education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

PHYSICAL SCIENCE P1
NOVEMBER 2024

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of 9 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 open between two subquestions, for 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. 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, etc. where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. 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 B.

1.1 Which ONE of the following is not a SCALAR quantity?

A Time

B Speed

C Mass

D Weight (2)

1.2 The tendency of an object to resist a change in motion is called …

A acceleration.

B inertia.

C momentum.

D velocity. (2)

1.3 The following two forces act on an object. A 150 N horizontal force to the right and a 120 N vertical force acting upwards.

The magnitude of the resultant force acting on the object is …

A 270 N

B 192,09 N

C 90 N

D 30 N (2)

1.4 Two spheres of masses **M** and **m** experiences a gravitational force of **F** when the distance between their centres is **r.** The distance is now HALVED. The new gravitational force between them after the distance is halved is …

A $^{1}/_{2}$ F

B 2 F

C 4F

D $^{1}/_{4}$ F (2)

1.5 A person stands on a bathroom scale that is calibrated in Newton, in a stationary elevator. The reading on the bathroom scale is *w*. The elevator now accelerates downwards. How will the reading on the bathroom scale change?

It will …

A not change.

B increase.

C decrease.

D be zero. (2)

1.6 **P**, **Q** and **R** are three charged spheres. When **P** and **Q** are brought near each other, they experience an attractive force. When **Q** and **R** are brought near each other, they experience a repulsive force.

Which ONE of the following statements is true about the charges?

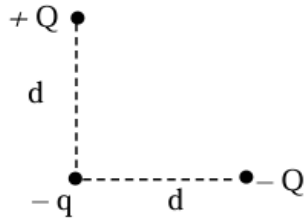
A **P** and **R** have charges with the same sign.

B **P**, **Q** and **R** have equal charges.

C **P** and **R** have charges with opposite signs.

D **P**, **Q** and **R** have the same sign. (2)

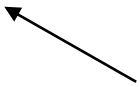
1.7 Two charges, **+Q** and **–Q**, are placed a distance **d** from a negative charge **–q**. The charges, **+Q** and **–Q**, are located along lines that are perpendicular to each other, as shown in the diagram below.

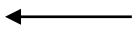


Which ONE of the following arrows CORRECTLY shows the direction of the net force acting on charge **–q** due to the presence of charges **+Q** and **–Q**?

A 

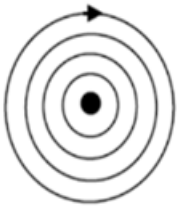
B 

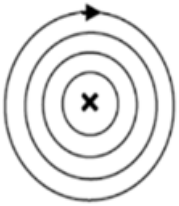
C 

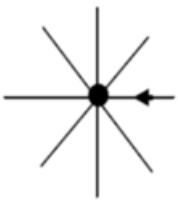
D 

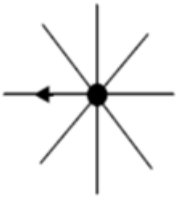
(2)

1.8 Which ONE of the sketches below represent the correct magnetic field pattern around a straight current-carrying conductor?

A 

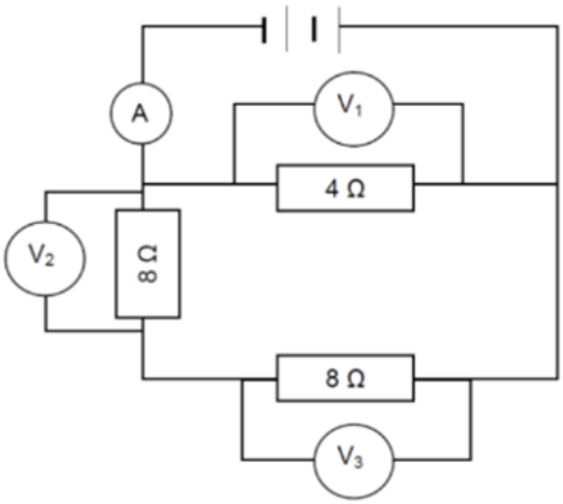
B 

C 

D 

(2)

1.9 In the circuit diagram below, the battery has negligible internal resistance. The resistance of the ammeter and the wires may also be ignored. The reading on voltmeter V_3 is equal to …



A V_1

B $V_1 - V_2$

C $2\ V_1$

D $^1/_2\ V_1$ (2)

1.10 Power can be defined as …

A the rate at which energy is transformed in an electric circuit.

B work done per unit charge.

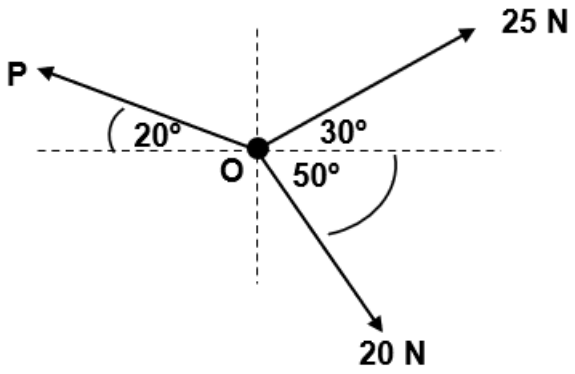
C the rate of flow of charge.

D the product of voltage and resistance. (2)

[20]

QUESTION 2 (Start on a new page.)

The free-body diagram below shows 3 forces that are acting simultaneously on an object.



2.1 Define the term *vector quantity*. (2)

2.2 Calculate the magnitude of the vertical component of the force 25 N. (3)

2.3 Calculate the magnitude of the horizontal component of the force 20 N. (3)

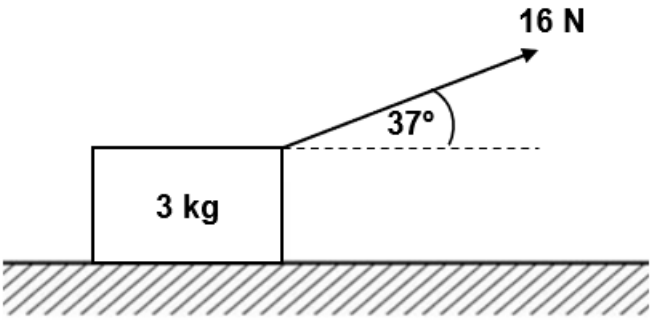
2.4 Determine the magnitude of the force **P** if the F_x net is 15,49 N. (6)

2.5 Calculate the net resultant force of the vertical components. (F_y net). (6)
[20]

QUESTION 3 (Start on a new page.)

A 3 kg block is pulled to the right on a rough horizontal plane by a 16 N force which makes an angle of 37º to the horizontal, as shown in the diagram below.

The block moves at a constant speed.



3.1 Define the term *acceleration*. (2)

3.2 What is the magnitude of the acceleration of the block? (1)

3.3 Calculate the magnitude of the kinetic frictional force. (3)

3.4 Draw a labelled force diagram showing all forces acting on the 3 kg block. (4)

3.5 Calculate the value of the kinetic frictional coefficient of the surface. (5)

The angle between the 16 N force and the horizontal is now increased.

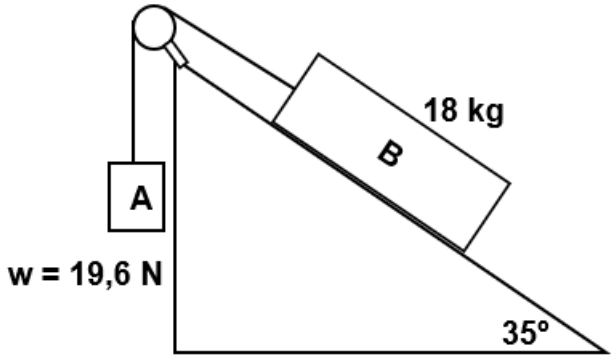
3.6 What effect will this change have to the answer calculated in QUESTION 3.3?

Choose from INCREASE, DECREASE or REMAIN THE SAME. Support your answer. (3)
[18]

QUESTION 4 (Start on a new page.)

Two blocks **A** and **B** are connected by a light inextensible string are held stationary as shown in the diagram below. Block **A** has a weight of 19,6 N and block **B** has a mass of 18 kg. The kinetic frictional force on block **B** is 20 N.

Upon release, block **A** starts to accelerate upwards and block **B** accelerates down the smooth slope of angle 35º to the horizontal.



4.1 State Newton's Third Law of Motion in words. (2)

4.2 Draw a labelled free-body diagram showing all forces acting on block **B**. (4)

4.3 Calculate the magnitude of the acceleration of the two blocks. (7)

4.4 Determine the tension in the string connecting the blocks. (2)
[15]

QUESTION 5 (Start on a new page.)

An object resting on the surface of Planet **Z** experiences a gravitational acceleration of 7,4 $m.s^{-2}$. Planet **Z** has a mass of 4×10^{18} kg.

5.1 State the universal Law of Gravitation in words. (2)

5.2 Calculate the radius of Planet **Z**. (4)

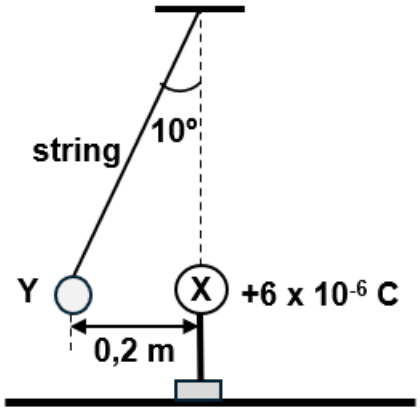
5.3 Determine the gravitational force exerted on the object by planet **Z** if the object's mass is 100 kg. (4)

5.4 How will the Force calculated in QUESTION 5.3 compare to the force that the object exerts on Planet **Z**? Choose from HIGHER THAN, LOWER THAN OR EQUAL TO. (1)
[11]

QUESTION 6 (Start on a new page.)

A small sphere, **Y**, carrying an unknown charge, is suspended at the end of a light inextensible string which is attached to a fixed point. Another sphere, **X**, carrying a charge of +6 x 10^{-6} C, placed on an insulated stand, is brought close to sphere **Y**.

Sphere **Y** experiences an electrostatic force from sphere **X** and comes to rest 0,2 m away from sphere **X**, with the string at an angle of 20º with the vertical, as shown in the diagram below.



6.1 What is the nature of the charge on sphere **Y**? Choose from POSITIVE or NEGATIVE. (1)

6.2 Draw an electric field pattern that exist between the two spheres. (3)

6.3 Sphere **X** exerts a force of 3,09 N on sphere **Y**.

6.3.1 State Coulomb's law in words. (2)

6.3.2 Calculate the magnitude of the charge on sphere **Y**. (4)

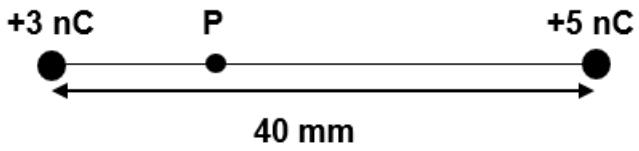
6.3.3 Draw a labelled free body diagram showing all forces acting on sphere **Y**. (3)

6.3.4 Determine the magnitude of the tension in the string. (3)

6.3.5 Calculate the mass of sphere **Y**. (4)
[20]

QUESTION 7 (Start on a new page.)

Two point charges of +3 nC and +5 nC, are fixed 40 mm apart. Point **P** lies 12 mm away from the +3 nC charge.



7.1 Which charge produces the strongest electric field strength at point **P**? Choose from +3 nC or +5 Nc (1)

7.2 Explain your answer in QUESTION 7.1. (2)

7.3 Define the term *electric field at a point*. (2)

7.4 Determine the net electric field at point **P** from the 2 charges. (6)
[11]

QUESTION 8 (Start on a new page.)

A coil with 300 windings and a surface area of $4 \times 10^{-4}\ m^3$ is rotated at constant speed in a constant magnetic field of 1,5 T. An emf of 2,5 V is induced in the coil.

8.1 State Farraday's Law of Electromagnetic Induction in words. (2)

8.2 Calculate:

8.2.1 Change in magnetic flux if the angle of the coil relative to the magnetic field changes from 0° to 90° (3)

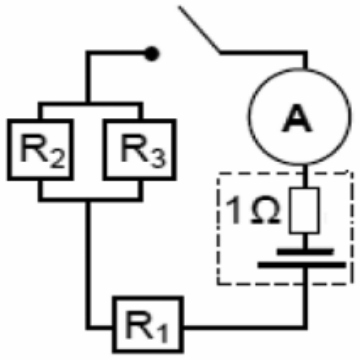
8.2.2 Time it takes the coil to rotate from 0° to 90° (4)

8.3 By what factor will the induced emf change if a coil with 150 windings is used under the same conditions? Give a reason for the answer. (2)

8.4 Mention TWO ways in which the induced EMF can be reduced. (2)
[13]

QUESTION 9 (Start on a new page.)

9.1 In the electric circuit diagram below, the battery has and EMF of 6 V and an internal resistance of 1 Ω.
The total external resistance of the circuit is 9 Ω.



9.1.1 Define the term *EMF*. (2)

9.1.2 What is the reading on the ammeter when the switch is open? (1)

The switch is now closed.

9.1.3 Calculate the current passing through resistor R_1. (4)

9.1.4 The power dissipated in resistor R_1 is 1,8 W. The resistance of resistor R_3 is 4 times that of resistor R_2.

Calculate the resistance of R_2. (6)

9.1.5 Resistor R_2 is now removed. How will this change affect the lost volts? Choose from INCREASE, DECREASE or REMAIN THE SAME? (1)

9.1.6 Explain the answer on question 9.1.5. (3)

9.2 A hairdryer operates at a potential difference of 250 V and a current of 8,5 A. It takes a learner 10 minutes to completely dry her hair. Eskom charges energy usage at R1,67 per kWh.

Calculate the cost of operating the hairdryer for the 10 minutes. (5)
[22]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	G	9,8 $m \cdot s^{-2}$
Gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth	R_E	6,38 m x 10^6 m
Coulomb's constant	K	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum	C	3,0 x 10^8 $m \cdot s^{-1}$
Charge on electron	E	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg
Mass of Earth	M	5,98 x10^{24} kg

TABLE 2: FORMULAE

FORCES

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

ELECTROSTATICS

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

ELECTROMAGNETISM

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

ELECTRIC CIRCUITS

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