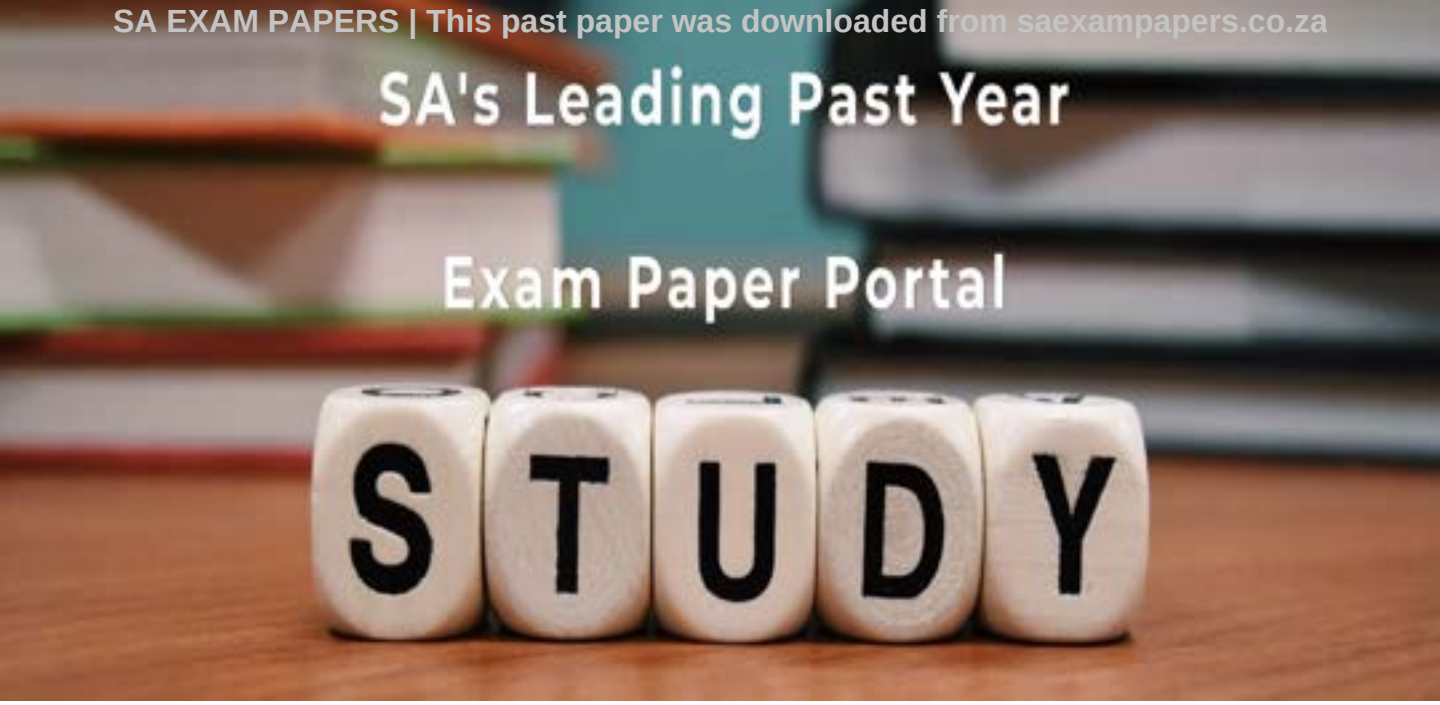


LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES
CONTROL TEST MARKING GUIDELINES
13 MARCH 2024

MARKS: 100

THIS MARKING GUIDELINE CONSISTS OF 11 PAGES

QUESTION 1

1.1 C ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 B ✓✓ (2)

1.7 A ✓✓ (2)

1.8 B ✓✓ (2)

1.9 D ✓✓ (2)

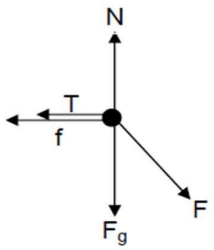
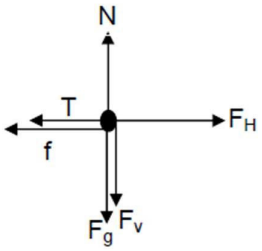
1.10 B ✓✓ (2)

[20]

QUESTION 2

2.1 A body will remain in its state of rest or motion at a constant velocity unless a non-zero resultant/net force acts on it. ✓✓ (2)

2.2

OPTION 1:	**OPTION 2:**
	

Acceptable labels		
F	**$F_{applied}$/Force applied/F_A**	✓
F_g	**w/F_w/weight/mg/gravitational force**	✓
N	**Normal (force)/F_{normal}/F_N**	✓
f	**Friction/F_f/f_k**	✓
T	**F_T/Tension**	✓

(5)

Notes:

- **Mark awarded for label and arrow.**

- **Do not penalise for length of arrow since drawing is not to scale.**
- **Any other additional force(s): 4/5**
- **If force(s) does/do not make contact with body: 4/5**

2.3

OPTION 1	**OPTION 2: SYSTEM APPROACH**
For Q: $F_{net} = ma$ $F_{net} = 0$ $T - f_k = 0$ } Any one ✓ $T - 1$ ✓ $= 0$ ✓ $T = 1$ N **For P:** $F_{net} = ma$ $F_{net} = 0$ $F_x - T - f_k = 0$ $F\cos 30^o$ ✓ $- 1 - 2,5 = 0$ ✓ $\therefore F = 4,04$ N ✓	$F_{net} = ma$ $F_{net} = 0$ $F_x - f_{kQ} - f_{kP} = 0$ } Any one ✓ $F\cos 30^o - 1 - 2,5 = 0$ ✓ $\therefore F = 4,04$ N ✓ **NB: Maximum marks: 3/6**

(6)

2.4 LEFT ✓

- The only force acting on the object is frictional force. ✓
- According to Newton's Second Law, the body will accelerate in the direction of the (net) force. ✓

(3)

2.5 Increases ✓

(1)

[17]

QUESTION 3

3.1.1 The collision during which the total kinetic energy ✓ of the objects in the system is conserved/stays the same. ✓ (2)

3.1.2 $\sum K_i = \sum K_f$ Any one ✓ (4)

$$\frac{1}{2}m_x v_{xi}^2 + \frac{1}{2}m_y v_{yi}^2 = \frac{1}{2}m_x v_{xf}^2 + \frac{1}{2}m_y v_{yf}^2$$

$$\frac{1}{2}(1{,}56)(3)^2 + \frac{1}{2}(m)(0)^2 \checkmark = \frac{1}{2}(1{,}56)(0)^2 + \frac{1}{2}(m)(2)^2 \checkmark$$

$$m = 3{,}51\ kg \checkmark$$

3.2.1 Yes ✓ (1)

3.2.2 **No negative marking from QUESTION 3.2.1** (3)

- Crumple zones increase the collision time/contact time (Δt) ✓
- According to $F_{net} = \frac{\Delta p}{\Delta t}$, for constant Δp, $F_{net} \propto \frac{1}{\Delta t}$ ✓
- If Δt increases then F_{net} decreases, hence less damage ✓

3.2.3 The total linear momentum of an isolated system remains constant (is conserved) ✓✓ **(2 or 0)** (2)

3.2.4 **OPTION 1: EAST AS POSITIVE** (4)

$\sum p_i = \sum p_f$ ✓ Any one ✓

$$m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_B v_{Bf}$$

$$(1350)(20) + (1500)(-10) \checkmark = (1350)(-5) + (1500)v_{Bf} \checkmark$$

$$v_{Bf} = -12{,}50\ m \cdot s^{-1}$$

$$= 12{,}50\ m \cdot s^{-1} \text{ eastwards} \checkmark$$

OPTION 2: WEST AS POSITIVE

$\sum p_i = \sum p_f$ ✓

$$m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_B v_{Bf}$$

$$(1350)(-20) + (1500)(10) \checkmark = (1350)(5) + (1500)v_{Bf} \checkmark$$

$$v_{Bf} = -12{,}50\ m \cdot s^{-1} \checkmark$$

$$v_{Bf} = 12{,}50\ m \cdot s^{-1} \checkmark \text{ eastwards}$$

[16]

QUESTION 4

4.1 An object which has been given an initial velocity and on which the only force acting is the gravitational force. ✓✓ (2)

4.2

OPTION 1 **Upward positive** $v_f = v_i + a\Delta t$ ✓ $-24,5 = 24,5$ ✓ $+ (-9,8)\Delta t$ ✓ $\Delta t = 5\ s$ ✓	**OPTION 2** **Downward positive** $v_f = v_i + a\Delta t$ ✓ $24,5 = -24,5$ ✓ $+ (9,8)\Delta t$ ✓ $\Delta t = 5\ s$ ✓
OPTION 3 **Upward positive** $v_f = v_i + a\Delta t$ ✓ $0 = 24,5$ ✓ $+ (-9,8)\Delta t$ ✓ $\Delta t = 2,5\ s$ Total time = 2,5 + 2,5 = 5 s ✓	**OPTION 4** **Downward positive** $v_f = v_i + a\Delta t$ ✓ $0 = -24,5$ ✓ $+ (9,8)\Delta t$ ✓ $\Delta t = 2,5\ s$ Total time = 2,5 + 2,5 = 5 s ✓
OPTION 5 **Upward positive** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ 0 ✓ $= 24,5\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓ $\Delta t = 5\ s$ ✓	**OPTION 6** **Down positive** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ 0 ✓ $= -24,5\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓ $\Delta t = 5\ s$ ✓

(4)

4.3 **POSITIVE MARKING FROM QUESTION 4.3** (4)

OPTION 1

Upward positive

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

$$\Delta y_{last} = \Delta y_{(5)} - \Delta y_{(4)}$$

$$= \left\{24,5(5) + \frac{1}{2}(-9,8)(5)^2\right\}\checkmark - \left\{24,5(4) + \frac{1}{2}(-9,8)(4)^2\right\}\checkmark$$

$$\Delta y_{last} = -19,6\ m$$

$$\text{Distance} = |\Delta y| = 19,6\ m \checkmark$$

(4)

OPTION 2

Downward positive

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

$$\Delta y_{last} = \Delta y_{(5)} - \Delta y_{(4)}$$

$$= \left\{-24.5(5) + \frac{1}{2}(9,8)(5)^2\right\} \checkmark - \left\{-24,5(4) + \frac{1}{2}(9.8)(4)^2\right\} \checkmark$$

$$\Delta y_{last} = 19,6\ m$$

Distance $= |\Delta y| = 19,6\ m$ ✓

OPTION 3

Upward positive

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

$$= (24,5(4) \checkmark + \frac{1}{2}(-9,8)(4)^2 \checkmark$$

$$= 19,6\ m$$

Distance $= |\Delta y| = 19,6\ m$ ✓

OPTION 4

Downward positive

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

$$= (-24,5(4) \checkmark + \frac{1}{2}(9,8)(4)^2 \checkmark$$

$$= 19,6\ m$$

Distance $= |\Delta y| = 19,6\ m$ ✓

OPTION 5

Upward positive

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

$$\Delta y = 24,5(1) \checkmark + \frac{1}{2}(-9,8)(1)^2 \checkmark$$

$$= 19,6\ m$$

Distance $= |\Delta y| = 19,6\ m$ ✓

OPTION 6

Downward positive

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

$$\Delta y = -24,5(1) \checkmark + \frac{1}{2}(9,8)(1)^2 \checkmark$$

$$= -19,6\ m$$

Distance $= |\Delta y| = 19,6\ m \checkmark$

OPTION 7

Upward positive

$$v_f = v_i + g\Delta t$$

$$= 24,5 + (-9,8)(4)$$

$$= -14,7\ m \cdot s^{-1} \checkmark$$

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

$$= -14,7(1) + \frac{1}{2}(-9,8)(1)^2 \checkmark$$

$$= -19,6\ m \checkmark$$

OPTION 8

Downward positive

$$v_f = v_i + g\Delta t$$

$$= -24,5 + 9,8(4)$$

$$= 14,7\ m \cdot s^{-1} \checkmark$$

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

$$= 14,7(1) + \frac{1}{2}(9,8)(1)^2 \checkmark$$

$$= 19,6\ m \checkmark$$

4.4.1 **POSITIVE MARKING FROM QUESTION 4.2** (3)

OPTION 1	**OPTION 2**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$-56 = v_i(4) + \frac{1}{2}(-9,8)(4)^2$ ✓	$56 = v_i(4) + \frac{1}{2}(9,8)(4)^2$ ✓
$v_i = 5,6\ m\cdot s^{-1}$ ✓	$v_i = -5,6\ m\cdot s^{-1}$
	$v_i = 5,6\ m\cdot s^{-1}$ ✓

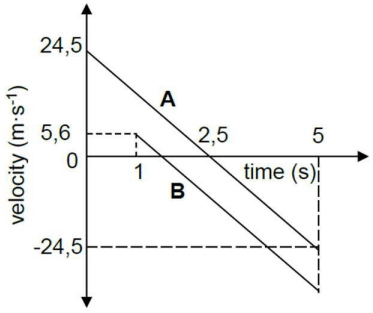
4.4.2 **POSITIVE MARKING FROM QUESTION 4.4.1** (3)

OPTION 1	**OPTION 2**
Upward positive	**Downward positive**
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$= 5,6 + (-9,8)(4)$ ✓	$= -5,6 + (9,8)(4)$ ✓
$= -33,6\ m\cdot s^{-1}$	$= 33,6\ m\cdot s^{-1}$ ✓
$= 33,6\ m\cdot s^{-1}$ ✓	

4.5 **POSITIVE MARKING FROM QUESTION 4.2 AND 4.3**

OPTION 1

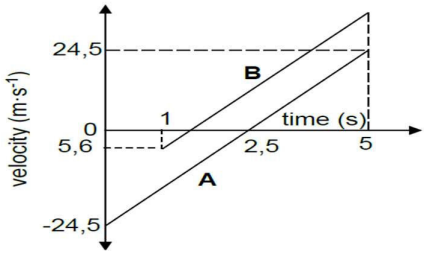
Upward positive



Marking criteria	
Correct shape of **A**	✓
Correct shape of graph **B** parallel to **A** below **A**.	✓
Time at which both **A** and **B** reach the ground 5 s	✓
Time for **A** to reach the maximum height 2,5 s.	✓

OPTION 2

Downward positive



Marking criteria	
Correct shape of **A**	✓
Correct shape of graph **B** parallel to **A** above **A**.	✓
Time at which both **A** and **B** reach the ground 5 s	✓
Time for **A** to reach the maximum height 2,5 s.	✓

(4)

[20]

QUESTION 5

5.1.1 Ketone (s) ✓ (1)

5.1.2 Pentanal (2)

ACCEPT:

2,2-dimethylpropanal

2-methylbutanal

3-methylbutanal

Marking criteria

- Correct functional group, i.e. – al ✓
- Whole name correct ✓

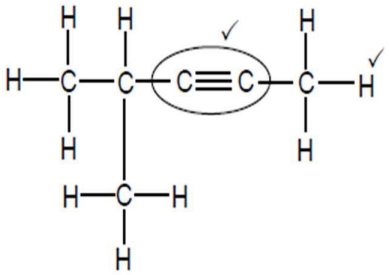
5.2.1 5-bromo-2,3-dimethylhexane

Marking criteria

- Correct stem i.e. hexane ✓
- All substituents (bromo and dimethyl) correctly identified ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓

(3)

5.2.2



Marking criteria

- Whole structure correct. **2/2**
- Only functional group correct **½**

If:

- Molecular formula 0/2
- Condensed structural formula ½

(2)

5.3.1 The C atom bonded to the hydroxyl group is bonded to only one other C-atom. ✓✓ **(2 or 0)** (2)

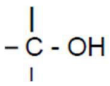
OR

The hydroxyl group/-OH is bonded to a C atom which is bonded to two hydrogen atoms. ✓✓ **(2 or 0)**

OR

The hydroxyl group/functional group/-OH is bonded to a primary C atom/ the first C atom. ✓✓ **(2 or 0)**

OR

The functional group  is bonded to only one other C-atom. ✓✓ **(2 or 0)**

5.3.2 Esterification/condensation ✓ (1)

5.3.3 Butanoic acid ✓ (1)

[12]

QUESTION 6

6.1.1 Liquid ✓ (1)

6.1.2 Solid ✓ (1)

6.2.1 (2)

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

The temperature at which the vapour pressure equals the atmospheric (external) pressure. ✓✓

6.2.2 Lower than ✓ (1)

6.2.3 (3)

Marking criteria
- Compare structures ✓
- Compare the strength of intermolecular forces ✓
- Compare the energy required to overcome intermolecular forces ✓

2,2-dimethylbutane

Structure:
- More branched/more compact/more spherical/smaller surface area (over which intermolecular forces act). ✓

Intermolecular forces:
- Weaker/less intermolecular forces/Van der Waals forces/London forces/Dispersion forces. ✓

Energy:
- Less energy needed to overcome or break intermolecular forces/Van der Waals forces. ✓

OR

Hexane

Structure:
- Longer chain length/unbranched/less compact/less spherical/larger surface area (over which intermolecular forces act) ✓

Intermolecular forces
- Stronger/more intermolecular forces/Van der Waals force/London force/dispersion forces. ✓

Energy
- More energy needed to overcome or break intermolecular forces/Van der Waals forces. ✓

[08]

QUESTION 7

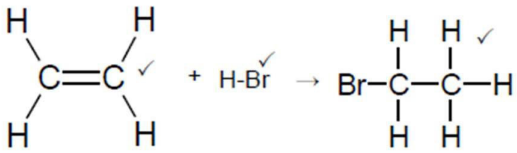
7.7.1 Addition/hydration ✓ (1)

7.1.2 Addition/halogenation/bromination ✓ (1)

7.2.1 Water/H_2O ✓ (1)

7.2.2 (Dilute) sulphuric acid/H_2SO_4 **OR** (Dilute) phosphoric acid/H_3PO_4 ✓ (1)

7.3



(3)

NOTE: Do not penalise HBr

[07]

TOTAL: 100 MARKS