Learning channel

STUDY Mate

Department of Education

GRADES 8–11 ISSUE 4 JULY 2007

Learning activities for Grades 8–11

Content

Parents and teachers. Please pass this supplement on to your children and learners.

Education Minister Naledi Pandor

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GRADE 11 ENGLISH LESSON NOTES

Lesson 4

Research Skills

If you are given a project at school, start by reading the instructions very carefully. Look at the project. Why are you doing research? Are you going to present the information as

- An oral;
- A written piece;
- A poster;
- A model; or
- Something else?

FIRST check how long the oral or written piece has to be. Do NOT start before you know what the end product has to be.

Examine the assessment criteria BEFORE you begin. USE the assessment criteria to help you produce the BEST piece of work you possibly can.

How to go about research

There are steps you need to go through BEFORE you start reading, opening a book, or searching the Internet.

Narrow the problem and state it precisely

Focus ONLY on what you are asked to research. Ignore everything that is not part of your project.

Set up reading targets

Simpler topics or problems require simpler reading targets.

However, when the research topic is broad, prepare in advance a framework of questions. These questions will help you narrow the focus of the project and help you to find the information you need. This means that your reading and research will go faster because you will not wade through a massive amount of irrelevant material. You will approach your reading with a mind full of questions. A questioning mind-set should greatly increase both your reading comprehension and your retention of the information.

The key words in your topics and sub-topics will now serve as clue words for finding your information. These will send you to appropriate books and chapters, and, within a chapter, to the target information.

Group questions under major subdivisions, then slot in sub-topics. Do not forget to revise your questions in the light of your research reading.

Use suitable books and other sources

If you use the Internet, you should also use a reference book. START with the reference book, so that if you are short of a key piece of information, or you need more detail, you go onto the Internet with a good idea of what you have already and exactly what you are looking for. If you start with thousands of Internet sites, you will be overwhelmed. Thoughtfully appraise the qualifications of the writer or investigator whose findings are reported. Do NOT accept everything you read on the Internet.

Use a table of contents and index as aids

How can you see whether the book really contains the information you seek?

a. Turn to the table of contents for an outline; and
b. Use the index.

The index may not list the exact word you have in mind - use a synonym. Take advantage of cross-referencing (you will see the "*see also cross references*" phrase used in indexes), which will send you to other words. Do not forget to keep a working bibliography, so that you can acknowledge the sources that you have used.

Scan a passage for information

Successful scanning tips:

1. Have your reading targets clearly in mind before you begin scanning.
2. Watch for chapter division headings and side headings that tell you whether to look there or not.
3. Zoom in on paragraph openings.
4. Examine summary paragraphs at the close of chapters.

Discriminate between relevant and irrelevant information.

Make notes efficiently from scattered sources

You may use any note-taking methods and record your notes in a way that suits you best. Use mind-maps or cards.

Cards are useful because they can be rearranged in whatever order you want and can be used if you are preparing a speech. You can also add and throw away easily, without having to recopy. If you use cards, remember to write on one side of the card only.

Use your own words. Do not plagiarise

*You can use the words of the original material **ONLY**:*

1. If you wish to quote directly a writer who has expressed an idea more vividly, persuasively or compactly than you could express it; or
2. If you wish to quote an authority directly to reinforce an argument.

Bring your notes together into an orderly presentation

Don't start writing too soon. The organising you are doing requires strenuous logical thinking. Do not try to hurry this!
You should now have a final outline.
Write your rough draft, or prepare notes for your talk.
Write the final bibliography.

ACTIVITIES

Investigate **ONE** pair of famous lovers. Choose from the following:

Bonny and Clyde; Antony and Cleopatra; Othello and Desdemona; Arthur and Guinevere; Dido and Aeneas; Tristan and Isolde.

Use the skills outlined above. Set your work out under the following headings:

1. Background Information (deal with BOTH characters)
2. Relationship
3. What may be learnt from their love story?

Write approx 10-15 lines under each heading (80-120 words). Total length: 250-300 words

BIBLIOGRAPHY: This refers to the books, magazines, encyclopaedias, etc that you use for your research. Set your bibliography out like this:

Author's surname, Author's initial: Title of Book; Publisher, Page
Author's surname, Author's initial: Title of Magazine; Publisher, Page
Name of Encyclopaedia, Publisher, Page

NOTE: If you use an Internet source, you must provide the following:

- The name of the site
- The web address
- The name of the author
- The credentials of the author, eg Professor X, Department of Media Studies, Harvard University, Cambridge, Mass.

Write or type up your research on A4 file paper. Attach the Assessment Grid. Illustrations: 1-2

Answers and assessment

Content/research	Excellent	V good	Good	Average	Poor	V weak
	7	6	5	4	3-2	1
Length correct Interesting information Details accurate Relevant to topic						
Response to information	5		4	3	2	1
Thoughtful analysis Intelligent opinion Clear point of view						
Language and style	5	4	3	2	1	0
Grammar, spelling and punctuation correct Paragraphs well structured, use of sentences and paragraphs Use of own words, no plagiarism						
Presentation	3		2		1	
Neatness (handwriting, blue pen, headings underlined with a ruler) Bibliography (layout, details) Illustrations (1-2)						
TOTAL: 20						

PHYSICAL SCIENCES

Mechanics

The force of gravity

Lesson 4

Introduction

We all know, from first-hand, empirical evidence, that a body that is released from near the earth's surface will fall. But what does "fall" actually mean? We see "falling" in terms of an object dropping towards the ground.

Here is a snowboarder. He has just ramped off the edge of a snowdrift.

Although he still has forward momentum he is also falling under the influence of Earth's gravitational pull.

Here is a snowboarder. He has just ramped off the edge of a snowdrift.

Although he still has forward momentum he is also falling under the influence of Earth's gravitational pull.

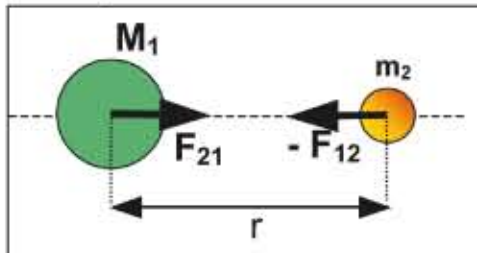
But according to Newton's Third Law of Motion, for every action (Earth's pull on the snowboarder) there must be an equal (in size) but opposite (in direction) force of reaction.

What is the force of reaction here?

But according to Newton's Third Law of Motion, for every action (Earth's pull on the snowboarder) there must be an equal (in size) but opposite (in direction) force of reaction.

Gravity: A force of mutual attraction

Newton also formulated a fourth law that tells us about the attractive force between two objects having mass. Newton said that because two bodies close enough to one another will attract each other with forces that are equal in size but opposite in direction, we speak of a **MUTUAL force of (gravitational) attraction**. Such a pair of forces is an **action-reaction pair**.



When two masses ($\mathbf{M_1}$ and $\mathbf{m_2}$), whose centres are a distance **r** apart, exert a gravitational force on each other, the force ($\mathbf{F_{12}}$) with which the first mass ($\mathbf{M_1}$) attracts the second mass ($\mathbf{m_2}$) is equal in magnitude but opposite in direction to the force with which the second mass attracts the first mass i.e. $-\mathbf{F_{21}}$.

Newton's law of universal gravitation

The force between two bodies depends on the sizes of the masses and their distance apart. Newton identified how these quantities were related:

F_g (gravitational force) α $m_1 \times m_2$ *[the **product** of the masses]*

$F_g \alpha 1/r^2$ *[the **reciprocal of the square of the distance between their centres**]*

When we have something proportional to more than one variable, the variables can be combined. If we have identified all the variables, we can then rewrite the relationship in the form of an equation by introducing what is called a "constant of proportionality".

$$F \alpha \frac{m_1 \times m_2}{r^2}$$

Mass and distance apart are the only variables that affect the force of attraction between two bodies. By introducing a constant of proportionality "**G**", known as the "universal gravitational constant", we get this equation:

$$F = G\frac{m_1 \times m_2}{r^2}$$

This is **Newton's Law of Universal Gravitation**. An important aspect of the equation is that when the centres of two masses ($\mathbf{m_1}$ and $\mathbf{m_2}$) are **r** metres apart, they experience a mutual force of attraction that **obeys an "inverse square law"**. If the distance between the bodies is doubled the force between them becomes one quarter of its initial strength (and **not** one half). Newton also showed that when a body like the moon orbits another body like the earth, the orbiting body follows an elliptical path.

A worked example

A man stands on the surface of the earth and then jumps into the air. He is certainly aware of the force that the earth exerts on him as it brings him down to earth. What he is probably not aware of is the force that HE (the man) exerts on the EARTH.

If he looked at Newton's Second Law he might realize that the earth's mass is so huge compared to his own that the acceleration caused by his force on the earth is so small that it is negligible. We even have a name for the earth's force on the man: we call it his **weight**!

As we also know, the force of gravity of the earth on an object is given by "mass x the acceleration due to gravity of the earth (**g**)" i.e. w = m.g.

We know that $\mathbf{g_E}$ is about 10 m.s^{-2}. The "acceleration due to gravity" means that when a body falls in the earth's gravitational field it will increase its downward velocity by 10 m.s^{-1} each second. We also know that the earth's circumference (C) is about 40 000 km (or 4 x 10^7 m) so we can calculate the Earth's radius (from $C=2\pi r$).

Using the formula for Newton's Law of Universal Gravitation, the mass of the Earth can also be calculated provided that we know the value of the universal gravitational constant. Fortunately Henry Cavendish devised an ingenious method of doing this so we know that the value of $\mathbf{G = 6{,}67 \times 10^{-11}}$ N.m^2.kg^{-2}.

$$F_{Earth\ on\ man} = m_{man} \cdot g_E = G \cdot \frac{M_{Earth} \times m_{man}}{r_{Earth}^2}$$

$$\therefore \quad g_E = G \cdot \frac{M_{Earth}}{r_{Earth}^2}$$

$$\text{and} \quad M_{Earth} = \frac{g_E \cdot r_{Earth}^2}{G}$$

From the final equation in the box we can calculate a value for $\mathbf{M_{Earth}}$ at approximately 6,4 x 10^{24} kg. (*Can you get this answer?*) Now can you also see why the mutual force of attraction between the man and the earth has so little noticeable effect on the earth?

The equation for the acceleration due to gravity on or near the surface of the Earth ($\mathbf{g_E}$) also tells us that it depends only on the Earth's mass ($\mathbf{M_{Earth}}$) and its radius ($\mathbf{r_{Earth}}$). This means that a tennis ball and a large iron ball will accelerate towards the earth with exactly the same acceleration i.e. large objects and small objects fall with the same acceleration. (Galileo discovered this surprising result through careful experiment.)

When we do the section on electrostatics and Coulomb's Law (Lesson 9), we will find that the equation for forces of electrostatic attraction and repulsion is very similar to the equation for the Law of Universal Gravitation. In Coulomb's Law we have a constant of proportionality $\mathbf{k} = 9 \times 10^9$ N.m^2.C^{-2}. Both follow the inverse square law.

The gravitational field

We will deal with the concept of a field again in the section on electricity and electrostatics (Lesson 9). **A field refers to a region in space where a force can be felt**. So when we have a mass positioned somewhere in space there is a gravitational field associated with that mass.
Look at the equations in the box. We can see that

$$g_E \propto 1/r_{Earth}^2$$

This means that as "r" gets bigger (as we get further from the mass) so the strength of the field decreases "as the square of the distance". This means, for instance, that if the distance doubles then the field drops to ¼ of its strength at a distance of one radius from the centre of the mass.

In gravitational fields, the field strength can be measured by the acceleration of our test mass. If we place a unit mass (1 kg) in the earth's gravitational field (quite close to the earth's surface), that mass will accelerate towards the earth at approximately 10 m.s^{-2}. We can also say that masses will experience a force of 10 N for each kilogram of their mass. So if you are asked what is the strength of the earth's gravitational field near the surface of the earth, you can reply with confidence: "very nearly 10 N.kg^{-1}". (This is the same as saying that any mass placed near the surface of the earth will accelerate towards the earth with an acceleration of 10 m.s^{-2}.

The mass of Earth's moon is much less than the earth's. Its radius is also very different from Earth's. These two factors combine to give a gravitational field strength of about 1,6 N.kg^{-1}, or one sixth that of the earth. A mass near the surface of the moon accelerates towards it at 1,6 m.s^{-2}.

Gravitational action-reaction pairs

From Newton's Third Law. ***when mass A attracts mass B, mass B attracts mass A with a force equal in size but opposite in direction.*** So when the earth attracts the moon, the moon also attracts the earth. These two forces are an ***action-reaction pair***.

LIFE SCIENCES

Tissues, cells and molecular study

Fungi

Lesson 3

1. Introduction

Fungi belong to the Kingdom Mycophyta. All fungi – eg, mushrooms, yeast (used in the baking of bread), toadstools and moulds - flourish in a warm, dark and moist environment. Mould can be found growing on stale bread, cheese, rotting fruit, in the soil and also on dead wood.

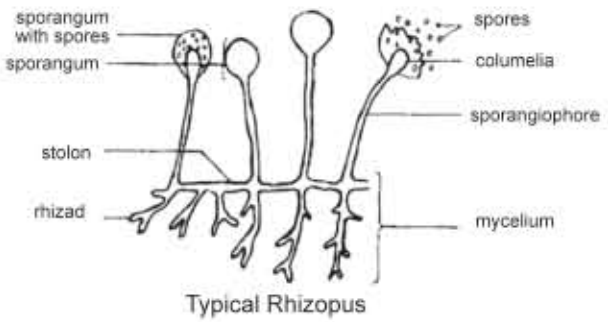
2. Structure

Fungi have a definite nucleus so they are called eukaryotic and are classified as plants because they have a cell wall. Fungi have no chloroplasts so they must obtain food from their environment. They are therefore classified as heterotrophic (can not manufacture their own food).

Generally fungi have a thallus structure. This means that they have no true leaves, stems or roots. Most fungi consist of threadlike hyphae, rather than individual cells. The hyphae are coenocytic, which means that the cytoplasm and nuclei are distributed throughout the structures, with no cross walls to divide it into separate cells.

Types of hypha are:

- Rhizoids - hyphae that grow into root-like structures and absorb nutrients;
- Stolons - hyphae that grow sideways along the substrate;
- Sporangiophores – hyphae that grow upwards; and
- Mycelium – the total mass of all the hyphae together.



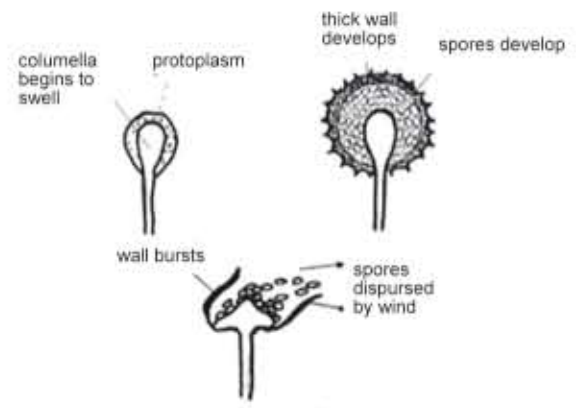
Typical Rhizopus

Typical Rhizopus

Yeast cells have no hyphae. They are separate cells enclosed by a cell wall and contain one nucleus, a vacuole and cytoplasm.

3. Reproduction

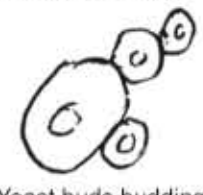
Asexual reproduction occurs when conditions are favourable. A swollen tip develops on the end of the sporangiophore, called a sporangium. A cross wall called the columella separates the sporangiophore from the sporangium. The sporangium contains spores. When it is ripe, the sporangium bursts, releasing the spores into the air. The spores land on a substrate like bread and germinate into promycelium.



Asexual reproduction of bread mould

Sexual reproduction of bread mould

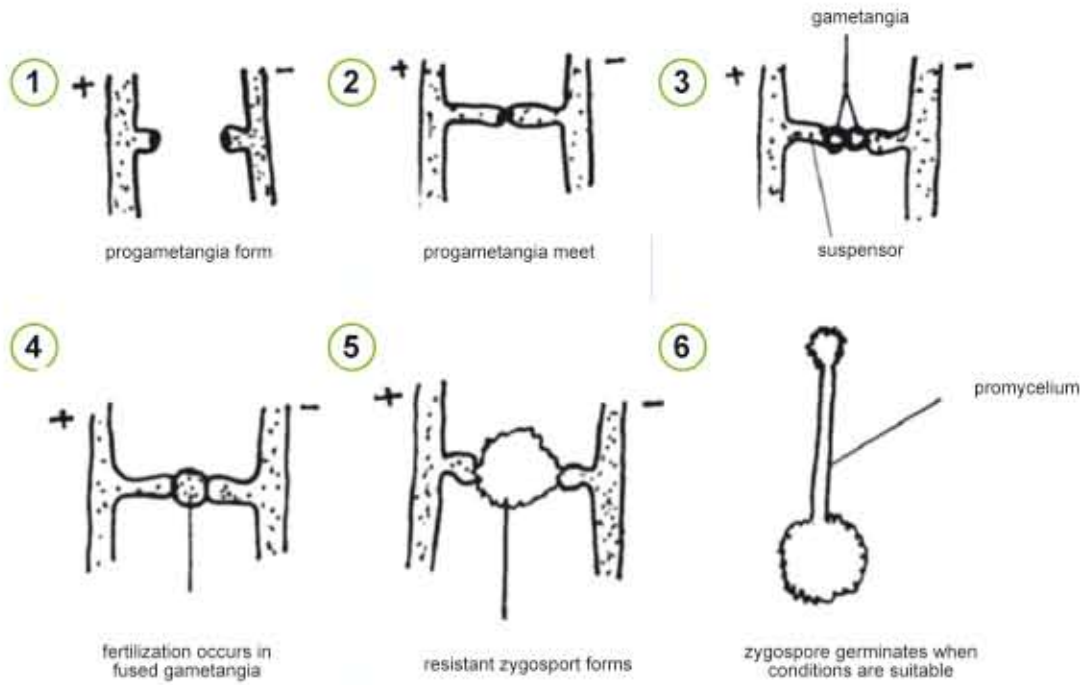
Yeast cells reproduce asexually by making buds. A bud is an outgrowth that develops on the side of the mother cell. This bud breaks off and a new independent yeast cell results.



Yeast buds budding

Asexual reproduction of bread mould

Sexual reproduction takes place when conditions are unfavourable. Two erect hyphae (a + and a – hyphae) grow next to each other. A swelling called the gametangium, develops on each hypha and contains a gamete. The gametangia grow until they touch. The cell wall dissolves and the two gametes fuse to form a diploid zygote. A thick coat develops around the zygote called a zygospore. When conditions are favourable again, the diploid zygote will undergo meiosis to halve the chromosomes, resulting in haploid structure. The zygospore will burst open to release haploid spores. The spores develop into promycelium.



Sexual reproduction of bread mould

4. Nutrition

Fungi are heterotrophic and must take their food into their body. Some species are parasitic and obtain nutrition from a host. These fungi will cause diseases. Some species are saprophytic and live on dead organic matter. The saprophytic fungi are important because they decompose dead organisms to provide nutrients to the soil.

Bread mounds spread across the surface of the bread. Each rhizoid secretes enzymes called cellulase to break down cellulose and amylase to break down starch into glucose. The glucose is absorbed into the cells through the rhizoid hyphae, so digestion is extracellular. Yeast is used in the fermentation process to produce alcohol, carbon dioxide and energy by breaking down glucose. The process is called fermentation and occurs during anaerobic respiration. Yeast is used to produce beer, spirits and wine.

5. Diseases

In plants, fungal hyphae penetrate the tissue of their host and digest the cells. Sporangia produce fine spores on the surface of the leaves. The spores germinate and absorb nutrients from the leaves, until the infection causes the death of the plant. Parasitic fungi – eg, blight, mildews and rusts - cause losses to plant crops. Through biotechnology, new varieties of plants are developed that are resistant to fungal diseases and fungicides are developed to kill fungal infestations. In humans, Tinea causes ringworm and athlete's foot. The skin becomes infected, resulting in skin irritation, swelling and redness. Tinea is contagious and is spread by direct contact with the spores or infected people. Fungicidal ointments or powders are applied directly to the infected area and this kills the fungus. Traditional healers advise infected people to soak feet in a solution of potassium permanganate or to rub peeled cloves of garlic, aloe sap or grated ginger root onto the infected area. Gentian Violet solution is also known to cure ringworm effectively.

Candida is a yeast that lives in the human body. Natural bacteria control the Candida population. When a person is ill or has been on antibiotics, the immunity is low and the candida takes advantage growing out of control. A yeast infection - like vaginal thrush, oral thrush, generalised candida and skin thrush - result. Symptoms are red inflamed areas with a yellowish discharge and the skin becomes itchy and inflamed. Vaginal and oral thrush are spread by physical contact. A person can take interflora or eat yoghurt when taking a course of antibiotics. Once candida has caused infection, anti-yeast creams and prescription tablets must be taken and used. Traditional healers advise the use of a tea made of myrrh or marigold flowers. The tea can be used as a mouth wash for oral thrush or adding a teaspoon of salt to the mixture, as a vaginal wash.

6. Biological importances

Fungi are used to produce antibiotics. Blue mould is used to produce penicillin and soil fungus is used to produce streptomycin.

- Yeast is used to make bread.
- The fermentation process is used to produce beer, spirits and wine.
- Mushrooms, truffles and morels are used in cooking.
- Biotechnology: a fungus called fusarium graminearum is used to produce a food product rich in myco-proteins, which is high in protein and dietary fibre but low in fat, so it makes a very good meat supplement.

MATHEMATICAL LITERACY SPECIAL

Calculating costs

Telephone cards and public telephones

Sequence of activities:

1. Setting the scene

Telephone cards for use in public telephones provide a form of credit – you pay for telephone calls that you have not made yet. In this lesson we examine the different ways in which that credit can be used most effectively by comparing the costs of the different kinds of calls that can be made from a public telephone using a phone card.

2. Reading the table

Look at the Telkom table provided and read the table and study how telephone calls from a public phone are charged. You should be able to answer at least the following questions:

- How is the cost of a telephone call determined?
  Answer: Fixed cost of R 0,50 per "metering" period. The length of the "metering" period s determined by the kind of call.
- What are the different factors that affect the cost of a call?
  Answer: **Time of day** (note the times are slightly different for landline and mobile calls); **distance** (in the case of landline calls only) and of course **duration**

The key idea is for you to establish is that calls from a public phone are charged at a fixed rate per unit and that the length of a unit is determined by different factors such as time of day, distance of call and whether you call a Telkom number or a cellular number.

To test your understanding of this idea, complete the following table:

Number of units for different telephone calls			Call duration (minutes)								
			0,5	1	1,5	2	2,5	3	3,5	4	4,5
To Telkom	Std time	Local									
		Long distance									
	Callmore time	Local									
		Long distance									
To mobile numbers		Rate 1									
		Rate 2									

The following are typical calculations used to complete the table:

- **4 minute long call to a Telkom phone during standard time:**
  4 min × 60 sec/min = 240 sec
  240 sec ÷ 20,7 sec/unit = 11,59 units
  but calls are charged "per unit or part thereof"
  therefore 12 units × R 0,50 per unit = R 6,00
- **2½ minute call to a mobile phone during Rate 2 time:**
  2½ min × 60 sec/min = 150 sec
  150 sec ÷ 17,6 sec/unit = 8,52 units
  but calls are charged "per unit or part thereof"
  therefore 9 units × R 0,50 per unit = R 4,50

Answers

Number of units for different telephone calls			Call duration (minutes)								
			0,5	1	1,5	2	2,5	3	3,5	4	4,5
To Telkom	Std time	Local	1	2	2	3	3	4	4	5	5
		Long distance	2	3	5	4	8	9	11	12	14
	Callmore time	Local	1	1	1	2	2	2	2	3	3
		Long distance	1	2	3	4	4	5	6	7	8
To mobile numbers		Rate 1	3	6	9	11	14	17	19	22	25
		Rate 2	2	4	6	7	9	11	12	14	16

3. Making sense of the information in the completed table

Unlike many of the tables that we deal with, the values in this table (the number of units needed for a particular call) do not always increase as the time increases. Consider the values for the Callmore local calls: 1; 1; 1; 2; 2; 2; 2; 3; 3 – why do these values not always increase as the time increases? This is the result of the way in which calls are charged – "per interval or part thereof."

4. Units per telephone card and minutes of telephone time

Establish the number of units that different telephone cards represent.
Calculate the number of minutes these units represent for each of the different types of calls in the Telkom table (this will involve conversion from seconds to minutes and hours). Represent this graphically by means of a bar graph.

5. Would it make more sense to give a child a phone card or a cellular phone?

Develop a response to this question based on the calculation done here and on your view of the benefits of using a cellular phone versus using a phone card.

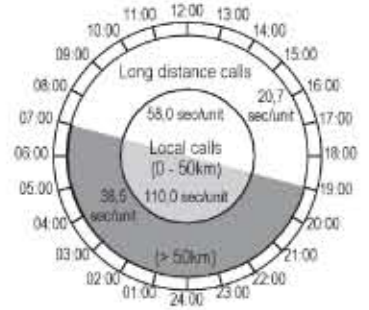
Data required:
Data available at www.telkom.co.za

Telephone call charges from public phones		Rand (excl VAT)	Rand (incl VAT)
	Unit charge per metering period	0,439	0,50
Calls to Telkom phones	**Metering period in seconds**		
	Standard time: Monday to Friday 07:00 to 19:00	Callmore time: Monday to Friday 19:00 to 07:00 and Friday 19:00 to Monday 07:00	
Local (0-50 km)	58,0	110,0	
Long distance (> 50km)	20,7	38,5	
Calls to mobile cellular phones	**Metering period in seconds**		
	Rate 1: Weekdays from 07:00 to 20:00	**Rate 2:** Monday to Friday 20:00 to 07:00 and Friday 20:00 to Monday 07:00	
	11,2	17,6	
source: www.telkom.co.za			

Different Telkom telephone cards available:
R10,00; R 20,00; R 30,00 etc.

Possible extensions:

- Develop a diagrammatic representation of the costs for a call from a public telephone to a mobile telephone.
- Develop a graph for the information found in the table.
- Compare the cost of using a telephone card on a Telkom public phone with the cost of making a telephone call from a street vendor service.



A diagrammatic representation of the information in the table above for calls to Telkom phones

Materials needed:

- Basic calculators

Other resources:

- Newspaper advertisements for Telkom phone cards

Mathematical concepts dealt with:

- Basic calculations
- Working with formulae
- Tables of values
- Arithmetical operations
- Interpreting answers in context
- Expenses
- Input values
- Output values
- Describing trends
- Ratio/proportion
- Rate
- Conversion of units

MATHEMATICAL LITERACY SPECIAL

The cost of using a Telkom public phone

Telephone call charges from public phones		Rand (excl VAT)	Rand (incl VAT)
	Unit charge per metering period	0,439	0,50
Calls to Telkom phones	**Metering period in seconds**		
	Standard time: Monday to Friday 07:00 to 19:00	Callmore time: Monday to Friday 19:00 to 07:00 and Friday 19:00 to Monday 07:00	
Local (0-50 km)	58,0	110,0	
Long distance (> 50km)	20,7	38,5	
Calls to mobile cellular phones	**Metering period in seconds**		
	Rate 1: Weekdays from 07:00 to 20:00	**Rate 2:** Monday to Friday 20:00 to 07:00 and Friday 20:00 to Monday 07:00	
	11,2	17,6	

source: www.telkom.co.za

Task 1

Use the table and calendar provided to answer the following questions.

April 2005						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

1.1 What is the VAT inclusive charge for a metering period?

1.2 At what rate (Standard Time; Callmore time; Rate 1 or rate 2) will the following calls be charged?

(a) To Telkom at 16:00 on 26/04/05
(b) To Telkom at 19:30 on 26/04/05
(c) To Cellular at 19:30 on 26/04/05
(d) To Telkom at 13:00 on 27/04/05
(e) To Telkom at 13:00 on 30/04/05
(f) To Cellular at 08:00 on 07/05/05

1.3 How long (in seconds) is the metering period for each of the following calls?

(a) To Telkom (45km) at 16:00 on 15/04/05
(b) To Cellular phone at 16:00 on 15/04/05
(c) To Telkom (98km) at 19:30 on 16/04/05
(d) To Cellular phone at 19:30 on 16/04/05
(e) To Telkom (15km) at 11:30 on 17/04/04
(f) To Cellular at 11:30 on 17/04/04
(g) To Telkom (1125km) at 14:00 on 18/04/05
(h) To Cellular at 14:00 on 18/04/05

1.4 How much will each of the following calls cost?

(a) To Telkom (45km) at 20:00 on 15/04/05 duration 7 minutes
(b) To Cellular phone at 20:00 on 15/04/05 duration 7 minutes
(c) To Telkom (78km) at 16:00 on 07/04/05 duration 4 minutes
(d) To Cellular phone at 16:00 on 07/04/05 duration 4 minutes

1.5 How long will you be able to speak for if you have R2,00 and want to make the following calls?

(a) A **local call** to a **Telkom** phone during **Standard time**
(b) A **long distance call** to a **Telkom** phone during **Standard time**
(c) A **local call** to a **Telkom** phone during **Callmore time**
(d) A **long distance call** to a **Telkom** phone during **Callmore time**
(e) A call to a mobile number during **Rate 1** time
(f) A call to a mobile number during **Rate 2** time

Task 2: Complete the table below

Number of units for different telephone calls			0,5	1	1,5	2	2,5	3	3,5	4	4,5
To Telkom	Std time	Local									
		Long distance									
	Callmore time	Local									
		Long distance									
To mobile numbers		Rate 1									
		Rate 2									

Task 3: Use graph paper to draw graphs that can be used to determine the cost of:

(a) A **local call** to a **Telkom** phone during **Standard time**
(b) A **long distance call** to a **Telkom** phone during **Standard time**
(c) A **local call** to a **Telkom** phone during **Callmore time**
(d) A **long distance call** to a **Telkom** phone during **Callmore time**
(e) A call to a mobile number during **Rate 1** time
(f) A call to a mobile number during **Rate 2** time

Task 1

1.1 R0,50

1.2
- (a) Standard time
- (b) Callmore time
- (c) Rate 1
- (d) Standard time
- (e) Callmore time
- (f) Rate 2

1.3
- (a) 58 sec
- (b) 11,2 sec
- (c) 38,5 sec
- (d) 17,6 sec
- (e) 110,0 sec
- (f) 17,6 sec
- (g) 20,7 sec
- (h) 11,2 sec

1.4 The method used in solving the question is shown in question (a)
- (a) Local call; Callmore time (17,6 sec/unit)
  7 min = 7 min × 60 sec/min = 420 sec
  units = 420 sec ÷ 17,6 sec/unit = 4 units
  (note 3,818 units is rounded up to 4)
  cost = 4 units × R0,50/unit = **R2,00**
- (b) R12,00
- (c) R6,00
- (d) R11,00

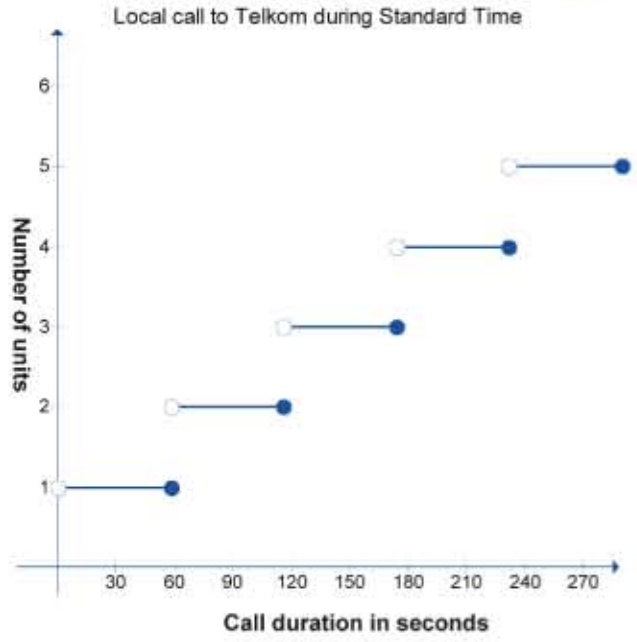
1.5 The method used in solving the question is shown in question (a)
- (a) no. units = R2,00 ÷ R0,50/unit = 4 units
  local call / standard time ⇒ 58 sec/unit
  ∴ time = 4 units × 58 sec/unit = 232 sec
  232 sec = 3 min 52 sec
- (b) 82,8 sec = 1 min 22,8 sec
- (c) 440 sec = 7 min 20 sec
- (d) 154 sec = 2 min 34 sec
- (e) 44,8 sec
- (f) 70 sec = 1 min 10 sec

Task 2

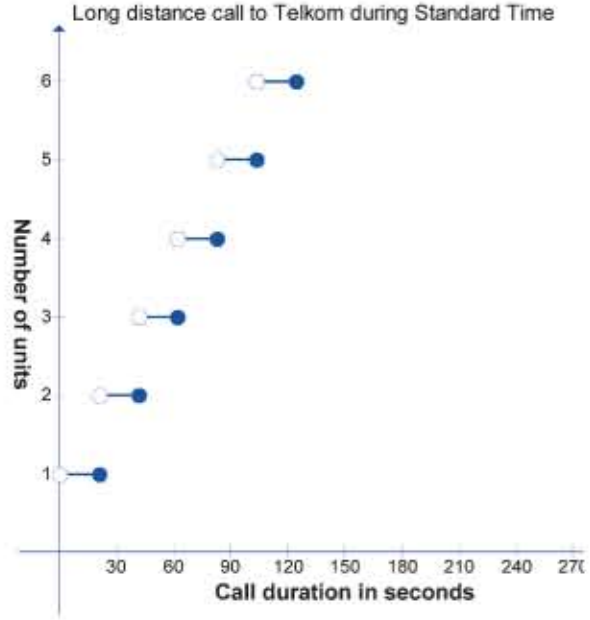
Number of units for different telephone calls			Call duration (minutes)								
			0,5	1	1,5	2	2,5	3	3,5	4	4,5
To	Std time	Local	*1*	*2*	*2*	*3*	*3*	*4*	*4*	*5*	*5*
		Long distance	*2*	*3*	*5*	*6*	*8*	*9*	*11*	*12*	*14*
	Callmore time	Local	*1*	*1*	*1*	*2*	*2*	*2*	*2*	*3*	*3*
		Long distance	*1*	*2*	*3*	*4*	*4*	*5*	*6*	*7*	*8*
To mobile numbers		Rate 1	*3*	*6*	*9*	*11*	*14*	*17*	*19*	*22*	*25*
		Rate 2	*2*	*4*	*6*	*7*	*9*	*11*	*12*	*14*	*16*

Task 3

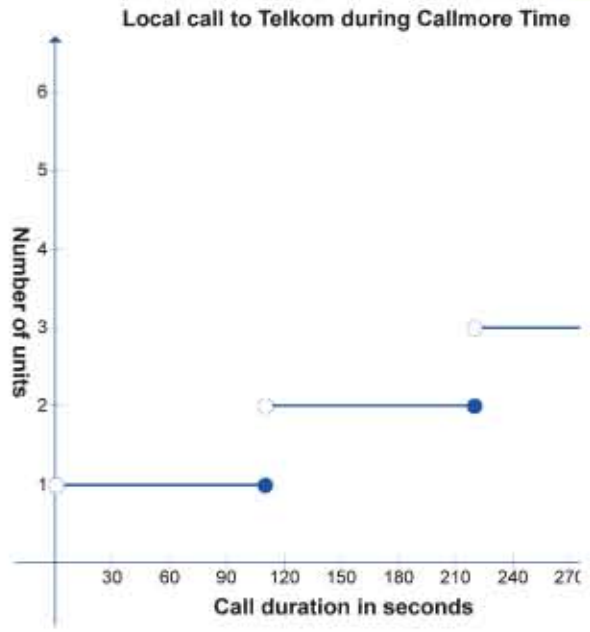
(a)



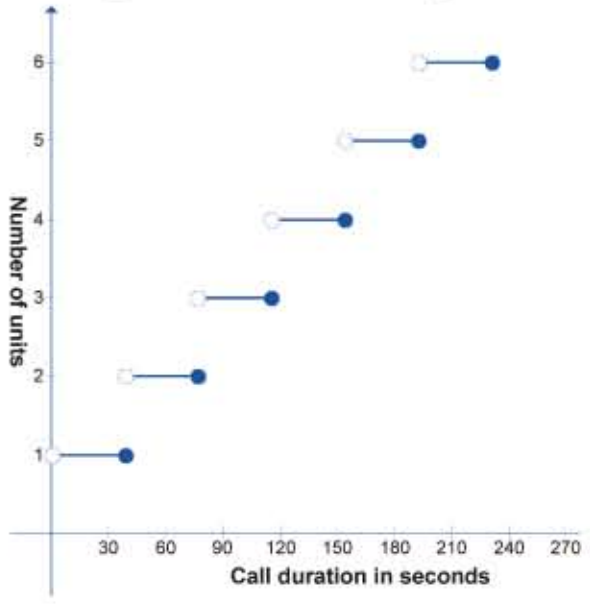
(b)



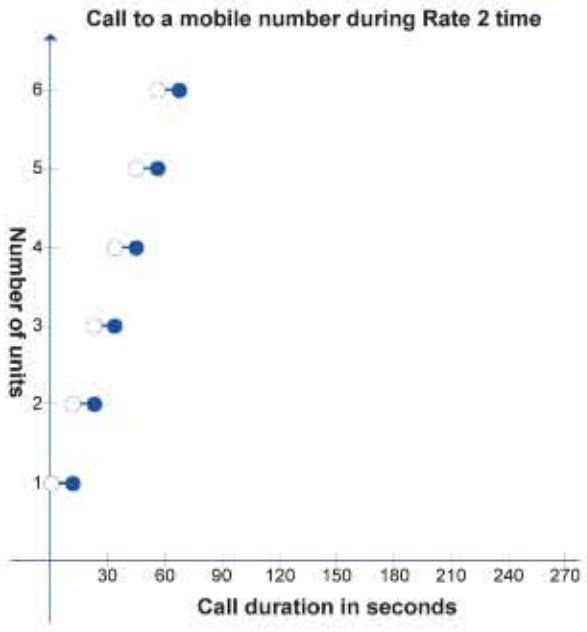
(c)



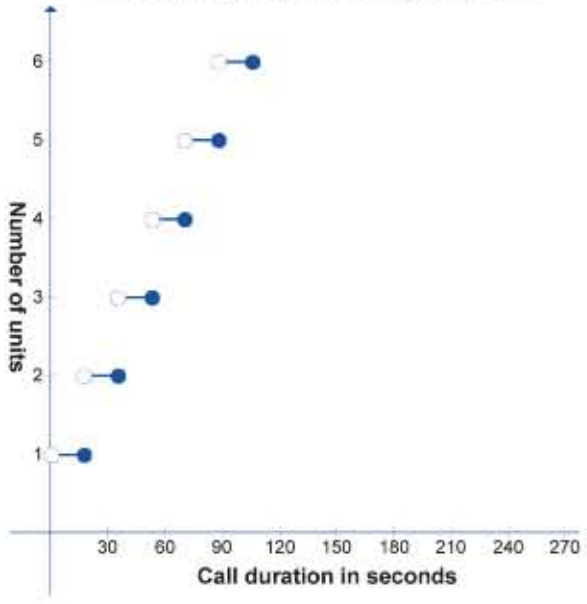
(d)



(e)



(f)



PHYSICS EXAMINATION PAPER GRADE 10 - Page 1

Section A

Question 1: One-word answers

Write only the word/term for each of the following descriptions next to the question number (1.1 - 1.5). In some questions you may need to choose from the terms given in brackets.

1.1 Velocity can be defined as the rate of change of ... . (1)

1.2 The distance between two consecutive crests on a wave (1)

1.3 The ratio of the speed of light in a vacuum to the speed of light in an optical medium (1)

1.4 Materials that do not conduct electricity (1)

1.5 A stationary charge creates a(n) (gravitational/electric/magnetic) field. (1)
[5]

Question 2: Matching items

Match the information in COLUMN A with the information in COLUMN B by writing only the letter (A - J) next to the question number (2.1 - 2.5).

COLUMN A		COLUMN B	
2.1	Magnetic field lines	A	angle of incidence is equal to the critical angle
2.2	The gradient of a velocity vs time graph	B	coulomb
2.3	Total internal reflection	C	displacement
2.4	Standing waves	D	formed by interference of refracted and reflected waves
2.5	Unit of resistance	E	direction from south to north pole
		F	acceleration
		G	ohm
		H	angle of incidence is greater than the critical angle
		I	direction from north to south pole
		J	formed by interference of incident and reflected waves

[5]

PHYSICS EXAMINATION PAPER GRADE 10 - Page 2

Question 3: True or false

Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (3.1 - 3.5). If the statement is FALSE write down the correct statement.

3.1 A charged ruler 'bends' a thin stream of water from a running tap because water molecules are polar. (2)

3.2 When an object falls vertically in the absence of friction, its gravitational potential energy increases. (2)

3.3 The amplitude of a transverse wave is the vertical distance from the trough to the crest. (2)

3.4 Endoscopes make use of the refraction of light. (2)

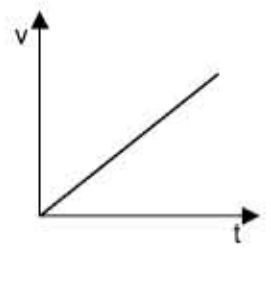
3.5 Iron and steel can be magnetised because they are ferromagnetic. (2)
[10]

Question 4: Multiple-choice questions

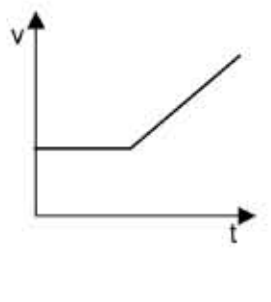
Various possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer, which in your opinion, is the correct or best one and mark the appropriate block with a cross (X).

4.1 A car travels at constant speed up a long hill. It then travels faster as it goes down the other side of the hill. Which ONE of the following speed vs time graphs best represents the motion of the car?

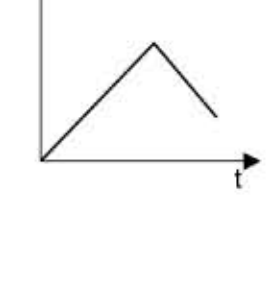
A



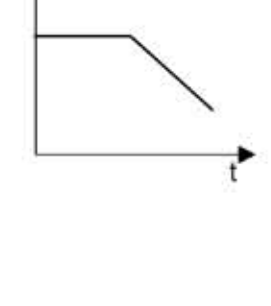
B



C



D



4.2 A stone is dropped from the top of a building. After 2 s the stone will have ... than it had at the top of the building.

A greater gravitational potential energy
B less kinetic energy
C greater kinetic energy
D less mechanical energy (3)

4.3 When light travels from air into water, the light ray is refracted. Which ONE of the following combinations, regarding the direction of refraction and the speed of the ray, is correct?

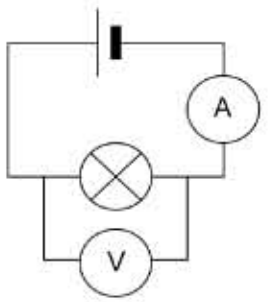
	Direction of refraction	Speed of ray
A	Away from the normal	Increases
B	Away from the normal	Decreases
C	Towards the normal	Increases
D	Towards the normal	Decreases

(3)

4.4 A glass rod is charged positively by rubbing the glass rod with a silk cloth. During this process ...

A electrons are transferred from the glass rod to the silk cloth.
B electrons are transferred from the silk cloth to the glass rod.
C protons are transferred from the glass rod to the silk cloth.
D protons are transferred from the silk cloth to the glass rod. (3)

4.5 Consider the closed circuit represented below.



How will the ammeter and voltmeter readings change, if the bulb burns out?

	Ammeter reading ...	Voltmeter reading ...
A	increases.	increases.
B	becomes zero.	becomes zero.
C	does not change.	does not change.
D	becomes zero.	does not change.

(3)
[15]

TOTAL SECTION A: 35

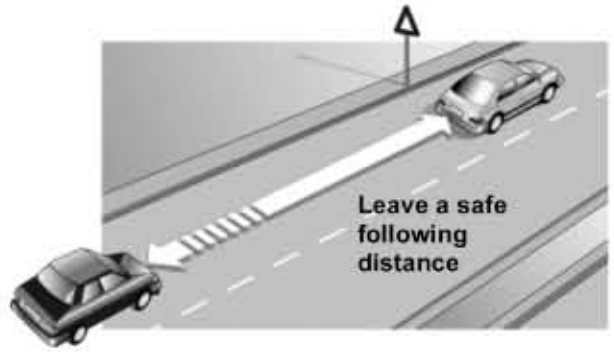
Section B

Instructions and information

1. In ALL calculations, formulae and substitution must be shown.
2. Round off your answers to TWO decimal places.

Question 5

Speeding and unsafe following distances are some of the many factors that cause fatal accidents on South African roads. During a road safety campaign the traffic authorities investigated the influence of speed on stopping distances to make drivers aware of the dangers of speeding. The results of an investigation, for a uniformly accelerated motion, are illustrated in the table below. All values are approximate values.



Speed ($km \cdot h^{-1}$)	Stopping distance (m)
32	12
48	23
64	36
80	53
96	74
112	96

5.1 Draw a fully labelled graph of stopping distance (on the dependent, y-axis) vs speed (on the independent, x-axis). Plot the points and sketch your graph. Use graph paper. (5)

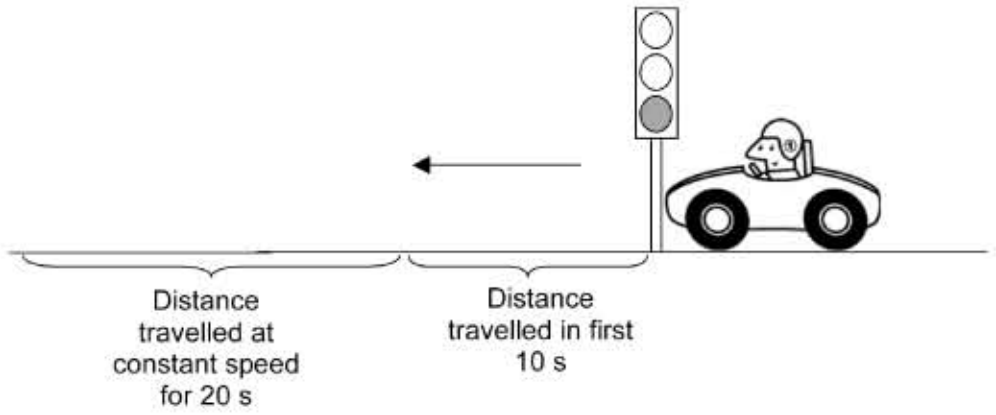
5.2 What is the relationship between speed and stopping distance? (2)

5.3 From your graph, read off the stopping distance for a car travelling at 100 $km \cdot h^{-1}$. Show clearly on your graph how you determined this distance. (2)

5.4 The number of cars on our roads increases as more South Africans buy their own cars. Name THREE precautions that they can take to reduce road fatalities. (3)
[12]

Question 6

A car is stationary at a red traffic light. When the light changes to green the car accelerates at 1,6 $m \cdot s^{-2}$ along a straight level road for 10 s. The car then moves at a constant speed for the next 20 s.



6.1 Calculate the speed of the car after the first 10 s. (4)

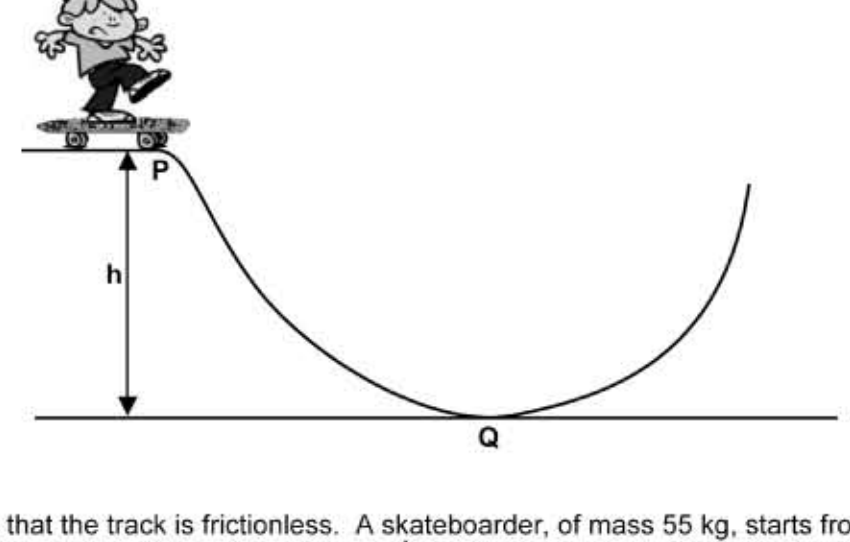
6.2 Calculate the distance that the car moves during the first 10 s. (4)

6.3 Calculate the distance travelled at constant speed. (4)

6.4 Draw a sketch graph of speed vs time for the first 30 s of the car's motion. Use the speed value calculated in QUESTIONS 6.1 on your graph. (4)
[16]

Question 7

A skateboard track is shown below.



Assume that the track is frictionless. A skateboarder, of mass 55 kg, starts from rest at position P and reaches a speed of 3 $m \cdot s^{-1}$ at position Q.

7.1 State, in words, the principle of **conservation of mechanical energy**. (2)

7.2 Calculate the height **h** from which a skateboarder must skate to reach a speed of 3 $m \cdot s^{-1}$ at position Q. (5)

7.3 Skateboard racing has become a favourite hobby among young people in many areas in South Africa. Young people race down the steepest streets that they can find.

7.3.1 Why do they look for the steepest streets? (2)

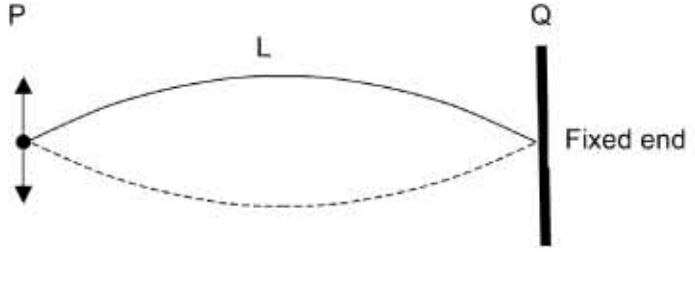
7.3.2 State TWO possible dangers associated with skateboard racing in streets. (2)

7.3.3 Why is it reasonable to assume that mechanical energy will not be conserved when skateboarding in the street? (2)
[13]

Question 8

The generation of standing waves is a very common occurrence in everyday life. It occurs in vibrating strings (e.g. guitars, violins etc) and solid objects where waves are reflected between boundaries (eg. a bridge). The production of sound in all musical instruments depends on the generation of standing waves.

The diagram below shows a string of length, L, fixed at one end (point Q). It is shaken to and fro at point P, until a standing wave of one segment (loop) is formed.



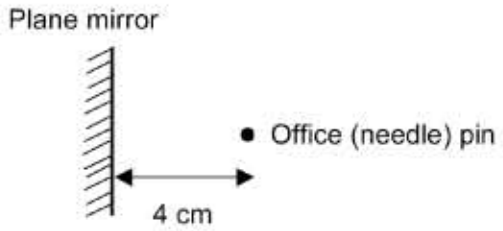
8.1 Name THREE conditions necessary for the formation of standing waves. (3)

8.2 Redraw the above diagram in your answer book. Below your sketch now draw the standing wave pattern formed, on the same string of length L, if the frequency is two times greater than the first pattern. On your sketch label all the nodes and anti-nodes. (4)

8.3 What do the nodes and anti-nodes represent? (2)
[9]

Question 9

An experiment is performed to determine the relationship between the angle of incidence and the angle of reflection. An office (needle) pin is fixed vertically in front of a plane mirror as shown below.



9.1 Draw a vertical line, 10 cm long, to represent the mirror. Draw a dot at a perpendicular distance of 4 cm from the mirror, to represent the office (needle) pin. Draw a ray from the dot so that the ray makes an angle of 55° with the mirror. Draw an accurate ray diagram showing the following:

- Angle of incidence
- Normal to the mirror
- Reflected ray that produces the sharpest image
- Position of the image (6)

9.2 Measure the angle of reflection and state the relationship between the angle of incidence and the angle of reflection. (4)

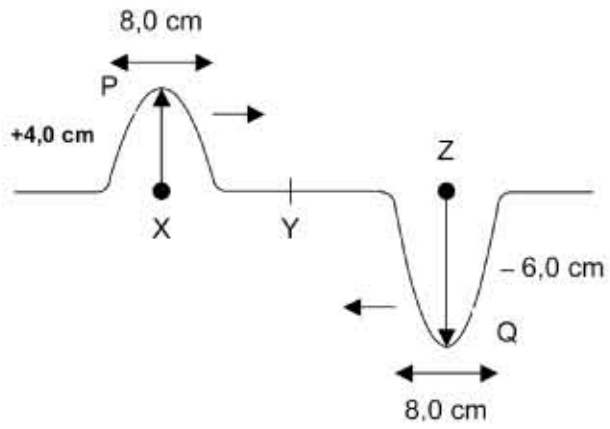
9.3 Describe the image that is formed inside the mirror. (3)

9.4 Explain the difference between *specular (regular) reflection* and *diffuse reflection*. (2)
[15]

Question 10

Pulses form part of our everyday lives. It can be the result of a chain collision on the highway, spectators standing up and sitting down during a Mexican wave at a sports event, or the sudden compression of air caused by an explosion.

Two pulses, P and Q in a string, approach each other at the same speed. Pulse P has an amplitude of +4,0 cm when it is at position X. Pulse Q has an amplitude of – 6,0 cm when it is at position Z. Points X and Z are the same distance from point Y. The pulses both have a length of 8,0 cm. Pulse P and Q meet at position Y. Assume that no energy is lost.



10.1 Write down the definition of a pulse. (2)

10.2 Write down the name of the phenomenon that occurs when the two pulses meet at position Y. (2)

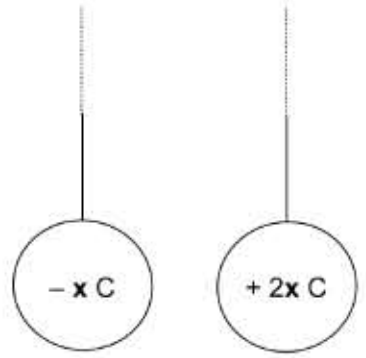
10.3 Make a labelled sketch to show what happens when the pulses P and Q meet at position Y. Also indicate the pulse length. (3)

10.4 Make a labelled sketch to show what happens when pulse P reaches position Z. (2)

10.5 Pulse P travels from position X to position Z, a distance of 0,6 m, in 1,5 s. Calculate the speed of pulse P. (4)
[13]

Question 11

Two insulated, graphite-coated polystyrene spheres are suspended from threads. The spheres are held a small distance apart. The charges on the spheres are – **x** C and + 2**x** C. When the spheres are released they move towards each other.



11.1 Explain why the spheres move towards each other when they are released. (2)

The two spheres now touch each other.

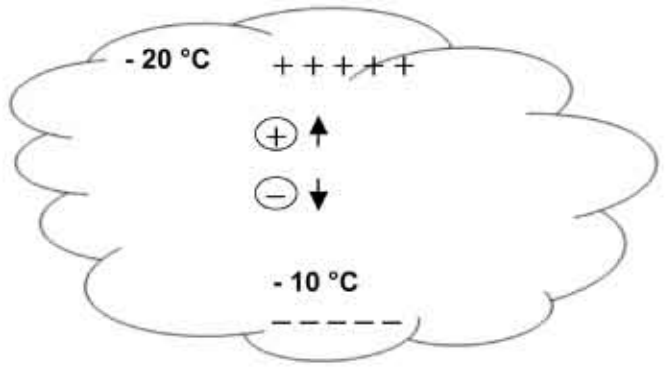
11.2 Calculate the charge on each sphere. (3)

11.3 Will the force now be one of attraction or repulsion? Give a reason for your answer. (3)

11.4 Will two charged spheres that touch ALWAYS move away from each other? Explain your answer. (3)
[11]

Question 12

During a thunderstorm, strong air currents inside clouds rub ice crystals against each other. This results in a separation of charge and hence a *potential difference*. The potential difference between the top and the bottom of a storm cloud can be millions of volts. Friction leaves the top of the cloud positively charged and the bottom of the cloud negatively charged. Generally, low lying clouds have a temperature of – 10 °C at the bottom and – 20 °C at the top.



When lightning strikes, negative charge from the bottom of the cloud leaps down through the air to the ground. A lightning flash usually consists of several static discharges one after another. The temperature inside a flash can be around 25 000 °C.

12.1 Define the following terms:

12.1.1 Electric current (2)

12.1.2 Potential difference (3)

12.2 Explain why ice crystals are formed in the clouds. (2)

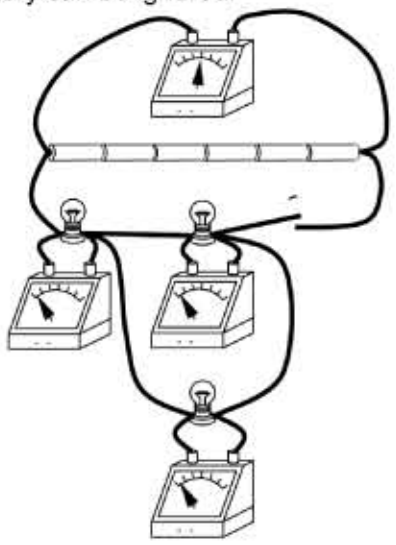
In one of the lightning flashes 75 A of electric current passes from the bottom of the cloud to the ground below in 1,5 s.

12.3 Calculate the amount of charge that passes from the cloud to the ground in the lightning flash. (4)

12.4 The potential difference between the bottom of the cloud and the ground is 2 000 000 V. Use your answer from QUESTION 12.3 to calculate the amount of heat energy produced during the lightning flash. (4)
[15]

Question 13

In the circuit represented below, the bulbs are identical. The resistance of the connecting wires and the battery can be ignored.



13.1 Draw a circuit diagram for the circuit using the correct symbols. (3)

After the switch is closed the reading on voltmeter V_1 is 4 V. Determine the following:

13.2 Reading on voltmeter V_2 (2)

13.3 Reading on voltmeter V_3 (2)

13.4 Reading on voltmeter V_4 (2)

13.5 EMF of each cell in the battery (2)
[11]

TOTAL SECTION B: 115

GRAND TOTAL: 150

Data for physical sciences grade 10 - paper 1 (physics)

Table 1: Physical constants

Name	Symbol	Value
Acceleration due to gravity	*g*	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^8$ $m \cdot s^{-1}$

Table 2: Formulae

Motion

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

Weight and mechanical energy

$F_g = mg$	$U = E_p = mgh$
$K = E_k = \frac{1}{2}mv^2$	

Waves, light and sound

$v = f\lambda$ or $v = \nu\lambda$	$T = \frac{1}{f}$ or $T = \frac{1}{\nu}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTRICITY AND MAGNETISM

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$

Section A

Question 1

1.1 Displacement ✓ (1)

1.2 Wavelength ✓ (1)

1.3 Refractive index ✓ (1)

1.4 Insulators or non-conductors ✓ (1)

1.5 Electric ✓ (1)
[5]

Question 2

2.1 I ✓ (1)

2.2 F ✓ (1)

2.3 H ✓ (1)

2.4 J ✓ (1)

2.5 G ✓ (1)
[5]

Question 3

3.1 True ✓✓ (2)

3.2 False. ✓✓ Its gravitational potential energy decreases. (2)

3.3 False. ✓✓ The amplitude is the vertical distance from the position of rest to the crest or trough. (2)

3.4 False ✓✓ Endoscopes make use of total internal reflection of light. (2)

3.5 True ✓✓ (2)
[10]

Question 4

4.1 B ✓✓✓ (3)

4.2 C ✓✓✓ (3)

4.3 D ✓✓✓ (3)

4.4 A ✓✓✓ (3)

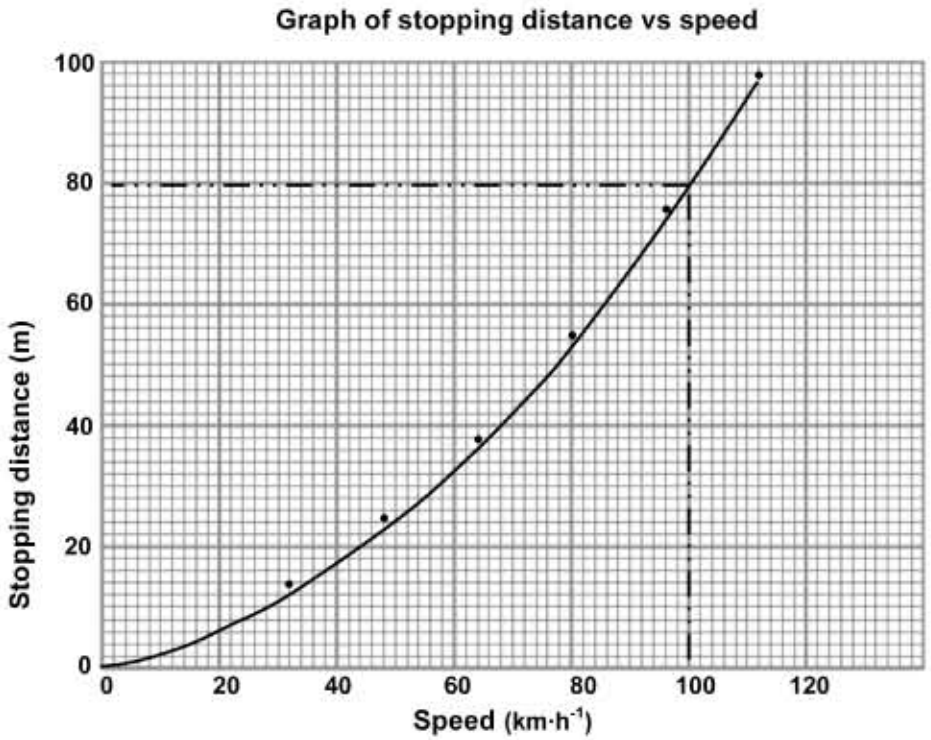
4.5 D ✓✓✓ (3)
[15]

Total Section A = [35]

Section B

Question 5

5.1



Checklist	1	0
Relevant heading and correct labels with units on both axes.		
Correct scale on x –axis		
Correct scale on y–axis		
All points correctly plotted.		
Curve drawn correctly.		
Total 5		

(5)

5.2 Stopping distance increases more and more rapidly as the car's

5.2 Stopping distance increases more and more rapidly as the car's speed increases OR stopping distance $\propto$ (speed)^2 ✓✓ (2)

5.3 78 – 82 km·h^{-1} ✓ Indicated on graph / Mark positively from graph ✓ (2)

5.4 Any three relevant precautions which will increase the reaction time. ✓✓✓

Examples:
Do not drink and drive.
Ensure the car's brakes are in good condition.
Do not use a cell phone while driving.
Keep a safe following distance.
Keep to the speed limit.
Do not overload your car - as mass increases stopping distance increases.
Tyres should have enough tread. (3)
[12]

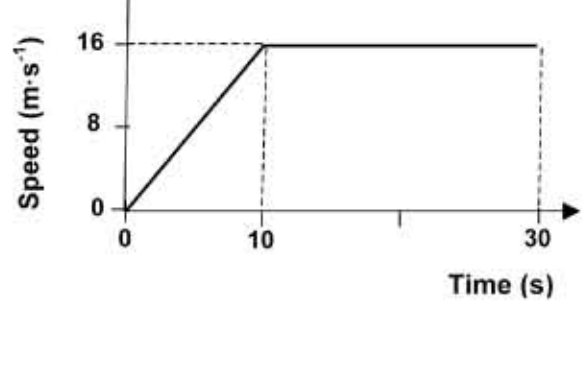
Question 6

6.1 $v_f = v_i + at$ ✓= 0 ✓+ (1,6)(10) ✓= 16 m·s^{-1}✓ (4)

6.2 $\Delta x = v_i t + \frac{1}{2}at^2$ ✓ =(0)(10)✓+ $\frac{1}{2}$(1,6)(10)^2 ✓= 80 m ✓ (4)

6.3 $\Delta x = v_i t + \frac{1}{2}at^2$ ✓ =(16)(20)✓+ $\frac{1}{2}$(0)(20)^2 ✓= 320 m.✓

6.4



Checklist	1	0
Time, 10 s and 30 s indicated on x-axis		
Speed (16 m·s^{-1}) indicated on y-axis		
Line correctly drawn for first 10 s		
Line correctly drawn for last 20 s		
Total: 4		

(4)
[16]

Question 7

7.1 The sum of the gravitational potential energy and kinetic energy ✓ in an isolated system ✓is constant. (2)

7.2 From conservation principle
Total mechanical energy at P = total mechanical energy at Q

$Mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_f^2$✓

(55x 9,8 x h)✓ +(0 = 0) ✓+ (½ x 55) ✓ x(3)^2

$h = \frac{9}{2\times 9,8} = 0,45$ m✓ (5)

7.3.1 The steeper the slope, the greater the value of **h** and the faster one can go down the slope, provided the distance along the slope remains constant, OR $v^2 \propto h_i$ ✓✓ (2)

7.3.2 Any two dangers ✓✓

Examples:
- The faster one goes the more difficult it is to stop or slow down.
- The risk of being run down by passing vehicles.
- There is a danger of head-on collisions when vehicles try to avoid young people.
- There is an increasing risk of crashing into obstacles and hurting themselves.
- Such risks also affect families and communities emotionally and economically. (2)

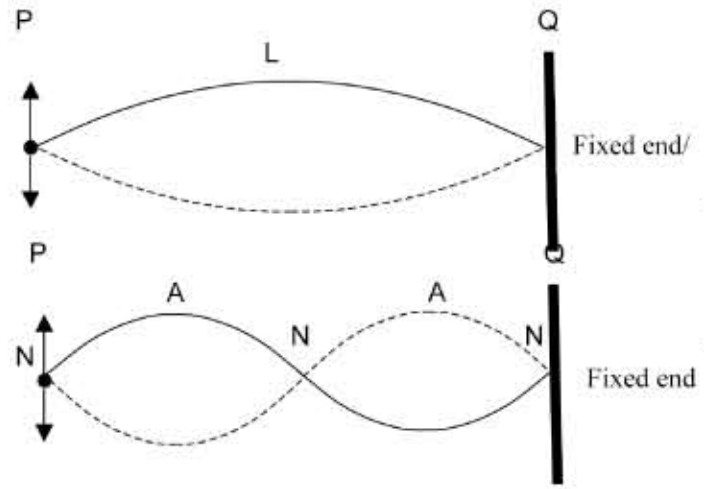
7.3.3 Loss of energy due to friction between wheels of skateboard and street due to roughness of street surface /Not an isolated system✓✓ (2)
[13]

Question 8

✓

8.1 Superimposed incident and reflected wave have equal – wavelengths, ✓speed ✓and amplitude. (3)

8.2



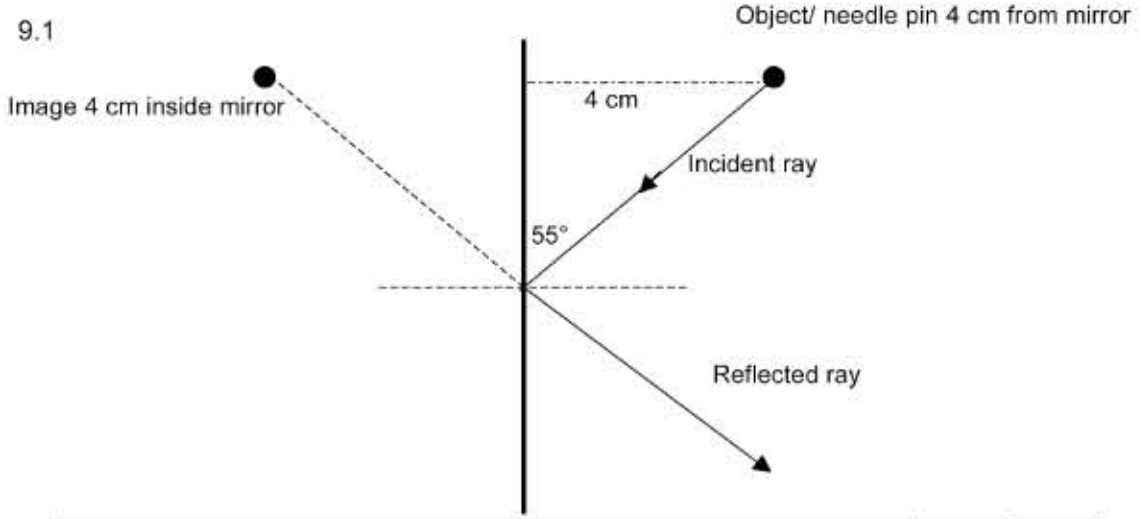
- ✓ same length L
- ✓ same amplitude
- ✓ half wavelength
- ✓ All nodes and antinodes

(4)

8.3 Antinodes – points of maximum disturbance✓
Nodes – point of zero disturbance ✓ (2)
[9]

Question 9

9.1



Checklist	1	0
Plane mirror 10 cm in length		
Office (needle) pin 4 cm ⊥ to mirror		
Incident ray at 55° to mirror (35° to normal)		
Normal at 90° to mirror		
Reflected ray at 55° to mirror (35° to normal)		
Image 4 cm inside mirror		
Total 6		

(6)

9.2 35° ✓✓
Angle of incidence equals angle of reflection✓✓ (4)

9.3 Upright
Same size as object
Laterally inverted
Image distance = object distance
Virtual
[Any three] (3)

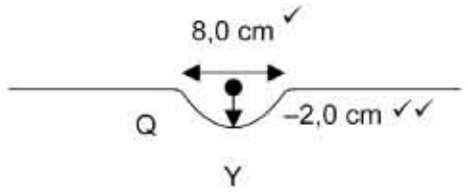
9.4 Specular (or regular reflection) occurs when light rays are reflected as a parallel beam or forms a sharp image, ✓ while during diffuse reflection reflected rays are scattered haphazardly. ✓ (2)
[15]

QUESTION 10

10.1 Pulse is a single disturbance in a medium✓✓ (2)

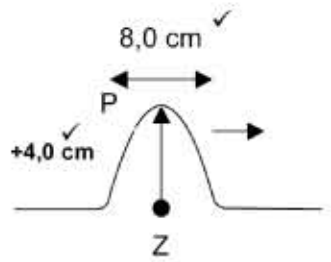
10.2 Superposition / interference / destructive interference ✓✓ (2)

10.3



(3)

10.4



(2)

10.5 $\Delta x = v\Delta t$ ✓ ∴ 0,6 ✓ = v(1,5) ✓ ∴ v = 0,4 m·s^{-1}✓ (4)
[13]

QUESTION 11

11.1 Attract each other due to opposite charges. ✓✓ (2)

11.2 New charge = $\frac{Q_1 + Q_2}{2} = \frac{-x + 2x}{2} = \frac{x}{2}$ C ✓ (3)

11.3 Repulsion ✓ ✓✓
The nature of the charge / Sign of the charge on both spheres is the same
(3)

11.4 No. ✓ If the nett charge is zero, they will not move apart. ✓✓
(3)
[11]

QUESTION 12

12.1.1 Flow of charge (**not** rate of flow of charge) ✓✓ (2)

12.1.2 Work done in moving a unit charge from a point of low potential tc a point of high potential ✓✓✓.. (3)

12.2 Low temperatures cause water droplets to freeze. ✓✓ (2)

12.3 Q = It ✓= 75 ✓x 1,5 ✓= 112,5 C ✓ (4)

12.4 $$V = \frac{W}{Q} \checkmark$$

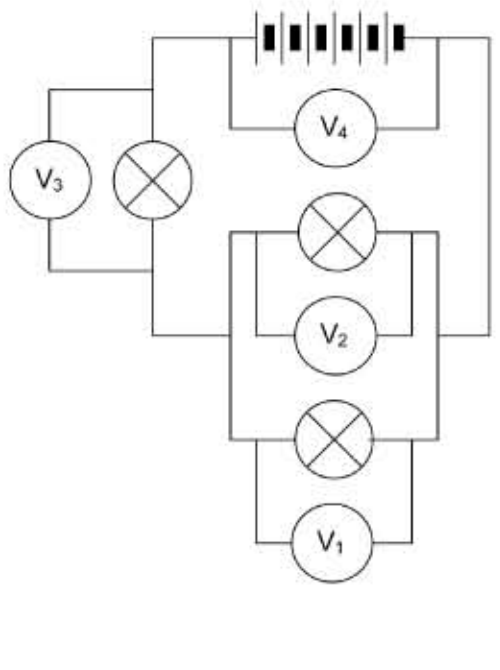
$$\therefore 2\ 000\ 000 \checkmark = \frac{W}{112{,}5} \checkmark$$

$$\therefore \quad W = 225\ 000\ 000\ J\checkmark = 225\ MJ$$

(4)
[15]

QUESTION 13

13.1



Checklist	1	0
6 Cells correctly represented in series.		
Bulbs correctly represented in parallel and in series.		
Voltmeters connected in parallel across bulbs and cells.		
Total 3		

(3)

13.2 4 V ✓✓ (2)

13.3 8 V ✓✓ (2)

13.4 12 V ✓✓ (2)

13.5 2 V ✓✓ (2)
[11]

TOTAL MARKS OF QUESTION PAPER = 150