LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

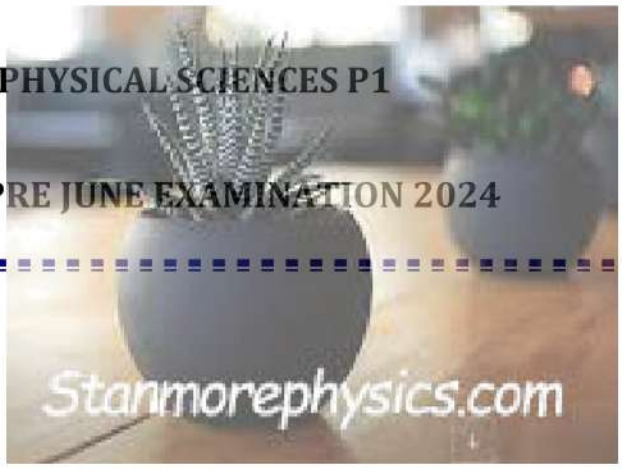
SEKHUKHUNE SOUTH DISTRICT

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P1

PRE JUNE EXAMINATION 2024



DURATION : 3 HOURS

MARKS :150

This question paper consists of 14 pages including 2 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of EIGHT (8) 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 used in this question paper.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEETS.
7. Show all formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. Write neatly and legibly.

QUESTION 1 (Multiple-choice questions)

Various options are provided as possible answers to the following question. Choose the answer and write only the letter (A-D) next to the question number (1.1 to 1.10) in the ANSWER BOOK. Each question has only ONE correct answer.

1.1. Which ONE of the following combinations consists of only SCALAR quantities.

A. Velocity, speed and time

B. Time, distance and speed

C. Acceleration, speed and distance

D. Displacement, velocity and acceleration

(2)

1.2. A constant, resultant force acts on a body which is moving freely in a straight line. Which PHYSICAL QUANTITY remains constant?

A. Velocity

B. Acceleration

C. Displacement

D. Time

(2)

1.3. Which ONE of the following, regarding frictional force, is CORRECT?

A. It depends on the area of contact.

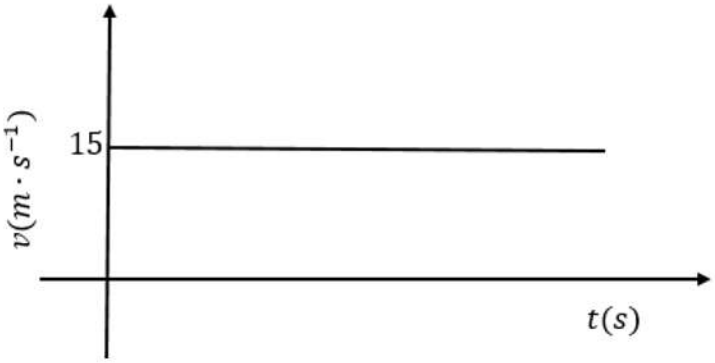
B. It depends upon the velocity of motion.

C. It is proportional to the normal force.

D. It is proportional to the applied force.

(2)

1.4. An object of mass 250kg moving across a rough horizontal surface at constant velocity. The diagram below shows the velocity time graph of the car as it moves.



Which law describes the motion of the object?

A. Newton's first law of motion
B. Newton's second law of motion.
C. Newton's third law of motion.
D. Newton's law of Universal Gravitation. (2)

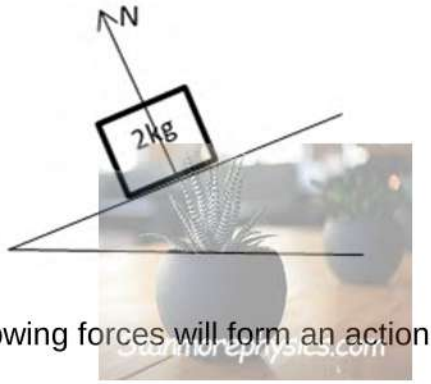
1.5. If the distance of an object above the surface of the Earth is increased, the weight of this object will…..

A. Increase.
B. Decrease.
C. Remain the same.
D. Increase then suddenly decreases. (2)

1.6. The acceleration due to gravity on Earth is ***g***. Which ONE of the following represents the acceleration due to gravity on a planet that has TWICE the mass and HALF the radius of the EARTH?

A. $\frac{1}{2}g$
B. $2g$
C. $4g$
D. $8g$ (2)

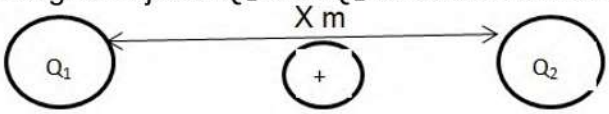
1.7. A block of mass 2kg rests on an inclined plane. The normal force is represented by N, as shown in the diagram below.



Which ONE of the following forces will form an action-reaction pair with the Normal?

A. Vertical component of gravitational force
B. The force of the surface on the block
C. The force of the block on the surface
D. The weight of the block. (2)

1.8. A positive test charge is placed midway between two identical positively charged objects Q_1 and Q_2 as shown in the diagram below.



The net electrostatic force experienced by the test charge will be:

A. Upwards
B. To the right
C. Zero
D. To the left (2)

1.9. The magnitude of the electric field at point **P** from a positive point charge **q** is **x** N.C^{-1}. Which ONE of the statements below regarding electric field is correct?

A. A +1 C charge placed at P will experience a force of x N directed away from q.

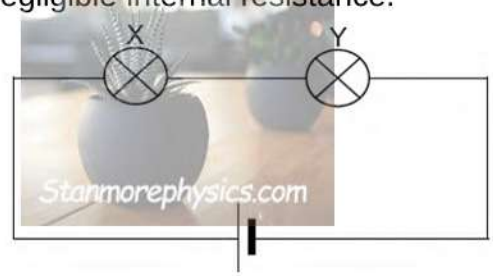
B. The force of +2 C charge placed at point P will have a magnitude of $\frac{1}{4}x$ N directed away from q.

C. A +1 C charge placed at P will experience a force of magnitude x N directed towards q.

D. The force of +2 C charge placed at point P will have a magnitude of $\frac{1}{4}x$ N directed towards q.

(2)

1.10. The diagram below shows two light bulbs, X and Y, connected in series to a cell with negligible internal resistance.



If the bulb X glows brighter than bulb Y, then the……

A. Current through bulb X is smaller than that through bulb Y.

B. Resistance of bulb X is smaller than that of bulb Y.

C. Resistance of bulb X is greater than that of bulb Y.

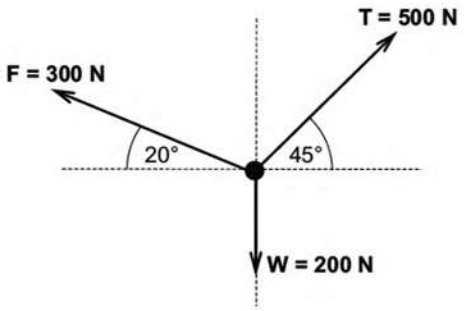
D. Current through bulb X is greater than that through bulb Y.

(2)

[20]

QUESTION 2 (Start on a new page)

2.1. Three vectors, T, F and W act on an object as shown in the diagram below.



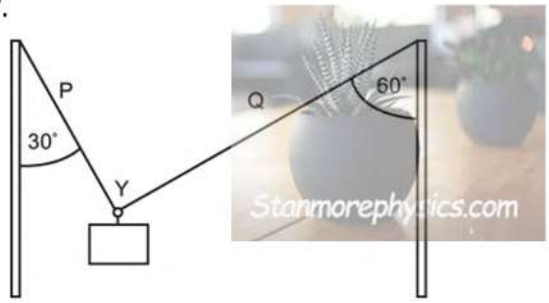
2.1.1. Define the term *resultant vector*. (2)

Calculate the:

2.1.2. Vertical component of vector T. (2)

2.1.3. The magnitude and direction of resultant vector acting on the object. (6)

2.2. Two light strings are strung between two vertical poles. A mass **m** of weight **w** hangs from the strings attached to a ring at point **Y** as shown in the diagram below.



2.2.1. Are the two forces acting on point Y in equilibrium? Write YES or NO. Explain your answer. (2)

2.2.2. Draw a closed vector diagram showing all the forces acting at point Y and indicate all the angles. (3)

2.2.3. The tension in string P is 600 N. Calculate the tension in rope Q. (2)

2.2.4. Calculate the mass **m** hanging from the two strings. (4)

[21]

QUESTION 3 (Start on a NEW page)

Crate **P** of mass 1, 25 kg is connected to another crate, **Q**, of mass 2 kg by a light inextensible string. The two crated placed on a rough horizontal surface. A constant force **F** of magnitude 7,5 N, acting at an angle θ to the horizontal, is applied on crate **Q**, as shown in the diagram below.

The crates accelerate at 0,1 $m.s^{-2}$.

Crate **P** experiences a constant frictional force of 1,8 N and the crate **Q** experiences a constant frictional force of 2,2 N.

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

3.2. Draw a labeled free-body diagram showing all the forces acting on crate **P**. (4)

3.3. Calculate the magnitude of:

3.3.1. The tension in the string. (4)

3.3.2. The angle θ (4)

3.4. Determine whether the two crates are made of the same material. (4)

3.5. At a certain stage of motion, the string snaps.

How will EACH of the following be affected when this happens?

3.5.1. The acceleration of crate Q. Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

3.5.2. Motion of crate P. (3)

[22]

QUESTION 4 (Start on a new page)

A rocket of weight 196 000 N moves vertically upwards with a uniform velocity of velocity of 400 $m.s^{-1}$ in 2,6 s. Ignore the effects of air friction.

4.1. Define the term *weight*. (2)

4.2. Calculate the mass of the rocket. (3)

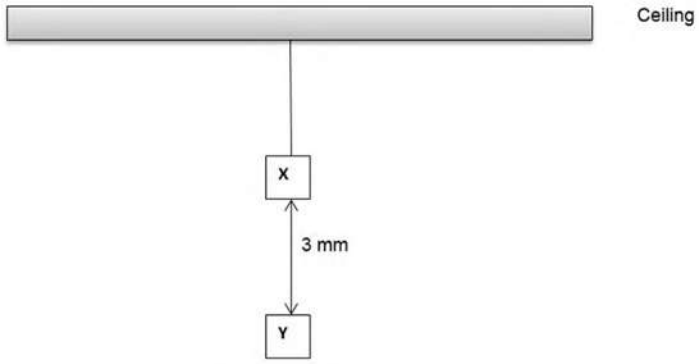
4.3. Determine the difference in weight of the rocket on the surface of the Earth and 2,6 s away from the Earth. (5)

4.4. Explain the term *weightlessness*. (2)

[12]

QUESTION 5 (Start on a new page)

A charged sphere **X** is suspended from a ceiling by a light inextensible, insulated string. Another charged sphere **Y**, of mass 0,9 g and carrying a charge of $+4 \times 10^{-6} C$ hangs STATIONARY vertically below charge **X**. The spheres are 3 mm apart as shown in the diagram below.



5.1. State Coulumb's law in words. (2)

5.2. State whether charge **X** is POSITIVE or NEGATIVE. (1)

5.3. Draw a labeled free-body diagram showing all the forces acting on sphere **Y**. (2)

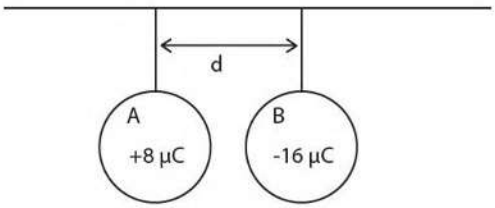
5.4. Calculate the magnitude of the charge on sphere **X**. (5)

5.5. How does the electrostatic force experienced by sphere **Y** compared to that experienced by sphere **X**. (2)

[12]

QUESTION 6(Start on a new page)

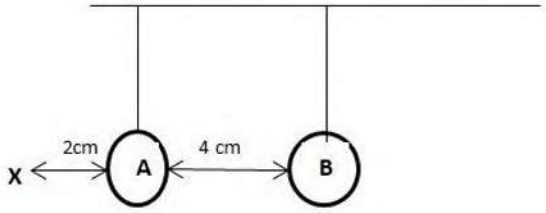
Two identical metal spheres, **A** and **B** have charges $+8\mu C$ and -16μC respectively. They are suspended from a horizontal wooden pole and placed a distance 4 cm apart from each other as shown in the diagram below.



6.1. Define the term *electric field*. (2)

6.2. Draw the electric field pattern around the two charges. (3)

6.3. The spheres are allowed to touch and returned to their original position.



6.3.1. Were electrons transferred TO or FROM sphere A? Explain your answer. (2)

6.3.2. Determine the number of electrons transferred from sphere **B**. (5)

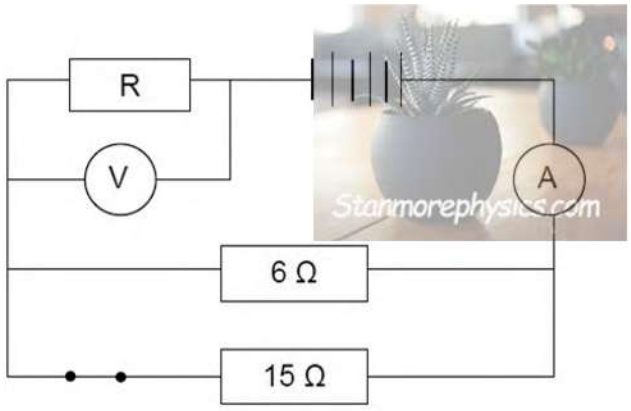
6.3.3. Calculate the net electric field at point **X**, placed 2 cm from sphere **A**. (6)

6.3.4. Calculate the electrostatic force that an electron will experience when placed at point **X**. (3)

[21]

QUESTION 7(Start on a new page)

The circuit below consists of **6Ω**, **15Ω** and an unknown resistor **R**. An ammeter, a high resistance voltmeter, a closed switch and a battery of emf **25V** are connected as shown in the diagram below. The resistance of the battery and the connecting hours are negligible.



The power dissipated in 15Ω resister is 20 W.

7.1. Define the term *power*. (2)

7.2. Explain why the voltmeter is connected in parallel. (2)

7.3. Calculate the resistance of the parallel combination. (3)

7.4. Calculate the reading on **A**. (4)

7.5. Determine the unknown resistor **R**. (4)

The switch is now OPENED

7.6. How will the reading on V be affected? (1)

7.7. Explain your answer to QUESTION 7.6. (3)

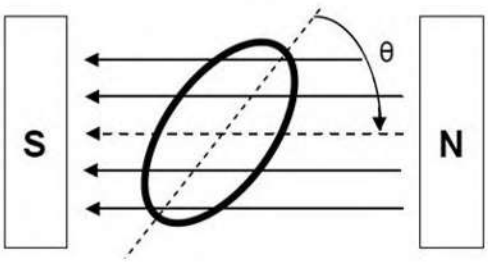
7.8. Calculate the energy dissipated in 6Ω in 2 minutes with the switch closed. (4)

7.9. The 15Ω resistor is used for an average of 5 hours per day. The cost of electricity is 60 cents per kWh. Calculate the cost to operate it for 30 days. (3)

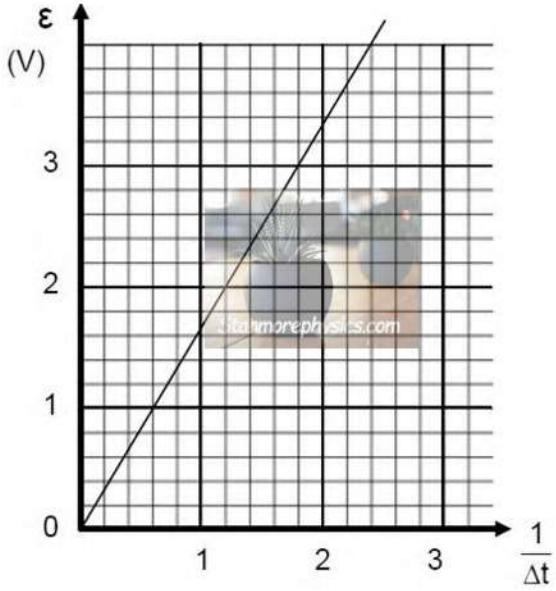
[26]

QUESTION 8 (Start on a new page)

An experiment was carried out to investigate one of the factors that affect the induced emf. An induction coil of radius 3.9 cm with 200 windings was used as shown in the diagram below.



The graph below shows how the induced emf varies with the inverse of time.



8.1. State Faraday's law in words (2)

8.2. Write down the:

8.2.1. Independent variable. (1)

8.2.2. Dependent variable. (1)

8.3. Formulate an investigative question for this experiment. (2)

8.4. Use the information in the graph to calculate the change in magnetic flux. (5)

8.5. If the circular coil is replaced with a square coil with a side length of 3.9 cm, and same movement is made in the same amount of time, will the induced emf be the same as, larger than or smaller than? (1)

8.6. Explain your answer to **QUESTION 8.6** above. (2)

8.7. State other two ways in which the induced emf can be increased. (2)

[16]

TOTAL MARKS: 150

DATA SHEET FOR PHYSICAL SCIENCES GRADE 11

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 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 the Earth	M_E	5,98 x 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/*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

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

ELECTROSTATICS

$n = \frac{Q}{e}$	$Q_{new} = \frac{Q_1 + Q_2}{2}$
$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$	

ELECTRIC CIRCUITS

$Q = I\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$
$R_s = R_1 + R_2 + \cdots$	$V = \frac{W}{q}$
$R = \frac{V}{I}$	