Bergvliet High School

GRADE 10

Physical Science
Physics P1
10 November 2023

MARKS: 100
TIME: 2 hours
EXAMINER: G. O'Connor
MODERATORS: Z. Booysen, S. Van Harte, T. Abrahams

This question paper consists of 11 pages and 1 data sheet.
Detach this sheet and attach it to the front of your answer sheets.

Name: _____ Teacher: Bn/ Oc/ Vh / Am

For official use only					
Question 1	Marker	Moderator	**Question 6**	Marker	Moderator
Question 2	Marker	Moderator	**Question 7**	Marker	Moderator
Question 3	Marker	Moderator	**Question 8**	Marker	Moderator
Question 4	Marker	Moderator	**Question 9**	Marker	Moderator
Question 5	Marker	Moderator	**Total**	Marker	Moderator
			Percentage		
Signature	Marker		**Signature**	Moderator	

INSTRUCTIONS

1. Write your **NAME** and science teacher code (**Bn/Oc/Vh/Am**) in the appropriate space on the Cover Page and all scripts handed in.
2. The question paper consists of 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 SHEET.
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: Bn/Vh/Oc/Am**

Question 1

Make a **cross (X)** in the appropriate box next to the relevant question number (1.1 – 1.5)

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
		Total		/10

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 number (1.1–1.5), for example 1.10 E.

1.1 Choose the correct combination that represents a SCALAR and a VECTOR.

	SCALAR	***VECTOR***
A.	Time	Temperature
B.	Distance	Speed
C.	Mass	Force
D.	Acceleration	Velocity

(2)

1.2 The number of sound vibrations per second is equivalent to the:

A. Speed

B. Period

C. Frequency

D. Amplitude (2)

1.3 If _____ and _____ increase, then an object's potential energy will increase.

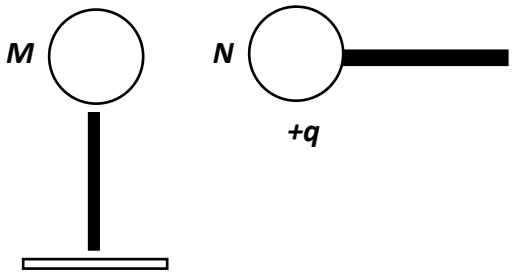
A. mass, velocity

B. time, acceleration

C. force, speed

D. mass, height (2)

1.4 A neutral sphere, ***M***, is placed on an insulated stand. An identical sphere, ***N***, carries a charge of ***+q*** as shown in the sketch.



M and ***N*** make contact with each other. What is the magnitude of the charge on sphere ***M*** when sphere ***N*** is removed?

A. $-q$

B. $\sqrt{q}$

C. $+\frac{q}{2}$

D. 0 (2)

1.5 Which ONE of the following will result in the greatest total resistance?

A. Two 1 Ω resistors in series.

B. Two 2 Ω resistors in series.

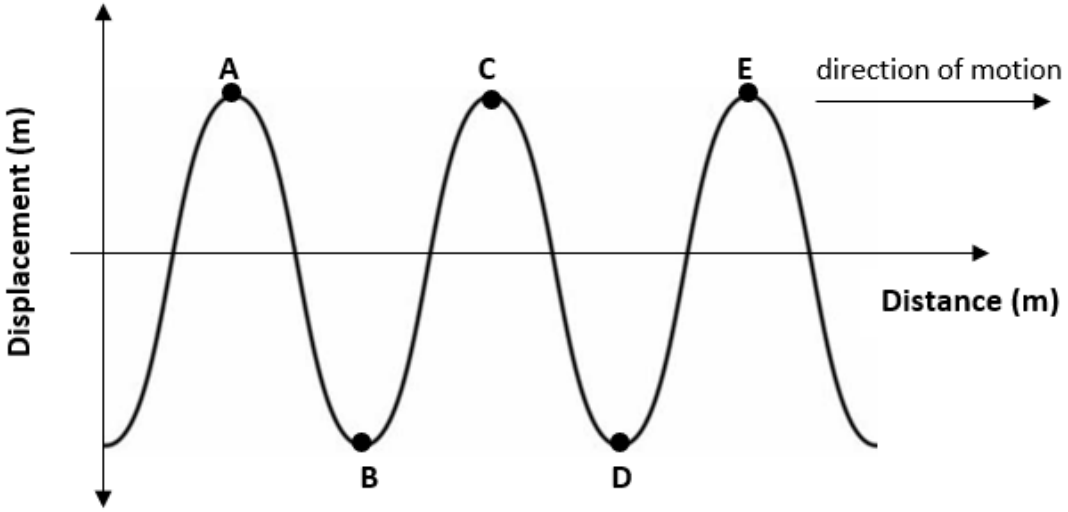
C. Three 3 Ω resistors in parallel.

D. Two 1 Ω resistors in parallel. (2)

[10]

QUESTION 2 (Start on a new page.)

2.1 Consider the wave below. The wavelength is 2 m.



2.1.1 Identify the type of wave represented here. (1)

2.1.2 How many wavelengths are there from point A to point E? (1)

2.1.3 Write down two points that are IN PHASE with each other. (1)

2.1.4 What is the distance between point A and point D? (2)

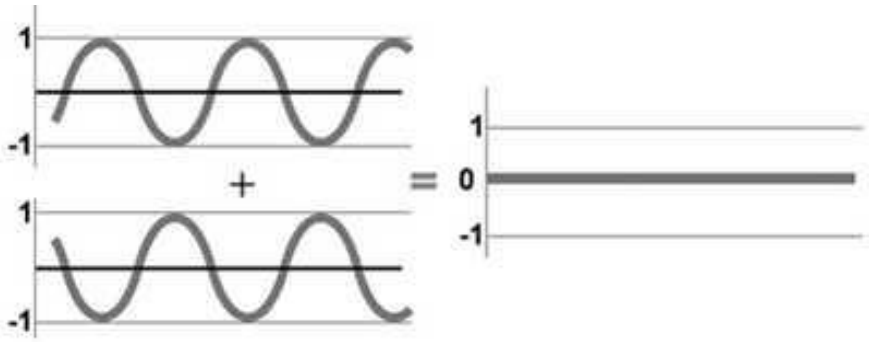
Point A in the wave above moves a distance of 20 m in a time of 10 seconds.

Calculate the:

2.1.6 Frequency of the wave. (3)

2.1.7 Period of the wave. (3)

2.2 Consider the event below that occurs when two waves undergo interference.



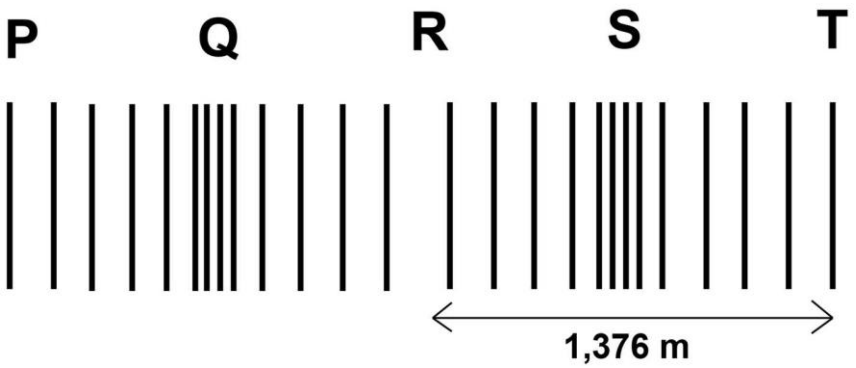
2.2.1 Name the type of interference demonstrated here. (1)

2.2.2 What is the amplitude of the resulting wave? (1)

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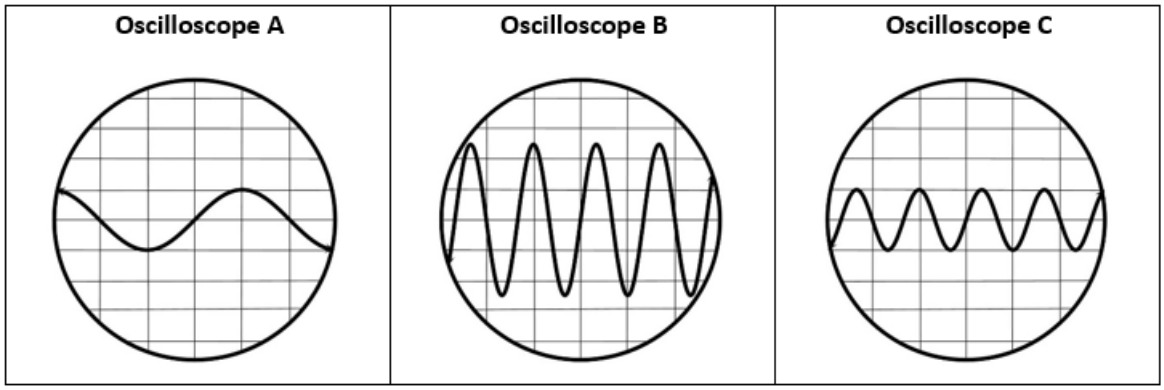
QUESTION 3 (Start on a new page.)

The following pattern of a sound wave, associated with human speech, has a frequency of 500 Hz.



3.1 Calculate the speed of this sound wave. (3)

3.2 Consider the three diagrams illustrating different sound waves on oscilloscopes.



3.2.1 Which oscilloscope (A, B or C) illustrates the loudest sound? (1)

3.2.2 Which oscilloscope (A, B or C) illustrates the lowest pitch? (1)

3.2.3 Which two oscilloscopes show sound waves with equal periods? (1)

[6]

QUESTION 4 (Start on a new page.)

When food is heated in a microwave oven, the microwaves cause the water molecule in the food to vibrate at $2{,}45 \times 10^9$ times per second.

4.1 If the speed of an electromagnetic wave is 3×10^8 m.s^{-1}, determine the wavelength of the waves. (4)

4.2 Determine the energy of a photon of the electromagnetic wave. (4)

4.3 Name two other uses of microwaves apart from cooking purposes. (2)

[10]

QUESTION 5 (Start on a new page.)

Consider two identical conducting spheres, ***A*** and ***B***, on insulated stands.
Sphere ***A*** contains $3{,}75 \times 10^{10}$ electrons in excess, while sphere ***B*** has a net charge of +9 nC.
[1 nC = 1×10^{-9} C]



5.1 What type of charge does sphere ***A*** possess? (1)

5.2 Calculate the net charge on sphere ***A***. Express your answer in **nC**. (4)

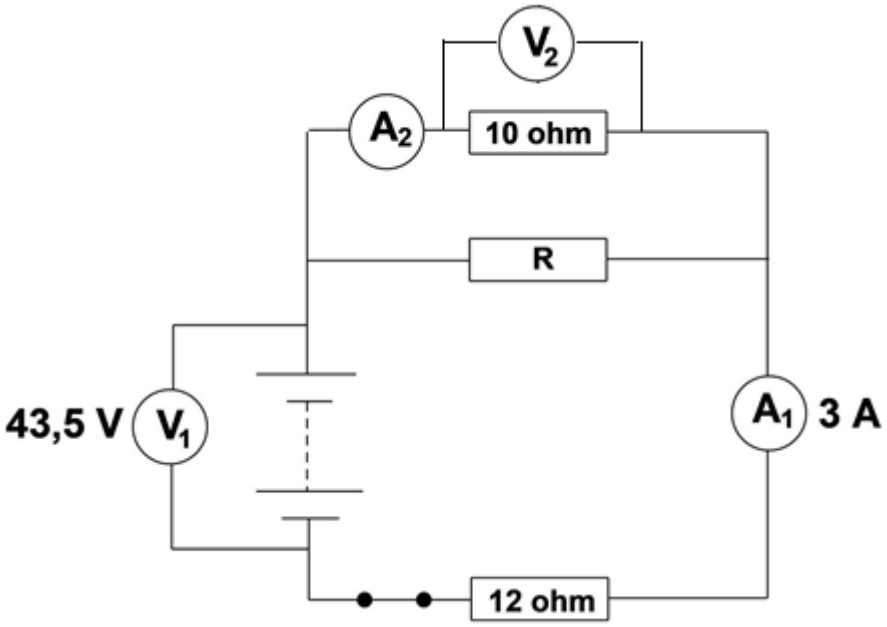
5.3 What type of force exists between the two conducting spheres, attractive or repulsive? Explain your answer. (2)

5.4 State the principle of quantization of charge. (2)

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QUESTION 6 (Start on a new page.)

Use the circuit diagram below to answer the questions that follow.



6.1 Define *current.* (2)

6.2 Calculate the:

6.2.1 Reading on voltmeter $\mathbf{V_2}$**.** (4)

6.2.2 Reading on ammeter $\mathbf{A_2}$**.** (2)

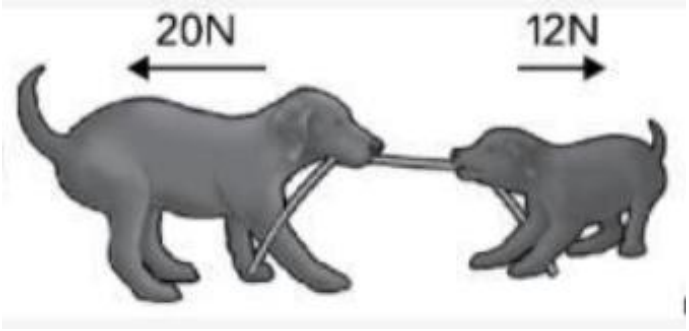
6.2.2 Resistance of resistor ***R***. (4)

6.3 How will the reading on the voltmeter change if resistor ***R*** burns out? Give a reason for your answer. (3)

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QUESTION 7

A larger dog and a smaller dog play tug of war with a rope.



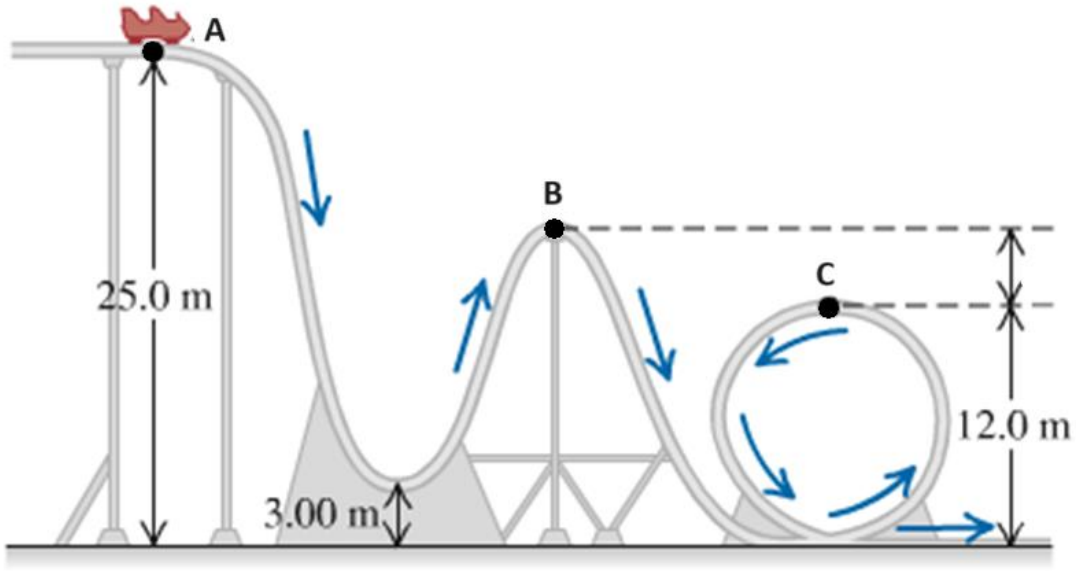
7.1. Define the term *resultant vector.* (2)

7.2 Show the resultant force by means of a vector diagram. (3)

[5]

QUESTION 8 (Start on a new page.)

A 350kg rollercoaster starts from rest at point A and slides down a frictionless loop-the-loop.



8.1 State the *Law of Conservation of Mechanical Energy.* (2)

8.2 Calculate the gravitational potential energy of the rollercoaster at **Point A**. (3)

8.3 What is the overall mechanical energy of the system? (1)

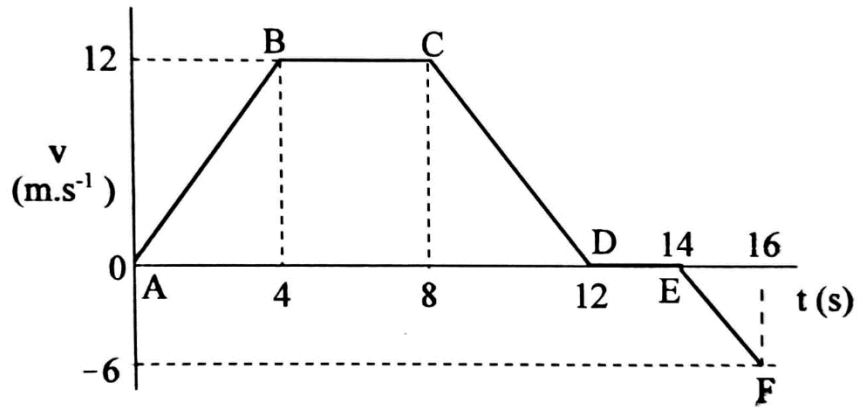
8.4 Use your knowledge of the conservation of mechanical energy to calculate the velocity of the rollercoaster car at **Point C.** (4)

8.5 An 80kg person now gets into the rollercoaster car. How will this affect the mechanical energy of the system?
Write only INCREASE, DECREASE, or STAYS THE SAME. (1)

[11]

QUESTION 9 (start on a new page)

A velocity time graph is shown below. Study the graph and answer the questions that follow.



9.1 Describe what an observer watching the motion of the car would see over the 16s. (5)

9.2 Define *acceleration.* (2)

9.3 Calculate the acceleration of the car between **Point C** and **Point D.** (4)

Later on, the same car is driving at 100km.h^{-1} North on a straight road when he sees a cow 60m ahead of him. The motorist's reaction time is 0,7s. The acceleration is - 8m.s^{-2}. Calculate the:

9.4 Distance travelled during the reaction time. (3)

9.5 The distance the car will travel before coming to a complete stop from the moment he first sees the cow. (4)

9.6 The time taken to come to a stop from the time he presses on the brake. (3)

[21]

TOTAL: 100 MARKS

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J·s
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2} mv^2$ or/*of* $E_k = \frac{1}{2} mv^2$

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{Q}$