education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P1 (PHYSICS)

NOVEMBER 2006

MARKS: 150

TIME: 3 hours

This question paper consists of 16 pages, a 1-page answer sheet, a 1-page information sheet and graph paper.

INSTRUCTIONS AND INFORMATION

1. Write your name and/or examination number (and centre number if applicable) in the space provided on the ANSWER SHEET and ANSWER BOOK.

2. Answer ALL the questions.

3. Answer SECTION A on the attached ANSWER SHEET.

4. Answer SECTION B in the ANSWER BOOK.

5. Non-programmable calculators may be used.

6. Appropriate mathematical instruments may be used.

7. Number the answers correctly according to the numbering system used in this question paper.

8. Wherever motivation, discussion, et cetera is required, be brief.

Copyright reserved

SECTION A

Answer this section on the attached ANSWER SHEET.

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]

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)

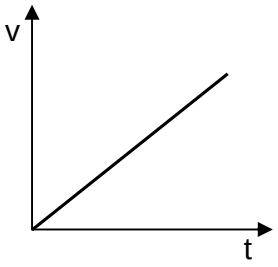
[10]

QUESTION 4: MULTIPLE-CHOICE QUESTIONS

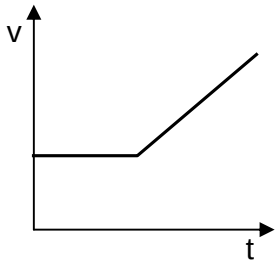
Various possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer, which in your opinion, is the correct or best one and mark the appropriate block with a cross (X).

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?

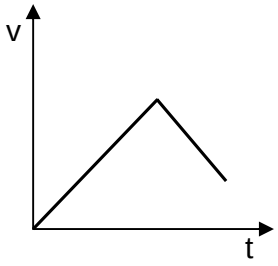
A



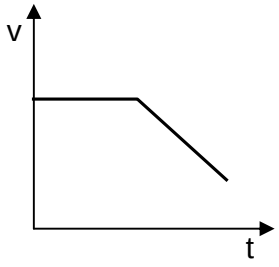
B



C



D



(3)

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 ...

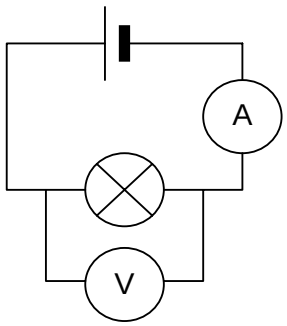
A electrons are transferred from the glass rod to the silk cloth.

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

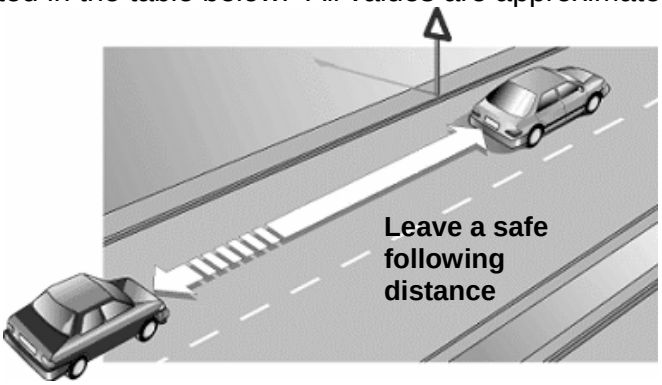
1. Answer this section in the ANSWER BOOK.

2. In ALL calculations, formulae and substitution must be shown.

3. 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 the graph paper provided. (5)

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

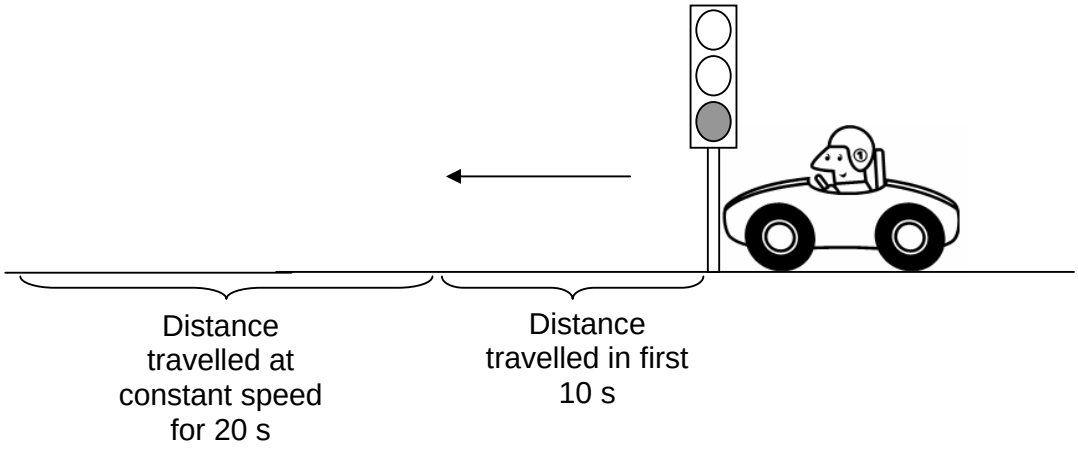
5.3 From your graph, read off the stopping distance for a car travelling at 100 $km \cdot h^{-1}$. Show clearly on your graph how you determined this distance. (2)

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)

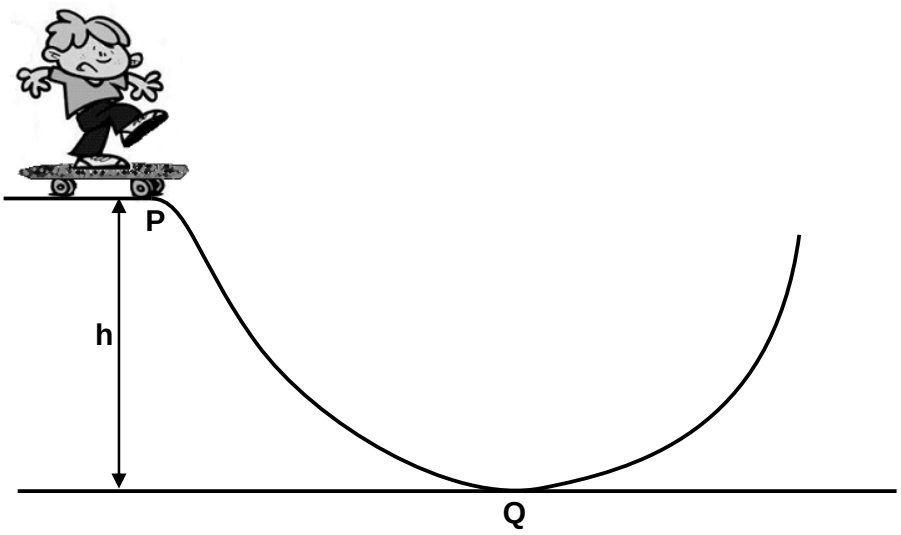
6.3 Calculate the distance travelled at constant speed. (4)

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)

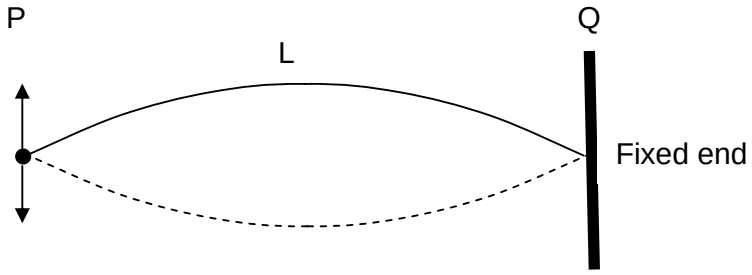
7.3.3 Why is it reasonable to assume that mechanical energy will not be conserved when skateboarding in the street? (2)

[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.



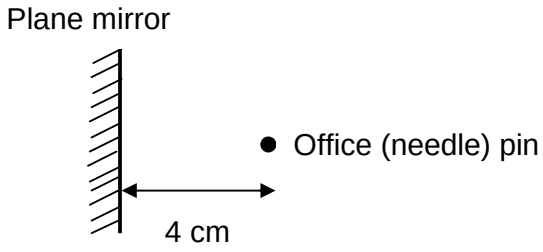
8.1 Name THREE conditions necessary for the formation of standing waves. (3)

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)

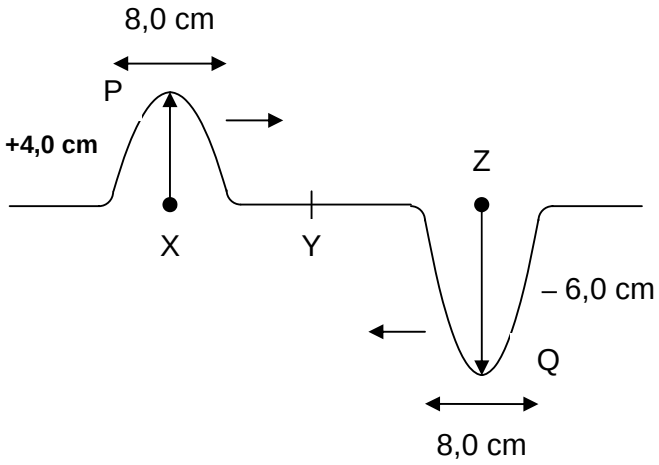
9.4 Explain the difference between *specular (regular) reflection* and *diffuse reflection*. (2)

[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)

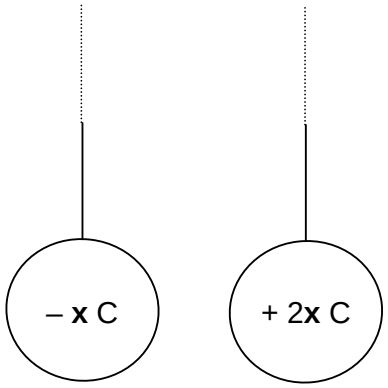
10.4 Make a labelled sketch to show what happens when pulse P reaches position Z. (2)

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)

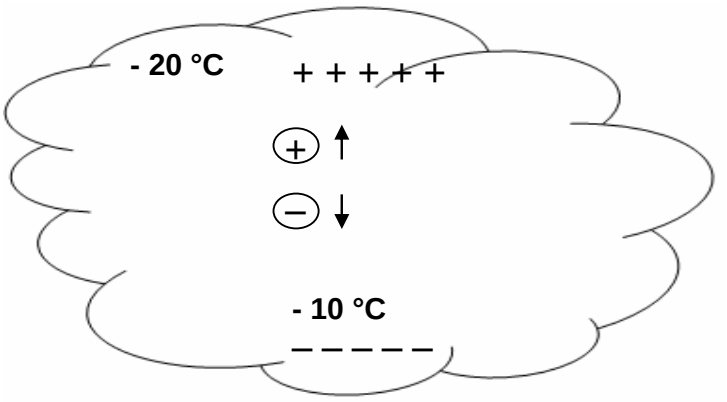
11.3 Will the force now be one of attraction or repulsion? Give a reason for your answer. (3)

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 ^{o}C at the bottom and – 20 ^{o}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)

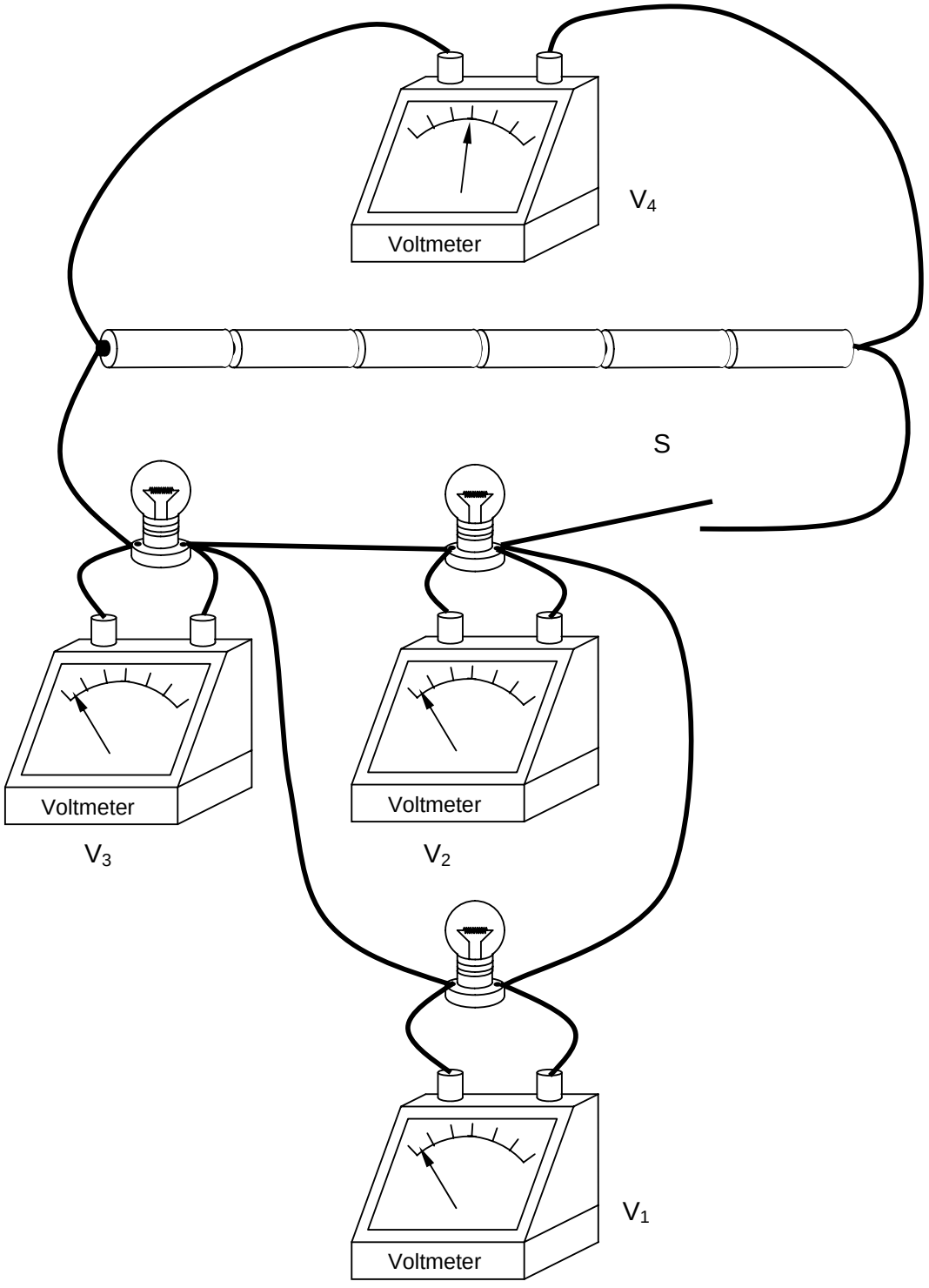
In one of the lightning flashes 75 A of electric current passes from the bottom of the cloud to the ground below in 1,5 s.

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

NATIONAL SENIOR CERTIFICATE EXAMINATION
NASIONALE SENIOR SERTIFIKAAT-EKSAMEN

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOO*L	VALUE / *WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	*g*	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION / *BEWEGING*

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

WEIGHT AND MECHANICAL ENERGY / *GEWIG EN MEGANIESE ENERGIE*

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

WAVES, LIGHT AND SOUND / *GOLWE, LIG EN KLANK*

$v = f\lambda$ 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 / *ELEKTRISITEIT EN MAGNETISME*

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

Copyright reserved

EXAMINATION NUMBER OR NAME
***EKSAMENNOMMER OF NAAM*:**

PHYSICAL SCIENCES GRADE 10 ANSWER SHEET
FISIESE WETENSKAPPE GRAAD 10 ANTWOORDBLAD

QUESTION 1 / *VRAAG 1*

1.1 _____ (1)
1.2 _____ (1)
1.3 _____ (1)
1.4 _____ (1)
1.5 _____ (1)
[5]

QUESTION 2 / *VRAAG 2*

2.1 _____ (1)
2.2 _____ (1)
2.3 _____ (1)
2.4 _____ (1)
2.5 _____ (1)
[5]

QUESTION 3 / *VRAAG 3*

3.1 _____
_____ (2)
3.2 _____
_____ (2)
3.3 _____
_____ (2)
3.4 _____
_____ (2)
3.5 _____
_____ (2)
[10]

QUESTION 4 / *VRAAG 4*

4.1	A	B	C	D
4.2	A	B	C	D
4.3	A	B	C	D
4.4	A	B	C	D
4.5	A	B	C	D

(5 x 3) [15]

TOTAL SECTION A / *TOTAAL AFDELING A* 35

EXAMINATION NUMBER OR NAME
***EKSAMENNOMMER OF NAAM*:**

Graph Paper for QUESTION 5 / *Grafiekpapier vir VRAAG 5*