GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2022

GRADE 11

PHYSICAL SCIENCES: PHYSICS

(PAPER 1)

TIME: **2 hours**

MARKS: **100**

10 pages + 1 graph paper and 2 data pages

P.T.O.

INSTRUCTIONS AND INFORMATION:

1. Write your name in the appropriate space on the ANSWER BOOK.

2. This question paper consists of SEVEN questions. Answer ALL questions in the ANSWER BOOK except QUESTION 3.1 which has to be answered on the GRAPH PAPER attached to this question paper. Write your name in the appropriate space on the GRAPH PAPER.

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, 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. 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, et cetera where required.

12 Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

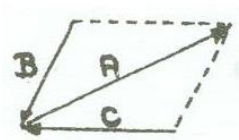
Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question numbers (1.1 to 1.6) in the ANSWER BOOK, for example 1.7 A.

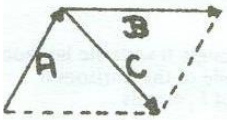
1.1 In which of the following pairs do both items refer to vector quantities?

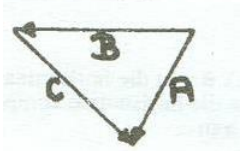
A Mass and weight
B Acceleration and weight
C Force and mass
D Time and acceleration (2)

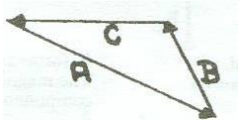
1.2 In which vector diagram below is the following statement true?

$$\vec{A} = \vec{B} + \vec{C}$$

A 

B 

C 

D 

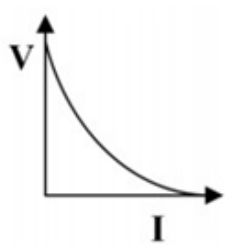
(2)

1.3 An astronaut has a weight F_g on Earth. What distance, in terms of the radius of the Earth (r), will the astronaut be if his weight is a ¼ of his weight (F_g) on the surface of the Earth?

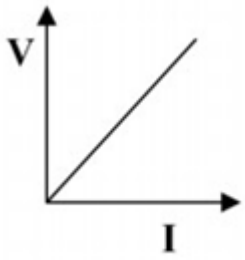
A 2r
B R
C ½ r
D ¼ r (2)

1.4 Which of the following graphs best represents the relationship between the potential difference (V) across an ohmic conductor and the current (I) in the conductor at constant temperature?

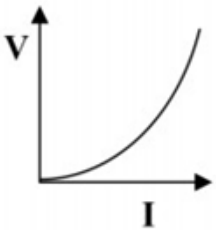
A



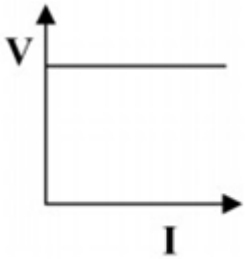
B



C



D



(2)

1.5 The direction of a magnetic field around a current-carrying conductor is:

A Clockwise around the conductor with conventional current into the page
B Clockwise around the conductor with conventional current out of the page
C Clockwise around the conductor with electron current into the page
D Parallel to the conductor in the same direction as convectional current (2)

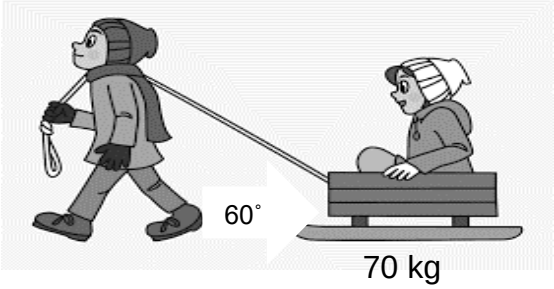
1.6 A positively charged object has …

A more electrons than neutrons.
B more protons than neutrons.
C equal amount of electrons and protons.
D more protons than electrons. (2)

[12]

QUESTION 2 (Start on a new page.)

A boy is pulling a girl on a sled, with a total mass of 70 kg across the snow at a constant velocity of 2,5 m·s^{-1}. The rope makes an angle of 60° with the horizontal. The tension in the rope is 120 N. Friction cannot be ignored.



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

2.2 Draw a labelled free body diagram of all the forces acting on the sled with the girl. (4)

2.3 Calculate the:

2.3.1 Horizontal component of the tension in the rope (2)

2.3.2 Vertical component of the tension in the rope (1)

2.4 While the sled is pulled with a constant velocity of 2,5 m·s^{-1} to the left, the boy let go of the rope. Calculate the acceleration which the sled experiences while it is stopped by the kinetic friction if μ_k = 0,23. (6)

[15]

QUESTION 3 (Start on a new page.)

Learners in the grade 11 class do an experiment to investigate the laws of friction. They measure the maximum static frictional force (f_{smax}) and the kinetic frictional force (f_K) for varying values of the normal force. They tabulate their results as follows.

Readings	N (in Newtons)	f_{smax} (in Newtons)	f_K (in Newtons)
1	1,5	0,9	0,63
2	2	1,2	0,84
3	4	2.4	1,68

3.1 Use the information from the table above and draw both graphs on the same set of axis on the GRAPH PAPER provided. (Addendum A) Label both the graphs. (5)

3.2 State the relationship between the kinetic frictional force (f_K) and the normal (N) force as shown on the plotted graphs. Explain the answer. (2)

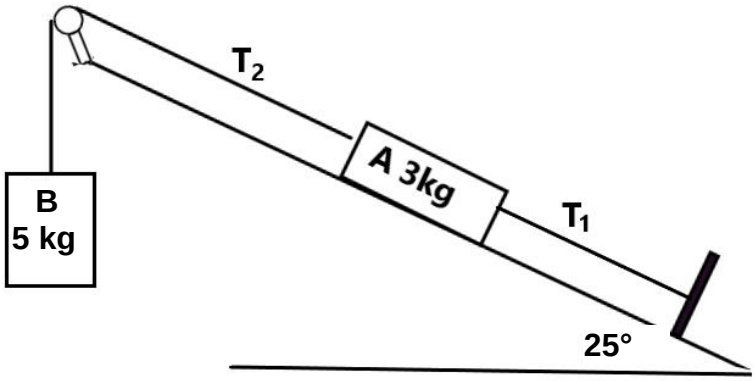
3.3 Calculate the coefficient of static friction(μ_s) using values for f_{smax} from the graph. (3)

3.4 The gradient of the kinetic frictional graph is less steep than the graph for maximum static friction. Explain the statement by referring to the relationship between f_{smax} and f_K. (2)

[12]

QUESTION 4 (Start on a new page.)

In the pulley system below, a 3 kg block **A** is suspended on a rough inclined surface, forming an angle of 25° with the horizontal. A 5 kg block **B** is attached by a string T_2, running over a frictionless pulley. Block **A** is attached to a fixed plate by string T_1.



4.1 State Newton's *first law of motion* in words. (2)

4.2 Draw a fully labelled free body diagram to show all the forces acting on block **A**. (4)

4.3 Calculate the tension in the string T_2. (3)

String T_1 is cut, and the system starts to accelerate. The coefficient of friction of the inclined surface is 0,44.

4.4 Calculate:

4.4.1 The frictional force acting on Block **A**.

4.4.2 The magnitude of the acceleration of the system. (4)

4.4.3 The magnitude of the tension force in T_2. (3)

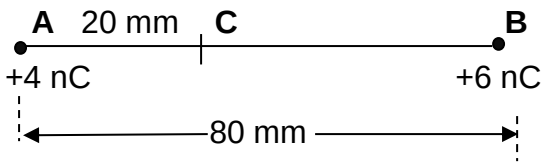
4.5 If the angle of the incline is increased to 30°, how will the coefficient of kinetic friction change? Write only INCREASES, DECREASES or REMAINS THE SAME.

Explain the answer by referring to the relationship between the forces acting on block **A**. (2)

[22]

QUESTION 5 (Start on a new page.)

A and **B** are two point charges of +4 nC and +6 nC respectively, separated by a distance of 80 mm as shown in the diagram. **C** is a point 20 mm east of **A**.



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

5.2 Draw the electric field pattern between the two charges (**A** and **B**) as if they were identical in magnitude. (3)

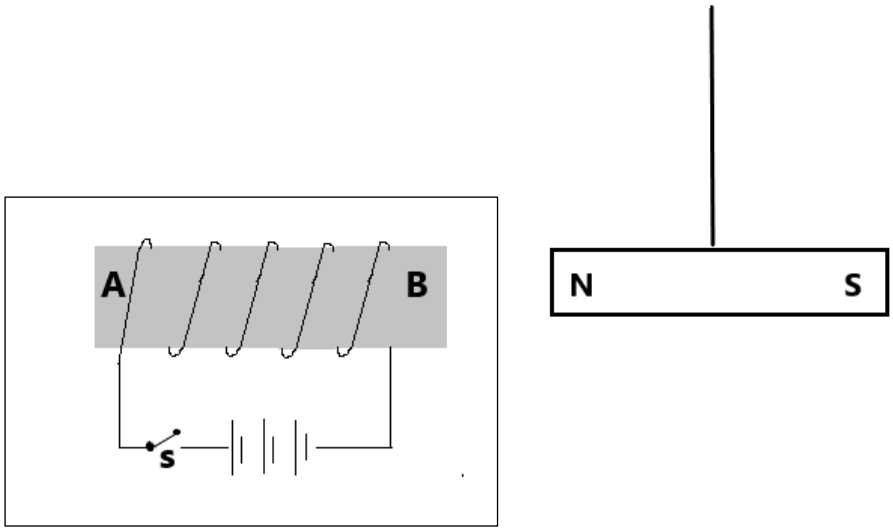
5.3 Calculate the number of electrons that are added or removed to give a charge of +5 nC. (3)

5.4 Calculate the magnitude and direction of the net electric field strength at point **C**. (6)

[14]

QUESTION 6 (Start on a new page.)

The solenoid on the left, connected to a battery is placed close to the bar magnet on the right, suspended on a light inextensible string and allowed to move freely, is shown in the diagram below.



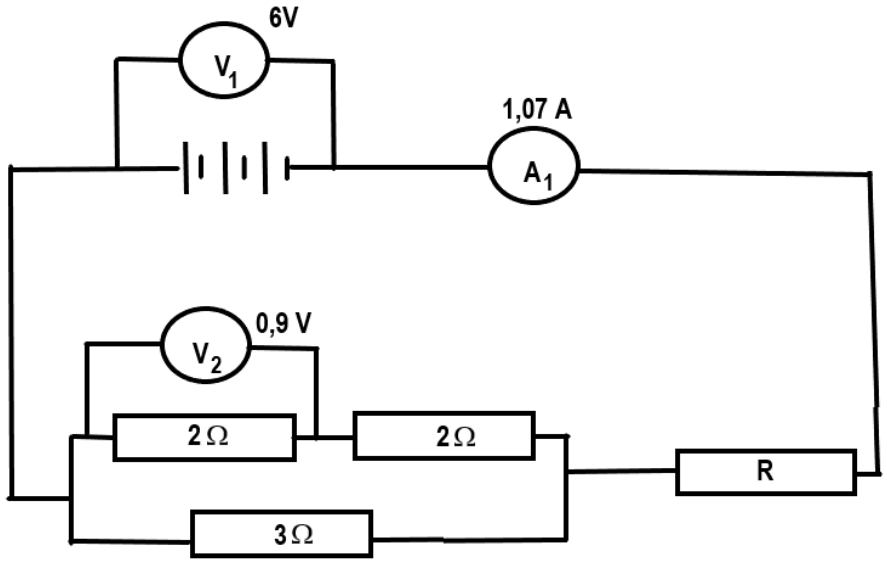
6.1 State *Faraday's law of electromagnetic induction* in words. (2)

6.2 In which direction will the suspended magnet move when the switch, **S,** in the circuit of the solenoid is closed? Write only TOWARDS, AWAY FROM, REMAINS AT THE SAME PLACE. Explain why this will happen. (3)

6.3 Name THREE changes that can be made to the system on the left to increase the effect on the magnet. (3)
[8]

QUESTION 7 (Start on a new page.)

The following circuit diagram consists of a 6V battery and four resistors as shown in the diagram below. Ammeter A_1 has a reading of 1,07A. Voltmeter V_2 has a reading of 0,9 V.



7.1 Give the meaning of a 6V reading on the battery. (2)

7.2 Calculate the effective resistance of the parallel connection. (3)

7.3 Find the total voltage over the parallel resistance. (2)

7.4 Calculate the resistance of resistor **R**. (5)

7.5 If one of the 2Ω resistors burns out, what will happen to:

7.5.1 The total resistance of the circuit? Write only INCREASES, DECREASES or REMAINS THE SAME. (2)

7.5.2 The current reading on A_1? Write only INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (3)

[17]

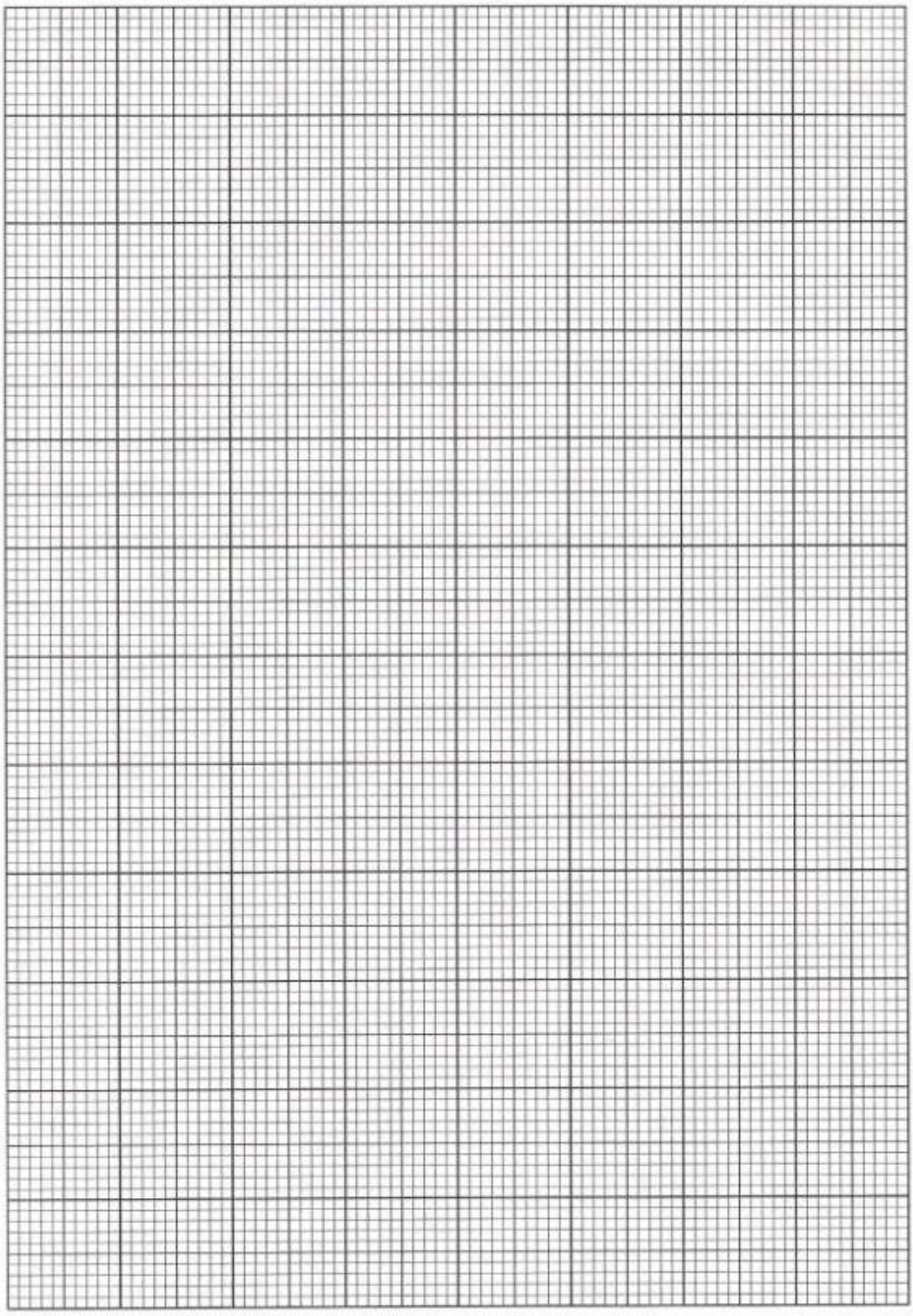
TOTAL: 100

END

ADDENDUM A

QUESTION 3.1

NAME OF LEARNER:_____



DATA FOR PHYSICAL SCIENCES GRADE 11 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (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 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*

*M*OTION/*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*

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

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/*ELEKTRIESE STROOMBANE*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + ...$	$R = r_1 + r_2 + r_3 + ...$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$