Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2012

PHYSICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

* P H S C E 1 *

This question paper consists of 19 pages.

INSTRUCTIONS AND INFORMATION

1. Write your full Name and Surname (and/ or Exam Number if applicable) in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK.

2. Answer ALL the questions.

3. This question paper consists of TWO sections:

   SECTION A: 25 Marks
   SECTION B: 125 Marks

4. Answer SECTION A on the attached ANSWER SHEET and SECTION B in the ANSWER BOOK.

5. Non-programmable calculators may be used.

6. Appropriate mathematical instruments may be used.

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

8. Data sheets are attached for your use.

9. Wherever motivations, discussions, etc. are required, be brief.

SECTION A

Answer this section on the ANSWER SHEET.

QUESTION 1 ONE WORD ITEMS

Give ONE word/term for EACH of the following statements. Write only the word/term next to the question number (1.1 – 1.5) in the answer book.

1.1 A system in which neither friction nor air resistance is acting on. (1)

1.2 The product of the net force and constant velocity at which an object is moving. (1)

1.3 The device in a car that charges the car's battery and powers the car's electric system when its engine is running. (1)

1.4 Waves that meet out of phase produce this phenomenon. (1)

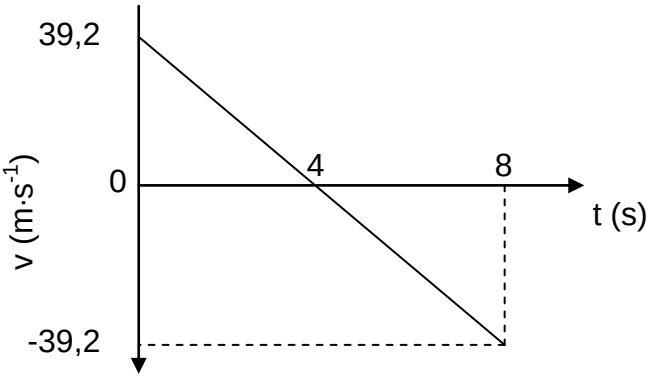
1.5 The electromagnetic waves that are used in fluorescent lighting tubes and in fluorescent pens. (1)

[5]

QUESTION 2 MULTIPLE CHOICE QUESTIONS

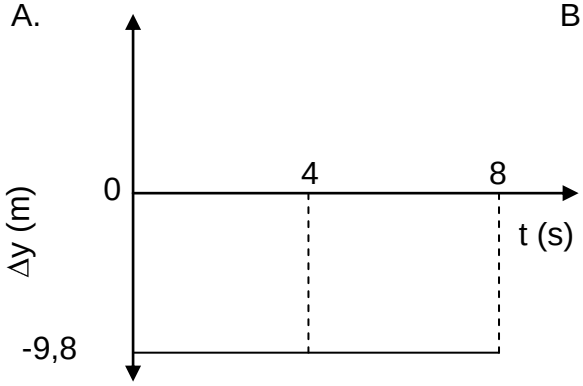
Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and make a cross (X) in the correct block (A – D) next to the question number (2.1 – 2.10) on the ANSWER SHEET.

2.1 Norma hits the cricket ball from the ground straight up in the air. The following graph of velocity vs. time was drawn. Upwards is taken as positive. Study the graph and answer the question that follows:

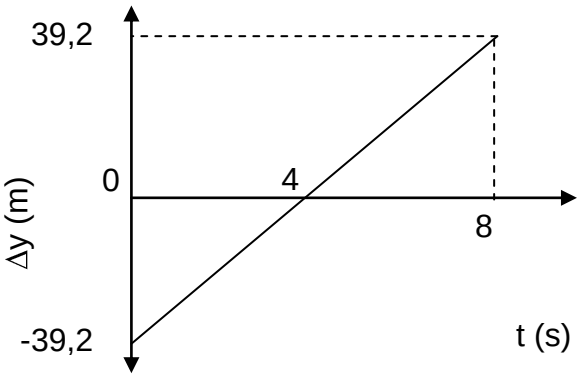


Which of the following graphs represents the corresponding position vs. time graph from the graph above?

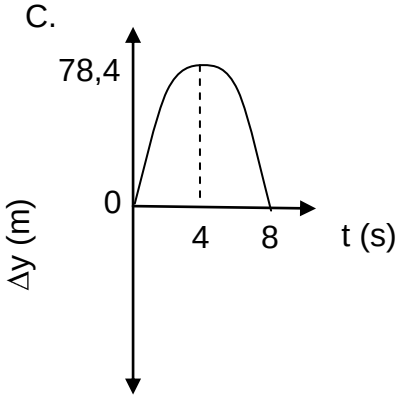
A.



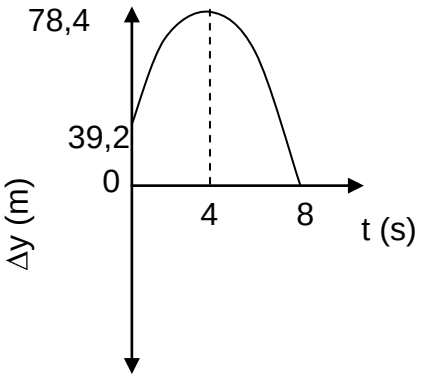
B.



C.



D.

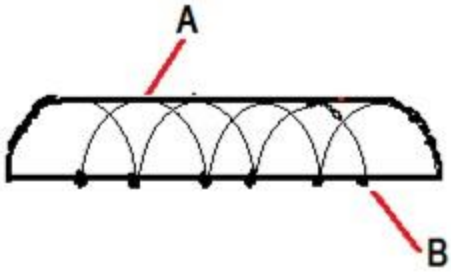


(2)

2.2 The product of mass and the rate of change in velocity of an object is known as …

A. impulse.
B. momentum.
C. net force.
D. change in momentum. (2)

STUDY THE DIAGRAM BELOW TO ANSWER QUESTIONS 2.3 AND 2.4



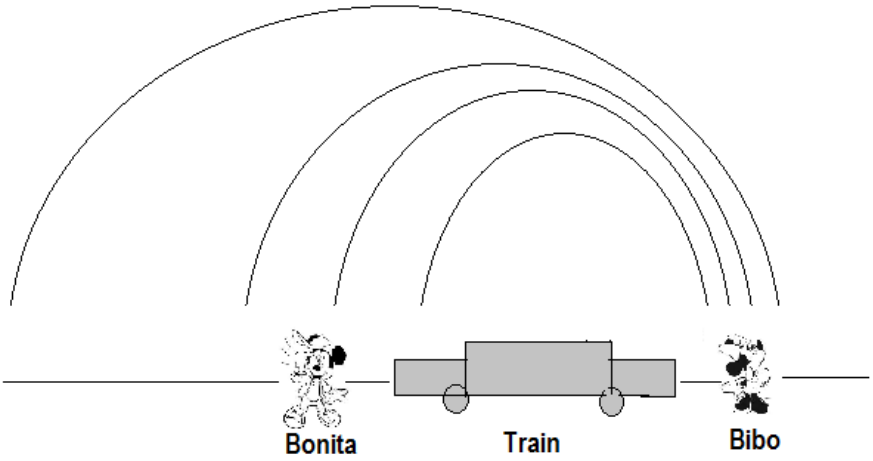
2.3 "A" in the diagram is an imaginary line connecting all adjacent points that are in phase in a wave and is called a …

A. wavelet.
B. wave crest.
C. wave source.
D. wave front. (2)

2.4 "B" in the diagram is the …

A. wavelength.
B. wave crest.
C. secondary wavelet.
D. wave speed. (2)

CONSIDER THE DIAGRAM BELOW TO ANSWER QUESTIONS 2.5 AND 2.6



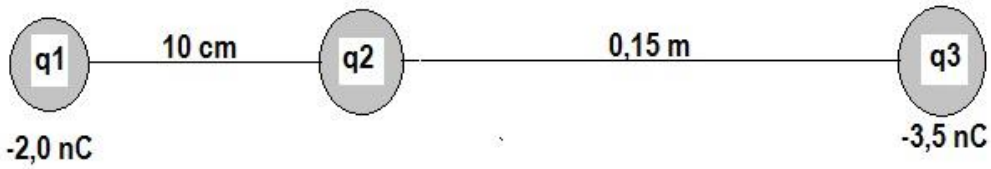
2.5 What does the diagram imply about the motion of the train?

A. The train is stationary.
B. The train moves towards Bibo.
C. The train moves towards Bonita.
D. The train is moving away from Bibo. (2)

2.6 The frequency and pitch of the sound heard by Bonita compared to that heard by Bibo is …

A. smaller sound frequency and lower pitch.
B. smaller sound frequency and higher pitch.
C. greater sound frequency and higher pitch.
D. greater sound frequency and lower pitch. (2)

2.7 Three point charges lie along the same straight line as shown in the diagram.



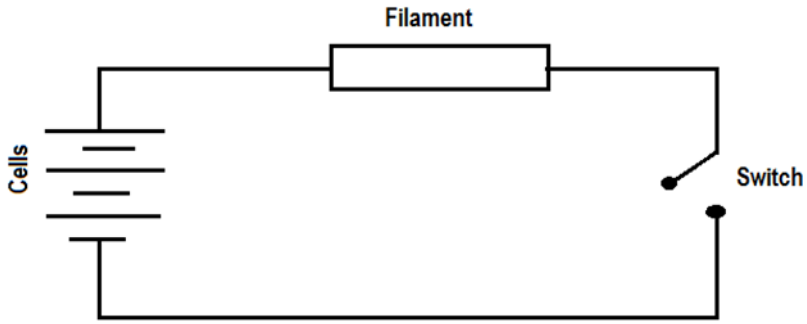
The magnitude of the net electric field on q2 is …

A. 1 400 $N.C^{-1}$
B. 4×10^2 $N.C^{-1}$
C. $1,8 \times 10^3$ $N.C^{-1}$
D. $3,2 \times 10^3$ $N.C^{-1}$ (2)

2.8 The device, when connected to a resistor, that can act as a time delay in an electronic device is a/an …

A. impendence.
B. diode.
C. dielectric.
D. capacitor. (2)

2.9 The electric circuit of a torch consists of three cells, a switch and a small light bulb. The electric torch is designed to use a D-type cell, but the only cells that are available for use are AA-type cells.



The specifications of these types of cells are shown in the table below

Cell type	emf for each cell	Appliance for which it is designed	Current drawn from each cell when connected to the appliance
D	1,5 V	Torch	300 mA
AA	1, 5V	TV remote control	30 mA

What is likely to happen to the brightness of the torch bulb when the D-type cells are replaced by AA-type cells in the closed electric torch circuit?

	What is likely to happens
A.	The bulb is dimmer.
B.	The bulb will not go on.
C.	The brightness remains the same.
D.	The bulb is brighter.

(2)

2.10 In a coal-fired power plant, steam is used to turn turbine blades. The type of energy conversion which applies here is …

A. mechanical energy to electrical energy.
B. chemical energy to electrical energy.
C. electrical energy to chemical energy.
D. mechanical energy to chemical energy. (2)

[20]

TOTAL SECTION A: 25

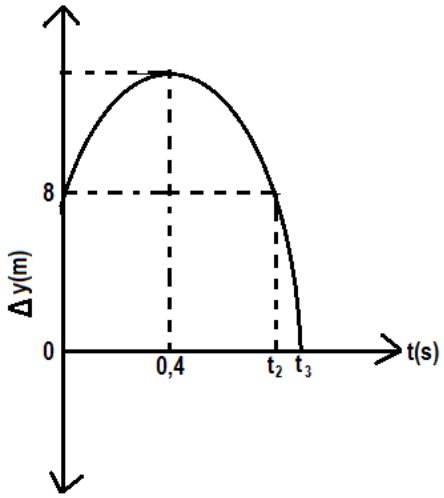
SECTION B

INSTRUCTIONS

1. Start each question on a new page.
2. Leave one line between two subsections, e.g. between QUESTIONS 3.1 and 3.2.
3. The FORMULAE and SUBSTITUTIONS must be shown in ALL calculations.
4. Round off all answers to TWO decimal places.
5. Answer this section in the ANSWER BOOK.

QUESTION 3

The graph below is not drawn to scale and it shows the motion of a baseball that is thrown vertically upwards from a balcony which is some distance from the ground. It takes 0,4 s to reach the highest point, before it falls back to the ground. Study the graph and answer the questions that follow.



3.1 How high is the balcony above the ground? (1)

3.2 Determine the magnitude of the time t_2 without using the equations of motion. Motivate your answer. (2)

3.3 Calculate the initial velocity of the ball. (3)

3.4 Calculate the maximum height that the ball reaches above the ground. (4)

3.5 Calculate the final velocity of the ball when it reaches the ground. (4)

3.6 Calculate the time, t_3, that the ball was in the air. (3)

3.7 Draw a corresponding acceleration versus time for the motion of the baseball. (2)

[19]

QUESTION 4

Ongie and Georgie are investigating the effect that external forces have on the **sum of kinetic energy and gravitational potential energy** of an object. They conduct two investigations:

INVESTIGATION ONE

They rolled the ball on a highly polished floor (smooth surface) between two positions marked A and B.

INVESTIGATION TWO

They rolled the ball on a carpeted floor (rough surface) between two positions marked A and B.

4.1 Provide a single term for the phrase that is written bold in the statement above. (1)

4.2 4.2.1 Compare the speed of the ball in positions A and B in INVESTIGATION ONE. Justify your answer. (2)

4.2.2 Compare the speed of the ball in positions A and B in INVESTIGATION TWO. Justify your answer. (2)

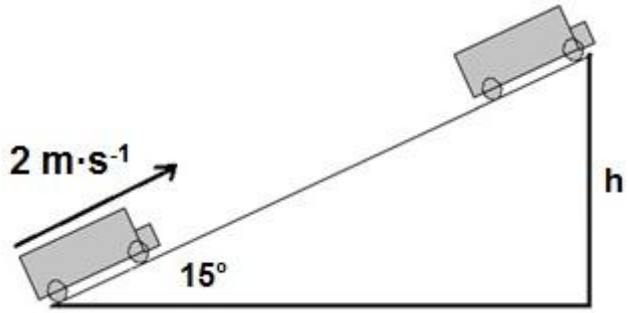
4.3 Using the responses given in QUESTIONS 4.2.1 and 4.2.2, what conclusion can be drawn from both investigations? (4)

4.4 Name and state the principle of physics that Ongie and Georgie ended up investigating. (2)

[11]

QUESTION 5

A 400 kg car is stuck at the bottom of the ramp, inclined at 15° to the horizontal. When pulled up along the ramp, the car experiences a frictional force of 1400 N and moves at a constant speed of 2 m•s^{-1}.



5.1 Draw a free body diagram to show all the forces acting on the car while being pulled up the ramp. (4)

5.2 What is the net work done on the car when it reaches the top of the ramp? Use the work-energy theorem to justify your answer. (2)

5.3 Calculate the magnitude of the force applied to pull the car up the ramp. (4)

5.4 Calculate the power rating of the applied force which pulls the car up the incline at a constant speed of 2 m•s^{-1}. (3)

5.5 If the distance travelled by the car from the bottom to the top of the ramp is 6 m, calculate the height (h) of the ramp. (2)

A mountain climber and a hiker, having equal masses, both start off exactly at the same time at the foot of the mountain. The hiker takes a longer but easier route hiking up the mountain and is the first to arrive at the top. The climber arrives later at the top.

5.6 Explain using relevant equations …

5.6.1 which one (climber or hiker) does more work against gravity in getting to the top of the mountain. (2)

5.6.2 which one has more power. (2)

[19]

QUESTION 6

A bird watcher, sitting on a rock, hears the shrill cry of a hawk at a frequency of 700 Hz. The sound produced by the hawk has a frequency of 900 Hz.

The speed of sound on the day is 343 $m \cdot s^{-1}$.

6.1 Is the hawk moving away from or towards the bird watcher? (1)

6.2 State the phenomenon that is observed by the bird watcher. (1)

6.3 Calculate how fast the hawk is moving. (4)

Learners from Dudes Secondary School collected the following data to test a hypothesis. They used a radar gun with the help of police on the road between Aliwal North and Cookhouse.

Frequency heard by a listener (Hz)	**Velocity of the sound source ($m \cdot s^{-1}$)**
500	0
580	15
660	30
740	45
820	60

Learners' hypothesis:

The faster a sound source moves towards a stationary listener, the lower the frequency of the sound heard by a stationary listener.

6.4 6.4.1 For this investigation, give TWO variables that are kept constant. (2)

6.4.2 Clearly indicate the independent and dependent variables on the graph by plotting them on the correct axis.
(No need to plot the values or draw the graph) (2)

6.4.3 Should the learners reject or accept their hypothesis?
Justify your answer. (1)

[11]

QUESTION 7

The diagrams below show the diffraction patterns for a yellow light (with a wavelength of 582 nm) and a blue light (with a wavelength of 460 nm) that are passed through the same slit in turns. Study the diagrams carefully and answer the questions that follow.

DIFFRACTION PATTERN A

DIFFRACTION PATTERN B

7.1 State Huygen's principle. (2)

7.2 Which diffraction pattern represents the yellow light? **A or B**

Justify your answer. (3)

7.3 Calculate the position of the first dark band for the blue light if the width of the slit is 5×10^{-6} m. (3)

7.4 If the width of the slit is made smaller than 5×10^{-6} m, how will the diffraction patterns above be affected? Give a reason for your answer. (2)

[10]

QUESTION 8

Read the article below and answer the questions that follow:

Research continues to warn about the danger of sunlight to the eyes and skin. Doctors wisely respond by recommending eye-protection and sunscreen while outdoors during daylight. Curiously, however, some lighting manufacturers say lamps duplicating sunshine are good for vision and eye health. Who is right?

From scientific point of view: light is made up of electromagnetic particles that travel in waves. These waves range from the longest wavelength to the shortest wavelength to form the electromagnetic spectrum. The following waves form part of the spectrum though not in order: visible light, gamma rays, ultraviolet, microwaves, X-rays, radio waves, infrared.

{www.mdsupport.org/library/hazard.html}

8.1 Explain how sunscreen works and give TWO reasons why it is important to wear sunscreen when spending time in the sun. (3)

8.2 Which type of electromagnetic waves has the shortest wavelength of all the electromagnetic radiation? (1)

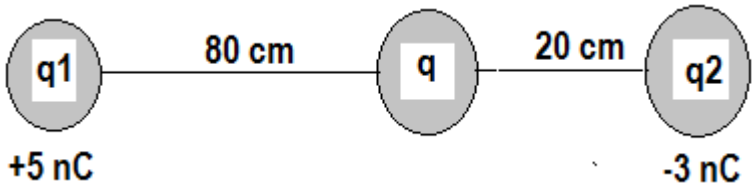
8.3 Briefly explain why an X-ray technician (radiographer) at Dora Nginza-hospital has to be protected by lead when an X-ray is taken of a young girl's arm to determine if the arm is broken **while** a technician who works for *Umhlobo Wenene* radio station does not need to be protected when attending to technical problems at the radio station. (2)

8.4 FM-broadcast is transmitted on a frequency of 100 MHz. Calculate its wavelength. (3)

[9]

QUESTION 9

Three point charges q1 = +5 nC, q2 = -3 nC and q (with an unknown magnitude) are arranged as follows:



9.1 State Coulomb's law of electrostatics in words. (2)

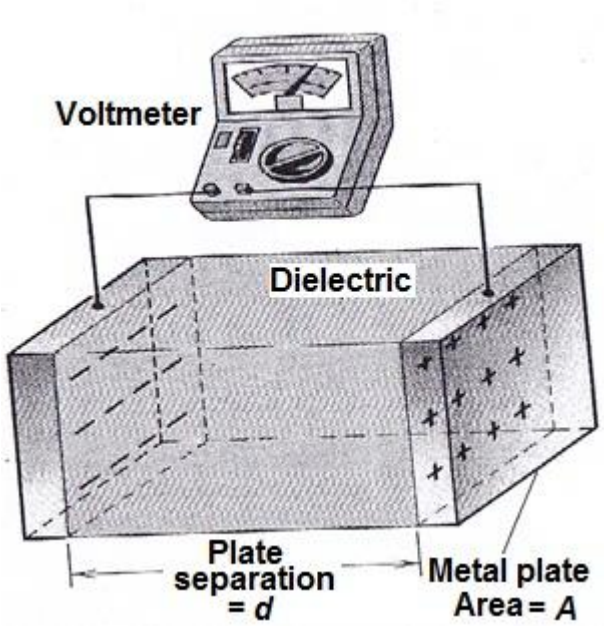
9.2 Draw the electric field pattern between q1 and q2 if q is removed from the system. (2)

9.3 If the net electrostatic force on q is 12 x 10^{-4}N to the right, calculate the magnitude of q. (6)

[10]

QUESTION 10

A voltmeter is connected to two parallel plates that form part of a capacitor as shown in the diagram.



10.1 Draw the electric field pattern between the plates of a capacitor. (3)

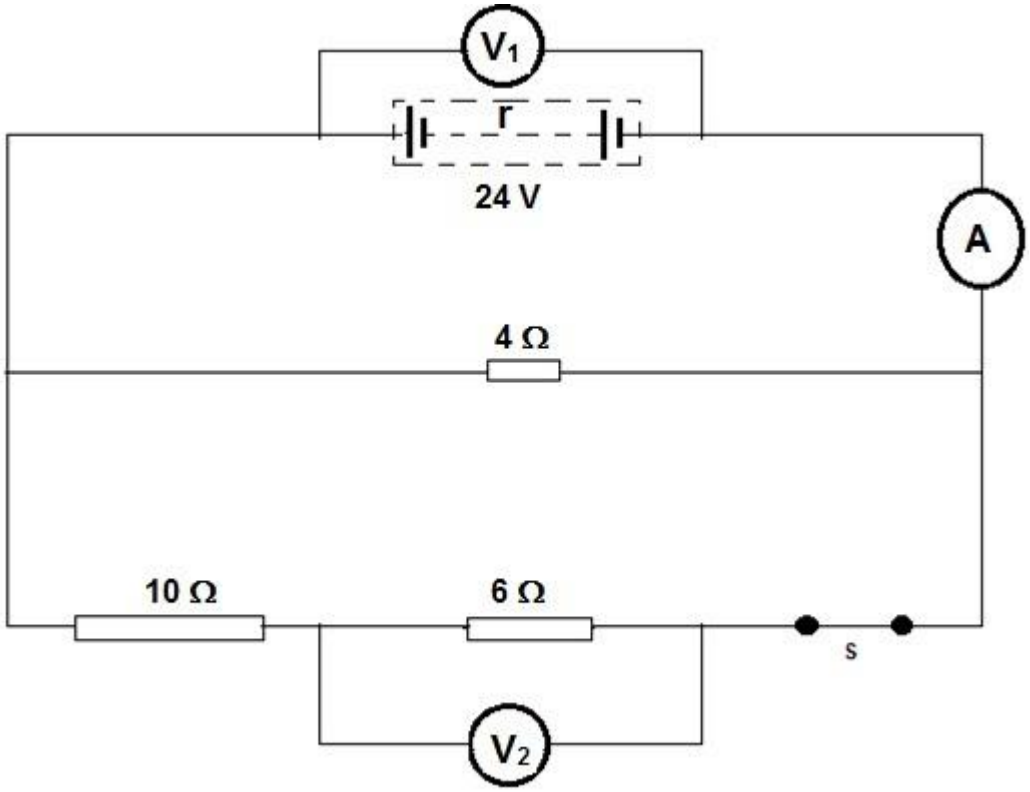
10.2 Each plate of the capacitor above has the dimensions 20 cm and 3 m. The capacitor stores a charge of 3 µC when a 1,5 V flashlight battery provides a potential difference between the plates.

10.2.1 Calculate the capacitance. (3)

10.2.2 Calculate the plate separation (distance 'd' between the plates). (3)
[9]

QUESTION 11

In the diagram, a battery of emf 24 V with an internal resistance r is connected in a circuit as shown.



11.1 Show by means of calculation that the effective resistance of the external circuit is 3,2 Ω. (2)

11.2 When switch S is closed the reading on the ammeter is 6 A.

Calculate:

11.2.1 the reading on V_2 (4)

11.2.2 the internal resistance of the battery. (3)
[9]

QUESTION 12

An electric food blender is connected to a 172 V AC plug point and the blender has a resistance of 20 Ω.

Calculate:

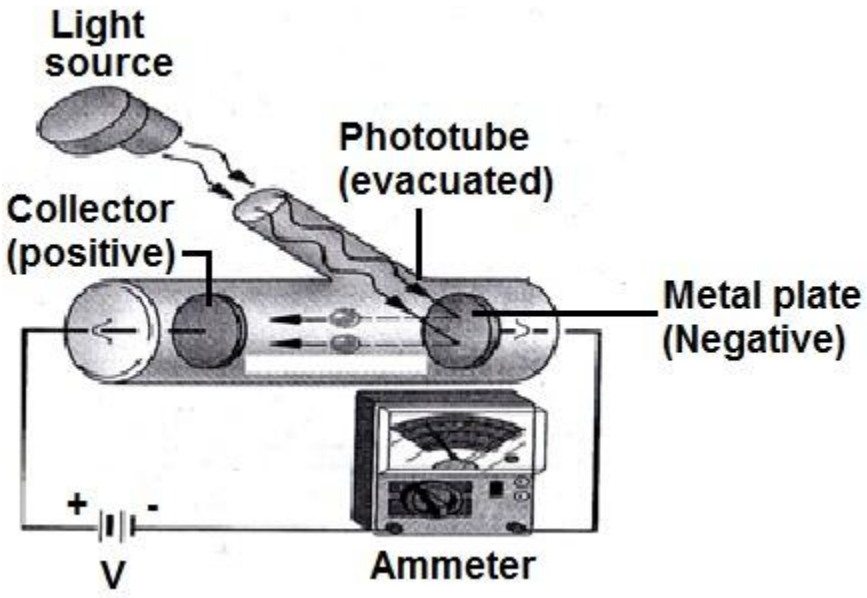
12.1 The peak voltage of the blender (3)

12.2 The peak current of the blender (3)

12.3 The average power (3)
[9]

QUESTION 13

Agrippa, Nancy and Absalom set up the apparatus as arranged below, using potassium metal, an ammeter, a battery, conducting wires and a light source.



- They darkened the room and shone ultra-violet light on the cathode of potassium metal
- They started by using a 40 W light bulb, followed by 100 W and 200 W light bulbs
- Electrons were ejected from the potassium metal surface each time

13.1 Name the phenomenon they are investigating here. (1)

13.2 Which property of light are they changing when using 40 W, 100 W and 200 W light bulbs? (1)

13.3 What effect will the changing of the bulbs as mentioned, have on the ammeter reading?
Write down only INCREASE, DECREASE or REMAIN THE SAME.
Explain. (2)

A photon of ultra violet light with a wavelength of 60 nm collides with an electron in the potassium metal and ejects the electron. The kinetic energy with which the electron leaves the metal is 2,8 x 10^{-18} J.

13.4 Calculate the threshold frequency of potassium metal. (4)

13.5 There are schools in the remote areas of the province of Eastern Cape which do not have electricity generated by Eskom. How can those schools produce electricity by using the particle nature of light? (1)
[9]

TOTAL SECTION B: 125

GRAND TOTAL: 150

DATA / GEGEWENS

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIESE KONSTANTES

NAME/*NAAM*	SYMBOL/ *SIMBOOL*	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 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J·s
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Permittivity of free space *Permittiwiteit van vry ruimte*	ε_0	8,85 x 10^{-12} $F \cdot m^{-1}$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION / *BEWEGING*

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$

WORK, ENERGY AND POWER / *ARBEID, ENERGIE EN DRYWING*

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_P = mgh$
$K = \frac{1}{2}mv^2$ or/of $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/of $W_{net} = \Delta E_k$ $\Delta K = K_f - E_i$ or/of $\Delta E_k = E_{kf} - E_{ki}$
$P = \frac{W}{\Delta t}$	$P = Fv$

WAVES, SOUND AND LIGHT / GOLWE, KLANK EN LIG

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ or/of $f_L = \frac{v \pm v_L}{v \pm v_b} f_b$	$E = hf$ $E = h\frac{c}{\lambda}$
$\sin\theta = \frac{m\lambda}{a}$	$E = W_0 + E_k$ where/waar $E = hf$ and/en $W_0 = hf_0$ and/en $E_k = \frac{1}{2}mv^2$

ELECTROSTATICS / *ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$E = \frac{V}{d}$	$E = \frac{F}{q}$
$U = \frac{kQ_1Q_2}{r}$	$V = \frac{W}{q}$
$C = \frac{Q}{V}$	$C = \frac{\varepsilon_0 A}{d}$

ELECTRIC CIRCUITS / *ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	emf (ε) = I(R + r) *emk* (ε) = I(R + r)
$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

ALTERNATING CURRENT / WISSELSTROOM

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ / $I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$	$P_{average} = V_{rms}I_{rms}$ /	$P_{gemiddeld} = V_{wgk}I_{wgk}$
	$P_{average} = I^2_{rms}R$ /	$P_{gemiddeld} = I^2_{rms}R$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ / $V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$	$P_{average} = \frac{V^2_{rms}}{R}$ /	$P_{gemiddeld} = \frac{V^2_{rms}}{R}$

PHYSICAL SCIENCES: P1
FISIESE WETENSKAPPE: V1

ANSWER SHEET
ANTWOORDBLAD

NAME:
***NAAM*:** _____

SECTION A
AFDELING A

QUESTION 1: ONE WORD ITEMS
VRAAG 1: EENWOORD-ITEMS

1.1 _____ (1)

1.2 _____ (1)

1.3 _____ (1)

1.4 _____ (1)

1.5 _____ (1)
[5]

QUESTION 2: MULTIPLE CHOICE QUESTIONS
VRAAG 2: MEERVOUDIGEKEUSE-VRAE

2.1	A	B	C	D
2.2	A	B	C	D
2.3	A	B	C	D
2.4	A	B	C	D
2.5	A	B	C	D
2.6	A	B	C	D
2.7	A	B	C	D
2.8	A	B	C	D
2.9	A	B	C	D
2.10	A	B	C	D

(10x2) **[20]**

TOTAL SECTION A: 25
TOTAAL AFDELING A: 25