GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

NOVEMBER 2021

GRADE 11

PHYSICAL SCIENCES (PHYSICS)

PAPER 1

TIME: 2 hours

MARKS: 100

11 pages, an answer sheet and 2 data sheets

EXEMPLAR

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 the questions in the ANSWER BOOK except QUESTION 5.3 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 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. 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.

EXEMPLAR

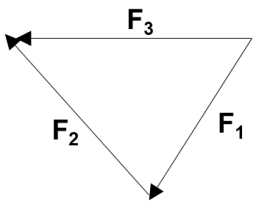
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

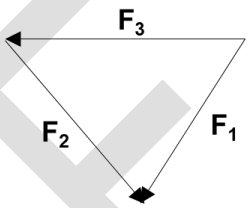
Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g., 1.11 E. Each question has only ONE correct answer.

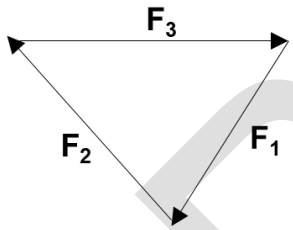
1.1 Which of the following quantities is a vector quantity?

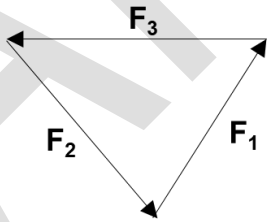
A Weight
B Speed
C Time
D Energy (2)

1.2 The following three forces are in equilibrium on a single point.

A


B


C


D


(2)

1.3 A box of 1,5 kg is being pushed with a force of 20 N at an angle of 15° to the horizontal position, as shown in the diagram.

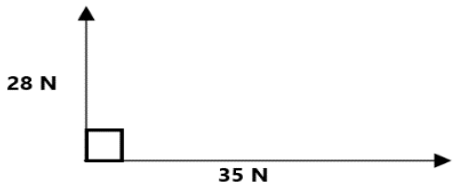


The normal force is ...

A 14,70 N.
B 9,52 N.
C 19,88 N.
D 5,18 N. (2)

DRAFT

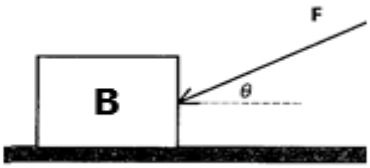
1.4 Two forces act on an object as shown.



Calculate the magnitude of the resultant force.

A 44,82 N
B 63 N
C 52,45 N
D 7,94 N (2)

1.5 The diagram below shows a force with a magnitude **F** applied onto a block **B**, resting on a flat surface, at an angle θ.



The angle is now decreased. The acceleration and the frictional force will change as follows:

	ACCELERATION	FRICTIONAL FORCE
A	Increases	Increases
B	Decreases	Increases
C	Decreases	Decreases
D	Increases	Decreases

1.6 A 10 kg object is located at 1,9 x 10^6 m from the centre of a larger object whose mass is 8,4 x 10^{24} kg.

What is the size of the force acting on the smaller object?

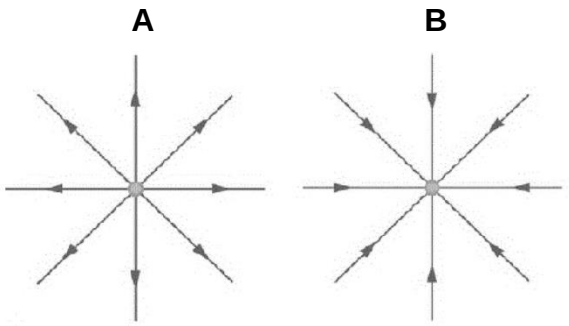
A 1552,02 N
B 29,48 x 10^8 N
C 1552,02 kg
D 29,48 x 10^8 kg

DRAFT

1.7 The potential difference over a specific resistor is changed, while the temperature of the resistor is kept constant. The resistance of the resistor will ...

A increase as the potential difference increases.
B decrease as the potential difference decreases.
C increase as the potential difference decreases.
D remain constant. (2)

1.8 The following diagrams represent charges.



Which of the following is correct?

	Charge A	Charge B
A	- q	- q
B	+ q	- q
C	- q	+ q
D	+ q	+ q

(2)

1.9 In an electric circuit the potential difference is doubled across a particular resistor. If the resistance does not change, the power in the resistor will change from P to …

A ½ P.
B ¼ P.
C 2 P.
D 4 P. (2)

1.10 Two identical point charges **A** and **B** having charges of –3pC and +9pC respectively, are allowed to touch and are then moved apart. What is the charge in pC on each sphere now?

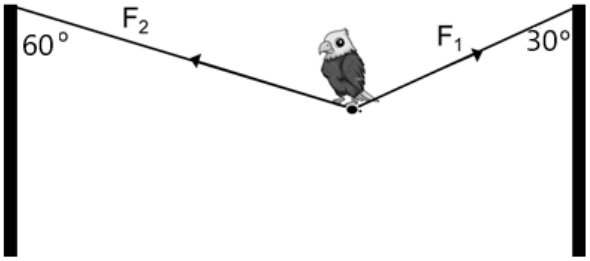
	A	B
A	+3	–9
B	+3	+3
C	–3	–3
D	0	0

(2)
[20]

DRAFT

QUESTION 2 (Start on a new page.)

A bald eagle with a mass of 5 kg is perched on a light, inextensible rope between two poles as shown in the diagram. The eagle is stationary on the rope.



2.1 What is the magnitude of the resultant force of the system? (2)

2.2 Draw a labelled free-body diagram showing all the forces acting on the eagle. (3)

2.3 Calculate the weight of the eagle. (3)

2.4 Calculate the magnitude of $\mathbf{F_1}$ and $\mathbf{F_2}$. (4)

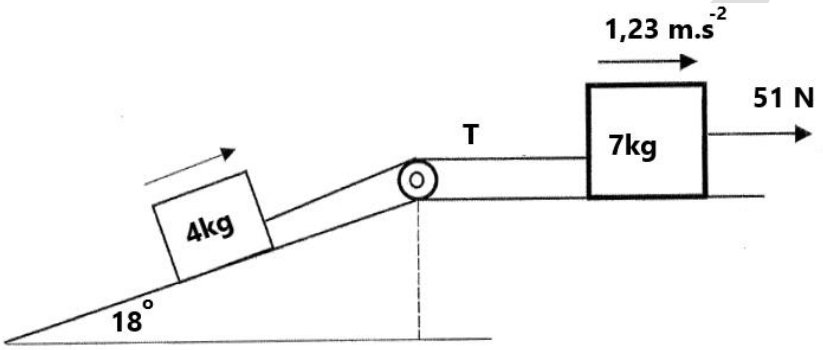
[12]

DRAFT

QUESTION 3 (Start on a new page.)

Two blocks of mass, of 7 kg and 4 kg respectively, are joined with an inelastic string of negligible mass. The string runs over a frictionless pulley. The 7 kg block is on a rough horizontal surface while the 4 kg block is on a rough inclined plane of 18˚ to the horizontal surface.

A force of magnitude 51 N is applied to the 7 kg block, parallel to the horizontal surface, causing the blocks to accelerate at 1,23 $m.s^{-2}$ in the direction shown.
The 7 kg block experiences a 12 N frictional force as it moves to the right.



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

3.2 Draw a labelled free body diagram showing ALL the forces that act on the 4 kg block. (4)

3.3 Calculate the magnitude of the tension in the string that joins the two blocks together. (3)

3.4 Calculate the magnitude of the net force acting on the 4 kg block. (2)

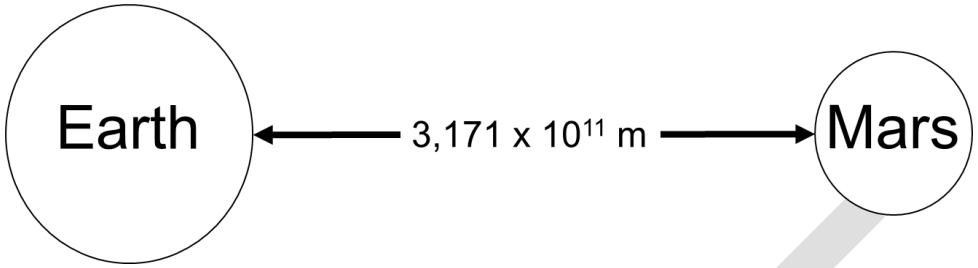
3.5 Calculate the co-efficient of kinetic friction between the 4 kg block and the surface. (6)

3.6 Identify a Newton's Third Law pair which acts on the 7 kg block. (2)
[19]

DRAFT

QUESTION 4 (Start on a new page.)

On 13 May 2021 Mars and Earth were 3,171 x 10^{11} m away from each other's surfaces.



Mars has a mass of 6,417 x 10^{23} kg and a radius of 3,4 x 10^{6} m.
Earth has a mass of 5,98 x 10^{24} kg and a radius of 6,38 x 10^{6} m.

4.1 State *Newton's Law of Universal Gravitation,* in words. (2)

4.2 Calculate the force of attraction between Mars and the Earth. (4)

4.3 *Perseverance*, a car-sized Mars rover enters the Martian atmosphere.

4.3.1 Calculate the acceleration due to the gravity on Mars. (3)

4.3.2 How does the acceleration calculated in QUESTION 4.3.1 change as *Perseverance* gets closer to the surface? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

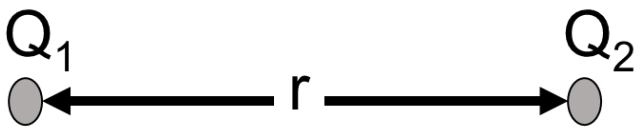
4.3.3 Explain the answer in QUESTION 4.3.2. (2)
[12]

DRAFT

QUESTION 5 (Start on a new page.)

A group of physicists want to investigate the relationship between the electrostatic force experienced by two point charges and the distance between the point charges.

The following is a simplified diagram of the experiment.



They record the following results:

Test	r (cm)	r^2 (cm^2)	F (N)
1	2	4	359,50
2	3	9	149,64
3	4	16	89,88
4	5	25	52,29
5	6	36	38,65

5.1 Write a suitable investigative question for this investigation. (2)

5.2 State the following variables:

5.2.1 Independent variable (1)

5.2.2 Dependent variable (1)

5.2.3 Control variable (1)

5.3 Draw an accurate diagram of r^2 versus F on the graph paper provided. (4)

5.4 From the graph you have drawn, what conclusion can you make about the relationship between distance and force between the two points of charges? (2)

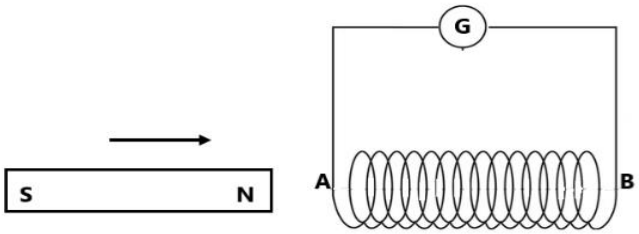
5.5 Name and state the relevant law related to this experiment. (2)

[13]

DRAFT

QUESTION 6 (Start on a new page.)

The following diagram shows a solenoid **AB** connected to a galvanometer (able to record very small currents). The magnet is now moved as indicated.



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

6.2 State what will happen to the reading on the galvanometer when:

6.2.1 The magnet is pushed into the solenoid (1)

6.2.2 The magnet is held still inside the solenoid (1)

6.3 The magnet is moved into the solenoid.

6.3.1 Identify the polarity of point **A** on the solenoid. (1)

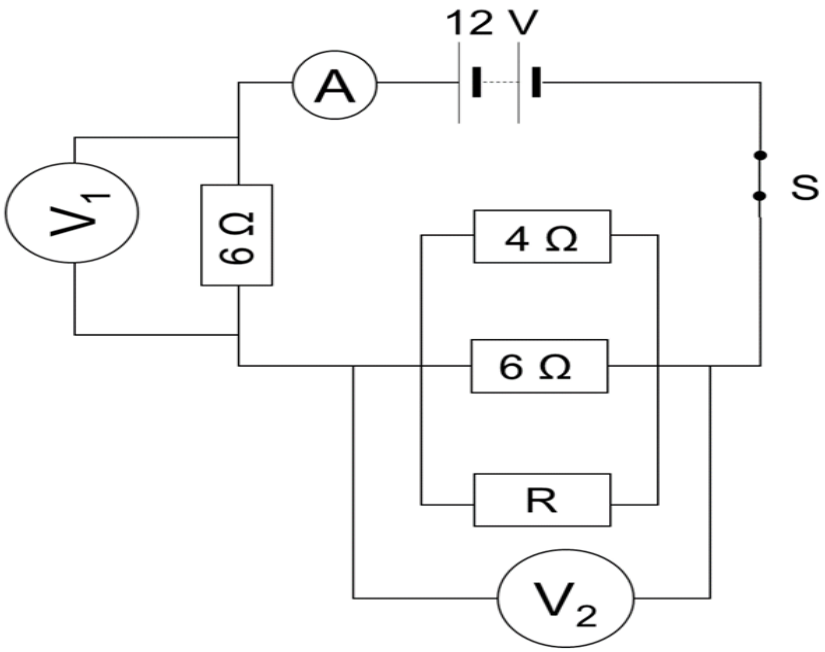
6.3.2 Indicate the direction a current will flow in the solenoid: **A** to **B** or **B** to **A**. (2)

6.3.3 Explain the rule and how you used it to get the answer to QUESTION 6.3.2. (2)
[9]

DRAFT

QUESTION 7 (Start on a new page.)

In the circuit below, the battery has an emf of 12 V. The resistance of the wires and battery may be ignored. The switch **S** is now CLOSED, and the reading on V_2 is 3V.



7.1 Define the term *electric current*. (2)

7.2 Calculate the reading on the ammeter. (4)

7.3 Calculate the total resistance of the circuit. (2)

7.4 Calculate the resistance of **R**. (4)

7.5 If resistor **R** is removed from the circuit, what would happen to the reading on voltmeter $\mathbf{V_1}$? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

7.6 Explain your answer to QUESTION 7.5. (2)

[15]

TOTAL: 100

END

Question 5.3: Answer Sheet

Name: _____

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 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 electron*	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*

$v_f = v_i + a\Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^{\ 2} = v_i^{\ 2} + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2} \right) \Delta t$

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*

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