003 m ✓

OR Amplitude = $\frac{1}{2}$(6) ✓ (method)

= 3 mm ✓ [–1 if no or incorrect SI units] (2)

2.1.3 $f = \frac{1}{T}$ ✓ (method)

= $\frac{1}{0,2}$ ✓ (substitution)

= 5 Hz ✓ (accuracy; SI units) (3)

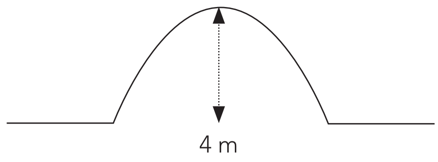
2.1.4 $v = f\lambda$ ✓ (method)

= (5)(0,06) ✓ (substitution; conversion to m)

= 0,30 m.s^{-1} ✓ (accuracy; SI units) (3)

2.2 2.2.1 destructive ✓ interference ✓ (2)

2.2.2



Shape of pulse ✓

Amplitude of pulse ✓ (2)

2.3 2.3.1 reflection OR echo ✓ (1)

2.3.2 Distance = speed × time ✓ (method)

= (1 450)(3) ✓ (substitutions)

= 4 350 m

Depth = $\frac{1}{2}$distance ✓ (method)

= 2 175 m ✓ (accuracy; SI units) (4)

2.4 2.4.1 The speed of light is much faster than the speed of sound. ✓ (1)

2.4.2 Sound is caused by pressure difference (pressure waves) travelling through the air. ✓ When the electric current of a lightning bolt travels through the air, it causes a sudden great difference in pressure ✓ as the charge accelerates (moves, flows) between the Earth and the clouds. ✓ This causes thunder. (3)

2.5 2.5.1 a) $v = f\lambda$ ✓ (method)

$3 \times 10^8 = (2\,287,5 \times 10^6)\lambda$ (substituting speed of light ✓; conversion ✓)

$\lambda = \frac{3 \times 10^8}{2\,287,5 \times 10^6}$

= 0,13 m ✓ (accuracy; SI units) (4)

b) distance = speed × time ✓ (method)

$3,84 \times 10^8 = 3 \times 10^8 t$ ✓ (substitutions)

t = 1,28 s ✓ (accuracy; SI units) (3)

2.5.2 There is no atmosphere on the Moon. ✓

Sound waves require a medium in which to propagate (travel). ✓ (2)

2.5.3 a) Radiation treatment of cancer

Radiation of food to keep it free from microbes (keep it fresh for longer)

OR any other valid use ✓ (1)

b) Highly penetrating radiation harms living cells ✓ (can cause mutations or cancer)

[Do not accept a vague statement that 'they are harmful'] (1)

[34]

Question 3

3.1 3.1.1 Number of electrons = $\frac{Q}{e}$ ✓ (method)

$= \frac{-5 \times 10^{-9} \checkmark}{-1{,}6 \times 10^{-19} \checkmark}$ (conversion; substitution for e)

$= 3{,}13 \times 10^{10}$ ✓ (accuracy; no units required) (4)

3.1.2 attraction ✓ (1)

3.1.3 $Q = \frac{+13-5 \checkmark}{2 \checkmark}$ (finding the total charge (in nC); dividing by 2)

= +4 ✓ nC (accuracy; no SI units required) (3)

3.1.4 Charge cannot be created or destroyed. ✓ It can only be transferred from one object to another. ✓

(OR Law of conservation of charge ✓ – award 1 mark because the reasoning is correct) (2)

3.2 3.2.1 The potential difference between two points in a circuit is the amount of energy transferred (or work done) per unit charge passing through. ✓✓ (2)

3.2.2 $R_s = 5 + 3$ ✓ (method or correct answer of 8)

$= 8\ \Omega$

OPTION 1

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ (method)

$= \frac{1}{2} + \frac{1}{8}$ ✓ (substitutions)

$= \frac{5}{8}$

$R = \frac{5}{8}$

$= 1{,}6\ \Omega$ ✓ (accuracy; SI units; <u>must</u> say R = ..) (4)

OPTION 2

$R_p = \frac{2 \times 8}{2 + 8}$ ✓✓ (method; substitutions)

$= 1{,}6\ \Omega$ ✓ (accuracy; SI units)

3.2.3 a) 9,6 V ✓ (1)

b) Voltage across parallel branch = 9,6 V

A series circuit is a potential difference divider.

The 9,6 V will split up over the 3 W and the 5 W resistor in proportion to the resistors.

$V_{3\Omega} = \frac{5 \checkmark}{8 \checkmark} \times 9{,}6$ ✓ (method; substituting 3; substituting 8)

= 3,6 V ✓ (accuracy; SI units)

ALTERNATIVE SOLUTION

Some candidates may have learnt how to use Ohm's Law $V = IR$

$V = IR$

9,6 ✓ = I (8) ✓ (method; substitutions)

$I = \frac{9{,}6}{8} = 1{,}2$ A

$V_{3\Omega} = (1{,}2)(3)$ ✓ (substitutions)

= 3,6 V ✓ (accuracy; SI units) (4)

3.3 3.3.1 Electric current is the rate of flow of charge. ✓✓ (2)

3.3.2 $Q = I\Delta t$ ✓ (method)

$= (2{,}0)\,(3 \times 60)$ ✓✓ (substitutions; conversion to seconds)

$= 360$ C ✓ (accuracy; SI units) (4)

3.3.3 $W = I^2R\Delta t$ ✓ (method)

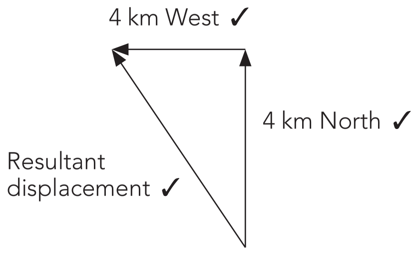
$= (2{,}0)^2(15)$ ✓ (3×60) ✓ (substitutions; conversion to seconds)

$= 10\ 800$ J ✓ (accuracy; SI units) (4)

[31]

Question 4

4.1 4.1.1



(NB Arrows in the correct directions) (3)

4.1.2 $R^2 = 4^2 + 7^2$ ✓ (method)

$R = 8{,}06$ km ✓ (accuracy; SI units)

$\tan \theta = \frac{4}{7}$ ✓ (method OR equivalent method)

$\theta = 29{,}74°$ ✓ (accuracy) west of north ✓ (direction)

OR 60,26° north of west (5)

4.1.3 Distance is the path length. ✓ The hiker's distance is 4 + 7 = 11 km. ✓

Displacement is the change in position. ✓

His displacement is 8,06 km at 29,74° W of N. ✓ (4)

4.2 4.2.1 Acceleration is the rate of change of velocity. ✓✓ (2)

4.2.2 600 m ✓ forwards ✓ (2)

4.2.3 Yes. ✓

$40\ \text{m.s}^{-1} = 40 \times \frac{60 \times 60}{1\ 000}$ ✓ (method)

$= 144\ \text{km.h}^{-1}$ ✓ (accuracy; SI units) (3)

4.2.4 $v_f^2 = v_i^2 + 2a\Delta x$ ✓ (method)

$(40)^2$ ✓ $= 0 + 2a(600)$ ✓ (substitutions)

$a = \frac{1\ 600}{1\ 200}$

$= 1{,}33\ \text{m.s}^{-2}$ ✓ (accuracy; SI units) (4)

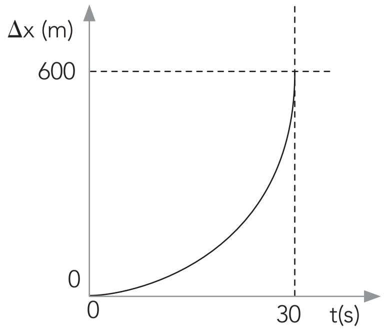
4.2.5 $v_f = v_i + a\Delta t$ ✓ (method)

40 ✓ $= 0 + 1{,}33\Delta t$ ✓ (substitutions; c.o.e. from 4.2.4)

$\Delta t = \frac{40}{1{,}33}$ ✓

= 30 s (or 30,08 s round up 'error') ✓ (accuracy; SI units) (4)

4.2.6



✓ y-axis and its values

✓ x-axis and its values

✓ shape (parabola curving upwards)

✓ coordinates of 30 s and 600 m (4)

4.2.7 $E_k = \frac{1}{2}mv^2$ ✓ (method)

$= \frac{1}{2}(1\,000)$ ✓ $(40)^2$ ✓ (substitutions)

= 800 000 J ✓ (accuracy; SI units) (4)

4.3 4.3.1 a) AB: Constant velocity (forward) ✓

b) BC: Constant acceleration; ✓ slowing down ✓

c) CD: Constant acceleration (speeding up) ✓

d) DE: Constant acceleration (slowing down to stop) ✓ (5)

4.3.2 No. The car slowed down ✓ but it began accelerating (speeding up) immediately before the velocity was 0 m.s^{-1}. ✓ (2)

4.3.3 a = gradient of the v–t graph

$= \frac{1 - 15}{8\ 2}$ ✓ (correct values for 'rise' over 'run')

= –2,3 ✓ (accuracy; – negative sign)

= 2,3 m.s^{-2} backwards (in the opposite direction of its motion) ✓

[stating the value as positive with appropriate direction] (4)

4.3.4 Distance = area under the v–t graph

$= \frac{1}{2}(11 - 8)(12)$ ✓ $+ (9 - 8)(6)$ ✓ $+ \frac{1}{2}(11 - 9)(6)$ ✓ or equivalent method

= 48 m ✓ (accuracy; SI units) (4)

4.3.5 The driver of the car caused the accident because (s)he did not stop at the stop street ✓ and (s)he did not see the motorcyclist who was well within 80 m of the stop street at the time the driver entered the intersection. ✓ (2)

4.4 4.4.1 Gravitational potential energy is the energy an object possesses due to its height ✓ above a reference point. ✓ (2)

4.4.2 $E_p = mgh$ ✓ (method)

= (20)(9,8) ✓ (12) ✓ (substitutions)

= 2 352 J ✓ (accuracy; SI units) (4)

4.4.3 In an isolated system ✓ mechanical energy remains constant. ✓ (2)

4.4.4 $E_{\text{mechanical at the top of the cliff}} = E_{\text{mechanical at the bottom of the cliff}}$

$mgh_{\text{top}} + \frac{1}{2}mv_i^2 = mgh_{\text{bottom}} + \frac{1}{2}mv_f^2$ ✓ (method)

$2\,352 + 0$ ✓ $= 0 + \frac{1}{2}(20)v_f^2$ ✓ (substitutions)

$v_f^2 = \frac{2\,352}{10}$ ✓

$v_f = 15{,}34$ m.s^{-1} ✓ down ✓ (accuracy; SI units; direction) (5)

[65]

TOTAL MARKS: 150

4. Cognitive Analysis for Physical Sciences Grade 10: End-of-Year Physics Examination

	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Waves, light and sound	Electricity and magnetism	Mechanics and energy
Target %	15.0	35.0	40.0	10.0	40	35	75
Target (marks)	22	60	53	15	27	23	50
Actual (marks)	21	56	56	17	40	35	75
Actual %	14.0	37.3	37.3	11.3	26.7	23.3	50.0
Question 1							
1.1			2		2		
1.2		2			2		
1.3				2	2		
1.4		2				2	
1.5		2				2	
1.6		2					2
1.7			2				2
1.8		2					2
1.9				2			2
1.10				2			2
Question 2							
2.1.1	2				2		
2.1.2		2			2		
2.1.3		3			3		
2.1.4		3			3		
2.2.1		1	1		2		
2.2.1			2		2		
2.3.1		1			1		
2.3.2			4		4		
2.4.1		1			1		
2.4.2		3			3		
2.5.1 a)			4		4		
2.5.1 b)			3		3		
2.5.2				2	2		
2.5.3 a)	1				1		
2.5.3 b)	1				1		
Question 3							
3.1.1			4			4	
3.1.2	1					1	
3.1.3		3				3	
3.1.4	2					2	
3.2.1	2					2	

	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Waves, light and sound	Electricity and magnetism	Mechanics and energy
3.2.2		1	3			4	
3.2.3 a)			1			1	
3.2.3 b)				4		4	
3.3.1	2					2	
3.3.2		2	2			4	
3.3.3		2	2			4	
Question 4							
4.1.1		3					3
4.1.2			4	1			5
4.1.3	4						4
4.2.1	2						2
4.2.2		2					2
4.2.3		3					3
4.2.4			4				4
4.2.5			4				4
4.2.6				4			4
4.2.7		4					4
4.3.1			5				5
4.3.2			2				2
4.3.3		4					4
4.3.4		4					4
4.3.5			2				2
4.4.1	2						2
4.4.2		4					4
4.4.3	2						2
4.4.4.			5				5

5. Physical Sciences Grade 10: End-of-Year Chemistry Examination

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 6 questions, an answer sheet of 1 page and data sheets of 3 pages.
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 10 multiple choice questions. There is only one correct answer to each question. On the answer sheet, place a cross (X) over the letter (A, B, C or D) that corresponds to the most correct answer to each question.
6. Start each question on a new page.
7. Answer all questions.
8. **Show all working clearly in all calculations.**
9. Where appropriate round up answers to **two** decimal places.
10. **Write your name on the answer sheet.**

Question 1

Multiple choice questions

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and make a cross (X) over A, B, C or D for the question in the multiple choice answer grid on your Answer Sheet.

1.1 What is the name given to the type of matter which is composed of two or more elements combined in a definite ratio?

A A mixture

B A solution

C A compound

D An ion (2)

1.2 How many protons, neutrons and electrons does a sodium ion (Na^+) have?

	Protons	Neutrons	Electrons
A	11	12	11
B	11	12	10
C	12	11	11
D	12	11	10

(2)

1.3 Which of the following chemical formulae correctly represents the formula for ammonium carbonate?

A $(NH_3)_2CO_3$

B $(NH_4)_2CO_3$

C NH_3CO_3

D NH_4CO_3 (2)

1.4 What happens to the molecules of water when water is heated and water vapour begins to form?

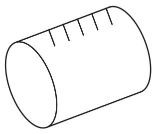
A The water molecules expand (grow bigger).

B The water molecules break down into hydrogen and oxygen.

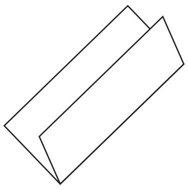
C The water molecules lose kinetic energy.

D The water molecules break free from the other water molecules. (2)

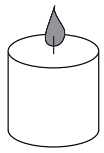
1.5 Tshepiso tips a beaker of carbon dioxide gas at room temperature over the top end of a folded piece of paper held near the flame of a candle. He sees that the flame goes out.



Beaker of carbon dioxide gas



Folded piece of paper



Burning candle

Tshepiso made the following statements.

1	Carbon dioxide is heavier than air.
2	Carbon dioxide freezes at –80°C.
3	Carbon dioxide extinguished the flame.
4	Carbon dioxide flowed down the folded paper.
5	Carbon dioxide is soluble in water.
6	Carbon dioxide does not support burning.

Which of these statements are inferences supported by his observations?

A 1 and 2 only

B 1, 4 and 6 only

C 1, 3, 4 and 6 only

D 2, 5 and 6 only (2)

1.6 Which of the following phase changes involves the release of heat?

1	Evaporation of water
2	Sublimation of ice
3	Melting of ice
4	Condensation of water vapour

A 1 and 3 only

B 2 and 4 only

C 2, 3 and 4 only

D 4 only (2)

1.7 What kind of reaction takes place when magnesium reacts with oxygen as shown in the equation below?

$2\ Mg + O_2 \rightarrow 2\ MgO$

A combustion

B acid–base

C decomposition

D addition (2)

1.8 Ethyne reacts with oxygen to form carbon dioxide and water.

The balanced chemical reaction is shown below:

$2\ C_2H_2\ (g) + 5\ O_2\ (g) \rightarrow 4\ CO_2\ (g) + 2\ H_2O\ (g)$

How many moles of C_2H^2 (g) are required to react completely with 10 moles of oxygen gas?

A 1

B 2

C 4

D 5 (2)

1.9 How many moles of water vapour (H_2O (g)) are produced when 2,5 moles of O_2 react with C_3H_8 as shown by this balanced chemical equation?

$C_3H_8 (g) + 5 O_2 (g) \rightarrow 3 CO_2 (g) + 4 H_2O (g)$

A 2,0

B 3,0

C 4,0

D 8,0 (2)

1.10 Which of the following substances is an acid?

A NaOH

B $NaHCO_3$

C HNO_3

D NH_3 (2)

10 × (2) = **[20]**

Question 2

2.1 Give the correct scientific term or name for each of the following:

2.1.1 The group 1 metals (1)

2.1.2 A positive ion (1)

2.1.3 The number of nucleons in an atom of a specific element (1)

2.1.4 Atoms of the same element which differ in the number of neutrons (1)

2.1.5 The person who first formulated the nuclear model of the atom (1)

2.1.6 The person who formulated the 'plum pudding' model for the atom (1)

2.1.7 The tendency of an atom in a molecule to attract the bonding electron pairs (1)

2.1.8 The element with atoms that have the following electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^5$ (1)

2.1.9 The energy released when an atom attracts an electron to form a negative ion (1)

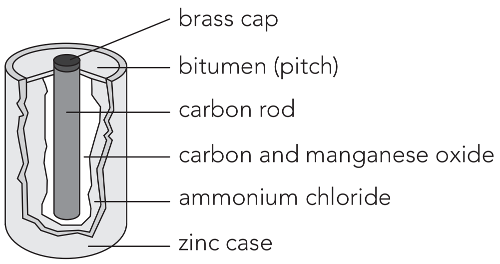
2.1.10 The type of chemical bonding where sharing of electrons occurs (1)

2.2 Explain the difference between:

2.2.1 A pure and an impure substance (2)

2.2.2 A homogeneous and a heterogeneous mixture (2)

2.3 The materials that make up a battery are shown in the following diagram.



Classify each of the named substances as an element, compound or a mixture, e.g.
Bitumen (pitch): mixture (5)

[19]

Question 3

3.1 3.1.1 Define relative atomic mass. (2)

3.1.2 The element chlorine (atomic number 17) occurs in nature as two different atoms with mass numbers of 35 and 37, respectively. 76% of chlorine atoms occur as ${}^{17}_{35}C\ell$.
Show that the relative atomic mass of chlorine is 35,5. (3)

3.2 Consider an atom of phosphorus.

3.2.1 What is the number of the period that phosphorus is found in? (1)

3.2.2 What is the number of the group that phosphorus is found in? (1)

3.3 Draw an Aufbau diagram of a nitrogen atom. (3)

3.4 Use s, p notation to show the electron configuration of a potassium ion. (2)

3.5 Predict the type of bonding that occurs between potassium and nitrogen.
Give a reason for your answer. (3)

3.6 Draw a Lewis diagram to show the bonding in potassium nitride. (3)

3.7 When phosphorus combines with nitrogen a different type of chemical bond is formed.

3.7.1 Name the type of bond formed when phosphorus combines with nitrogen. (2)

3.7.2 Write a chemical formula for phosphorus nitride. (2)

3.8 Potassium is a metal.

3.8.1 Describe the type of chemical bonding that is found in all metals. (2)

3.8.2 With reference to the type of bonding found in metals, explain why metals are good conductors of electric current. (2)

3.9 The first ionisation energy of potassium is lower than that of sodium.

3.9.1 Define *the first ionisation energy of an element.* (2)

3.9.2 Explain why the first ionisation energy of potassium is less than that of sodium. (3)

3.9.3 Predict whether the first ionisation energy of calcium will be greater or less than that of potassium. (1)

3.9.4 Justify your answer to 3.9.2. (2)

3.10 Oxygen forms polar covalent bonds with hydrogen, and with carbon.

3.10.1 Explain what a *polar covalent bond* is. (2)

3.10.2 Explain why the bond between hydrogen and oxygen is a *polar covalent* bond. (2)

3.10.3 Explain why water (H_2O) is a polar molecule, but carbon dioxide (CO_2) is a non-polar molecule. (4)

[42]

Question 4

4.1 Give ONE way in which chemical change is similar to physical change. (2)

4.2 Give TWO ways in which chemical change differs from physical change. (4)

4.3 Small amounts of each of the following substances are placed individually into test tubes. Each sample is heated strongly for 3 minutes over a Bunsen burner to a maximum temperature of 500 °C. The sample is then allowed to cool down to room temperature in its test tube over the next 15 minutes.

	Chemical formula	**Melting point (°C)**
Paraffin wax	$C_{20}H_{22}$	67
Sugar	$C_{12}H_{22}O_{11}$	160
Table salt	$NaC\ell$	801
Ammonium chloride	$NH_4C\ell$	338

4.3.1 Identify the substance that will NOT melt during the 3 minutes of heating. (1)

4.3.2 At about 175°C sugar turns into a brown syrup, emitting a rich mouth-watering scent. When the brown syrup cools, it remains brown, and its taste is no longer as sweet as the sugar was to begin with. It tastes like caramel, and it also has a sharp bitter taste.

Is it a physical or a chemical change which occurs when sugar is heated to 175 °C? Justify your answer with reference to the information which you have been given. (2)

4.3.3 Molten ammonium chloride gives off ammonia and hydrogen chloride gases at 340 °C.

a) Write a balanced equation (with phase symbols) to represent this reaction. (3)

b) Name the type of reaction which occurs when ammonium chloride crystals form ammonia and hydrogen chloride gas. (1)

4.4 When powdered ammonium chloride reacts with powdered barium hydroxide, the temperature of the test tube in which they react drops by 15 °C.

The balanced equation to represent this reaction is:

$2\ NH_4C\ell\ (s) + Ba(OH)_2\ (s) \rightarrow BaC\ell_2\ (aq) + 2\ NH_3\ (g) + 2\ H_2O\ (\ell)$

4.4.1 Calculate the molar mass of $NH_4C\ell$. (4)

4.4.2 Calculate the number of moles of barium hydroxide in 10 g of $Ba(OH)_2$. (4)

4.4.3 Calculate the number of moles of $NH_4C\ell$ that will react completely with 10 g of $Ba(OH)_2$. (2)

4.4.4 Calculate the mass of $NH_4C\ell$ which reacts completely with 10 g of $Ba(OH)_2$. (2)

4.4.5 Calculate the volume of NH_3 gas which is given off at standard temperature and pressure when 10 g of $Ba(OH)_2$ reacts completely with $NH_4C\ell$. (4)

4.4.6 Explain what is meant by 'an exothermic reaction'. (2)

4.4.7 The temperature of the test tube drops significantly during this reaction. Is this an exothermic reaction? Justify your answer briefly. (2)

[33]

Question 5

5.1 Balance the following two chemical equations:

5.1.1 H_2SO_4 (aq) + LiOH (aq) → Li_2SO_4 (aq) + H_2O (ℓ) (2)

5.1.2 C_3H_8 (g) + O_2 (g) → CO_2 (g) + H_2O (g) (3)

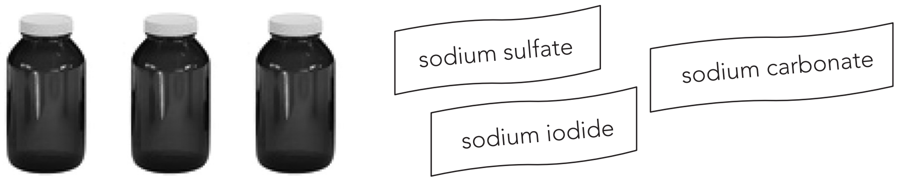
5.2 Name the following types of chemical reactions:

5.2.1 $Pb(NO_3)_2$ (s) → PbO (s) + NO_2 (g) (2)

5.2.2 2 NH_4OH (aq) + H_2SO_4 (aq) → $(NH_4)_2SO_4$ (aq) + 2 H_2O (ℓ) (2)

5.2.3 Zn (s) + 2 HCℓ (aq) → $ZnC\ell_2$ (aq) + H_2 (g) (2)

5.3 While sorting out the chemicals in the chemical storeroom, you find three bottles of sodium salts which are unlabelled. Three labels lie next to the three bottles but you do not know which label belongs to each of the bottles. Having learnt about identifying anions you decide to conduct tests on each of the substances in the bottles, and then to label them correctly.



All the substances are sodium salts so they are all white crystals.

The names of the salts are: **sodium sulfate**, **sodium carbonate** and **sodium iodide**.

Your first step in testing the salts is to dissolve a small sample of each in water and to make up three solutions which you label A, B and C.

5.3.1 All of the salts used above are soluble in water. Explain how we know this about the salts of sodium. (2)

5.3.2 Explain how you can test a sample to find out if an iodide is present. (2)

5.3.3 Solution B tests positive for sulfate ions. Describe what you observe when you test solution B. (2)

5.3.4 Solution C tests positive for carbonate ions. Describe the test that you carry out, and the results you obtain to confirm the presence of carbonate ions. (4)

[21]

Question 6

> *Safe drinking water and adequate sanitation are crucial for poverty reduction, crucial for sustainable development and crucial for achieving any and every one of the Millennium Development Goals.*
>
> (Ban Ki-moon, UN Secretary General)

Most of the Earth's water is found in the oceans, while on land we have access to fresh water in dams, lakes, rivers and reservoirs.

6.1 Give TWO reasons why 'fresh water' is not always safe for humans to drink. (2)

6.2 Write down the letters (a) to (e) and next to them write the appropriate 'missing' word or phrase from the paragraph that follows. Do not use words which are used in the paragraph itself.

Water from the oceans ……(a)……. during the day to form clouds. The clouds that are blown from the sea over the land drop their moisture by the process of ……(b)…… when it rains. On very cold days the moisture in the clouds can freeze to form ……(c)…… which will then fall as snow or hail. Solid rivers of water in the polar regions of Earth are called ……(d)…… The most important form of water to sustain life on Earth is that form which is in the ……(e)…… phase. (5)

The water cycle describes the passage of water molecules from one phase to another throughout the Earth's bodies of water.

6.3 Is the water cycle describing chemical or physical processes? Explain briefly. (2)

Drought affects many communities in South Africa from time to time. The local municipality in your region has decided to build a dam on the usually fast flowing river which passes nearby your town. They have obtained permission from the Department of Environmental Affairs and are about to begin the project. This project will take three years before the dam wall is completed, and another three years of 'normal average' rainfall for the dam to reach its capacity.

6.4 Give TWO ENVIRONMENTAL ADVANTAGES of building a dam to store water for the use of the people in the town and immediate surrounding districts. (2)

6.5 Give TWO ECONOMIC DISADVANTAGES of building a dam for these purposes. (2)

A local farmer uses large amounts of artificial fertilisers to ensure that his market gardening (vegetable) crops grow at faster rates so that he can maximise his profits. His vegetable gardens surround a steep portion near where the dam will be. Water used to irrigate his crops will run off from the agricultural land into the dam, and excess rainwater will also run through his fields into the dam. This 'runoff of water' is likely to cause the water in the dam to lack soluble oxygen.

6.6 Give the name that is used for water which is lacking dissolved oxygen due to pollution. (2)

[15]

TOTAL MARKS: 150

TIME: 2 HOURS

END OF TEST

Physical Sciences Grade 10: End-of-Year Chemistry Examination

ANSWER SHEET

NAME: ______________________________

Question 1

Multiple choice questions

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

DATA SHEET

GRADE 10 TERM 4

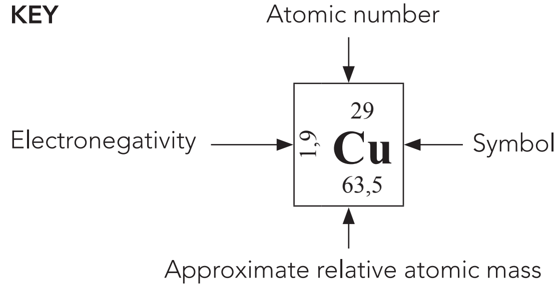
Table 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Magnitude of charge on electron	e	$1,6 \times 10^{-19}$ C
Mass of an electron	m_e	$9,1 \times 10^{-31}$ kg
Standard pressure	p^θ	$1,01 \times 10^5$ Pa
Molar gas volume at STP	V_m	22,4 $dm^3.mol^{-1}$
Standard temperature	T^θ	273 K
Avogadro's constant	N_A	$6,02 \times 10^{23}$ mol^{-1}

Table 2: CHEMISTRY FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$	$n = \frac{V}{V}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MW}$		

Table 3: PERIODIC TABLE



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

Table 4: SOLUBILITY TABLE

Soluble compounds		**Exceptions**
Almost all salts of Na^+, K^+ and NH_4^+		
All salts of $C\ell^-$, Br^- and I^-	⇔	Halides of Ag^+, Hg_2^{2+} and Pb^{2+}
Compounds containing F^-	⇔	Fluorides of Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+} and Pb^{2+}
Salts of nitrate, NO_3^- chlorate, $C\ell O_3^-$ perchlorate, $C\ell O_4^-$ acetate, CH_3COO^- (or $C_2H_3O_2^-$)		$KC\ell O_4$
Salts of sulfate, SO_4^{2-}	⇔	Sulfates of Sr^{2+}, Ba^{2+} and Pb^{2+}

Insoluble compounds		**Exceptions**
All salts of carbonate, CO_3^{2-} phosphate, PO_4^{3-} oxalate, $C_2O_4^{2-}$ chromate, CrO_4^{2-} sulfide, S^{2-}	⇔	Salts of NH_4^+ and alkali metal cations
Most metal hydroxides, OH^- and oxides, O^{3-}		

6. Physical Sciences Grade 10: End-of-Year Chemistry Examination Memorandum

Question 1

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

Question 2

2.1 2.1.1 Alkali(s) or alkali metals ✓ (1)

2.1.2 Cation ✓ (1)

2.1.3 Mass number ✓ (1)

2.1.4 Isotope(s) ✓ (1)

2.1.5 (Sir Ernest) Rutherford ✓ (1)

2.1.6 (JJ) Thomson ✓ (1)

2.1.7 Electronegativity ✓ (1)

2.1.8 Chlorine ✓ (1)

2.1.9 Electron affinity ✓ (1)

2.1.10 Covalent bonding ✓ (1)

2.2 2.2.1 A pure substance is composed of a single substance only ✓ whereas an impure substance is a mixture of two or more different substances. ✓ (2)

2.2.2 A homogeneous mixture has all substances in the same phase ✓ whereas a heterogeneous mixture has some substances in different phases. ✓ (2)

2.3 Brass: Mixture ✓ (an alloy)

Carbon: Element ✓

Carbon and manganese oxide: Mixture ✓

Ammonium chloride: Compound ✓

Zinc: Element ✓ (5)

[It is possible that candidates may not mention 'carbon and manganese oxide' and they may only mention manganese oxide. In this case they will classify manganese oxide as a compound, and should still receive full marks.]

[19]

Question 3

3.1 3.1.1 The relative atomic mass of an element is the mass of an 'average' atom of that element ✓ compared with the mass of an atom of carbon-12. ✓ (2)

3.1.2 Consider 100 atoms of chlorine.

76 atoms has a mass of 35 (a.m.u.) and 24 atoms have a mass of 37 (a.m.u.)

Total mass of 100 atoms = (76) (35) ✓ + (24) (37) ✓

= 2 660 + 888

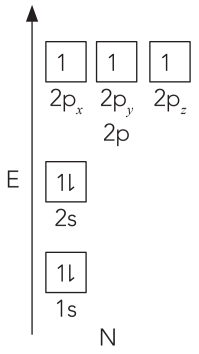
= 3 548

Average mass of chlorine atoms = 35,48 ✓ = 35,5 (when rounded up) (3)

3.2 3.2.1 3 ✓ (1)

3.2.2 15 ✓ (1)

3.3 Aufbau diagram of a nitrogen atom



✓ Correct number of electrons

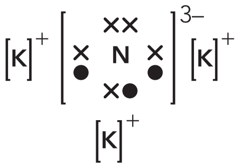
✓ Correct energy levels

✓ 3 unpaired p electrons (3)

3.4 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ ✓✓ (2)

3.5 Ionic bonding. ✓ Potassium is a metal ✓ and nitrogen is a non-metal. ✓ (3)

3.6



✓ Three potassium cations

✓ One nitride anion (charge –3)

✓ One pair of lone electrons (3)

3.7 3.7.1 Polar ✓ covalent (bond) ✓ (2)

3.7.2 PN ✓✓ [Accept NP ✓ for 1 mark as the valencies are correct] (2)

3.8 3.8.1 Metallic bonding ✓ consists of a sea of (valence) electrons surrounding cations ✓ (2)

3.8.2 When a voltage is applied across a metal, the free electrons move ✓ towards the positive terminal (and electrons are supplied at the negative terminal). ✓ (2)

3.9 3.9.1 The first ionisation energy of an element is the amount of energy required to remove the first ✓ electron from an atom. ✓ (2)

3.9.2 A potassium atom has its valence electron further away from its nucleus ✓ than the valence electron in a sodium atom, because it has 4 energy levels, whereas sodium only has 3. ✓ The valence electron of potassium experiences less force of attraction from its nucleus than that of sodium, ✓ therefore the first ionisation energy of potassium is less than that of sodium. (3)

3.9.3 First ionisation energy of calcium will be greater ✓ than that of potassium. (1)

3.9.4 Calcium has a greater number of protons in its nucleus ✓ so the force of attraction on the valence electron will increase ✓ and therefore it will require more energy to remove the first electron from calcium. (2)

3.10 3.10.1 A polar covalent bond arises between two atoms when they share ✓ the bonded pair of electrons unequally ✓ (or when one atom has a stronger attraction to the bonded pair of electrons than the other one has). (2)

3.10.2 Oxygen has a higher electronegativity than hydrogen ✓ OR a polar covalent bond forms between oxygen and hydrogen ✓, therefore the oxygen atom has a greater force of attraction on the bonded pair of electrons than hydrogen does. ✓ (2)

3.10.3 Water molecules are polar molecules because they contain two polar covalent bonds which are not aligned symmetrically ✓ and therefore there is an uneven distribution of charge inside the molecule ✓ (and hence it is a polar molecule).

Carbon dioxide molecules also have two polar covalent bonds inside their molecules. ✓ These bonds are aligned symmetrically so that there is an even distribution of charge within the molecule ✓ (and carbon dioxide molecules are non-polar). (4)

[42]

Question 4

4.1 Both physical and chemical changes involve changes in energy (either energy taken in or energy released). ✓✓ (2)

4.2 ANY TWO valid differences:

Chemical change involves the formation of new substances (the rearrangement of atoms to form new substances). ✓✓

Chemical change involves the breaking of chemical bonds. ✓✓

Chemical changes are not easily reversed. ✓✓

Physical change involves change of phase (or state). ✓✓ (4)

4.3 4.3.1 Table salt OR $NaC\ell$ ✓ (1)

4.3.2 Chemical change ✓

The syrup is a new substance that was formed because it has different properties to the sugar: a different taste, colour and odour (scent or smell). ✓ (2)

4.3.3 a) $NH_4C\ell\ (\ell) \rightarrow NH_3\ (g) + HC\ell\ (g)$

✓ Correct reactant

✓ Correct products

✓ Correct phase symbols (3)

b) Decomposition ✓ (OR gas-forming) (1)

4.4 4.4.1 $M(NH_4C\ell) = 14$ ✓ $+ 4(1)$ ✓ $+ 35,5$ ✓

$= 53,5\ g.mol^{-1}$ ✓ (4)

4.4.2 $n = \frac{m}{M}$ ✓

$= \frac{10}{137,3 + 2(16 + 1)}$

$= \frac{10}{171,3}$

$= 0,06$ ✓ $(0,058)$ mol (4)

4.4.3 $n = 2 \times 0,06$ ✓

$= 0,12$ ✓

OR $n = 2 \times 0,058$ ✓ (c.o.e. from 4.4.2)

$= 0,12$ ✓ (2)

4.4.4 $m = nM$

$= (0,12)(56,5)$ ✓

$= 6,78$ g ✓ (2)

4.4.5 $V = nVm$ ✓

$= (0,12)$ ✓ $(22,4)$ ✓

$= 2,69\ dm^3$ ✓ (4)

4.4.6 A reaction is exothermic if there is more energy (heat) given off by the reaction than is taken in. ✓ (2)

4.4.7 No OR Endothermic ✓

The drop in temperature of the test tube tells us that heat was taken from the environment to drive the reaction. ✓ (2)

[33]

Question 5

5.1 5.1.1 $H_2SO_4\,(aq) + 2\,LiOH\,(aq)$ ✓ $\rightarrow Li_2SO_4\,(aq) + 2\,H_2O\,(\ell)$ ✓ (2)

5.1.2 $C_3H_8\,(g) + 5\,O_2\,(g)$ ✓ $\rightarrow 3\,CO_2\,(g)$ ✓ $+ 4\,H_2O\,(g)$ ✓ (3)

5.2 5.2.1 Decomposition ✓✓ (OR gas-forming) (2)

5.2.2 Acid–base ✓✓ (2)

5.2.3 Gas-forming ✓✓ (OR redox) (2)

5.3 5.3.1 Sodium is an alkali metal. ✓ All alkali salts are soluble in water. ✓ (2)

5.3.2 Add a few drops of silver nitrate (or lead nitrate) to a sample of the salt solution. ✓

If a precipitate forms, add a few drops of concentrated nitric acid. ✓

If a yellow precipitate remains, then iodide ions are present in the original solution. (2)

5.3.3 With bairum chloride: A cloudy white precipitate forms. ✓ It doesn't dissolve when concentrated nitric acid is added. ✓ (2)

5.3.4 Add diluted acid ✓✓ (e.g. hydrochloric acid) to a solution of the salt (or to the powdered salt). Gas bubbles will form if carbonate is present. ✓✓ (4)

[21]

Question 6

6.1 Human and animal activity in areas higher upstream may have polluted the river water.

It may therefore contain bacteria or E. coli which are harmful to humans. ✓

It may contain dissolved substances such as heavy metal ions or poisonous substances. ✓ (2)

6.2 a) evaporates ✓

b) precipitation ✓

c) ice ✓

d) glaciers ✓

e) liquid ✓ (5)

6.3 Physical (process). ✓ Water changes phase during the water cycle. (It doesn't change from one substance to another.) ✓ (2)

6.4 TWO ENVIRONMENTAL ADVANTAGES:

Water will be available to the community in times of drought. ✓

Dams can prevent flooding of valleys. ✓

Dams can prevent soil erosion during floods. ✓

[Any TWO valid reasons which improve the local environment for humans, flora and fauna.] (2)

6.5 TWO ECONOMIC DISADVANTAGES:

An enormous cost in building a dam. ✓

Local farmers and settlers in the valley will lose their homes and land, which will cost them and the municipality a lot. ✓

Local farmers will lose their means of making money. ✓

[Any TWO valid reasons which affect people financially.] (2)

6.6 Eutrophication ✓✓ (2)

[15]

7. Cognitive Analysis for Physical Sciences Grade 10: End-of-Year Chemistry Examination

	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Matter and materials	Chemical change	Chemical systems
TARGET %	15.0	40.0	35.0	10.0	47	40	13
TARGET (marks)	22	60	53	15	70	60	20
ACTUAL (marks)	23	59	52	16	69	62	19
ACTUAL %	15.3	39.3	34.7	10.7	47	41	12
Question 1							
1.1		2			2		
1.2		2			2		
1.3		2			2		
1.4			2		2		
1.5			2				2
1.6		2					2
1.7		2				2	
1.8		2				2	
1.9			2			2	
1.10			2			2	
Question 2							
2.1.1	1				1		
2.1.2	1				1		
2.1.3		1			1		
2.1.4	1				1		
2.1.5	1				1		
2.1.6	1				1		
2.1.7	1				1		
2.1.8	1				1		
2.1.9		1			1		
2.1.10	1				1		
2.2.1	2				2		
2.2.2	2				2		
2.3		5			5		
Question 3							
3.1.1		2			2		
3.1.2			3		3		
3.2.1		1			1		
3.2.2		1			1		
3.3			3		3		
3.4			2		2		
3.5			3		3		
3.6			3		3		
3.7.1		2			2		
3.7.2			2		2		

	1: Recall	2: Comprehension	3: Analysis, application	4: Evaluation, synthesis	Matter and materials	Chemical change	Chemical systems
3.8.1	2				2		
3.8.2				2	2		
3.9.1	2				2		
3.9.2				3	3		
3.9.3			1		1		
3.9.4				2	2		
3.10.1		2			2		
3.10.2			2		2		
3.10.3				4	4		
Question 4							
4.1		2				2	
4.2		4				4	
4.3.1			1			1	
4.3.2		2				2	
4.3.3			4			4	
4.4.1		4				4	
4.4.2			4			4	
4.4.3			2			2	
4.4.4			2			2	
4.4.5			4			4	
4.4.6	2					2	
4.4.7				2		2	
Question 5							
5.1.1		2				2	
5.1.2				3		3	
5.2.1		2				2	
5.2.2		2				2	
5.2.3		2				2	
5.3.1		2				2	
5.3.2			2			2	
5.3.3			2			2	
5.3.4			4			4	
Question 6							
6.1		2					2
6.2	5						5
6.3		2					2
6.4		2					2
6.5		2					2
6.6		2					2

G. ADDITIONAL WORKSHEETS

1. Worksheet 1

Underline the correct answer

1. The energy of an object resulting from motion is __________ energy.
   - A. kinetic
   - B. potential
   - C. mechanical
   - D. thermal

2. The unit for kinetic energy is the __________
   - A. watt
   - B. joule
   - C. newton
   - D. volt

3. Which of the following would produce the greatest increase in the kinetic energy of a moving object?
   - A. Doubling its mass
   - B. Doubling its velocity
   - C. Halving its mass
   - D. Halving its velocity

2. Answers for Worksheet 1

1. A. Kinetic

2. B. Joule

3. B. Doubling its velocity

3. Worksheet 2

In the spaces below each question, set out your solution to the problem. Remember units!

1. A girl has a mass of 55 kg. She climbs 12 m up a tree.

   What is her gain in GPE?

2. An owl has a mass of 4 kg. It dives to catch a mouse, losing 800 J of GPE.

   How high was the bird to begin with?

3. An astronaut has a total mass of 110 kg.

   On the Moon, he climbs into his spacecraft, 5 m up a ladder.

   His GPE increases by 880 J.

   What is the strength of gravity on the Moon?

4. Answers for Worksheet 2

1. [Earth’s gravity = 10 N/kg]

   Change in GPE = mass × gravity × change in height

   = (55 × 10 × 12)

   = 6 600 J

   Gain in GPE = 66 kJ

2. Change in GPE = mass × gravity × change in height

   800 = 4 × 10 × change in height

   $\frac{800}{40}$ = change in height

   Change in height = 20 m

3. Change in GPE = mass × gravity × change in height

   880 = 110 × gravity × 5

   Gravity on the Moon = 1,6 N/kg

5. Worksheet 3

In the spaces below each question, set out your solution to the problem. You may have to use the kinematic equations to solve some of these problems.

1. Phumlane throws a rock straight up at a velocity of 10 m/s.

   How high does it go?

2. A cannon ball has a velocity of 220 m/s.

   It falls to Earth and has a velocity of 200 m/s just before it hits.

   What percentage of the energy was lost as heat?

3. A 200 kg motorcycle travelling at 20 m/s suddenly speeds up to 30 m/s.

   How much work was done?

4. How much work does the gravity of a planet do on a satellite as it orbits?

5. Ayanda throws a rock with a mass of m off a cliff of height h.

   The rock's initial velocity is v_o.

   What is the velocity of the rock just before it hits the ground?

6. Answers for Worksheet 3

1. $\frac{1}{2}mv_o{}^2 = mgh$

   $h = \frac{(v_o)^2}{2g}$

   $= \frac{(10)^2}{2 \text{ x } 10}$

   $= 5$ m

2. Heat $= \frac{1}{2}mv_o{}^2 - \frac{1}{2}mv_f^2$

   $= \frac{1}{2}m(v_o{}^2 - v_f^2)$

   $= \frac{1}{2}m(200^2 - 220^2)$

   % lost as heat $= \frac{[\frac{1}{2}m(200^2 - 200^2)]}{\frac{1}{2}m200^2} \times 100\%$

   $= \frac{200^2 - 200^2}{(200^2)} \times 100\%$

   $= 17\%$

3. $W = \Delta k$

   $= \frac{1}{2}m(30^2 - 20^2)$

   $= 50\ 000$ J

4. zero

5. $v = (v_o{}^2 + 2gh)^{0.5}$