LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 11



PHYSICAL SCIENCES

CONTROL TEST

13 MARCH 2024

MARKS: 100

TIME: 2 HOURS

THIS QUESTION PAPER CONSISTS OF 11 PAGES AND 1 DATA SHEET

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

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SECTION A

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible 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 the ANSWER BOOK, e.g. 1.11 E. Each question has only ONE correct answer.

1.1 The force exerted by a surface on an object which is in contact with it and acts perpendicular to the surface is called:

A Gravitational force.

B Frictional force.

C Applied force.

D Normal force. (2)

1.2 The gravitational acceleration on the surface of a planet of radius ***R*** is ***g***.

The gravitational acceleration at a height of ***3R*** above the surface of the same planet is:

A $\frac{g}{16}$

B $\frac{g}{9}$

C 16 g

D 9 g (2)

1.3 The mass of a man on Earth is 85 kg. What will the mass of the same man be on the surface of a planet which has the same mass as Earth but half the radius of the Earth?

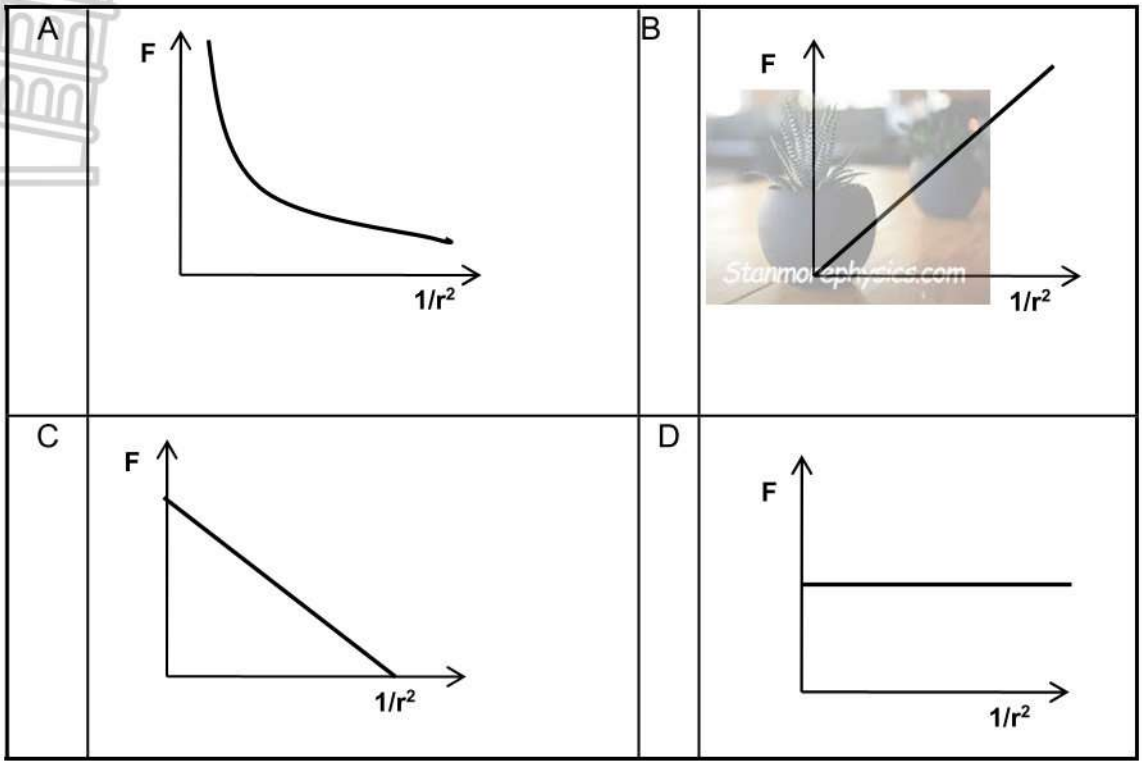
A 42,5 kg

B 21,25 kg

C 85 kg

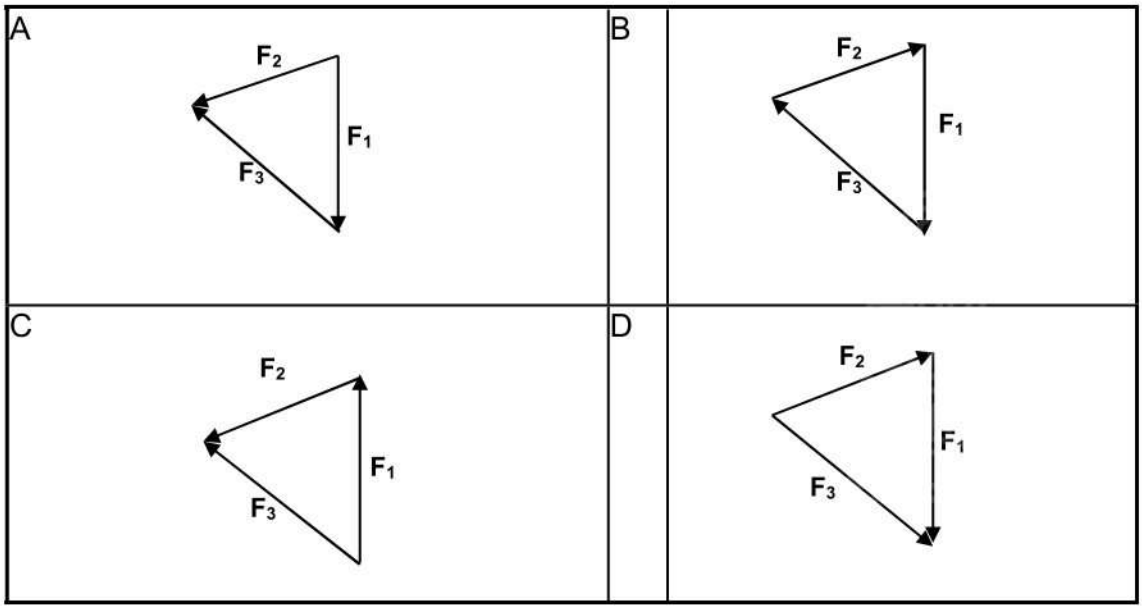
D 340 kg (2)

1.4 An object placed a distance **r** from the centre of a planet experiences an attractive force **F**. Which ONE of the graphs below represents the relationship between the force **F** and the distance **r** from the centre of the planet?



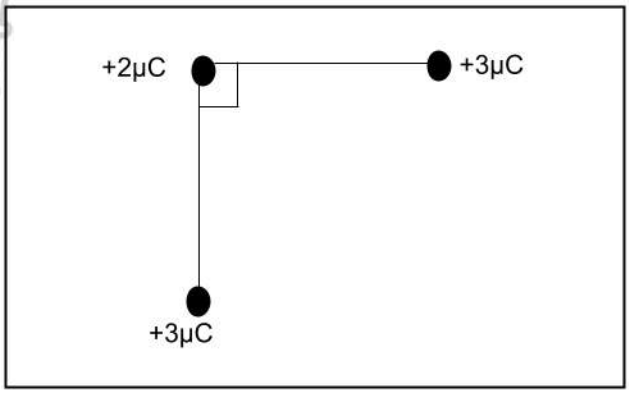
(2)

1.5 Three forces acting on an object are in equilibrium. Which ONE of the vector diagrams below indicates the forces in equilibrium?



(2)

1.6 Three point-charges of magnitude +2 µC, +3 µC and +3 µC are placed in a vacuum to form a right-angle as shown in the diagram below.

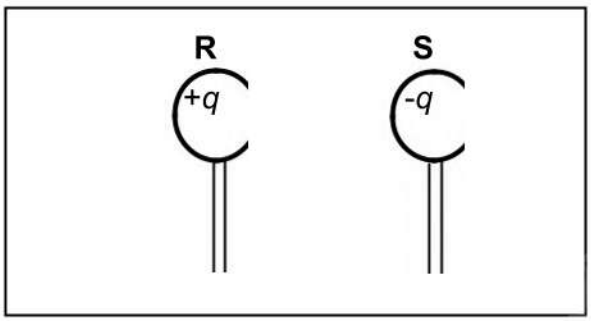


The net force acting on the + 2 µC can by represented by …



(2)

1.7 Two identical spheres, **R** and **S**, on insulated stands, carrying charges of $+q$ and $-q$ respectively, are placed a distance ***r*** apart. Sphere **R** exerts an electrostatic force of magnitude ***F*** on sphere **S**.



The two spheres are now brought into contact and are then returned to their original positions.

The magnitude of the electrostatic force that sphere **R** exerts on sphere **S** is now:

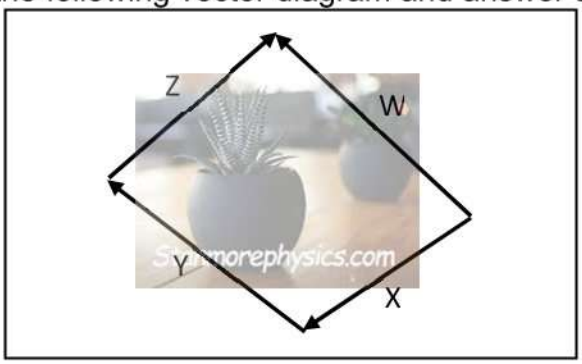
A F

B $\frac{F}{2}$

C zero

D 2F (2)

1.8 Consider the following vector diagram and answer the question.



Which ONE of the vectors is the resultant of the other three vectors?

A Y
B X
C W
D Z (2)

1.9 A girl which has a weight of 600 N is standing on a bathroom scale in a lift that is moving and she noticed that the scale reads 660 N. Which ONE of the following is theCORRECT conclusion about the motion of the lift? The lift is:

A Moving downwards at constant velocity.
B Accelerating downwards.
C Moving upwards at constant velocity.
D Accelerating upwards. (2)

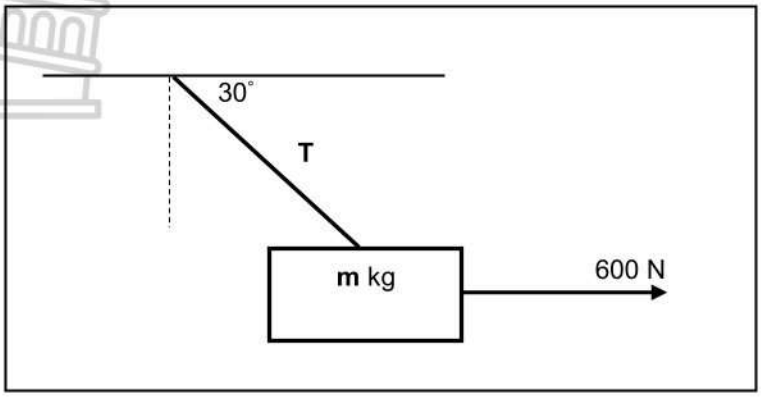
1.10 Passengers in a moving car are advised to wear safety belts. This will reducetheir chances of getting injured in the event of an accident. This precaution is an application of which ONE of the following Physics laws?

A Newton's first law
B Newton's second law
C Newton's third law
D Newton's law of universal gravitation (2)

[20]

QUESTION 2

A 600 N force is applied horizontally on a block of mass **m** kg by means of a massless inextensible rope. The block remains stationary when the angle that the rope makes with the horizontal is 30°.



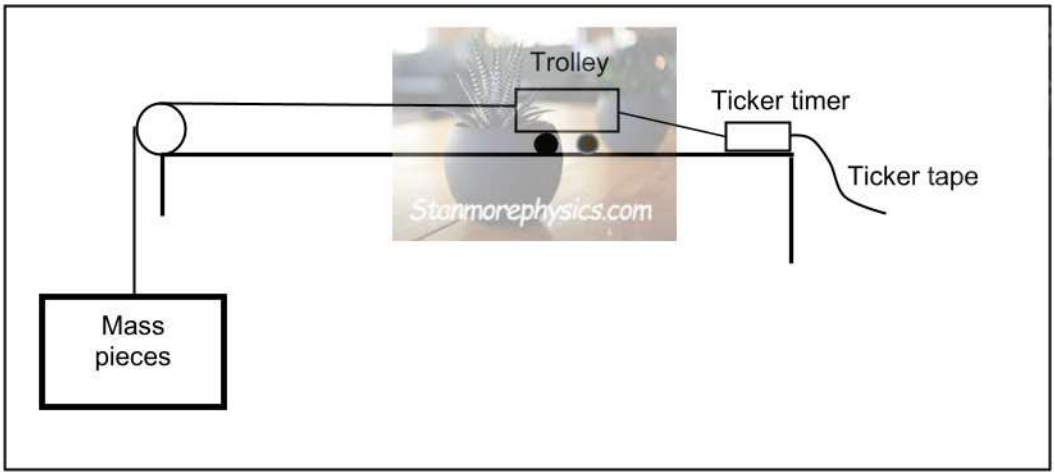
2.1 Explain why the block is stationary. (2)

2.2 Use either calculation or construction to determine the tension, **T**, in the rope. Use a scale of 1 cm : 100 N. (4)

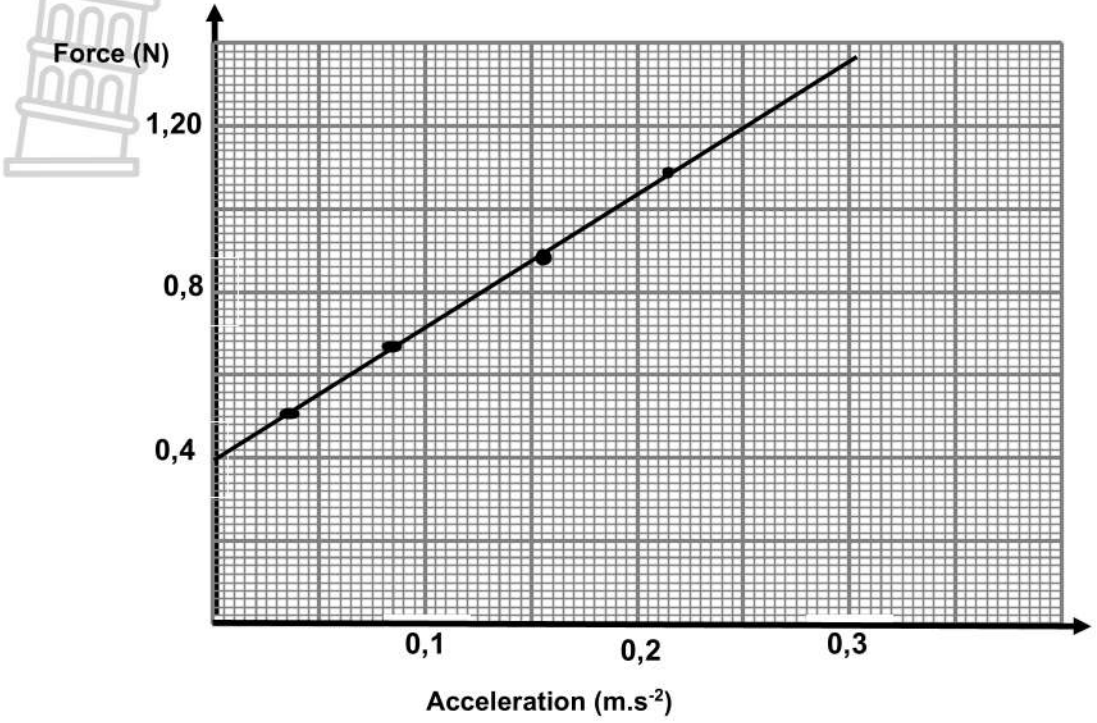
2.3 Calculate the mass (**m**) of the block. (6)
[12]

QUESTION 3

Learners conducted an investigation to determine the relationship between acceleration and applied force. During the investigation, a mass piece which hangs vertically by means of an inextensible string that passes over a frictionless pulley is used to accelerate a trolley across a horizontal surface as shown in the diagram below. Four different mass pieces were used to obtain four sets of readings.



A ticker timer and tape are attached to the trolley. As the trolley moves, the ticker timer makes dots on the tape. The tape is used to analyse the motion. The learners' results are plotted on a graph as shown below.



3.1 For this investigation write down:

3.1.1 The conclusion of the learners. (2)

3.1.2 An expression to calculate the net force acting on the trolley. (1)

3.2 Give a reason why the graph does not start from the origin (0;0). (2)

3.3 What physical quantity does the intercept on the vertical axis represent? (1)

3.4 What physical quantity does the gradient of the graph represent? (1)

3.5 Use the information from the graph to calculate the mass of the trolley. (4)

3.6 The learners conducted another investigation using a trolley of a larger mass than the trolley used in the first investigation but made of the same material. (3)

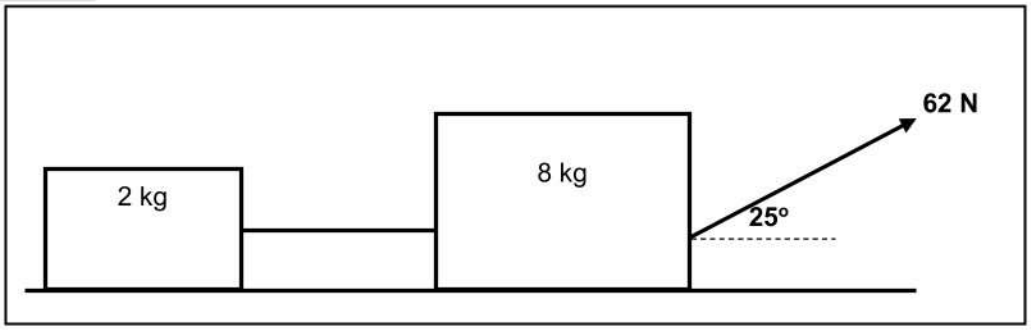
3.6.1 How does the vertical axis intercept of the graph of the second investigation compare with that of the first investigation? Answer LESS THAN, GREATER THAN or REMAINS THE SAME. (1)

3.6.2 Explain your answer to QUESTION 3.6.1. (2)

[14]

QUESTION 4

Two blocks of masses 8 kg and 2 kg are connected with a light inextensible string and placed on a ROUGH horizontal surface. When a force of 62 N is applied to the 10 kg block at an angle of 25° with the horizontal, the system accelerates at 3 $m.s^{-2}$ to the right as shown on the diagram below. The 2 kg block experiences a constant frictional force of 2,1 N.



4.1 State Newton's second law of motion in words. (2)

4.2 Draw a free body diagram of all forces acting on the 8 kg block. (5)

4.3 Calculate the:

4.3.1 Tension in the string connecting the two blocks. (4)

4.3.2 Coefficient of kinetic friction between the 8 kg block and the surface. (6)

4.4 The angle at which the force is applied is decreased to 10°.

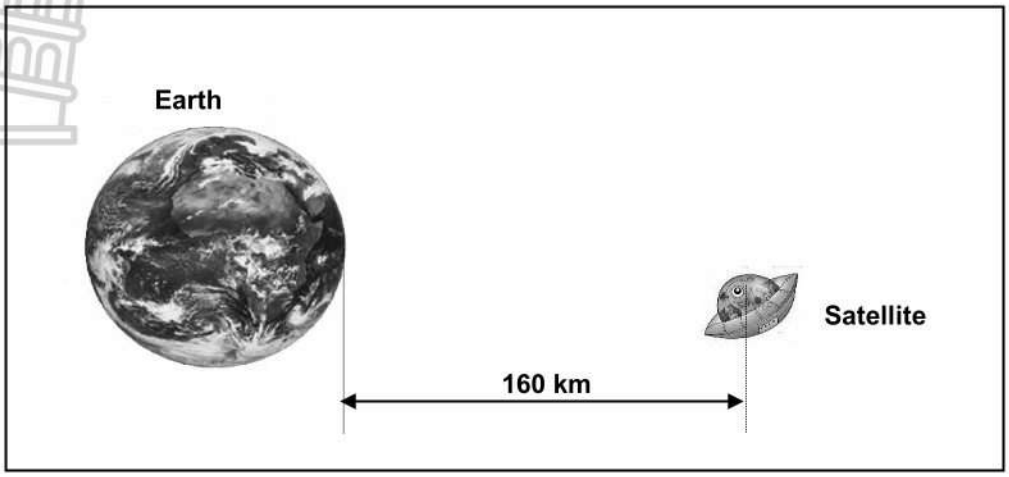
4.4.1 How will the answer in QUESTION 4.3.2 change? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

4.4.2 Explain your answer to QUESTION 4.4.1. (1)

[19]

QUESTION 5

A satellite of mass 980 kg is orbiting the Earth at a distance of 160 km from the surface of the Earth as shown on the diagram below.



5.1 State Newton's Law of Universal Gravitation in words. (2)

5.2 Calculate the magnitude of the force that the Earth exerts on the satellite to keep it in orbit. (5)

5.3 Calculate the weight of the satellite on the Earth surface. (3)

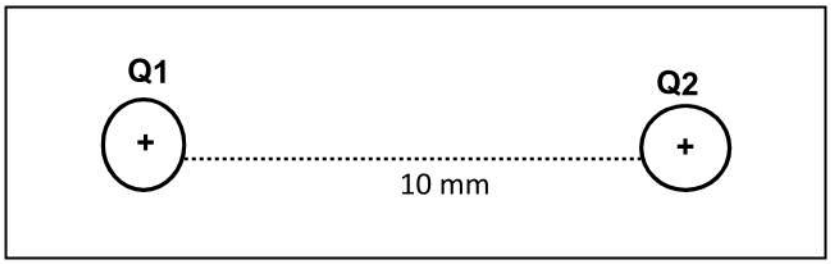
5.4 State THREE differences between mass and weight. (3)

[13]

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QUESTION 6

Two identical point charges are placed 10 mm apart in a vacuum as shown below.The electrostatic force that **Q1** exerts on **Q2** is 8 N.



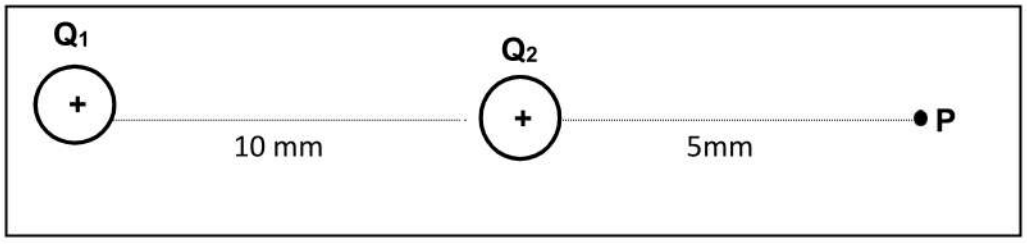
6.1 Draw the electric field pattern between the two charges. (3)

6.2 State *Coulomb's law* in words. (3)

6.3 Calculate the magnitude of each charge. (5)

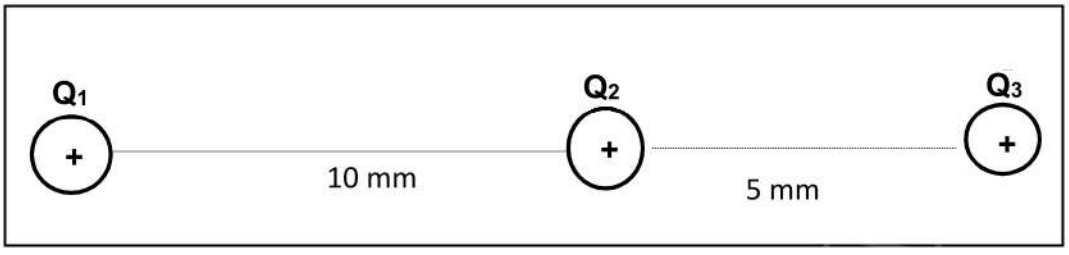
6.4 Define electric field at a point. (2)

6.5 Calculate the net electric field at point **P**, as shown on the diagram below.



(6)

6.6 A third charge **Q3** of magnitude 5 µC is now placed at point **P** as shown in the diagram below.



Calculate the net electrostatic force experienced by point charge **Q3** due to point charge **Q1** and **Q2**. (3)

[22]

TOTAL: 100 MARKS

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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•s^{-2}
Universal gravitational constant / *Universelegravitasiekonstant*	G	6,67 × 10^{-11} N•m^{2}•kg^{-2}
Speed of light in a vacuum / *Spoed van lig in 'n vakuum*	c	3,0 × 10^{8} m•s^{-1}
Planck's constant / *Planck se konstante*	h	6,63 × 10^{-34} J•s
Coulomb's constant / *Coulomb se konstante*	k	9,0 × 10^{9} N•m^{2}•C^{-2}
Charge on electron / *Lading op elektron*	e	-1,6 × 10^{-19} C
Electron mass / *Elektronmassa*	m_e	9,11 × 10^{-31} kg
Mass of earth / *Massa op aarde*	M	5,98 × 10^{24} kg
Radius of earth / *Radius van aarde*	R_E	6,38 × 10^{3} km

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*

$F_{net} = ma$	$w = mg$
$\mu_k = \frac{f_k}{N}$	$\mu_s = \frac{f_s^{max}}{N}$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$p = mv$
$F = \frac{Gm_1m_2}{d^2}$ or/of $F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{d^2}$ or/of $g = \frac{GM}{r^2}$

ELECTROSTATICS/*ELEKTROSTATIKA*

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

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