

education

**MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

NKANGALA DISTRICT

PHYSICAL SCIENCES


17 MARCH 2023
Stanmorephysics.com

MARKS: 100

TIME: 2 hours

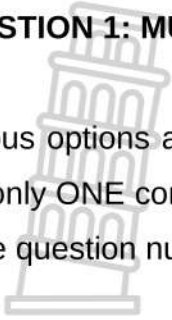
This question paper consists of 13 pages and 3 data sheets.

INSTRUCTIONS AND INFORMATION

- 
1. Write your name and class (for example 12 A) in the appropriate spaces on the FOLIO PAPER.
 2. This question paper consists of 7 questions. Answer ALL the questions in the FOLIO PAPERS.
 3. Start EACH question on a NEW page in the FOLIO PAPERS.
 4. Number the answers correctly according to the numbering system used in this question paper.
 5. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
 6. You may use a non-programmable calculator.
 7. You may use appropriate mathematical instruments.
 8. You are advised to use the attached DATA SHEET.
 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.

QUESTION 1: MULTIPLE CHOICE

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the correct answer and write only the letter (A–D) next to the question number (1.1–1.6) in the FOLIO PAPER, for example 1.11 E.



1.1 A ball is projected vertically upwards. Ignore air resistance.

Which ONE of the following statements about the acceleration of the ball at its maximum height is CORRECT?

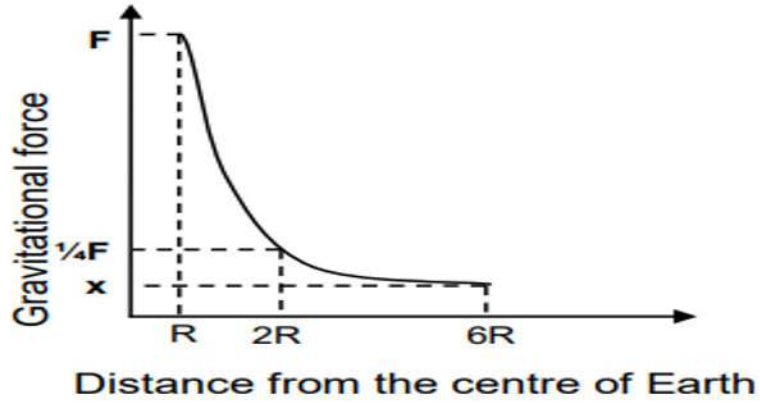
The acceleration is equal to ...

- A zero.
- B g and is directed downwards.
- C g and is directed upwards.
- D g and is directed horizontally.

(2)

1.2 The graph below, not drawn to scale, shows the relationship between the gravitational force on a given mass and its distance from the centre of Earth.

The magnitude of the force on the mass at a distance R from the centre of Earth is F .

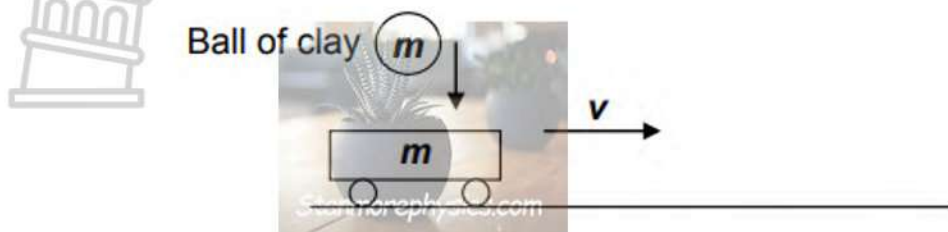


Which ONE of the following is the CORRECT representation of the magnitude of force x shown on the graph?

- A $6F$
- B $36F$
- C $\frac{1}{6}F$
- D $\frac{1}{36}F$

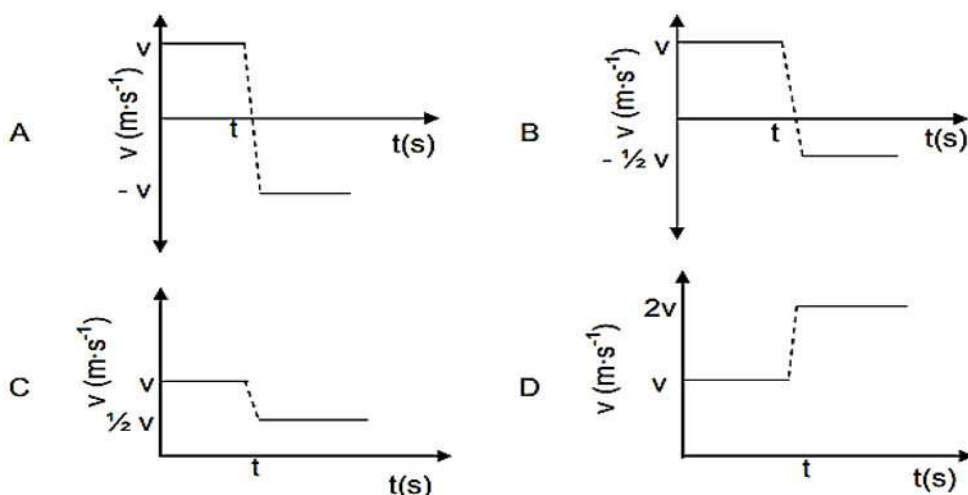
(2)

- 1.3 A trolley of mass m is moving at constant velocity v to the right on a frictionless horizontal surface. A ball of clay, also of mass m , dropped vertically, falls onto the trolley at time t , as shown in the diagram below.

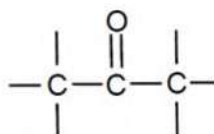


The ball of clay sticks to the trolley.

Which ONE of the velocity-time graphs below CORRECTLY represents the velocity of the trolley before and after time t ?



- 1.4 Study the structural formula of the functional group below.



The structure above is the functional group of ...

- | | | | |
|---|----------|---|------------------|
| A | Esters | B | Ketones |
| C | Aldehyde | D | Carboxylic acids |

(2)

1.5 Which ONE of these compounds has the highest vapour pressure at room temperature?



- A Propane
- B Ethanol
- C Ethanal
- D Fluoroethane

(2)

1.6 When butane is subjected to high temperatures and pressures, the following reaction takes place:



Which ONE of the following represents Y?

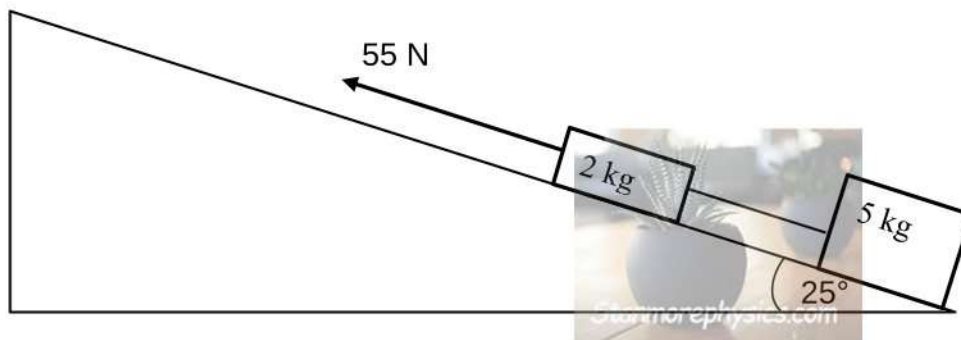
- | | | | |
|---|-------------------------------------|---|------------------------------|
| A | CHCCH_3 | B | CH_2CHCH_3 |
| C | $\text{CH}_3\text{CH}_2\text{CH}_3$ | C | $\text{CH}_3\text{CHCHCH}_3$ |

(2)

[12]

QUESTION 2

A block of mass 2 kg is connected to another block of mass 5 kg by a light inextensible string. Both blocks are on an inclined plane of 25° to the horizontal. The 2 kg is pulled by a constant force of 55 N parallel to the plane as shown in the diagram below. The magnitude of the kinetic frictional force between the surface and the 5 kg block is 14,21 N. The coefficient of kinetic friction between the 2 kg block and the surface is 0,32.

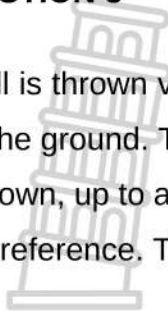


- 2.1 Define the term **normal force**. (2)
- 2.2 Draw a labelled free-body diagram showing ALL the forces acting on the 2 kg block as it moves up the inclined plane. (5)
- 2.3 Calculate the magnitude of the:
- 2.3.1 Kinetic frictional force between the 2 kg block and the surface. (3)
- 2.3.2 Tension in the string connecting the two blocks. (6)

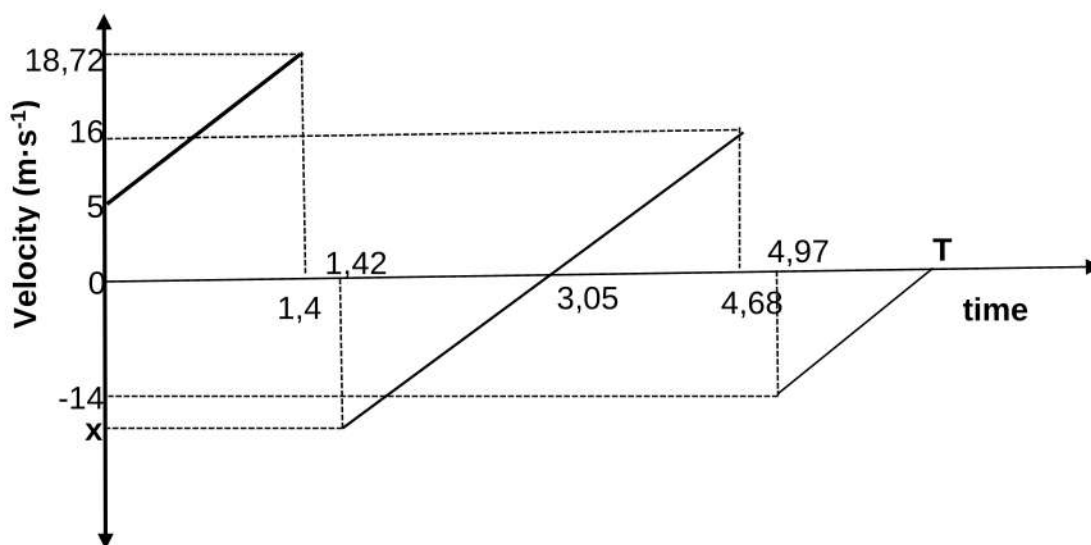
[16]

QUESTION 3

A ball is thrown vertically downwards from the top of a building and bounces a few times as it hits the ground. The velocity-time graph below describes the motion of the ball from the time it is thrown, up to a certain time T. Take **downwards** as the positive direction and the ground as zero reference. The graph is NOT drawn to scale. The effects of air friction are ignored.



VELOCITY-TIME GRAPH

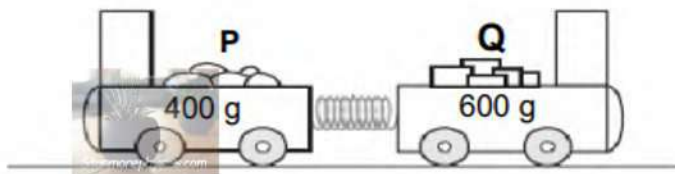


- 3.1 Define the term *free fall*. (2)
- 3.2 Calculate the height from which the ball is thrown. (3)
- 3.3 Calculate the time (T) shown on the graph. (3)
- 3.4 Write down the value of **x**. (1)
- 3.5 Calculate the maximum height reached by the ball after the first bounce. (3)
- 3.6 Sketch the position-time graph for the complete motion of the ball. Take GROUND as ZERO POSITION. Clearly show the following on the graph:
 - The height from which the ball was thrown.
 - The maximum height reached by the ball after the first bounce.
 - The time T. (5)

[17]

QUESTION 4

The diagram shows two trolleys, P and Q, held together by means of a compressed spring on a flat, frictionless horizontal track. The masses of P and Q are 400 g and 600 g respectively. When the trolleys are released, it takes 0,32 s for the spring to unwind to its natural length. Trolley Q then moves to the right at $4.5 \text{ m}\cdot\text{s}^{-1}$.

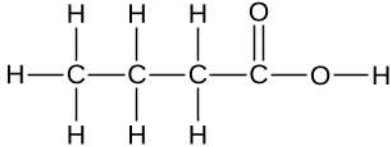
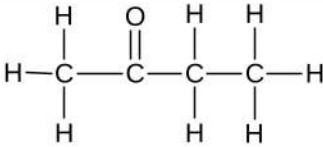
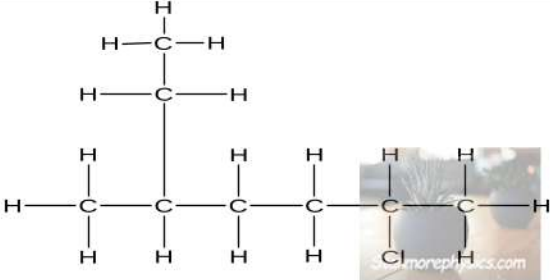
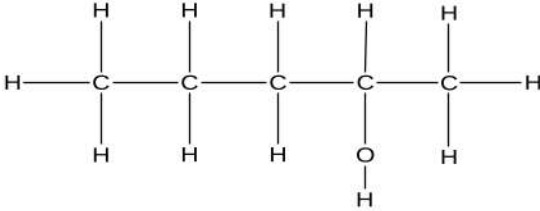


- 4.1 State the *principle of conservation of linear momentum* in words. (2)
- 4.2 Calculate the velocity of trolley P after the trolleys are released. (4)
- 4.3 Calculate the magnitude of the average force exerted by the spring on trolley Q. (4)
- 4.4 How does the magnitude of the force calculated in QUESTION 4.2 compare to the magnitude of the force exerted by the spring on trolley P? Write down only LARGER THAN, SMALLER THAN or THE SAME. (1)

[11]

QUESTION 5

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

A	$\text{CH}_3\text{C}(\text{CH}_3)_2\text{CH}_2\text{CH}_3$	B	$\text{CH}_3\text{CHCHCH}_2\text{CH}_3$
C		D	
E		F	
G	Methyl propanoate	H	Propanal

5.1 Is compound B SATURATED or UNSATURATED? Give reason for the answer. (2)

5.2 Write down the LETTER(S) that represents EACH of the following:

5.2.1 An aldehyde. (1)

5.2.2 A compound with the general formula C_nH_{2n} . (1)

5.2.3 Two compounds that are FUNCTIONAL isomers. (1)

5.2.4 A ketone. (1)

5.3 Write down the IUPAC name of:

5.3.1 Compound A. (3)

5.3.2 Compound E. (3)

5.4 Write down the STRUCTURAL FORMULA of:

5.4.1 Compound G. (2)

5.4.2 Positional isomer of compound F. (2)

[16]

QUESTION 6

A laboratory technician is provided with three unmarked bottles containing an ALCOHOL, ALDEHYDE and ALKANE with similar molecular mass. She takes a sample from each bottle and labels them X, Y and Z. To identify each compound, she determines the boiling point under the same conditions. The results are in the table below.

SAMPLE	BOILING POINT
X	76 °C
Y	36 °C
Z	118 °C

(2)

6.1 Define the term *boiling point*.

6.2 Write down the letter that represent the compound with the lowest vapour pressure. (1)

6.3 Give a reason for the answer in QUESTION 6.2. (2)

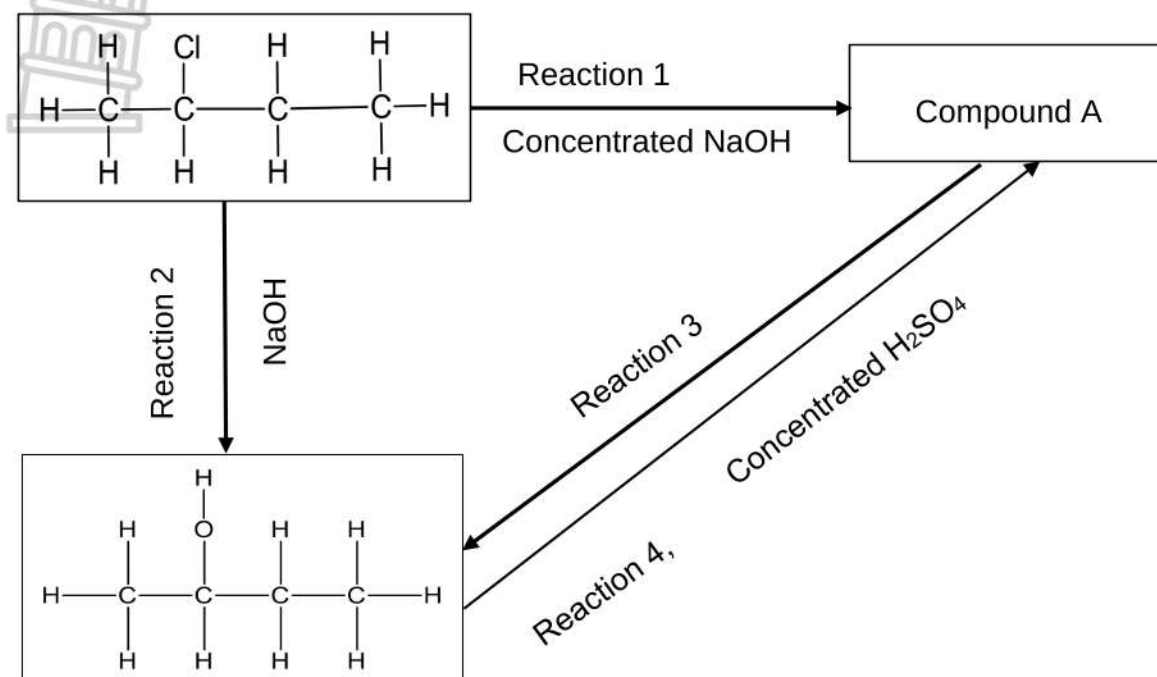
6.4 Copy the letters X, Y and Z and write down the homologous series that is represent by each letter. (3)

6.5 Refer to THE TYPE OF INTERMOLECULAR FORCES present in each compound and FULLY explain how you arrived at the answer given in QUESTION 6.4. (4)

[12]

QUESTION 7

7.1 2-chlorobutane undergoes two different reactions, as shown in the diagram below.



Write down the type of reaction represented by:

7.1.1 Reaction 1. (1)

7.1.2 Reaction 2. (1)

7.1.3 Reaction 3. (1)

7.1.4 Reaction 4. (1)

For reaction 1 write down the:

7.1.5 IUPAC Name of organic compound A. (2)

7.1.6 Structural formula of organic compound A. (2)

7.1.7 Reaction condition other than concentrated NaOH. (1)

For reaction 2 write down the:

7.1.8 Two reaction conditions. (2)

For reaction 4 write down the:

7.1.9 Function of H_2SO_4 . (1)

7.2 Alkanes are used as a FUEL.

7.2.1 Write down the property of alkanes that is responsible for them to be used as a fuel. (1)

7.2.2 Using molecular formula write down the balanced combustion reaction of propane. (3)

[16]

GRAND TOTAL: 100

4.2 Information sheets – Paper 1 (Physics)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 m·s ⁻²
Universal gravitational constant	G	6,67 x 10 ⁻¹¹ N·m ² ·kg ⁻²
Radius of earth	R _E	6,38 x 10 ⁶ m
Mass of earth	M _E	5,98 x 10 ²⁴ kg
Speed of light in a vacuum	c	3,0 x 10 ⁸ m·s ⁻¹
Planck's constant	h	6,63 x 10 ⁻³⁴ J·s
Coulomb's constant	k	9,0 x 10 ⁹ N·m ² ·C ⁻²
Charge on electron	e	-1,6 x 10 ⁻¹⁹ C
Electron mass	m _e	9,11 x 10 ⁻³¹ kg

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

FORCE

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

WORK, ENERGY AND POWER

$W = F \Delta x \cos \theta$	$U = mgh$ 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 $W_{nc} = \Delta E_k + \Delta E_p$	
$P = \frac{W}{\Delta t}$	$P = Fv$

4.3 Information sheets – Paper 2 (Chemistry)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Standard pressure	p^\ominus	$1,013 \times 10^5 \text{ Pa}$
Molar gas volume at STP	V_m	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$
Standard temperature	T^\ominus	273 K
Charge on electron	e	$-1,6 \times 10^{-19} \text{ C}$
Avogadro's constant	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$

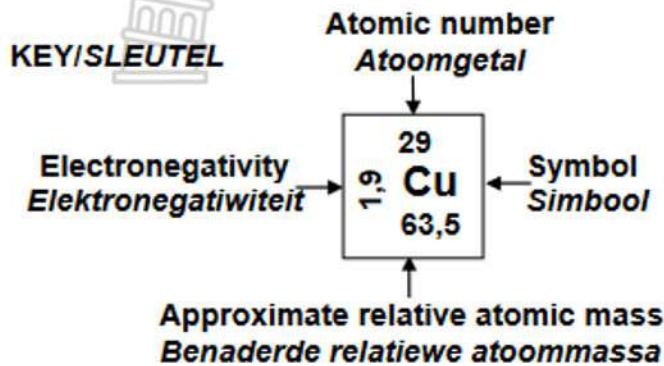
TABLE 2: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$\text{pH} = -\log[\text{H}_3\text{O}^+]$
$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ at 298 K	
$E_{\text{cell}}^\ominus = E_{\text{cathode}}^\ominus - E_{\text{anode}}^\ominus$	
$E_{\text{cell}}^\ominus = E_{\text{reduction}}^\ominus - E_{\text{oxidation}}^\ominus$	
$E_{\text{cell}}^\ominus = E_{\text{oxidising agent}}^\ominus - E_{\text{reducing agent}}^\ominus$	

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

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
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 98	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 1,6 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tl 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															
			58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175	
			90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

KEY/SLEUTEL



29 Cu 63,5



education

**MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES

17 MARCH 2023

MARKING GUIDELINE

Stanmorephysics.com

MARKS: 100

This marking guideline consists of 10 pages

QUESTION 1: MULTIPLE CHOICE

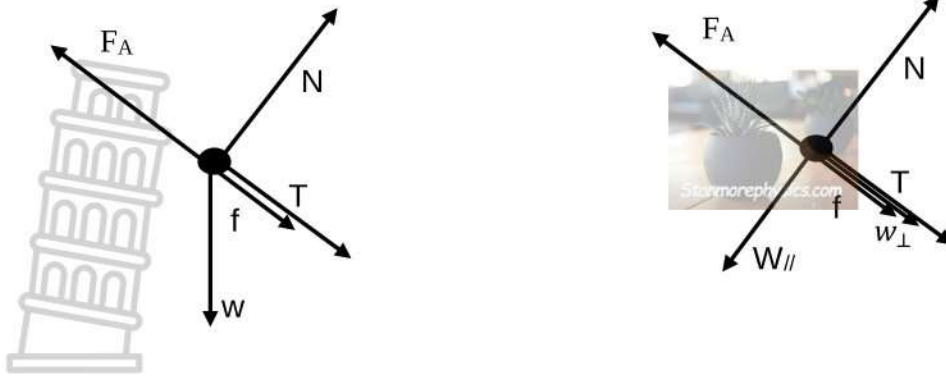
- | | | |
|-----|------|-----|
| 1.1 | B ✓✓ | (2) |
| 1.2 | D ✓✓ | (2) |
| 1.3 | C ✓✓ | (2) |
| 1.4 | B ✓✓ | (2) |
| 1.5 | A ✓✓ | (2) |
| 1.6 | B ✓✓ | (2) |

[12]

QUESTION 2

- 2.1 The force or the 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/Aanvaar die volgende simbole.	
N✓	F_N /Normal/Normaal/Normal force/Normaalkrag /35 N
F_A ✓	Applied force/ Fapplied/toegepas
f✓	F_f / f_k / f_r / frictional force/wrywingskrag/kinetic frictional force/kinetiese wrywingskrag
T✓	Tension/Spanning/ F_T / F / F_s
w✓	F_g /mg/weight/ $F_{\text{Earth on block}}$ /19,6 N/gravitational force/gewig/ $F_{\text{aarde op blok}}$ / gravitasiekrag

Notes/Aantekeninge

- Mark is awarded for label and arrow. /Punt word toegeken vir byskrif en pyltjie
- Do not penalise for length of arrows. /Moenie vir die lengte van die pyltjies penaliseer nie.
- Deduct 1 mark for any additional force. /Trek 1 punt af vir enige addisionele krag.
- If force(s) do not make contact with body/dot /Indien krag(te) nie met die voorwerp/ kolletjie kontak maak nie: Max./Maks: 4/5
- If arrows missing/Indien pyltjies uitgelaat is: Max./Maks: 4/5

(5)

2.3.1 $f_k = \mu_k N$ ✓
 $= 0,32 \times 2 \times 9,8 \cos 25^\circ$ ✓
 $= 5,68 \text{ N}$ ✓

(3)

POSITIVE MARKING FROM 2.3.1

Substitute the value a into (1):

2.3.2 **For the 5 kg mass**

$$\begin{aligned}
 F_{\text{net}} &= ma \\
 T - (f + mg \sin \theta) &= ma \\
 T - (14,21 + 5 \times 9,8 \sin 25^\circ) &= 5a \\
 T - 34,918 &= 5a \dots\dots\dots(1)
 \end{aligned}$$

$$\begin{aligned}
 T - 34,918 &= 5 \times 0,874 \\
 T &= 39,29 \text{ N} \\
 \text{OR}
 \end{aligned}$$

Substitute the value a into (2):

$$\begin{aligned}
 41,037 - T &= 2 \times 0,874 \\
 T &= 39,29 \text{ N}
 \end{aligned}$$

For the 2 kg mass

$$\begin{aligned}
 55 - (T + 5,68 + 2 \times 9,8 \sin 25^\circ) &= 2a \\
 41,037 - T &= 2a \dots\dots\dots(2) \\
 (1) + (2): 6,119 &= 7a \\
 a &= 0,874 \text{ m.s}^{-2}
 \end{aligned}$$

(6)

[16]

QUESTION 3

3.1 (Motion during which) the only force acting is the force of gravity/ gravitational force. ✓✓

(NOTE: 2 or 0)

3.2

<u>OPTION 1</u>	
$ \begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} \Delta t^2 \\ &= 5 \times 1,4 + \frac{1}{2} \times 9,8 \times 1,4^2 \\ &= 16,60 \text{ m} \end{aligned} $	$ \begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} \Delta t^2 \\ &= -5 \times 1,4 + \frac{1}{2} \times -9,8 \times 1,4^2 \\ &= -16,60 \\ \Delta y &= 16,60 \text{ m} \end{aligned} $
<u>OPTION 2</u> $ \begin{aligned} \Delta y &= \left(\frac{v_f + v_i}{2} \right) \Delta t \\ &= \left(\frac{18,72 + 5}{2} \right) \times 1,4 \\ \Delta y &= 16,60 \text{ m} \end{aligned} $	<u>OPTION 3</u> $ \begin{aligned} v_f^2 &= v_i^2 + 2a\Delta y \\ 18,72^2 &= 5^2 + 2 \times 9,8 \Delta y \\ \Delta y &= 16,60 \text{ m} \end{aligned} $
<u>OPTION 4</u> Height = Area under the graph 16,60 m Hoogte = Area onder die grafiek = Area of/van □ + Area of/van Δ = (5)(1,4) + (½)(1,4)(18,72) = 16,60 m	<u>OPTION 5</u> Height = Area of trapezium Hoogte = Area van trapesium = ½ (5 + 18,72) × 1,4 = 16,60 m Any one/Enige een

3.3

$$v_f = v_i + a\Delta t \checkmark$$

$$0 = -14 + (9,8)\Delta t \checkmark$$

$$\Delta t = 1,43$$

$$\therefore T = 6,4s \checkmark$$

3.4

$$-16 \text{ (m}\cdot\text{s}^{-1}) \checkmark$$

3.5

OPTION 1

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} \Delta t^2 \checkmark \\ &= -16 \times 1,63 + \frac{1}{2} \times 9,8 \times 1,63^2 \checkmark \\ &= -13,06 \\ &= 13,06 \text{ m} \checkmark \end{aligned}$$

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} \Delta t^2 \checkmark \\ &= 16 \times 1,63 + \frac{1}{2} \times -9,8 \times 1,63^2 \checkmark \\ &= 13,06 \text{ m} \checkmark \end{aligned}$$

OPTION 2

$$\begin{aligned} \Delta y &= \left(\frac{v_f + v_i}{2} \right) \Delta t \checkmark \\ &= \left(\frac{0 + (-16)}{2} \right) \times 1,63 \checkmark \\ &= -13,04 \\ \Delta y &= 13,04 \text{ m} \checkmark \end{aligned}$$

OPTION 2

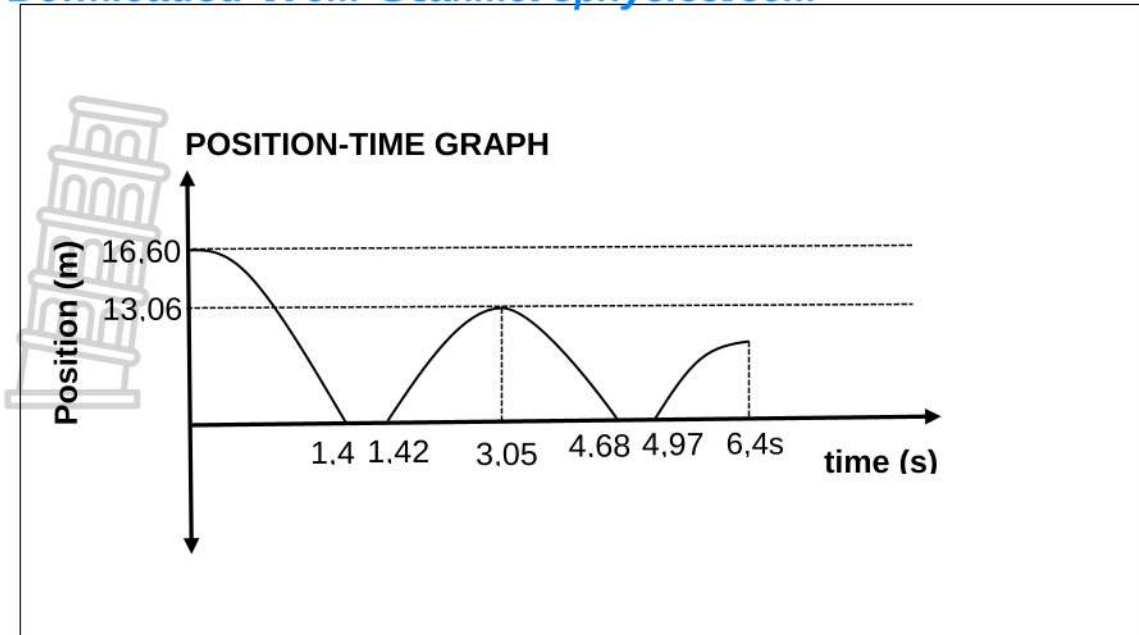
$$\begin{aligned} v_f^2 &= v_i^2 + 2a\Delta y \checkmark \\ 0^2 &= (-16)^2 + 2 \times 9,8 \Delta y \checkmark \\ \Delta y &= 13,06 \text{ m} \checkmark \end{aligned}$$

OPTION 4

Height = Area under the graph 1 ✓
 Hoogte = Area onder die grafiek
 = Area of/van Δ
 = $(\frac{1}{2})(1,63)(16)$ ✓
 = 13,04 m ✓

RANGE [13,04 m-13,06 m]

3.6



Criteria for graph/Kriteria vir grafiek	Marks/Punte
The height from which the ball was thrown is clearly indicated.	✓
The maximum height reached by the ball after the first bounce clearly indicated.	✓
Time T clearly shown	✓
Shape of the graph	✓✓
NB. Accept the graph sketched on the negative side.	

QUESTION 4

4.1 The total linear momentum in a closed system ✓ remains constant./is Conserved. ✓

Die totale lineêre momentum in 'n geslote stelsel ✓ bly konstant/bly behoue. ✓

OR/OF

In a closed/isolated system, ✓ the total momentum before a collision is equal to the total momentum after the collision. ✓

In 'n geslote/geïsoleerde stelsel is die totale momentum voor 'n botsing gelyk aan die totale momentum na die botsing.

(2)

4.2 $\sum p_i = \sum p_f$ ✓

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$$(m_1 + m_2) v_i = m_1 v_{1f} + m_2 v_{2f}$$

$$0 = (0,4) v_{1f} + 0,6 (4,5)$$
 ✓

$$v_{1f} = -6,75 \text{ m} \cdot \text{s}^{-1}$$

$$= 6,75 \text{ m} \cdot \text{s}^{-1} \text{ to the left/na links}$$
 ✓

(4)

4.3

<p><u>OPTION 1/OPSIE 1</u></p> $\Delta p = F_{\text{net}} \Delta t$ $[(0,6)(4,5) - 0] = F_{\text{net}} (0,32)$ ✓ $F_{\text{net}} = 9 \text{ N}$ ✓ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t$ $0,6(4,5 - 0) = F_{\text{net}}(0,3)$ ✓ $F_{\text{net}} = 8,44 \text{ N}$ ✓	<p><u>OPTION 2/OPSIE 2</u></p> $v_f = v_i + a \Delta t$ $4,5 = 0 + a(0,32)$ ✓ $a = 14,0625 \text{ m} \cdot \text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,6(14,0625)$ ✓ $F_{\text{net}} = 8,44 \text{ N}$ ✓
<p><u>OPTION 3/OPSIE 3</u></p> $\Delta p = F_{\text{net}} \Delta t$ $[(0,4)(6,75) - 0] = F_{\text{net}} (0,32)$ ✓ $F_{\text{net}} = 8,44 \text{ N}$ ✓ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t$ $0,4(6,75 - 0) = F_{\text{net}}(0,3)$ ✓ $F_{\text{net}} = 8,44 \text{ N}$ ✓	<p><u>OPTION 4/OPSIE 4</u></p> $v_f = v_i + a \Delta t$ $6,75 = 0 + a(0,32)$ ✓ $a = 21,09375 \text{ m} \cdot \text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,4(21,09375)$ ✓ $F_{\text{net}} = 8,44 \text{ N}$ ✓

(4)

4.4 THE SAME ✓

(1)

QUESTION 5

5.1 Unsaturated ✓

ANY ONE

- It has double/multi bond between C atoms. ✓
- It does NOT contain the maximum number of H atoms bonded to C atoms.
- Compound B is an alkene.

(2)

5.2.1 H ✓

5.2.2 B ✓

5.2.3 C and G ✓

5.2.4 D ✓

5.3.1 2,2-dimethylbutane



Marking Criteria:

- Stem, i.e. butan. ✓
- Two methyl groups ✓
- Correct numbering of substituents ✓

- IF/INDIEN: Any error e.g. hyphens omitted and/or incorrect sequence: Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./Maks. 2/3

(3)

5.3.2 2-chloro-5-methylheptane

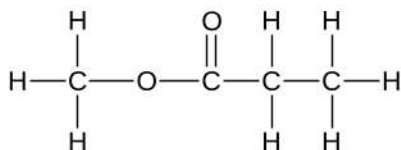
Marking Criteria:

- Stem, i.e. heptan. ✓
- Bromo and methyl groups ✓
- Correct numbering of substituents ✓

- IF: Any error e.g. hyphens omitted and/or incorrect sequence: Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./Maks. 2/3

(3)

5.4.1

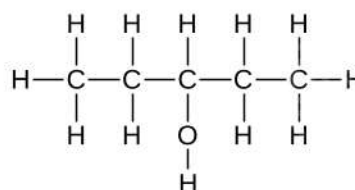
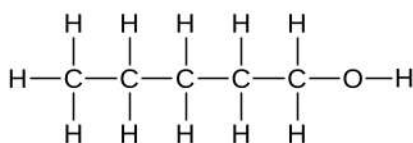


Marking Criteria:

- Whole structure correct: ✓
- Only functional group correct: ✓
- IF: More than one functional group: 1/2

(2)

5.4.2



Marking Criteria:

ANY of those structures

- Whole structure correct: ✓
- Correct position of the functional group: ✓

(2)

[16]

QUESTION 6

- 6.1 The temperature at which the vapour pressure equals atmospheric/external pressure. ✓✓ (2 or 0). (2)
- 6.2 Z ✓ (1)
- 6.3 It has the highest boiling point ✓✓ (2)
- 6.4 X- Aldehyde ✓ (3)
 Y- Alkane ✓
 Z- Alcohol ✓
- 6.5
- Alkane has London forces/dispersion/induced dipole forces. ✓
 - Aldehyde has dipole-dipole forces ✓
 - Alcohol has hydrogen bonding. ✓
 - Hydrogen bonding are stronger intermolecular than dipole-dipole and London forces/dispersion/induced dipole forces, and dipole-dipole forces are stronger than London forces/dispersion/induced dipole forces ✓

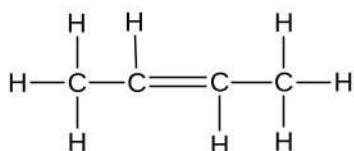
(4)

[12]

QUESTION 7

- 7.1.1 Elimination (dehydrohalogenation) ✓ (1)
- 7.1.2 Substitution (hydrolysis) ✓ (1)
- 7.1.3 Addition (hydration) ✓ (1)
- 7.1.4 Elimination (dehydration) ✓ (1)
- 7.1.5 But-2-ene ✓ (1)

7.1.6



Marking Criteria:

ANY of the structures

- Whole structure correct: ✓
- Correct position of the functional group: ✓
- IF/INDIEN: More than one functional: group: 1/2

(2)

- 7.1.7 Strong heat ✓ (1)

- 7.1.8
- Mild heat ✓ (2)
 - Dilute strong base ✓
- 7.1.9 To speed up the reaction / acts as a catalyst / dehydrating agent. ✓ (1)
- 7.2.1 They are highly flammable ✓ (1)
- 7.2.2 $\text{C}_3\text{H}_8 + 5\text{O}_2 \checkmark \rightarrow 4\text{H}_2\text{O} + 3\text{CO}_2 \checkmark$ (✓ bal) (3)

[16]

Total: 100