Bergvliet High School

GRADE 10

Physical Science
PAPER 1
5 November 2024

MARKS: 100
TIME: 2 hours
EXAMINER: T Abrahams
MODERATOR/S: Z Booysen, K Stuck, S Van Harte

This question paper consists of 9 pages and 2 data sheets.
Detach this sheet and attach it to the front of your answer sheets.

Name: MEMORANDUM Teacher: Ab /Bo / St/Vh

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

INSTRUCTIONS

1. Write your **NAME** and science teacher code (**Bo/St/Vh**) in the appropriate space on the Cover Page and all scripts handed in.
2. The question paper consists of 8 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 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.

Answer Sheet

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

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

Question 1 Multiple choice questions

Four options are provided as possible answers to the following questions. Each question has only **ONE** correct answer. Choose the answer and make a **cross (X)** in the block on the **ANSWER SHEET** next to the question number (1.1-1.5).

1.1 The maximum displacement of a particle from its equilibrium position is …

A. Period
B. Amplitude ✓✓
C. Wavelength
D. Frequency

(2)

1.2 What is the frequency of a sound wave traveling at 340 $m.s^{-1}$, with a wavelength of 60 cm?

A. 566,67 Hz ✓✓
B. 5,67 Hz
C. 204 Hz
D. 20 400 Hz

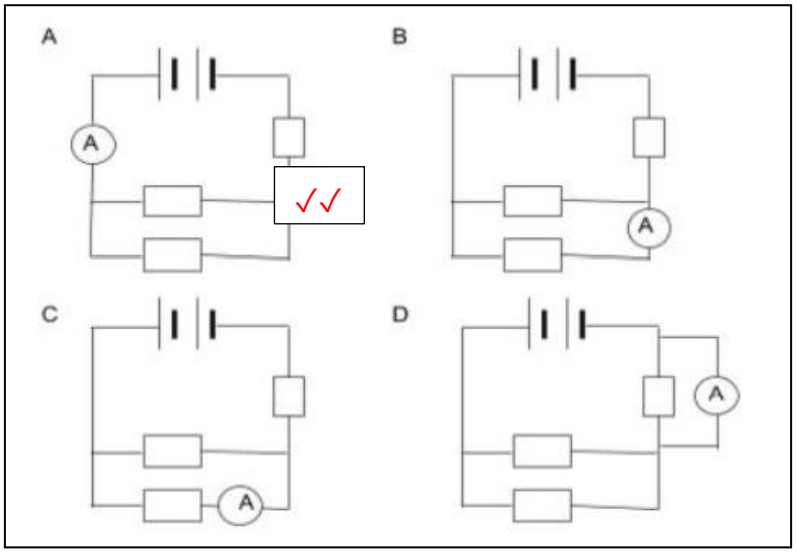
(2)

1.3 Which one of the following types of electromagnetic waves has the LONGEST wavelength?

A. Gamma rays
B. Ultraviolet rays
C. Microwaves ✓✓
D. X rays

(2)

1.4 In which one of the following circuit diagrams is the ammeter connected **correctly** so that it measures the TOTAL current in the circuit?



(2)

1.5 Which quantity can be derived from the gradient of a Position vs time graph?

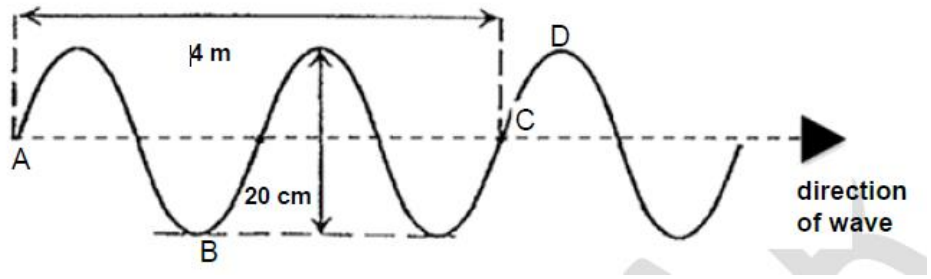
A. Acceleration
B. Distance
C. Displacement
D. Velocity✓✓

(2)

[10]

Question 2 (Start question on new page)

The diagram below represents a transverse wave with the frequency of 1,5 Hz moving from left to right.



2.1 Define a *transverse wave.* (2)

A transverse wave is a wave in which the particles of the medium vibrate at right angles to the direction of the motion of the wave. ✓✓

2.2 Determine the:

2.2.1 Amplitude of the wave in meter (3)

Amplitude = 0,5(20) ✓

= 10 cm ✓

= 0,1 m ✓

2.2.2 Wavelengh (2)

Wavelength = ½ (4) ✓

= 2 m ✓

2.2.3 Amount of complete waves. (1)

3 ✓

2.3 Calculate:

2.3.1 The period of the wave (3)

T = 1/f ✓

= 1/1,5 ✓

= 0,67 s ✓

2.3.2 The speed of the wave

v = f. λ ✓

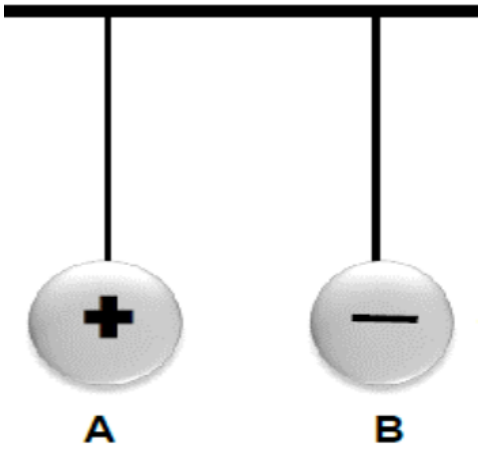
= (1,5)(2) ✓

= 3 $m.s^{-1}$ ✓ (3)

[13]

Question 3

Two small, identical spheres A and B are suspended on long strings, as shown in the diagram below. The spheres carry charges of +5 x10^{-9} C and -2 x10^{-9} C respectively.



3.1 State the *Principle of Conservation of Charge.*

The principle of conservation of charge states that the net charge of an isolated system remains constant during any physical process.✓✓ (2)

3.2 The two spheres are brought into contact and then separated again. Which sphere, A or B, will gain electrons? Motivate the answer.

A ✓ Electrons move from the negative sphere to the positive sphere. ✓ or B has excess number of electrons or A has deficiet number of electrons (2)

3.3 Calculate the:

3.3.1 Charge on each sphere after contact (3)

$Q = \frac{Q1+Q2}{2}$ ✓

$= \frac{5X10^{-9}+(-2X10^{-9})}{2}$ ✓

$= + 1,5 \times 10^{-9}$ C ✓

3.3.2 The amount of charge being transferred. (2)

Difference in net charge on B= QFinal- Qinitial

$= +1.5x10^{-9} - (-2x10^{-9})$ ✓

$=3.5x10^{-9}$ ✓

3.3.3 Number of electrons transferred during contact on **SPHERE B.** (3)

$n = \frac{\Delta Q}{e}$ ✓

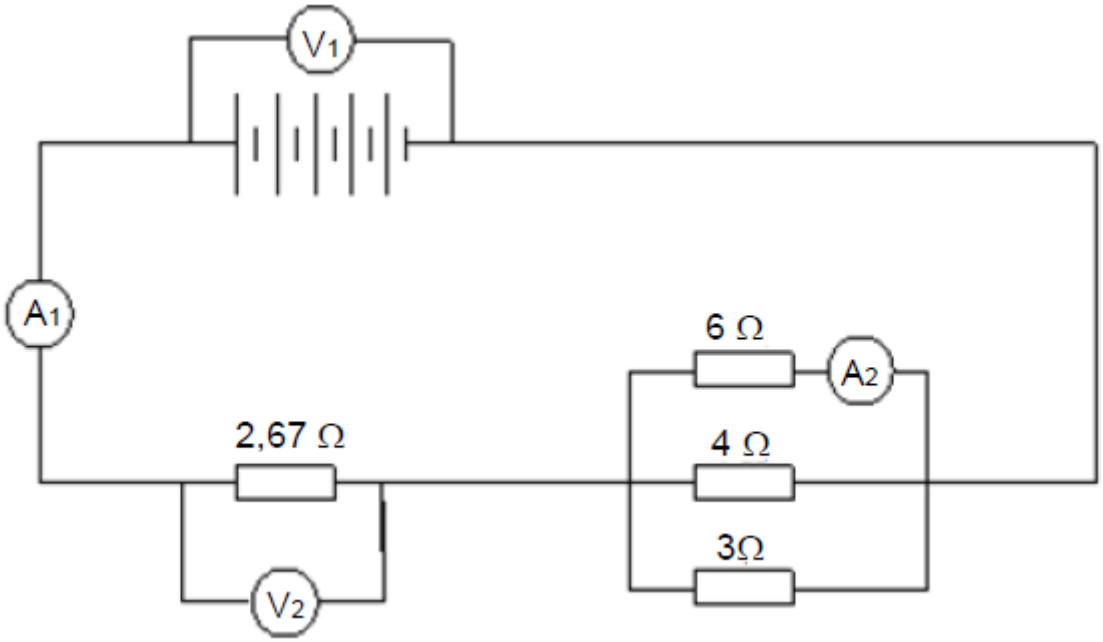
$= \frac{3.5x10^{-9}}{1.6x10^{-9}}$

$= 2,19 \times 10^{10}$ electrons ✓

[12]

Question 4 (Start question on new page)

In the circuit diagram below, each cell has a voltage of 1,5 V. Use the diagram to answer the questions that follow.



4.1 Define the term e*mf*

The work performed per unit charge by the battery✓✓ (2)

4.2 What is the reading on V_1?

V1= 5 x 1.5 ✓

7,5 V ✓

(2)

4.3 Calculate the following:

4.3.1 Total resistance of the circuit

$\frac{1}{Rp} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$ ✓

$= \frac{1}{6} + \frac{1}{4} + \frac{1}{3}$ ✓

Rp = 1,3 Ω

R_T = Rs + Rp

R_T = 2,67 + 1,3 ✓

R_T = 3,97 Ω ✓

(4)

4.3.2 Reading on A_1

$I = \frac{V}{R}$ ✓

$I = \frac{7.5}{3.97}$ ✓

$I = 1{,}88\ A$ ✓

(3)

4.3.3 The reading on V_2

$I = \frac{V}{R}$ ✓

$1.88 = \frac{V}{2.67}$ ✓

$V = 5{,}01\ V$ ✓

(3)

4.4 Determine the magnitude of the charge that flows through A1 in 6 minutes

$Q = I.\ \Delta t$ ✓

$= 1.88\ (360)$ ✓

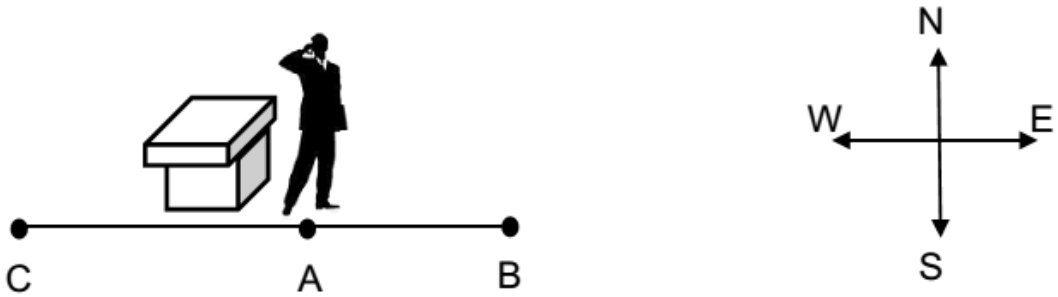
$= Q = 676{,}8\ C$ ✓

(3)

[17]

Question 5 (Start on New page)

An impatient businessman paces up and down while making a business call on his cell phone.



He starts at his desk and walks 5 m east (from A to B) and then walks 7 m west (from B to C). This process takes him 20 s.

5.1 Determine the:

5.1.1 The total distance that the businessman paces. (2)

12 m ✓✓

5.1.2 The businessman's displacement at C relative to A. (2)

2 m ✓west ✓

5.2 Use a vector scale diagram and represent the two displacements of the man (from A to B AND from B to C). Label ALL the vectors clearly and write down the displacements next to the vectors.

Use a scale of 1 cm representing 1 m for your diagram.



5m = 5 cm and facing correct direction. ✓

7 m = 7cm and facing the correct direction. ✓

(2)

5.4 Calculate the man's average velocity

$v = \frac{\Delta x}{\Delta t}$ ✓

$v = \frac{-2}{20}$ ✓

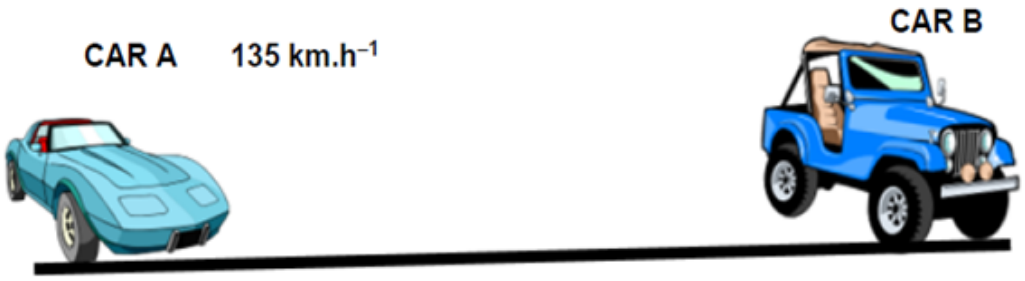
$v = 0{,}1\ m.s^{-1}$ ✓west ✓

(4)

[10]

Question 6 (Start question on new page)

Car A driving at 135 km.h^{-1} approaches a stationery car B. The driver of car B noticed that car A is approaching him at a very high speed. The driver of car B reacted suddenly by accelerating his car from rest at 1,5 m·s^{-2} for 11,5 s. After 11,5 s car B continued driving.



6.1 Convert 135 km.h^{-1} to m·s^{-1}.

$\frac{135km^{-1}}{3.6}$ ✓

$37,5\ m{\cdot}s^{-1}$ ✓

(2)

6.2 Determine the magnitude of velocity of car B after 11.5 seconds.

$v_f = v_i + a\Delta t$ ✓

$= 0$ ✓ $+ (1,5)(11,5)$ ✓

$= 17,25\ m{\cdot}s^{-1}$ ✓

(4)

6.3 How far has car B driven after 11,5 seconds?

$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$= 0$ ✓ $(11.5) + \frac{1}{2}(1,5)(11,5)^2$ ✓

$= 99,19\ m$ ✓

(4)

6.4 The driver of car A suddenly hit the brakes and managed to stop after 40 m. What acceleration does car A experience to come to a standstill after 4 seconds?

$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$40 = (37,5)(4)$ ✓ $+ \frac{1}{2}(a)(4)^2$ ✓

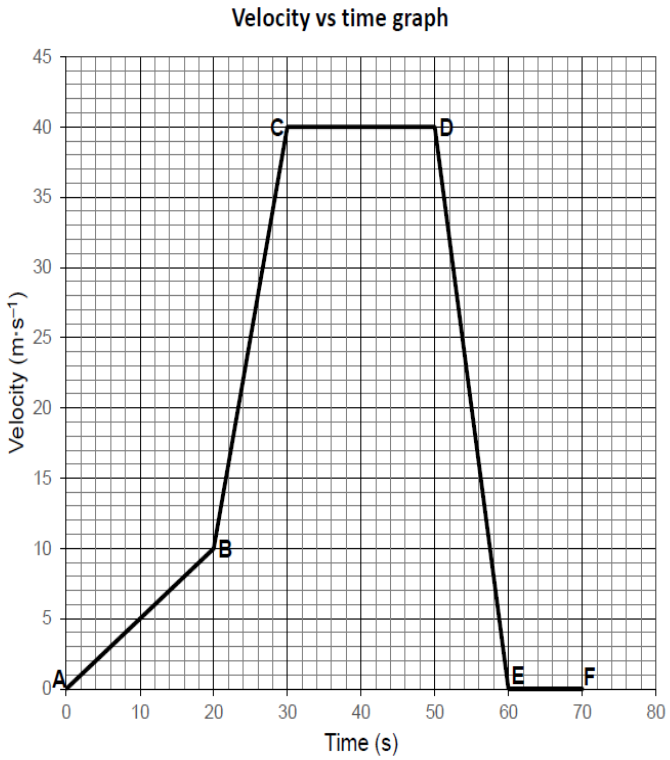
$a = -13,75\ m{\cdot}s^{-2}$ ✓

(4)

[14]

Question 7 (Start on New page)

Study the velocity versus time graph below for the motion of a car travelling east.



7.1 Define the term acceleration.

The rate of change in velocity. ✓✓

OR

The change in velocity per unit time. ✓✓

(2)

7.2 Use the graph to describe the motion of the car in the following sections

7.2.1 **AB**

The car starts from rest and velocity increases to 10 m·s⁻1 in 20 seconds. ✓

(1)

7.2.2 **CD**

Velocity is constant (uniform). ✓

(1)

7.2.3 **EF**

Car has stopped. ✓

(1)

7.3 Without using equations of motion,Calculate:

7.3.1 The displacement of the car between A and B.

$\Delta x = area\ \Delta$ ✓

$=\frac{1}{2}$ (10 X 20) ✓

= 100 m eastwards ✓ only award mark if direction indicated.

(3)

7.3.2 The acceleration of the car between D and E.

$a=\frac{\Delta v}{\Delta t}$ ✓

$=\frac{0-40}{60-50}$ ✓

$= -4\ m.s^{-2}$ ✓

or

$= 4\ m{\cdot}s^{-2}$, in the opposite direction or west (deceleration in opposite direction) ✓

(3)

7.4 In which section, AB or BC, is the acceleration of the car the greatest? Give a reason for your answer

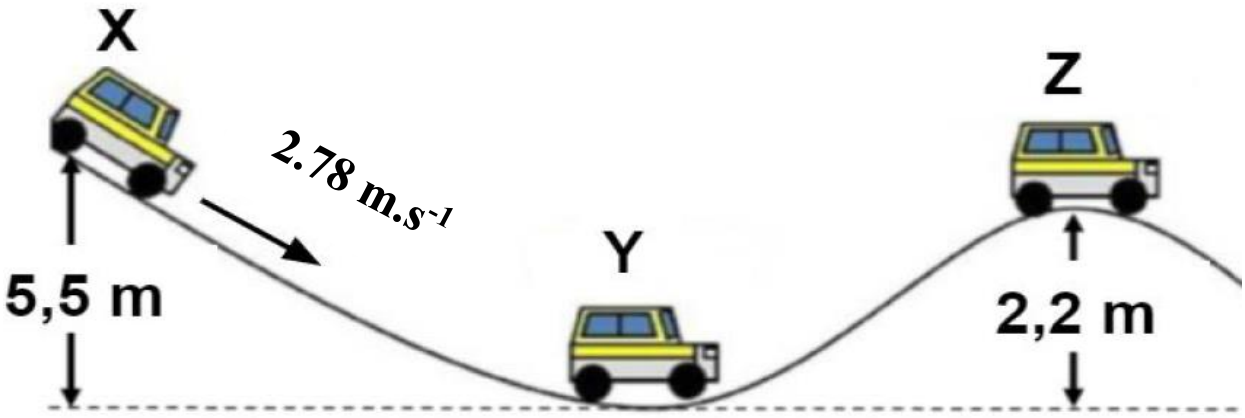
BC ✓, Steeper slope. ✓

(2)

[13]

Question 8 (Start on New page)

A toy car with mass 0,85kg moves along a smooth frictionless track as shown in the diagram. At position **X**, 5,5m above the ground, it is travelling at a speed of 2.78 $m.s^{-1}$ and travels through point **Y** to **Z** along the track. Use the diagram to answer the questions that follow:



8.1 State in words the *Principle of Conservation of Mechanical Energy*.

The total energy in an isolated system is constant✓✓

(2)

8.2 At which position (**X**, **Y**, or **Z**) is the car having the greatest gravitational potential energy? Give a reason for your answer.

X✓It has the greatest height(higher position) ✓

(2)

8.3 Calculate the kinetic energy at point X?

$E_k = 1/2\ mv^2$ ✓

$= 1/2 \times 0,85 \times 2,78^2$✓

$= 3,28J$✓

(3)

8.4 Using the Principle of Conservation of Mechanical Energy, Calculate the velocity as it reaches point **Y.**

$E_{top} = E_{bottom}$

$(mgh + 1/2\ mv^2)_X = (mgh + 1/2mv^2)_Y$ ✓

$45,82 + 3,28 = 0 + 1/2 \times 0,85v^2$ ✓

$49,1 = 0,425v^2$✓

$V = \sqrt{\frac{49.1}{0,425}} = 10,75\ m.s^{-1}$✓

(4)

[11]

TABLE:

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

FORMULA:

MOTION/BEWEGING

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

WORK, ENERGY AND POWER/ARBEID, ENERGIE EN DRYWING

$U = mgh$ of/or $E_p = mgh$	$K = \frac{1}{2} mv^2$ of/or $E_k = \frac{1}{2} mv_2$
$E_M = E_k + E_p$ of/or $E_M = U + K$	

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

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

ELECTROSTATICS/ELEKTROSTATIKA

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

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