Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2025

PHYSICAL SCIENCES P1

MARKS 150

TIME: 3 hours

This question paper consists of 17 pages including 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate space in the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, et cetera where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page in the ANSWER BOOK.
11. All diagrams are NOT necessarily drawn according to scale.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in your ANSWER BOOK, for example, 1.11D.

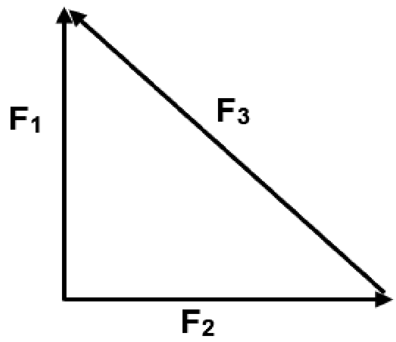
1.1 Vector **B** and vector **–B** are acting on the same point **X.** The angle between the two vectors is …

A 180°.
B 90°.
C 0°.
D 270°. (2)

1.2 Two forces, $\mathbf{F_1}$ and $\mathbf{F_2}$, act on a point. If $\mathbf{F_1}$ and $\mathbf{F_2}$ act in the same direction, the maximum resultant has a magnitude of 13 N. If forces $\mathbf{F_1}$ and $\mathbf{F_2}$ act in opposite directions the magnitude of the minimum resultant force is 7 N. The magnitude of the two forces, in newton, is …

A 10 and 5.
B 16 and 10.
C 3 and 10.
D 8 and 5. (2)

1.3 In the vector diagram below, the resultant (net) vector is …

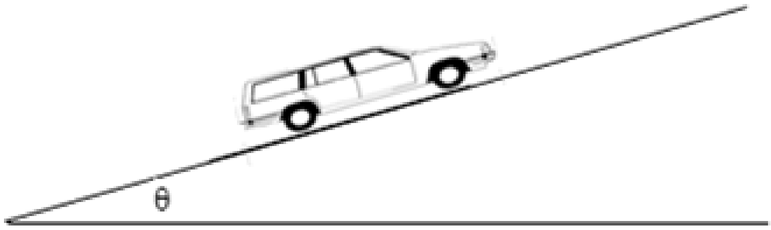


A Zero.
B F_1.
C F_3.
D F_2. (2)

1.4 A boy, who is standing in a lift, observes a 20 N mass piece suspended from a spring balance fixed to the roof of the lift. He sees that the reading on the spring balance is less than 20 N for a short interval. The CORRECT description for the motion of the lift during this short interval is that the lift is …

A accelerating upwards
B not moving
C accelerating downwards
D moving at a constant velocity (2)

1.5 A car of mass *m* moving up a rough incline at a constant acceleration, **a**, under the influence of an applied force $\mathbf{F_A}$. The incline makes an angle $\boldsymbol{\theta}$ with the horizontal. The coefficient of kinetic friction between the surface and the wheels of the car is μ_k.



The magnitude of the frictional force acting on the car, can be calculated as …

A $\mathbf{F_A} - \mu_k mg\cos\theta$.
B $\mu_k mg\sin\theta - \mathbf{F_A}$.
C $\mu_k mg\sin\theta$.
D $\mu_k mg\cos\theta$. (2)

1.6 The gravitational force which the earth exerts on the moon is …

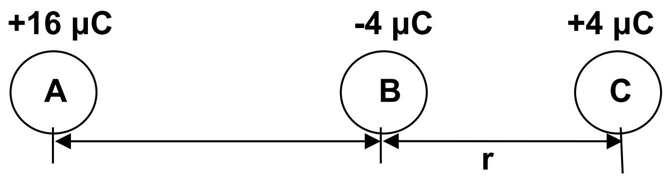
A directly proportional to the distance between their centers.
B inversely proportional to the mass of the moon.
C inversely proportional to the product of the mass of the moon and the mass of the earth.
D inversely proportional to the square of the distance between their centers. (2)

1.7 The centers of two identical metallic spheres, each carrying a charge **Q**, are a distance **r** apart. Which ONE of the following pairs of changes (made simultaneously) will double the electrostatic force that one charged sphere exerts on the other?

	DISTANCE BETWEEN CENTERS OF SPHERES	MAGNITUDE OF CHARGES
A	decrease the distance to $\frac{\mathbf{r}}{2}$	double the charges on both spheres
B	decrease the distance to $\frac{\mathbf{r}}{2}$	reduce the charge on one sphere to $\frac{\mathbf{Q}}{2}$
C	decrease the distance to $\frac{\mathbf{r}}{\sqrt{2}}$	reduce the charges on both spheres to $\frac{\mathbf{Q}}{2}$
D	decrease the distance to $\frac{\mathbf{r}}{\sqrt{2}}$	double the charges on both spheres

(2)

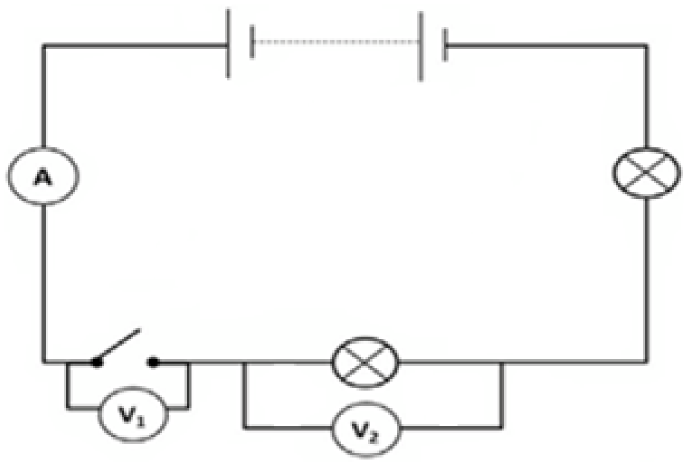
1.8 Three small identical spheres, **A**, **B** and **C** is charged as shown in the diagram below. The distance between sphere **B** and **C** is **r**.



For sphere **B** to experience no resultant electrostatic force, the distance between **A** and **B** must be …

A ¼ **r**.
B ½ **r**.
C 2 **r**.
D 4 **r**. (2)

1.9 The battery in the circuit diagram below has a potential difference of 12 V and negligible internal resistance. Two voltmeters, $\mathbf{V_1}$ and $\mathbf{V_2}$, are connected to the circuit, as shown in the diagram below.



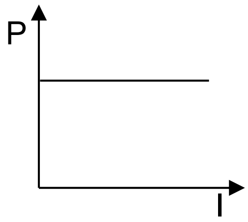
When the switch is open, the CORRECT readings on $\mathbf{V_1}$ and $\mathbf{V_2}$ will be as follows:

	$\mathbf{V_1}$	$\mathbf{V_2}$
A	12 V	12 V
B	0 V	12 V
C	12 V	0 V
D	0 V	0 V

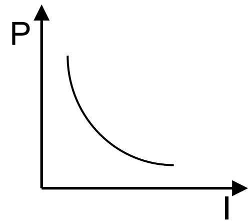
(2)

1.10 Which ONE of the following graphs best represents the relationship between the electrical power and the current in a given Ohmic conductor?

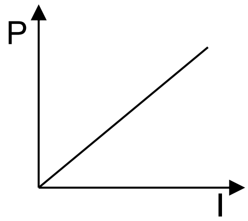
A



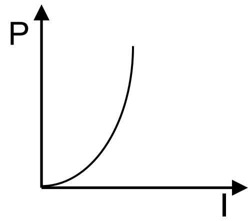
C



B



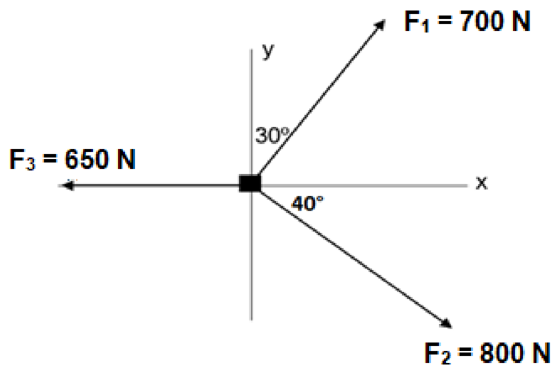
D



(2)
[20]

QUESTION 2 (Start on a new page.)

Three forces, $\mathbf{F_1}$, $\mathbf{F_2}$ and $\mathbf{F_3}$, NOT DRAWN TO SCALE, are applied to a crate of 25 kg as shown in the diagram below.



2.1 Define the term *vector*. (2)

2.2 Calculate the:

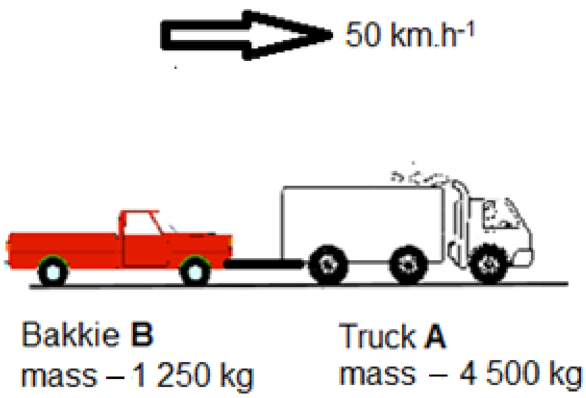
2.2.1 Magnitude and direction of the resultant of the three forces (9)

2.2.2 Magnitude of the gravitational force acting on the crate (2)

2.3 Explain why the three forces will not form a closed vector diagram. (2)
[15]

QUESTION 3 (Start on a new page.)

Truck **A**, of mass 4 500 kg travels at a CONSTANT VELOCITY while towing bakkie **B**, of mass 1 250 kg. The engine of truck **A** produces a force of 11 270 N. The road surface exerts a frictional force of 8 820 N on truck **A**.



3.1 Write down Newton's Second Law of motion in words. (2)

3.2 Calculate the:

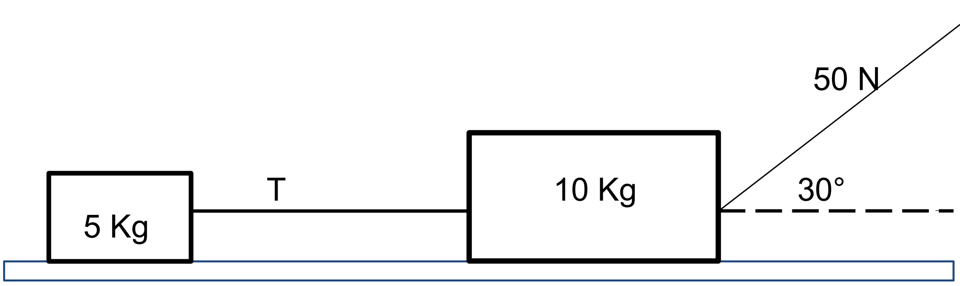
3.2.1 Coefficient of kinetic friction for the road surface (3)

3.2.2 Frictional force exerted by the road on bakkie **B** (3)

3.2.3 Magnitude tension in the tow rope (3)
[11]

QUESTION 4 (Start on a new page.)

A boy pulls a 10 kg block, that is attached to a 5 kg block by a light, inextensible string of negligible mass, with a force of 50 N at an angle of 30° with the horizontal as shown in the diagram below. The coefficient of kinetic friction between the surface and the 10 kg block is 0,18. The 5 kg block experiences a kinetic frictional force of 9 N.



4.1 Define *kinetic frictional force* in words. (2)

4.2 Draw a labelled free body diagram showing all the forces acting on the 10 kg block. (5)

4.3 Calculate the magnitude of the:

4.3.1 Normal force exerted on the 10 kg block (3)

4.3.2 Acceleration of the blocks (7)

4.4 How will the magnitude of the normal force calculated in QUESTION 4.3.1 be affected if the angle between the applied force and the horizontal decreases?

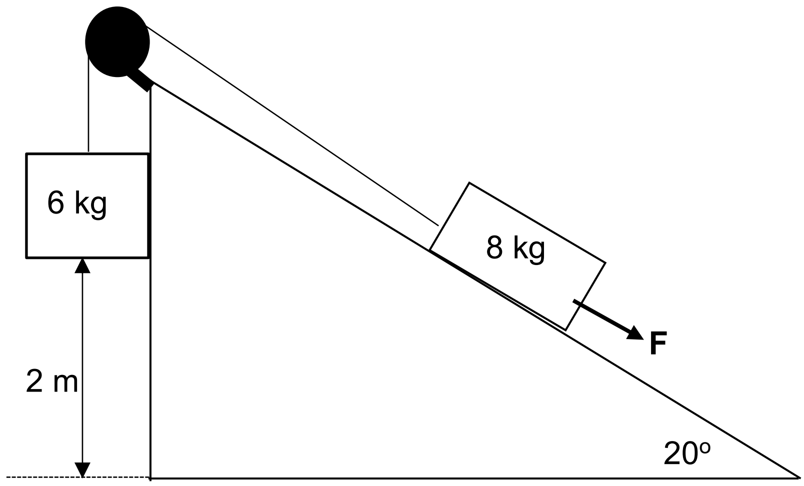
Choose from INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (3)

4.5 Use PHYSICS PRINCIPLES to explain why it is very dangerous when children are not secured in a child's car seat when travelling in a car. (3)

[23]

QUESTION 5 (Start on a new page.)

A block of mass 8 kg is held at rest on a rough inclined plane which makes an angle of 20° with the horizontal by a force **F** that acts down the inclined plane. The block is connected by a light inextensible string which passes over a light frictionless pulley to another block of mass 6 kg. The 6 kg block hangs vertically at 2 m above the ground as shown in the diagram below.



The coefficient of kinetic friction between the 8 kg block and the surface of the inclined plane is 0,25. Ignore the effects of air friction.

5.1 State Newton's first law in words. (2)

5.2 Draw a free-body diagram showing ALL the forces acting on the 6 kg block before motion. (2)

5.3 Calculate the magnitude of:

5.3.1 The frictional force acting on the 8 kg block. (3)

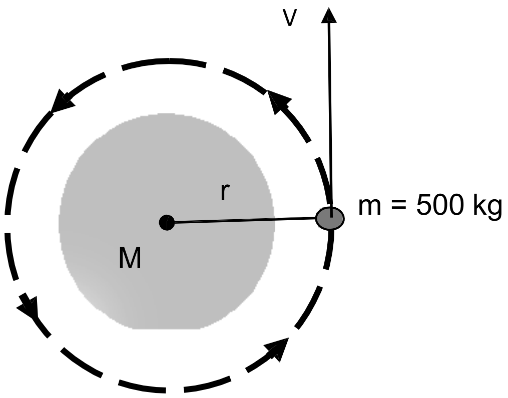
5.3.2 Force **F**, that will keep the blocks at rest. (5)

5.4 The force **F** is now removed, and the blocks accelerate at 2,6 $m.s^{-2}$. Calculate the speed with which the 6 kg block will strike the ground. (3)

[15]

QUESTION 6 (Start on a new page.)

A satellite of mass 500 kg orbits the earth as shown in the diagram below. The earth exerts a force of 250 N on the satellite.



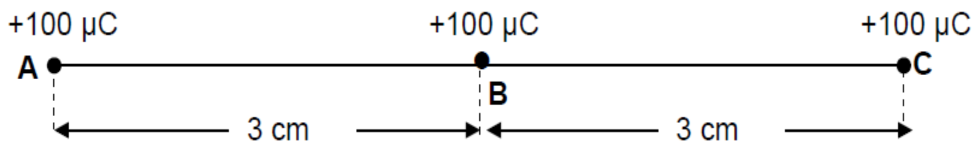
A learner argues that the earth exerts a bigger force on the satellite because it has a larger mass.

6.1 Name and state the law that you can use to clarify the learner's misconception. (3)

6.2 Calculate the distance of the satellite above the surface of the earth. (5)
[8]

QUESTION 7 (Start on a new page.)

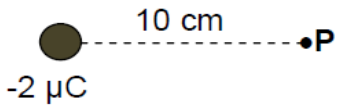
Three identical point charges **A**, **B** and **C**, all of magnitude +100 μC, are equally spaced on a straight line in a vacuum. The charges are a distance of 3 cm from each other as shown in the diagram below.



7.1 Write down Coulomb's Law in words. (2)

7.2 Calculate the net electrostatic force experienced by point charge **C** due to charge **A** and **B**. (6)

7.3 A negative charge of -2 μC is positioned 10 cm from point **P**, as shown in the diagram below.



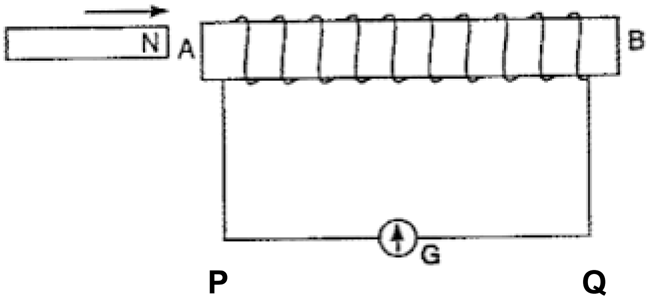
7.3.1 Define *electric field at point* in words. (2)

7.3.2 Draw an electric field pattern around with the -2 μC charge. (2)

7.3.3 Calculate the electric field strength at point **P**. (3)
[15]

QUESTION 8 (Start on a new page.)

The north pole of a magnet is pushed into a solenoid as shown in the diagram below.



8.1 What is the polarity of the magnetic field of the solenoid at point **A**? (2)

8.2 In which direction will the current in the galvanometer deflect? Write down TOWARDS P or TOWARDS Q. (2)

8.3 A coil with 350 turns has an area of 0,08 m^2. It is held with its axis coinciding with the direction of a magnetic field of strength 0,6 T. In order to induce an emf in the coil, it is pulled out of the magnetic field in 0,25 seconds.

8.3.1 State Faraday's law of electromagnetic induction. (2)

8.3.2 Mention TWO ways in which the magnitude of the induced emf can be increased. (2)

Calculate the:

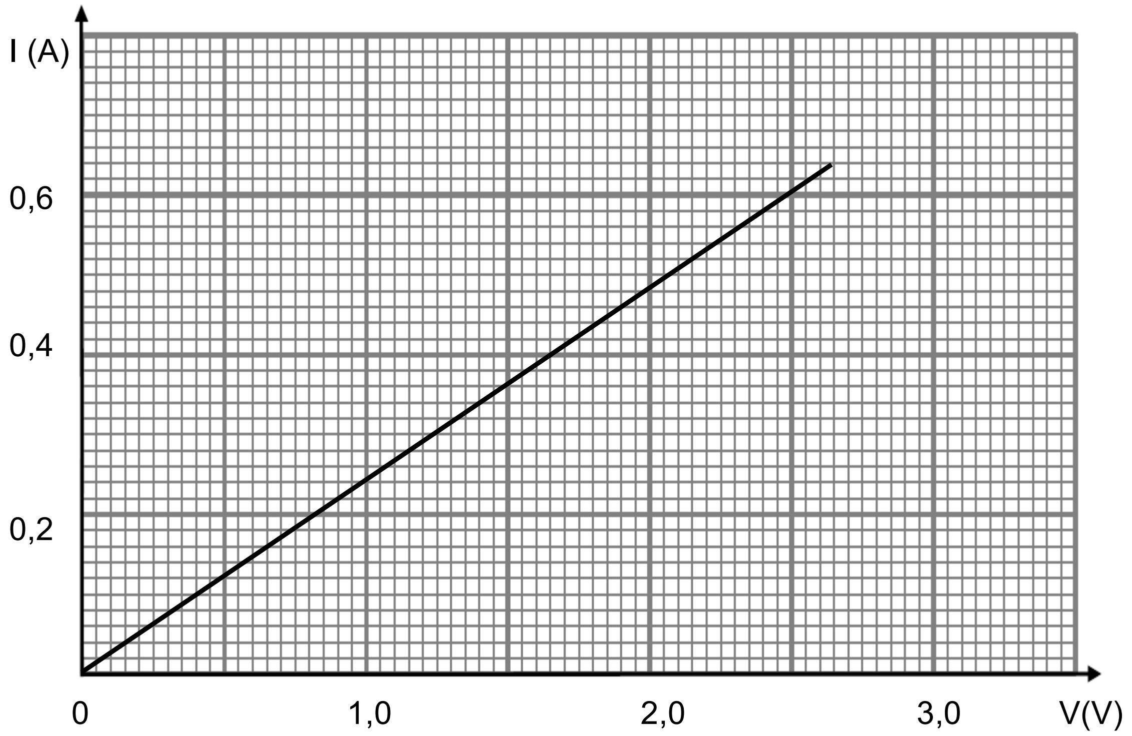
8.3.3 Magnetic flux linkage (3)

8.3.4 Magnitude of the induced emf (3)
[14]

QUESTION 9 (Start on a new page.)

Learners investigate the relationship between current in a conductor and the potential differences across the ends of the conductor. The graph below is obtained from their investigation.

GRAPH OF CURRENT VERSUS POTENTIAL DIFFERENCE



9.1 Is the conductor ohmic or non-ohmic? Explain the answer. (3)

9.2 Write down the:

9.2.1 Dependant variable for this investigation (1)

9.2.2 Control variables for this investigation (2)

9.3 The learners intend to use the conductor to construct an electric heater that should be rated 150 W and draw a maximum current of 6 A.

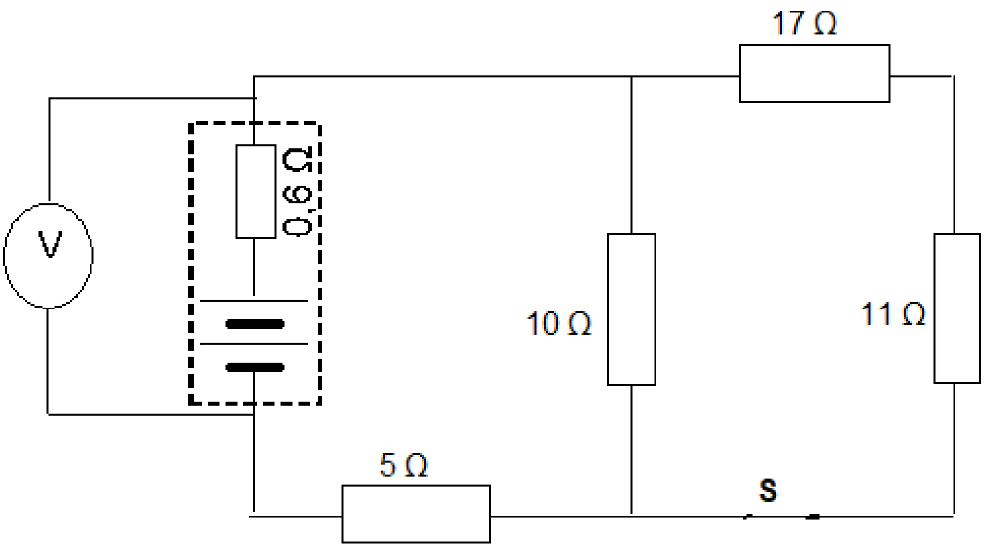
9.3.1 Calculate the gradient of the above graph. (3)

9.3.2 Use a calculation to motivate whether this conductor is suitable to be used for this electric heater. (6)

[15]

QUESTION 10 (Start on a new page.)

The battery used in the circuit diagram below has an internal resistance of 0,6 Ω. It is observed that 12 J of energy is given to each coulomb of charge that passes through the battery per second.



The resistance of the connecting wires can be ignored.

10.1 Write down the term that is used to describe the underlined words. (1)

10.2 Calculate the current that flows through the 5 Ω resistor. (6)

10.3 Determine the reading on the voltmeter. (3)

Switch S is now opened.

10.4 Will the reading on the voltmeter, V, INCREASE, DECREASE or REMAIN THE SAME. (1)

10.5 Briefly explain the answer to QUESTION 10.4. (3)
[14]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/ *SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity / *Swaartekragversnelling*	g	9,8 $m{\bullet}s^{-2}$
Universal gravitational constant / *Universelegravitasiekonstant*	G	$6{,}67 \times 10^{-11}$ $N{\bullet}m^{2}{\cdot}kg^{-2}$
Speed of light in a vacuum / *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}$ $m{\bullet}s^{-1}$
Coulomb's constant / *Coulomb se konstante*	k	$9{,}0 \times 10^{9}$ $N{\bullet}m^{2}{\bullet}C^{-2}$
Charge on electron / *Lading op elektron*	e	$-1{,}6 \times 10^{-19}$ C
Electron mass / *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}$ kg
Mass of earth / *Massa op aarde*	M	$5{,}98 \times 10^{24}$ kg
Radius of earth / *Radius van aarde*	R_E	$6{,}38 \times 10^{6}$ m

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

FORCE/*KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$	$f_s^{max} = \mu_s N$
$f_k = \mu_k N$	$g = G\frac{M}{d^2}$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$	$n = \frac{Q}{q_e}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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