Bergvliet High School

GRADE 11

Physical Science

Physics Paper 1

11 November 2024

MARKS: 150

TIME: 3 hours

EXAMINER: S. van Harte

MODERATOR/S: Z. Booysen/ K. Stuck

This question paper consists of 14 pages with 1 Graph and 2 data sheets.

Detach this sheet and attach it to the front of your answer sheets.

Name: _____ Teacher: Bo / Vh / Su

For official use only							
Question 1	Marker	**20**	Moderator	**Question 7**	Marker	**15**	Moderator
Question 2	Marker	**16**	Moderator	**Question 8**	Marker	**11**	Moderator
Question 3	Marker	**23**	Moderator	**Question 9**	Marker	**23**	Moderator
Question 4	Marker	**14**	Moderator				
Question 5	Marker	**10**	Moderator	**Total**	Marker	**150**	Moderator
Question 6	Marker	**18**	Moderator	**Percentage**	Marker	**100**	Moderator
Signature	Marker			**Signature**	Moderator		

INSTRUCTIONS

1. Write your **NAME** and science teacher code (**Bo/Vh/Su**) in the appropriate space on the Cover Page and all scripts handed in.
2. The question paper consists 9 questions. Answer ALL the questions.
3. Start EACH question on a NEW page.
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.

Answer Sheet

Name: _____ **Teacher Code: Bo/Vh/Su**

Question 1

Make a **cross (X)** in the appropriate box next to the relevant question number (1.1 – 1.10)

1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D
		Total		/20

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Make a cross (**X**) in the appropriate box next to the relevant question number (1.1 – 1.10) on the answer sheet provided.

1.1 The driver of a motor car places a book on the level dashboard of his car in front of him. He observes that the book slides towards the windscreen when the brakes are applied.

Which of Newton's Laws best explains this motion of the book?

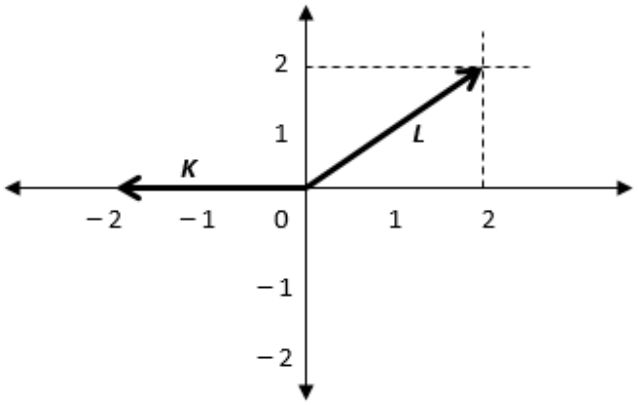
A. First Law

B. Second Law

C. Third Law

D. Law of Universal Gravitation (2)

1.2 Consider the following two vectors.



The resultant of vectors ***K*** and ***L*** is:

A. 0 N.

B. 4 N to the right and 2 N down.

C. 2 N up.

D. 2 N down. (2)

1.3 What is the NAME of the perpendicular force that a surface exerts on an object in contact with the surface?

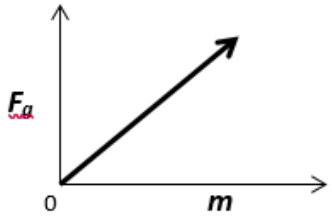
A. Normal Force

B. Tension

C. Kinetic frictional force

D. Gravitational force (2)

1.4 A graph of the gravitational force (F_g) versus the mass (m) of an object is shown below.



Which ONE of the following CORRECTLY represents the slope of the graph?

A. Velocity of the object.

B. Weight of the object.

C. Acceleration due to gravity (g).

D. Universal gravitation constant (G). (2)

1.5 The electrostatic force between two charged spheres, a distance ***r*** apart, is ***F***. When the charge on each sphere is doubled and the distance between the spheres is also doubled, the force between the spheres will now be …

A. ½ ***F***

B. ***F***

C. 2***F***

D. 4***F*** (2)

1.6 The electrostatic force between two charged particles is positive.
Which ONE of the following is CORRECT?

A. The magnitudes of the two charges are equal.

B. One charge is positive while the other is negative.

C. The electrostatic force between the charges is attractive.

D. The electrostatic force between the charges is repulsive. (2)

1.7 Which one of the following graphs correctly represents the relationship between potential difference (V) and current (I) for an ohmic conductor?

A. $V \propto I^{-1}$

B. $VI \propto 1$

C. $V^{-1} \propto I$

D. $V \propto I$ (2)

1.8 The rate of flow of charge is the...

A. Power

B. Current

C. Charge

D. Energy (2)

1.9 When a straight conductor is carrying current:

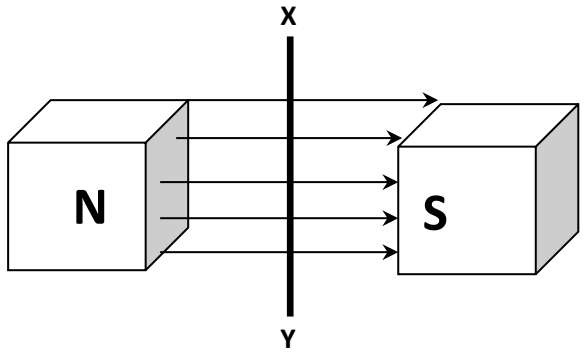
A. There are straight, perpendicular magnetic field lines around it.

B. There are magnetic field lines parallel to the conductor.

C. There are circular, perpendicular magnetic field lines around it.

D. There are no magnetic field lines. (2)

1.10 A conducting wire, **XY**, moves between two magnets as shown below.



Which ONE of the following actions can lead to an increased induced current in wire **XY**?
Move the wire:

A. Quickly and with a weak magnet.

B. Slowly and with a weak magnet.

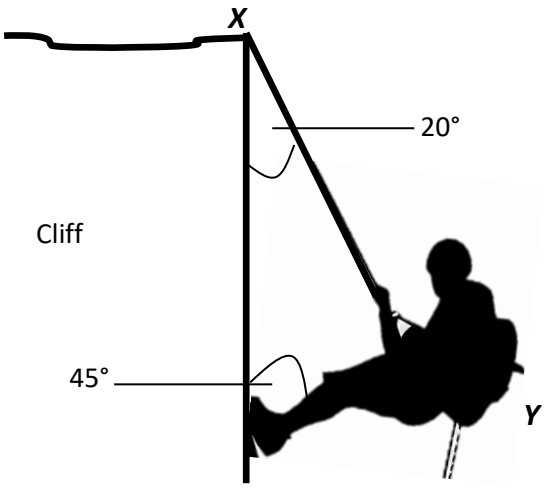
C. Quickly and with a strong magnet.

D. Slowly and with a strong magnet. (2)

[20]

QUESTION 2 (Start on a new page.)

During a mountain climbing exercise, a person, mass 50 kg, hangs from an inextensible nylon rope that is attached to point **X** on the vertical cliff. The person's legs push against the cliff so that they make an angle of 45° with the cliff, as indicated in figure. The angle that the rope makes with the cliff is 20°.



Point ***Y*** is in equilibrium.

2.1 Explain what is meant by *Point **Y** is in equilibrium*. (2)

2.2 Draw a VECTOR DIAGRAM showing all the forces acting on point **Y**. (3)

2.3 Determine the magnitude of the:

2.3.1 Weight of the person. (3)

2.3.2 Tension in the string, if the applied force by the person's legs is 185N. (4)

2.4 Give the NAME of the type of frictional force that acts between the cliff and the person's shoes while point **Y** is in equilibrium. (1)

2.5 The rope comes loose at point X and the person falls downwards until the safety cable (which is attached much further down to the cliff) brings the person to a stop. The person experiences weightlessness for this short period while falling. Ignore air resistance.

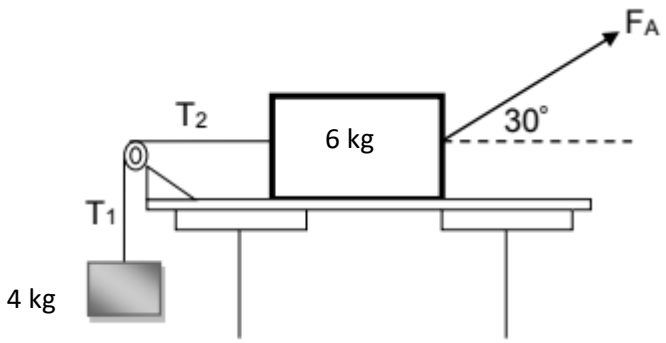
2.5.1 Explain what is meant by *weightlessness*. (2)

2.5.2 Give the NAME of the force acting on the person during this falling motion. (1)

[16]

QUESTION 3 (Start on a new page.)

An object with a mass of 4 kg is allowed to hang over a frictionless pulley with a light inextensible string that is attached to the 6 kg box. The box is pulled on a rough surface with an applied force, F_A, of 50 N at an angle of 30° to the horizontal and is moving at a CONSTANT VELOCITY to the right.



3.1 3.1.1 Draw a force diagram of forces acting on a 4 kg object. (2)

3.1.2 Determine the magnitude of the tension force on the 4 kg object. (4)

3.2 Draw a free-body diagram of ALL forces exerted on the 6 kg box. (5)

3.3 What is the magnitude of the tension, T_2, on the 6 kg box? (1)

3.4 Calculate the friction force between the surface and the 6 kg box. (4)

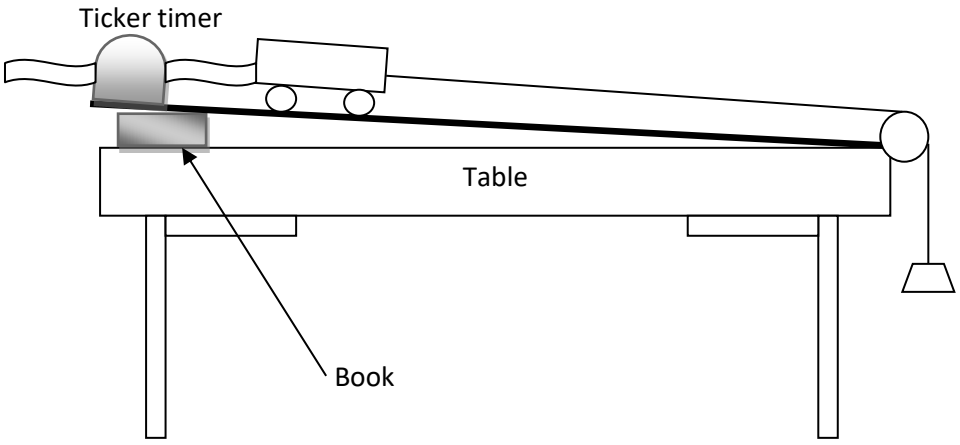
3.5 Calculate the coefficient of friction of the surface and the 6 kg box. (5)

3.6 How will the frictional force be influenced if the angle is increased to 35°?
Choose from INCREASES, DECREASES or REMAINS THE SAME, and give a reason. (2)

[23]

QUESTION 4 (Start on a new page.)

Learners set up a runway as shown in the diagram to investigate the relationship between mass and acceleration.



The following are the results that were obtained during the investigation:

m (trolley mass) in gram (*g*)	***a*** (m.s^{-2})	***ma*** (N)
200	**X**	2
400	5	2
600	3,33	**Y**
Z	2,5	2
1000	2	2

4.1 Calculate the values of **X**, **Y** and **Z** in the table. (3)

4.2 Give the scientific reason why learners have placed a book under the track. (1)

4.3 Which variable is kept constant during this investigation? (1)

4.4 On the graph paper provided, draw a graph of acceleration versus mass for the above investigation. (5)

4.5 From the graph, provide the acceleration of a trolley of mass 500g. (1)

4.6 Explain the relationship between acceleration and mass from the learner's conclusion based on the graph obtained. (2)

4.7 Name the law that was investigated by the learners. (1)

[14]

QUESTION 5 (Start on a new page.)

A proton (p+) in a hydrogen atom is a distance of r = 5,29 x 10^{-11} m apart from and a proton in another hydrogen atom in the formation of a hydrogen gas molecule.
The mass of a proton is 1,67 x 10^{-27} kg.

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

5.2 How does the gravitational force experienced by the one proton compare to the gravitational force experienced by the other proton? Write only GREATER THAN EQUAL TO, OR LESS THAN. (1)

5.3 State the Physics Law, in words, that is applicable to the answer given in QUESTION 5.2 above. (2)

5.4 Calculate the magnitude of the gravitational forces that exist between the two protons. (4)

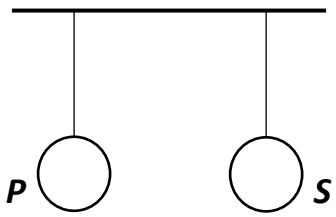
5.5 Is this gravitational force between the protons, as calculated in QUESTION 5.4, ATTRACTIVE or REPULSIVE? (1)

[10]

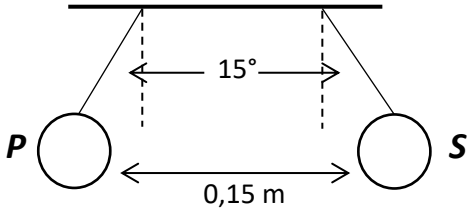
QUESTION 6 (Start on a new page.)

Two metal spheres, ***P*** and ***S***, with initial charges of $-3 \times 10^{-9}\ C$ and $+6 \times 10^{-9} C$ respectively, are suspended from insulated strings. They come into contact with each other and then move to a position of $15°$ with the vertical, with a distance of 0,15 m between their centres.

Before contact



After contact



6.1 Define *Coulomb's law*. (2)

6.2 Why do the two spheres hang at 15° after coming into contact with each other? (2)

6.3 Calculate the number of electrons present on sphere ***P*** before contact. (3)

6.4 Calculate the charge on each sphere after they have been in contact. (3)

6.5 Did sphere ***P*** GAIN or LOSE electrons during contact. (1)

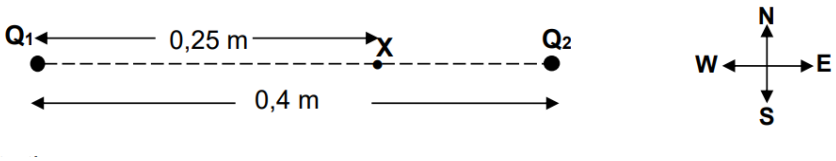
6.6 Draw the electric field between and around spheres ***P*** and ***S*** after they have been in contact. (3)

6.7 Calculate the magnitude of electrostatic force between the two spheres after contact. (4)

[18]

QUESTION 7 (Start on a new page.)

Two charged particles, Q_1 and Q_2, are placed 0,4 m apart along a straight line.
The charge on Q_1 is + 2 x 10^{-5} C, and the charge on Q_2 is – 8 x 10^{-6} C. Point **X** is 0,25 m east of Q_1, as shown in the diagram below.



7.1 Define the *electric field strength at a point*. (2)

7.2 Draw a free body diagram of the electric fields at point **X**. (2)

7.3 Calculate the net electric field strength at point **X** as shown in the diagram above. (6)

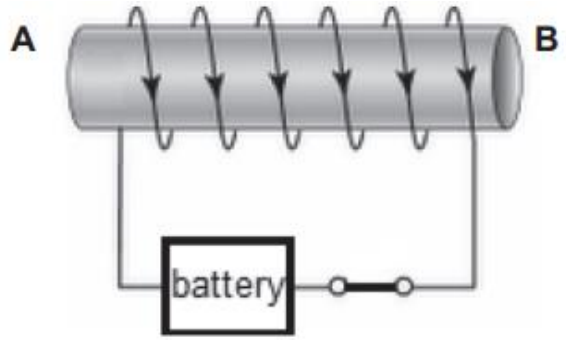
7.4 A charge, Q_3, has a magnitude of -4 x 10^{-5} C and is placed at point **X**.
What is the net electrostatic force Q_3 will experience? (4)

7.5 How will the electric field strength compare if point **X** is shifted 0,05 m West. Only write LESS THAN, EQUAL TO or GREATER THAN. (1)

[15]

QUESTION 8 (Start on a new page.)

8.1 A solenoid is shown in the diagram below



The current passes into the solenoid at ***A*** and out of the solenoid at ***B***.

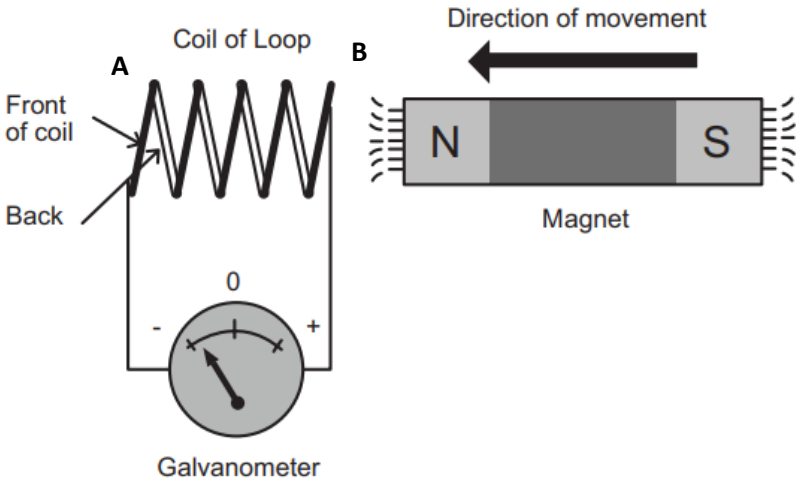
8.1.1 What type of magnet has a similar magnetic field to that of a solenoid? (1)

8.1.2 Which end (***A*** or ***B***) is connected to the positive end of the battery (1)

8.1.3 Which end (***A*** or ***B***) is the north pole of the solenoid? (1)

8.1.4 What rule did you use to determine this? Describe the rule. (2)

8.2 A magnet is brought near a solenoid or coil as shown in the diagram below.



8.2.1 Why does the galvanometer deflect as the magnet is brought near to the coil? (1)

8.2.2 What law is being used to predict the direction of the induced current? (1)

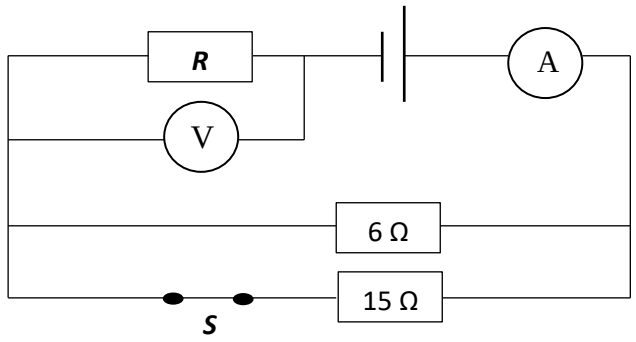
8.2.3 Which way will the current pass through the coil? Only write **A to B** or **B to A**. (1)

8.2.4 Give three ways in which the strength of the induced current can be increased. (3)

[11]

QUESTION 9 (Start on a new page.)

9.1 The circuit below consists of a 6 Ω and 15 Ω resistor connected in parallel and an unknown resistor ***R***, in series. An ammeter, a high-resistance voltmeter, a closed switch and battery are connected, as shown. The resistance of the battery and wires can be ignored.



The total power dissipated in the **parallel part of the circuit is 50 W.**

9.1.1 Define the term *power*. (2)

9.1.2 Explain why voltmeters need to have high resistance. (1)

9.1.3 Calculate the effective resistance of the parallel combination. (3)

9.1.4 Calculate the potential difference across the resistors in parallel. (3)

9.1.5 Calculate the current through resistor ***R***. (3)

The switch in the circuit is now OPENED.

9.1.6 How will the reading on the voltmeter (V) be influenced?
Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

9.1.7 Explain the answer to QUESTION 9.1.6. (2)

9.2 An appliance, labelled 3 500 W, is used for an average of 5 hours per day.
The cost of electricity is 99 cents per kWh.

9.2.1 Calculate the energy used by the geyser for 5 hours per day. (4)

9.2.2 Calculate the cost of electricity to operate the geyser for a month with 30 days. (4)

[23]

TOTAL: 150

Name:_____ **Teacher Code: Bo/Vh/Su**

Annexure A: Graph Paper Question 4.4

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}$ $J \cdot s$
Charge on electron	e^-	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg
Gravitational constant	G	$6,67 \times 10^{-11}$ $N.m^2.kg^{-2}$

FORCE/*KRAG*

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

ELECTROSTATICS

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

$F = \frac{kQ_1Q_2}{r^2}$ $\quad (k = 9,0 \times 10^9 N \cdot m^2 \cdot C^{-2})$

ELECTRIC CIRCUITS & ELECTROMAGNETISM

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