LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

MOPANI WEST

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES CONTROLLED TEST 2

14 SEPTEMBER 2023

MARKS: 100

TIME: 2 hours

This question paper consists of 12 pages WITH data sheets

INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate space on the ANSWER BOOK.
2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.
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. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, et cetera where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

1.1 Which ONE of the following physical quantities is a scalar quantity?

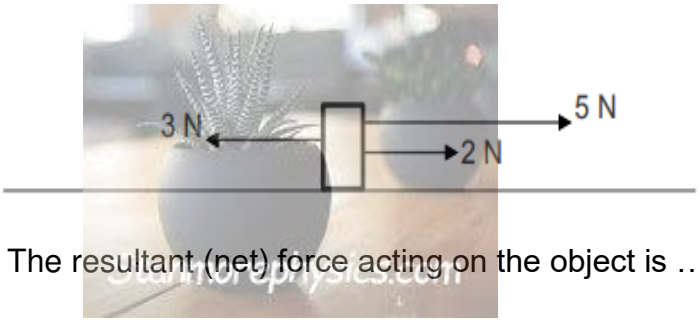
A A weight of 5N

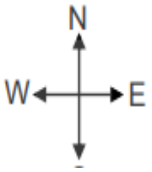
B A velocity of 10m.s^{-1} east

C A current of 2A

D A negative of 0, 4 m.s^{-2} (2)

1.2 Three forces act simultaneously on an object, as shown below.





The resultant (net) force acting on the object is …

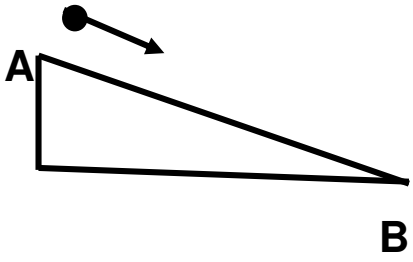
A 10 N west

B 4 N west

C 10 east

D 4 N east (2)

1.3 An object of mass, m , is released from rest from the top of a frictionless inclined plane, AB, as shown below



Which one of the following is correct regarding the total mechanical energy of the object?

A $(E_p + E_k)_A > (E_p + E_k)_B$

B $(E_p + E_k)_A < E_p + E_k)_B$

C $(E_p + E_k)_A = (E_p + E_k)_B$

D $(E_p + E_k)_A = -(E_p + E_k)_B$ (2)

1.4 A car is travelling at a speed of 30m.s^{-1} on a straight road. What would be the speed of the car in km.h^{-1}

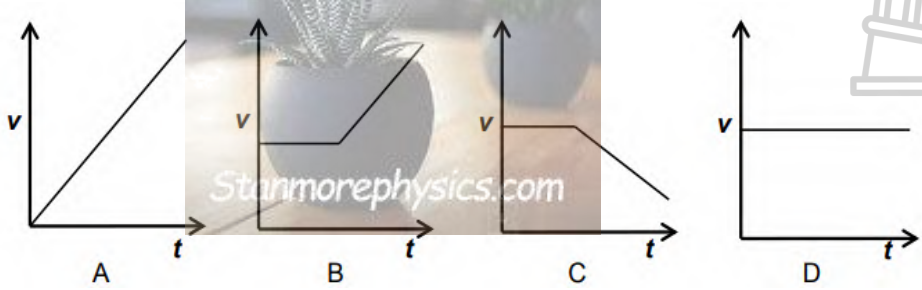
A 8,33 km.h^{-1}

B 30 km.h^{-1}

C 108 km.h^{-1}

D 130 km.h^{-1}

1.5 A car is travelling at a constant velocity a long a straight road. It then slows down uniformly. Which ONE of the velocity – time graphs below best represents the motion of the car?



(2)

(2)

1.6 There are … atoms of Hydrogen in 2 moles of NH_3.

A 5×10^{23}

B $3,1 \times 10^{24}$

C $3,61 \times 10^{24}$

D 4×10^{23} (2)

1.7 Which ONE of the following molecular mass represents Hydrogen Chloride?

A 57,5

B 35,5

C 36,5

D 40,5 (2)

1.8 Study the equation below: $H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

Which ONE of the statements below is CORRECT?

A 2 molecules of hydrogen gas react with 1 atom of Oxygen gas to form 2 atoms of water vapour

B 2 moles of Hydrogen gas react with 1 mole of Oxygen gas to form 2 moles of water vapour

C 4 atoms of Hydrogen gas react with 2 molecules of Oxygen gas to form 2molles of water vapour

D 4g of Hydrogen gas react with 16g of Oxygen gas to form 18 of water vapour (2)

1.9 Avogradros number is equal to the number of …

A atoms in 1 mole CO
B atoms in 1 mole Br_2
C molecules in 1 mole Au
D molecules in 1 mole N_2 (2)

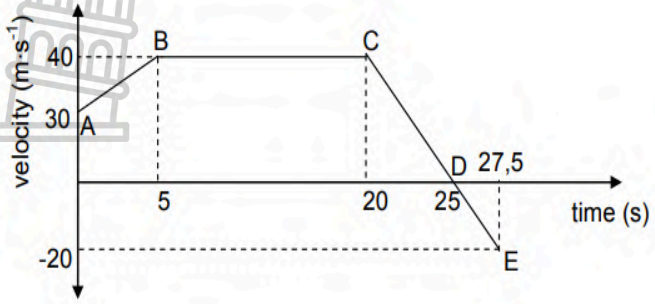
1.10 The percentage of Hydrogen in C_2H_4 is …

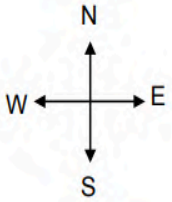
A 4 %
B 85, 71 %
C 66, 67 %
D 14,29% (2)

[20]

QUESTION 2

The velocity versus time graph for a racing car moving eastwards, is shown below





2.1 Write down the initial velocity of the car. (2)

2.2 Write down the speed of the car at time t = 10s (2)

2.3 Describe the motion of the car for the section labelled CD
(2)

2.4 Support the answer to QUESTION 2.3 above by calculating the acceleration for section CD (5)

2.5 Without any calculation, compare the magnitude of the acceleration of the car in part DE with that of part CD of the journey. Write only GREATER THAN, LESS THAN, or EQUAL TO.
Give a reason for the answer. (2)

2.6 Determine the total displacement for the motion of the car (7)

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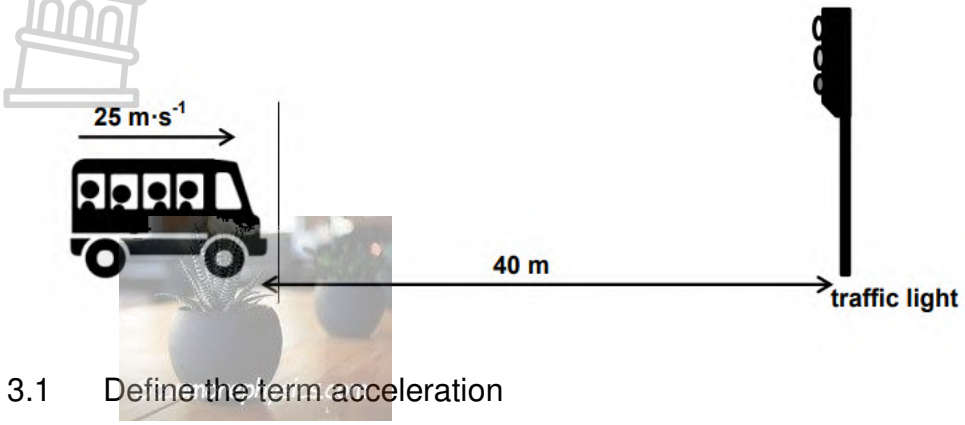
QUESTION 3

A taxi is travelling at a speed of 25 m.s^{-1}when a traffic light, 40 m ahead, changes to red



3.1 Define the term acceleration (2)

The driver takes 1 s to react (reaction time) before he slams on the brakes. The taxi then stops within 2s.

3.2 Is the velocity and acceleration of the braking taxi in the SAME DIRECTION as it moves towards the traffic light? (1)

3.3 Give a reason for the answer to QUESTION 3.2 (1)

3.4 Calculate the distance the taxi travels during the reaction time (4)

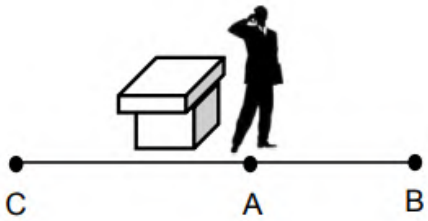
3.5 Will the taxi stop at the traffic light? Show ALL calculations (5)

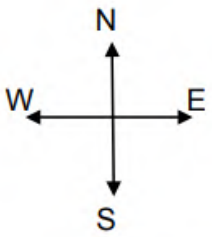
3.6 Draw a position versus time graph for the motion of the taxi. (4)

[17]

QUESTION 4

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





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

4.1 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 1m for your diagram (3)

4.2 What is the businessman's change in position at C relative to A? (2)

4.3 Calculate the total distance the man covers. (3)

4.4 Explain why the value calculated in QUESTION 4.2 differs from the one calculated in QUESTION 4.3 (2)

4.5 Define the term velocity. (2)

4,6 Calculate the man's average velocity. (5)

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QUESTION 5

5.1 The reaction between magnesium and dilute hydrochloric acid is represented by the balanced equation below.

$Mg(s) + 2HCl\ (aq) \rightarrow MgCl_2(aq) + H_2(g)$

During an experiment, 1.5 g of magnesium reacts with excess dilute hydrochloric acid to produce hydrogen gas at STP.

Calculate the:

5.1.1 Mass (in gram) of hydrogen gas produced. (6)

5.1.2 Volume (in dm^3) of hydrogen gas produced at STP (4)

5.1.3 Mass (in gram) of $MgCl_2$ produced (3)

5.1.4 Number of chlorine atoms present in the $MgCl_2$ produced (5)

5.2 The empirical formula of a certain compound is to be determined. On analysis of a sample of the compound it was found to contain 71,65% Cl, 24,27% C and 4,07% H.

5.2.1 Define the term empirical formula (2)

5.2.2 Determine the empirical formula of the compound. Show ALL calculations (6)

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DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	G	$9{,}8\ m{\cdot}s^{-2}$
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	$6{,}63 \times 10^{-34}\ J{\cdot}s$
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* $E_k = \frac{1}{2}mv^2$

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3{\cdot}mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 **H** 1																	**He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

Ce 140	**Pr** 141	**Nd** 144	**Pm**	**Sm** 150	**Eu** 152	**Gd** 157	**Tb** 159	**Dy** 163	**Ho** 165	**Er** 167	**Tm** 169	**Yb** 173	**Lu** 175
Th 232	**Pa**	**U** 238	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**

KEY/*SLEUTEL*

Atomic number *Atoomgetal*

Electronegativity *Elektronegatiwiteit*

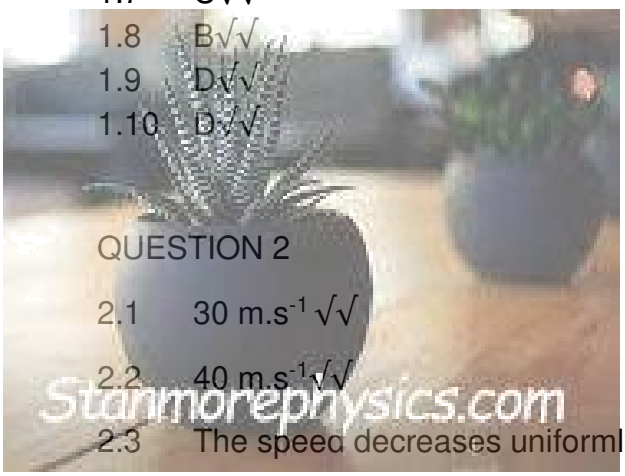
29 **Cu** 63,5 (1,9)

Symbol *Simbool*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

Grade 10 test term 3 MEMO

1.1 A √√
1.2 C√√
1.3 C√√
1.4 C√√
1.5 C√√
1.6 C√√
1.7 C√√
1.8 B√√
1.9 D√√
1.10 D√√ **[20]**



QUESTION 2

2.1 30 m.s^{-1} √√

2.2 40 m.s^{-1} √√

2.3 The speed decreases uniformly (from 40 m.s^{-1} to 0 m.s^{-1})

Or

The car slows down √and finally stops√

2.4 $a = \frac{\Delta y}{\Delta x}$ √

$= \frac{(0)-40}{25-20}$ √√

= - 8 m.s^{-2}√

2.5 Equal to√ / same gradient√

2.6 OPTION 1

Displacement = Area under the v/t graph

=(A trapezium + A rectangle + A triangle) – A triangle 2

= $^1/_2$(20 + 15)(10) √ + (30 x 20) √ + $^1/_2$(5 x 40) √ - $^1/_2$ (2,5 x 20) √

= 850 m√ east√

OR

Displacement = Area under the v/t graph

=(A trapezium + A rectangle + A triangle) – A triangle 2

$= {}^{1}/_{2}(40 + 30)(5)\surd + (15 \times 40)\surd + {}^{1}/_{2}(5 \times 40)\surd - {}^{1}/_{2}(2{,}5 \times 20)\surd$

= 850 m√ east√

QUESTION 3

3.1 Acceleration is the rate of change of velocity

OR

Acceleration is the change in velocity per unit time

3.2 No

3.3 Velocity to the right, acceleration to the left

OR

Taxi slowing down so <u>acceleration is in opposite direction to movement</u>.

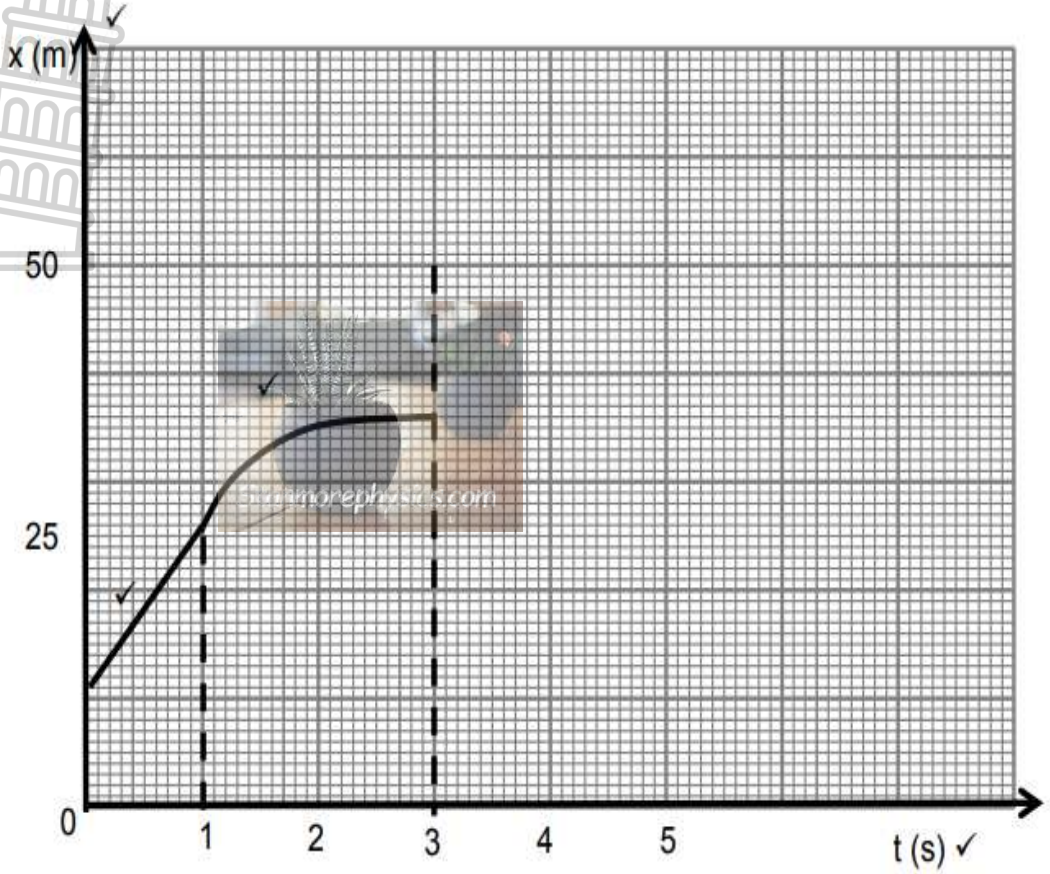
3.4

OPTION 1	OPTION 2
$\Delta X = Vit + {}^{1}/_{2}\, a\Delta t^2\surd$ $= 25 \times 1\surd + {}^{1}/_{2} \times 0 \times 1^2\surd$ $= 25\ m\surd$	$\Delta x = \frac{(vf - vi)}{2}\Delta t\surd$ $= \frac{25+25}{2}\surd x\ 1\surd$ $= 25m\surd$
OPTION 3	
$\Delta x = \frac{\Delta x}{\Delta t}\surd$ $25\surd = \frac{\Delta x}{1}\surd$ $\Delta x = 25\ m\surd$	(4)

3.5 POSITIVE MARKING FROM 3.4

$\Delta x = \frac{(vf - vi)}{2}\Delta t\surd$ $= \frac{0+25}{2}$ x 2√ = 25m ∴ total distance = 25 + 25√ = 50m√ Taxi will not stop at the traffic light as distance > 40m√	Vf = vi + a Δt $= \frac{0-25}{2}$ = - 12,5 m.s^{-2} Vf^2 = vi^2 + 2aΔx 0 = 25^2+ 2 x -12,5 x Δx ∴ total distance = 25 + 25√ = 50m√ Taxi will not stop at the traffic light as distance > 40m√
Option 3 Vf = vi + a Δt√ $= \frac{0-25}{2}\surd$ = - 12,5 m.s^{-2} ΔX = Vit + $^1/_2$ aΔt^2 = 25 x2 + $^1/_2$ x – 12,5 x 2^2√ = 25 m ∴ total distance = 25 + 25 = 50m√ Taxi will not stop at the traffic light as distance > 40m√	(5)

3.6.



MARKING GUIDELINES/*NASIENRIGLYNE*

✓ Both axes correctly labelled

Beide asse korrek benoem

✓ Straight line (t =0 s and t = 1 s)

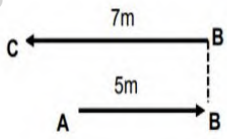
Reguitlyn (t =0 s en t = 1 s)

✓✓Curve shape (t = 1 s and t = 3)

Kurwe (t =1 s en t = 3)

(4)

QUESTION 4



Mark allocation/*Puntetoekenning*:

✓ 1 x line AB: length, arrow, label
1 x lyn AB: lengte, rigting, benoem
✓ 1 x line BC: length, arrow, label
1 x lyn BC: lengte, rigting, benoem

4.1 √√√ (3)

4.2 2m√ to the left√ (2)

4.3 Total distance = 5 + 7√√

= 12 m√ (3)

4.4 For the total distance, the whole path length travelled is considered√.

For change in position, only the original position and final position of the man are considered. √ (2)

4.5 Velocity is the rate of change of displacement√√ (2)

4.6 $V = \frac{\Delta x}{\Delta t}$√

$=\frac{2}{20}$√√

0,1m.s^{-1}√ west /left√ (5)

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QUESTION 5

5.1.1 $n(Mg) = \frac{m}{M}$

$= \frac{1,5}{24}$

$= 0,0625$ mol

$n(H_2) = nMg = 0,0625mol$

$m(H_2) = nM$

$= (0,0625)(2)$

$= 0,125g$

5.1.2 $n(H_2) = \frac{v}{Vm}$

$0,0625 = \frac{v}{22,4}$

$V = 1,4\ dm^{-3}$

5.1.3 $n(MgCl_2) = \frac{m}{M}$

$0,0625 = \frac{m}{95}$

$M = 5,95g$

5.1.4 $n(Cl) = \frac{n}{NA}$

$2(0,0625) = \frac{n}{6.02\ x\ 10}23$

$N(Cl) = 7,53 \times 10^{22}$

5.2.1 The formula which gives the simplest whole number ratio in the compound.

5.2.2 In 100g of compound

71,65g Cl, 24,27 g C and 4,07 g H

$n(Cl) = \frac{71,65}{35,5} = 2,02$ mol

$n(Cl) = \frac{24,27}{12} = 2,02$ mol

$n(Cl) = \frac{4,07}{1,} = 4,07$ mol

Whole number ratio

$$\frac{2,02}{2,02} = \frac{2,02}{2,02} = \frac{4,07}{2,02}$$

C : Cl:H = 1 : 2 : 1

Empirical formula is CH_2Cl