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Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2022

PHYSICAL SCIENCES (PHYSICS) P1

MARKS: 100

TIME: 2 hours

This question paper consists of 15 pages, including 3 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate space on the ANSWER BOOK.
2. Answer ALL the questions.
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 sub-questions, for example 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.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.7) in the ANSWER BOOK, for example 1.8 C

1.1 Two equal vectors **P** and **-P** act on a common point **O**. The angle between the two vectors is …

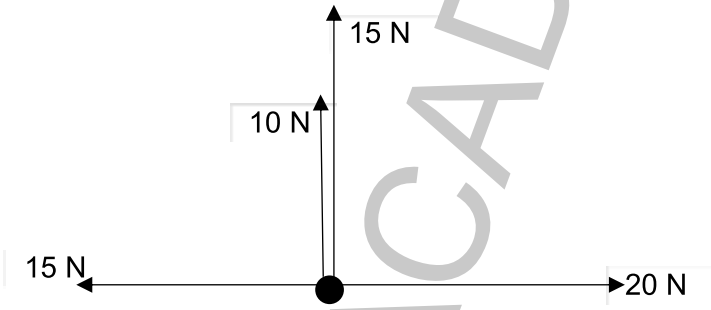
A 0°.

B 90°.

C 180°.

D 270°. (2)

1.2 Four vectors act on a point as indicated below.



The magnitudes of the resultant/net forces in the horizontal direction (F_X) and in the vertical direction (F_Y) are ...

	F_X	F_Y
A	35 N	25 N
B	5 N	25 N
C	35 N	5 N
D	5 N	5 N

(2)

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1.3 The mass of a man on planet **R** is **m** kg. The acceleration due to gravity on planet **S** is twice the acceleration due to gravity on planet **R**. The mass of the same man on planet **S** will be ...

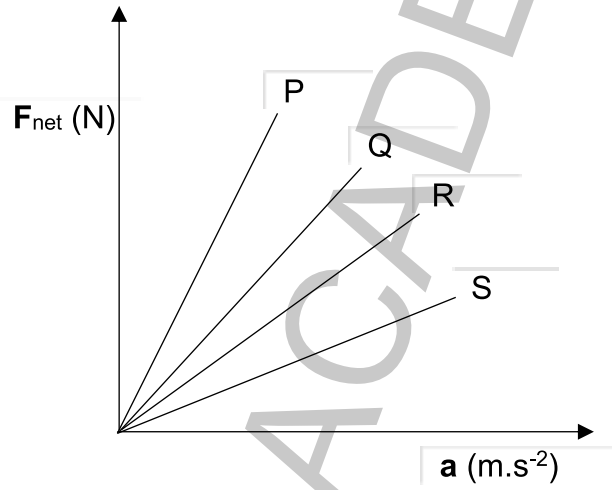
A **m** kg.

B 2**m** kg.

C $\frac{1}{2}$**m** kg.

D 4**m** kg. (2)

1.4 The graphs below show the relationship between acceleration **a,** and net force $\mathbf{F_{net}}$ for four objects **P**, **Q**, **R** and **S**.



Which ONE of the objects has the greatest mass?

A **P**

B **Q**

C **R**

D **S** (2)

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1.5 Two identical positively charged spheres, which are free to move, are placed near each other on a frictionless surface.

Which ONE of the following CORRECTLY describes the motion of the two spheres? They move away from each other with:

A Increasing acceleration

B Decreasing acceleration

C Constant acceleration

D Zero acceleration (2)

1.6 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor.

This statement describes …

A Ohm's Law.

B Coulomb's Law.

C Faraday's Law.

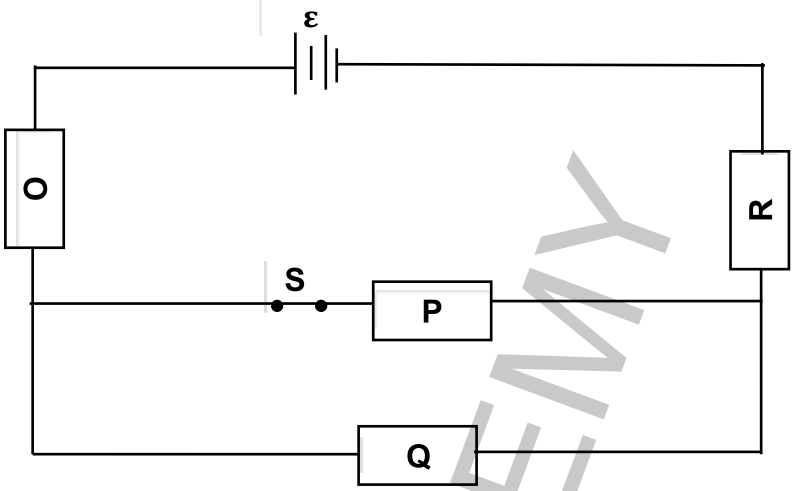
D magnetic law. (2)

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1.7 The four resistors **O**, **P**, **Q**, and **R** in the circuit below are identical. The battery has an emf ε and negligible internal resistance. The switch **S** is initially CLOSED.



Switch **S** is now OPENED. Which ONE of the following combinations of changes will occur in **O**, **Q** and **R**?

	CURRENT IN O	CURRENT IN Q	CURRENT IN R
A	Decrease	Remains the same	Decrease
B	Increase	Remains the same	Increase
C	Increase	Increase	Increase
D	Decrease	Increase	Decrease

(2)
[14]

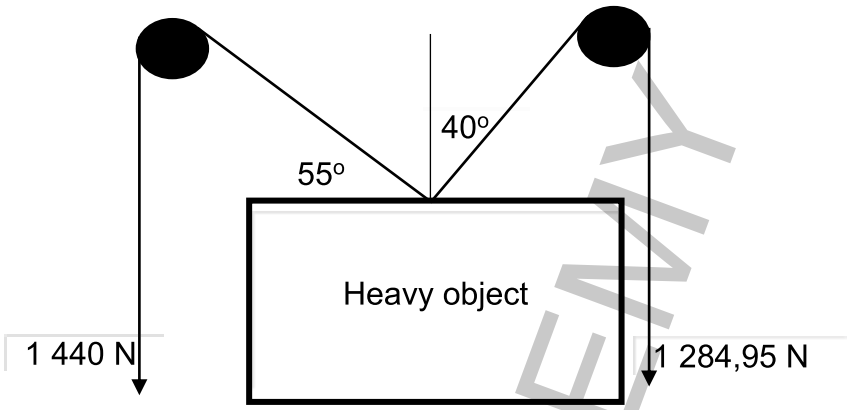
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QUESTION 2 (Start on a new page.)

A pulley system is used to keep a heavy object at rest as shown on the diagram below.



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

2.2 Draw a vector diagram showing the forces acting on the object. Label the forces and indicate the angles on your diagram. (4)

2..3 Calculate the weight of the object. (3)
[9]

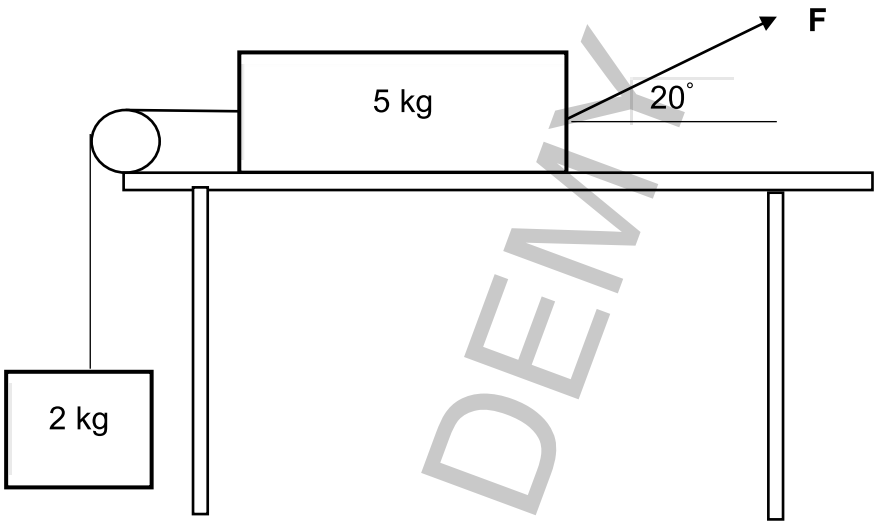
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QUESTION 3 (Start on a new page.)

Two blocks of masses 5 kg and 2 kg are connected by a light inextensible string. A force **F** is applied on 5 kg at an angle of 20° to the horizontal and the system of blocks accelerates to the right at 2 $m.s^{-2}$ as shown on the diagram below. The kinetic frictional force on the 5 kg block is 10 N.



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

3.2 Draw a free-body diagram of ALL forces acting on the 5 kg block. (5)

3.3 Calculate the:

3.3.1 Tension in the string (3)

3.3.2 Force **F** as shown on the diagram (4)

3.3.3 Coefficient of kinetic frictional force on the 5 kg block (4)

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QUESTION 4 (Start on a new page.)

A rescue helicopter is lifting two people upwards as shown in the diagram below. The tension in the cable is 1 205,4 N while the helicopter ascends at a CONSTANT SPEED. Ignore air resistance.



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

4.2 Calculate the combined mass of the two people. (4)

4.3 The helicopter now starts to accelerate upwards at 2,25 $m.s^{-2}$. Calculate the tension in the cable. (4)

[10]

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QUESTION 5 (Start on a new page.)

The moon is the earth's nearest neighbour. The distance between the centres of the earth and the moon is $3,84 \times 10^8$ m. The mass of the moon is $7,5 \times 10^{22}$ kg.

5.1 State Newton's Law of universal gravitation in words. (2)

5.2 Calculate the force exerted by the earth on the moon. (4)

5.3 What is the magnitude of the force exerted by the moon on the earth? Explain your answer. (2)
[8]

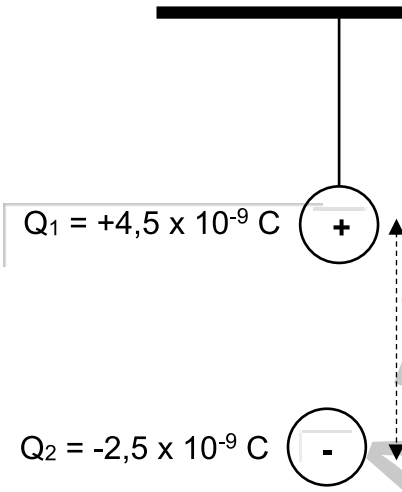
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QUESTION 6 (Start on a new page.)

6.1 Two small spheres, each of mass **5 g**, are arranged as shown on the diagram below. **Q_1**, with a charge of +4,5 x 10^{-9} C, is suspended from a light inextensible string secured to a support. **Q_2**, with a charge of -2,5 x 10^{-9} C, is placed vertically below **Q_1** so that both charges are in a straight line. Both spheres come to EQUILIBRIUM when Q_2 is **3 cm** from Q_1. Ignore the effects of air friction.



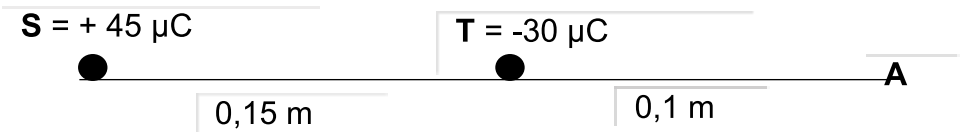
6.1.1 Calculate the number of electrons that were removed from **Q_1** to give it a charge of +4,5 x 10^{-9} C. Assume that the sphere was neutral before being charged. (3)

6.1.2 Draw a labelled free-body diagram showing all the forces acting on sphere **Q_1**. (3)

6.1.3 State Coulomb's Law in words. (2)

6.1.4 Calculate the magnitude of the tension in the string. (5)

6.2 Two-point charges **S** and **T** are placed at 0,15 m apart, as shown in the diagram below. **S** carries a charge of +45 µC and **T** a charge of -30 µC. Point **A** is 0,1 m to the right of point charge **T** on the same line as the two-point charges.



6.2.1 Define *electric field at a point* in words. (2)

6.2.2 Draw the electric field pattern between the two-point charges. (3)

6.2.3 Calculate the net electric field at point **A** due to the two-point charges. (6)

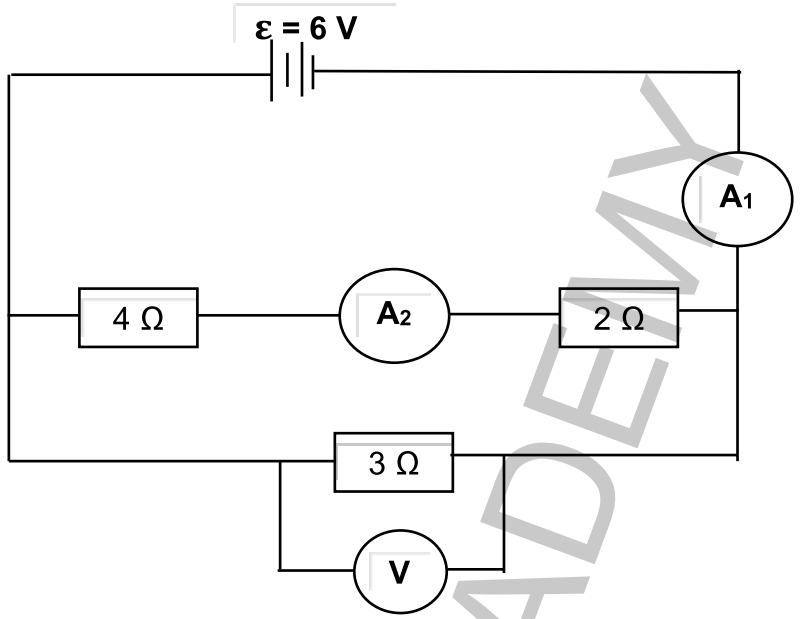
[24]

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QUESTION 7 (Start on a new page.)

In the circuit diagram below the battery has emf of 6 V and negligible internal resistance.



7.1 Calculate the:

7.1.1 Effective resistance in the circuit (3)

7.1.2 Reading on ammeter **A_1** (3)

7.1.3 Reading on ammeter **A_2** (3)

7.1.4 Power dissipated by the 4 Ω resistor (3)

7.2 What is the reading on voltmeter **V**? No calculation is required. (1)

7.3 A kettle is rated 1 500 W. Calculate how much a learner will pay for electricity for using the kettle for 4 hours. Eskom charges 1 kWh electricity at R2,05. (4)

[17]

TOTAL: 100

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DATA FOR PHYSICAL SCIENCES GRADE 12

PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12

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•s^{-2}
Universal gravitational constant / *Universele gravitasiekonstante*	G	6,67 × 10^{-11} N•m^{2}·kg^{-2}
Speed of light in a vacuum / *Spoed van lig in 'n vakuum*	c	3,0 × 10^{8} m•s^{-1}
Planck's constant / *Planck se konstante*	h	6,63 × 10^{-34} J•s
Coulomb's constant / *Coulomb se konstante*	k	9,0 × 10^{9} N•m^{2}•C^{-2}
Charge on electron / *Lading op elektron*	e	-1,6 × 10^{-19} C
Electron mass / *Elektronmassa*	m_e	9,11 × 10^{-31} kg
Mass of earth / *Massa op aarde*	M	5,98 × 10^{24} kg
Radius of earth / *Radius van aarde*	R_E	6,38 × 10^{3} km

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TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ 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/*KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$	$\mu_s = \frac{f_s^{max}}{N}$
$\mu_k = \frac{f_k}{N}$	

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*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N.m^2.C^{-1})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N.m^2.C^{-1})$	$n = \frac{Q}{q_e}$

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ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

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