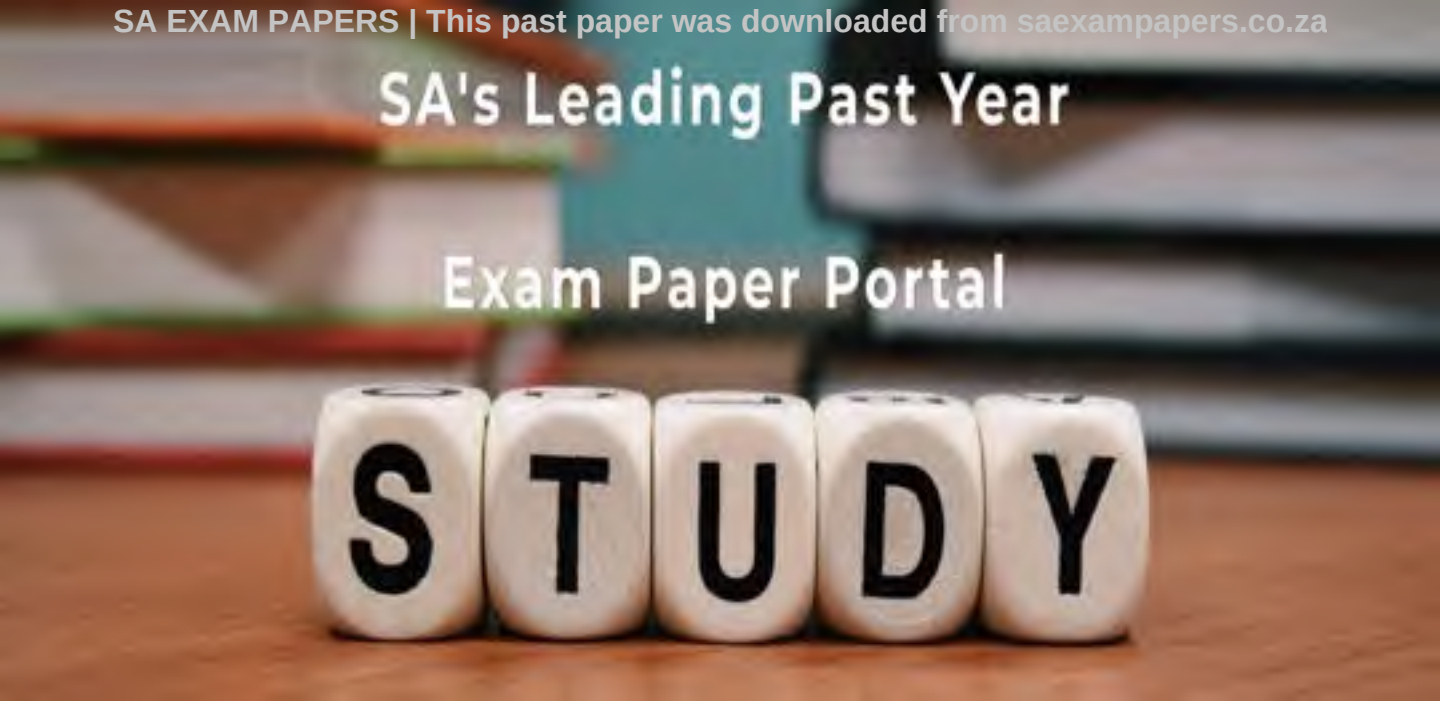


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KWAZULU-NATAL PROVINCE
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# NATIONAL SENIOR CERTIFICATE

## GRADE 12

## PHYSICAL SCIENCES

## COMMON ASSESSMENT TASK

## MARCH 2025 TEST

## MEMO

**MARKS: 100**

**These marking guidelines consist of 9 pages.**

## QUESTION 1

1.1 A✓✓ (2)

1.2 B ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

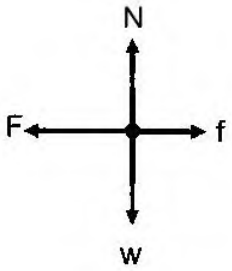
1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

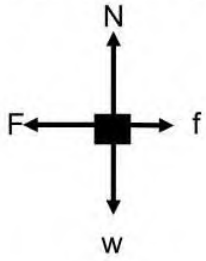
**[12]**

## QUESTION 2

2.1




Accept force diagram:




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

**Notes**

- Mark awarded for label and arrow.
- Do not penalise for length of arrows since drawing is not to scale.
- Any other additional force(s): Max $^3/_4$
- 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 | $F_{net} = ma$ / $F + f = ma$ ✓ Any one |
| $F - 70$ ✓ $= (60)(1,5)$ ✓ | $-F + 70$ ✓ $= (60)(-1,5)$ ✓ |
| $F = 160$ N ✓ | $F = 160$ N ✓ |

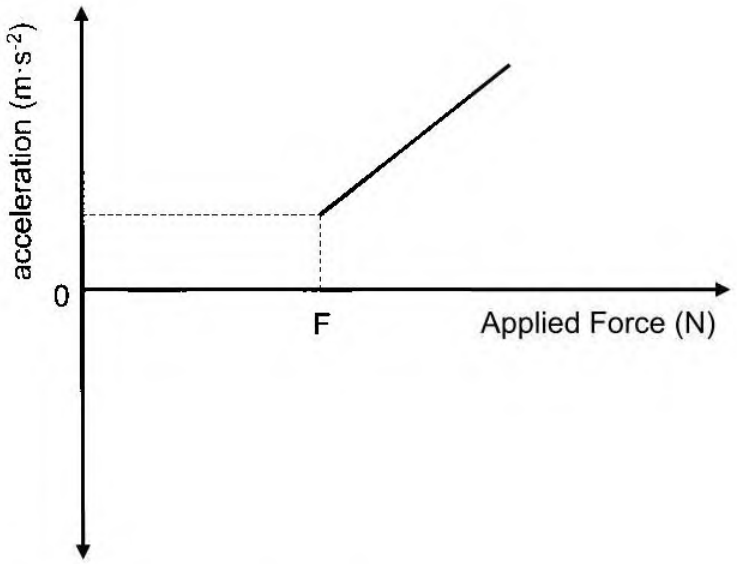
**Note:** DO NOT award the fourth mark if the final anwer is F = -160 N

(4)

2.3

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

(3)




2.4 The boy continues to move forward✓ (1)

2.5 Newton's First law✓

A body will remain in its state of rest or motion at constant velocity unless a non-zero net force acts on it.✓✓ (3)

**[15]**

## QUESTION 3

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

| **Marking criteria:** |
|---|
| If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark |

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

3.3.1

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

(3)

3.3.2

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

(3)

3.4.1

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

(3)

3.4.2

| | |
|---|---|
| **OPTION 1**<br>**UPWARDS AS POSITIVE**<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (20)(5)$ ✓ $+ \frac{1}{2}(-9,8)(5)^2$ ✓<br>$= -22,50$<br>height = 22,50 m ✓ | **OPTION 1**<br>**UPWARDS AS NEGATIVE**<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (-20)(5)$ ✓ $+ \frac{1}{2}(9,8)(5)^2$ ✓<br>$= 22,50$ m ✓ |
| **OPTION 2**<br>**UPWARD AS POSITIVE**<br>**POSITIVE MARKING FROM Q 3.3.1**<br>$\Delta t = 5 - 2x2.04 = 0,92s$<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (-20)(0,92)$ ✓ $+ \frac{1}{2}(-9,8)(0,92)^2$ ✓<br>$= -22,55$<br>height = 22,55 m ✓ | **OPTION 2**<br>**DOWNWARD AS POSITIVE**<br>**POSITIVE MARKING FROM Q 3.3.1**<br>$\Delta t = 5 - 2x2.04 = 0,92s$<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (20)(0,92)$ ✓ $+ \frac{1}{2}(9,8)(0,92)^2$ ✓<br>$= 22,55$ m ✓ |
| **OPTION 3**<br>**UPWARDS AS POSITIVE**<br>**POSITIVE MARKING FROM Q 3.3.1**<br>**Starting from the maximum height**<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (0)(2,96)$ ✓ $+ \frac{1}{2}(-9,8)(2,96)^2$ ✓<br>$= -42,93$m<br>Height of the building = 42,93 – 20,41<br>= 22,52 m ✓ | **OPTION 3**<br>**UPWARDS AS NEGATIVE**<br>**POSITIVE MARKING FROM Q 3.3.1**<br>**Starting from the maximum height**<br>$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓<br>$= (0)(2,96)$ ✓ $+ \frac{1}{2}(9,8)(2,96)^2$ ✓<br>$= 42,93$ m<br>Height of the building = 42,93 – 20,41<br>= 22,52 m ✓ |
| **OPTION 4**<br>**POSITIVE MARKING FROM Q 3.4.1**<br>$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓<br>$\Delta y = \left(\frac{20 - 29}{2}\text{ ✓}\right)(5)$ ✓<br>$\Delta y = 22,50$ m ✓ | **OPTION 5**<br>**POSITIVE MARKING FROM Q 3.4.1**<br>$v_f^2 = v_i^2 + 2a\Delta y$ ✓<br>$(-29)^2$ ✓ $= 20^2 + 2(-9,8)\Delta y$ ✓<br>$\Delta y = 22,50$ m ✓ |
| **OPTION 6**<br>**POSITIVE MARKING FROM Q 3.3.1 & 3.4.1**<br>$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓<br>$\Delta y = \left(\frac{0 - 29}{2}\text{ ✓}\right)(2,96)$ ✓<br>$\Delta y = 42,93$ m<br>Height of the building = 42,93 – 20,41 = 22,52 m ✓ | |

(4)

**[17]**

## QUESTION 4

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

4.2

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

(3)

4.3 **POSITIVE MARKING FROM QUESTION 4.2**
$25\,952 \text{ kg m·s}^{-1}$ to the right ✓ (1)

4.4

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

In an isolated system the total linear momentum is conserved/remains constant. ✓✓ (2)

4.5

**OPTION 1**

**POSITIVE MARKING FROM QUESTION 4.1**

**RIGHT AS POSITIVE**

$\sum p_i = \sum p_f$
$m_c v_{ic} + m_b v_{ib} = (m_c + m_b)v_f$ } ✓Any one

$\underline{(1600)(22,22)} + 0$ ✓ $= (1600 + m_b)(6)$ ✓

$\therefore m_b = 4325,33 \text{ kg}$ ✓

**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

$\underline{(1600)(-22,22)} + 0$ ✓ $= (1600 + m_b)(-6)$ ✓

$\therefore m_b = 4325,33 \text{ kg}$ ✓

**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

$m_b(6 - 0)$ ✓ $= -(-25952)$ ✓

$\therefore m_b = 4325,33 \text{ kg}$ ✓

**RIGHT AS NEGATIVE**

$\Delta p_b = -\Delta p_c$
$m_b(v_{bf} - v_{bi}) = -m_c(v_{cf} - v_{ci})$ } ✓ Any one

$m_b(-6 - 0)$ ✓ $= -25952$ ✓

$\therefore m_b = 4325,33 \text{ kg}$ ✓

(4)
**[12]**

## QUESTION 5

5.1 A series of organic compounds that can be described by the same general formula. ✓✓ **OR**
A series of organic compounds in which one member differs from the next with a $CH_2$ group. (2)

5.2.1 Aldehydes ✓ (1)

5.2.2 Butanone or Butan-2-one ✓✓ (2)

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

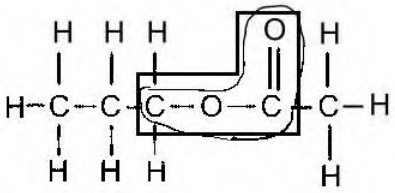
**Marking criteria**
- Correct stem: pentane ✓
- Correct substituents: dibromo and dimethyl ✓
- IUPAC name completely correct ✓ (3)

5.3.2 $C_nH_{2n}O_2$✓ (1)

5.4.1 C and D (must have both) ✓✓ (2)

5.4.2 F ✓ (Accept the name of the compound) (1)

5.5.1



**Marking criteria**
- Correct functional group ✓
- Correct number of carbon atoms on either side of functional group ✓
- Whole structure correct ✓ (3)

5.5.2 Propyl✓ ethanoate✓ (2)

5.5.3 Sulphuric acid / $H_2SO_4$ ✓ (1)

5.6 **Marking criteria**

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

$$n(C_5H_{10}O_2) = \frac{m}{M}$$
$$= \frac{90,78}{102} \checkmark$$
$$= 0,89 \text{ mol}$$

$$n(C_5H_{10}O_2) : n(C_3H_7OH)$$
$$1:1$$

$$n(C_3H_7OH) = \frac{m}{M}$$
$$0,89 \checkmark = \frac{m}{60} \checkmark$$
$$m = 53,4 \text{ g}$$

$$\% \text{ Purity} = \frac{53,4}{60} \times 100\% \checkmark$$
$$= 89\% \checkmark$$

(5)
**[23]**

**QUESTION 6**

6.1 Flammable/inflammable ✓ (1)

6.2 B✓ and D✓ (accept the names of compounds) (2)

6.3 The boiling points of carboxylic acids are higher than the boiling points of alcohols (of comparable molecular mass). . ✓✓

OR

The longer the chain length the higher the boiling point

OR

The 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]**

## QUESTION 7

7.1 Hydroxyl (group) ✓ (1)

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

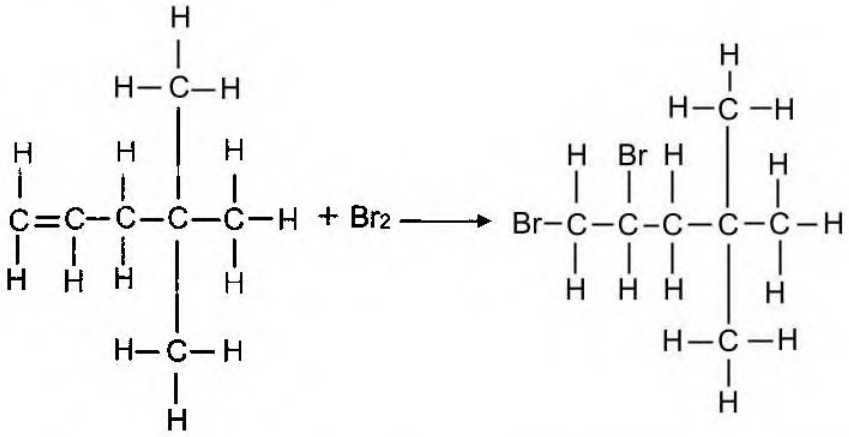
**Marking criteria**
- Correct stem (pentanol) ✓
- Correct substituent: dimethyl ✓
- IUPAC name completely correct ✓ (3)

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**