GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

JUNE 2024

GRADE 11

PHYSICAL SCIENCES: PHYSICS
PAPER 1

TIME: **2 hours**

MARKS: **100**

10 pages + 2 data sheets

INSTRUCTIONS AND INFORMATION:

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of EIGHT questions. Answer ALL 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 subquestions, e.g. 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, etc. where required.

12 Write neatly and legibly.

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 numbers (1.1 – 1.8) in the ANSWER BOOK, for example 1.9 A.

1.1 Vector R and – R are acting on a common point O. The angle between the two vectors is:

A 270°
B 180°
C 90°
D 0° (2)

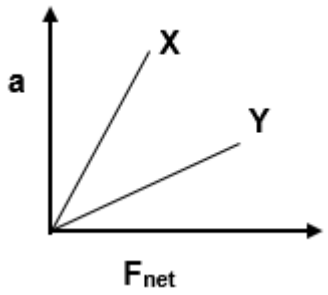
1.2 Which ONE of the following groups of the physical quantities are vectors?

A Acceleration, speed and velocity
B Mass, distance and acceleration
C Acceleration, force and velocity
D Mass, speed and velocity (2)

1.3 Which ONE of the following quantities is a measure of the inertia of a body?

A Acceleration
B Energy
C Mass
D Velocity (2)

1.4 The graphs below show the relationship between the net force and the acceleration for two masses **X** and **Y**.



Which ONE of the following statements is TRUE?

A The bodies have equal masses.
B Body **X** has a smaller mass.
C Body **Y** has a smaller mass.
D The mass does not affect the gradient of the graphs. (2)

1.5 The magnetic flux linkage through a coil depends on ...

A the thickness of the wire in the coil.
B the angle between the coil and the magnetic field.
C the direction of the magnetic field.
D the material the coil is made of. (2)

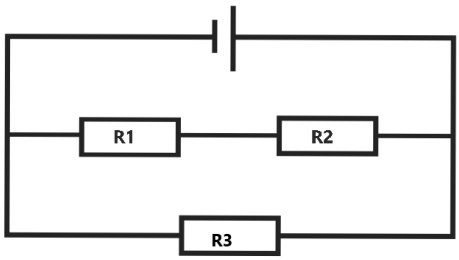
1.6 The electric field strength is …

A the work done to move a unit charge from infinity to that point.
B zero, except when there is a charge at that point.
C equal to the charge at that point.
D the force per unit charge at that point. (2)

1.7 The work done by a resistor with a potential difference **V** is equal to ***x*** Joule. If the potential difference across the same resistor is DOUBLED, and the resistance and time stay constant, the possible amount of energy that could be delivered will be equal to:

A x^2
B $2x$
C $4x$
D $0{,}5x$ (2)

1.8 In the given electrical circuit, if the current through all three resistors is equal, which of the following statements must be TRUE?

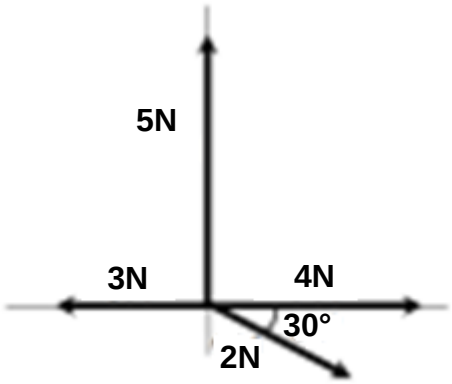


A R_1 and R_2 added together have the same resistance as R_3.
B R_1 and R_3 have equal resistance.
C R_1, R_2 and R_3 have equal resistance.
D R_1 and R_2 each have more resistance than R_3. (2)

[16]

QUESTION 2 (Start on a new page.)

The diagram below shows four forces of 2N, 3N, 4N and 5N acting on an object on the same plane. The 2N force is 30° anticlockwise from the x-axis. The diagram is not drawn to scale.



2.1 Define the term *resultant force*. (2)

2.2 Calculate:

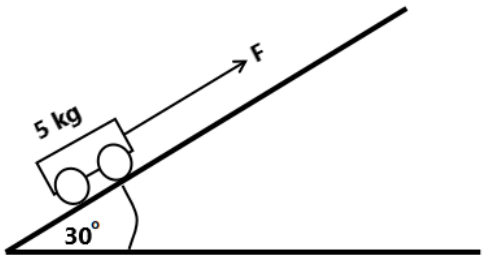
2.2.1 The magnitude of the resultant force acting on the object. (7)

2.2.2 The direction of the resultant force. (2)

[11]

QUESTION 3 (Start on a new page.)

A 5 kg trolley is at rest on a rough inclined surface, which makes an angle of 30° with the horizontal. A constant force is applied, causing the trolley to accelerate up the incline for 2 m at 0,45 $m \cdot s^{-2}$. (Ignore the rotational effects of the wheels and air friction.)



3.1 State Newton's *Second Law of Motion* in words. (2)

3.2 Draw a labelled, free-body diagram showing ALL the forces acting on the trolley as it moves up the slope. (4)

3.3 If the coefficient of kinetic friction along the incline μk is 0,18, calculate the:

3.3.1 Frictional force on the trolley as it moves up the slope. (3)

3.3.2 Applied force **F**. (4)

3.4 Will the frictional force between the trolley and surface INCREASE, DECREASE or REMAIN THE SAME if the angle between the horizontal and the incline increases? Explain your answer. (3)

3.5 A spaceship, with a mass 1 000 kg, is moving in an orbit 100 km above the Earth's surface.

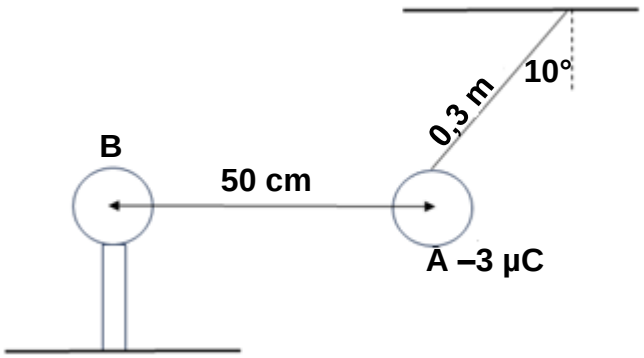
3.5.1 State Newton's *Law of Universal Gravitation* in words. (2)

3.5.2 Calculate the magnitude of the gravitational force that the spaceship will experience. (4)

[22]

QUESTION 4 (START ON A NEW PAGE.)

A small sphere **A**, with a mass of 0,2 kg and a charge of -3μC is fastened to the end of a 0,30 m long light, flexible, inextensible string (with negligible mass). The string is suspended by a hook in the ceiling. Another identical small sphere, **B**, is placed to the left of sphere **A**. Sphere **A** experiences an attraction force and moves towards sphere **B**. When sphere **A** is in static equilibrium, the string makes an angle of 10° with the vertical and it is found that the distance between the spheres is 50 cm, as shown in the diagram (not drawn to scale) below.



4.1 State *Coulomb's Law* in words. (2)

4.2 Draw a labelled, free-body diagram of all the forces acting on sphere **A**. (3)

4.3 Calculate:

4.3.1 The force experienced by sphere **A**. (3)

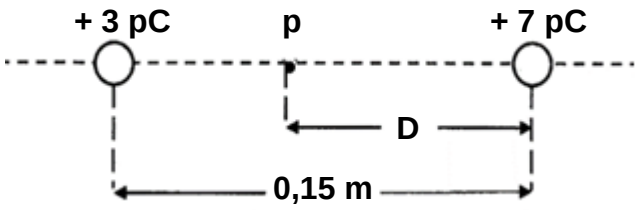
4.3.2 The charge on sphere **B**. (3)

4.4 How will the force experienced by sphere **A** change if the distance between the two spheres is changed to 0,4 m? Choose from INCREASE, DECREASE or REMAIN THE SAME. Explain the answer. (3)

[14]

QUESTION 5 (Start on a new page.)

Two point charges of magnitude +3 pc and +7 pC, are placed a distance of 0,15 m apart. **P** is a point on the line joining the two charges, a distance of **D** metres, from the +7 pC charge, such that the NET electric field at point **P** is ZERO.



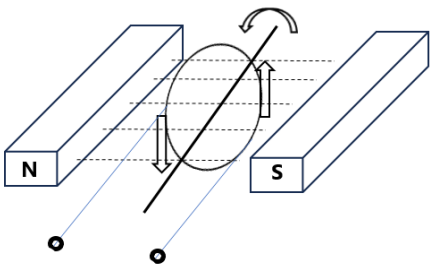
5.1 Draw the electrical field pattern between the two charges as if they are identical in magnitude. (3)

5.2 Calculate distance **D** in metres. (4)

[7]

QUESTION 6 (START ON A NEW PAGE)

A coil with a diameter of 0,6 m contains 60 turns and lies so that the magnetic field strength is at its maximum of +0,15 T. The field then changes to its minimum in 1,6 s. ($A = \pi r^2$)



6.1 State *Faraday's Law of Electromagnetic Induction* in words. (2)

6.2 Calculate:

6.2.1 The change in the magnetic flux in the loop. (4)

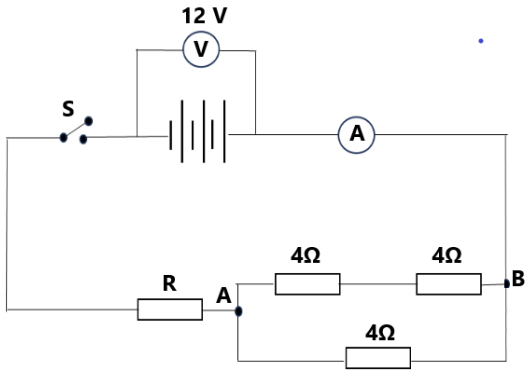
6.2.2 The average induced emf in the loop in 1,6 s. (3)

6.3 If the coil is now rotated in 1,8 s, how would it change the induced emf? Write only INCREASE, DECREASE or REMAIN THE SAME. Explain the answer. (3)

[12]

QUESTION 7 (Start on a new page.)

In the circuit diagram below the emf of the cell is 12 V. The internal resistance of the cell is negligible.



7.1 Define the term *emf*. (1)

7.2 Calculate the total effective resistance between **A** and **B**. (3)

7.3 When switch **S** is closed, the ammeter reads 2,57 A.

Calculate:

7.3.1 The resistance of resistor **R**. (4)

7.3.2 The potential difference over resistor **R**. (2)

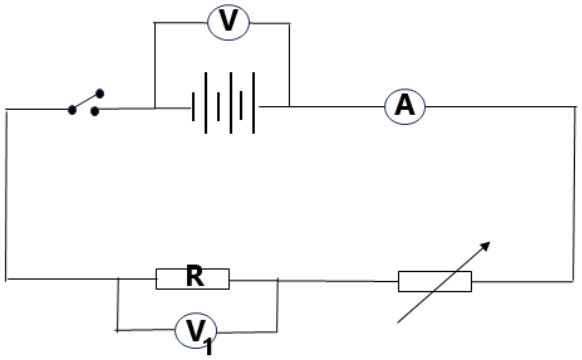
A learner connects an ammeter directly between points **A** and **B**.

7.4 How will the power dissipated by resistor **R** be affected? Choose from INCREASE, DECREASE or REMAIN THE SAME. Explain the answer. (3)

[13]

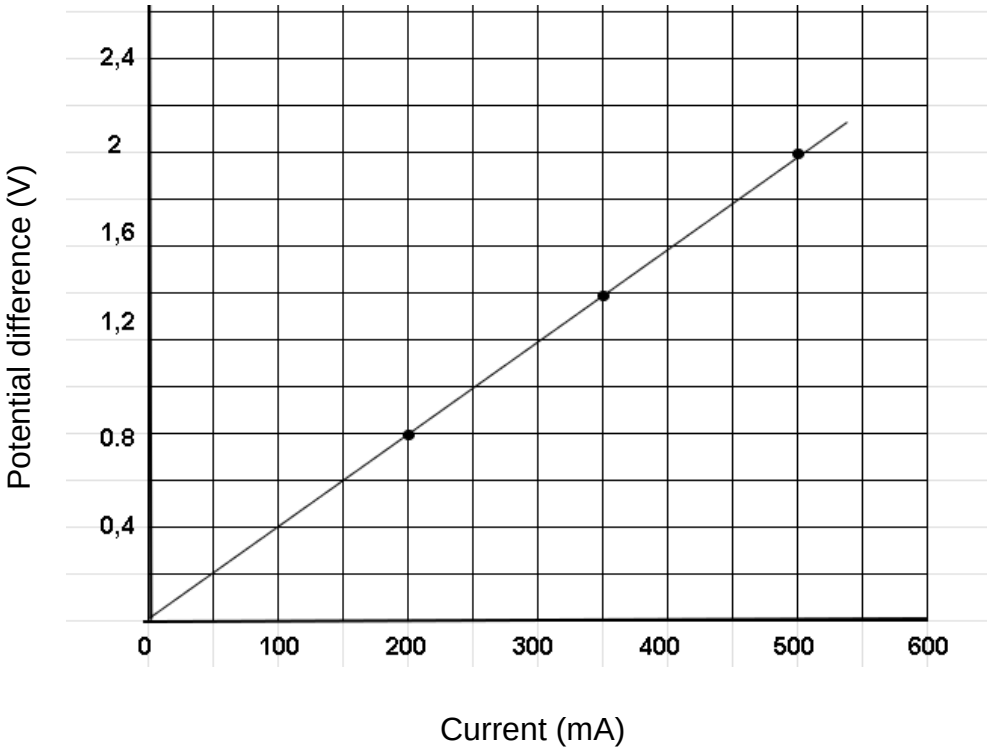
QUESTION 8 (Start on a new page)

A group of learners want to investigate the relationship between the potential difference across a resistor and the current through the resistor by changing the current with the help of a rheostat. They set up the circuit as in the diagram below.



They obtained the following graph from their results:

<u>Graph showing the relationship between current and potential difference over a resistor</u>



8.1 Identify the:

8.1.1 Independent variable. (1)

8.1.2 Dependent variable. (1)

8.1.3 A factor that must be controlled. (1)

8.2 Name the variable that is represented by the gradient of the graph. (1)

8.3 Find the resistance of the resistor **R**. (1)
[5]

TOTAL: 100

END

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 $m \cdot s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Straal van die Aarde*	R_E	6,38 x 10^6 m
Coulomb's constant *Coulomb se konstante*	K	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Mass of the Earth *Massa van die Aarde*	M	5,98 x 10^{24} kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

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

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

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

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$V = \frac{W}{Q}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$	$R = R_1 + R_2 + R_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$