KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P1

JUNE EXAMINATION

2025

TIME: 1.5 hours

MARKS: 75

This question paper consists of 11 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK.**
2. This question paper consists of **SIX** questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subsections, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, et cetera where required.

QUESTION 1: MULTIPLE CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 — 1.5) in the ANSWER BOOK, for example 1.6E

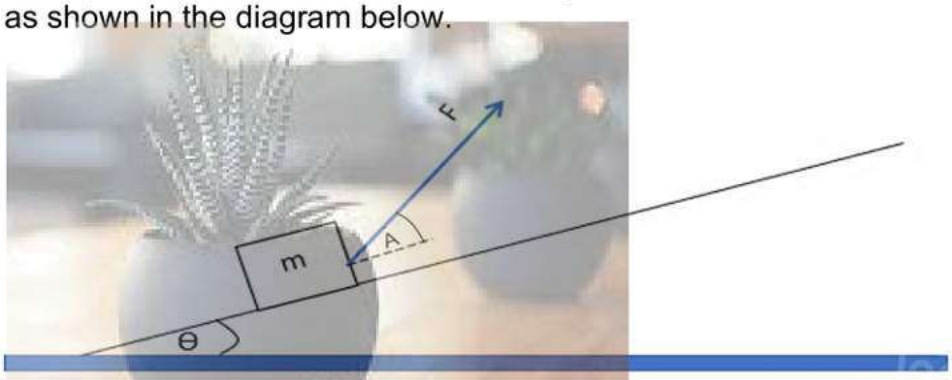
1.1 Two forces P and Q, can be represented by a single force of magnitude 12 N. If the magnitude of force P is 5 N, which one of the following is a possible magnitude of force Q?

A 20 N
B 14 N
C 6 N
D 5 N (2)

1.2 Which of the following statements best illustrates the concept of inertia?

A A ball moving through a vacuum in space.
B An object comes to rest after the force acting on it is removed.
C The driver of a car moves in a forward direction when the car suddenly stops.
D A ball striking the ground and bouncing back up. (2)

1.3 An object of mass m is pulled UP a rough incline at a CONSTANT VELOCITY as shown in the diagram below.



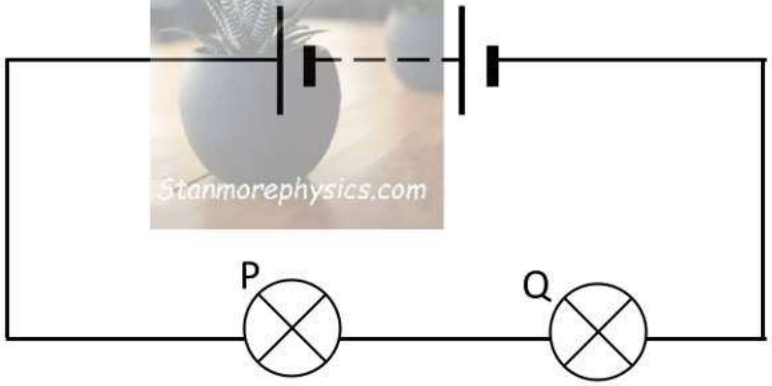
Which ONE of the following equations is correct for the relationship between the forces acting on the object?

A $F\cos A + f_k = mg\sin\Theta$
B $mg\sin\Theta + f_k - F\cos A = 0$
C $F\cos A - f_k + mg\sin\Theta = 0$
D $F\cos A = mg\sin\Theta$ (2)

1.4 Two charged objects repel each other with a force F when they are separated by a distance d. The distance between the same two charges is reduced to ½ d. The new force, in terms of F, will now be ...

A ½ F
B ¼ F
C 2F
D 4F (2)

1.5 The diagram below shows two light bulbs, P and Q, connected in series to a battery.



If bulb P glows brighter than bulb Q, then the ...

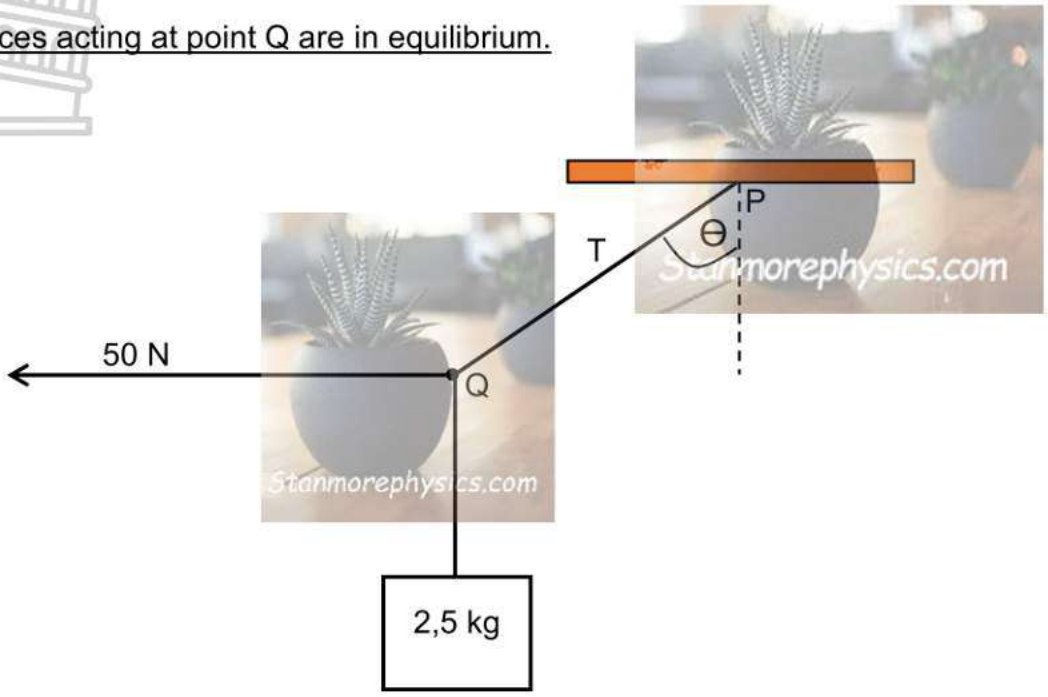
A resistance of bulb P is greater than that of bulb Q.
B resistance of bulb P is smaller than that of bulb Q.
C current through bulb P is smaller than that through bulb Q.
D current through bulb P is greater than that through bulb Q. (2)

[10]

QUESTION 2

An object with a mass of 2,5 kg hangs from a string that is attached to the ceiling at point P. A force F of magnitude 50 N, acting horizontally from point Q on the string, pulls the string to the left, as shown in the diagram below.

<u>The forces acting at point Q are in equilibrium.</u>



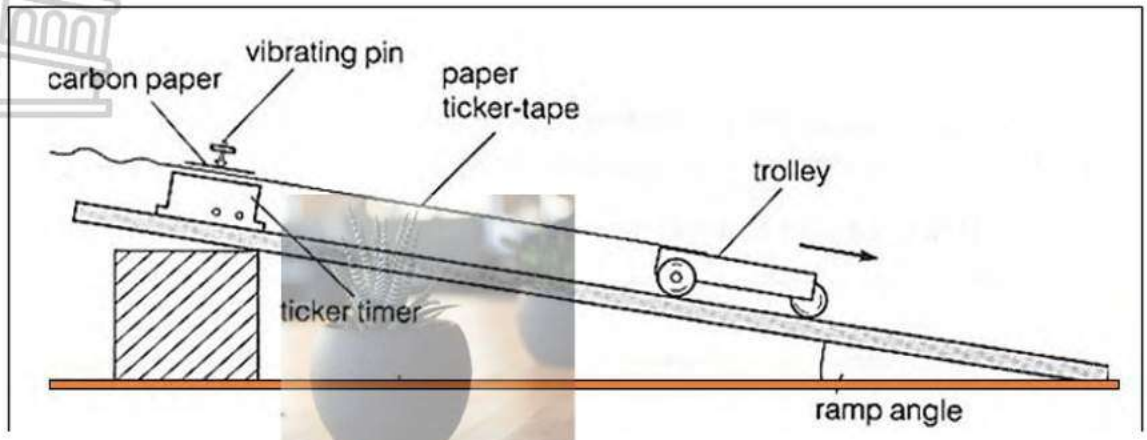
2.1 Write down a conclusion that can be made from the underlined statement above. (1)

2.2 Calculate the magnitude of the tension T in the string (4)

[5]

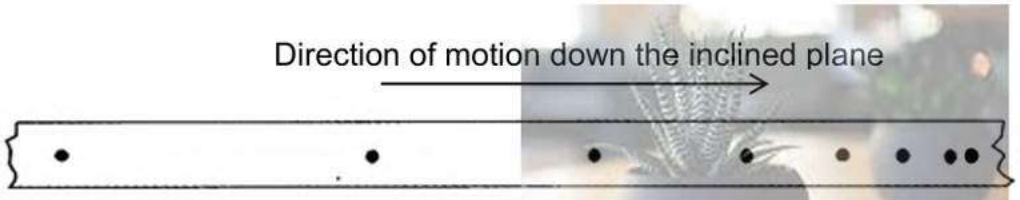
QUESTION 3

A student conducts an experiment to investigate the relationship between the resultant force on an object, and acceleration. The experiment is set up using a trolley on an inclined runway, and a ticker timer that makes 50 dots every second.



3.1 Calculate the period of the ticker timer. (2)

When the trolley is released from the top of the runway, it moves down the slope and the following ticker tape is produced:



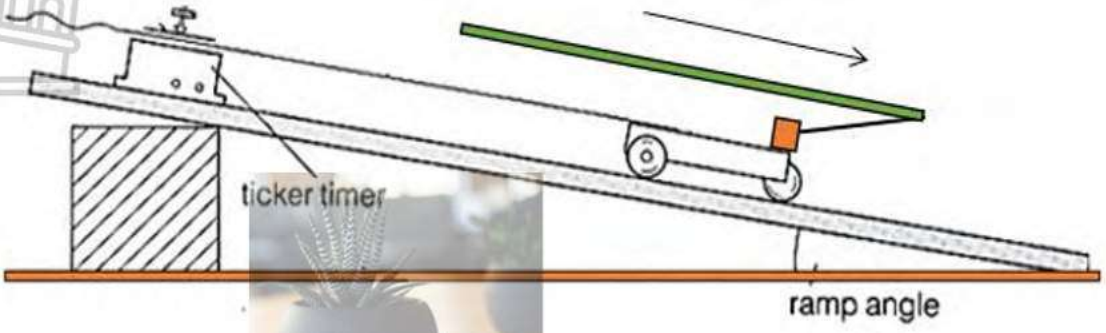
3.2 Briefly explain why the dots on the tape are initially very close together. (2)

The slope of the runway is adjusted so that the dots are evenly spaced.

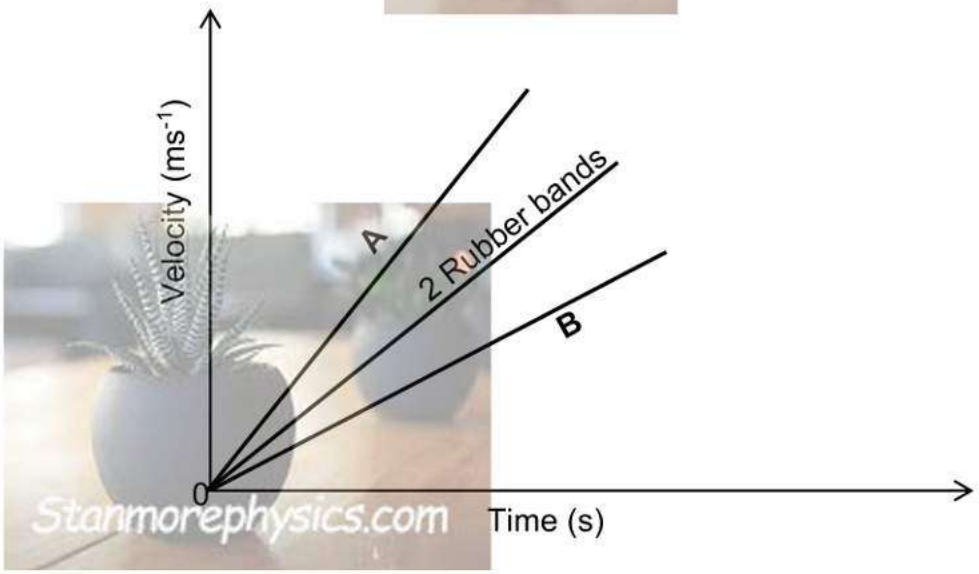
3.3 Was the ramp angle INCREASED or DECREASED? (1)

3.4 What is the magnitude of the resultant force now acting on the trolley? (1)

3.5 The trolley is now accelerated by first using one rubber band, then two rubber bands and finally three rubber bands. The rubber bands are stretched to the same extent each time.



The three sets of results are plotted on a velocity-time graph shown below.



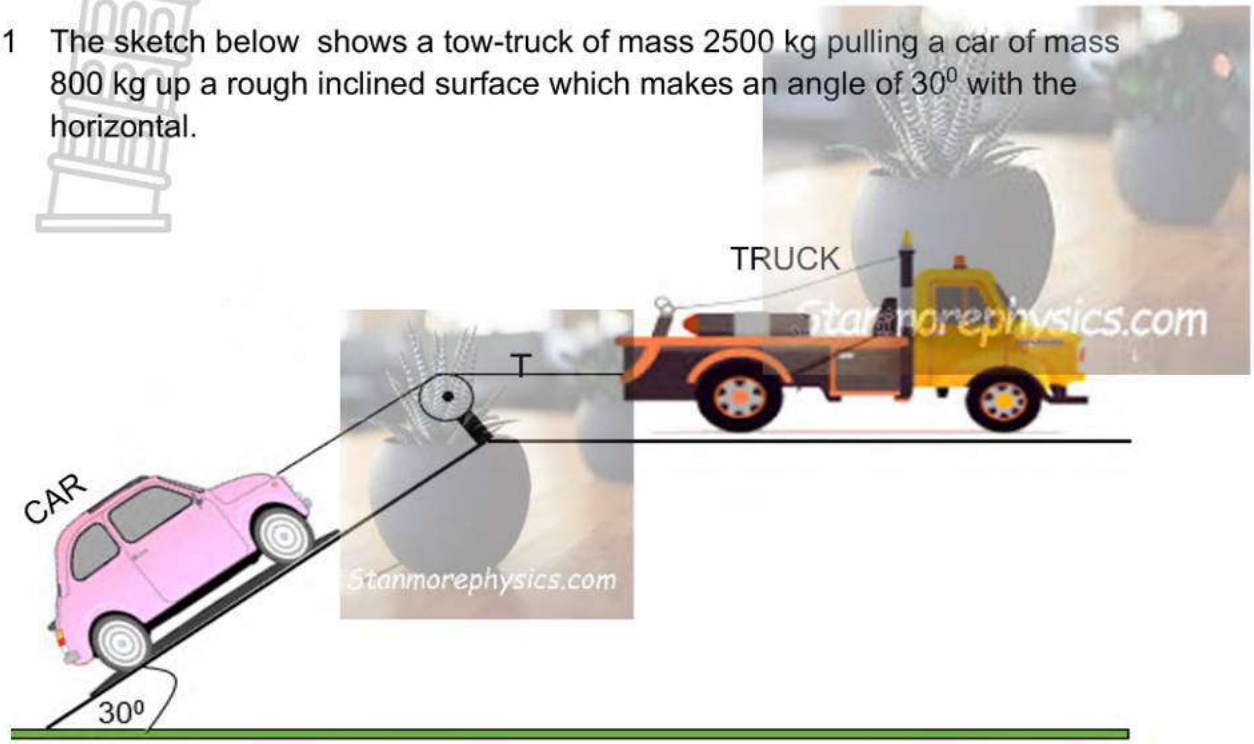
3.5.1 Which graph represents the results when THREE rubber bands were used? Choose from **A** or **B**. Give a reason for the answer. (2)

3.5.2 Sketch a graph to show the relationship between the acceleration of the trolley and the force (in rubber bands units) acting on the trolley. (2)

[10]

QUESTION 4

4.1 The sketch below shows a tow-truck of mass 2500 kg pulling a car of mass 800 kg up a rough inclined surface which makes an angle of 30^0 with the horizontal.



The co-efficient of kinetic friction between the car and the surface is 0,25.The net force acting on the truck is 1520 N, and the tension in the cable is T. Ignore the rotational effects of the wheels.

4.1.1 State Newton's Second Law of motion in words. (2)

4.1.2 Draw a labelled free body diagram showing all the forces acting on the car. (4)

4.1.3 Calculate the kinetic frictional force that the car experiences as it moves up the surface. (3)

4.1.4 Calculate the tension T in the cable . (5)

4.2 A spaceship, with its engines switched off, is moving towards Earth.The mass of the spaceship is 1250 kg.

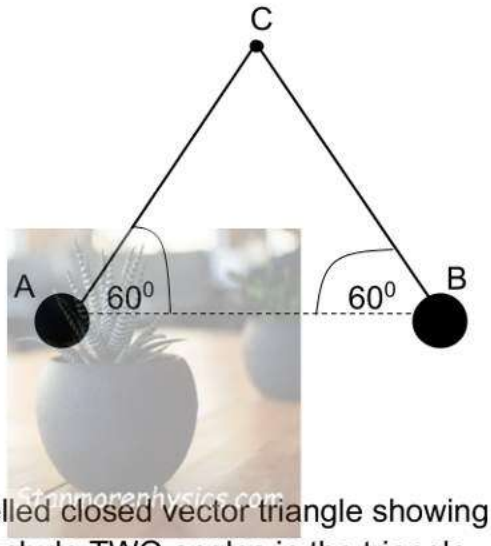
4.2.1 State Newton's Law of universal gravitation in words. (2)

4.2.2 Calculate the distance between the spaceship and the centre of Earth when Earth exerts a force of 2458 N on the spaceship. (4)

[20]

QUESTION 5

5. Two small, identical positively charged spheres, A and B, are suspended from the ceiling at point C by non-conducting threads as shown below

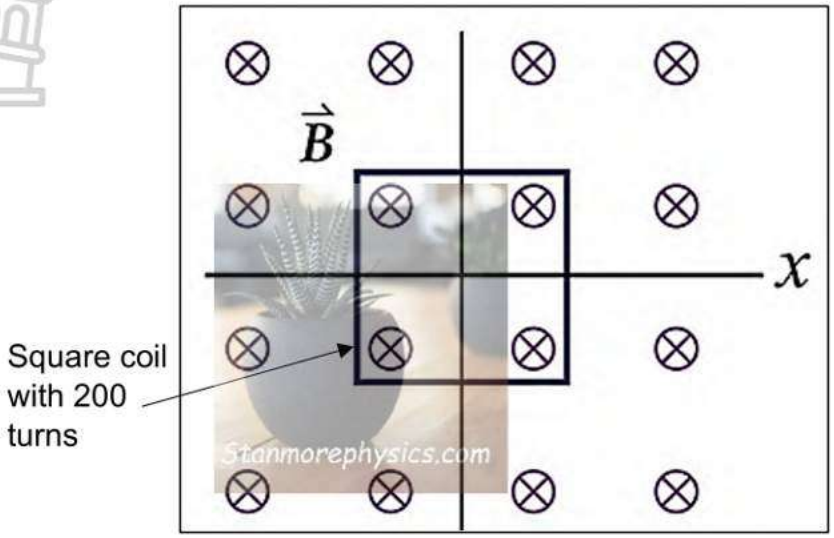


5.1.1 Draw a labelled closed vector triangle showing all the forces acting on sphere A. Include TWO angles in the triangle. (4)

5.1.2 If the mass of each sphere is 1,5 g,calculate the magnitude of the electrostatic force acting on sphere A. (3)

5.1.3 Calculate the magnitude of the electric field at sphere A due to sphere B if the charge on each sphere is 4,80 nC. (3)

5.2 A square coil with sides of length 0,25 m contains 200 turns and is positioned perpendicular to a uniform magnetic field of magnitude 0.75 T. The coil is then quickly pulled from the field in 0.20 s, moving perpendicular to the magnetic field, to a region where there is no magnetic field.



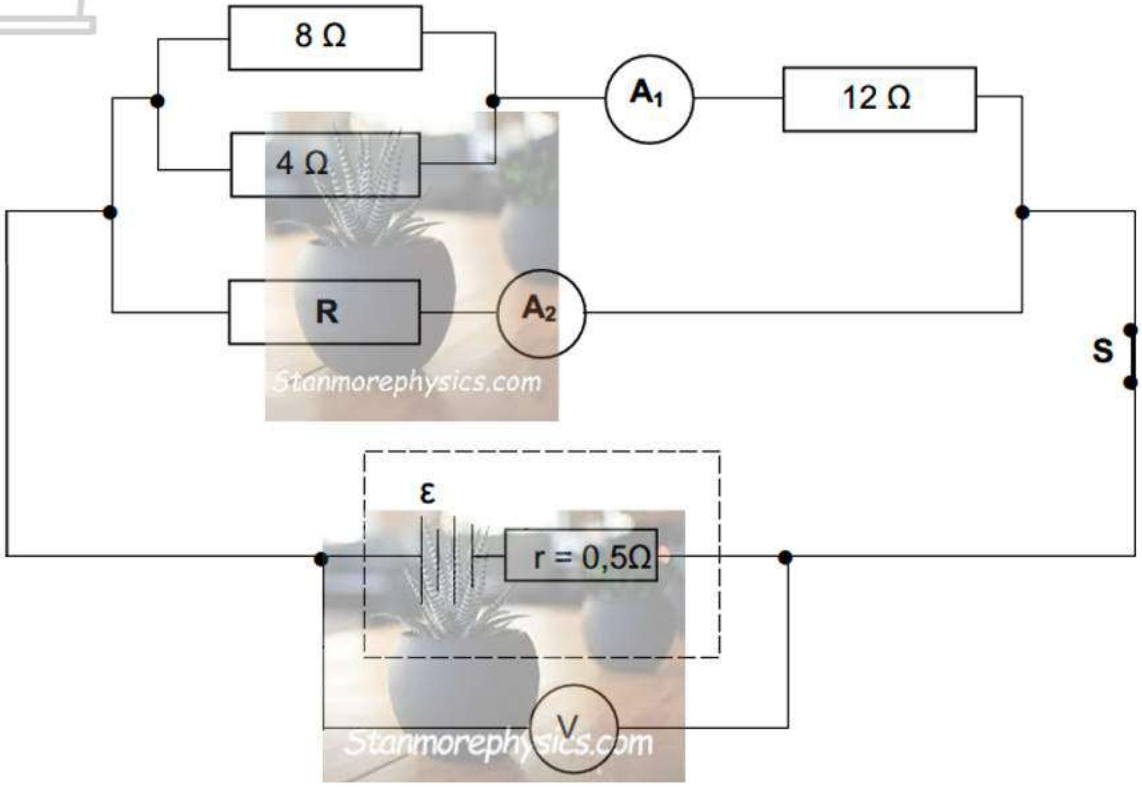
5.2.1 State Faradays Law of electromagnetic induction in words. (2)

5.2.2 Calculate the emf induced across the coil. (5)
[17]

QUESTION 6

6.1 State Ohm's Law in words. (2)

A battery with an internal resistance of 0,5 Ω and an unknown emf (ε) is connected to four resistors and a switch as shown in the circuit below. A high-resistance voltmeter (V) is connected across the battery. A_1 and A_2 are ammeters of negligible resistance.



With switch S closed, the current passing through the 8 Ω resistor is 0,5 A, and resistor R delivers 12 W of power.

6.2 Calculate:

6.2.1 The reading on ammeter A_1 (3)

6.2.2 The reading on ammeter A_2 (5)

6.2.3 The emf of the battery (ε) (3)
[13]

TOTAL MARKS: [75]

DATA SHEET

PHYSICS :

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 m·s^{-2}
Universal gravitational constant	G	6,67 x 10^{-11} N·m^2·kg^{-2}
Radius of the Earth	R_E	6,38 x 10^6 m
Mass of the Earth	M_E	5,98 x 10^{24} kg
Coulomb's constant	k	9,0 x 10^9 N·m^2·C^{-2}
Charge on electron	e	–1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE

MOTION

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

FORCE

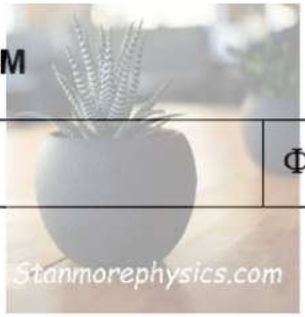
$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or $g = G\frac{M}{r^2}$

ELECTROSTATICS

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

ELECTROMAGNETISM

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



ELECTRIC CIRCUITS

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

Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES

MARKING GUIDELINES

COMMON TEST

JUNE 2025

Final Memo

NATIONAL

SENIOR CERTIFICATE

GRADE 11

NB: This marking guideline consists of 6 pages.

QUESTION ONE

1.1 B ✓✓
1.2 C ✓✓
1.3 B ✓✓
1.4 D ✓✓
1.5 A ✓✓

5 x 2 = [10]

QUESTION TWO

2.1 The resultant force acting on the system is zero. ✓✓ (2 or 0) (2)

2.2
W = mg
= (2,50 x 9,8)
= 24,5 N

$T^2 = R_X^2 + R_Y^2$
$= (50)^2$ ✓ $+ (24,50)^2$ ✓
T = 55,68 N ✓ (3)

[5]

QUESTION 3

3.1 $T = \frac{1}{f}$

$= \frac{1}{50}$ ✓

= 0,02 s ✓ (2)

3.2 The trolley is starting from rest ✓. Initially very small distances are covered (per time period). ✓ (2)

3.3 Decreased ✓ (1)

3.4 Zero / 0 N ✓ (1)

3.5.1 A. ✓ It has the largest gradient, and hence the largest acceleration. ✓ (2)

3.5.2

Marking Rubric : Graph	
Criteria	Mark allocation
Straight line graph with a positive gradient	1 mark
Line passing through the origin	1 mark

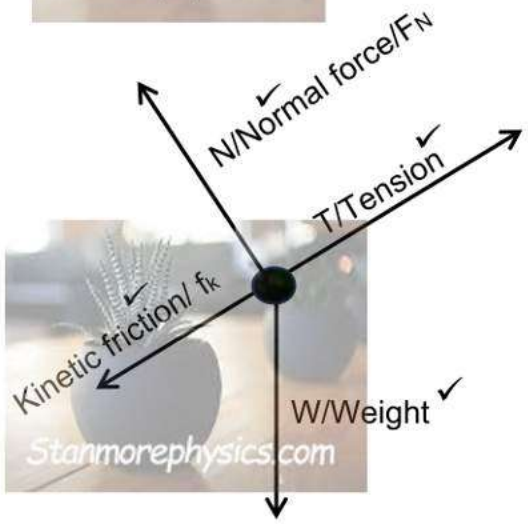
(2)

[10]

QUESTION 4

4.1.1 When a net/resultant force acts on an object, the object accelerates in the direction of the resultant force. This acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object.✓ (2)

4.1.2



(4)

4.1.3 $f_k = \mu_k N$✓

$= (0,25)(800(9,8)\cos 30^0)$ ✓

$= 1697,41$ N✓ (3)

4.1.4 $F_{NET} = ma$

$1520 = 2500\ a$✓

$a = 0,608\ ms^{-2}$

$F_{NET} = ma$

$T + (-fk) + (-W//) = ma$ } ✓ (Any one)

$T + (-1697,41) + (-(800)(9,8)\sin 30^0)$ ✓ $= 800(0,608)$ ✓

$T = 6103,81$ N✓ (5)

4.2

4.2.1 Every body in the universe attracts every other body with a gravitational force that is directly proportional to the product of their masses✓ and inversely proportional to the square of the distance between their centres. ✓
(Marks must only be awarded if the definition is in context with the gravitational law) (2)

4.2.2 $F = \frac{Gm_1m_2}{r^2}$✓

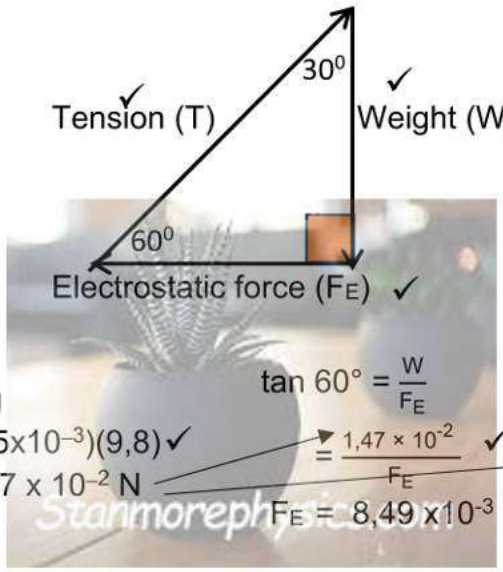
2458✓ $= \frac{(6,67X10^{-11})(1250)(5,98X10^{24})}{(r)^2}$ ✓

$r = 1,42 \times 10^7$ m✓ (4)

[20]

QUESTION 5

5.1.1



Any two angles correctly shown✓

(4)

5.1.2 $W = mg$
$= (1,5x10^{-3})(9,8)$✓
$= 1,47 \times 10^{-2}$ N

$\tan 60° = \frac{W}{F_E}$
$= \frac{1,47 \times 10^{-2}}{F_E}$ ✓
$F_E = 8,49 x10^{-3}$ N✓

OR

$\tan 30° = \frac{F_E}{W}$
$F_E = 1,47 \times 10^{-3} \tan 30°$ ✓
$F_E = 8,49 x10^{-3}$ N✓ (3)

5.1.3 **Positive marking from Question 5.1.2**

$E = F/q$✓

$E = \frac{8,49 \times 10^{-3}}{4,8 \times 10^{-9}}$ ✓

$= 1,77 x10^6$ N·C^{-1}✓ (3)

5.2.1 The induced emf in a conductor is directly proportional to the rate of change of the magnetic flux linkage through the conductor. ✓✓ (2)

5.2.2 $A = s \times s$
$= 0,25 \times 0,25$
$= 0,0625\ m^2$

$\Phi = BA\cos\theta$
$= (0,750)(0,0625)\cos 0° ✓$
$= 4,69 \times 10^{-2}\ Wb$

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ ✓
$= -\frac{200(4,69 \times 10^{-2} - 0)}{0,20}$ ✓ ✓
$= 46,9\ V$ ✓ (Ignore the negative sign) (5)

[17]

QUESTION 6

6.1 The current flowing through a conductor at a constant temperature ✓ is directly proportional to the potential difference across it. ✓ (2)

6.2 $V = IR = (8)(0,5) = 4\ V$
$I_{4\Omega} = \frac{4}{4}$
$= 1A$
$I_{A_1} = 1$ ✓ $+ 0,5$ ✓ $= 1,5A$ ✓ (3)

6.3 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$Rp = (\frac{1}{8} + \frac{1}{4})^{-1}$ ✓

$= 2,666\ \Omega$

$V_{(Rp + 12\Omega)} = IR$

$= \underline{(1,5)\ (2,666+12)}$ ✓

$= 22\ V$

I_{A2}

$P = VI$ ✓

$12 = 22\ I$ ✓

$I_{A2} = 0,55\ A$ ✓

(5)

6.5 $\varepsilon = IR + Ir$ ✓

$= 22 + (1,5 + 0,55)(0,5)$ ✓

$= 23,025\ V$ ✓

(3)

[13]

TOTAL : 75 MARKS