KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P1

COMMON TEST

JUNE 2024

MARKS: 75

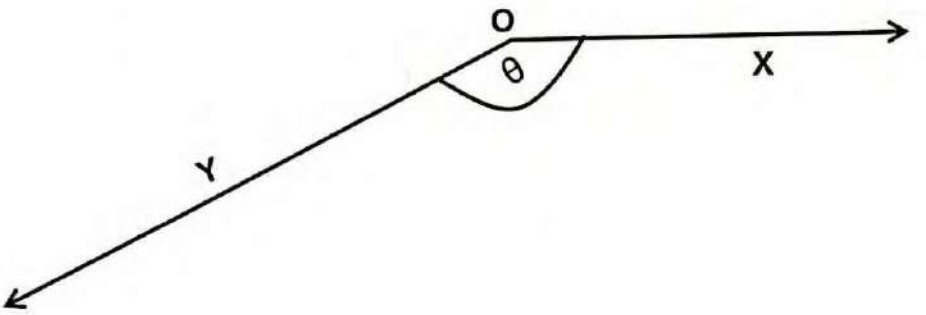
DURATION: 1 ½ hours

This question paper consists of 13 pages including 2 data sheets and a detachable sheet for Question 2.3

QUESTION 1: MULTIPLE CHOICE QUESTIONS

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 1.6 D.

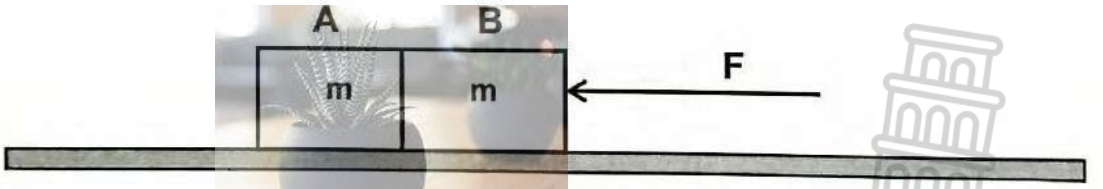
1.1 Two forces X and Y act at the same point O as shown in the sketch below. The magnitudes of the forces X and Y are 6 N and 8 N respectively. The angle θ can be changed. Which ONE of the following forces CANNOT be the magnitude of the resultant force?



A 1 N
B 2 N
C 10 N
D 13 N

(2)

1.2 Two blocks A and B of identical mass **m**, in contact with each other, are placed on a frictionless, horizontal surface. A force of magnitude **F** is applied to block B and the system accelerates to the left with an acceleration **a**. If the mass of B is doubled and the force **F** is halved, then the new acceleration will be …



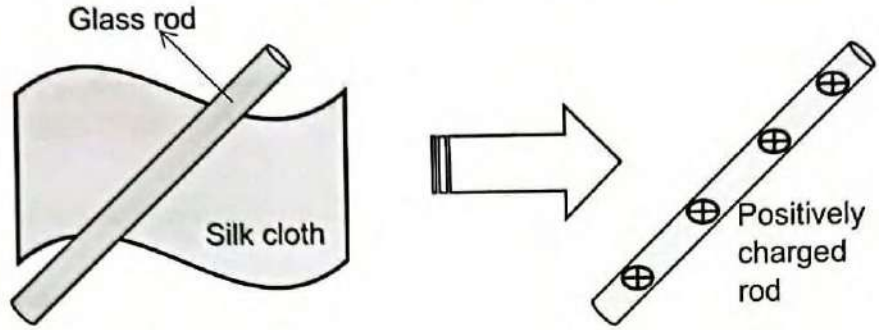
A $\frac{2}{9}$ **a**
B $\frac{1}{2}$ **a**
C $\frac{1}{4}$ **a**
D $\frac{1}{3}$ **a**

(2)

1.3 Which ONE of the following statements is TRUE for the gravitational attraction between a man and the Earth?

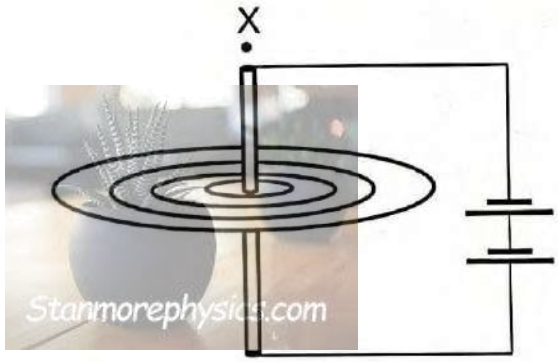
A The man and Earth have the same acceleration
B The man and Earth exert the same force of attraction on each other.
C The acceleration of the man is independent of the Earth's mass.
D The force of attraction that Earth exerts on the man is greater than the force of attraction that the man exerts on Earth. (2)

1.4 A glass rod becomes positively charged after being rubbed by a silk cloth. The glass rod becomes positively charged because …



A the glass rod gains protons
B the silk cloth loses protons
C the glass rod loses electrons
D the silk cloth loses electrons (2)

1.5 The sketch below shows the magnetic field around a straight current carrying conductor viewed from point X.
Which ONE of the following CORRECTLY describes the direction of the conventional current through the conductor and the direction of the magnetic field lines?

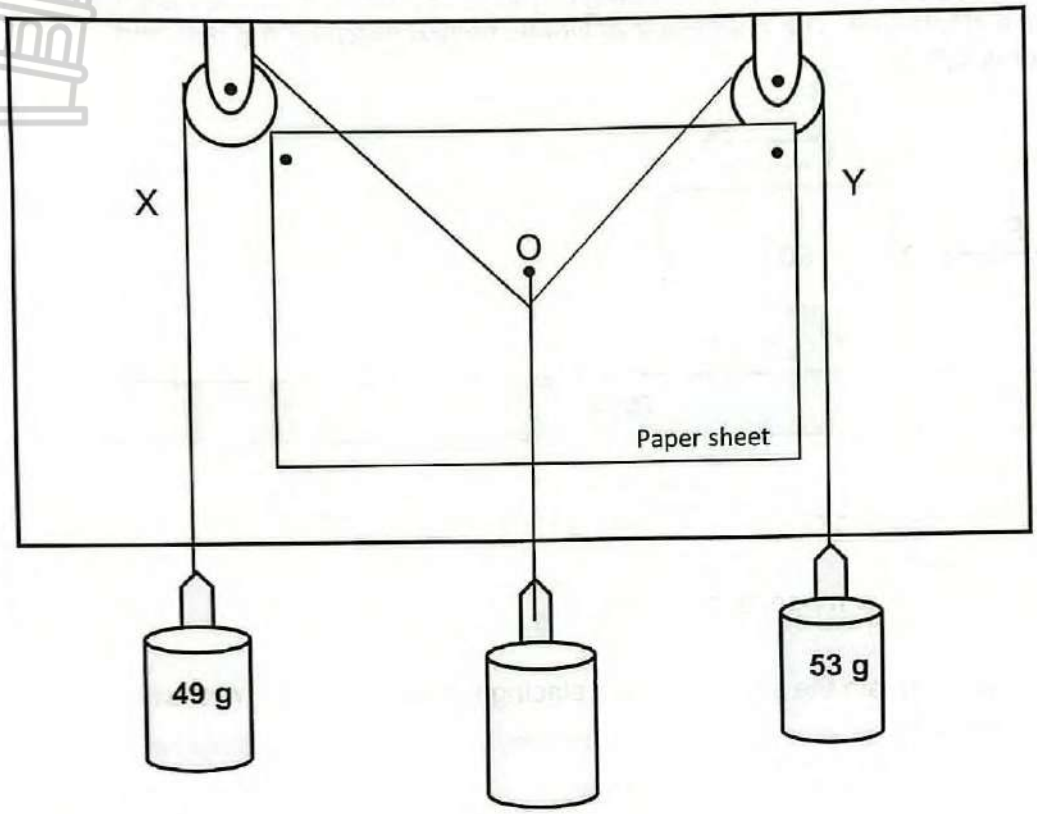


	DIRECTION OF CONVENTIONAL CURRENT	DIRECTION OF MAGNETIC FIELD
A	Downwards	Clockwise
B	Downwards	Anticlockwise
C	Upwards	Clockwise
D	Upwards	Anticlockwise

(2)
[10]

QUESTION 2

The apparatus shown below was used to determine the resultant of two co-planar forces X and Y acting at a common point O.



2.1 Define *resultant force.* (2)

2.2 Explain why pulleys are used in this experiment. (2)

2.3 An INCOMPLETE diagram for the results of this investigation is given *on PAGE 13 of this question paper.* Complete the diagram and determine the magnitude of the resultant force.

Use a scale of 10mm = 1 N

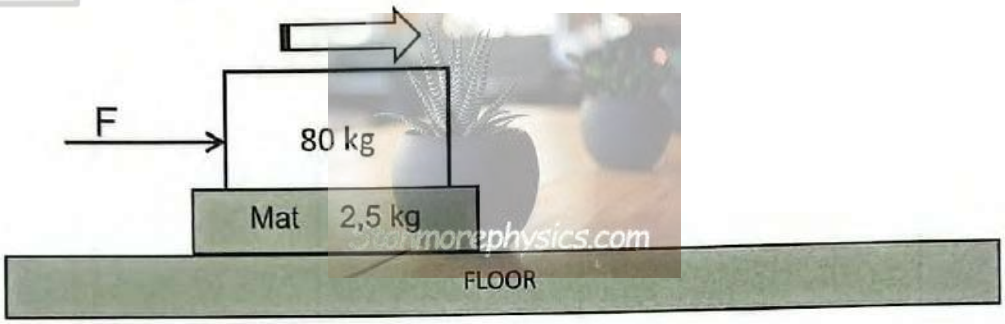
Write your name on the sheet provided, and submit it with your answer book. (4)

2.4 Write down the name of the force that keeps this system at rest. (1)

[9]

QUESTION 3

3.1 The diagram below shows a box of mass 80 kg placed on a rubber gym mat of mass 2,5 kg which is in contact with the floor. The box is initially at rest. A man pushes the box across the floor to the right with a force of magnitude F. The box does not slip on the mat during its motion and they move across the floor as a single unit. The coefficient of kinetic friction between the mat and the floor is 0,025.

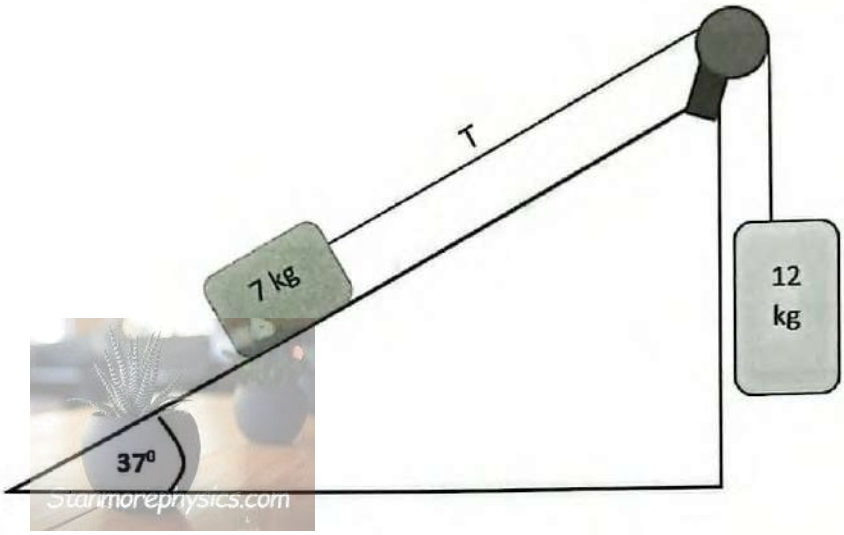


If the box accelerates at 2,33 $m \cdot s^{-2}$ during its motion,

3.1.1 Calculate the magnitude of force F. (5)

3.1.2 Briefly explain the significance of placing the box on a gym mat when pushing it. (2)

3.2 The diagram below shows two blocks of masses 7 kg and 12 kg, attached to each other with an inextensible string of negligible mass. The 7 kg block is placed on a rough inclined surface that makes an angle of 37° with the horizontal while the 12 kg block is suspended in the air.
The kinetic frictional force between the 7 kg block and the surface is 13,13 N.



When the blocks are released, the 7 kg block accelerates up the inclined surface.

3.2.1 State *Newton's second law of motion* in words (2)

3.2.2 Draw a labelled free-body diagram for the 7 kg block. (4)

3.2.3 Calculate the magnitude of the tension T in the string. (6)

[19]

QUESTION 4

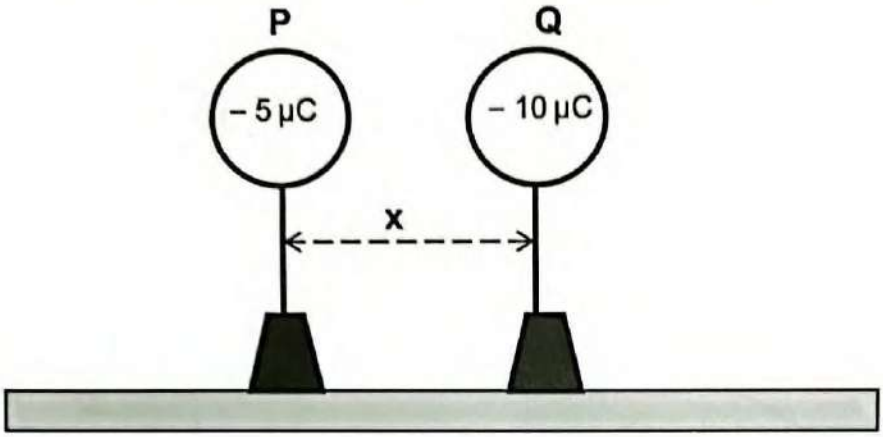
4.1 State Newton's *law of universal gravitation* in words. (2)

4.2 The weight of a rocket on the surface of the Earth is 1×10^6 N.
At an altitude of 1000 km above the surface of the Earth, the rocket's mass decreases by 12 % due to fuel consumption. Calculate the magnitude of the gravitational force that the Earth exerts on the rocket when it is at this altitude. (5)

[7]

QUESTION 5

5.1 Two identical metal spheres, P and Q, placed on insulated stands, are separated by a distance **x** metres as shown in the diagram below. The charges on the spheres are – 5 μC and – 10 μC respectively.



The spheres experience an electrostatic force.

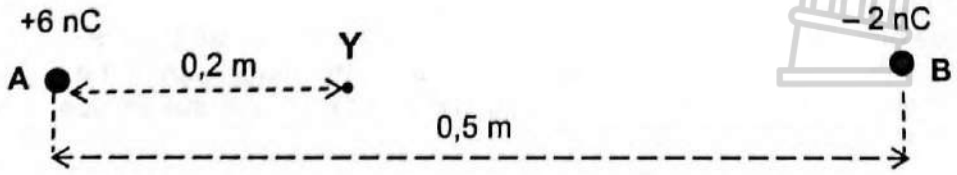
5.1.1 In which direction will sphere P experience this force? Choose from TO THE LEFT or TO THE RIGHT. (1)

The spheres are now made to touch and are then placed at their original positions.

5.1.2 Were electrons REMOVED FROM or TRANSFERRED TO sphere P? Give a reason for the answer. (2)

5.1.3 Calculate the distance **x** between the centres of the two spheres if the magnitude of the force now experienced by P is 1,2 N. (3)

5.2 Two point charges **A** and **B** of magnitudes +6 nC and –2 nC respectively are placed a distance 0,5 m apart. **Y** is a point 0,2 m to the right of **A** on the line joining the two point charges as shown below.

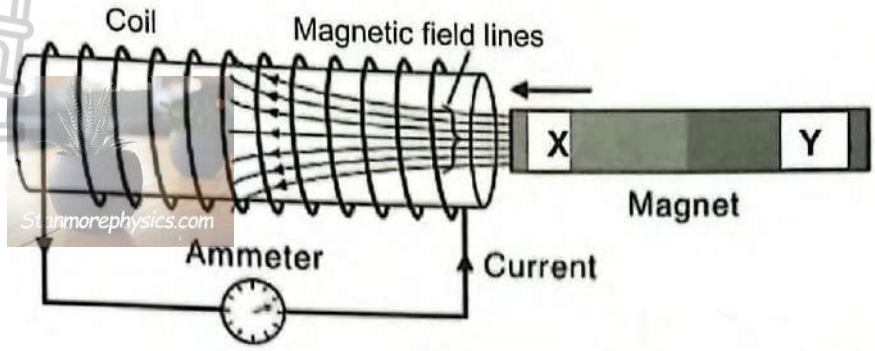


Calculate the magnitude of the NET electric field at point Y. (5)

[11]

QUESTION 6

The apparatus shown below is used to demonstrate Faraday's law of electromagnetic induction.



Google image : Science facts

6.1 State *Faraday's law of electromagnetic induction* in words. (2)

6.2 State TWO ways in which the deflection on the ammeter can be increased. (2)

6.3 Is **X** the NORTH POLE or the SOUTH POLE of the magnet? (1)

6.4 The area of the circular end of the coil is 0,8 m^2. The magnet is moved into the coil with its axis coinciding with the direction of the magnetic field, as shown in the diagram.

The magnetic flux linked to the coil changes from 0,6 Wb to 0,3 Wb in 2 seconds.

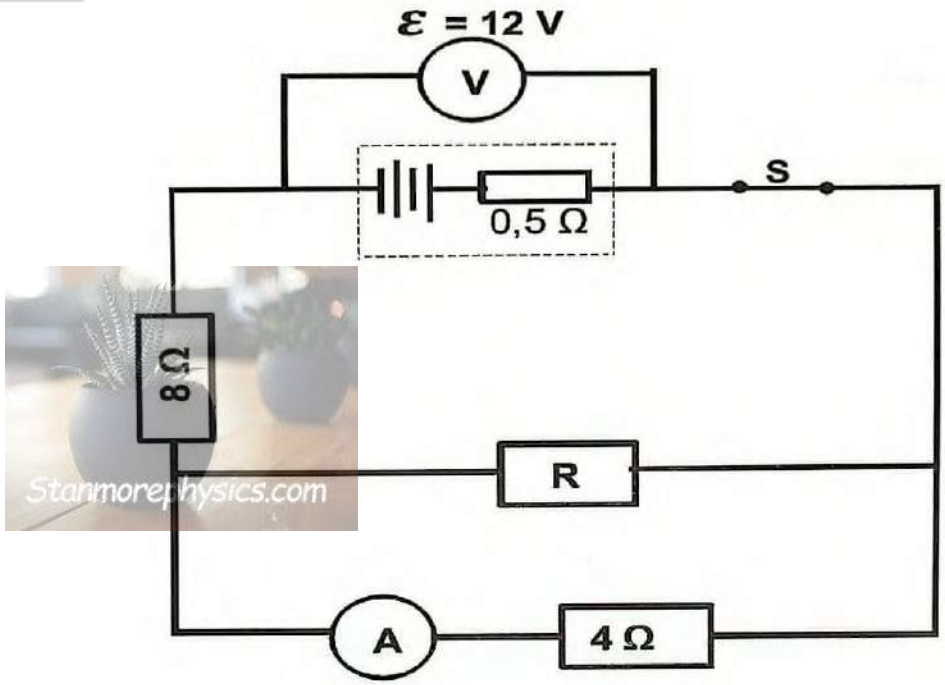
Calculate the number of turns in the coil if an emf of 7,5 V is induced in the coil. (3)

[8]

QUESTION 7

In the circuit shown below resistor R has an unknown resistance. The battery has an emf of 12 V and an internal resistance of 0,5 Ω. The ammeter, connecting wires and switch S have negligible resistance.

When switch S is closed, the voltmeter reads 11,4 V.



Calculate:

7.1 the current through the 8 Ω resistor. (3)

7.2 The reading on the ammeter. (4)

7.3 The resistance of resistor R. (4)

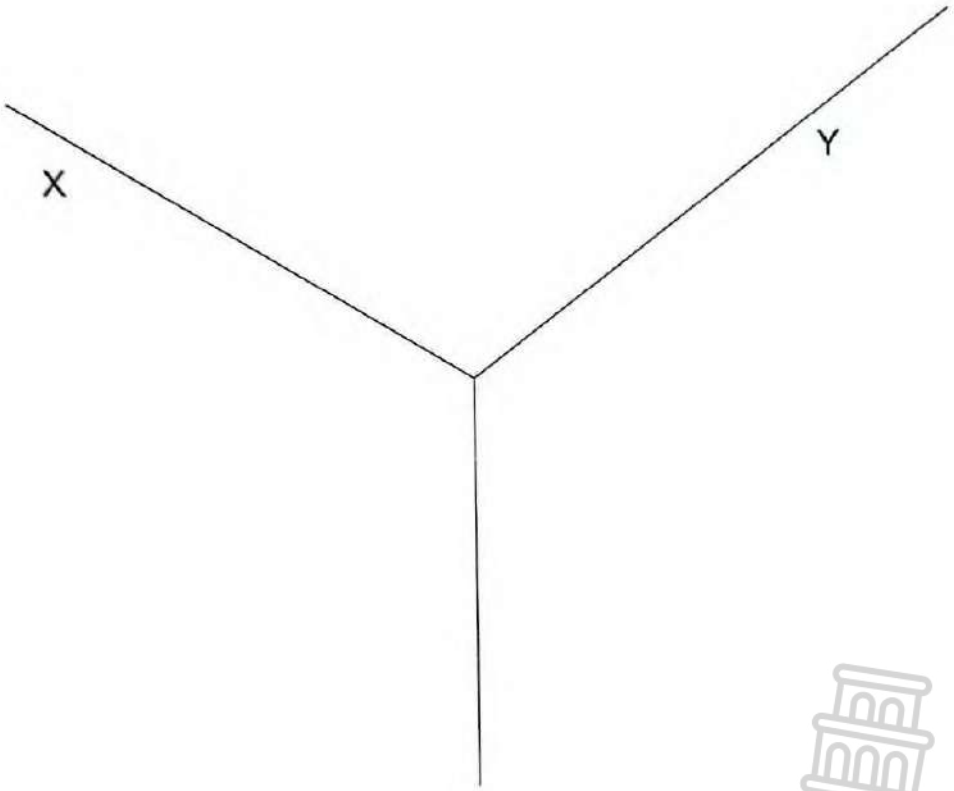
[11]

TOTAL MARKS: 75

DETACH THIS PAGE

NAME OF LEARNER : _____

Question 2.1.3



DATA SHEET

PHYSICS

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8\ m\cdot s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}\ N\cdot m^2\cdot kg^{-2}$
Radius of the Earth	R_E	$6,4 \times 10^{6}\ m$
Mass of the Earth	M_E	$5,98 \times 10^{24}\ kg$

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

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

ELECTRIC CIRCUITS

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

Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES

PAPER 1

MARKING GUIDELINES

COMMON TEST

GRADE 11

NB: This marking guideline consists of 6 pages.

QUESTION 1

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

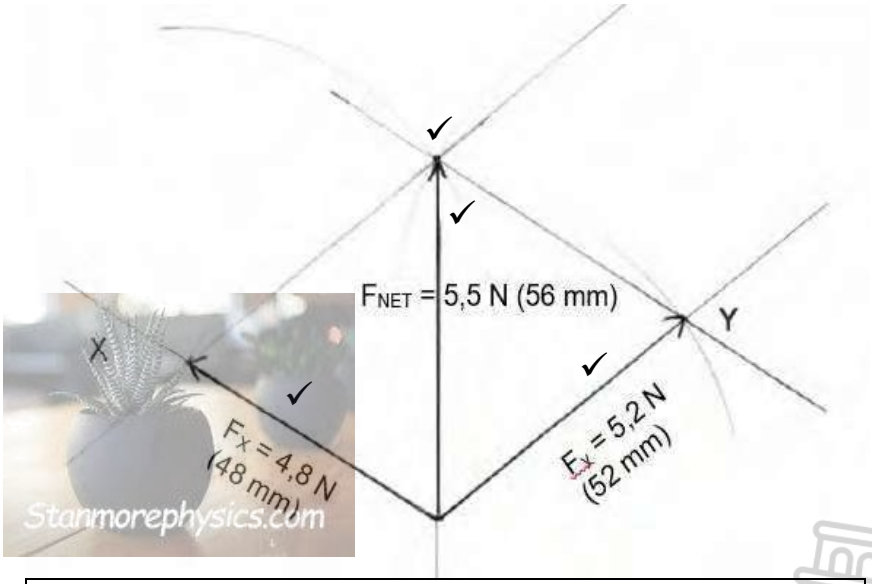
[10]

QUESTION 2

2.1.1 A single force having the same effect as two or more forces together at a point. ✓✓ (2)

2.1.2 Changes the direction of the forces ✓ without changing the magnitude. ✓ (2)

2. 1. 3



(4)

Marking Rubric : Scale Diagram	
Criteria	Mark allocation
Forces F_X and F_Y correctly plotted using ANY SCALE	2 x 1 = (2)
Resultant force is correctly drawn by completing the parallelogram accurately.	(1)
Accept a range of : F_{NET}	5,2 N – 5,7 N (1)

2.1.4 Equilibrant ✓ (1)

[9]

QUESTION 3

3.1.1 $f_K = \mu_K \cdot N$ ✓
$= 0,025 \times (82,5)(9,8)$ ✓
$= 20,213$ N

$F_{NET} = ma$
$F + (-f_K) = ma$ ✓ any one
$F + (-20,213) = 82,5(2,33)$ ✓
$F = 212,44$ N ✓

(5)

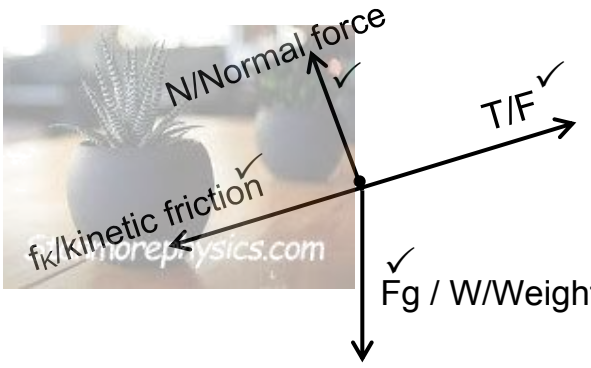
3.1.2 It has a smaller co-efficient of kinetic friction ✓ as compared to the block being in direct contact with the floor, hence a smaller kinetic frictional force ✓

(2)

3.2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force. The acceleration is directly proportional to the net force ✓ and inversely proportional to the mass of the object. ✓

(2)

3.2.2



Note: If the components of the weight are provided, no marks to be avoided for Fg

(4)

3.2.3 **7 kg mass**

$F_{g//} = mg\sin\Theta$
$= 7(9,8) \sin 37° = 41,285$ N

$F_{net} = ma$
$T + (-f_K) + (-F_{g//}) = ma$ ✓
$T - 13,13 - 7(9,8) \sin 37°$ ✓ $= 7a$ ✓
$T - 54,415 = 7a$ …..(1)
$T = 77,70$ N ✓

12 kg mass

$F_{net} = ma$
$W - T = ma$ ✓
$(12 \times 9,8) - T = 12a$ ✓
$-T + 117,6 = 12a$ …(2)

(6)
[19]

QUESTION 4

4.1 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 of the gravitational law) (2)

4.2 $W = mg$
$\underline{1 \times 10^6 = m(9,8)}$ ✓
$m = 1,02 \times 10^5$ kg

$$F = \frac{Gm_1m_2}{r2} \checkmark$$

$$F = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(8,98 \times 10^4)}{(6,4 \times 10^6 + 1 \times 10^6)^2} \checkmark \checkmark$$

$= 6,54 \times 10^5$ N ✓ (5)

[7]

QUESTION 5

5.1.1 TO THE LEFT✓ (1)

5.1.2 TRANSFERRED TO P✓
P has a bigger deficiency of electrons. ✓ (2)

5.1.3 $F = \frac{kQ_1Q_2}{r^2}$ ✓
$1,2 = \frac{(9\times10^9)(7,5\times10^{-6})(7,5\times10^{-6})}{x^2}$ ✓
x = 0,65 m ✓ (3)

NOTE: If any other value is used for Coulomb's const (k), award marks for substitution and final answer if it is computed correctly

5.2 $E_{A\rightarrow Y} = \frac{kQ}{r^2}$ ✓

$= \frac{(9\times10^9)(6\times10^{-9})}{(0,2)^2}$ ✓

= 1350 NC^{-1}

$E_{B\rightarrow Y} = \frac{kQ}{r^2}$

$= \frac{(9\times10^9)(2\times10^{-9})}{(0,3)^2}$ ✓

= 200 $N\cdot C^{-1}$

E_{NET} = 1350 + 200 ✓

= 1550 $N\cdot C^{-1}$ ✓ (5)

[11]

QUESTION 6

6.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linked with the conductor.✓✓ (2)

6.2 Increase speed at which the magnet is moved relative to the coil ✓
Increase the number of turns in the coil ✓
Use stronger magnets (accept any 2) (2)

6.3 North pole (1)

6.4 Remove this question.

Question 6 will be reduced to 5 marks, and then converted to 8 marks.						
Mark obtained	0	1	2	3	4	5
Converted mark	0	2	3	5	6	8

[8]

QUESTION 7

7.1
$$r = \frac{V_{lost}}{I} \checkmark$$
$$0,5 = \frac{0,6}{I} \checkmark$$
$$I_{8\Omega} = 1,2 \text{ A} \checkmark$$
(3)

7.2 **Positive marking from Question 7.1**

$V_{8\Omega} = IR_8$
$= \underline{1,2 \times 8} \checkmark$
$= 9,6 \text{ V}$
$V_p = V_{ext} - V_{8\Omega}$
$= \underline{11,4 - 9,6} \checkmark = 1,8 \text{ V}$

$V_p = I_4R_4$
$\underline{1,8 = I_4 \times 4} \checkmark$
$I_4 = 0,45 \text{ A} \checkmark$

(4)

7.3 **Positive marking from Question 7.2**

OPTION 1

$\varepsilon = IR + Ir$
$\underline{12 = 1,2 (8 + R_P) + 1,2 (0,5)} \checkmark$
$R_P = 1,5 \Omega$

OPTION 2

$V_{ext} = I_{TOT} \times R_{ext}$
$11,4 = 1,2 \times R_{ext} \checkmark$
$R_{ext} = 9,5 \Omega$

$R_p = R_{ext} - R_8$
$= 9,5 - 8$
$= 1,5 \Omega$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark$$
$$\frac{1}{1,5} = \frac{1}{R} + \frac{1}{4} \checkmark$$
$R = 2,4 \Omega \checkmark$

OPTION 3

$I_R = I_{TOT} - I_4$
$= \underline{1,2 - 0,45} \checkmark = 0,75 \text{ A}$

$V_R = I_R \times R \checkmark$
$1,8 = 0,75 \times R \checkmark$
$R = 2,4 \Omega \checkmark$

(4)
[11]

TOTAL : 75 MARKS