education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

PHYSICAL SCIENCE P1

JUNE 2024

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 2 DATA SHEETS.

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of 6 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 and appropriate mathematical instruments.
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. You are advised to use the attached DATA SHEETS provided.
11. Write neatly and legibly.

QUESTION 1

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 1.6) in the ANSWER BOOK, e.g. 1.7 B.

1.1 The following quantities are all vectors except

A weight.

B acceleration.

C mass.

D displacement. (2)

1.2 The diagram below shows a robot pushing a wooden block across a rough horizontal surface. The block has a constant acceleration of 0,25 $m.s^{-2}$.

Which ONE of the following statements is CORRECT regarding the scenario above?

A The block is moving with a constant velocity.

B The force applied by the robot on the block is greater than the kinetic frictional force that the block is experiencing.

C The velocity of the block is decreasing.

D The force applied by the robot on the block is smaller than the kinetic frictional force that the block is experiencing. (2)

1.3 Two spheres of masses **M** and **m** experience a gravitational force of **F** when the distance between their centres is **r.** The distance is now DOUBLED. The new gravitational force between them after the distance is doubled is …

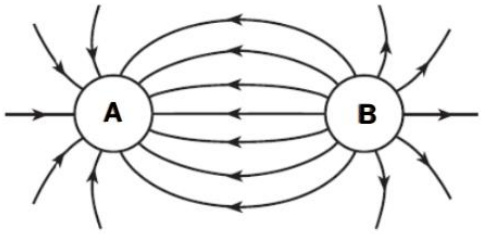
A $\frac{1}{2}$ F.

B 2 F.

C 4 F.

D $\frac{1}{4}$ F. (2)

1.4 The electric field between two charged spheres, **A** and **B**, is shown below.



Which ONE of the following statements regarding the charges on sphere **A** and **B** is CORRECT?

A Both spheres are positively charged.

B Both spheres are negatively charged.

C Sphere A is positively charged, and sphere B is negatively charged.

D Sphere A is negatively charged, and sphere B is positively charged. (2)

1.5 The direction of flow of current in a coil rotated across a magnetic field can be changed by:

(i) Changing the direction of the rotation.

(ii) Switching the poles of the magnet.

(iii) Increasing the speed of the rotation of the coil inside the magnetic field.

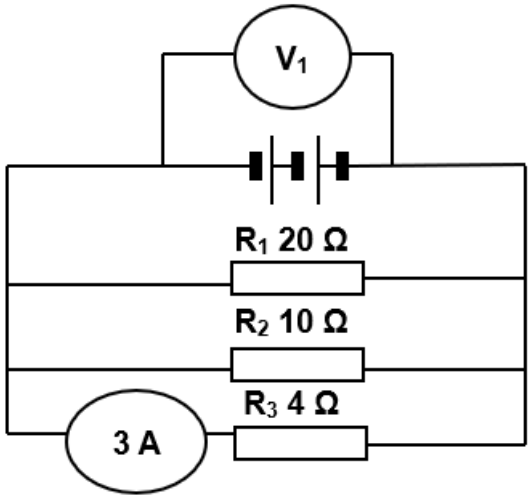
A (i) and (ii) only.

B (i) and (iii) only

C (ii) and (iii) only

D (i), (ii) and (iii). (2)

1.6 Consider the circuit diagram below:



The total resistance of this circuit is

A 2,5 Ω.

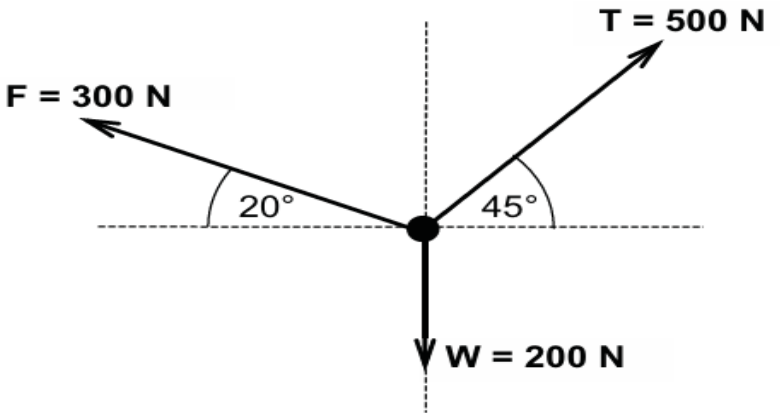
B 0,4 Ω.

C 34 Ω.

D 10,67 Ω. (2)
[12]

QUESTION 2

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



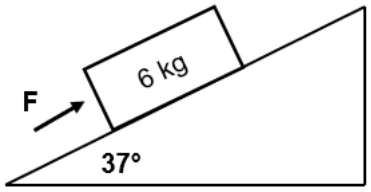
2.1 Define the term *resultant vector*. (2)

2.2 Calculate the vertical component of the force **F**. (3)

2.3 Determine the magnitude of the resultant force on the object. (7)
[12]

QUESTION 3

3.1 A 6 kg block is pushed up a rough inclined surface by a constant force **F**. It moves with a CONSTANT SPEED. The surface makes an angle of 37^{o} to the horizontal as shown.
The block experiences a constant frictional force of 14,614 N.



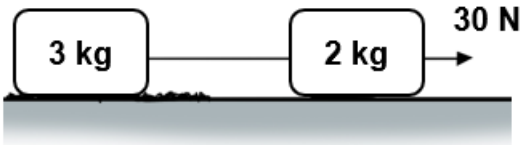
3.1.1 What is the magnitude of the acceleration of the block? (1)

3.1.2 Name and state the Law used to determine the answer in question 3.1.1 above. (3)

3.1.3 Calculate the magnitude of the force **F**. (3)

3.1.4 Calculate the value of the kinetic frictional coefficient of the inclined surface. (3)

3.2 Two blocks of mass 3 kg and 2 kg respectively, are connected by a light inextensible rope. The 2 kg block is pulled to the right by a 30 N force and moves on a smooth surface while the 3 kg block move on a rough surface with a kinetic frictional coeffecient of 0,24, as shown in the diagram below.



3.2.1 Define the term *normal force*. (2)

3.2.2 Draw a free-body diagram showing all forces acting on the 2 kg block. (4)

3.2.3 Calculate the acceleration of the two blocks. (5)

3.3 A 700 kg object is placed 100 metres from the surface of the earth.

3.3.1 State the Universal Law of Gravity in words. (2)

3.3.2 Calculate the gravitational force that the earth exerts on the object. (4)

[27]

QUESTION 4

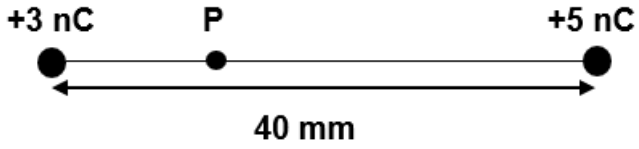
4.1 Two charged spheres of 3 nC and 5 nC are placed 40 mm apart as shown below.

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

4.1.2 Calculate the electrostatic force exerted by the +3 nC charge on the +5 nC**.** (4)

4.1.3 How will the electrostatic force exerted by the +5 nC charge on the +3 nC charge compare to the answer in 4.1.2 above? Write only HIGHER THAN, LOWER THAN or EQUAL TO. (1)

A third charged sphere **P** is placed 10 mm to the right of the +3 nC sphere as shown below.

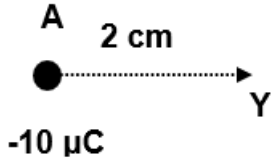


The net electrostatic force on the +3 nC sphere from the +5 nC sphere and sphere **P** is zero.

4.1.4 What is the charge on sphere **P**? Choose only POSITIVE or NEGATIVE. (1)

4.1.5 Calculate the charge on sphere **P**. (5)

4.2 A charged sphere **A** holding a charge of −10 µC, is held fixed in position on a horizontal, insulated surface. Point **Y** lies 2 cm to the right of sphere **A**.



4.2.1 Draw an electric field pattern around sphere **A**. (2)

4.2.2 Determine the number of electrons that sphere **A** has. (3)

4.2.3 Determine the electric field strength at point **Y**. (4)

[22]

QUESTION 5

An induced emf of magnitude 3.5 V across the ends of a conducting wire with 200 windings is directly proportional to the rate of change in the magnetic flux.

The conducting wire has a surface area of $2,8 \times 10^{-3}$ m^2, and 200 windings. It is rotated in the magnetic field of 2,5 T at a constant speed.

5.1 Name the law represented by the underlined statement above. (1)

5.2 Calculate:

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

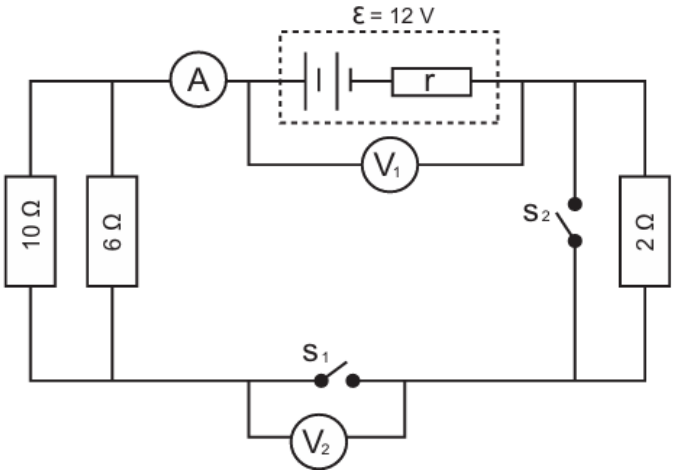
5.2.2 Time it takes the coil to rotate from 0° to 90° (3)

5.3 Name THREE things that can be done to increase the induced emf in this scenario. (3)

[10]

QUESTION 6

The battery in the circuit represented below has an emf of 12 V and an internal resistance **r**. Voltmeter V_1 is connected across the battery. The conducting wires are ohmic conductors with negligeable resistance.



Switches S_1 and S_2 are both open.

6.1 Define the term *Ohmic Conductor*. (2)

6.2 What is the reading on V_2? (1)

6.3 Calculate the total external resistance of the circuit (4)

Switch S_1 is now closed. Switch S_2 remains open. The reading on V_1 is now 10 V.

6.4 Determine:

6.4.1 The reading on ammeter A (3)

6.4.2 The internal resistance of the battery (3)

6.5 Both switches S_1 and S_2 are now closed. How will the lost volts be affected? Choose from INCREASES, DECREASES or REMAINS THE SAME.
Explain the answer. (4)

[17]

TOTAL: 100

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

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

FORCE/*KRAG*

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

ELECTROSTATICS/*ELEKTROSTATIKA*

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

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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