education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

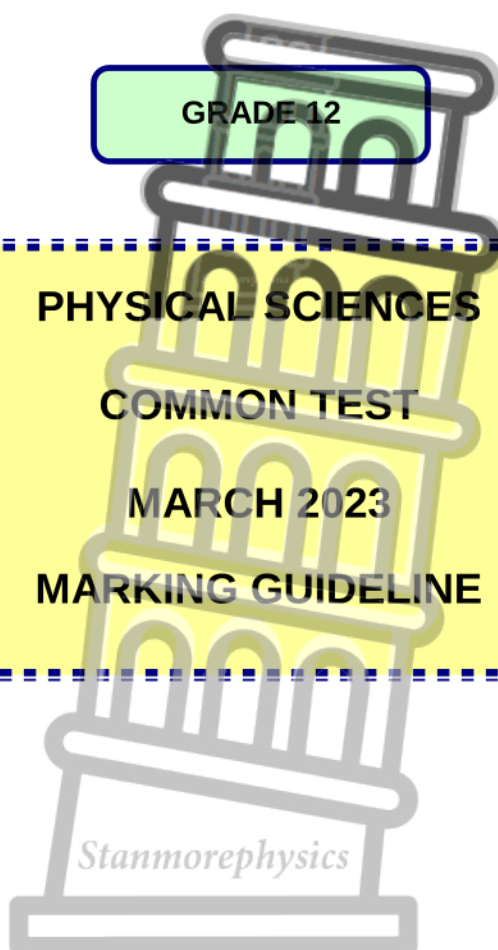**GRADE 12**

PHYSICAL SCIENCES

COMMON TEST

MARCH 2023

MARKING GUIDELINE

MARKS : 100

Stanmorephysics

This Marking Guideline consists of 10 pages.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1   D✓✓

1.2   C✓✓

1.3   C✓✓

1.4   B✓✓

1.5   A✓✓

1.6   B✓✓

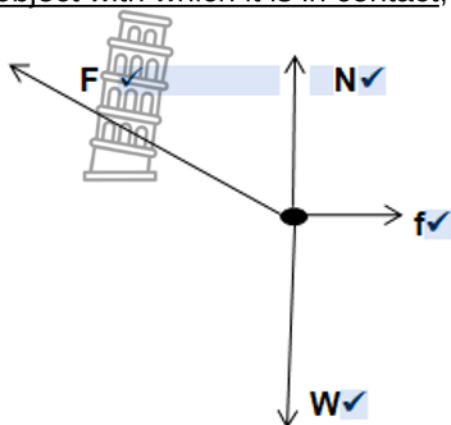1.7   C✓✓

1.8   A✓✓

1.9   B✓✓

1.10   A✓✓

[20]

QUESTION 2 (Start on a new page.)

2.1 **Normal force** is the force or component of a force which <u>a surface exerts on an object with which it is in contact</u>, and which is <u>perpendicular to the surface</u>.✓✓ (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 $f_s^{max} = \mu_s N$ ✓

$140 = 0,3N$ ✓

$\overline{N = 466,67N}$ ✓

(3)

2.4 **POSITIVE MARKING FROM 2.3**

$F_x = f_s^{max} = 140N$ ✓

$N = F_g - F_y$

$\overline{466,67 = (60)(9,8) - F_y}$ ✓

$F_y = 121,33N$

$\tan\theta = \dfrac{F_y}{F_x}$

$\tan\theta = \dfrac{121,33}{140}$ ✓

$\theta = 40.91^0$ ✓

(4)
[13]

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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 +aΔt✓
$\underline{-6,27}$✓ = -2 + (-9,8)Δt ✓
Δt   =   0,44 s ✓

Downwards positive

v_f = v_i +aΔt✓
$\underline{6,27}$✓ = 2 + (9,8)Δt ✓
Δt = 0,44 s ✓

OPTION 2/OPSIE 2
Upwards positive

Δy = v_iΔt + ½ aΔt^2 ✓
-1,8 ✓= (-2)Δt + ½ (-9,8)Δt^2 ✓

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

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

= 0,44 s ✓

Downwards positive
Δy = v_iΔt + ½ aΔt^2 ✓
1,8 ✓= (2)Δt + ½ (9,8)Δt^2 ✓

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

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

= 0,44 s ✓

                                                                                                                               (4)

OPTION 3

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

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

$$\Delta t = \boxed{0,44 \text{ s}}\checkmark$$

(4)

3.2.2   **Upwards positive:**

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$0^2 = v_i^2 + 2(-9,8)(0,9)\checkmark$$

$$v_i = \underline{4,2 \text{ m·s}^{-1}} \checkmark \underline{\text{upwards}} \checkmark$$

Downwards positive:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$0^2 = v_i^2 + 2(9,8)(0,9) \checkmark$$

$$v_i = \underline{4,2 \text{ m·s}^{-1}} \checkmark \underline{\text{upwards}}\checkmark$$

(4)

3.2.3   **Upwards positive:**

$$F_{net}\Delta t = m\Delta v$$
$$\underline{F_{net}(0,2) = (0,5)[(4,2 - (-6,27)]}\checkmark$$
$$F_{net} = 26,175 \text{ N}$$
$$F_{net} = F - F_g$$
$$\underline{26,1755 = F - (0,5)(9,8)}\checkmark$$
$$F = 31,075 \text{ N}\checkmark$$

✓ for either equation

Downwards positive:

$$F_{net}\Delta t = m\Delta v \checkmark$$
$$\underline{F_{net}(0,2) = (0,5)[(-4,2 - (6,27)]}\checkmark$$
$$F_{net} = -26,175 \text{ N}$$
$$F_{net} = 26,175 \text{ N}$$
$$F_{net} = F_g - F$$
$$\underline{- 26,1755 = (0,5)(9,8) - F}\checkmark$$
$$F = 31,075 \text{ N}\checkmark$$

✓ for either equation

(4)

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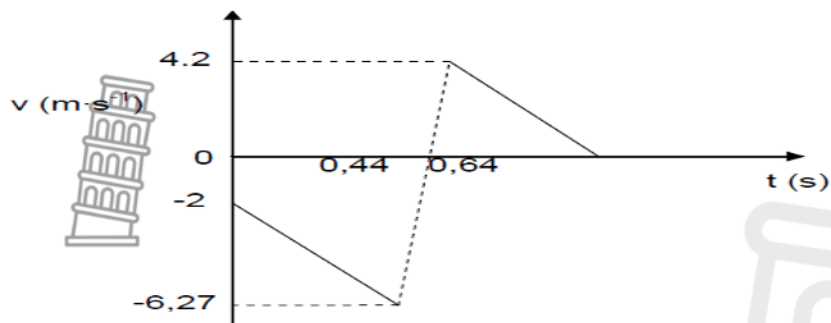
Downwards positive:
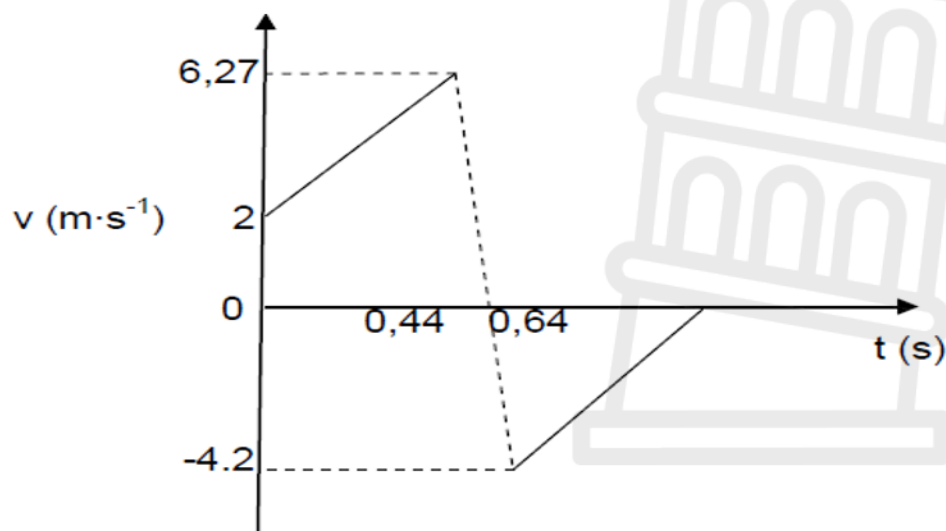
Criteria for graph	Marks
2 straight discontinuous parallel lines, one above and one below the time axis	✓
First part of the graph starts at $v = 2$ m·s^{-1} at $t = 0$ s and extends until $v = 6{,}27$ m·s^{-1} at $t = 0{,}44$ s.	✓
Second part of graph starts at $v = 4{,}2$ m·s^{-1} at $t = 0{,}64$ s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

(3)
[16]

QUESTION 4 (Start on a new page.)

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

4.2   **Right as Positive:**

$\Sigma p_i = \Sigma p_f$

$\Delta pA = - \Delta pB$

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

$\left. \begin{array}{c} \end{array} \right\}$ Any one✓

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

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

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

Left as Positive:

$\Sigma p_i = \Sigma p_f$

$\Delta pA = - \Delta pB$

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

$\left. \begin{array}{c} \end{array} \right\}$ Any one✓

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

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

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

                                                              (4)

4.3

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

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

$\qquad\qquad = 7,4 \, \text{J}$

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

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

$\qquad\qquad = 0,65 \, \text{J}$

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

$\therefore$ INELASTIC✓

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

                                                                  (5)
                                                                   [11]

QUESTION 5

5.1.1   <u>4,5 – dimethyl</u>✓ <u>hex – 2 –</u> ✓<u>ene</u>✓

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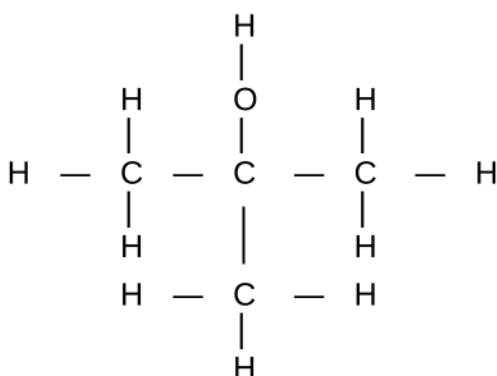
Marking criteria:
• Correct functional group: $\frac{1}{2}$
• Whole structure correct: $\frac{2}{2}$

(2)

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

5.3.2   but – 1 – ene ✓   (1)

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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)
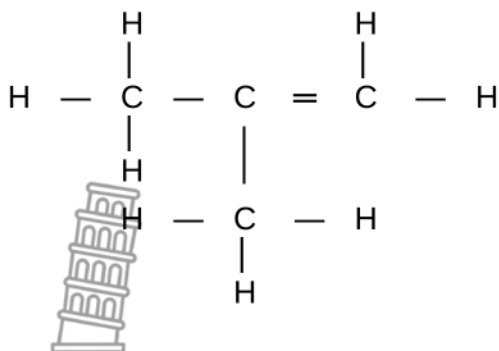   **[18]**

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✓
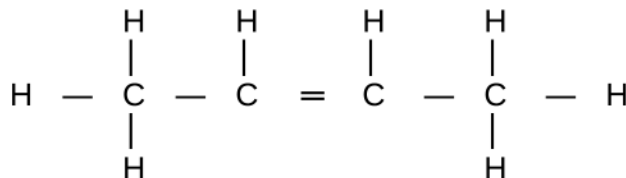   - That require less energy to overcome. ✓   (3)
                                                                                         [10]

QUESTION 7

7.1   hydrolysis✓   (1)

7.2.

H — C — C = C — C — H

(with H atoms shown above and below the carbon chain)

| 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