



Johannesburg North District (D10)

GRADE 11

PHYSICAL SCIENCES: CONTROL TEST

13 MARCH 2026

MARKS:100

TIME: 2 hours

This question paper consists of 11 pages and a data sheet.

Please Turn Over

INSTRUCTIONS:

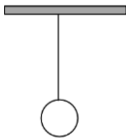
1. Write your name, class and science teacher's name on your answer sheet.
2. This page consists of **11 pages and a data sheet**
3. Number the questions correctly according to the number system used in the question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. Rule off after each complete question, for example at the end of the whole of QUESTION 2 and before starting QUESTION 3.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, et cetera where required.
11. Write neatly and legibly.

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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 **(1.1–1.6)** in the ANSWER BOOK, for example **1.11. E**.

1.1 A sphere is hanging from the ceiling as shown in the diagram.



The force in the rope that is attached to the sphere is...

- A Normal force.
- B Frictional force.
- C Tension force.
- D Force of Gravity

(2)

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

A		B	
C		D	

(2)

1.3 Two forces, **P** and **Q**, are acting on a car which is moving at a **CONSTANT VELOCITY** in a straight line. Force **P** is the driving force and force **Q** is the frictional force. What is the relationship between the magnitudes of the two forces?

- A. $P < Q$
- B. $P = Q$
- C. $P + Q > 0$
- D. $P + Q < 0$

(2)

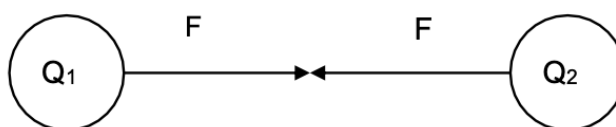
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- 1.4 Object **X** with an unknown mass is a distance **r** away from object **Y** with mass **M**. Object **X** exert a force **F** on object **Y**. What will the force **F** be if **X** is placed at a distance **2r** from object **Y**?

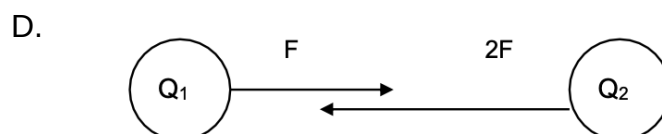
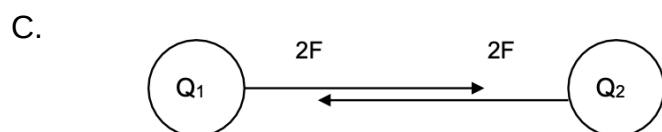
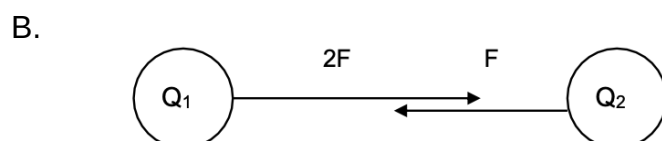
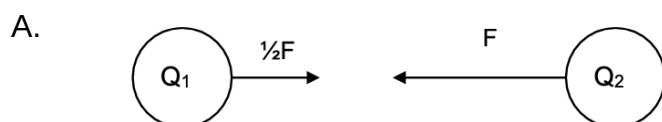
- A. $\frac{1}{4} F$
 B. $\frac{1}{2} F$
 C. $2 F$
 D. $4 F$

(2)

- 1.5 Two identical charged particles carry equal charges **Q₁** and **Q₂**. Each charged particle experiences an electrostatic force of magnitude **F** as shown in the diagram below.



Q₁ is doubled, the distance between the particles remains the same. Which one of the following representations is CORRECT?



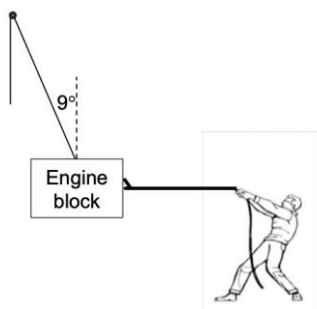
(2)

[5 x 2] = [10]

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QUESTION 2

An engine block of mass 650 kg is suspended from a fixed point by an inextensible cable. A learner pulls a rope, attached to the engine block, horizontally to the right so that the cable forms an angle of 9° with the vertical. The engine is then kept stationary in this position.



- 2.1 Write down a term for the phrases below:
- 2.1.1 “A single vector that has the effect as two or more vectors” (1)
- 2.1.2 “The engine is then kept stationary in this position” (1)
- 2.2 Draw a free body diagram of the forces acting on the engine block when it is kept stationary. (3)
- 2.3 Write down the magnitude of the resultant force acting on the engine block (1)
- 2.4 Calculate the magnitude of the:
- 2.4.1 Tension force (3)
- 2.4.2 Horizontal pulling force (3)
- 2.5 The cable can withstand a maximum of 7500N. the engine block is now pulled to the right so that the cable now forms an angle of 32° with the vertical.
- 2.5.1 Calculate the tension in cable. (2)
- 2.5.2 Will the cable snap? Answer **Yes** or **No** and **provide a reason for your answer.** (2)

[16]

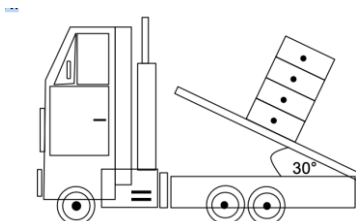
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QUESTION 3

A wooden cabinet of unknown mass, **m**, rests on the back of a tip-up truck.

The back tilts slowly, until it makes an angle of 30° with the horizontal. The cabinet remains stationary.

The maximum static friction between the surface of the truck and wooden cabinet is 294 N.



3.1 Define the term **Static friction** in words (2)

3.2 **Calculate** the magnitude of the

3.2.1 Mass of the wooden cabinet (4)

3.2.2 Coefficient of static friction (3)

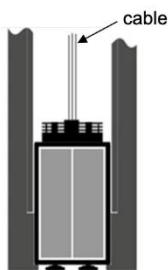
3.3 The angle of 30° is now decreased. How will this change affect the following:

Write down only, **Increase, Decrease or Remain the Same.**

3.3.1 The coefficient of friction, calculated in Question 3.2.2. (1)

3.3.2 The frictional force. (1)

3.4 A girl stands in a stationary lift. The combined weight of the girl and the lift is 5 000N



3.4.1 State **Newton's First Law** of motion in words (2)

3.4.2 How will the tension in the lift cables change when the lift accelerates upwards?

Write down only **Increases, Decreases or Remains the Same.** (1)

3.4.3 The cable of the lift suddenly snaps while it is moving upwards.

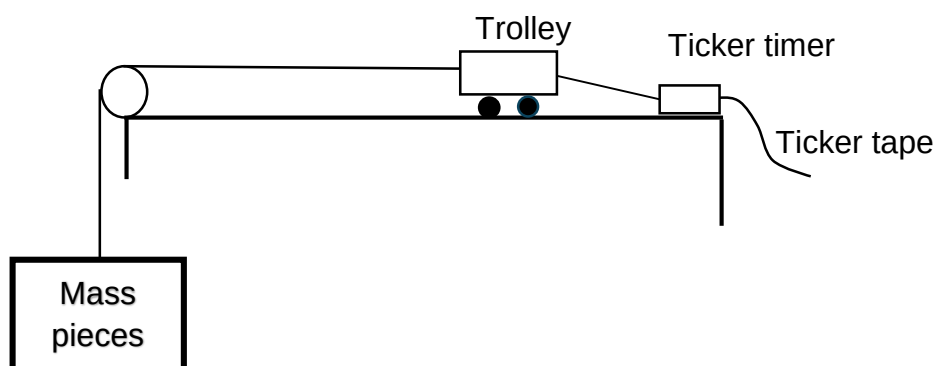
Explain the observed movement of the lift (2)

[16]

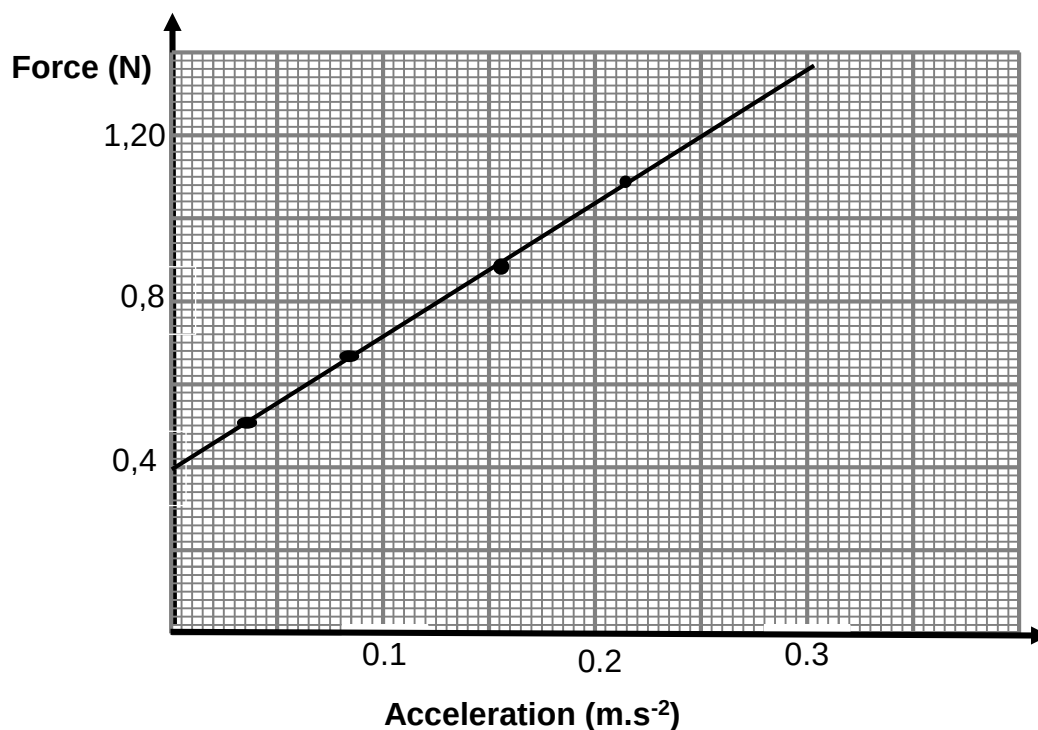
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QUESTION 4

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.



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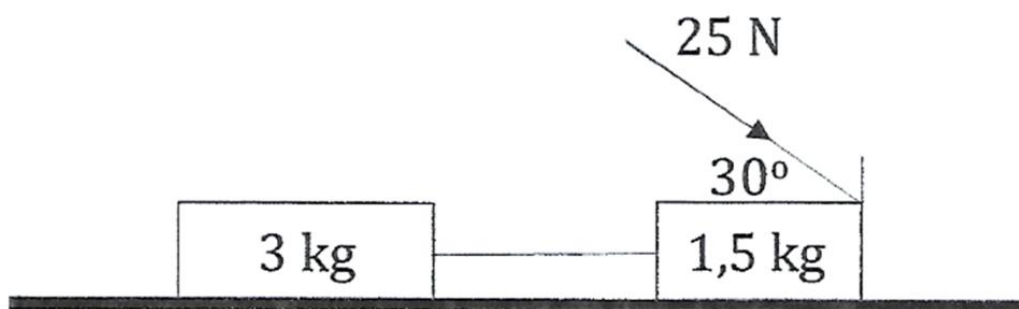
- 4.1 For this investigation write down:
- 4.1.1 The independent variable (1)
 - 4.1.2 The conclusion of the learners (1)
 - 4.1.3 An expression to calculate the net force acting on the trolley (1)
- 4.2 Give a **reason** why the graph does not start from the origin (0;0). (2)
- 4.3 What **physical quantity** does the intercept on the vertical axis represent? (1)
- 4.4 What **physical quantity** does the gradient of the graph represent? (1)
- 4.5 Use the information from the graph to calculate the mass of the trolley (3)
- 4.6 The learners conducted another investigation using a trolley of a bigger mass than the trolley used in the first investigation. The same material was used.
- 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.**
- Give a reason for the answer. (2)

[12]

Please Turn Over

QUESTION 5:

A learner constructs a push toy using two blocks with masses 1,5 kg and 3 kg respectively. The blocks are connected by a massless, inextensible rope. The learner then applies a force of 25 N at an angle of 30° to the 1,5 kg block by means of a light rigid rod, causing the toy to move across a flat, rough, horizontal surface, as shown in the diagram below.



The coefficient of kinetic friction (μ_k) between the surface and BOTH blocks is 0,15.

- 5.1 Draw a labelled free-body diagram showing ALL the forces acting on the 1,5 kg block. (5)
- 5.2 Calculate the magnitude of the kinetic frictional force acting on the 1,5 kg block. (3)
- 5.3 State **Newton's Second Law of Motion** in words. (2)
- 5.4 **Calculate** the magnitude of the:
 - 5.4.1 Acceleration of the 1,5 kg block (5)
 - 5.4.2 The tension in the rope connecting the two blocks. (2)

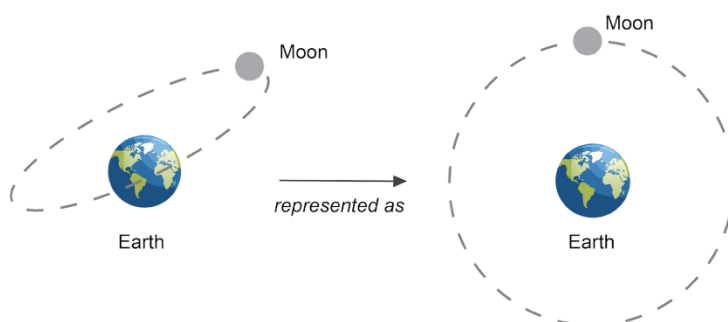
[17]

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QUESTION 6

The moon and the Earth are far from each other but exert a force on each other. Scientists discovered that the distance between the centre of the Earth and the centre of Moon is 384 400 **km** between their centres.

The mass of the Moon is $7,35 \times 10^{22}$ kg and the mass of Earth is $5,98 \times 10^{24}$ kg.

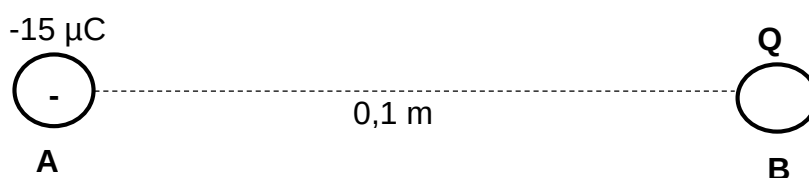


- 6.1 State **Newton's law of Universal Gravitation** in words (2)
- 6.2 Calculate the magnitude of the gravitational force between the earth and the moon (5)
- 6.3 The gravitational acceleration on the moon is g . How will the gravitational acceleration change if:
- 6.3.1 The mass of the moon is doubled (1)
- 6.3.2 The mass is 4 times greater, and the distance is quartered (2)
- [10]

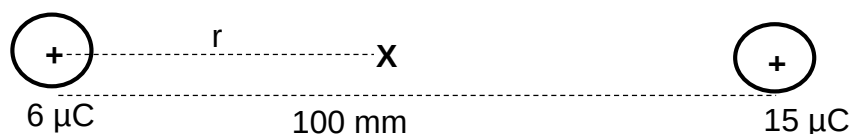
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QUESTION 7

A small sphere **A** carrying a charge of $-15\ \mu\text{C}$ is brought into contact with an identical neutral sphere **B**. After a while, sphere **B** gains a charge of **Q** and the spheres repel each other. The sphere is then placed a distance of 0,1 m apart as shown on the diagram below.



- 7.1 Define the term **Electric field** (2)
- 7.2 Calculate the number of electrons that will be transferred to the neutral sphere when they touch. (4)
- 7.3 Draw the electric field pattern around the two charged spheres after they are separated. (3)
- 7.4 Calculate the electrostatic force between the two charged spheres. (4)
- 7.5 Two positive point charges of magnitude $6\ \mu\text{C}$ and $15\ \mu\text{C}$ are placed 100 mm apart in a vacuum as shown on the diagram below.



When an electron is placed at point **X**, a distance **r** to the right of the $6\ \mu\text{C}$.
The net field is **zero**.

Calculate the distance **r** in metres. (5)

[19]

GRAND TOTAL – 100 MARKS

DATA FOR PHYSICAL SCIENCES GRADE 11

PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8 \text{ m.s}^{-2}$
Gravitational constant	G	$6,67 \times 10^{-11} \text{ N.m}^2.\text{kg}^{-2}$
Radius of the Earth	R_E	$6,38 \times 10^6 \text{ m}$
Coulomb's constant	k	$9,0 \times 10^9 \text{ N.m}^2.\text{C}^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^8 \text{ m.s}^{-1}$
Charge on electron	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass	m_e	$9,11 \times 10^{-31} \text{ kg}$
Mass of the Earth	M_E	$5,98 \times 10^{24} \text{ kg}$

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{\text{net}} = ma$	$F_g = mg / w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$\mu_s = \frac{f_{s(\text{max})}}{N}$
$\mu_k = \frac{f_k}{N}$	

WAVES, LIGHT AND SOUND

$v = f\lambda$	$T = \frac{1}{f}$
$n = \frac{c}{v}$	$n_i \sin \theta_i = n_r \sin \theta_r$

ELECTROSTATICS

$F = \frac{kQ_1Q_2}{r^2} \quad (k = 9 \times 10^9 \text{N} \cdot \text{m}^2 \cdot \text{C}^{-2})$	$E = \frac{kQ}{r^2} \quad (k = 9 \times 10^9 \text{N} \cdot \text{m}^2 \cdot \text{C}^{-2})$
$n = \frac{Q}{e}$	$E = \frac{F}{q}$

ELECTROMAGNETISM

$\varepsilon = -N \frac{\Delta\phi}{\Delta t}$	$\phi = BA \cos \theta$
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CURRENT ELECTRICITY

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$R = R_1 + R_2 + \dots$
$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$	$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$