



KWAZULU-NATAL PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**



MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions et cetera where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE CHOICE QUESTIONS

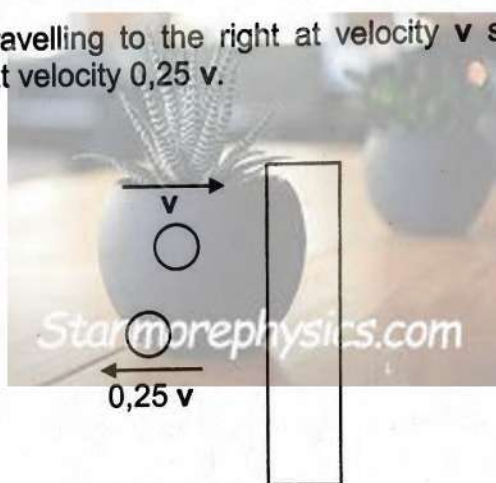
Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.6) in the ANSWER BOOK.

- 1.1 An astronaut with a mass of 70 kg is on a planet where his weight is 550 N.
The gravitational acceleration on the planet is ... $\text{m}\cdot\text{s}^{-2}$.

- A 7,86
- B 0,13
- C 38500
- D 786

(2)

- 1.2 A ball of mass m travelling to the right at velocity v strikes a wall and rebounds to the left at velocity $0,25 v$.



The change in momentum of the ball is ...

- A $0,75 mv$ left.
- B $1,25 mv$ left.
- C $0,75 mv$ right.
- D $1,25 mv$ right.

(2)

- 1.3 A girl throws a ball upwards.

Which ONE of the following combinations give the DIRECTIONS of the ball's velocity, acceleration, and the net force that the ball experiences as it travels upwards just after leaving the girl's hand?

	Velocity	Acceleration	Net Force
A	Upward	Downward	Downward
B	Upward	Upward	Upward
C	Downward	Downward	Downward
D	Upward	Downward	Upward

(2)

1.4 Consider the molecular formula below:



The name of the homologous series that the above compound belongs to is a/an...

- A ketone.
- B alcohol.
- C aldehyde.
- D carboxylic acid.

(2)

1.5 Given the following four organic molecules: Ethanal, ethanol, ethanoic acid, and ethane.

Which ONE of the following is CORRECT when the above compounds are arranged in their decreasing order of vapour pressure?

- A Ethanoic acid, ethanol, ethanal, ethane.
- B Ethanoic acid, ethanal, ethanol, ethane
- C Ethane, ethanol, ethanal, ethanoic acid.
- D Ethane, ethanal, ethanol, ethanoic acid.

(2)

1.6 Which ONE of the following reaction types will be used to prepare ethene and propane from pentane under high temperatures and pressures?

- A Combustion
- B Esterification
- C Thermal cracking
- D Photosynthesis

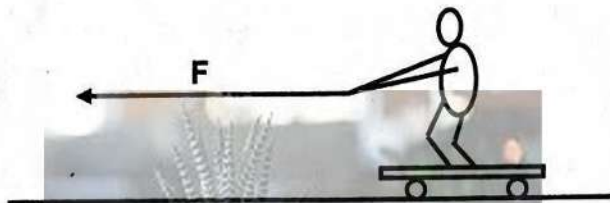
(2)

[12]

QUESTION 2 (Start on a new page)

A boy on a skateboard is pulled by a horizontal force **F** to the left, as shown in the sketch below. The combined mass of the boy and skateboard is 60 kg. A total frictional force of 70 N opposes the motion. The boy and skateboard accelerate at $1,5 \text{ m}\cdot\text{s}^{-2}$ to the left.

Ignore the rotational effects of the wheels.



- 2.1 Draw a labelled free-body diagram showing all the forces acting on the boy and skateboard together. (4)
- 2.2 Calculate the magnitude of the force **F**. (4)
- 2.3 The force **F** is increased several times, and the acceleration is measured for each value of **F**, while all other forces remain constant.

Draw a sketch graph for the system showing the relationship between acceleration and **F**, from the moment the force **F** acts on the system. (3)

- 2.4 When force **F** is removed, the boy and skateboard continue to move to the left for a short distance. The skateboard then hits a stone and stops.

Explain what happens to the boy. (1)

- 2.5 Name and state the physics law which is applied in QUESTION 2.4. (3)

[15]

QUESTION 3 (Start on a new page)

A ball is thrown vertically upwards from the top of a building at a velocity of $20 \text{ m}\cdot\text{s}^{-1}$. The velocity-time graph for part of the motion of the ball is shown below. Ignore air resistance.



3.1 Define a *projectile*. (2)

3.2 Write down the magnitude and direction of the acceleration of the ball. (2)

3.3 Determine the:

3.3.1 Time taken for the ball to reach the maximum height (3)

3.3.2 Maximum height reached by the ball above the building (3)

The ball continues in its motion and hits the ground 5 seconds after it was thrown.

3.4 Calculate the:

3.4.1 Speed with which the ball hits the ground (3)

3.4.2 Height of the building (4)

[17]

QUESTION 4 (Start on a new page)

A car of mass $1\,600\text{ kg}$ travelling to the right at $80\text{ km}\cdot\text{h}^{-1}$ runs into the back of a stationary bakkie of unknown mass. The two vehicles stick together and move to the right at $6\text{ m}\cdot\text{s}^{-1}$.

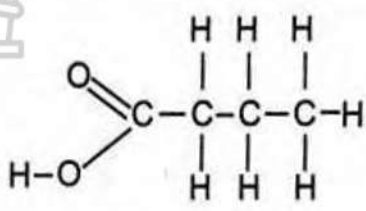
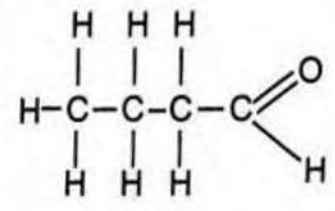
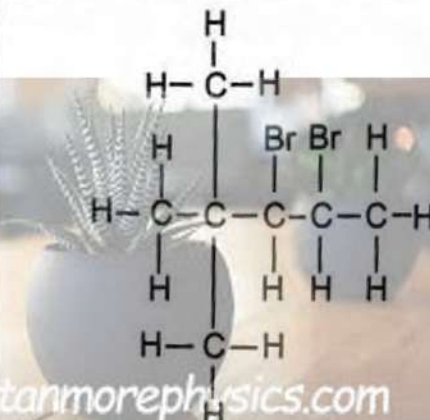


- 4.1 Convert $80\text{ km}\cdot\text{h}^{-1}$ to $\text{m}\cdot\text{s}^{-1}$. (2)
- 4.2 Calculate the change in momentum of the car. (3)
- 4.3 Write down the magnitude and direction of the change in momentum of the bakkie. (1)
- 4.4 State the *principle of conservation of linear momentum* in words. (2)
- 4.5 Calculate the mass of the bakkie. (4)

[12]

QUESTION 5 (Start on a new page)

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

A		B	
C	Pentan-2-one	D	$\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$
E		F	Methyl propanoate

5.1 Define the term *homologous series*. (2)

5.2 Consider the organic compound **B**.

Write down the:

5.2.1 Homologous series to which this compound belongs (1)

5.2.2 IUPAC name of the functional isomer of this compound (2)

5.3 Write down the:

5.3.1 IUPAC name of compound **E** (3)

5.3.2 GENERAL FORMULA of the homologous series to which compound **A** belongs (1)

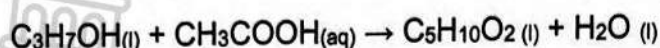
5.4 Write down the LETTER(s) of the compound(s) that represent(s):

5.4.1 The positional isomers (2)

5.4.2 An ester (1)

When making an ester, 60 g of propan-1-ol reacts with excess ethanoic acid to produce 90,78 g of the ester.

The balanced equation for the reaction is:



5.5 Write down the:

5.5.1 STRUCTURAL FORMULA of the ester produced. (3)

5.5.2 IUPAC name of the ester. (2)

5.5.3 NAME or FORMULA of the catalyst used. (1)

5.6 Calculate the percentage purity of propan-1-ol. (5)
[23]

QUESTION 6 (Start on a new page)

Experiments 1 and 2 are performed to determine the boiling points of carboxylic acids and alcohols. The results obtained are shown in the table below.

EXPERIMENT	IUPAC NAME		MOLECULAR MASS (g.mol ⁻¹)	BOILING POINT (°C)
1	A	Methanoic acid	46	100,8
	B	Ethanol	46	78,4
2	C	Propanoic acid	74	141,2
	D	Butanol	74	117,7

6.1 Write down the property of alcohols which could make an experiment dangerous. (1)

6.2 Write down LETTERS of TWO compounds which are alcohols. (2)

6.3 What conclusion can be drawn from the results of these two experiments? (2)

6.4 Predict how the vapour pressure of compounds A and B will compare. (2)

6.5 From the table above, the boiling point of the carboxylic acid in experiment 2 is higher than the boiling point of the carboxylic acid in experiment 1.

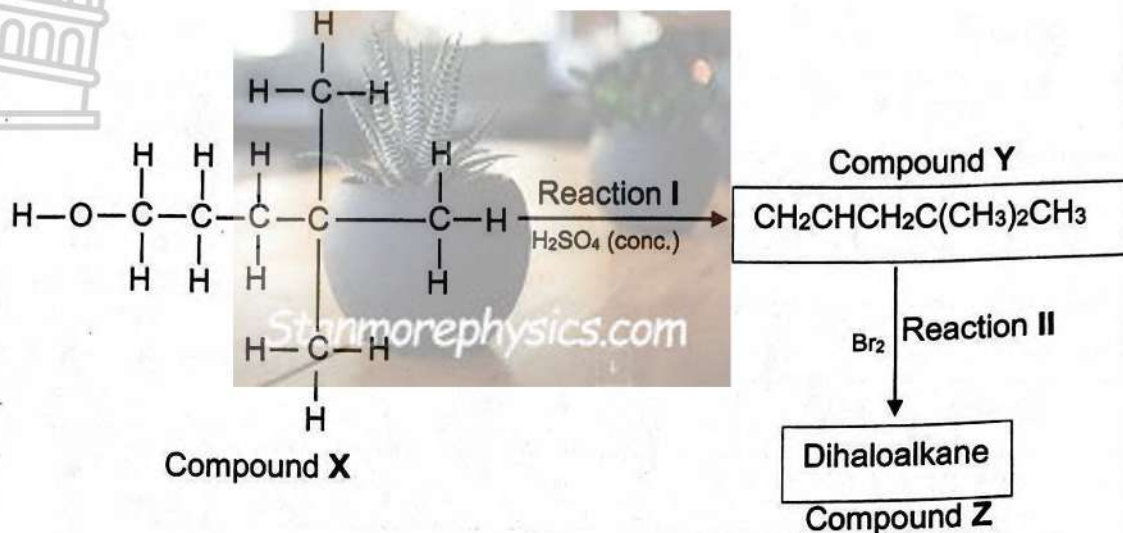
Explain this observation by referring to the molecular structure, intermolecular forces and energy.

(3)
[10]

QUESTION 7 (Start on a new page)

Study the flow diagram below.

An organic compound **Z** is produced from compound **X** using reactions I and II.



- 7.1 NAME the functional group of compound **X**. (1)
- 7.2 Write down the IUPAC name of compound **X**. (3)
- 7.3 NAME the homologous series of the organic product that would be produced if compound **X** were now treated with a carboxylic acid in the presence of hot, concentrated sulphuric acid. (2)
- 7.4 Identify the homologous series of compound **Y**. (1)
- 7.5 NAME the type of addition reaction represented by reaction II. (1)
- 7.6 Using STRUCTURAL formulae, write down the balanced chemical equation for reaction II. (3)

[11]**TOTAL: 100**

DATA FOR PHYSICAL SCIENCES GRADE 12
GEGEWENS VIR FISIIESE WETENSKAPPE GRAAD 12

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIIESE KONSTANTES

NAME / NAAM	SYMBOL / SIMBOOL	VALUE / WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Universal gravitational constant <i>Universele gravitasiekonstante</i>	G	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Speed of light in a vacuum <i>Spoe van lig in 'n vakuum</i>	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Planck's constant <i>Planck se konstante</i>	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Coulomb's constant <i>Coulomb se konstante</i>	k	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
Charge on electron <i>Lading op electron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$
Mass of Earth <i>Massa van Aarde</i>	M	$5,98 \times 10^{24} \text{ kg}$
Radius of Earth <i>Radius van Aarde</i>	R_E	$6,38 \times 10^6 \text{ m}$

TABLE 2: PHYSICAL CONSTANTS/TABEL 2: FISIIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure <i>Standaarddruk</i>	p^θ	$1,013 \times 10^5 \text{ Pa}$
Molar gas volume at STP <i>Molêre gasvolume by STD</i>	V_m	$22,4 \text{ dm}^3\cdot\text{mol}^{-1}$
Standard temperature <i>Standaardtemperatuur</i>	T^θ	273 K
Charge on electron <i>Lading op elektron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Avogadro's constant <i>Avogadro-konstante</i>	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$

TABLE 3: PHYSICS FORMULAE / TABEL 3: 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 / KRAAG

$F_{\text{net}} = ma$	$p = mv$
$f_{s(\text{max})} = \mu_s N$	$f_k = \mu_k N$
$w = mg$	$F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$
$F = \frac{Gm_1 m_2}{r^2}$	$g = \frac{Gm}{r^2}$

WORK, ENERGY AND POWER / ARBEID, ENERGIE EN DRYWING

$W = F \Delta x \cos \theta$	$U = mgh$ or/of $E_p = mgh$
$K = \frac{1}{2} mv^2$ or/of $E_k = \frac{1}{2} mv^2$	$W_{\text{net}} = \Delta K$ or/of $W_{\text{net}} = \Delta E_k$ $\Delta K = K_f - K_i$ or/of $\Delta E_k = E_{kf} - E_{ki}$
$W_{\text{nc}} = \Delta K + \Delta U$ or/of $W_{\text{nc}} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{\text{ave}} = F v_{\text{ave}}$ / $P_{\text{gem}} = F v_{\text{gem}}$	

TABLE 4: CHEMISTRY FORMULAE/TABEL 4: CHEMIE FORMULES

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/of $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$	$\text{pH} = -\log[\text{H}_3\text{O}^+]$
$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ at/by 298 K	
$E_{\text{cell}}^{\theta} = E_{\text{cathode}}^{\theta} - E_{\text{anode}}^{\theta} / E_{\text{sel}}^{\theta} = E_{\text{katoode}}^{\theta} - E_{\text{anode}}^{\theta}$ or/of $E_{\text{cell}}^{\theta} = E_{\text{reduction}}^{\theta} - E_{\text{oxidation}}^{\theta} / E_{\text{sel}}^{\theta} = E_{\text{reduksie}}^{\theta} - E_{\text{oksidase}}^{\theta}$ or/of $E_{\text{cell}}^{\theta} = E_{\text{oxidisingagent}}^{\theta} - E_{\text{reducingagent}}^{\theta} / E_{\text{sel}}^{\theta} = E_{\text{oksideermiddel}}^{\theta} - E_{\text{reduseermiddel}}^{\theta}$	
$I = \frac{Q}{\Delta t}$	$n = \frac{Q}{e}$ where n is the number of electrons/ waar n die aantal elektrone is

TABLE 3: THE PERIODIC TABLE OF ELEMENTS



KEY/SLEUTEL																	
Atomic number Atoomgetal																	
Electronegativity Elektronegatiwiteit																	
Approximate relative atomic mass Benaderde relatiewe atoommassa																	
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 H 1,0	3 Li 7,0	4 Be 9,0	9	5 B 10,8	6 C 12,0	7 N 14,0	8 O 16,0	9 F 19,0	10 Ne 20,0	11 Na 23,0	12 Mg 24,3	13 Al 27,0	14 Si 28,1	15 P 31,0	16 S 32,1	17 Cl 35,5	18 Ar 40,0
19 K 39,1	20 Ca 40,1	21 Sc 45,0	22 Ti 47,9	23 V 50,9	24 Cr 52,0	25 Mn 54,9	26 Fe 55,8	27 Co 58,9	28 Ni 58,7	29 Cu 63,5	30 Zn 65,4	31 Ga 70,0	32 Ge 72,6	33 As 74,9	34 Se 79,0	35 Br 79,9	36 Kr 83,8
37 Rb 85,5	38 Sr 87,6	39 Y 88,9	40 Zr 91,2	41 Nb 92,9	42 Mo 95,9	43 Tc 98,0	44 Ru 101,1	45 Rh 102,9	46 Pd 106,4	47 Ag 107,9	48 Cd 112,4	49 In 114,8	50 Sn 118,7	51 Sb 121,8	52 Te 127,6	53 I 126,9	54 Xe 131,3
55 Cs 132,9	56 Ba 137,3	57 La 138,9	58 Ce 140,1	59 Pr 140,9	60 Nd 144,2	61 Pm	62 Sm 150,4	63 Eu 151,9	64 Gd 157,3	65 Tb 158,9	66 Dy 162,5	67 Ho 164,9	68 Er 167,3	69 Tm 168,9	70 Yb 173,0	71 Lu 174,9	72 Hf 178,5
87 Fr	88 Ra	89 Ac	90 Th 232,0	91 Pa	92 U 238,0	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

KEY/SLEUTEL

Atomic number
AtoomgetalElectronegativity
ElektronegatiwiteitSymbol
SimboolApproximate relative atomic mass
Benaderde relatiewe atoommassa



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EDUCATION
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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**PHYSICAL SCIENCES
COMMON ASSESSMENT TASK
MARKING GUIDELINE**
Stanmorephysics.com
MARCH 2025 TEST

MARKS: 100

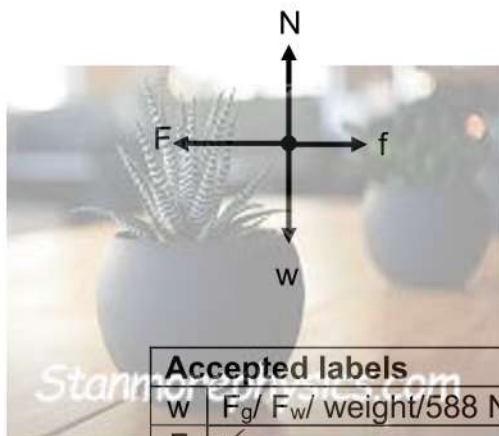
These marking guidelines consist of 9 pages.

QUESTION 1

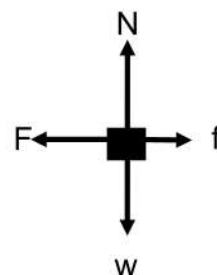
- 1.1 A ✓✓ (2)
- 1.2 B ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 B ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 C ✓✓ (2)
- [12]**

QUESTION 2

2.1



Accept force diagram:



Accepted labels

w	F_g / F_w / weight/588 N/gravitational force ✓
F	✓
f	(kinetic) friction/ F_f / f_k ✓
N	F_N /Normal/ F_{normal} ✓

Notes

- Mark awarded for label and arrow.
- Do not penalise for length of arrows since drawing is not to scale.
- Any other additional force(s): Max $\frac{3}{4}$
- If everything correct, but no arrows: Max/Maks $\frac{3}{4}$

(4)

2.2

LEFT AS POSITIVE

$$\left. \begin{array}{l} F_{net} = ma \\ F + f = ma \end{array} \right\} \checkmark \text{ Any one}$$

$$F - 70 \checkmark = (60)(1,5) \checkmark$$

$$F = 160 \text{ N } \checkmark$$

LEFT AS NEGATIVE

$$\left. \begin{array}{l} F_{net} = ma \\ F + f = ma \end{array} \right\} \checkmark \text{ Any one}$$

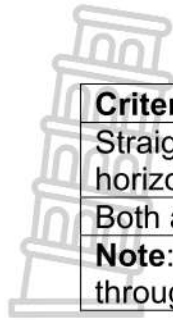
$$-F + 70 \checkmark = (60)(-1,5) \checkmark$$

$$F = 160 \text{ N } \checkmark$$

(4)

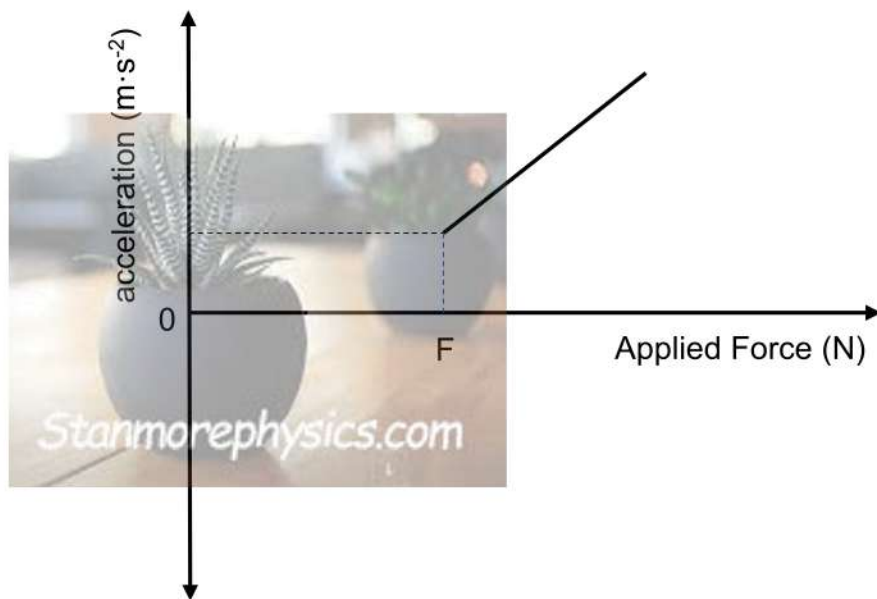
Note: DO NOT award the fourth mark if the final answer is $F = -160 \text{ N}$

2.3



Criteria for graph	
Straight line with a positive gradient (accept if line is drawn from the horizontal-axis)	✓✓
Both axes labelled.	✓
Note: If the extrapolated straight line or the straight line passes through the origin, max: 2/3	

(3)



2.4 The boy continues to move forward✓

(1)

2.5 Newton's First law✓

A body will remain in its state of rest or motion at constant velocity unless a non-zero net force acts on it.✓✓

(3)
[15]

QUESTION 3

- 3.1 An object which has been given an initial velocity and then moves under the influence of gravitational force only. ✓✓ (2)

Marking criteria:

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark

- 3.2 $9,8 \text{ m} \cdot \text{s}^{-2}$ ✓ downwards ✓ (2)

- | 3.3.1 | UPWARDS AS POSITIVE | DOWNWARDS AS POSITIVE | |
|-------|---|---|-----|
| | $v_f = v_i + a\Delta t$ ✓
$0 = 20 + (-9,8)\Delta t$ ✓
$\Delta t = 2,04 \text{ s}$ ✓ | $v_f = v_i + a\Delta t$ ✓
$0 = -20 + (9,8)\Delta t$ ✓
$\Delta t = 2,04 \text{ s}$ ✓ | (3) |

- | 3.3.2 | OPTION 1
POSITIVE MARKING FROM Q 3.3.1 | OPTION 2 | |
|-------|---|--|-----|
| | $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓
$= \{ (20)(2,04) + \frac{1}{2} (-9,8)(2,04)^2 \}$ ✓
$= 20,41 \text{ m}$ ✓ | $v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = 20^2 + 2(-9,8)\Delta y$ ✓
$\Delta y = 20,41 \text{ m}$ ✓ | |
| | OPTION 3
POSITIVE MARKING FROM Q 3.3.1
$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$ ✓
$\Delta y = \left\{ \left(\frac{20 + 0}{2} \right) (2,04) \right\}$ ✓
$\Delta y = 20,40 \text{ m}$ ✓ | OPTION 4
POSITIVE MARKING FROM Q 3.3.1
maximum height $= \frac{1}{2} b \cdot h$ ✓
$= \frac{1}{2} (2,04)(20)$ ✓
$= 20,40 \text{ m}$ ✓ | (3) |
| | ACCEPT OPTIONS THAT USE CONSERVATION OF MECH ENERGY | | |

- | 3.4.1 | UPWARDS AS POSITIVE | DOWNWARDS AS POSITIVE | |
|-------|---|---|-----|
| | $v_f = v_i + a\Delta t$ ✓
$= 20 + (-9,8)(5)$ ✓
$= -29 \text{ m} \cdot \text{s}^{-1}$
$\therefore v_f = 29 \text{ m} \cdot \text{s}^{-1}$ ✓ | $v_f = v_i + a\Delta t$ ✓
$= -20 + (9,8)(5)$ ✓
$= 29 \text{ m} \cdot \text{s}^{-1}$ ✓ | (3) |

3.4.2

<p>OPTION 1 UPWARDS AS POSITIVE $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (20)(5) \checkmark + \frac{1}{2} (-9,8)(5)^2 \checkmark$ $= -22,50$ height = 22,50 m ✓</p>	<p>OPTION 1 UPWARDS AS NEGATIVE $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (-20)(5) \checkmark + \frac{1}{2} (9,8)(5)^2 \checkmark$ $= 22,50 \text{ m} \checkmark$</p>
<p>OPTION 2 UPWARD AS POSITIVE POSITIVE MARKING FROM Q 3.3.1 $\Delta t = 5 - 2 \times 2,04 = 0,92 \text{ s}$ $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (-20)(0,92) \checkmark + \frac{1}{2} (-9,8)(0,92)^2 \checkmark$ $= -22,55$ height = 22,55 m ✓</p>	<p>OPTION 2 DOWNWARD AS POSITIVE POSITIVE MARKING FROM Q 3.3.1 $\Delta t = 5 - 2 \times 2,04 = 0,92 \text{ s}$ $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (20)(0,92) \checkmark + \frac{1}{2} (9,8)(0,92)^2 \checkmark$ $= 22,55 \text{ m} \checkmark$</p>
<p>OPTION 3 UPWARDS AS POSITIVE POSITIVE MARKING FROM Q 3.3.1 Starting from the maximum height $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (0)(2,96) \checkmark + \frac{1}{2} (-9,8)(2,96)^2 \checkmark$ $= -42,93 \text{ m}$ Height of the building = 42,93 – 20,41 = 22,52 m ✓</p>	<p>OPTION 3 UPWARDS AS NEGATIVE POSITIVE MARKING FROM Q 3.3.1 Starting from the maximum height $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (0)(2,96) \checkmark + \frac{1}{2} (9,8)(2,96)^2 \checkmark$ $= 42,93 \text{ m}$ Height of the building = 42,93 – 20,41 = 22,52 m ✓</p>
<p>OPTION 4 POSITIVE MARKING FROM Q 3.4.1 $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$ $\Delta y = \left(\frac{20 - 29}{2} \right) (5) \checkmark$ $\Delta y = 22,50 \text{ m} \checkmark$</p>	<p>OPTION 5 POSITIVE MARKING FROM Q 3.4.1 $v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-29)^2 \checkmark = 20^2 + 2(-9,8)\Delta y \checkmark$ $\Delta y = 22,50 \text{ m} \checkmark$</p>
<p>OPTION 6 POSITIVE MARKING FROM Q 3.3.1 & 3.4.1 $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$ $\Delta y = \left(\frac{0 - 29}{2} \right) (2,96) \checkmark$ $\Delta y = 42,93 \text{ m}$ Height of the building = 42,93 – 20,41 = 22,52 m ✓</p>	

(4)

[17]

QUESTION 4

4.1 $\frac{80}{3,6} = 22,22 \text{ m}\cdot\text{s}^{-1} \checkmark\checkmark$

(2)

4.2

POSITIVE MARKING FROM QUESTION 4.1**RIGHT AS POSITIVE**

$$\begin{aligned}\Delta p &= m(v_f - v_i) \checkmark \\ &= 1\,600 (6 - 22,22) \checkmark \\ &= -25\,952 \text{ kg}\cdot\text{s}^{-1} \\ &= \underline{25\,952 \text{ kg}\cdot\text{s}^{-1} \text{ to the left}} \checkmark\end{aligned}$$

RIGHT AS NEGATIVE

$$\begin{aligned}\Delta p &= m(v_f - v_i) \checkmark \\ &= 1\,600 (-6 - (-22,22)) \checkmark \\ &= 25\,952 \text{ kg}\cdot\text{s}^{-1} \\ &= \underline{25\,952 \text{ kg}\cdot\text{s}^{-1} \text{ to the left}} \checkmark\end{aligned}$$

(3)

4.3

POSITIVE MARKING FROM QUESTION 4.225 952 kg m·s⁻¹ to the right ✓

(1)

4.4

Marking criteria

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark

In an isolated system the total linear momentum is conserved/remains constant. ✓✓

(2)

4.5

OPTION 1**POSITIVE MARKING FROM QUESTION 4.1****RIGHT AS POSITIVE**

$$\begin{aligned}\sum p_i &= \sum p_f \\ m_c v_{ic} + m_b v_{ib} &= (m_c + m_b) v_f \quad \left. \vphantom{\sum p_i = \sum p_f} \right\} \checkmark \text{ Any one} \\ \underline{(1600)(22,22)} + 0 \checkmark &= (1600 + m_b)(6) \checkmark \\ \therefore m_b &= 4325,33 \text{ kg} \checkmark\end{aligned}$$

RIGHT AS NEGATIVE

$$\begin{aligned}\sum p_i &= \sum p_f \\ m_c v_{ic} + m_b v_{ib} &= (m_c + m_b) v_f \quad \left. \vphantom{\sum p_i = \sum p_f} \right\} \checkmark \text{ Any one} \\ \underline{(1600)(-22,22)} + 0 \checkmark &= (1600 + m_b)(-6) \checkmark \\ \therefore m_b &= 4325,33 \text{ kg} \checkmark\end{aligned}$$

OPTION 2**RIGHT AS POSITIVE**

$$\begin{aligned}\Delta p_b &= -\Delta p_c \\ m_b(v_{bf} - v_{bi}) &= -m_c(v_{cf} - v_{ci}) \quad \left. \vphantom{\Delta p_b = -\Delta p_c} \right\} \checkmark \text{ Any one} \\ m_b(6 - 0) \checkmark &= -(-25952) \checkmark \\ \therefore m_b &= 4325,33 \text{ kg} \checkmark\end{aligned}$$

RIGHT AS NEGATIVE

$$\begin{aligned}\Delta p_b &= -\Delta p_c \\ m_b(v_{bf} - v_{bi}) &= -m_c(v_{cf} - v_{ci}) \quad \left. \vphantom{\Delta p_b = -\Delta p_c} \right\} \checkmark \text{ Any one} \\ m_b(-6 - 0) \checkmark &= -25952 \checkmark \\ \therefore m_b &= 4325,33 \text{ kg} \checkmark\end{aligned}$$

(4)

[12]

QUESTION 5

5.1 A series of organic compounds that can be described by the same general formula. ✓✓

OR

A series of organic compounds in which one member differs from the next with a CH_2 group.

(2)

5.2.1 Aldehydes ✓

(1)

5.2.2 Butanone or Butan-2-one ✓✓

(2)

5.3.1 3,4-dibromo-2,2-dimethylpentane

Marking criteria

- Correct stem: pentane ✓
- Correct substituents: dibromo and dimethyl ✓
- IUPAC name completely correct ✓

(3)

5.3.2 $\text{C}_n\text{H}_{2n}\text{O}_2$ ✓

(1)

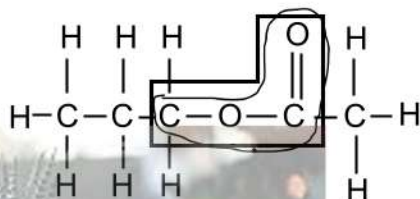
5.4.1 C and D (must have both) ✓✓

(2)

5.4.2 F ✓ (Accept the name of the compound)

(1)

5.5.1

**Marking criteria**

- Correct functional group ✓
- Correct number of carbon atoms on either side of functional group ✓
- Whole structure correct ✓

(3)

5.5.2 Propyl ✓ ethanoate ✓

(2)

5.5.3 Sulphuric acid / H_2SO_4 ✓

(1)

5.6

Marking criteria

- Calculate moles of $C_5H_{10}O_2$
- Using the mole ratio: $n(C_5H_{10}O_2):n(C_3H_7OH) = 1:1$
- Substitute $60 \text{ g} \cdot \text{mol}^{-1}$ into $n = \frac{m}{M}$
- Substitute into the formula for percentage purity
- Final answer



$$n(C_5H_{10}O_2) = \frac{m}{M}$$

$$= \frac{90,78}{102} \checkmark$$

$$= 0,89 \text{ mol}$$

$$n(C_3H_7OH) = \frac{m}{M}$$

$$0,89 \checkmark = \frac{m}{60} \checkmark$$

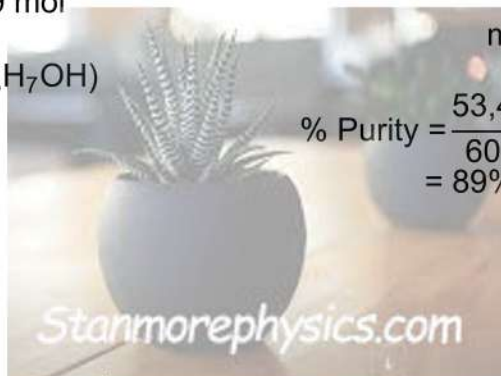
$$m = 53,4 \text{ g}$$

$$n(C_5H_{10}O_2) : n(C_3H_7OH)$$

$$1:1$$

$$\% \text{ Purity} = \frac{53,4}{60} \times 100\% \checkmark$$

$$= 89\% \checkmark$$



(5)
[23]

QUESTION 6

- 6.1 Flammable/inflammable ✓ (1)
- 6.2 B✓ and D✓ (accept the names of compounds) (2)
- 6.3 The boiling points of carboxylic acids are higher than the boiling points of alcohols (of comparable molecular mass). ✓✓
OR
The longer the chain length the higher the boiling point
OR
The boiling points of alcohols are lower than the boiling points of carboxylic acids (of comparable molecular mass). (2)
- 6.4 Vapour pressure of compound B will be higher than that of compound A. ✓✓
OR
Vapour pressure of compound A will be lower than that of compound B. (2)
- 6.5
- Carboxylic acid in experiment 2 (propanoic acid) has a longer chain length/greater surface area than the carboxylic acid in experiment 1 (methanoic acid). ✓
 - The longer the chain length/greater surface area, the stronger the intermolecular forces. ✓
 - More energy needed to overcome the intermolecular forces in compound C. ✓

(3)
[10]

QUESTION 7

7.1 Hydroxyl (group) ✓ (1)

7.2 4,4-dimethylpentan-1-ol OR 4,4-dimethyl-1-pentanol

Marking criteria

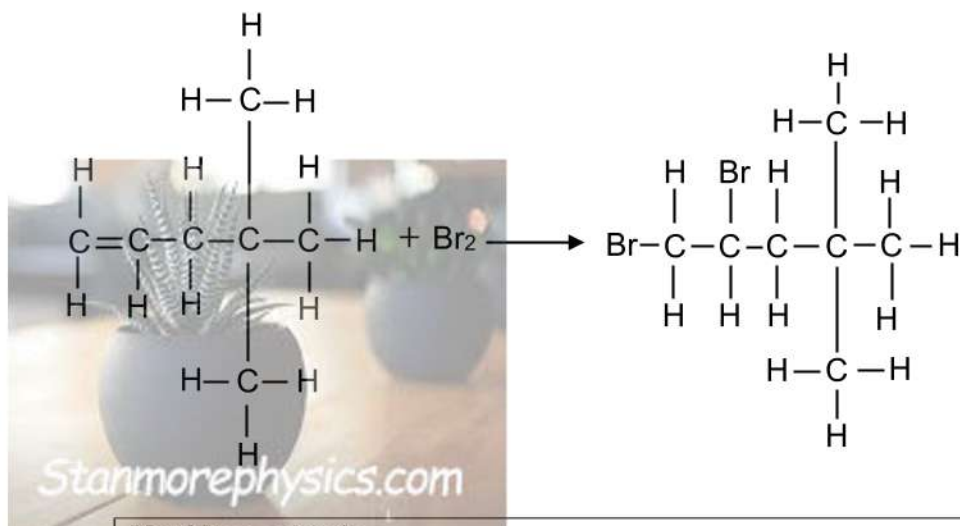
- Correct stem (pentanol) ✓
- Correct substituent: dimethyl ✓
- IUPAC name completely correct ✓ (3)

7.3 Esters ✓✓ (2)

7.4 Alkenes ✓ (1)

7.5 Halogenation / bromination ✓ (1)

7.6

**Marking criteria**

- Correct structure for compound **Y** ✓
- Correct structure for compound **Z** ✓
- Addition of Br₂ ✓ (3)

TOTAL: 100