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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

PHYSICAL SCIENCES

MARCH 2026

MARKS: 100

TIME: 2 hours

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This question paper consists of 11 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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.
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 subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answer to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.7) in the ANSWER BOOK, e.g. 1.8 E.

1.1 The physical quantity which is a quantitative measure of the resistance of an object to any change in its state of rest or motion is called …

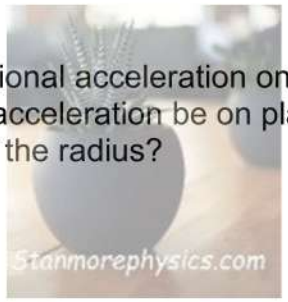
A weight.

B acceleration.

C mass.

D friction. (2)

1.2 The magnitude of the gravitational acceleration on Earth is g. What will the value of the gravitational acceleration be on planet X, which has the same mass as Earth, but half the radius?



A $\frac{1}{4}g$

B $\frac{1}{2}g$

C $2g$

D $4g$ (2)

1.3 Which one of the following best describes an inelastic collision?

A Both momentum and kinetic energy are conserved.

B Total kinetic energy is not conserved but total linear momentum is conserved.

C Neither kinetic energy nor momentum are conserved.

D Kinetic energy is conserved but total linear momentum is not conserved. (2)

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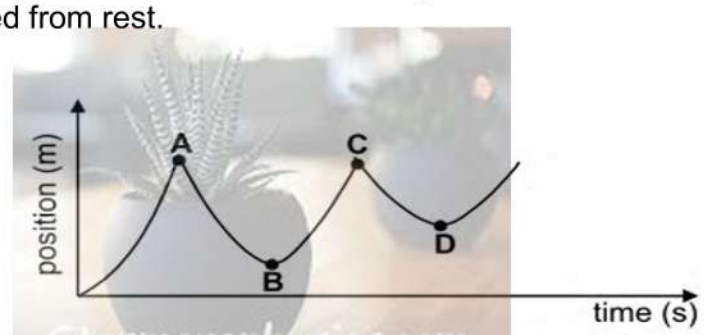
1.4 A ball is released from rest from a certain height above the floor and bounces off the floor several times. The position-time graph below represents the motion of the bouncing ball from the instant it was released from rest.



Neglecting air resistance, which point (**A**, **B**, **C** or **D**) on the graph represents the position-time coordinates of the maximum height reached by the ball after the SECOND bounce?

A A

B B

C C

D D (2)

1.5 Which ONE of the following pairs of compounds are FUNCTIONAL isomers?

A Methanol and methanal

B Butane and 2-methylpropane

C Propan-1-ol and propan-2-ol

D Propanoic acid and methyl ethanoate (2)

1.6 Which ONE of the following compounds has the HIGHEST vapour pressure?

A Ethanal

B Ethane

C Ethanol

D Ethanoic acid (2)

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1.7 When 2-chlorobutane is strongly heated in the presence of concentrated sodium hydroxide, the major product formed is …

A but-1-ene.

B butan-1-ol.

C but-2-ene.

D butan-2-ol. (2)

[14]

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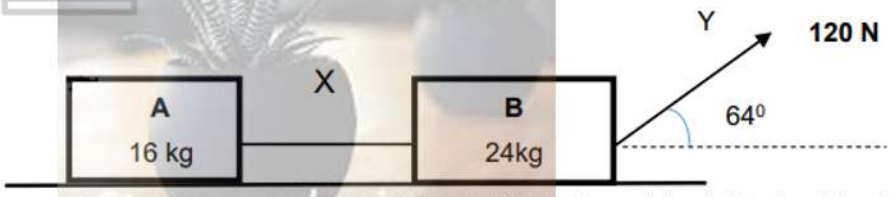
QUESTION 2

A worker, at a construction site, pulls two blocks A and B of masses 16 kg and 24 kg respectively across a rough horizontal surface by means of a light inextensible rope, Y at an angle of 64 ° to the horizontal. The 16 kg and 24 kg blocks experiences frictional force of 3,2 N and 4,3 N, respectively.



The worker exerts a constant force of 120 N on block B. the blocks are joined by a light bar X, the masses of rope Y and bar X are negligible.

2.1 State Newton's Second Law of Motion in words. (2)

2.2 Draw a labelled free-body diagram showing ALL the forces acting on the 24 kg block. (5)

2.3 **Calculate the magnitude of**:

2.3.1 The normal force on block B (2)

2.3.2 Coefficient of kinetic friction on block B (4)

2.4 Determine the magnitude of the tension in bar X (6)
[19]

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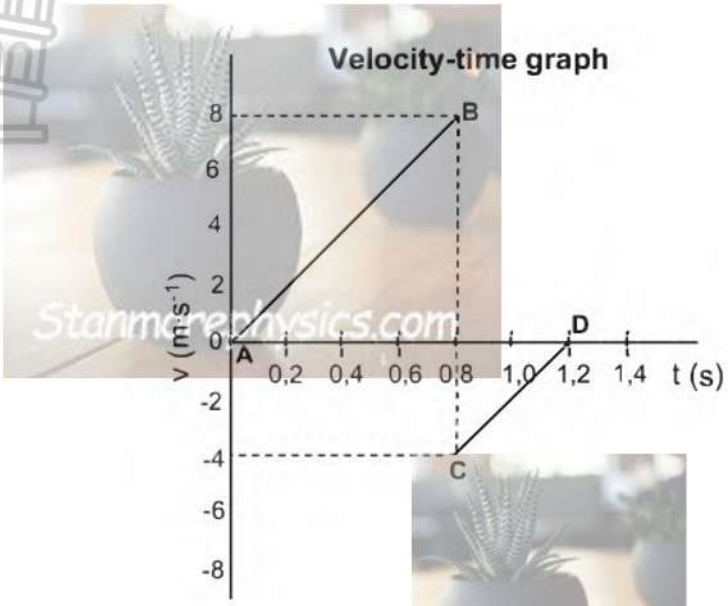
QUESTION 3

The graph below shows the velocity-time graph for the ball that is dropped and bounces. Ignore air resistance.



Two learners argue about the ball in the above scenario. One learner says the ball is a projectile, while the other disagree.

3.1 Define the term *projectile*. (2)

3.2 Describe the motion of the ball between points A and B on the graph above. (2)

3.3 From the graph, determine the:

3.3.1 Direction in which the ball is moving between points C and D (1)

3.3.2 Number of times the ball bounces (1)

3.4 Using EQUATIONS OF MOTION ONLY:

3.4 3.4.1 Calculate the height at which the ball was dropped. (3)

3.4.2 Determine the maximum height reached by the ball after it bounces off the ground. (3)

[12]

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QUESTION 4

The diagram below shows a 70 kg gymnastic dancer who jumped in the air and landed her left foot on the floor at 8 $m.s^{-1}$. She slid and came to a complete stop after 0.6 seconds.

4.1 Define the term impulse in words. (2)

4.2 Calculate the dancer's change in momentum. (3)

4.3 Determine the net force which the floor exerts on the dancer's foot. (3)

4.4 What is the effect on the magnitude of the force which the floor exerts on the dancer's foot if she lands in a shorter period?
Choose from: Increases, Decreases or Remains the same. Use relevant laws in physics to explain your answer. (3)
[11]

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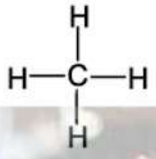
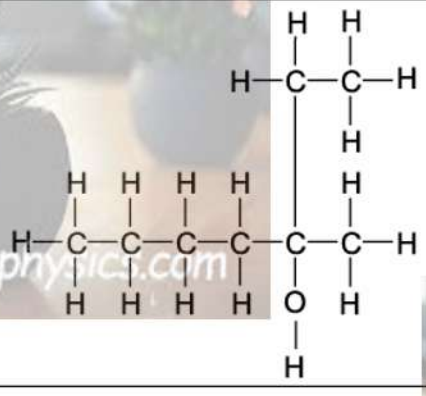
QUESTION 5

The letters **A** to **E** in the table below represent organic compounds.

A		**B**	Propyl ethanoate
C		**D**	Propanal
E	3,3-difloro-2-methylpentane		

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5.1 Write down the letter(s) that represent:

5.1.1 A compound with the general formula $C_nH_{2n}O$ (1)

5.1.2 A haloalkane (1)

5.1.3 A product of the reaction between alcohol and carboxylic acid (1)

5.2 For compound **C**, write down the:

5.2.1 Type of alcohol it is and give a reason for the answer (2)

5.2.2 IUPAC name (3)

5.2.3 Name of its functional group (1)

5.3 **B** has a FUNCTIONAL ISOMER.

5.3.1 Define the term *functional isomers*. (2)

5.3.2 Write down the IUPAC name of its FUNCTIONAL ISOMER. (2)

5.4 Write down the structural formula of compound **E**. (3)

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5.5 Compound **A** undergoes complete combustion according to the following balanced equation:

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

During the combustion, 1,8 kg of carbon dioxide is formed. Calculate the mass of CH_4 needed for this reaction. (4)
[20]

QUESTION 6

Compounds **A**, **B** and **C**, shown in the table below, are used to investigate a factor which influences the boiling point of organic compounds.

	COMPOUND
A	CH_3CH_2CHO
B	$CH_3CH_2CH_2CHO$
C	$CH_3CH_2CH_2CH_2CHO$

6.1 Define the term *boiling point*. (2)

6.2 For this investigation, write down the:

6.2.1 Independent variable (1)

6.2.2 Dependent variable (1)

6.3 Which ONE of the compounds (**A**, **B** or **C**) has the highest boiling point? (1)

6.4 Explain your answer to QUESTION 6.3, refer to the MOLECULAR STRUCTURE and STRENGTH OF INTERMOLECULAR FORCES between the compounds. (3)

6.5 How will the vapour pressure of 2-methylpropanal compare to that of compound **B**? Write down only HIGHER THAN, LOWER THAN or EQUAL TO. Explain the answer. (2)
[10]

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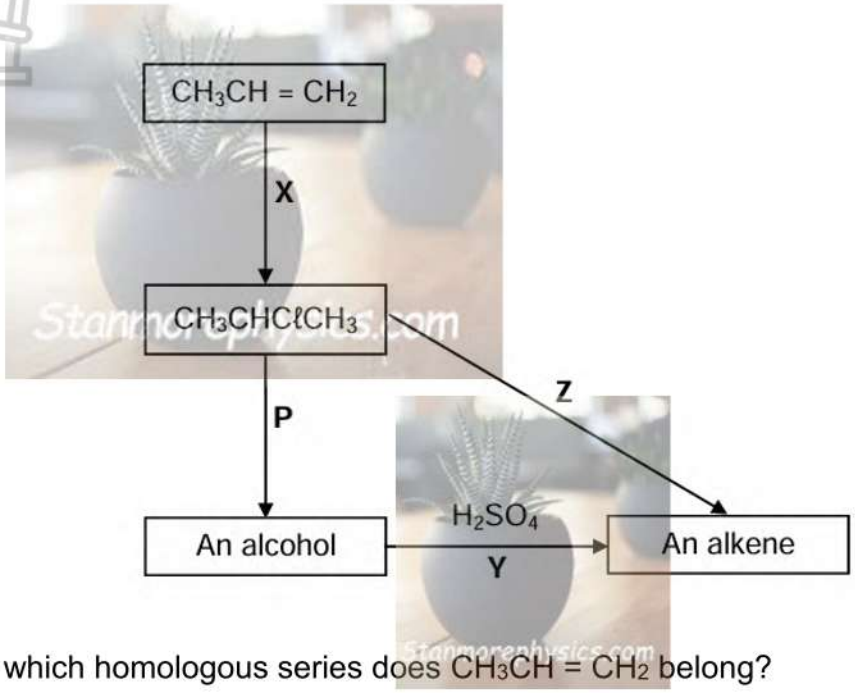
QUESTION 7

The flow diagram below shows the preparation of different organic compounds using $CH_3CH = CH_2$ as a starting reagent. X, Y, Z and P represent different organic reactions.



7.1 To which homologous series does $CH_3CH = CH_2$ belong? (1)

7.2 Write down the:

7.2.1 Type of addition reaction represented by **X** (1)

7.2.2 Structural formula and IUPAC name of the alcohol produced during reaction **P** (3)

7.2.3 Type of reaction of which **Y** is an example (1)

7.3 For reaction **Z**, write down:

7.3.1 The NAME of the inorganic product formed (1)

7.3.2 TWO reaction conditions needed (2)

7.3.3 A balanced equation for the production of the alkene, using CONDENSDED STRUCTURAL FORMULAE. (5)

[14]

TOTAL: 100

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TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

$n = \frac{m}{M}$

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THE PERIODIC TABLE OF ELEMENTS

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)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															

												58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152
64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175						
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr				

KEY

Atomic number

29
1,9 Cu
63,5

Electronegativity → ← Symbol

Approximate relative atomic mass

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PROVINCIAL ASSESSMENT

GRADE 12

GRAAD 12

PHYSICAL SCIENCES/ FISIESE WETENSKAPPE

MARCH 2026/ MAART 2026

MARKING GUIDELINES/ NASIENRIGLYNE

Stanmorephysics.com

MARKS/ PUNTE: 100

These marking guidelines consists of 8 pages
Hierdie naasienriglyne bestaan uit 8 bladsye

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Grade 12 – Marking guidelines

QUESTION / VRAAG 1

1.1 C ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 D ✓✓ (2)

1.6 B ✓✓ (2)

1.7 C ✓✓ (2)

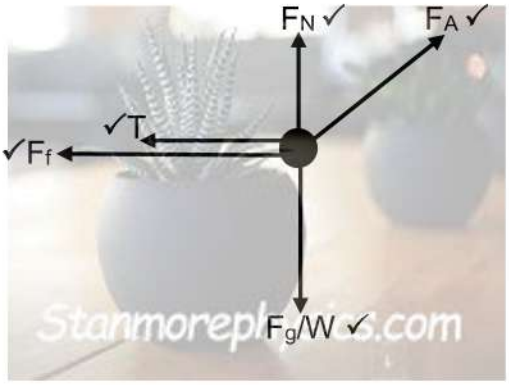
[14]

QUESTION / VRAAG 2

2.1 When a net force ✓ acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓

Wanneer 'n netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel en die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2



(5)

2.3.1 $N = mg - F_Y$

$= (24 \times 9,8) - 120\sin 64°$ ✓

$= 127.34$ N ✓

(2)

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2.3.2 $f_k = u_kN$ ✓

$4,3$ ✓ $= u_k\ (127.34)$ ✓

$u_k = 0.03$ ✓ (4)

2.4 **For block A/ Vir blok A:**

Fnet = ma
$T + f_k = ma$ ✓ any one

$T - 3,2 = 16a$

$T = 3,2 + 16a$… 1✓

For block B/ Vir blok B:

Fnet = ma

$F\cos\theta + T + f_k = ma$

$120\cos64° - T - 4,3 = 24a$ ✓

$48,305 - 24a = T$… 2

$48,305 - 24a = 16a + 3,2$ ✓

$a = 1,127…\ m•s^{-2}$

$T = 48,305 - 24\ (1,127…)$✓ = 21,24 N ✓

or $T = 3,2 + 16(1,127…)$ ✓ = 21,24 N ✓ (6)

[19]

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QUESTION / VRAAG 3

3.1 An object which has been given an initial velocity and then moves under the influence of gravitational force only. ✓✓

'n Voorwerp wat 'n aanvanklike snelheid gegee is en dan slegs onder die invloed van swaartekrag beweeg. ✓✓ (2)

3.2 Ball moves downwards ✓ from $0 m.s^{-1}$ and accelerates✓ with uniform acceleration till it hits the ground.

Bal beweeg afwaarts✓vanaf 0 $m.s^{-1}$ en versnel✓met eenvormige versnelling totdat dit die grond tref. (2)

3.3.1 Upwards✓ / *Opwaarts*✓ (1)

3.3.2 Once/ *Een keer* /1 ✓ (1)

3.4.1

Option/ Opsie 1:	**Option/ Opsie 2:**
$v_f^2 = v_i^2 + 2g\Delta y$ ✓ $(+8)^2 = (0)^2 + 2(9,8)\Delta y$✓ $\Delta y = 3,27$ m ✓	$\Delta y = v_i\Delta t + ½ g\Delta t^2$✓ $= (0)(0,8) + ½ (9.8)(0,8)^2$✓ $= 3.14$ m✓
Option/ Opsie 3: $\Delta y = (\frac{vi+vf}{2})\Delta t$ ✓ $=(\frac{0+8}{2})(0.8)$ ✓ $= 3.2$ m ✓	

(3)

3.4.2

Option/ Opsie 1:	**Option/ Opsie 2:**
$\Delta y = v_i\Delta t + ½ g\Delta t$ $= (-4)(0.4)$ ✓ + ½ $(9.8)(0.4)^2$ ✓ $= 0,82$ m ✓ (upwards)	$V_f^2 = v_i^2 + 2g\Delta y$ $(0)^2$ ✓$= (-4)^2 + 2(9,8)\Delta y$ ✓ $\Delta y = 0,82$ m ✓ (upwards)
Option 3: $\Delta y = (\frac{vi+vf}{2})\Delta t$ $= (\frac{-4+0}{2})$ ✓ (0,4) ✓ $= 0.8$ m ✓ (upwards)	

(3)
[10]

QUESTION / VRAAG 4

4.1 The product of the net/resultant force acting on an object and the time the net force acts on the object ✓✓

Die produk van die netto/resulterende krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk✓✓ (2)

4.2 $\Delta p = mv_f - mv_i$ ✓
$= (70)(0) - (70)(8)$ ✓
$= 560$ kg.m.s^{-1} upwards✓ (3)

4.3 **Positive marking from question 4.2/ Positiewe merk vanaf vraag 4.2**

$F_{net}\Delta t = \Delta p$ ✓
$F_{net}(0.6) = -560$ ✓ (3)

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F_{net} = 933.33 N upward/ opwaarts ✓

4.4 Increases. ✓ According to Newton's second law in terms of momentum, $F_{net} \propto 1/\Delta t$ ✓. Shorter contact time with the ground will increase the force experienced by the foot. ✓

Neem toe.✓ Volgens Newton se tweede wet in terme van momentum, $F_{net} \propto 1/\Delta t$. ✓*Korter kontaktyd met die grond sal die krag wat die voet ervaar, verhoog.*✓ (3)

[11]

QUESTION / VRAAG 5

5.1.1 D ✓ (1)

5.1.2 E ✓ (1)

5.1.3 B ✓ (1)

5.2.1 Tertiary✓ the carbon atom bonded to the -OH/hydroxyl group is attached to three other carbon atoms. ✓

Tersiêre✓ Die koolstofatoom wat aan die -OH/hidroksielgroep gebind is, is aan drie ander koolstofatome geheg.✓ (2)

5.2.2 3-methylheptan-3-ol/ 3-methyl-3-heptanol ✓✓✓

3-metielheptan-3-ol/ 3-metiel-3-heptanol✓✓✓ (3)

5.2.3 Hydroxyl ✓

Hidroksiel✓ (1)

5.3.1 Organic molecules with the same molecular formula but different functional groups. ✓✓

Organiese molekules met dieselfde molekulêre formule maar verskillende funksionele groepe.✓✓ (2)

5.3.2 Pentanoic acid ✓✓

Pentanoësuur✓✓ (2)

5.4

(3)

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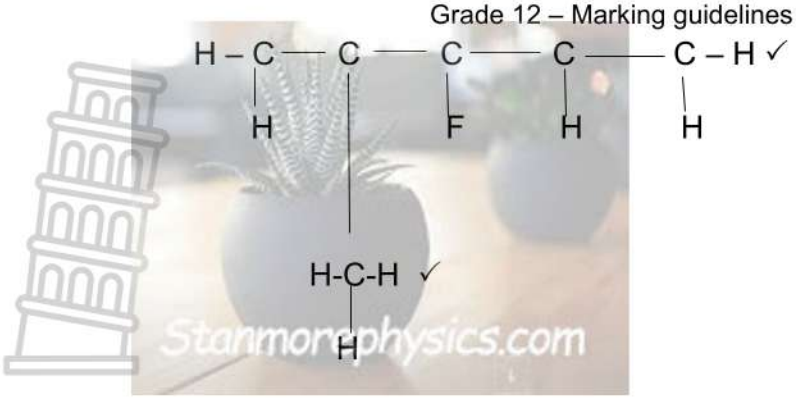

5.5 $n = \frac{m}{M}$ ✓

$= \frac{1800}{44}$ ✓

= 40.909 mol of CO_2

$n = \frac{m}{M}$

40.909 ✓ $= \frac{m}{16}$

= 654.54 g ✓

Accept/*Aanvaar*: 654,54 – 654,56 g (4)

[20]

QUESTION / VRAAG 6

6.1 The temperature at which vapour pressure of a substance is equal to the atmospheric pressure. ✓✓

Die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk.✓✓ (**2 or 0**)

6.2.1 Chain length/surface area/molecular mass ✓

Kettinglengte/oppervlak area/molekulêre massa✓ (1)

6.2.2 Boiling point. ✓

Kookpunt. ✓ (1)

6.3 C ✓ (1)

6.4 • <u>Chain length/surface area increases from compound A to C/ CH_3CH_2CHO to $CH_3CH_2CH_2CH_2CHO$</u>. ✓ (3)

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- Strength of intermolecular/London forces increase with an increase in chain length/surface area. ✓
- Amount of energy needed to overcome intermolecular/London forces increases as the chain length/surface area increase. ✓
- Therefore, the compound with the longest chain length/ largest surface area has the highest boiling point.

- *Kettinglengte/oppervlakarea neem toe van verbinding A na C/ CH_3CH_2CHO na $CH_3CH_2CH_2CH_2CHO$.* ✓
- *Die sterkte van intermolekulêre/Londen kragte neem toe met 'n toename in kettinglengte/oppervlakarea.* ✓
- *Die hoeveelheid energie wat benodig word om intermolekulêre/Londen kragte te oorkom, neem toe soos die kettinglengte/oppervlakarea toeneem.* ✓
- *Daarom het die verbinding met die langste kettinglengte/grootste oppervlakarea die hoogste kookpunt.*

6.5

- HIGHER THAN ✓, Boiling point of 2-methylpropanal is lower than that of B. ✓

ANY ONE

- 2-methylpropanal has shorter chain length/surface area than B. ✓

OR

- 2-methylpropanal has weaker intermolecular/London forces than B.

- *HOËR AS ✓Die kookpunt van 2-metielpropanal is laer as dié van B.* ✓

ENIGE EEN

- *2-metielpropanaal het 'n korter kettinglengte/oppervlakarea as B.* ✓

OF

2-metielpropanaal het swakker intermolekulêre/Londen kragte as B.

(2)
[10]

QUESTION / VRAAG 7

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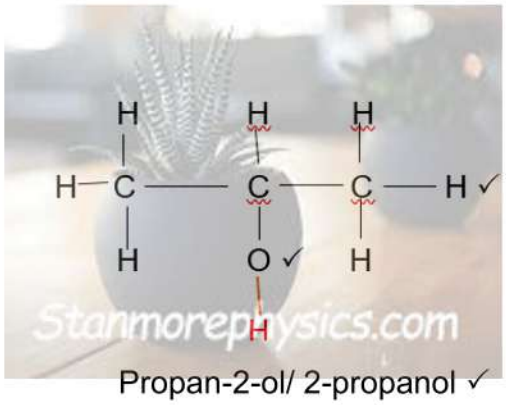
7.1 Alkene/ *Alkeen* ✓ (1)

7.2.1 Hydrohalogenation/hydrochlorination ✓

Hidrohalogenering/hidrochlorenasie✓ (1)

7.2.2



Propan-2-ol/ 2-propanol ✓

(3)

7.2.3 Elimination/dehydration ✓

Eliminasie/dehidrasie✓ (1)

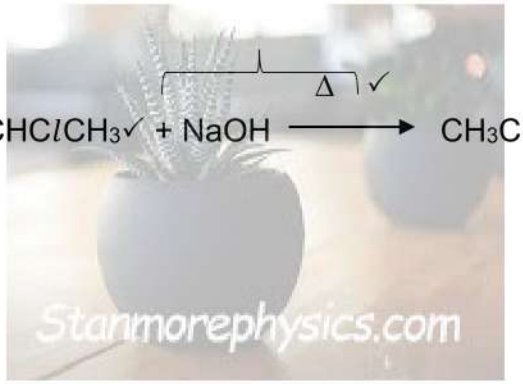
7.3.1 Water/sodium chloride ✓

Water/natriumchloried✓ (1)

7.3.2
- Concentrated strong base (NaOH/KOH) ✓
- More heat✓

- *Gekonsentreerde sterk basis (NaOH/KOH)*✓
- *Meer hitte*✓ (2)

7.3.3



(5)

[14]

TOTAL/TOTAAL: 100