Downloaded from Stanmorephysics.com

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON TEST

MARCH 2023

MARKS : 100

TIME : 2 Hours

Stanmorephysics

This question paper consists of 10 pages and 3 data sheets.

Copyright reserved

Downloaded from Stanmorephysics.com

INSTRUCTIONS AND INFORMATION

1. Write your NAME in the appropriate spaces 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, 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.

Downloaded from Stanmorephysics.com

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various 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 (1.1-1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 A body slides along a frictionless horizontal surface at CONSTANT VELOCITY. For which ONE of the following pairs are the magnitudes of both physical quantities ZERO?

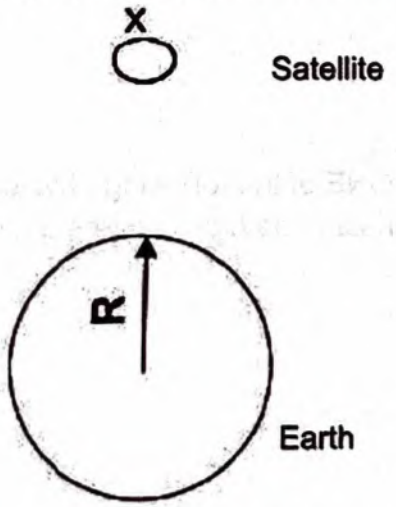
A Displacement and momentum.

B Acceleration and momentum.

C Displacement and net force.

D Acceleration and net force. (2)

1.2 A satellite orbits the Earth at a point X, where the gravitational force is a quarter (¼) of the gravitational force it experiences on the surface of the Earth.



If the radius of the Earth is **R**, then the height of the satellite ABOVE THE SURFACE of the Earth will be…

A 4R

B 2R

C R

D ½ R (2)

Downloaded from Stanmorephysics.com

1.3 A girl standing in a lift observes a 10N mass piece suspended from a spring balance that is fixed to the roof of the lift. She sees that the reading on the spring balance is GREATER than 10N for a short time interval. During this time interval the lift is....

A not moving.

B moving at constant velocity.

C accelerating upwards.

D accelerating downwards. (2)

1.4 A ball of mass m hits a wall at a speed of v and rebounds in a straight line in the opposite direction with the same speed.

The magnitude of the change in momentum of the ball will be...

A 0

B 2mv

C ½ mv

D mv (2)

1.5 A ball is thrown vertically upwards. Which ONE of the following physical quantities has a NON-ZERO value at the instant the ball changes direction?

A Acceleration

B Kinetic energy

C Momentum

D Velocity (2)

1.6 The molecular formula of an organic compound is $C_4H_{10}O$. Which ONE of the following is the FUNCTIONAL GROUP of the organic compound?

A Formyl group

B Hydroxyl group

C Carboxyl group

D Carbonyl group (2)

Downloaded from Stanmorephysics.com

1.7 A FUNCTIONAL ISOMER of ethyl propanoate is . . .

A C_4H_9CHO.

B $C_5H_{11}COOH$.

C C_4H_9COOH.

D $CH_3(CH_2)_3CHO$. (2)

1.8 Which ONE of the following is the EMPIRICAL FORMULA of 2 – methylpentane?

A C_3H_7

B C_6H_{14}

C C_6H_{12}

D C_3H_6 (2)

1.9 Which ONE of the following represents a product of the thermal cracking of butane?

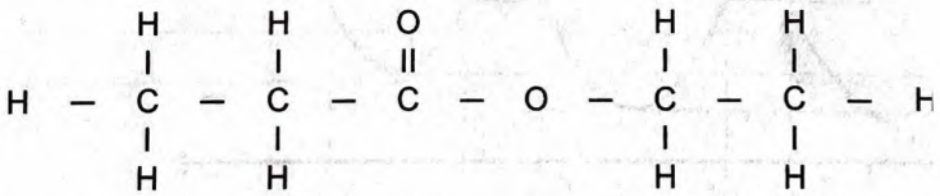
A C_2H_2

B C_2H_4

C C_4H_6

D C_4H_{10} (2)

1.10 Consider the structural formula of an organic compound given below:



This compound is the product of the reaction between . . .

A ethanol and propanoic acid.

B propanol and propanic acid.

C ethanol and ethanoic acid.

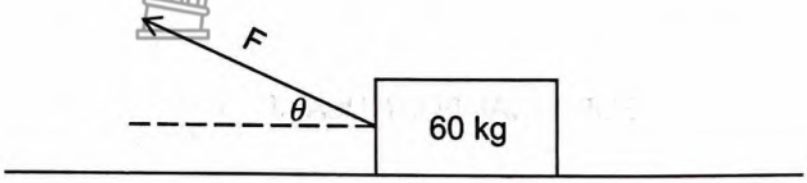
D propanol and ethanoic acid. (2)

[20]

Downloaded from Stanmorephysics.com

QUESTION 2 (Start on a new page.)

A force of magnitude F is applied at an angle θ with the horizontal to a box of mass 60 kg placed on the floor. With force F applied, the magnitude of the maximum static frictional force between the floor and the box is 140 N . The coefficient of static friction between the box and the floor is 0,3.
The applied force does not cause the box to lift off the floor.



2.1 Define *normal force*. (2)

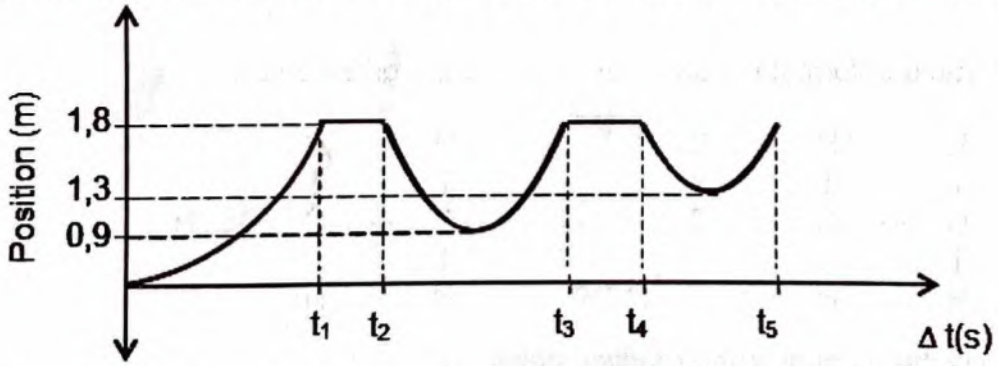
2.2 Draw the free body diagram showing all forces acting on the box. (4)

2.3 Calculate the magnitude of the normal force when the static frictional force is at its maximum. (3)

2.4 Determine the angle θ (4)
[13]

QUESTION 3 (Start on a new page.)

A ball of mass 0,5 kg is projected vertically downwards from a height of 1,8 m with an initial velocity of 2 m.s^{-1}. The ball hits the ground and bounces two times.
The position – time graph for the motion of the ball from the instant it is projected until it hits the ground after the second bounce is shown below. Ignore the effects of friction.



3.1 Write down the maximum vertical height reached by the ball after the SECOND bounce? (1)

3.2 The ball strikes the ground with a speed of 6,27 m.s^{-1} and is in contact with the ground for 0,2 s during the first bounce.

3.2.1 Calculate the time t_1 as indicated on the graph. (4)

3.2.2 Determine the velocity with which the ball leaves the ground after the first bounce. (4)

3.2.3 Calculate the magnitude of the force exerted by the ground on the ball during the first bounce. (4)

Downloaded from Stanmorephysics.com

3.3 Draw a velocity – time graph for the motion of the ball from the time that it is projected to the time it rebounds to a height of 0.9 m.

Clearly show the following on your graph:

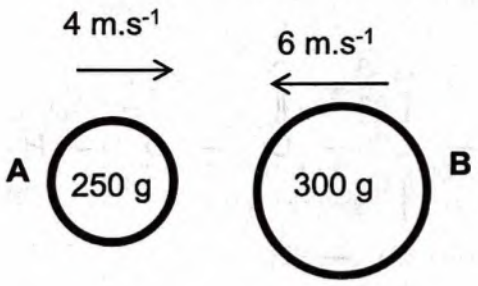
- The time when the ball hits the ground
- The velocity of the ball when it hits the ground
- The velocity of the ball when it rebounds off the ground.

(3)
[16]

QUESTION 4 (Start on a new page.)

Two balls, A and B, of mass 250 g and 300 g respectively collide head-on. Before the collision, ball A was moving at a velocity of 4 $m.s^{-1}$ to the right and ball B at 6 $m.s^{-1}$ to the left. After the collision ball A moved to the left with a velocity of 2 $m.s^{-1}$.

Before collision



4.1 Explain what is meant by an *isolated system* in Physics. (2)

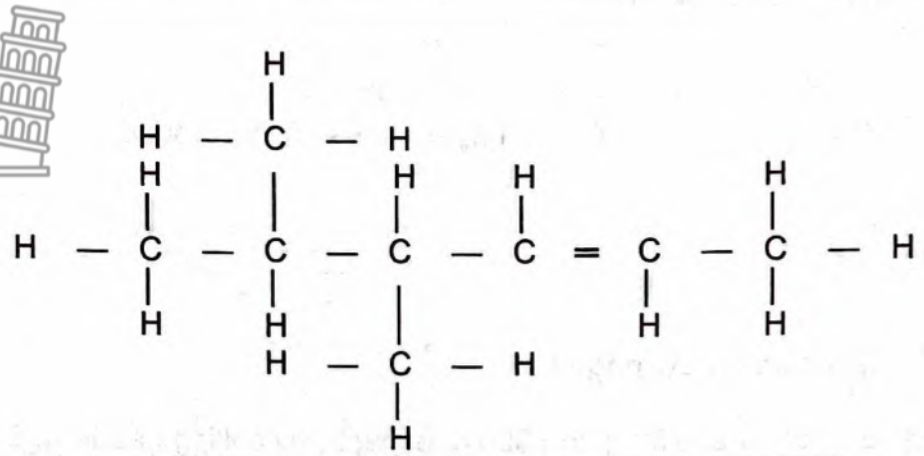
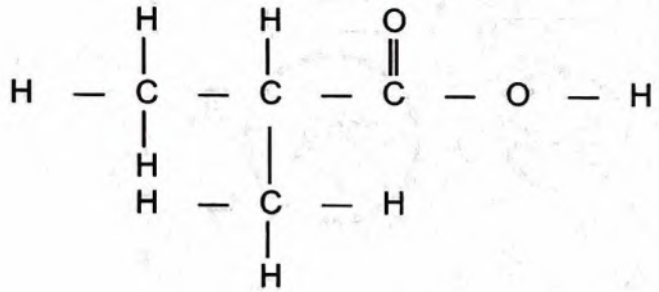
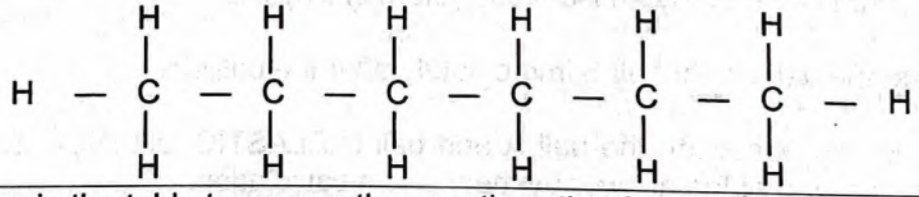
4.2 Calculate the velocity of ball B immediately after the collision. (4)

4.3 Is the collision between the ball A and ball B ELASTIC OR INELASTIC? Show how you arrived at the answer by means of a calculation. (5)
[11]

Downloaded from Stanmorephysics.com

QUESTION 5 (Start on a new page.)

Consider the letters A to E in the table below:

A	
B	$C_4H_{10}O$
C	$CH_3CCCH_2CH_3$
D	but – 2 – ene
E	
F	

Use the information in the table to answer the questions that follow.

5.1 Write down the:

5.1.1 IUPAC name of compound A. (3)

5.1.2 Letter that represents a compound that belongs to the same homologous series as ethyne. (1)

5.1.3 NAME of the functional group of compound E. (1)

5.1.4 General formula of the homologous series to which compound A belongs. (1)

Downloaded from Stanmorephysics.com

5.2 Compound B represents a TERTIARY alcohol. Write down the structural formula of compound B. (2)

5.3 Compound D has CHAIN and POSITIONAL isomers.

5.3.1 Define *positional isomer* (2)

5.3.2 Write down the IUPAC NAME of the POSITIONAL isomer of compound D (1)

5.3.3 Write down the structural formula of a CHAIN isomer of compound D (2)

5.4 Is compound C saturated or unsaturated? Give a reason for the answer (2)

5.5 Compound F undergoes complete combustion. Write a balanced equation using MOLECULAR FORMULAE to represent the reaction that takes place. (3)
[18]

QUESTION 6 (Start on a new page.)

The table below shows the results obtained during a practical investigation. Two experiments were conducted to determine the BOILING POINTS of compounds under the same conditions.

Experiment	Compound		Molecular Mass ($g.mol^{-1}$)	Boiling Point (°C)
1	A	CH_3COOH	60,5	11,8
	B	$CH_3(CH_2)_2COOH$	88,1	163
2	C	$CH_3CH_2CH_2OH$	60,1	97
	D	$CH_3(CH_2)_3CH_2OH$	88,1	137

6.1 Define *boiling point*. (2)

6.2 Apart from the conditions for determining boiling points, state the controlled variable for experiment 1. (1)

6.3 Write down the general conclusion for this investigation. (2)

6.4 Which compound will have the highest vapour pressure? (1)

6.5 The boiling points of compounds B and D are compared.

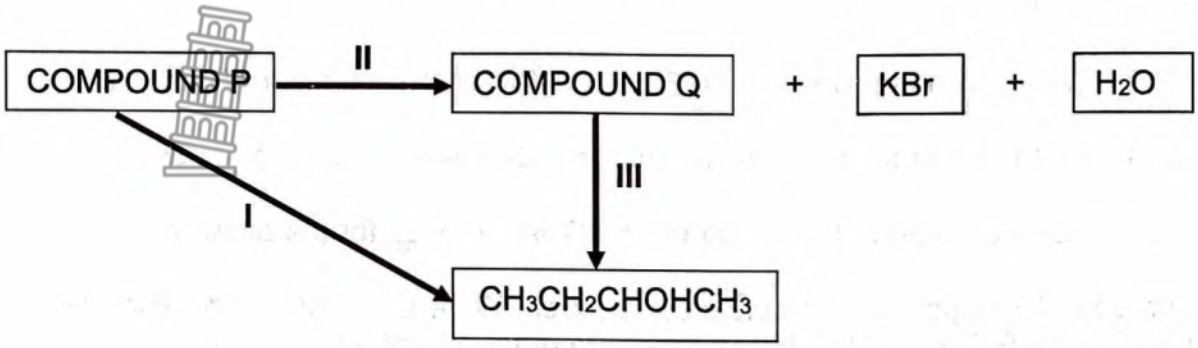
6.5.1 Write down the independent variable for this comparison. (1)

6.5.2 Fully explain the difference in the boiling points of the two compounds. (3)
[10]

Downloaded from Stanmorephysics.com

QUESTION 7 (Start on a new page.)

In the flow diagram below **I, II** and **III** represent organic reactions. P and Q are different organic compounds. Q is the major organic product.



7.1 Name the TYPE of substitution reaction represented by reaction **I**. (1)

7.2 Write down the STRUCTURAL formula for compound Q. (2)

7.3 Name the inorganic reagent used in reaction **III** (1)

7.4 Write down the type of reaction represented by reaction **III** (1)

7.5 The same INORGANIC reagent is used in reactions **I** and **II**.
Write down

7.5.1 The NAME or FORMULA of the inorganic reagent used. (1)

7.5.2 ONE difference between the inorganic reagent used in reactions **I** and **II**. (2)

7.6 Write down the IUPAC name of:

7.6.1 Compound P (2)

7.6.2 The organic product of reaction **III** (2)

[12]

TOTAL MARKS: [100]

Downloaded from Stanmorephysics.com

DATA FOR PHYSICAL SCIENCES (PHYSICS) GRADE 12

GEGEWENS VIR FISIESE WETENSKAPPE (FISIKA) GRAAD 12

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m\cdot s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}\ N.m^2.kg^{-2}$

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p = mv_f - mv_i$	$F_g = mg$
$F = \frac{Gm_1m_2}{r^2}$	
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$

Downloaded from Stanmorephysics.com

DATA FOR PHYSICAL SCIENCES GRADE 12
CHEMISTRY

TABLE 1: PHYSICAL CONSTANTS:

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

TABLE 2: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	

Downloaded from Stanmorephysics.com

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

KEY

Atomic number → 29
Electronegativity → 1,9 Cu ← Symbol
63,5 ← Approximate relative atomic mass

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

Copyright reserved

Downloaded from Stanmorephysics.com

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON TEST

MARCH 2023

MARKING GUIDELINE

MARKS : 100

Stanmorephysics

This Marking Guideline consists of 10 pages.

Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1 D✓✓

1.2 C✓✓

1.3 C✓✓

1.4 B✓✓

1.5 A✓✓

1.6 B✓✓

1.7 C✓✓

1.8 A✓✓

1.9 B✓✓

1.10 A✓✓

[20]

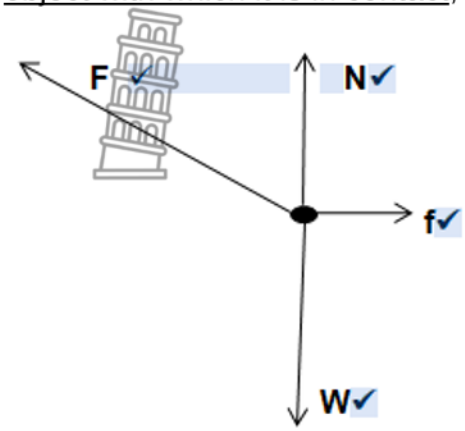
Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 2 (Start on a new page.)

2.1 **Normal force** is the force or component of a force which a surface exerts on an object with which it is in contact, and which is perpendicular to the surface.✓✓ (2)

2.2



	Accept the following symbols
N	Normal Force/Normal/F_N
f	Static friction/ f_s
W	Weight/F_W /Gravitational force/f_g
F	Force applied/F_A

Notes
- Mark is awarded for label and arrow.
- Do not penalize for length of the arrows.
- Deduct 1 mark or any additional force.
- If force(s) do not make contact with body/dot:*Max:3/4*
- If arrows missing but labels are there: *Max: 3/4*

(4)

2.3
$$f_s^{max} = \mu_s N \checkmark$$
$$140 = 0,3N \checkmark$$
$$N = 466,67N \checkmark$$

(3)

2.4 **POSITIVE MARKING FROM 2.3**

$$F_x = f_s^{max} = 140N \checkmark$$
$$N = F_g - F_y$$
$$466,67 = (60)(9,8) - F_y \checkmark$$
$$F_y = 121,33N$$
$$\tan\theta = \frac{F_y}{F_x}$$
$$\tan\theta = \frac{121,33}{140} \checkmark$$
$$\theta = 40.91^0 \checkmark$$

(4)
[13]

Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 3 (Start on a new page.)

3.1 0,5 m✓ (1)

3.2.1 **OPTION 1/*OPSIE 1***

Upwards positive

$v_f = v_i + a\Delta t$✓

-6,27✓ = -2 + (-9,8)Δt ✓

Δt = 0,44 s ✓

Downwards positive

$v_f = v_i + a\Delta t$✓

6,27✓ = 2 + (9,8)Δt ✓

Δt = 0,44 s ✓

OPTION 2/*OPSIE 2*

Upwards positive

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

-1,8 ✓= $(-2)\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓

$$\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Delta t = \frac{-2 \pm \sqrt{(2)^2 - 4(4.9)(-1.8)}}{2(4.9)}$$

= 0,44 s ✓

Downwards positive

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

1,8 ✓= $(2)\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓

$$\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Delta t = \frac{-2 \pm \sqrt{(-2)^2 - 4(4.9)(-1.8)}}{2(4.9)}$$

= 0,44 s ✓

(4)

Copyright reserved

Downloaded from Stanmorephysics.com

OPTION 3

$\Delta y = \frac{(vi + vf))}{2}\Delta t$ ✓

$1,8$✓ $= \frac{(2 + 6,27))}{2}\Delta t$ ✓

$\Delta t = 0,44$ s✓

(4)

3.2.2 **Upwards positive:**

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$0^2 = v_i^2 + 2(-9,8)(0,9)$✓

$v_i = 4,2\ m\cdot s^{-1}$ ✓upwards ✓

Downwards positive:

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$0^2 = v_i^2 + 2(9,8)(0,9)$ ✓

$v_i = 4,2\ m\cdot s^{-1}$ ✓ upwards✓

(4)

3.2.3 **Upwards positive:**

$F_{net}\Delta t = m\Delta v$

$F_{net}(0,2) = (0,5)[(4,2 - (-6,27)]$ ✓

$F_{net} = 26,175$ N

$F_{net} = F - Fg$

$26,1755 = F - (0,5)(9,8)$ ✓

$F = 31,075$ N✓

✓ for either equation

Downwards positive:

$F_{net}\Delta t = m\Delta v$ ✓

$F_{net}(0,2) = (0,5)[(-4,2 - (6,27)]$ ✓

$F_{net} = -26,175$ N

$F_{net} = 26,175$ N

$F_{net} = Fg - F$

$-26,1755 = (0,5)(9,8) - F$ ✓

$F = 31,075$ N✓

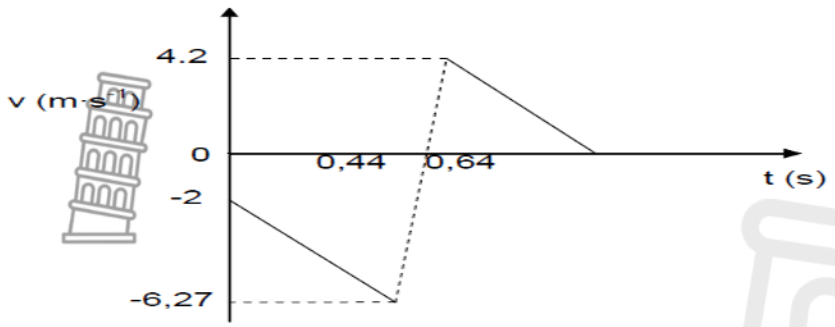
✓ for either equation

(4)

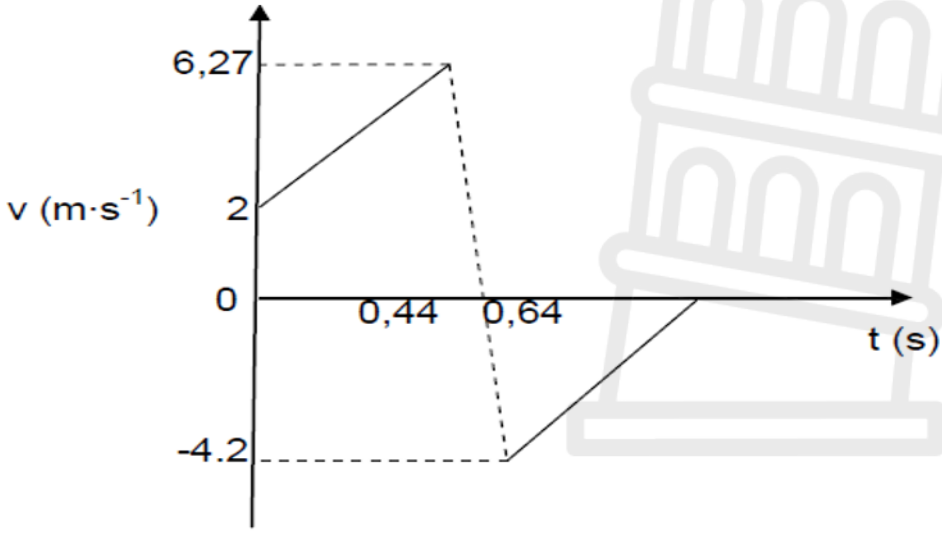
Copyright reserved

Downloaded from Stanmorephysics.com

3.5 **Upwards positive:**



Downwards positive:



Criteria for graph	Marks
2 straight discontinuous parallel lines, one above and one below the time axis	✓
First part of the graph starts at v = 2 m·s^{-1} at t = 0 s and extends until v = 6,27 m·s^{-1} at t = 0,44 s.	✓
Second part of graph starts at v = 4,2 m·s^{-1} at t = 0,64 s until v = 0 m·s^{-1}.	✓

(3)
[16]

Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 4 (Start on a new page.)

4.1 A system on which the net external force is zero.✓✓ (2)

4.2 **Right as Positive:**

$\Sigma p_i = \Sigma p_f$
$\Delta pA = -\Delta pB$
Any one✓

$m_A v_{i_A} + m_B v_{i_B} = m_A v_{f_A} + m_B v_{f_B}$

$(0,25)(4) + (0,3)(-6) = (0,25)(-2) + (0,3)(v_{f_2})$ ✓✓

$v_{f_2} = -1\,\text{m.s}^{-1}$

$v_{f_2} = 1\,\text{m.s}^{-1}$ to the left✓

Left as Positive:

$\Sigma p_i = \Sigma p_f$
$\Delta pA = -\Delta pB$
Any one✓

$m_A v_{i_A} + m_B v_{i_B} = m_A v_{f_A} + m_B v_{f_B}$

$(0,25)(-4) + (0,3)(6) = (0,25)(2) + (0,3)(v_{f_2})$ ✓✓

$v_{f_2} = 1\,\text{m.s}^{-1}$

$v_{f_2} = 1\,\text{m.s}^{-1}$ to the left✓

(4)

4.3 $\Sigma E_{k\,(before)} = \frac{1}{2} m_A v_{i_A}{}^2 + \frac{1}{2} m_B v_{i_B}{}^2$ ✓

$= \frac{1}{2}(0,25)(4)^2 + \frac{1}{2}(0,3)(-6)^2$ ✓

= 7,4 J

$\Sigma E_{k(after)} = \frac{1}{2} m_A v_{f_A}{}^2 + \frac{1}{2} m_B v_{f_B}{}^2$

$= \frac{1}{2}(0,25)(-2)^2 + \frac{1}{2}(0,3)(-1)^2$ ✓

= 0,65 J

$\Sigma E_{k\,(before)} \neq \Sigma E_{k(after)}$ ✓

∴ INELASTIC✓

NOTE: If starts with $\Sigma E_{k\,(before)} = \Sigma E_{k\,(after)}$ maximum 2/5

(5)
[11]

Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 5

5.1.1 4,5 – dimethyl✓ hex – 2 – ✓ene✓

Marking criteria:
- Identify as alkene:✓
- Hex – 2 -: ✓
- All the substituents correct and correctly numbered: ✓

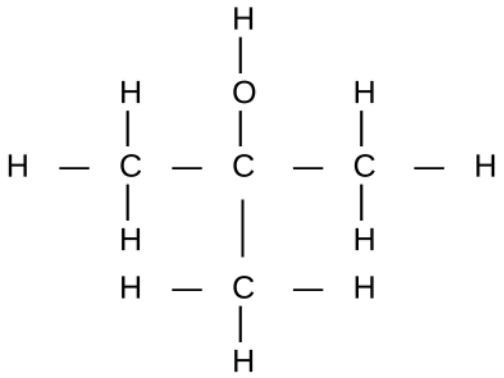
(3)

5.1.2 C ✓ (1)

5.1.3 carboxyl ✓ (1)

5.1.4 C_nH_{2n} ✓ (1)

5.2



Marking criteria:
- Correct functional group: $\frac{1}{2}$
- Whole structure correct: $\frac{2}{2}$

(2)

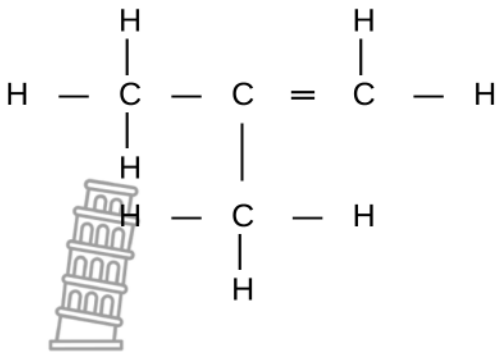
5.3.1 Organic molecules with the same molecular formula but different positions of the side chains/substituents/functional groups on the parent chain ✓✓ (2)

5.3.2 but – 1 – ene ✓ (1)

Copyright reserved

Downloaded from Stanmorephysics.com

5.3.3



Marking criteria:

- 3 carbons in parent chain with the double bond✓
- Methyl group as a substituent ✓

(2)

5.4 Unsaturated✓
There multiple bonds between C atoms in the hydrocarbon chain/triple bond between C atoms in the hydrocarbon chain. ✓ (2)

5.5 $2\ C_6H_{14} + 19\ O_2 \rightarrow 12\ CO_2 + 14\ H_2O$
Reactants ✓ Products ✓ Balancing ✓ (3)
[18]

QUESTION 6

6.1 The temperature at which the vapour pressure equals atmospheric (external) pressure. ✓✓ (2 or 0) (2)

6.2 Compounds have the same functional group/belong to the same homologous series✓ (1)

6.3 As the length of the carbon chain/molecular mass increases the boiling point increases for the same functional group/homologous series✓✓ (2)

6.4 A✓ (1)

6.5.1 Type of functional group/organic compound/homologous series. ✓ (1)

6.5.2
- B has 2 sites for hydrogen bonding✓ and
- therefore has stronger intermolecular forces✓
- That require more energy to overcome. ✓

OR

- D has only 1 site for hydrogen bonding✓ and
- therefore has weaker intermolecular forces✓
- That require less energy to overcome. ✓ (3)

[10]

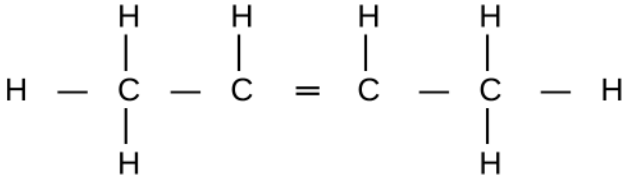
Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 7

7.1 hydrolysis✓ (1)

7.2.



Double bond between the second and third carbon atoms✓
Whole structure correct✓

(2)

7.3 Water(H_2O)/sulphuric acidH_2SO_4/phosphoric acidH_3PO_4/ hydrogen chloride(HCl) ✓ (1)

7.4 Addition/hydration ✓ (1)

7.5.1 Potassium hydroxide/KOH ✓ (1)

7.5.2 KOH in reaction **I** is dilute. ✓
KOH in reaction **II** is concentrated. ✓ (2)

7.6.1 2 - bromo✓butane✓ (2)

7.6.2 Butan✓ – 2 – ol ✓ (2)

[12]

TOTAL MARKS: 100

Copyright reserved

Downloaded from Stanmorephysics.com

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON TEST

MARCH 2024

Stanmorephysics.com

MARKS : 100

TIME : 2 Hours

This question paper consists of 10 pages and 3 data sheets.

Copyright reserved

Downloaded from Stanmorephysics.com

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SEVEN questions. Answer ALL the questions in your 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 sub questions, 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. You are advised to use the attached DATA SHEETS.
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. Write neatly and legibly.

Downloaded from Stanmorephysics.com

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Stanmorephysics.com

Various 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 (1.1-1.6) in the ANSWER BOOK, for example 1.11 D.

1.1 In which of the following cases is the net force on the object zero? An object which...

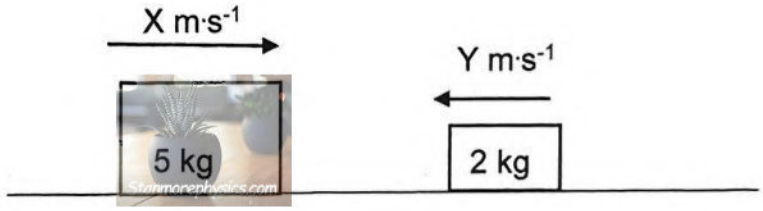
A moves with constant speed around a corner.

B moves under the influence of a force gravity only.

C moves with constant acceleration in a straight line.

D moves with equal displacements in equal time intervals.

1.2 A 5 kg block traveling at X $m \cdot s^{-1}$ to the right collides ELASTICALLY with a 2 kg block travelling at Y $m \cdot s^{-1}$ to the left as shown in the diagram below. The blocks remain coupled together after the collision and move to the right.



What change in TOTAL MOMENTUM and TOTAL KINETIC ENERGY takes place in the above collision?

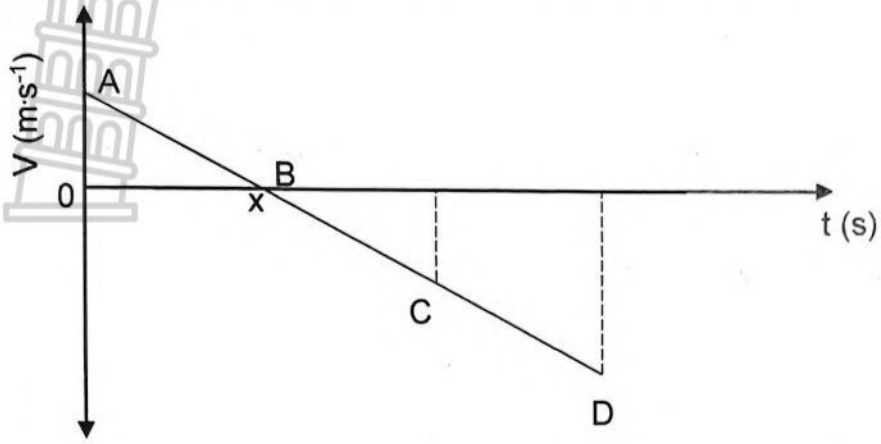
	Total momentum	Total kinetic energy
A	Remains constant	Decreases
B	Decreases	Increases
C	Increases	Increases
D	Remains constant	Remains constant

(2)

Copyright reserved

Downloaded from Stanmorephysics.com

1.3 The velocity time-graph below represents an object that has been projected vertically upwards from the edge of a cliff. It takes x seconds to reach the highest point above the ground, after which it falls past the edge of the cliff and strikes the ground. Ignore the effects of friction.



Which one of the following represent the height of the cliff?

A A - B

B B - C

C C - D

D A - D (2)

1.4 Which ONE of the following organic compounds has a formyl group as a functional group?

A Butane

B Butanal

C butan-2-ol

D butan-2-one (2)

1.5 Which ONE of the following compounds has the HIGHEST vapour pressure at room temperature?

A Ethane

B Ethanol

C Propane

D Fluoroethane (2)

Copyright reserved

Downloaded from Stanmorephysics.com

1.6 Which ONE of the following organic reactions will take place only when exposed to light?

A $CH_2CH_2 + H_2 \rightarrow CH_3CH_3$

B $CH_3CH_3 \rightarrow CH_2CH_2 + H_2$

C $CH_2CH_2 + Br_2 \rightarrow CH_2BrCH_2Br$

D $CH_3CH_3 + Br_2 \rightarrow CH_3CH_2Br + HBr$

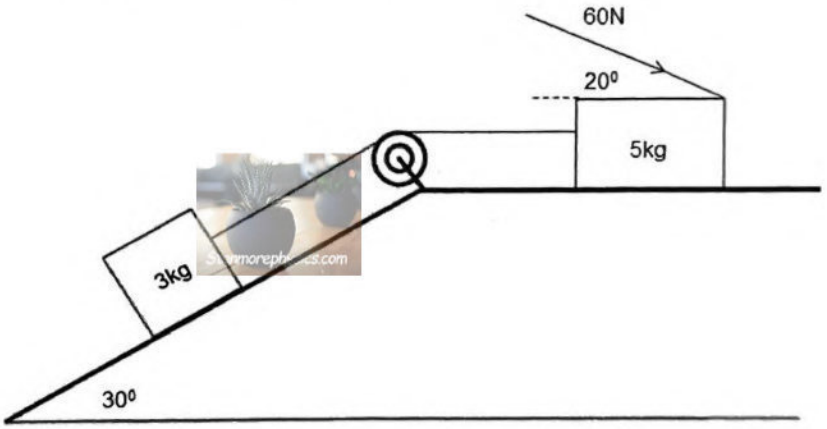
(2)

6 x 2 =**[12]**

QUESTION 2 (Start on a new page.)

A learner constructs a push toy using two blocks with masses 3 kg and 5 kg respectively. The blocks are connected by means of a light inextensible string. The string moves over a frictionless pulley.

The learner places the 3 kg block on a plane that is inclined at an angle of 30^0 to the horizontal. He then applies a force of 60 N at an angle of 20^0 to the 5 kg block by means of a light rigid rod, causing the toy to move across a flat, rough, horizontal surface, as shown in the diagram below.



The coefficient of kinetic friction between the surface and each block is 0,15.

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

2.2 Draw a labelled free-body diagram indicating all the forces acting on the 3 kg block. (4)

2.3 Calculate the magnitude of the:

2.3.1 Normal force acting on the 3 kg block (2)

2.3.2 Kinetic frictional force acting on the 5 kg block (3)

2.3.3 Tension in the string connecting the blocks (5)

[16]

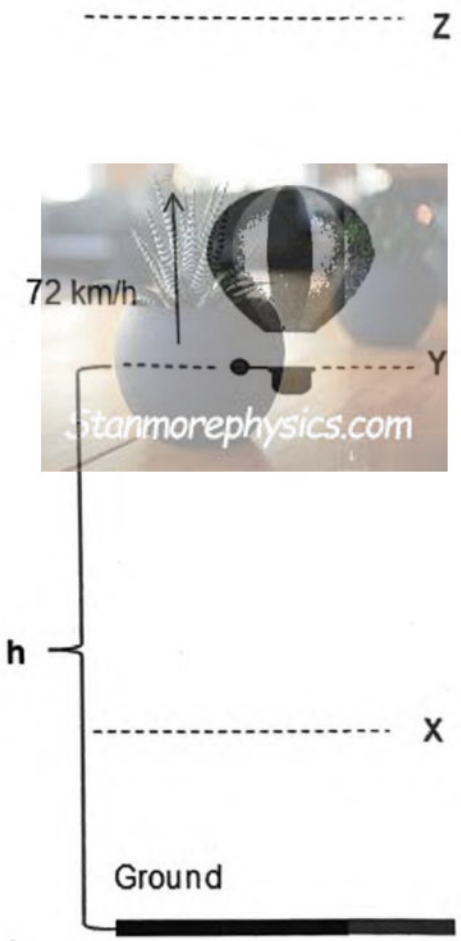
Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 3 (Start on a new page.)

A hot-air balloon moves vertically upwards at a CONSTANT VELOCITY of 72 km/h. When it is **h** meters above the ground, a ball is dropped from the balloon. The ball reaches its MAXIMUM HEIGHT above the ground at point **Z**. Refer to the diagram below.

Assume that the dropping of the ball has no effect on the speed of the hot-air balloon. Ignore air friction for the motion of the ball.



3.1 Give a reason why the ball keeps moving upwards after it is dropped. (1)

3.2 What is the acceleration of the ball at:

3.2.1 Point **X** (1)

3.2.2 Point **Z** (1)

3.3 Calculate the time it takes for the ball to reach its maximum height. (3)

3.4 Calculate the distance between the hot-air balloon and the ball, when the ball is at its maximum height. (6)

Copyright reserved

Downloaded from Stanmorephysics.com

3.5 Sketch a velocity-time graph in the ANSWER BOOK for the motion of the ball from the time it is dropped until it hits the ground.

Clearly show the following on your graph:

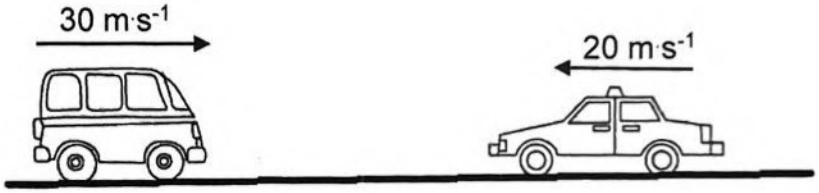
- The initial velocity
- The time it takes to reach its maximum height
- The time it passes point **Y** on its way downward

(4)

[16]

QUESTION 4 (Start on a new page.)

A minibus taxi with an unknown number of passengers travels at 30 $m \cdot s^{-1}$ when it collides head-on with a car of mass of 1 100 kg, travelling at 20 $m \cdot s^{-1}$, as shown in the diagram below. During the collision the vehicles stick together and travel at 10 $m \cdot s^{-1}$ immediately after the collision in the direction of the original motion of the taxi.



The average mass of a minibus taxi on South African roads is 1 500 kg. The law states that the combined mass of all the passengers in a minibus taxi and the taxi itself should not exceed 3 500 kg.

4.1 What is meant by the term *isolated system* in Physics? (2)

4.2 Was the minibus taxi overloaded? Support your answer with an appropriate calculation. (5)

The surface exerts a constant frictional force of 2500 N on the minibus taxi-car system as it comes to rest.

4.3 Calculate the distance that the minibus taxi-car system moves after the collision. (5)

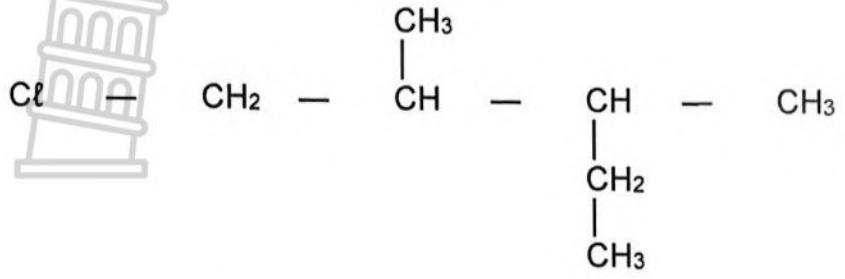
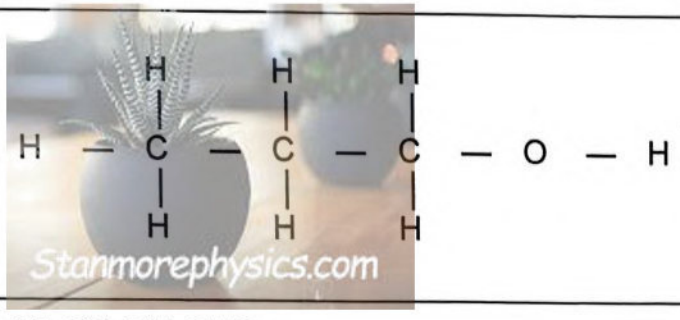
[12]

Copyright reserved

Downloaded from Stanmorephysics.com

QUESTION 5 (Start on a new page.)

The letters A to G in the table below represent six organic compounds.

A	
B	$CH_3COCH_2CH_3$
C	5,6 – dimethylhept – 2 – yne
D	
E	$CH_3CH_2CH_2CHO$
F	2,3 – dimethylpentan – 2 – ol

Use the above table to answer the following questions:

5.1 Write down the:

5.1.1 IUPAC name for compound A. (3)

5.1.2 Letters of the compounds that are FUNCTIONAL ISOMERS of each other. Give a reason for the answer. (3)

5.1.3 Letter of the compound that is classified as a TERTIARY alcohol. Give a reason for the answer. (3)

5.1.4 Structural formula of compound C. (3)

Copyright reserved

Downloaded from Stanmorephysics.com

5.2 Compound **D** is heated with an organic compound **P** in the presence of concentrated sulphuric acid as shown in the equation below:

$$\mathbf{D} + \mathbf{P} \xrightarrow[\text{heat}]{H_2SO_{4(CONC.)}} \mathbf{Q} + H_2O$$

The compound Q that is produced, contains 9,80 % hydrogen (H), 31,38 % oxygen(O) and 58,82 % carbon(C).

Write down the:

5.2.1 Empirical formula of compound Q. Support the answer with a relevant calculation. (6)

5.2.2 Structural formula of compound Q. (3)

5.2.3 Structural formula of the functional group of compound P. (1)

[22]

QUESTION 6 (Start on a new page.)

Two compounds M and P, shown in the table below, were used to investigate one of the factors that influences boiling point.

	COMPOUND	MOLECULAR MASS ($g.mol^{-1}$)
M	$C_4H_8O_2$	88
P	$C_5H_{12}O$	88

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

6.2 For this investigation write down the:

6.2.1 Dependent variable. (1)

6.2.2 Controlled variable. (1)

6.3 Write down the names of TWO homologous series that compound M can belong to. (2)

The boiling points of compounds M and P, are respectively, 79,8 °C and 138,5 °C.

6.4 Write down the name of the homologous series to which compound P belongs. (1)

6.5 Explain the difference in boiling points of compounds M and P. (4)

[11]

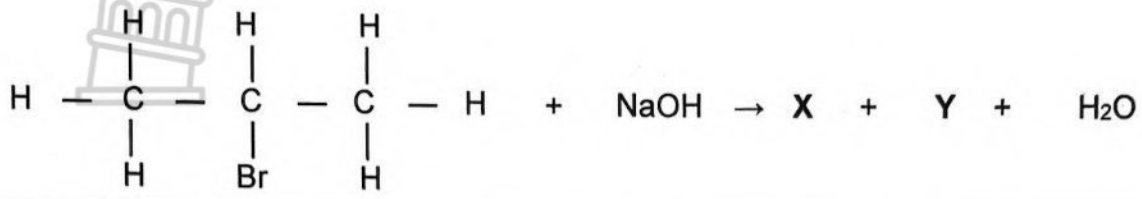
Copyright reserved

Downloaded from Stanmorephysics.com

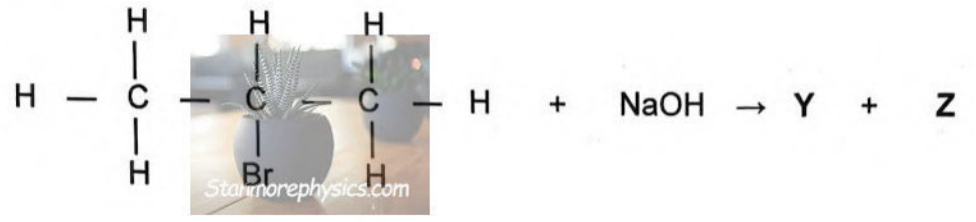
QUESTION 7 (Start on a new page.)

The equations below represent the reactions that takes place when an organic compound reacts with sodium hydroxide under different conditions:

REACTION I



REACTION II



X represents an organic product formed with a general formula C_nH_{2n}

7.1 Write down the:

7.1.1 Structural formula for compound X. (2)

7.1.2 Molecular formula for compound Y. (1)

7.2 For REACTION I, write down:

7.2.1 TWO conditions that must be satisfied for the reaction to take place. (2)

7.2.2 TWO terms that describe the type of reaction represented by REACTION I. (2)

7.3 Consider REACTION II.

Write down:

7.3.1 IUPAC name of compound Z. (1)

7.3.2 The type of reaction represented by REACTION II. Choose from: SUBSTITUTION, ADDITION or ELIMINATION. (1)

7.4 Both REACTIONS I AND II used NaOH as an inorganic reagent. Compare the NaOH used in REACTION I to the one used in REACTION II. (2)

[11]

TOTAL: 100

Copyright reserved

Downloaded from Stanmorephysics.com

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

KEY/*SLEUTEL*

Atomic number *Atoomgetal*	29
Electronegativity *Elektronegatiwiteit*	1,9
Symbol *Simbool*	Cu
Approximate relative atomic mass *Benaderde relatiewe atoommassa*	63,5

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

Copyright reserved

Downloaded from Stanmorephysics.com

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIESE KONSTANTES

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

Copyright reserved

Downloaded from Stanmorephysics.com

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

$F_{net} = ma$	$p = mv$
$f_{s(max)} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm1\ m_2}{r^2}$	$g = \frac{Gm}{r^2}$

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

Copyright reserved

Downloaded from Stanmorephysics.com

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON TEST

MARKING GUIDELINE

MARCH 2024

MARKS : 100

This marking guidelines consists of 9 pages.

Copyright reserved

Downloaded from Stanmorephysics.com

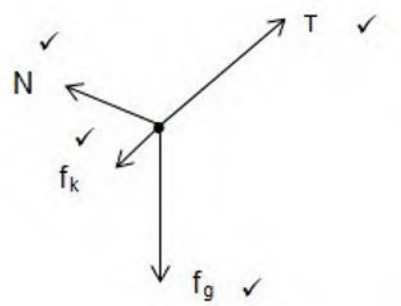
QUESTION 1

1.1 D✓✓ (2)
1.2 D✓✓ (2)
1.3 D✓✓ (Accept C) (2)
1.4 B✓✓ (2)
1.5 A✓✓ (2)
1.6 D ✓✓ (2)

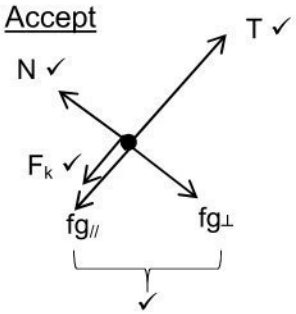
QUESTION 2

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.✓✓ (2)

2.2



Accept



Accepted labels	
W	F_g/F_w/Wight/Gravitational force
f_k	f/friction/Kinetic friction
N	F_N/Normal force
T	Tension/F_T/T

(4)

2.3.1 $N = F_{g_\perp}$

$N = mg\cos\theta$

$N = (3)(9,8)\cos 30^0$ ✓

$N = 25,46N$ ✓ (2)

2.3.2 $f_k = \mu_k N$ ✓

$f_k = (0,15)[(5)(9,8) + (60)\sin 20^0]$ ✓

$f_k = 10,43N$ ✓ (3)

2.3.3 **POSITIVE MARKING FROM 2.3.1 AND 2.3.2**

3kg:

$$\left.\begin{aligned} F_{net} &= ma \\ T + (-f_k) + (-f_{g_{//}}) &= ma \end{aligned}\right\} \checkmark$$

$T - (0,15)(25,46) - (3)(9,8)\sin 30^0 = (3)a$ ✓

$T = 3a + 18,52$ ……eq.1

Copyright reserved

Downloaded from Stanmorephysics.com

5kg:

$F_{net} = ma$
$f_x + (-f_k) + (-T) = ma$
$(60)\cos 20^0 - 10,43 - T = (5)a$ ✓
$T = 45,95 - 5a$ eq.2

$\therefore 3a + 18,52 = 45,95 - 5a$
$a = 3,43 m.s^{-2}$

$\therefore T = 3(3,43) + 18,52$ ✓
$T = 28,81N$ ✓

OR (5)

$T = 45,95 - 5(3,43)$ ✓
$T = 28,80N$ ✓

[16]

QUESTION 3

3.1 Inertia.✓ (1)

3.2

3.2.1 0 / zero / 9,8m.s^{-2} downwards ✓ (1)

3.2.2 9,8m.s^{-2} downwards✓ (1)

3.3	
Upwards Positive	**Upwards Negative**
$v_f = v_i + a\Delta t$ ✓ $0 = 20 + (-9,8)\Delta t$ ✓ $\Delta t = 2,04s$ ✓	$v_f = v_i + a\Delta t$ ✓ $0 = -20 + (9,8)\Delta t$ ✓ $\Delta t = 2,04s$ ✓

(3)

Downloaded from Stanmorephysics.com

3.4 POSITIVE MARKING FROM 3.3

Upwards Positive

$\Delta y = v_i \Delta t$ ✓

$\Delta y = (20)(2,04)$ ✓

$\Delta y = 40,80m$

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

$\Delta y = (20)(2,04) + (0,5)(-9,8)(2,04)^2$ ✓

$\Delta y = 20,41m$

OR

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$(0)^2 = (20)^2 + 2(-9,8)\Delta y$ ✓

$\Delta y = 20,41m$

Distance = 40,80 – 20,41 ✓
= 20,39 m✓

Upwards Negative

$\Delta y = v_i \Delta t$ ✓

$\Delta y = (-20)(2,04)$ ✓

$\Delta y = -40,80m$

$\Delta y = 40,80m$

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

$\Delta y = (-20)(2,04) + (0,5)(9,8)(2,04)^2$ ✓

$\Delta y = -20,41m$

$\Delta y = 20,41m$

OR

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$(0)^2 = (-20)^2 + 2(9,8)\Delta y$ ✓

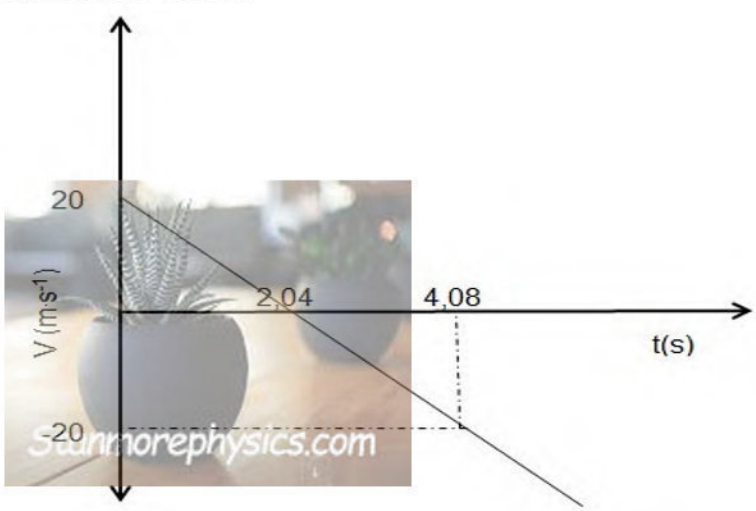
$\Delta y = 20,41m$

Distance = 40,80 – 20,41 ✓
= 20,39 m✓

(6)

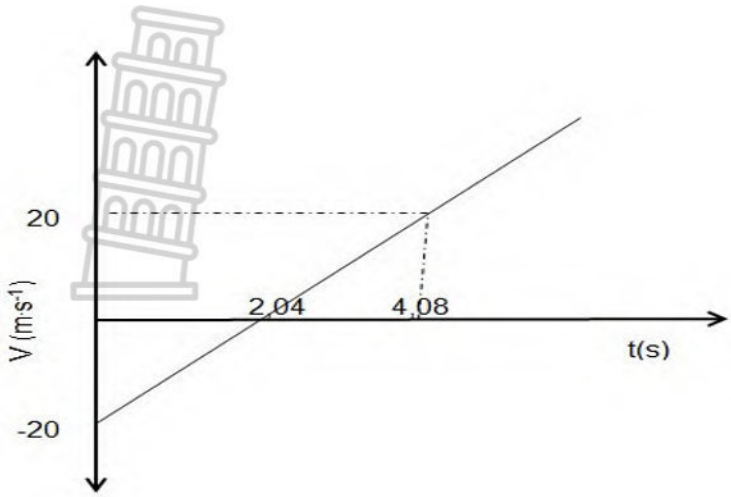
3.5 POSITIVE MARKING FROM 3.3 AND 3.4

Upwards Positive



Downloaded from Stanmorephysics.com

Upwards Negative



Marking criteria	
Initial velocity 20 m.s^{-1}/72 km/h	✓
Time for the ball at maximum height, 2,04s	✓
Time for the ball passing point Y, 4,08s	✓
Straight line graph extending beyond point Y.	✓

(4)

[16]

QUESTION 4

4.1 A system on which the net external force is zero.✓✓ (2 or 0) (2)

4.2

$$\left.\begin{array}{l}\sum p_{before} = \sum p_{after} \\ m_1 v_{i_1} + m_2 v_{i_2} = (m_1 + m_2) v_f\end{array}\right\} ✓$$

$m_1(30) + (1100)(-20)✓ = (m_1 + 1100)(10)✓$

$m_1 = 1650$ kg

The total mass is less than the allowed mass✓.

∴ No.✓ (5)

4.3 POSITIVE MARKING FROM 4.2

OPTION 1

$v_f^2 = v_i^2 + 2a\Delta x$✓

$\underline{(0)^2 = (10)^2 + 2(-0{,}91)\Delta x}$✓

$\Delta x = 54{,}95$m ✓

$F_{net} = ma$ ✓

$-2500 = 2750a$✓

$a = -0{,}91$ m.s^{-2}

(5)

Downloaded from Stanmorephysics.com

OPTION 2

$F_{net} = \frac{\Delta p}{\Delta t}$

$F_{net} = \frac{m(v_f - v_i)}{\Delta t}$ ✓

$-2500 = \frac{2750(0 - 10)}{\Delta t}$ ✓

Δt = 11 s

$\Delta x = \frac{v_i + v_f}{2} \times \Delta t$ ✓

$= \frac{10 + 0}{2} \times 11$ ✓

= 55 m ✓

[12]

QUESTION 5

5.1.1 1-chloro-2,3-dimethylpentane

Marking criteria:
• correct stem✓
• correct substituents: chloro and dimethyl✓
• IUPAC name completely correct including numbering, sequence and hyphen ✓

(3)

5.1.2 B and E ✓

Have the same molecular formula but different functional groups✓✓

OR

Have the same molecular formula but B is a ketone whereas E is an aldehyde✓✓

Marking criteria:
If any one of the underlined key phrases in the correct context is omitted , deduct 1 mark.
The underlined phrases must be in the correct context.

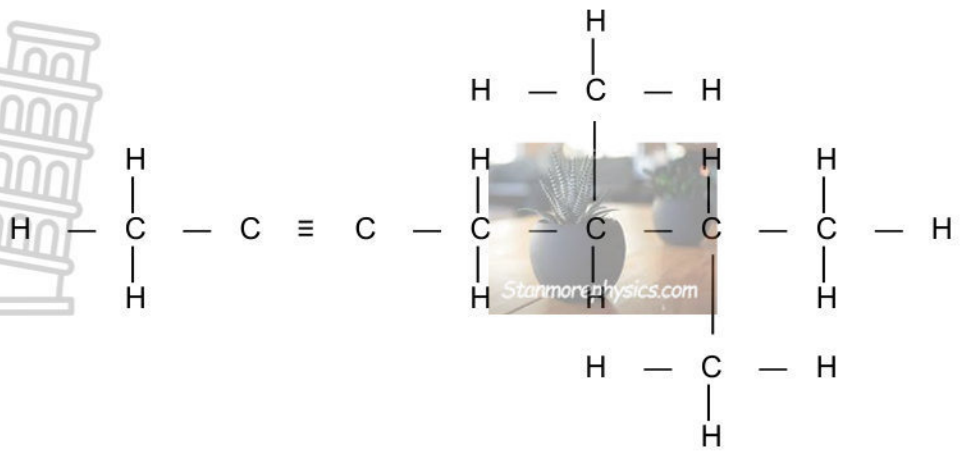
(3)

5.1.3 F ✓

The C atom bonded to the functional group/hydroxyl (group)/-OH is bonded to three other C atoms. ✓✓ (3)

Downloaded from Stanmorephysics.com

5.1.4



Marking criteria:
- Correct functional group✓
- correct stem and substituents: heptyne, dimethyl✓
- Whole structure correct ✓

(3)

5.2.1

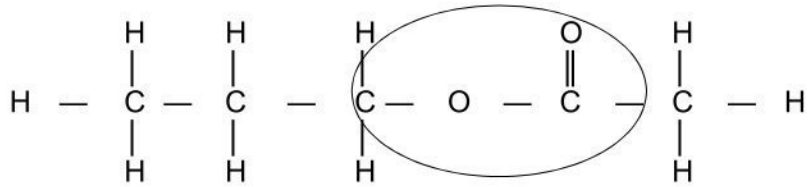
	H	O	C
%	9,80	31,38	58,82
m	9,80	31,38	58,82
$n = \frac{m}{M}$	$\frac{9,80}{1}$ ✓	$\frac{31,38}{16}$ ✓	$\frac{58,82}{12}$ ✓
	= 9,80	= 1,96	= 4,902
Ratio	5	1	2,5 ✓

$C_5H_{10}O_2$✓✓

Marking criteria:
- Correctly calculating number of mols of H✓, C✓ and O✓
- Correct ratio✓
- Correct empirical formula ✓✓

(6)

5.2.2

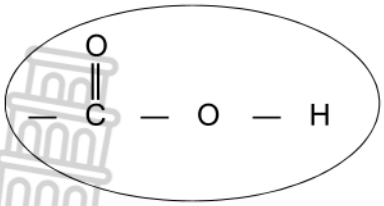


Marking criteria:
- Functional group correct✓
- Whole structure correct ✓✓

(3)

Downloaded from Stanmorephysics.com

5.2.3



✓

(1)
[22]

QUESTION 6

6.1.

Marking criteria: If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark. The underlined phrases must be in the correct context.

The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓

(2)

6.2.1 Boiling point. ✓ (1)

6.2.2 Molecular mass. ✓ (1)

6.3 Carboxyllic acid✓
Ester ✓ (2)

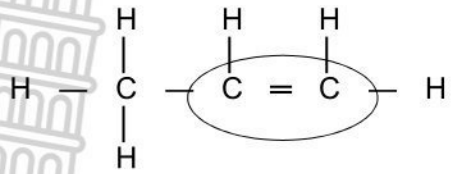
6.4 Alcohol✓ (1)

6.5 The intermolecular forces between molecules of M are dipole-dipole forces✓ while between molecules of P there are hydrogen bonds. ✓
The intermolecular forces between molecules of P are stronger✓ and require more energy to overcome. ✓ (4)
[11]

Downloaded from Stanmorephysics.com

QUESTION 7

7.1.1



Marking criteria:
- Functional group correct✓
- Whole structure correct ✓

(2)

7.1.2 NaBr✓ (1)

7.2.1 Concentrated strong base/NaOH✓(in ethanol)
Heat ✓ (2)

7.2.2 Elimination✓
dehydrohalogenation✓ (2)

7.3.1 Propan-2-ol✓ (1)

7.3.2 substitution✓ (1)

7.4 Concentrated NaOH in (I) ✓
Dilute NaOH in (II) ✓ (2)

[11]

TOTAL: 100

Stanmorephysics.com

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE EXAMINATION

GRADE 12

PHYSICAL SCIENCES

MARCH 2025

CONTROLLED TEST

MARKS:

TIME: 2 Hours

This question paper consists of 12 pages.

Copyright reserved

Testpapers.co.za

INSTRUCTIONS AND INFORMATION

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, 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.

Copyright reserved

Testpapers.co.za

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 (1.1-1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 A FORMYL GROUP of is the functional group of …

A alcohols.

B aldehydes.

C haloalkanes.

D ketones. (2)

1.2 The number of carbon atoms in an ALKYNE with 14 hydrogen atoms is …

A 7.

B 8.

C 9.

D 10. (2)

1.3 Which ONE of the following arranges the organic compounds in order of INCREASING VAPOUR PRESSURE?

A Methylbutane, dimethylpropane, pentane

B Dimethylpropane, methylbutane, pentane

C Pentane, methylbutane, dimethylpropane

D Pentane, dimethylpropane, methylbutane (2)

1.4 Which ONE of the following will decolourise orange bromine water RAPIDLY?

A $C_5H_{10}O_2$

B $C_5H_{10}O$

C C_5H_{12}

D C_5H_{10} (2)

Copyright reserved

Testpapers.co.za

1.5 The reaction of alkanes with halogens (X_2) can be represented by the following general equation:

$$C_nH_{2n+2} + X_2 \rightarrow C_nH_{2n+1}X + HX$$

The reaction above is an example of a/an …

A Substitution.

B Elimination.

C Condensation.

D Addition. (2)

1.6 A FUNCTIONAL (GROUP) ISOMER of butyl ethanoate is …

A 2-methylpentanoic acid.

B 2-methylhexanoic acid.

C Ethyl butanoate

D Propyl propanoate (2)

1.7 A constant net force applied to block **P** causes it to accelerate at 5 $m \cdot s^{-2}$. The SAME net force applied to block **Q** causes an acceleration of 2,5 $m \cdot s^{-2}$. What is the RATIO of the mass of block **P** to the mass of block **Q** ($m_P : m_Q$)?

A 1 : 2

B 2 : 1

C 1 : 4

D 4 : 1 (2)

Testpapers.co.za

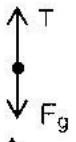
1.8 An elevator (lift) suspended by a cable is moving UPWARDS and SLOWING TO A STOP.

Neglect the effects of air resistance.

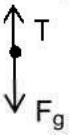
Which ONE of the following free-body diagrams for the elevator is CORRECT?

A

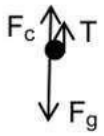
B



C



D



(2)

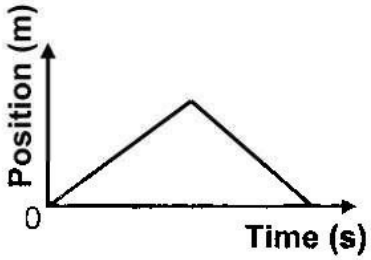
1.9 A ball dropped from rest, ELASTICALLY collides with the ground and bounces once.

Take the point of release as the zero position.

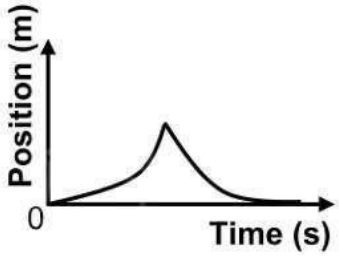
Neglect the effects of air resistance.

Which ONE of the following position-time sketch graphs below CORRECTLY represents the motion of the ball?

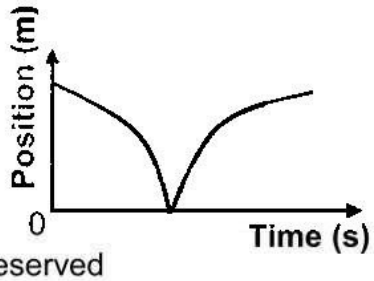
A



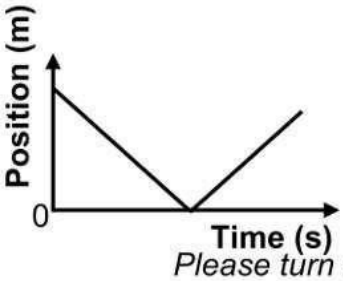
B



C



D



(2)

Copyright reserved

Testpapers.co.za

1.10 If an object has a velocity **x** and a kinetic energy **y**, then its momentum is given by …

A $\frac{y}{x^2}$.

B $\frac{xy}{2}$.

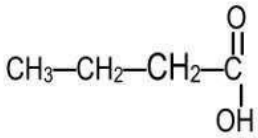
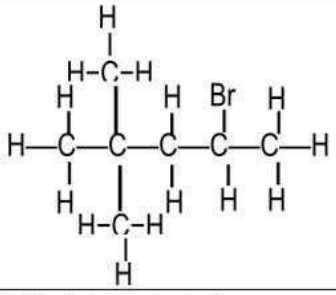
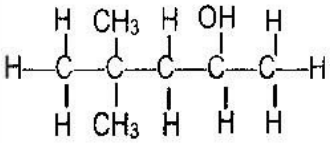
C $\frac{2y}{x}$.

D $\frac{2x}{y}$.

(2)
[20]

QUESTION 2 (Start on a new page)

P to **U** in the table below represents six organic compounds.

A	Pentanal	B	$CH_3CH_2COCH_2CH_3$
C		D	
E		F	Methyl propanoate

2.1 Define the term *functional group*. (2)

2.2 Write down the:

2.2.1 LETTER that represents the functional (group) isomer of compound **C** (1)

2.2.2 IUPAC name of the **alcohol** used to prepare compound **F** (1)

Testpapers.co.za

2.2.3 STRUCTURAL FORMULA of the functional group of compound **A** (1)

2.2.4 GENERAL FORMULAR of the homologous series to which compound **B** belongs (1)

2.2.5 Type of isomers represented by compounds **A** and **B** (1)

2.2.6 IUPAC name of the acid used to prepare compound **F** (1)

2.3 Write down the IUPAC name of:

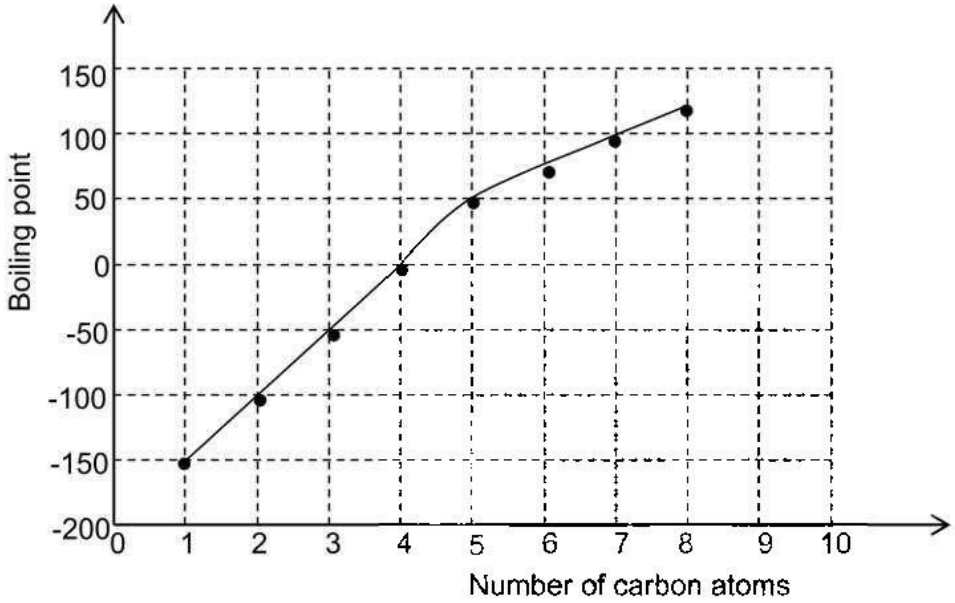
2.3.1 Compound **D** (2)

2.3.2 Compound **E** (2)

2.3.3 Compound **B** (2)
[14]

QUESTION 3 (Start on a new page)

Grade 12 learners conduct an investigation to determine the relationship between *boiling point* and the *number of carbon atoms* in straight-chain alkanes.
The results obtained are shown in the sketch graph below.



3.1 State the difference in MOLAR MASS between the successive members of the SAME homologous series. (1)

Testpapers.co.za

3.2 Name, **systematically**, the alkane with the HIGHEST boiling point. (1)

3.3 Write down the IUPAC name of the alkane that is the FIRST to be a liquid at room temperature (25° C). (1)

3.4 Write down the:

3.4.1 Independent variable (1)

3.4.2 Control variable (1)

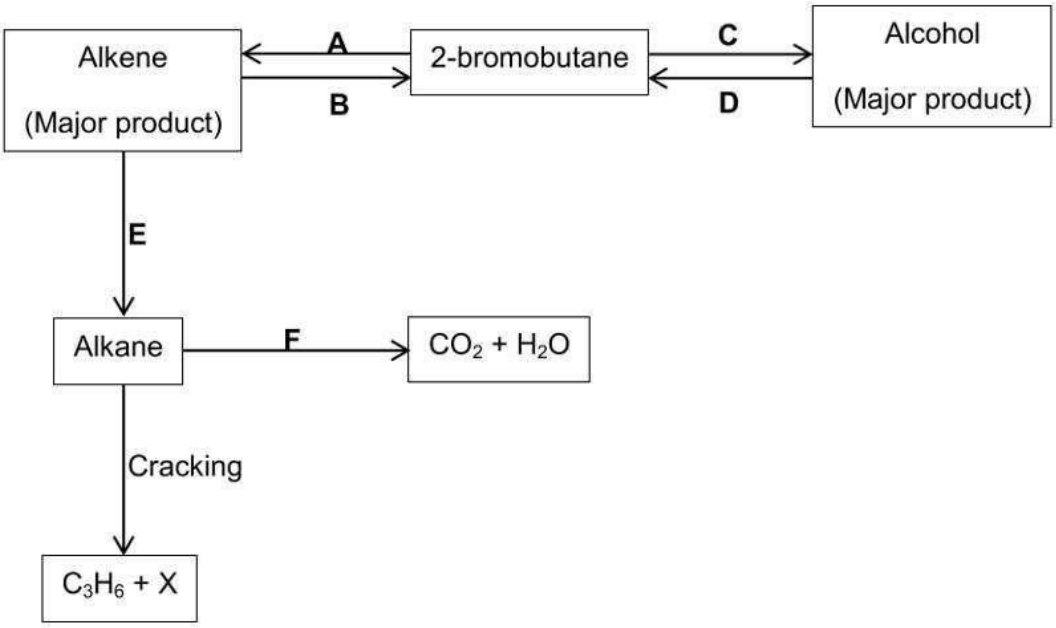
3.5 Briefly explain why only straight-chain alkanes are used in this investigation. (1)

3.6 Will the boiling point of the *structural isomer of butane* be HIGHER THAN, LOWER THAN, or **EQUAL** TO that of butane? (1)

3.7 Explain the answer to QUESTION 3.6 above. (3)
[10]

QUESTION 4 (Start on a new page)

The flow diagram below shows how **2-bromobutane** can be used to prepare organic compounds. **A-F** represent organic reactions.



4.1 Classify 2-bromobutane as a PRIMARY, SECONDARY, or TERTIARY haloalkane. (1)

Testpapers.co.za

4.2 Write down the type of reaction represented by:

4.2.1 F (1)

4.2.2 A (1)

4.2.3 C (1)

4.2.4 D (1)

4.2.5 E (1)

4.3 Write down the NAME or FORMULA of the inorganic reagent in reaction:

4.3.1 B (1)

4.3.2 D (1)

4.3.3 E (1)

4.4 State the IUPAC name of compound **X**. (1)

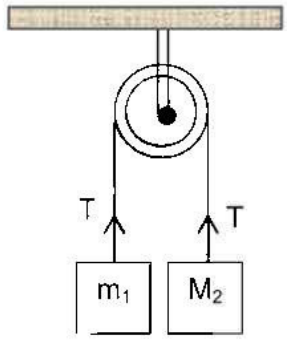
4.5 For reaction **B**, write down a balanced equation using STRUCTURAL FORMULAE. (4)

[14]

Testpapers.co.za

QUESTION 5 (Start on a new page)

The diagram below shows an apparatus that can be used to determine "**g**", the acceleration of free-fall. Two different masses, $\mathbf{m_1}$ and $\mathbf{m_2}$, are attached to a light inextensible cord which hangs over an ideal pulley, as shown in the diagram below.



The system has acceleration "**a**", with $\mathbf{m_2}$ going down and m_1 going up. This acceleration can be determined experimentally. The tension in the cord is **T** when the system moves.

5.1 Write down the NAME of the force in the cord. (1)

5.2 Draw a labeled free-body diagram for $\mathbf{m_2}$. (2)

5.3 Show that the expression for "**g**" in terms of the masses and the system acceleration "**a**", is $\frac{(m_1 + m_2)a}{m_2 - m_1}$. ( )

5.4 If $\mathbf{m_1}$ = 1,9 kg and $\mathbf{m_2}$ = 2,1 kg, calculate the value of "**g**" if the system moves through 0,245 m in 1 s, STARTING FROM REST. ( )

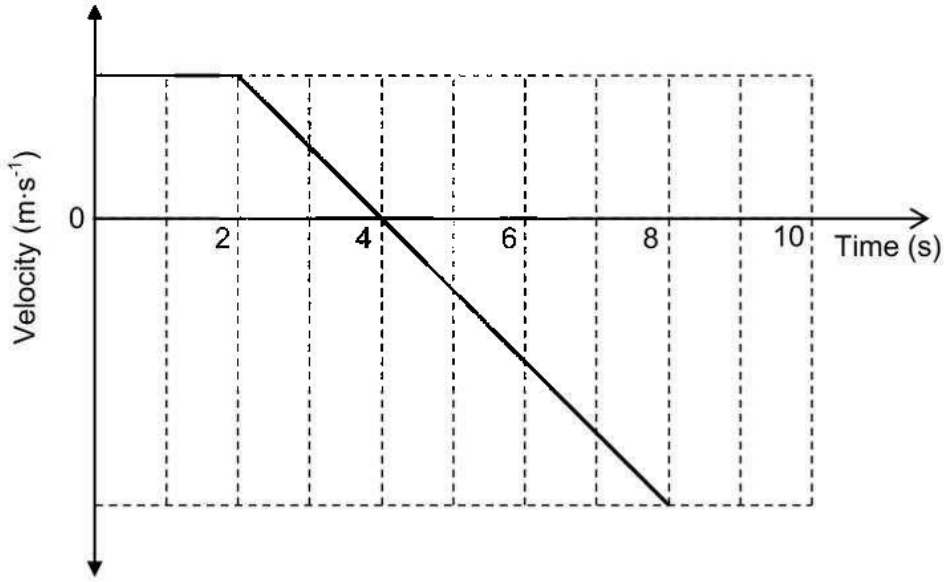
[ ]

Copyright reserved

Testpapers.co.za

QUESTION 6 (Start on a new page)

As a runaway scientific balloon ascends at 19,6 $m \cdot s^{-1}$, one of its instrument packages breaks free of a harness and **free-falls**. The graph below represents the vertical velocity of the package versus-time, from **before** it breaks free to **when it reaches the ground.**



6.1 Explain what is meant by the term *projectile*. (2)

6.2 Calculate the:

6.2.1 Maximum height above the break-free point that the package reaches ( )

6.2.2 Height of the break-free point above the ground ( )

6.3 Sketch a corresponding **position-time graph** for the motion of the package as depicted in the velocity-time graph above.

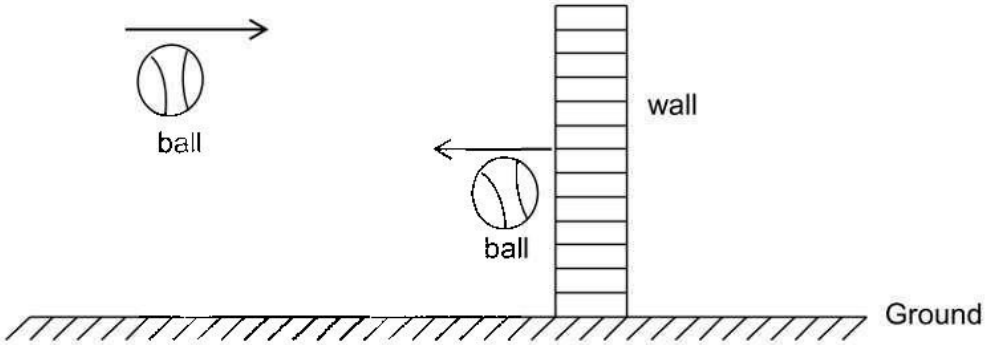
TAKE THE GROUND AS THE REFERENCE POSITION.

( )
[ ]

Testpapers.co.za

QUESTION 7 (Start on a new page)

A ball having a mass of 150 g strikes a wall with a speed of 5,2 $m \cdot s^{-1}$ and rebounds with only 50% of its initial kinetic energy.



Neglect the effects of air resistance.

7.1 Define, in words, the term *momentum* as applied in physics. (2)

7.2 Calculate the impulse on the wall from the ball. ( )

7.3 The ball is in contact with the wall for 7,6 x 10^{-3} s.
Calculate the average net force on the ball from the wall during this time interval. ( )

7.4 Sketch labeled vector diagrams (not to scale) to illustrate the relationship among the initial momentum (p_i), final momentum (p_f) and change in momentum (Δp) for the ball. ( )

[ ]

TOTAL : [100]

Testpapers.co.za

education

Lefapha la Thuto la Bokone Bophirima
Noordwes Departement van Onderwys
North West Department of Education
NORTH WEST PROVINCE

PROVINCIAL ASSESSMENT

PROVINSIALE ASSESSERING

GRADE/*GRAAD* 12

PHYSICAL SCIENCES

MARCH 2025

CONTROL TEST

MEMO

MARKS/*PUNTE*: 100

TIME/*TYD*: 2 hours/*uur*

Copyright reserved/*Copiereg voorbehou*

Please turn over/*Blaai om asseblief*

Testpapers.co.za

QUESTION 1/*VRAAG 1*

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

QUESTION 2/ *VRAAG 2*

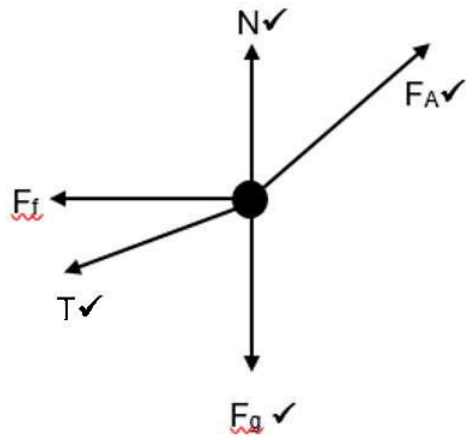
2.1 When a net force acts on an object of mass, the object will accelerate in the direction of the net force with an acceleration that is directly proportional to the net force✓ and inversely proportional to the mass of the object.✓

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

Marking criteria/*Nasienkriteria*
If any of the underlined key words or phrases in the correct context is omitted, deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde of frases in die korrekte konteks uitgelaat word, trek 1 punt af.* (2)

Testpapers.co.za

2.2



Accepted labels/*Aanvaarde benoemings* :	
Tension force /T/F_T/*Spankrag*	✓
Weight/W/Gravitational force/Fg/*Gewig*/*Gravitasiekrag*	✓
Normal force/F_N/Normal/N/*Normaalkrag*/*Normaal*	✓
Force applied/Fa/*Toegepaste krag*/F_T	✓
Frictional force/f/F_f/F_k/*Wrywingskrag*	✓

NOTE/*NOTA*:

- Mark is awarded for **label** and **arrow**. If no arrows 4/5 /*Punte word toegeken vir die **benoeming** en die **pyle**. Indien geen pylpunt 4/5.*
- Do not penalise for length of arrows./*Moet nie penaliseer vir die lengte van die pyle nie.*
- If incorrect angles (directions) of the applied force and/or Tension force - 4/5 / *Indien die verkeerde hoeke (rigtings) van die toegepaste krag en/of die spankrag – 4/5.*
- Any other additional forces - 4/5 /*Enige addisionele kragte – 4/5.*
- If components of applied force or tension force are drawn – 4/5 /*As komponente van toegepaste krag of spankrag geteken word – 4/5.*
- If any arrow does not touch the dot - 4/5 /*Indien enige pyl nie die kol raak nie – 4/5.*

(5)

Copyright reserved/*Copiereg voorbehou*

Testpapers.co.za

2.3

OPTION 1/*OPSIE 1*

4kg toy car / *4kg speelgoedkar*

Fnet =ma ✓

$-f + T_x = ma$

$-10 + T_x$ ✓$= 4a$

$T_x = 4a + 10$.....(1)

✓ **(any 1/*enige 1*)**

6kg toy car / *6kg speelgoedkar*

$-T_x - f + F_{ax} = ma$

$-T_x - 15 + 50\cos 30°$ ✓$= 6a$.....(2)

Sub (1) into (2) / *Vervang (1) in (2)*

$-(4a + 10) - 15 + 50\cos 30° = 6a$

$-(4a + 10) + 28{,}30127 = 6a$✓

$-10 + 28{,}30127 = 10a$

a= 1,83 $m.s^{-2}$ to the right ✓ *Ina regs*

OPTION 2/ *OPSIE 1*

4kg toy car/ *4kg speelgoedkar*

Fnet =ma ✓

$-f + T_x = ma$

$-10 + T\cos 25°$ ✓$= 4a$

$a = \frac{T\cos 25}{4} - \frac{10}{4}$.....(1)

✓ **(any 1/*enige 1*)**

6kg toy/ *5kg speelgoedkar*

$-T_x - f + F_{ax} = ma$

$-T\cos 25° - 15 + 50\cos 30°$ ✓$= 6a$.....(2)

Sub (1) into (2) / *Vervang (1) in (2)*

$-T\cos 25° - 15 + 50\cos 30° = 6\left(\frac{T\cos 25}{4} - \frac{10}{4}\right)$

T = 19.11 N

Sub T into (1) or (2) / *Vervang T in (1) of (2)*

$a = \frac{19.11\cos 25}{4} - \frac{10}{4}$ ✓

a= 1,83 $m.s^{-2}$ to the right ✓ (6)

2.4 **Positive marking from 2.3/*Positiewe nasien van 2.3***

Tx= 4(1,83) +10

= 17, 3204 N

Tx= T cos 25°

T= 17,3204 ÷ cos 25°✓

= 19,11 N✓

Note: two marks for answer if calculated in 2.3 above./ ***Nota**: twee punte vir die antwoord indien dit bereken is in 2.3 hierbo.* (2)

[15]

Testpapers.co.za

QUESTION 3/ *VRAAG 3*

3.1 A motion of an object during which the only force acting on it is the gravitational force. ✓✓
Die beweging van 'n voorwerp waarop die enigste krag wat daarop inwerk, die gravitasiekrag is. **(2 or/*of* 0)** (2)

3.2

3.2.1 90 m✓ (1)

3.2.2 9,8 $m \cdot s^{-2}$ downwards✓/*afwaarts* (1)

3.3 **TAKING UPWARD AS POSITIVE/*NEEM OPWAARTS AS POSITIEF***

3.3.1

Option 1/*Opsie 1* $V_f = V_i + a\Delta t$ ✓ $0 = V_i + (-9,8)(3)$ ✓ $V_i = 29,4\ m.s^{-1}$ upwards✓/*opwaarts*	**Option 2/*Opsie 2*** $V_f = V_i + a\Delta t$ ✓ $-V_i = V_i + (-9,8)(6)$ ✓ $V_i = 29,4\ m.s^{-1}$ upwards✓/*opwaarts*
Option 3/*Opsie 3* $\Delta y = V_i \Delta t + \frac{1}{2} a\Delta t^2$ ✓ $-90 = V_i \times 8,2 + \frac{1}{2}(-9.8)(8.2)^2$ ✓ $V_i = 29,4\ m.s^{-1}$ upwards✓/*opwaarts*	**Option 4/*Opsie 4*** $V_f^2 = V_i^2 + 2a\Delta y$ $= 0 + 2(-9.8)(-134)$ $V_f = 51.23\ m.s^{-1}$ $V_f^2 = V_i^2 + 2a\Delta y$ ✓ $51.23^2 = V_i^2 + 2(-9.8)(-90)$ ✓ $V_i = 29,34\ m.s^{-1}$ upwards ✓/*opwaarts*

Range/*Gebied* *(29,33-29,41)*
Note: Accept downwards as positive.
***Nota**: Neem afwaarts as positief.* (3)

3.3.2 **Positive marking from 3.3.1/*Positiewe nasien van 3.3.1***

$V_f^2 = V_i^2 + 2a\Delta y$✓
$= \underline{(29,4)^2 + 2(-9,8)(-90)}$ ✓
$= -51,27\ m.s^{-1}$
$= 51,27\ m.s^{-1}$ downwards✓/*afwaarts* (3)

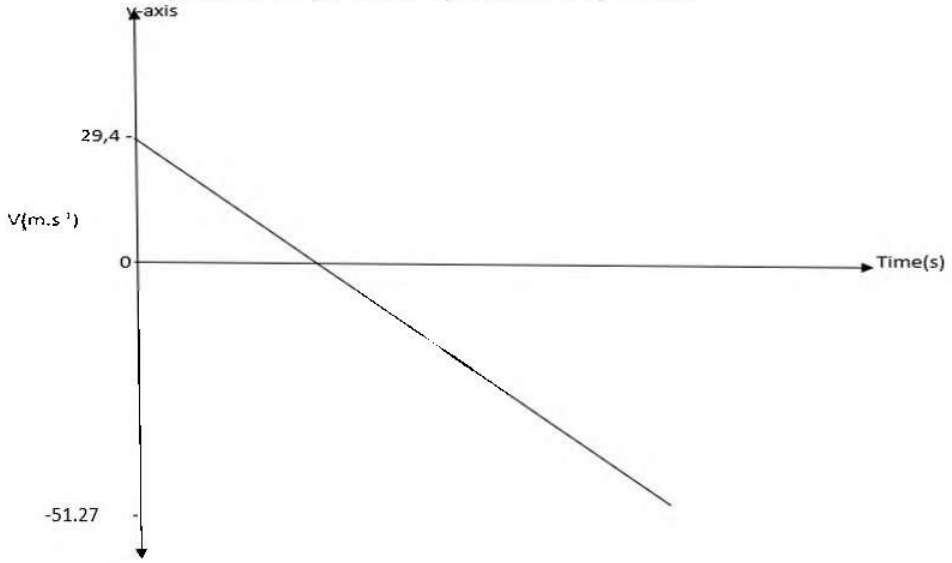
3.3.3 **Positive marking from 3.3.2/*Positiewe nasien van 3.3.2***

Option 1 /*Opsie 1* (upwards as positive/*opwaarts as positief*)	**Option 2/*Opsie 2*** (upwards as negative/*Opwaarts as negatief*)
$F_{net} = \frac{\Delta P}{\Delta t}$✓ $F_{net} = \frac{m(Vf - Vi)}{\Delta t}$ 130✓ $= \frac{1,2(16,5-(-51,27))}{\Delta t}$✓ $\Delta t = 0,63s$✓	$F_{net} = \frac{\Delta P}{\Delta t}$✓ $F_{net} = \frac{m(Vf - Vi)}{\Delta t}$ -130✓ $= \frac{1,2(-16,5-(51,27))}{\Delta t}$✓ $\Delta t = 0,63s$✓

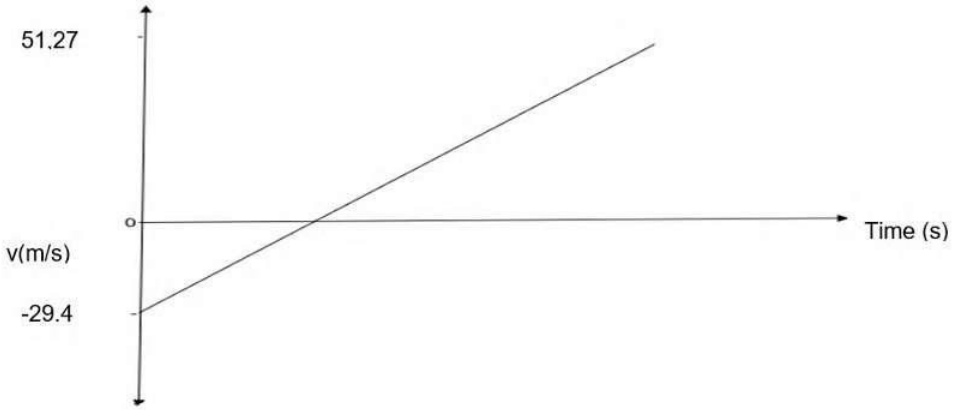
(4)

Testpapers.co.za

3.4 Upwards as positive/*Opwaarts as positief*



Downwards as positive / *Afwaarts as positief*



Criteria /*Kriteria*	**Mark allocation/ *Punte toekenning***
Graph starts at 29,4 m.s^{-1} / *Grafiek begin by 29,4 m.s^{-1}*	✓
Graph stops at 51,27 m.s^{-1}/ *Grafiek stop by 51,27 m.s^{-1}*	✓
Shape (straight line) with a negative/positive gradient / *Vorm (reguit lyn) met 'n negatiewe/positiewe gradiënt*	✓

(3)
[17]

Testpapers.co.za

QUESTION 4/ *VRAAG 4*

4.1 Net force/ *Netto krag* (1)

4.2 $\sum pi = \sum pf$ ✓

$m_A v_{iA} + m_B v_{iB} = (m_A + m_B)v_f$

$(2)(1,5) + (5)(0)$ ✓ $= (2+5)\ v_f$✓

$v_f = 0,43\ m.s^{-1}$ ✓ (4)

4.3 $\sum pi = \sum pf$

$m_A v_{iA} + m_B v_{iB} = (m_A + m_B)v_f$

$(2)(2) + (5)(0) = (2+5)\ v_f$ ✓

$v_f = 0,571\ m.s^{-1}$.

$$F_{net} = \frac{\Delta P}{\Delta t} ✓$$

$$= \frac{m(Vf - Vi)}{\Delta t}$$

$$= \frac{5(0,571-0)✓}{(0,25)✓}$$

= 11, 42 N east/right. ✓ /*oos/regs* (5)

4.4 No ✓/ *Nee*

- the change in velocity/change in momentum/contact time is not the same for the two trails. ✓/ *die verandering in snelheid/die verandering in momentum/kontaktyd is nie dieselfde vir die twee toetslopies nie.* (2)

[12]

QUESTION 5/*VRAAG 5*

5.1

5.1.1 D✓ (1)

5.1.2 B✓ (1)

5.2

5.2.1 4-ethyl-2,2-dimethylhexane /*4-etiel-2,2-dimetielheksaan*

Marking Criteria / *Nasienkriteria*	**Allocation/ *toekenning***
Parent name (**Hexane**) / *Stamnaam (**Heksaan**)*	✓
Two substituents (**ethyl and methyl**)/*Twee substituente (**etiel en metiel**)*	✓
The whole name correct./*Die hele naam korrek.*	✓

(3)

5.2.2 C_nH_{2n+2}✓ (1)

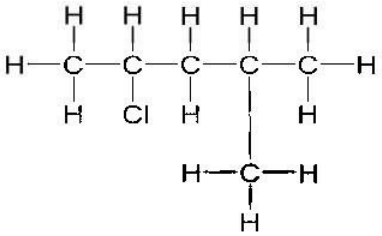
Testpapers.co.za

5.2.3 Butanal ✓✓

Marking Criteria/*Nasienkriteria*	**Allocation/ *toekenning***
Parent chain	✓
functional group/name ending with -al	✓

(2)

5.2.4



Marking Criteria/*Nasienkriteria*	**Allocation/ *toekenning***
Chlorine on the second carbon/*Chloor op die tweede koolstof*	✓
Methyl on the fourth carbon/*Metiel op die vierde koolstof*	✓
The whole structure correct./*Die hele struktuur korrek.*	✓

(3)

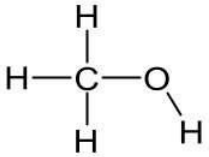
5.3.1 *Structural isomers*- organic compounds with the same molecular formula but different structural formula.
✓✓/*Struktuur isomere - organiese verbindings met dieselfde molekulêre formule maar verskillende struktuur formules.* (2)

5.3.2 Functional ✓ (isomers) /*Funksionele (isomere)* (1)

5.4

5.4.1 Methyl propanoate✓✓ /*Metielpropanoaat* (2)

5.4.2



Marking Criteria/*Nasienkriteria*	**Allocation/ *toekenning***
Hydroxyl group present/*Hidroksielgroep teenwoordig*	✓
The whole structure correct./*Die hele naam korrek*	✓

(2)

5.4.3 Water / H_2O✓ (1)

[19]

Testpapers.co.za

QUESTION 6/ *VRAAG 6*

6.1 The pressure exerted by a vapour in equilibrium with its liquid in a closed system. ✓✓ / *Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem.* (2 or/*of* 0) (2)

6.2 Compound B✓/*Verbinding B*

- Both compounds A and B have London forces / dispersion forces / Induced dipole forces ✓ /*Beide verbinding A en B het Londonkragte / dispersie kragte / geÏnduseerde dipoolkragte*
- Compound A has a smaller surface area/ shorter chain length/ more branches than compound B.✓/*Verbinding A het 'n kleiner kontakoppervlakte/ korter kettinglengte/ meer vertakkings as verbinding B*
- Compound A has weak intermolecular forces than compound B.✓/*Verbinding A het swakker intermolekulêre kragte as verbinding B*

OR/*OF*

- Both compounds A and B have London Forces/ dispersion forces / Induced dipole forces. ✓/*Beide verbindings A en B het London kragte / geÏnduseerde dipoolkragte*
- Compound B has a larger surface area/ longer chain length/ less branches than compound A. ✓/*Verbinding B het 'n groter kontakoppervlakte / langer kettinglengte / minder sykettings as verbinding A*
- Compound B has stronger intermolecular forces than compound A. ✓/*Verbinding B het sterker intermolekulêre kragte as verbinding A.*

(4)

Copyright reserved/*Copiereg voorbehou*

Testpapers.co.za

6.3

- Both compounds C and D have Hydrogen bonds (in addition to London forces and dipole-dipole) ✓/*Beide verbindings C en D het waterstofbindings (addisioneel tot die London kragte en dipool-dipool)*
- Compound C /propan-1-ol has one site for hydrogen bonding while compound D/ Ethanoic acid has two sites for hydrogen bonding. ✓ / *Verbinding C/propan-1-ol het een plek vir waterstofbindings terwyl verbinding D/etanoësuur twee plekke het vir waterstofbindings*
- The intermolecular forces of compound D are stronger than the intermolecular forces of compound C. ✓/*Intermolekulêre kragte van verbinding D is sterker as die intermolekulêre kragte van verbinding C.*
- More energy will be required to overcome the intermolecular f
- orces of compound D/ Ethanoic acid than that of compound C/ propan-1-ol. ✓ /*Meer energie sal benodig word om die intermolekulêre kragte te oorkom van verbinding D/ etanoësuur as die van verbinding C/propan-1-ol.*

(4)

[10]

Testpapers.co.za

QUESTION 7/ *VRAAG 7*

7.1

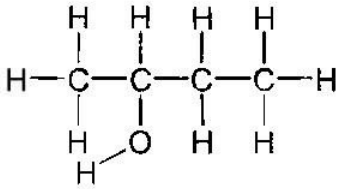
7.1.1 Elimination/ Dehydrohalogenation/ Dehydrobromination. ✓ /*Eliminasie/Dehidrohalogenering/Dehidrobromering* (1)

7.1.2 But-2-ene ✓✓ /*Butan-2-een* (2)

7.2

7.2.1 Substitution/ Hydrolysis✓/*Substitusie / Hidrolise* (1)

7.2.2



Marking Criteria/*Nasienkriteria*	**Allocation/ *toekenning***
Hydroxyl group present/*Hidroksielgroep teenwoordig*	✓
The whole name correct/*Die hele naam korrek*	✓

(2)

7.2.3 Dilute strong base/NaOH/KOH/LiOH✓ and Mild heat ✓ / *Verdunde sterk basis/ NaOH/KOH/LiOH en matige hitte.* (2)

7.3

7.3.1 Carboxylic acid✓/*Karboksielsuur* (1)

Copyright reserved/*Gepiereg voorbehou*

Testpapers.co.za

7.3.2

$n = \frac{m}{Mr}$ ✓

$= \frac{6,66}{1}$

= 6,66 mol

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

$= \frac{40}{12}$

= 3,33 mol

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

$= \frac{53,33}{16}$

= 3,33

✓

2: 1: 1 ✓

CH_2O

Molar mass empirical / *Empiriese molêre massa* = 30 $g \cdot mol^{-1}$✓

$\frac{molar\ mass}{molar\ mass\ emperical} = \frac{150}{30}$

= 5 ✓

Molecular formula / *Molekulêre formule* = $C_5H_{10}O_5$ ✓ (6)

[15]

TOTAL/*TOTAAL* 100

Testpapers.co.za

education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

PHYSICAL SCIENCES

CONTROL TEST

MARCH 2025

MARKS: 100

TIME: 2 hours

This paper consists of 16 pages including DATASHEET and the PERIODIC TABLE

Copyright reserved

Testpapers.co.za

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of SEVEN questions. Answer ALL questions 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, e.g. between QUESTION 2.1 and QUESTION 2.2

5. You may use a non-programmable pocket calculator.

6. Show ALL formulae and substitutions in ALL calculations.

7. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.

8. Give brief motivationa, discussions,etc. where required.

9. You are advised to use the attached DATA SHEETS.

10. Write neatly and legibly.

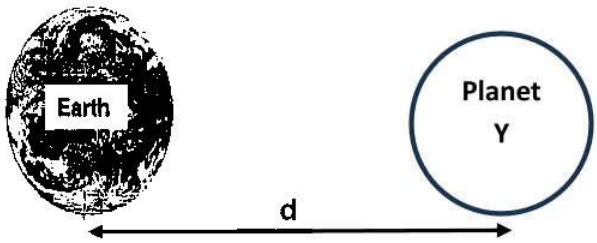
Copyright reserved

Testpapers.co.za

QUESTION 1

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 1.16) in the ANSWER BOOK, e.g. **1. 11 D.**

1.1 The gravitational force that the earth and Planet Y exerts on each other is **F** when there is a distance **d** between their centres. What would be the magnitude of the force experienced between the two when the distance between their centres is **3d**?



A 9F.

B $\frac{1}{3}$ F.

C $\frac{1}{9}$ F.

D 3 F. (2)

1.2 The change in momentum of an object can be equated to its…

A change in velocity.

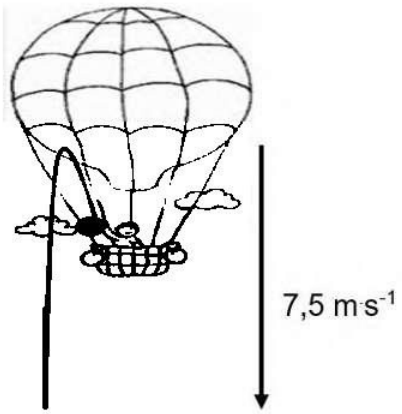
B product of mass and velocity.

C change in kinetic energy.

D product of net force and change in time. (2)

Testpapers.co.za

1.3 A hot air balloon is descending at a velocity of 7,5 $m \cdot s^{-1}$ when a boy throws a plastic disc upwards at a velocity of 4 $m \cdot s^{-1}$. What is the initial velocity of plastic disc?



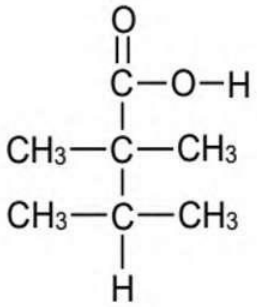
A 11,5 $m \cdot s^{-1}$ downwards.

B 3,5 $m \cdot s^{-1}$ downwards.

C 4 $m \cdot s^{-1}$ downwards.

D 7,5 $m \cdot s^{-1}$ downwards. (2)

1.4 The condensed structural formula of a compound is shown below.



Which one of the following is the correct IUPAC name for this compound?

A 2,2,1,1-tetramethylpropanoic acid

B 2,2,3- trimethylbutanoic acid

C 1,1,2,2-tetramethylpropanoic acid

D 3,2,2-trimethylbutanoic acid (2)

Testpapers.co.za

1.5 Which one of the following *functional groups* has the strongest intermolecular forces.

A Hydroxyl and Formyl

B Formyl and Carbonyl

C Hydroxyl and Carboxyl

D Carboxyl and Carbonyl (2)

1.6 The following cracking reaction takes place in high temperatures and pressures.

Pentane ⟶ X + Y

Which of the following compounds are likely to be the products of the above reaction?

A Ethene + propane

B Ethane + propane

C Propene + ethene

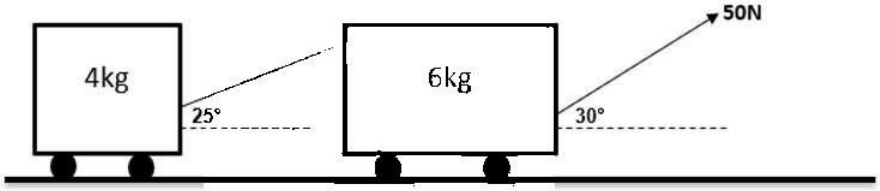
D Ethanol + propanol (2)

[12]

Testpapers.co.za

QUESTION 2

Two toy cars of mass 4kg and 6kg respectively are connected by a light inextensible rope inclined at 25° to the horizontal as shown. The 6kg toy car is pulled by a 50N applied force inclined at 30° to the horizontal. The kinetic frictional force experienced by the 4kg and 6 kg toy cars are 10 N and 15 N respectively.



2.1 State *Newton's second law of motion* in words. (2)

2.2 Draw a labelled free-body diagram showing all forces acting on the 6kg toy car. (5)

2.3 Calculate the acceleration experienced by the toy cars. (6)

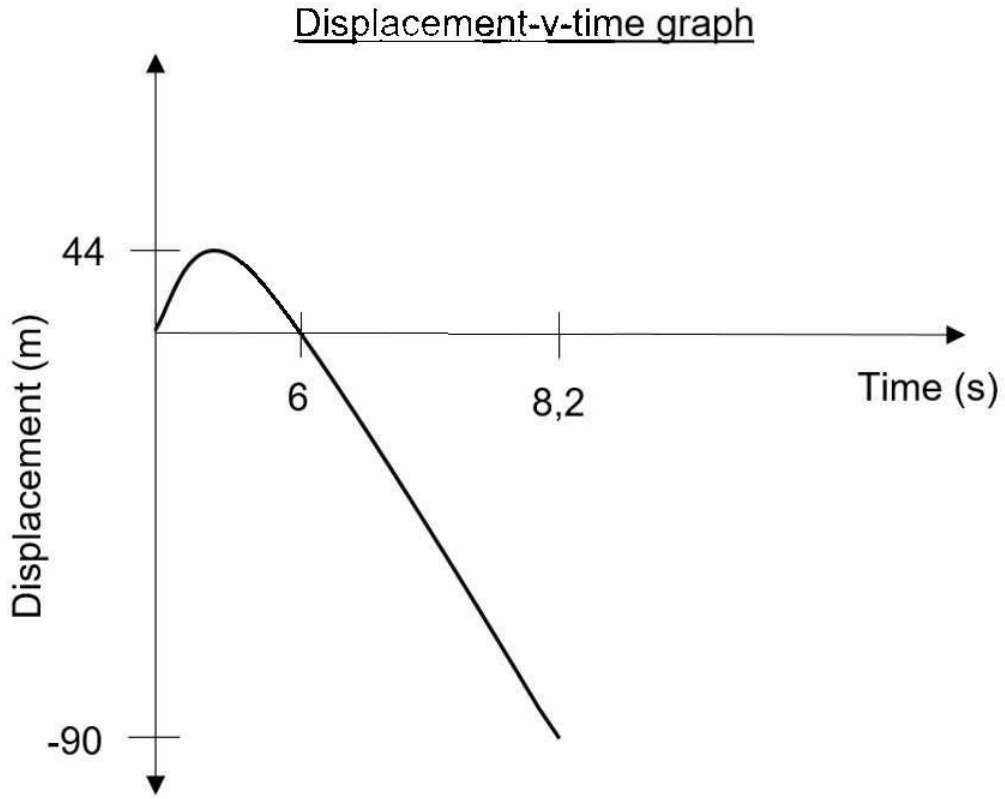
2.4 Calculate the tension on the rope. (2)
[15]

Testpapers.co.za

QUESTION 3

A girl was standing on top of a hotel building playing with a ball of mass 1,2 kg. She projected the ball upwards and failed to catch it on its way down. The ball fell to the ground.

The position versus time graph below shows the motion of the ball from the moment it was projected until it reached the ground.



3.1 Define the term Free *fall*. (2)

3.2

3.2.1 What is the height of the building from which the ball was thrown? (1)

3.2.2 What is the acceleration of the ball at maximum height? (1)

3.3 Using equations of motion only, Calculate the:

3.3.1 Initial velocity of the ball. (3)

3.3.2 Velocity with which the ball hits the ground. (3)

Testpapers.co.za

3.3.3 While the ball is in contact with the ground, it experiences a Net force of 130 N and then bounces off the ground with a velocity of 16,5 $m.s^{-1}$.
Calculate the time the ball was in contact with the ground. (4)

3.4 Draw a velocity versus time graph for the motion of the ball from the moment it was thrown until it strikes the ground.
On the graph show the following:

- Velocity at which the ball was thrown and
- Velocity at which the ball hits the ground. (3)

[17]

Testpapers.co.za

QUESTION 4

A group of learners were investigating the *rate of change in momentum* using two trolleys, Trolley **A** with mass 2 kg and Trolley **B** with a mass of 5 kg were placed on a flat frictionless surface. Trolley **A** moves easterly towards a stationery trolley **B**, the two trolleys collide and move together after the collision.
The table below shows the initial velocities of trolley **A** and the collision time for two collision trails that took place between the trolleys.

Trolley A	Initial velocity ($m \cdot s^{-1}$)	Contact time(s)
Trail 1	1,5	0.4
Trail 2	2	0.25

4.1 State the term represented by the words in italics in the above statement. (1)

4.2 Calculate the magnitude of the velocity of the two trolleys after collision in **trail 1**. (4)

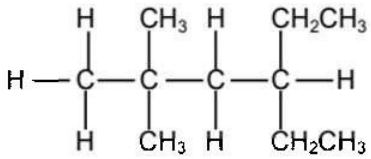
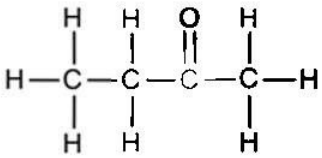
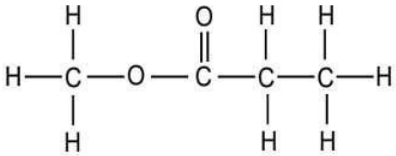
4.3 Calculate the net force experienced by trolley **B** in **trial 2**. (5)

4.4 Will the magnitude of the forces that the trolleys exert on each other in trial 1 be EQUAL to the magnitude of the forces in Trail 2? Choose from YES or NO. Give a reason for the answer. (2)
[12]

Testpapers.co.za

QUESTION 5

Consider organic compounds represented by letters **A** to **F** in the table below.

A		**B**	Butanoic acid
C		**D**	$CH_3CH(CH_3)CH_2CHClCH_3$
E	$CH_3CH_2CH_2COH$	**F**	

Use the information in the table to answer the questions that follow.

5.1 Write down a letter that represents the following.

5.1.1 A Haloalkane. (1)

5.1.2 A compound that has a Carboxyl group as a functional group. (1)

5.2 Write down the :

5.2.1 IUPAC name of compound **A**. (3)

5.2.2 General formula of compound **A.** (1)

5.2.3 IUPAC name of compound **E**. (2)

5.2.4 Structural formula of compound **D** . (3)

5.3 Compound **C** and **E** are isomers.

5.3.1 Define the term *structural isomer*. (2)

5.3.2 Identify the type of Isomerism between the two compounds? (1)

Testpapers.co.za

5.4 Compound **F** is an ester. Write down the…

5.4.1 IUPAC name of this ester. (2)

5.4.2 structural formula of the alcohol that was used to produce this ester. (2)

5.4.3 inorganic compound that is produced in the process of producing the ester. (1)

[19]

Copyright reserved

Testpapers.co.za

QUESTION 6

Learners use the following compounds to investigate the factors that affect the vapour pressure of organic compounds.

	COMPOUND	VAPOUR PRESSURE (kPa at 25°C)
A	2-methly propane	150
B	Butane	83
C	Propan-1-ol	54
D	Ethanoic acid	26

6.1 Define the term *Vapour pressure*. (2)

6.2 Which compound **A** or **B** has a higher boiling point?

Explain your answer. (4)

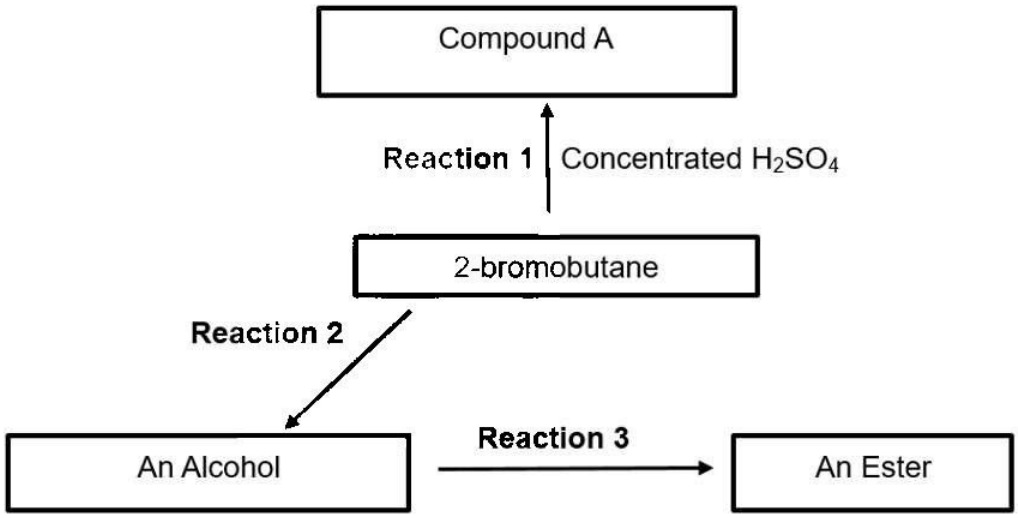
6.3 Explain the difference in vapour pressures of compound **C** and **D** by referring to the TYPE OF INTERMOLECULAR FORCES present in each compound. (4)

[10]

Testpapers.co.za

QUESTION 7

In the flow diagram below 2-bromobutane undergoes different reactions as illustrated. Answer the questions that follow.



7.1 Consider **reaction 1**, write down the:

7.1.1 Type of reaction that takes place. (1)

7.1.2 IUPAC name of compound A which is a major product. (2)

7.2 Consider **reaction 2**, write down the:

7.2.1 Type of reaction that takes place. (1)

7.2.2 Structural formula of the alcohol. (2)

7.2.3 Reaction conditions (2)

7.3 Consider **reaction 3**

7.3.1 Write down the homologous series to which the OTHER organic reactant in this reaction belongs. (1)

7.3.2 The ester contains 6,6% of Hydrogen(H), 40% of Carbon(C) and 53,33% of Oxygen (O). The molar mass of the ester is $150 g \cdot mol^{-1}$. Use a calculation to determine its molecular formula. (6)

[15]

TOTAL: 100

Testpapers.co.za

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8\ m\cdot s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}\ N\cdot m^2\cdot kg^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}\ m\cdot s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}\ J\cdot s$
Coulomb's constant	k	$9,0 \times 10^{9}\ N\cdot m^2\cdot C^{-2}$
Charge on electron	e	$-1,6 \times 10^{-19}\ C$
Electron mass	m_e	$9,11 \times 10^{-31}\ kg$
Mass of the Earth	M	$5,98 \times 10^{24}\ kg$
Radius of the Earth	R_E	$6,38 \times 10^{6}\ m$

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$ OR $F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{d^2}$ OR $g = \frac{GM}{r^2}$

Copyright reserved

Testpapers.co.za

CHEMISTRY

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

Testpapers.co.za

TABLE 3: PERIODIC TABLE

KEY

Atomic number → 29

Electronegativity → 1,9 Cu ← Symbol

63,5 ← Approximate relative atomic mass

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

Copyright reserved

Testpapers.co.za

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON ASSESSMENT TASK

MARCH 2025 TEST

MEMO

MARKS: 100

These marking guidelines consist of 9 pages.

Copyright reserved

Testpapers.co.za

QUESTION 1

1.1 A✓✓ (2)

1.2 B ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

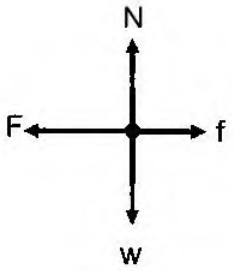
1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

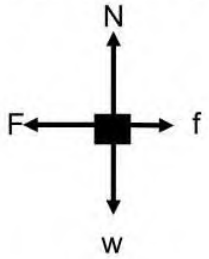
[12]

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 $^3/_4$
- If everything correct, but no arrows: Max/*Maks* $^3/_4$

(4)

2.2

LEFT AS POSITIVE	**LEFT AS NEGATIVE**
F_{net} = ma F + f = ma } ✓ Any one F – 70 ✓ = (60)(1,5) ✓ F = 160 N ✓	F_{net} = ma F + f = ma } ✓ Any one -F + 70 ✓= (60)(-1,5) ✓ F = 160 N ✓
Note: DO NOT award the fourth mark if the final anwer is F = -160 N	

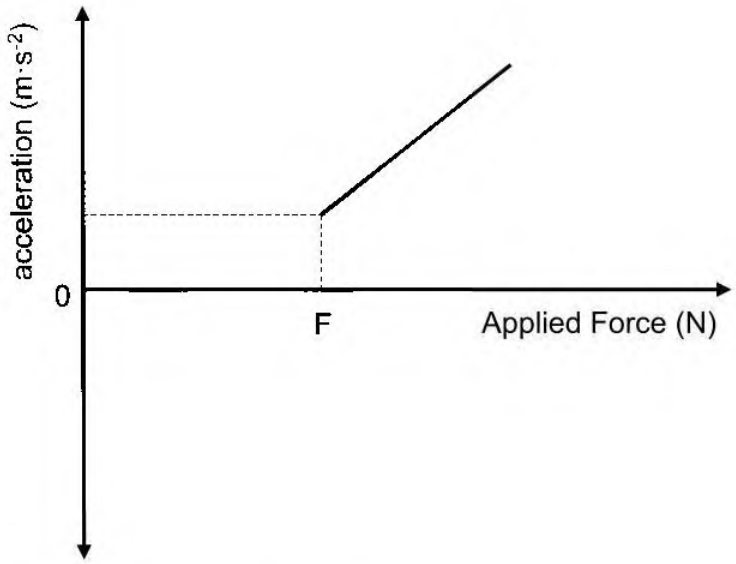
(4)

Testpapers.co.za

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]

Testpapers.co.za

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 $m \cdot s^{-2}$ ✓ downwards✓ (2)

3.3.1

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

(3)

3.3.2

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

(3)

3.4.1

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

(3)

Testpapers.co.za

3.4.2

OPTION 1 **UPWARDS AS POSITIVE** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (20)(5)$ ✓ $+ \frac{1}{2}(-9,8)(5)^2$ ✓ $= -22,50$ height = 22,50 m ✓	**OPTION 1** **UPWARDS AS NEGATIVE** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (-20)(5)$ ✓ $+ \frac{1}{2}(9,8)(5)^2$ ✓ $= 22,50$ m ✓
OPTION 2 **UPWARD AS POSITIVE** **POSITIVE MARKING FROM Q 3.3.1** $\Delta t = 5 - 2x2.04 = 0,92s$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (-20)(0,92)$ ✓ $+ \frac{1}{2}(-9,8)(0,92)^2$ ✓ $= -22,55$ height = 22,55 m ✓	**OPTION 2** **DOWNWARD AS POSITIVE** **POSITIVE MARKING FROM Q 3.3.1** $\Delta t = 5 - 2x2.04 = 0,92s$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (20)(0,92)$ ✓ $+ \frac{1}{2}(9,8)(0,92)^2$ ✓ $= 22,55$ m ✓
OPTION 3 **UPWARDS AS POSITIVE** **POSITIVE MARKING FROM Q 3.3.1** **Starting from the maximum height** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (0)(2,96)$ ✓ $+ \frac{1}{2}(-9,8)(2,96)^2$ ✓ $= -42,93$m Height of the building = 42,93 – 20,41 = 22,52 m ✓	**OPTION 3** **UPWARDS AS NEGATIVE** **POSITIVE MARKING FROM Q 3.3.1** **Starting from the maximum height** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= (0)(2,96)$ ✓ $+ \frac{1}{2}(9,8)(2,96)^2$ ✓ $= 42,93$ m Height of the building = 42,93 – 20,41 = 22,52 m ✓
OPTION 4 **POSITIVE MARKING FROM Q 3.4.1** $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $\Delta y = \left(\frac{20 - 29}{2}\right)$ ✓ (5) ✓ $\Delta y = 22,50$ m ✓	**OPTION 5** **POSITIVE MARKING FROM Q 3.4.1** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(-29)^2$ ✓ $= 20^2 + 2(-9,8)\Delta y$ ✓ $\Delta y = 22,50$ m ✓

(4)

OPTION 6 **POSITIVE MARKING FROM Q 3.3.1 & 3.4.1** $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $\Delta y = \left(\frac{0 - 29}{2}\right)$ ✓ $(2,96)$ ✓ $\Delta y = 42,93$ m Height of the building = 42,93 – 20,41 = 22,52 m ✓

[17]

Testpapers.co.za

QUESTION 4

4.1 $\frac{80}{3,6} = 22,22\ m{\cdot}s^{-1}$ ✓✓ (2)

4.2

POSITIVE MARKING FROM QUESTION 4.1	
RIGHT AS POSITIVE	**RIGHT AS NEGATIVE**
$\Delta p = m(v_f - v_i)$ ✓ $= 1\ 600\ (6 - 22,22)$ ✓ $= -\ 25\ 952\ kg\ m{\cdot}s^{-1}$ $=$ <u>$25\ 952\ kg\ m{\cdot}s^{-1}$ to the left</u> ✓	$\Delta p = m(v_f - v_i)$ ✓ $= 1600\ (-6 - (-22,22))$ ✓ $= 25\ 952\ kg\ m{\cdot}s^{-1}$ $=$ <u>$25\ 952\ kg\ m{\cdot}s^{-1}$ to the left</u> ✓

(3)

4.3 **POSITIVE MARKING FROM QUESTION 4.2**
$25\ 952\ kg\ m{\cdot}s^{-1}$ 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 <u>isolated</u> system the total <u>linear momentum is conserved/remains constant</u>. ✓✓ (2)

4.5

OPTION 1
POSITIVE MARKING FROM QUESTION 4.1 **RIGHT AS POSITIVE** $\sum p_i = \sum p_f$ $m_c v_{ic} + m_b v_{ib} = (m_c + m_b)v_f$ } ✓Any one $\underline{(1600)(22,22)} + 0$ ✓ $= (1600 + m_b)(6)$ ✓ $\therefore m_b = 4325,33\ kg$ ✓
RIGHT AS NEGATIVE $\sum p_i = \sum p_f$ $m_c v_{ic} + m_b v_{ib} = (m_c + m_b)v_f$ } ✓Any one $\underline{(1600)(-22,22)} + 0$ ✓ $= (1600 + m_b)(-6)$ ✓ $\therefore m_b = 4325,33\ kg$ ✓
OPTION 2 **RIGHT AS POSITIVE** $\Delta p_b = -\Delta p_c$ $m_b(v_{bf} - v_{bi}) = -m_c(v_{cf} - v_{ci})$ } ✓ Any one $m_b(6 - 0)$ ✓ $= -(-25952)$ ✓ $\therefore m_b = 4325,33\ kg$ ✓
RIGHT AS NEGATIVE $\Delta p_b = -\Delta p_c$ $m_b(v_{bf} - v_{bi}) = -m_c(v_{cf} - v_{ci})$ } ✓ Any one $m_b(-6 - 0)$ ✓ $= -25952$ ✓ $\therefore m_b = 4325,33\ kg$ ✓

(4)
[12]

Testpapers.co.za

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

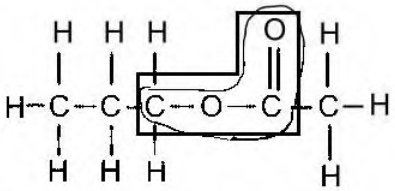
Marking criteria
- Correct stem: pentane ✓
- Correct substituents: dibromo and dimethyl ✓
- IUPAC name completely correct ✓ (3)

5.3.2 $C_nH_{2n}O_2$✓ (1)

5.4.1 <u>C and D</u> (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)

Testpapers.co.za

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 g·mol^{-1} into $n = \frac{m}{M}$
- Substitute into the formula for percentage purity
- Final answer

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

$= \frac{90,78}{102}$ ✓

$= 0,89$ mol

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

1:1

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

$0,89$✓ $= \frac{m}{60}$ ✓

$m = 53,4$ g

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

$= 89\%$ ✓

(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 boling 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]

Testpapers.co.za

QUESTION 7

7.1 Hydroxyl (group) ✓ (1)

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

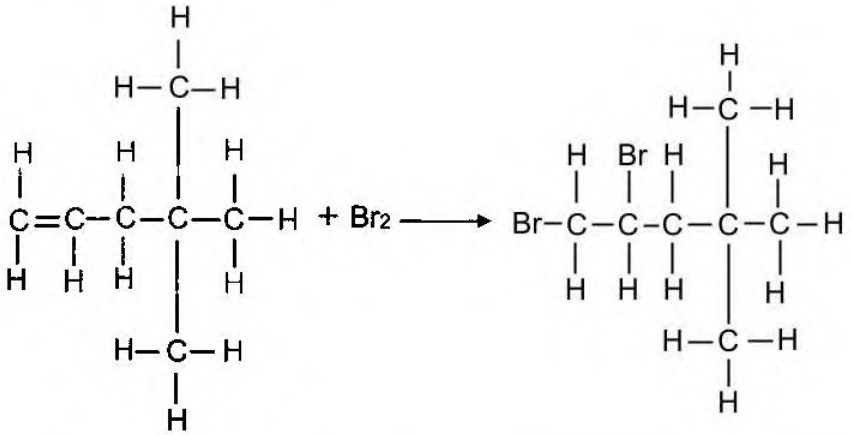
Marking criteria
• Correct stem (pentanol) ✓
• Correct substituent: dimethyl ✓
• IUPAC name completely correct ✓ (3)

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 Br_2 ✓ (3)

TOTAL: 100

Copyright reserved

Testpapers.co.za

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

COMMON ASSESSMENT TASK

MARCH 2025

MARKS: 100

TIME: 2 hours

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

Testpapers.co.za

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.

Testpapers.co.za

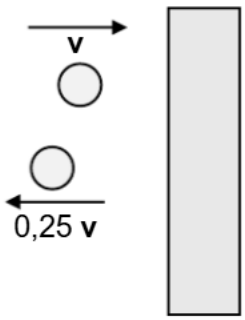
QUESTION 1: MULTIPLE CHOICE QUESTIONS

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 … $m \cdot s^{-2}$.

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)

Testpapers.co.za

1.4 Consider the molecular formula below:

C_3H_8O

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?

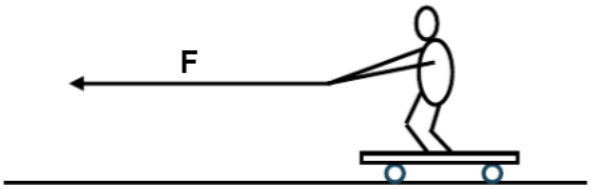
A Combustion
B Esterification
C Thermal cracking
D Photosynthesis (2)
[12]

Testpapers.co.za

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 $m \cdot s^{-2}$ 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)

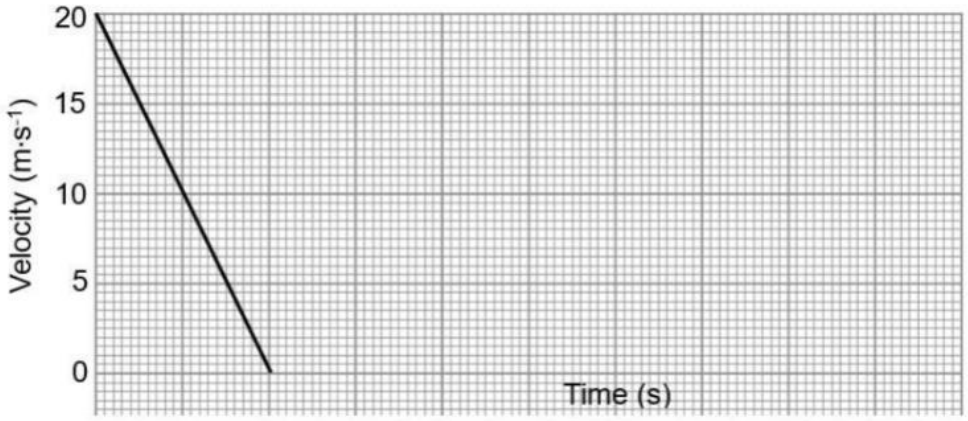
2.5 Name and state the physics law which is applied in QUESTION 2.4. (3)

[15]

Testpapers.co.za

QUESTION 3 (Start on a new page)

A ball is thrown vertically upwards from the top of a building at a velocity of 20 m·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)

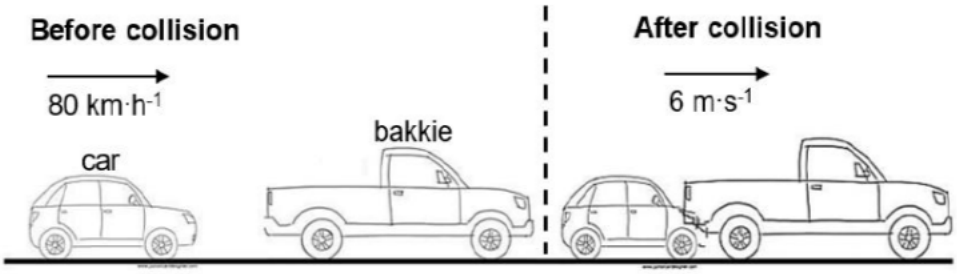
3.4.2 Height of the building (4)

[17]

Testpapers.co.za

QUESTION 4 (Start on a new page)

A car of mass 1 600 kg travelling to the right at 80 km·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 m·s^{-1}.



4.1 Convert 80 km·h^{-1} to m·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)

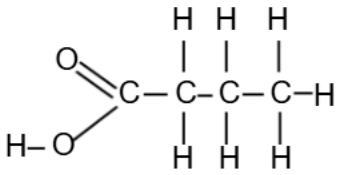
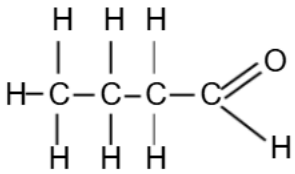
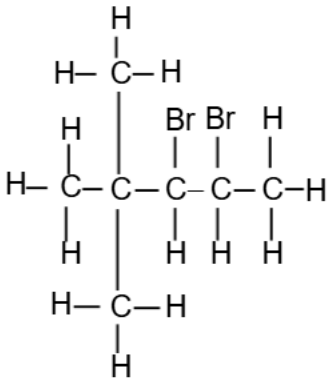
4.4 State the *principle of conservation of linear momentum* in words. (2)

4.5 Calculate the mass of the bakkie. (4)
[12]

Testpapers.co.za

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**	$CH_3CH_2COCH_2CH_3$
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)

Testpapers.co.za

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:

$$C_3H_7OH_{(l)} + CH_3COOH_{(aq)} \rightarrow C_5H_{10}O_{2\,(l)} + H_2O_{\,(l)}$$

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 (^0C)
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**.

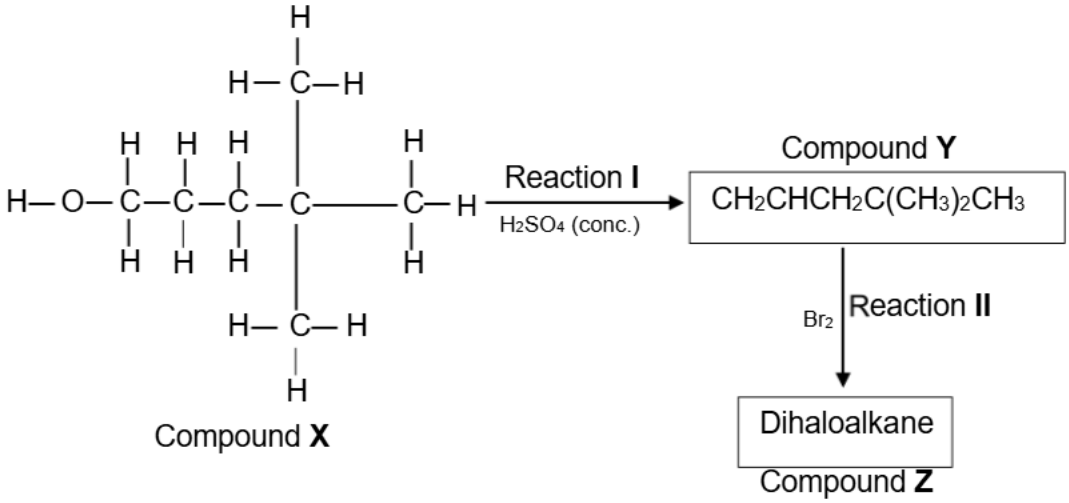
Explain this observation by referring to the molecular structure, intermolecular forces and energy. (3)
[10]

Testpapers.co.za

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

Copyright reserved

Testpapers.co.za

DATA FOR PHYSICAL SCIENCES GRADE 12

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIESE KONSTANTES

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

TABLE 2: PHYSICAL CONSTANTS/*TABEL 2: FISIESE KONSTANTES*

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

Testpapers.co.za

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 / KRAG

$F_{net} = ma$	$p = mv$
$f_{s(max)} = \mu_s N$	$f_k = \mu_k N$
$w = mg$	$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{Gm}{r^2}$

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* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ or/*of* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$ / $P_{gem} = Fv_{gem}$	

Testpapers.co.za

TABLE 4: CHEMISTYRY FORMULAE/*TABEL 4: CHEMIE FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ or/*of* $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ or/*of* $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	
$I = \frac{Q}{\Delta t}$	$n = \frac{Q}{e}$ where n is the number of electrons/ *waar n die aantal elektrone is*

Testpapers.co.za

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

KEY/*SLEUTEL*

Atomic number *Atoomgetal*

Symbol *Simbool*

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

Testpapers.co.za

education

Department of Education
FREE STATE PROVINCE

CONTROL TEST/ *KONTROLETOETS*

GRADE/*GRAAD* 12

PHYSICAL SCIENCES

MARCH 2025

CONTROLLED TEST

MARKING GUIDELINE/ *NASIENRIGLYN*.

This MARKING GUIDELINE consists of 15 pages/ *Hierdie NASIENRIGLYN bestaan uit 15 bladsye.*

Copyright reserved/*Kopiereg voorbehou*

Please turn over/*Blaai asseblief om*

Testpapers.co.za

QUESTION 1 / *VRAAG 1*

1.1 B ✓✓

1.2 C ✓✓

1.3 D ✓✓

1.4 D ✓✓

1.5 B ✓✓

1.6 A ✓✓

1.7 B ✓✓

1.8 C ✓✓

1.9 C ✓✓

1.10 A ✓✓

[20]

Copyright reserved/*Kopiereg voorbehou*

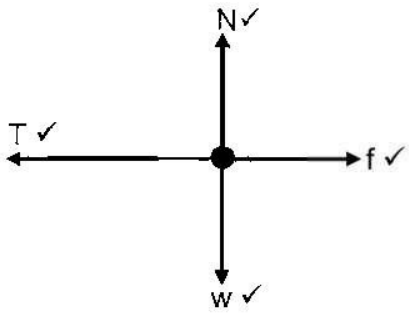
Testpapers.co.za

QUESTION 2 / *VRAAG 2*

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

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

2.2



(4)

ACCEPTED LABELS/*AANVAARBARE BYSKRIFTE*	
w	F_g /weight/gravitational force/ 39,2 N/
f	$F_{friction}$/F_f/friction/f_k/*wrywingskrag*
N	F_N/F_{normal}/Normal force/*Normaalkrag*/*Normaal*
T	F_T/Tension/*Spanning*

NOTE:
- 1 mark awarded for label and arrow.
- Deduct 1 mark ONCE for any additional forces.
- Do not consider the length of the forces.

LET WEL:
- *1 punt toegeken vir etiket en pyl.*
- *Trek 1 punt EEN keer af vir enige bykomende kragte.*
- *Moenie die lengte van die kragte in ag neem nie.*

Testpapers.co.za

2.3

Toolbox B/ *Gereedskapkis B*

$F_{net} = ma$
$T + (-f_k) = ma$
$T - \mu_k N = ma$
$T - 0{,}2 \times 4 \times 9{,}8$✓ $= 4 \times 5{,}852$✓
$T = 31{,}248$ N

Anyone/ *Enige een*✓

Toolbox A/ *Gereedskapkis A*
$F_{net} = ma$
$F + (-T) + (-f_k) = ma$
$F - T - \mu_k N = ma$ (6)
$F - 31{,}248 - 0{,}3 \times 6 \times 9{,}8$✓ $= 6 \times 5{,}852$✓
F = 84 N✓

2.4 Force of toolbox **A on earth**.✓✓
Krag van gereedskapkis A op aarde (2)

[14]

Testpapers.co.za

QUESTION 3 / *VRAAG 3*

3.1 Momentum is the product of an object's mass and its velocity.✓✓
Momentum is die produk van die massa en snelheid van 'n voorwerp. (2)
(2 or/of 0)

3.2.2 West / Westwards ✓✓
Wes / Weswaarts (2)

3.2.3 0 (N)/Zero ✓ (1)

3.3 Velocity/momentum is constant between 0 s and 10 s✓
Change in momentum/Δp = 0 ✓
∴According to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓, F_{net} = 0 N

Snelheid/momentum is konstant tussen 0 s en 10 s
Verandering in momentum/Δp = 0
∴Volgens Fnet = $\frac{\Delta p}{\Delta t}$, Fnet = 0 N

OR/OF

Velocity is constant between 0 s and 10 s✓
Change in velocity/Δv = 0 OR Acceleration/a = 0 ✓
∴According F_{net} = ma ✓ ,F_{net} = 0 N

Snelheid is konstant tussen 0 s en 10 s
Verandering in snelheid/Δv = 0 OF Versnelling/a = 0
∴Volgens Fnet = ma ,Fnet = 0 N

OR/OF

Gradient of graph between 0 s and 10 s = 0 ✓
Gradient of graph = $\frac{\Delta p}{\Delta t}$ ✓
∴ Accoding to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓ , F_{net} = 0

Gradiënt van grafiek tussen 0 s en 10 s = 0
Gradiënt van grafiek = $\frac{\Delta p}{\Delta t}$
∴Volgens Fnet = $\frac{\Delta p}{\Delta t}$, Fnet = 0 N (3)

Testpapers.co.za

3.4.1 $F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = p_f - p_i$
$F_{net}(5)$✓ = 40000 - (- 60000)✓
$F_{net} = 20000$ N

✓Any one/*Enige een*

$F_{net} = ma$
20000 = m(4)✓
m = 5000 kg✓ (5)

3.4.2 **POSITIVE MARKING FROM QUESTION 3.4.1**
POSITIEWE NASIEN VANAF VRAAG 3.4.1

p = mv✓
(- 60000) = (5000)v✓
v = - 12 $m \cdot s^{-1}$
v = 12 $m \cdot s^{-1}$ West/Westward/*Wes/Weswaart*✓ (3)

3.4.3 **POSITIVE MARKING FROM QUESTION 3.4.1 and 3.4.2.**
POSITIEWE NASIEN VANAF VRAAG 3.4.1 and 3.4.2.

$E_k = \frac{1}{2}mv^2$ ✓
$\sum E_{ki} = \frac{1}{2}m_{(truck)}v_{(truck)i}^2 + \frac{1}{2}m_{(car)}v_{(car)i}^2$
$\sum E_{ki} = \frac{1}{2}(5000)(12)^2 + \frac{1}{2}(2000)(20)^2$✓

$\sum E_{ki} = 360\ 000 + 400\ 000$
$\sum E_{ki} = 760\ 000$ J

$\sum E_{ki} \neq \sum E_{kf}$✓

∴ Inelastic / *onelasties*✓ (4)
[20]

Testpapers.co.za

QUESTION 4 / *VRAAG 4*

4.1 NO✓ *NEE*
Gravitational force is NOT the only force acting on the hot-air ballon/ Acceleration of the ballon is equal to zero/ Net force acting on the hot-air ballon is equal to zero.✓ (2)
Gravitasiekrag is NIE die enigste krag wat op die warmlugballon inwerk nie/Versnelling van die ballon is gelyk aan nul/ Netto krag wat op die warmlugballon inwerk is gelyk aan nul.

4.2 12 $m \cdot s^{-1}$✓upwards✓ (2)
12 $m \cdot s^{-1}$ opwaarts

4.3 **POSITIVE MARKING FROM QUESTION 4.2**
POSITIEWE NASIEN VANAF VRAAG 4.2.

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
Up/*Op* +ve	**Up/*Op* -ve**
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$0 = 12 + (-9{,}8)\Delta t$✓	$0 = -12 + (9{,}8)\Delta t$✓
$\Delta t = 1{,}22$ s ✓	$\Delta t = 1{,}22$ s ✓

(3)

4.4 **POSITIVE MARKING FROM QUESTION 4.2 and 4.3.**
POSITIEWE NASIEN VANAF VRAAG 4.2 and 4.3.

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
Up/*Op* +ve	**Up/*Op* -ve**
Max. height (camera)/*Maks. hoogte (kamera)*	**Max. height (camera)/*Maks. hoogte (kamera)***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$= 12(1{,}22) + \frac{1}{2}(-9.8)(1{,}22^2)$ ✓	$= -12(1{,}22) + \frac{1}{2}(9.8)(1{,}22^2)$ ✓
$= 7{,}35$ m	$= -7{,}35$ m
Height (hot-air balloon) after 1,22 s	**Height (hot-air balloon) after 1,22 s**
Hoogte (warmlugballon) na 1,22 s	***Hoogte (warmlugballon) na 1,22 s***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1{,}22) + \frac{1}{2}(0)(1{,}22^2)$ ✓	$= -12(1{,}22) + \frac{1}{2}(0)(1{,}22^2)$ ✓
$= 14{,}64$ m	$= -14{,}64$ m
∴ Distance/*Afstand* = $\underline{14{,}64 - 7{,}35}$ ✓	∴ Distance/*Afstand* = $\underline{-14{,}64 - (-7{,}35)}$ ✓
$= 7{,}29$ m ✓	$= -7{,}29$ m
	$= 7{,}29$ m ✓

Testpapers.co.za

OPTION/*OPSIE* 3
Up/*Op* +ve
Max. height (camera)/*Maks. hoogte (kamera)*
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = 12^2 + 2(-9,8)\Delta y$ ✓
$\Delta y = 7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= 14,64$ m

∴ Distance/*Afstand* = $\underline{14,64 - 7,35}$ ✓
$= 7,29$ m ✓

OPTION/*OPSIE* 4
Up/*Op* -ve
Max. height (camera)/*Maks. hoogte (kamera)*
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = -12^2 + 2(9,8)\Delta y$ ✓
$\Delta y = 7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= -12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= -14,64$ m

∴ Distance/*Afstand* = $-\underline{14,64 - (-7,35)}$ ✓
$= -7,32$ m
$= 7,29$ m ✓

OPTION/*OPSIE* 5
Up/*Op* +ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = (\frac{v_i + v_f}{2}) \times \Delta t$ ✓
$\Delta y = (\frac{12+0}{2}) \times 1,22$ ✓
$\Delta y = 7,32$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= 14,64$ m

∴ Distance/*Afstand* = $\underline{14,64 - 7,32}$ ✓
$= 7,32$ m ✓

OPTION/*OPSIE* 6
Up/*Op* -ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = (\frac{v_i + v_f}{2}) \times \Delta t$ ✓
$\Delta y = (\frac{-12+0}{2}) \times 1,22$ ✓
$\Delta y = -7,32$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= -12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= -14,64$ m

∴ Distance/*Afstand* = $-\underline{14,64 - (-7,32)}$ ✓
$= -7,32$ m
$= 7,32$ m ✓

Note: RANGE FINAL ANSWER (**7,29 m to 7,35 m**)
***Let wel**: REEKS FINALE ANTWOORD (**7,29 m tot 7,35 m**)* (5)

Testpapers.co.za

4.5 **OPTION/*OPSIE* 1**

Up/*Op* +ve

Time taken by the camera to reach the ground/ *Tyd wat die kamera neem om die grond te bereik*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$

$$-100\checkmark = 12\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2 \checkmark$$

$$\Delta t = 5{,}91 \text{ s}$$

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

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

$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2 \checkmark$$

$$\Delta t = 5 \text{ s}$$

Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

OPTION/*OPSIE* 2

Up/*Op* -ve

Time taken by the camera to reach the ground/ *Tyd wat die kamera neem om die grond te bereik*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$

$$100\checkmark = -12\Delta t + \frac{1}{2}(9{,}8)\Delta t^2 \checkmark$$

$$\Delta t = 5{,}91 \text{ s}$$

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

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

$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2 \checkmark$$

$$\Delta t = 5 \text{ s}$$

Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

Copyright reserved/*Kopiereg voorbehou*

Testpapers.co.za

OPTION/*OPSIE* 3:
POSITIVE MARKING FROM 4.3 AND 4.4
POSITIEWE NASIEN VANAF VRAAG 4.3 AND 4.4.
Up/*Op* +ve
Time taken by the camera to reach the ground from Max. height/
Tyd wat die kamera neem om die grond vanaf die Maksimum hoogte te bereik:

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$
$$-(100+7{,}35)\checkmark = 0\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2 \checkmark$$
$$\Delta t = 4{,}681 \text{ s}$$
$$\Delta t \text{ (total)} = 4{,}681 + 1{,}22$$
$$= 5{,}90 \text{ s}$$

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2\checkmark$$
$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2 \checkmark$$
$$\Delta t = 5 \text{ s}$$

Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

OPTION/*OPSIE* 4:
POSITIVE MARKING FROM 4.3 AND 4.4
POSITIEWE NASIEN VANAF VRAAG 4.3 AND 4.4.
Up/*Op* -ve
Time taken by the camera to reach the ground from the Max. height/
Tyd wat die kamera neem om die grond vanaf die Maksimum hoogte te bereik:

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$
$$(100+7{,}35)\checkmark = 0\Delta t + \frac{1}{2}(9{,}8)\Delta t^2 \checkmark$$
$$\Delta t = 4{,}681 \text{ s}$$
$$\Delta t \text{ (total)} = 4{,}681 + 1{,}22$$
$$= 5{,}90 \text{ s}$$

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2\checkmark$$
$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2 \checkmark$$
$$\Delta t = 5 \text{ s}$$

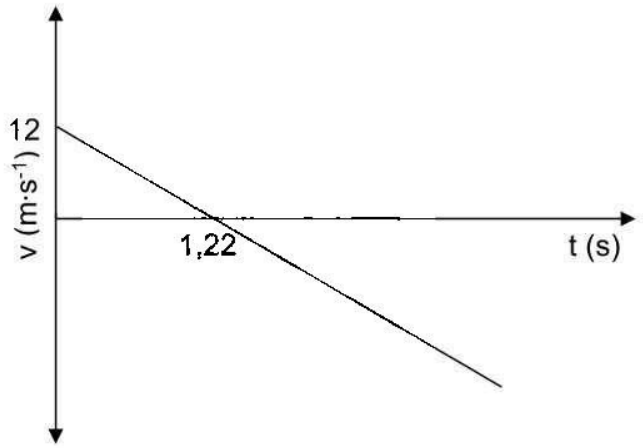
Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang (6)

Copyright reserved/*Kopiereg voorbehou*

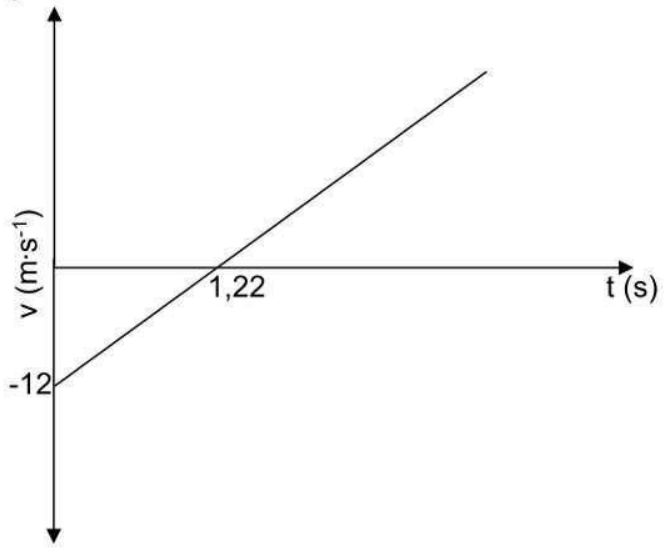
Testpapers.co.za

4.6 **POSITIVE MARKING FROM QUESTION 4.3**
POSITIEWE NASIEN VANAF VRAAG 4.3

OPTION/*OPSIE* 1
Up/*Op* +ve



OPTION/*OPSIE* 2
Up/*Op* -ve



Criteria for graph/ Kriteria vir grafiek	Marks
Graph starts at/ *Grafiek begin by* v = 12 m·s^{-1} at t = 0 s.	✓
Maximum height reached/*Maksimum hoogte bereik* (v = 0 m·s^{-1}) at//by t = 1,22 s.	✓
Correct shape as shown: straight line with gradient and section of the graph after max height longer than before max height./ *Korrekte vorm soos getoon: reguit lyn met gradiënt en snit van die grafiek na maksimum hoogte langer as voor maksimum hoogte.*	✓

(3)
[21]

Testpapers.co.za

QUESTION 5 / *VRAAG 5*

5.1.1 W ✓ (1)

5.1.2 Z ✓ (1)

5.1.3 V ✓ (1)

5.2 Hydroxyl (group) ✓ (1)
Hidroksiel (groep)

5.3.1 Propan-1-ol/ 1-propanol.✓✓ **(2 or 0)** (2)
Propaan-1-ol

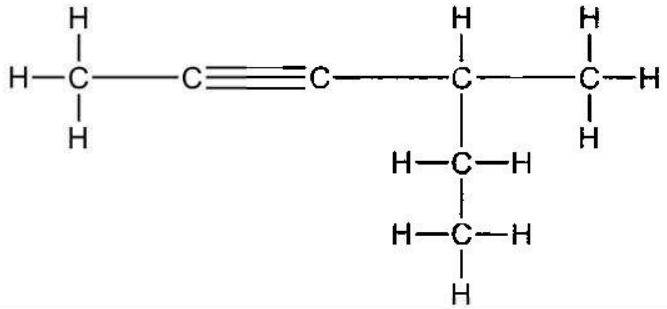
5.3.2 6-bromo-3-ethyl-2-methylheptane/ *6-bromo-3-etiel-2-metielheptaan*

Marking criteria:
- Correct stem i.e. heptane. ✓
- Substituents (bromo, ethyl and methyl) correctly identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas.✓

Nasienkriteria:
- *Korrekte stam d.i. heptaan.* ✓
- *Substituente (bromo, etiel en metiel) korrek geïdentifiseer.* ✓
- *IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

(3)

5.4



Marking criteria:
- Correct functional group (triple bond) drawn. ✓
- Whole structure correct.✓

Nasienkriteria:
- *Korrekte funksionele groep (drievoudige binding) getrek*
- *Hele struktuur korrek*

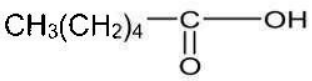
(2)

Testpapers.co.za

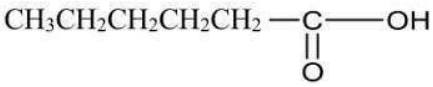
5.5.1 $C_nH_{2n}O_2$ ✓ (1)

5.5.2 $CH_3CH_2CH_2CH_2CH_2COOH$ OR $CH_3(CH_2)_4COOH$

OR



OR



Marking criteria:	Nasienkriteria:
• Functional group for carboxylic acids is correct (carboxyl group) ✓ • Whole structure is correct (carbon with 4 bonds, all H atoms shown) ✓	• Funksionele groep van karboksielsuur is korrek (karboksiel groep) ✓ • Hele struktuur is korrek (koelstof met 4 bindings, al H-atome word getoon) ✓

(2)
[14]

Testpapers.co.za

QUESTION 6 / *VRAAG 6*

6.1 The temperature at which the solid and liquid phases of a substance are at equilibrium.✓✓
Die temperatuur waarby die vaste- en vloeistoffases van 'n stof in ewewig is. (2)

6.2 (Type of) Functional group/Type of Intermolecular forces/ Homologous series.✓ (1)
(Tipe van) Funksionele groep/Tipe intermolekulêre kragte/ Homoloë reeks.

6.3 SECONDARY✓, carbon bonded to hydroxyl group (OH^-) is bonded to two other carbon atoms.✓ (2)
SEKONDÊR, koolstof gebind aan hidroksielgroep (OH-) is gebind aan twee ander koolstofatome

6.4 Liquid.✓ (1)
Vloeistof

6.5 A has london forces only✓, D has london forces and dipole-dipole forces✓, B has london forces, dipole-dipole forces and hydrogen bonds.✓

FROM A to D to B:

- Strength of intermolecular forces increases.✓
- Energy required to overcome the strength on intermolecular forces increases.✓

Therefore the melting point of D is greater than that of A but less than that of B.

A het slegs Londense magte, D het Londense kragte en dipool-dipoolkragte, B het Londense kragte, dipool-dipoolkragte en waterstofbindings.

VAN A tot D na B:

- Die sterkte van intermolekulêre kragte neem toe.
- Energie wat nodig is om die sterkte op intermolekulêre kragte te oorkom, neem toe.

Daarom is die smeltpunt van D groter as dié van A maar minder as dié van B.

Testpapers.co.za

OR/*OF*

A has london forces only✓, D has london forces and dipole-dipole forces✓,
B has london forces, dipole-dipole forces and hydrogen bonds.✓

FROM B to D to A:

- Strength of intermolecular forces decreases.✓
- Energy required to overcome the strength on intermolecular forces decreases.✓

Therefore the melting point of D is greater than that of A but less than that of B.

A het slegs Londense magte, D het Londense kragte en dipool-dipoolkragte,
B het Londense kragte, dipool-dipoolkragte en waterstofbindings.

VAN B tot D na A:

- *Die sterkte van intermolekulêre kragte neem af.*
- *Energie wat benodig word om die krag op intermolekulêre kragte te oorkom, neem af.*

Daarom is die smeltpunt van D groter as dié van A maar minder as dié van B (5)

[11]

Grand Total: 100 marks
Groottotaal: 100 punte

Copyright reserved/*Kopiereg voorbehou*

Testpapers.co.za

education

Department of Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 12

PHYSICAL SCIENCES

MARCH 2025

MARKS: 100

TIME: 2 HOURS

This paper consists of 12 pages and two information sheets.

Copyright reserved

Testpapers.co.za

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of SIX questions. Answer ALL 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 sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.

6. You may use a non-programmable pocket 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 where applicable.

11. Give brief motivations, discussions, et cetera where required.

12. Write neatly and legibly.

Copyright reserved

Testpapers.co.za

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 write down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 The equivalent unit of force is …

A $kg \cdot m \cdot s^{-1}$.

B $kg \cdot m \cdot s^{-2}$.

C $kg \cdot m \cdot s$.

D $kg \cdot m^{-1}$. (2)

1.2 A learner drops two identical cell phones, **A** and **B**, from the same height. Cell phone **A** falls on a concrete floor and its screen breaks and cell phone **B** falls on a woollen carpet and its screen does not break.

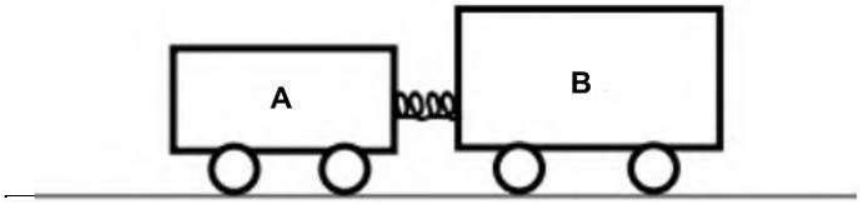
Which one of the following combinations is CORRECT for cell phone **B** compared to cell phone **A** for the same change in momentum?

	TIME OF CONTACT WITH CARPET	**NET FORCE ON CELL PHONE B**
A	Larger	Larger
B	Smaller	Larger
C	Larger	Smaller
D	Smaller	Smaller

(2)

Testpapers.co.za

1.3 Two trolleys, **A** and **B**, with masses $\frac{1}{2}m$ and $2m$ respectively are connected by the spring as shown in the diagram below. The trolleys are initially at rest. Ignore all types of friction.



When the spring is released, both trolleys have a momentum with a magnitude of p. Trolley **B** moves with a velocity of v to the right. The magnitude of the velocity of trolley **A** will be:

A v

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

C $2v$

D $4v$ (2)

1.4 An object is thrown vertically upwards. Which one of the following regarding the object's acceleration at the highest point of its motion is CORRECT? Ignore the effects of friction.

A $0\ m{\cdot}s^{-2}$

B $-9{,}8\ m{\cdot}s^{-2}$, downwards

C $9{,}8\ m{\cdot}s^{-1}$, downwards

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

1.5 A ball is dropped from rest and reaches a velocity v after it has travelled $3\ m$. What will the magnitude of the velocity of the ball be after it has travelled $9\ m$? Ignore the effects of friction.

A $\frac{1}{3}v$

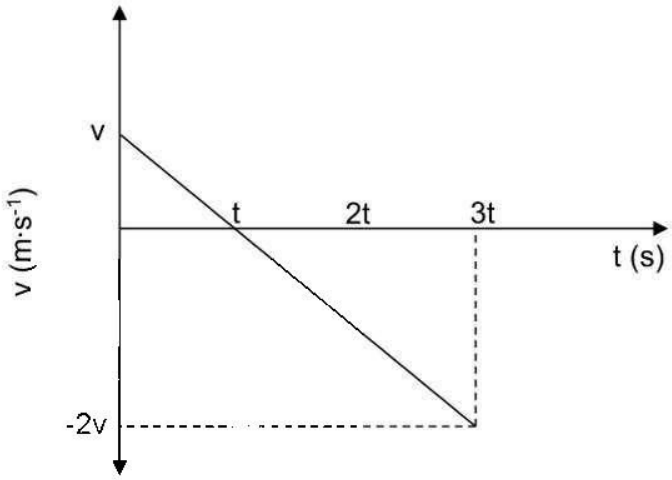
B $\sqrt{3}v$

C $3v$

D $6v$ (2)

Testpapers.co.za

1.6 The velocity versus time graph below represents the movement of an object that is initially projected vertically upwards. Ignore the effects of friction.



The displacement of the object after ***2t*** is …

A 0

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

C vt

D $-\frac{3}{2}vt$ (2)

1.7 $CH_3COOCH_2CH_2CH_3$ is a condensed structural formula of …

A pentanoic acid.

B propyl ethanoate.

C ethyl propanoate.

D methyl butanoate. (2)

Testpapers.co.za

1.8 The list below has IUPAC names of compounds with five carbons.

(i) Methyl butanoate.
(ii) Pentanoic acid.
(iii) Pentan-3-one
(iv) 2-methylbutanal

A Functional isomer of pentanal is … only.

A (iii) and (iv)

B (ii) and (iii)

C (iii)

D (iv) (2)

1.9 Which molecular formula of an organic compound is similar to the EMPIRICAL FORMULA of butanoic acid AND to which homologous series does the compound belong?

	MOLECULAR FORMULA	HOMOLOGOUS SERIES
A	$C_4H_8O_2$	Carboxylic acid
B	C_2H_4O	Carboxylic acid
C	C_2H_4O	Aldehydes
D	$C_2H_4O_2$	Esters

(2)

1.10 Which compound has the lowest boiling point?

A 2,2-dimethylpropane.

B 2-methylbutane.

C 2-chlorobutane.

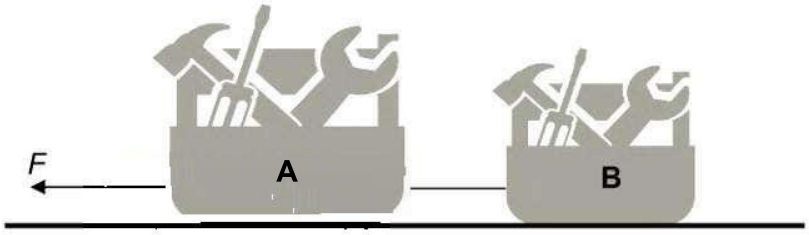
D Butan-1-ol. (2)

[20]

Testpapers.co.za

QUESTION 2

Toolbox **A** of mass *6 kg* is joined by an inextensible string to toolbox **B** with the mass of *4 kg*. A pulling force of **F** is exerted on **A** to accelerate the boxes to the left. The coefficient of kinetic friction on the boxes is *0,3* and *0,2* respectively. Both toolboxes accelerate at $5{,}852\ m{\cdot}s^{-2}$ to the left.



2.1 State Newton second law of motion in words. (2)

2.2 Draw a free body diagram showing all forces acting on toolbox **B**. (4)

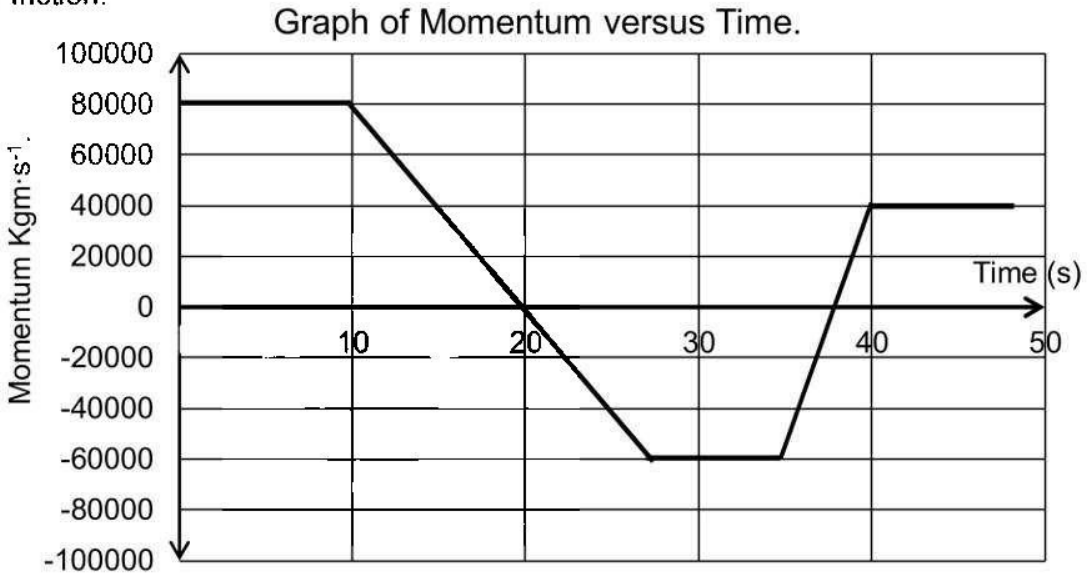
2.3 Calculate the magnitude of the pulling force ***F*** acting on the 6 kg box. (6)

2.4 Write down the reaction force to the weight of toolbox **A**. (2)
[14]

Testpapers.co.za

QUESTION 3

The following graph shows the change in **momentum** of a truck over a period of time. The truck is initially moving EASTWARDS in a straight line. Ignore the effects of friction.



3.1 Define the term *momentum*. (2)

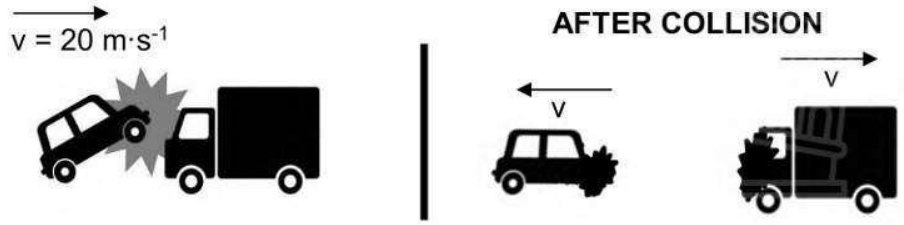
3.2 Write down the:

3.2.1 direction of the truck at t = 30 s. (2)

3.2.2 magnitude of the net force acting on the truck for the first 10 s. (1)

3.3 Explain your answer to QUESTION 3.2.2. (3)

3.4 The truck collides with a car at t = 35 s. The car has a mass of *2000 kg* and is moving at a constant velocity of *20 m·s⁻¹* east before the collision. After the collision, the car has a velocity to the west.



3.4.1 The ACCELERATION of the truck, between t = 35 s and t = 40 s, is *4 m·s⁻²* east. Calculate the mass of the truck. (5)

3.4.2 Calculate the velocity of the truck before the collision. (3)

Testpapers.co.za

The sum of the kinetic energy of the car and truck after the collision is $1,06 \times 10^6$ J.

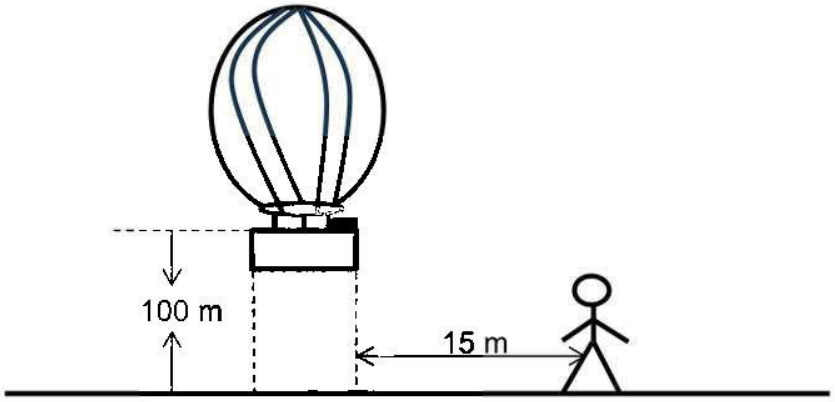
3.4.3 Prove by means of a calculation whether the collision between the car and the truck is *ELASTIC* or *INELASTIC*. (4)

[20]

Testpapers.co.za

QUESTION 4

A hot-air balloon is moving vertically upwards at a constant speed of *12 m·s⁻¹*.
A camera is accidentally dropped from the balloon at a height of *100 m* as shown in the diagram below. Ignore the effects of friction.



4.1 Is the hot-air ballon a projectile while it is moving upwards?
Write YES or NO and give a reason for your answer. (2)

4.2 What is the velocity of the camera immediately after it is dropped from the hot-air ballon. (2)

4.3 Calculate the time taken by the camera to reach its maximum height. (3)

4.4 Calculate the distance between the hot-air balloon and the camera when the camera is at its maximum height. (5)

4.5 A jogger running at a constant speed of 3 $m \cdot s^{-1}$, is 15 m away from the hot-air balloon as shown in the above diagram. If the jogger sees the camera at the same instant it is dropped from the balloon, will he be able to catch the camera before it strikes the ground?

Support your answer by means of a calculation. (6)

4.6 Draw a sketch graph of velocity versus time for the entire motion of the camera.

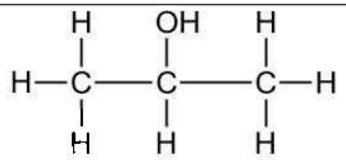
Indicate the following on the graph:
- Initial velocity
- Time taken to reach the maximum height (3)

[21]

Testpapers.co.za

QUESTION 5

Consider the compounds **V**, **W**, **X**, **Y** and **Z** in the table below.

	COMPOUNDS
V	2-methylpropane
W	$CH_3CCCH(CH_2CH_3)CH_3$
X	
Y	$C_6H_{12}O_2$
Z	$CH_3CHBrCH_2CH_2CH(CH_2CH_3)CH(CH_3)CH_3$

5.1 Write down a LETTER for a compound that is:

5.1.1 an unsaturated hydrocarbon. (1)

5.1.2 a haloalkane. (1)

5.1.3 a chain isomer of butane. (1)

5.2 Write down the NAME of the functional group of compound **X**. (1)

5.3 Give the IUPAC name of:

5.3.1 a positional isomer of **X.** (2)

5.3.2 compound **Z.** (3)

5.4 Draw a structural formula of compound **W**. (2)

5.5 Compound is **Y** a straight chain carboxylic acid. For compound **Y**, write down the:

5.5.1 general formula of the homologous series to which it belongs. (1)

5.5.2 condensed structural formula. (2)

[14]

Testpapers.co.za

QUESTION 6

A group of learners investigate the factors that affect the melting points of organic compounds **A**, **B**, **C** and **D**. Compound **D** has an unknown melting point **X**.
All these compounds have comparable molecular masses.

	COMPOUND	MELTING POINT (°C)
A	2-methylbutane	- 159,77
B	Butan-2-ol	- 115
C	Propanoic acid	- 21
D	2-fluorobutane	**X**

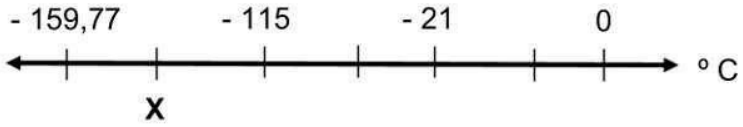
6.1 Define the term **melting point**. (2)

6.2 Give the independent **variable** for this investigation. (1)

6.3 What type of alcohol is compound **B**? Only write down PRIMARY, SECONDARY OR TERTIARY and give a reason for your answer. (2)

6.4 Is compound **C** a liquid or solid at 0°C? (1)

6.5 On the number line below (not drawn to scale), the unknown melting point is at a position as shown below. Write down a complete explanation for this.



(5)
[11]
GRAND TOTAL: 100

Testpapers.co.za

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}$ $N \cdot m^2 \cdot kg^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^8$ $m \cdot s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}$ J·s
Coulomb's constant	k	$9,0 \times 10^9$ $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg
Mass of the Earth	M	$5,98 \times 10^{24}$ kg
Radius of the Earth	R_E	$6,38 \times 10^6$ m

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$ OR $F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{d^2}$ OR $g = \frac{GM}{r^2}$

WORK, ENERGY AND POWER

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

Copyright reserved

Testpapers.co.za

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

KEY

Atomic number → 29

Electronegativity → 1,9 **Cu** ← Symbol

63,5 ← Approximate relative atomic mass

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

Testpapers.co.za

Copyright reserved