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.**

**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.

## 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 (1.1-1.6) 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·s$^{-1}$ to the right collides ELASTICALLY with a 2 kg block travelling at Y m·s$^{-1}$ to the left as shown in the diagram below. The blocks remain coupled together after the collision and move to the right.
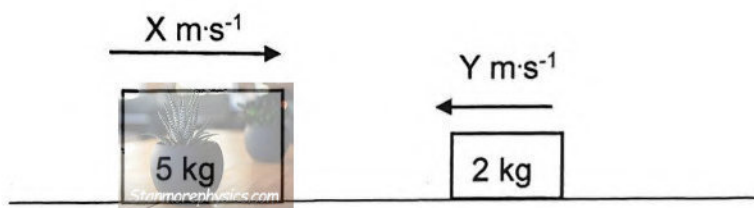


What change in TOTAL MOMENTUM and TOTAL KINETIC ENERGY takes place in the above collision?

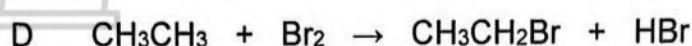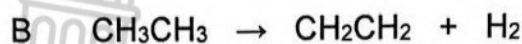| | Total momentum | Total kinetic energy |
|---|---|---|
| A | Remains constant | Decreases |
| B | Decreases | Increases |
| C | Increases | Increases |
| D | Remains constant | Remains constant |

(2)

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.
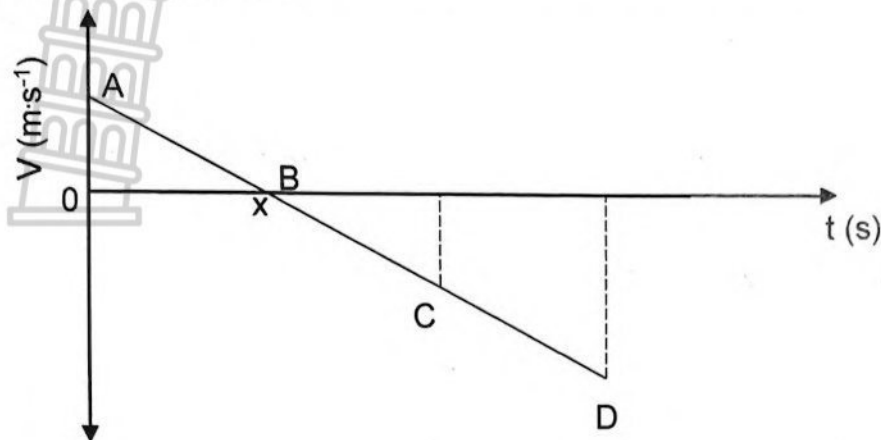


Which one of the following represent the height of the cliff?

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)

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      $CH_2CH_2 + Br_2 \rightarrow CH_2BrCH_2Br$
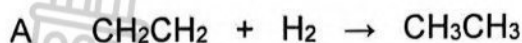
       D      $CH_3CH_3 + Br_2 \rightarrow CH_3CH_2Br + HBr$
                                                                                    (2)
                                                                    6 x 2 =**[12]**

## 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.
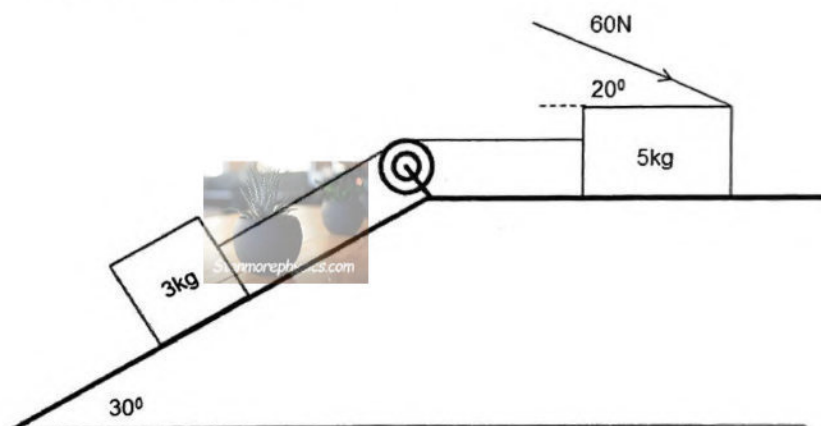


The coefficient of kinetic friction between the surface and each block is 0,15.

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]**

## 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.
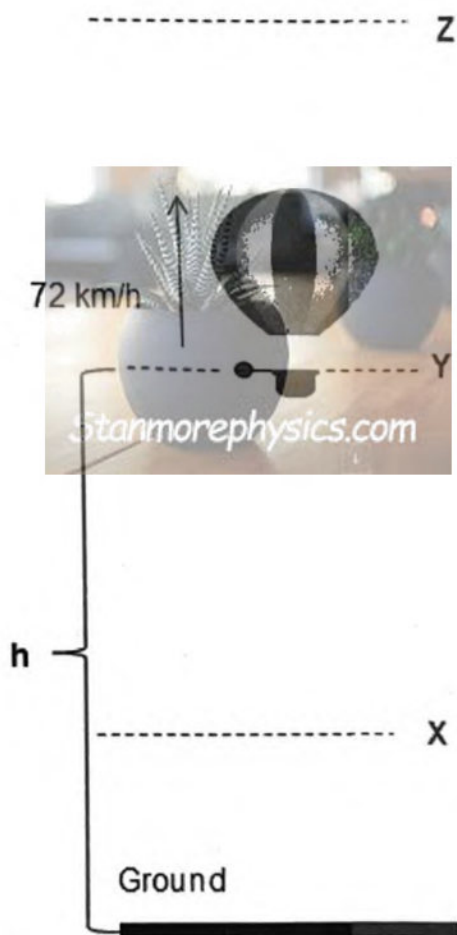


3.1 Give a reason why the ball keeps moving upwards after it is dropped. (1)

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)

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

30 m·s$^{-1}$            20 m·s$^{-1}$

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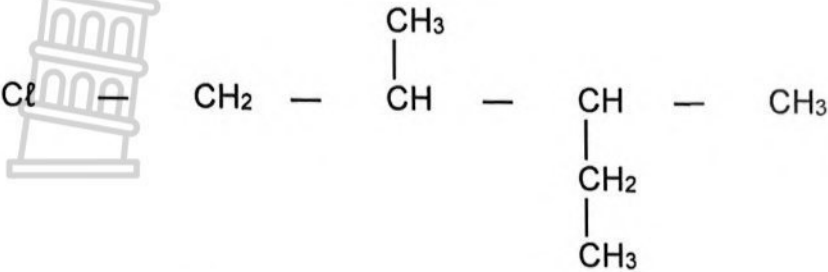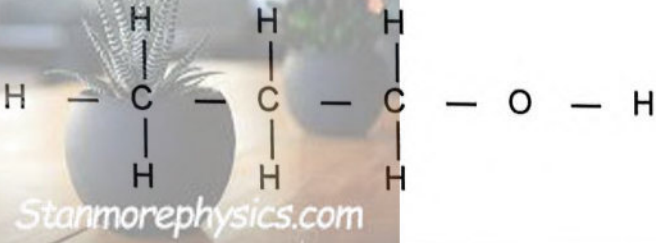
The surface exerts a constant frictional force of 2500 N on the minibus taxi-car system as it comes to rest.

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

**[12]**

## QUESTION 5 (Start on a new page.)

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

| A | |
|---|---|
| | $Cl - CH_2 - \overset{\overset{\displaystyle CH_3}{\textstyle \mid}}{CH} - \overset{\overset{\displaystyle CH}{\textstyle \mid}}{\underset{\underset{\displaystyle CH_3}{\textstyle \mid}}{\overset{\displaystyle CH_2}{\textstyle}}} - CH_3$ |
| B | $CH_3COCH_2CH_3$ |
| C | 5,6 – dimethylhept – 2 – yne |
| D | $H - \overset{\overset{\displaystyle H}{\textstyle \mid}}{\underset{\underset{\displaystyle H}{\textstyle \mid}}{C}} - \overset{\overset{\displaystyle H}{\textstyle \mid}}{\underset{\underset{\displaystyle H}{\textstyle \mid}}{C}} - \overset{\overset{\displaystyle H}{\textstyle \mid}}{\underset{\underset{\displaystyle H}{\textstyle \mid}}{C}} - O - H$ |
| 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)

Physical Sciences/P2                     March 2024 Common Test

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

$$D \;+\; P \xrightarrow[\text{heat}]{H_2SO_{4(CONC.)}} Q \;+\; H_2O$$
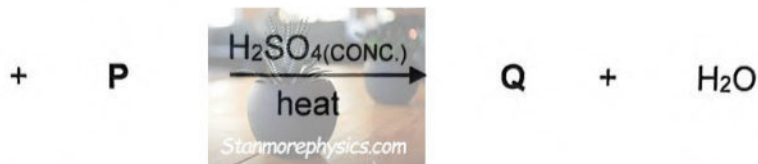
The compound Q that is produced, contains 9,80 % hydrogen (H), 31,38 % oxygen(O) and 58,82 % carbon(C).

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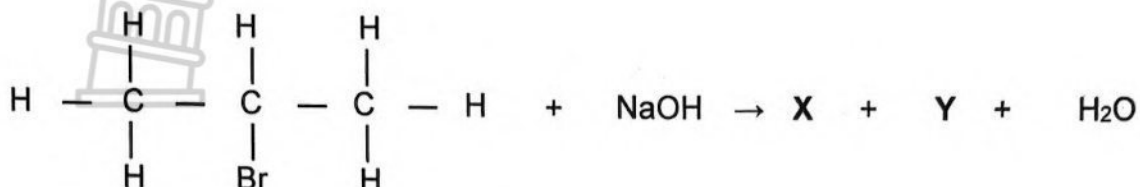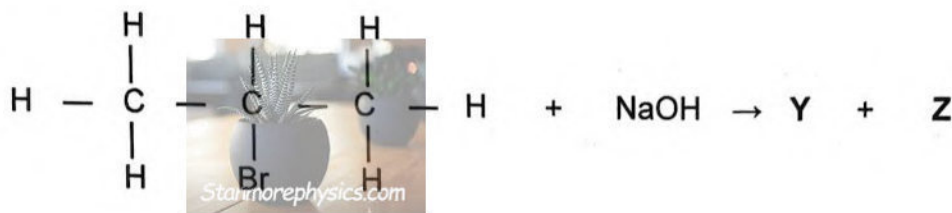
The boiling points of compounds M and P, are respectively, 79,8 °C and 138,5 °C.

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]**

## 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**

$$H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - H \quad + \quad NaOH \quad \rightarrow \quad \mathbf{X} \quad + \quad \mathbf{Y} \quad + \quad H_2O$$

**REACTION II**

$$H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - H \quad + \quad NaOH \quad \rightarrow \quad \mathbf{Y} \quad + \quad \mathbf{Z}$$

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**

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

**KEY/SLEUTEL**

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit → $\underset{63,5}{\overset{29}{\underset{1,9}{Cu}}}$ ← Symbool / Symbol

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,1 **H** 1, 1 | | | | | | | | | | | | | | | | | 2 **He** 4 |
| 1,0 **Li** 3, 7 | 1,5 **Be** 4, 9 | | | | | | | | | | | 2,0 **B** 5, 11 | 2,5 **C** 6, 12 | 3,0 **N** 7, 14 | 3,5 **O** 8, 16 | 4,0 **F** 9, 19 | 10 **Ne** 20 |
| 0,9 **Na** 11, 23 | 1,2 **Mg** 12, 24 | | | | | | | | | | | 1,5 **Aℓ** 13, 27 | 1,8 **Si** 14, 28 | 2,1 **P** 15, 31 | 2,5 **S** 16, 32 | 3,0 **Cℓ** 17, 35,5 | 18 **Ar** 40 |
| 0,8 **K** 19, 39 | 1,0 **Ca** 20, 40 | 1,3 **Sc** 21, 45 | 1,5 **Ti** 22, 48 | 1,6 **V** 23, 51 | 1,6 **Cr** 24, 52 | 1,5 **Mn** 25, 55 | 1,8 **Fe** 26, 56 | 1,8 **Co** 27, 59 | 1,8 **Ni** 28, 59 | 1,9 **Cu** 29, 63,5 | 1,6 **Zn** 30, 65 | 1,6 **Ga** 31, 70 | 1,8 **Ge** 32, 73 | 2,0 **As** 33, 75 | 2,4 **Se** 34, 79 | 2,8 **Br** 35, 80 | 36 **Kr** 84 |
| 0,8 **Rb** 37, 86 | 1,0 **Sr** 38, 88 | 1,2 **Y** 39, 89 | 1,4 **Zr** 40, 91 | **Nb** 41, 92 | 1,8 **Mo** 42, 96 | 1,9 **Tc** 43, — | 2,2 **Ru** 44, 101 | 2,2 **Rh** 45, 103 | 2,2 **Pd** 46, 106 | 1,9 **Ag** 47, 108 | 1,7 **Cd** 48, 112 | 1,7 **In** 49, 115 | 1,8 **Sn** 50, 119 | 1,9 **Sb** 51, 122 | 2,1 **Te** 52, 128 | 2,5 **I** 53, 127 | 54 **Xe** 131 |
| 0,7 **Cs** 55, 133 | 0,9 **Ba** 56, 137 | **La** 57, 139 | 1,6 **Hf** 72, 179 | **Ta** 73, 181 | **W** 74, 184 | **Re** 75, 186 | **Os** 76, 190 | **Ir** 77, 192 | **Pt** 78, 195 | **Au** 79, 197 | **Hg** 80, 201 | 1,8 **Tℓ** 81, 204 | 1,8 **Pb** 82, 207 | 1,9 **Bi** 83, 209 | 2,0 **Po** 84, — | 2,5 **At** 85, — | 86 **Rn** — |
| 0,7 **Fr** 87, — | 0,9 **Ra** 88, 226 | **Ac** 89, — | | | | | | | | | | | | | | | |

| 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** |

## 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<br>*Swaartekragversnelling* | $g$ | $9,8 \text{ m·s}^{-2}$ |
| Universal gravitational constant<br>*Universele gravitasiekonstante* | $G$ | $6,67 \times 10^{-11} \text{ N·m}^2\text{·kg}^{-2}$ |
| Speed of light in a vacuum<br>*Spoed van lig in 'n vakuum* | $c$ | $3,0 \times 10^8 \text{ m·s}^{-1}$ |
| Planck's constant<br>*Planck se konstante* | $h$ | $6,63 \times 10^{-34} \text{ J·s}$ |
| Coulomb's constant<br>*Coulomb se konstante* | $k$ | $9,0 \times 10^9 \text{ N·m}^2\text{·C}^{-2}$ |
| Charge on electron<br>*Lading op electron* | $e^-$ | $-1,6 \times 10^{-19} \text{ C}$ |
| Electron mass<br>*Elektronmassa* | $m_e$ | $9,11 \times 10^{-31} \text{ kg}$ |
| Mass of Earth<br>*Massa van Aarde* | $M$ | $5,98 \times 10^{24} \text{ kg}$ |
| Radius of Earth<br>*Radius van Aarde* | $R_E$ | $6,38 \times 10^6 \text{ m}$ |

## 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

| | |
|---|---|
| $F_{net} = ma$ | $p = mv$ |
| $f_{s(max)} = \mu_s N$ | $f_k = \mu_k N$ |
| $F_{net} \Delta t = \Delta p$<br>$\Delta p = mv_f - mv_i$ | $w = mg$ |
| $F = \dfrac{Gm_1 m_2}{r^2}$ | $g = \dfrac{Gm}{r^2}$ |

### 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 $W_{net} = \Delta E_k$<br><br>$\Delta K = K_f - K_i$ or/of $\Delta E_k = E_{kf} - E_{ki}$ |
| $W_{nc} = \Delta K + \Delta U$ or/of $W_{nc} = \Delta E_k + \Delta E_p$ | $P = \dfrac{W}{\Delta t}$ |
| $P_{av} = F \cdot v_{av}$ / $P_{gem} = F \cdot v_{gem}$ | |

**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.

**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
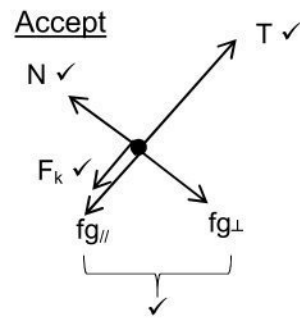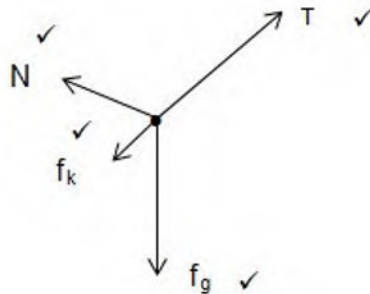


| Accepted labels | |
|---|---|
| **W** | $F_g/F_w$/Wight/Gravitational force |
| **$f_k$** | f/friction/Kinetic friction |
| **N** | $F_N$/Normal force |
| **T** | Tension/$F_T$/T |

(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:

$F_{net} = ma$
$T + (-f_k) + (-f_{g_{ll}}) = ma$  ⎫ ✓

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

$T = 3a + 18,52$ …………eq.1

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

$\therefore 3a + 18,52 = 45,95 - 5a$

$a = 3,43 m.s^{-2}$

$\therefore T = 3(3,43) + 18,52$ ✓

$T = 28,81 N$ ✓

OR

(5)

$T = 45,95 - 5(3,43)$ ✓

$T = 28,80 N$ ✓

**[16]**

**QUESTION 3**

(1)

**3.1** Inertia. ✓

**3.2**

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

**3.2.2** $9,8 m.s^{-2}$ downwards ✓   (1)

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

(3)

Please turn over

**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**
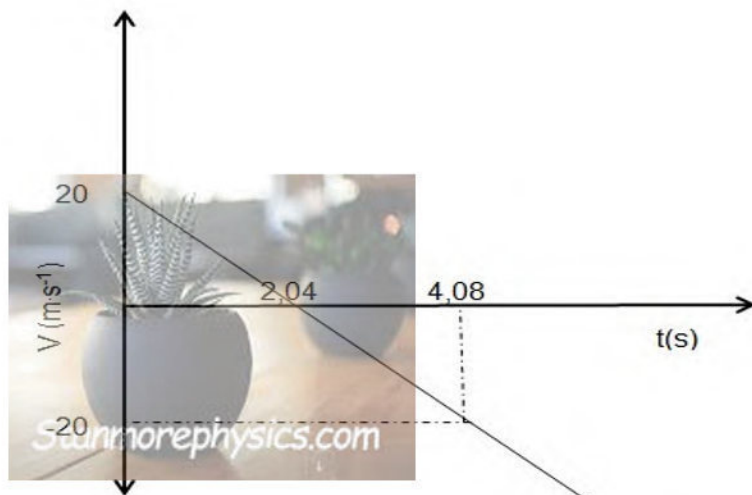
**Upwards Negative**
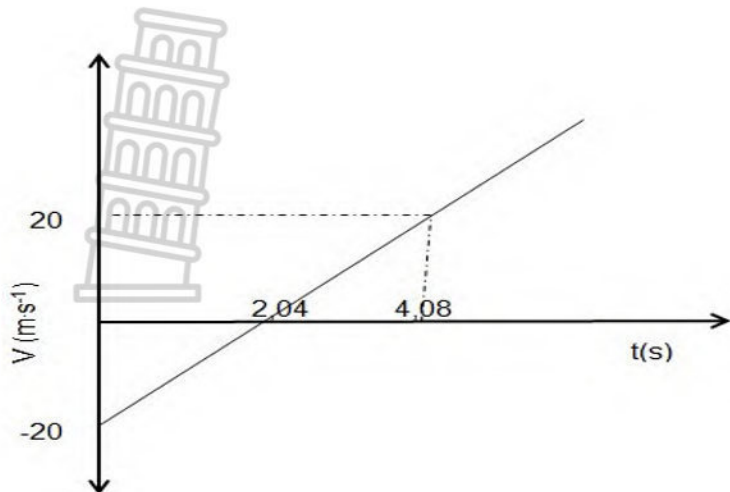


| Marking criteria | |
|---|---|
| Initial velocity 20 m.s$^{-1}$/72 km/h | ✓ |
| Time for the ball at maximum height, 2,04s | ✓ |
| Time for the ball passing point Y, 4,08s | ✓ |
| Straight line graph extending beyond point Y. | ✓ |

(4)

**[16]**

## QUESTION 4

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

**4.2**

$$\sum p_{before} = \sum p_{after}$$
$$m_1 v_{i_1} + m_2 v_{i_2} = (m_1 + m_2)v_f \quad \text{✓}$$
$$m_1(30) + (1100)(-20) \text{✓} = (m_1 + 1100)(10) \text{✓}$$
$m_1$ = 1650 kg
The total mass is less than the allowed mass✓.
∴ No.✓

(5)

**4.3 POSITIVE MARKING FROM 4.2**
**OPTION 1**

$v_f^2 = v_i^2 + 2a\Delta x$✓          $F_{net} = ma$ ✓
$\underline{(0)^2 = (10)^2 + 2(-0,91)\Delta x}$✓          -2500 = 2750a✓
$\Delta x$ = 54,95m ✓          a = -0,91 m.s$^{-2}$

(5)

**OPTION 2**

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

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

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

$$\Delta t = 11 \text{ s}$$

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

$$= \frac{10 + 0}{2} \times 11$$ ✓

$$= 55 \text{ m}$$ ✓

**[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 <u>same molecular formula</u> but <u>different functional groups</u>✓✓
                    OR
Have the <u>same molecular formula</u> but <u>B is a ketone whereas E is an aldehyde</u>✓✓

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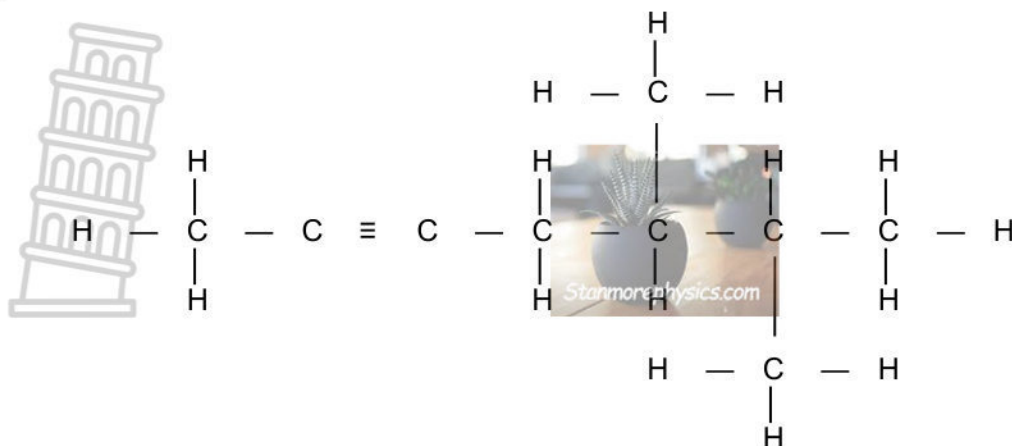> The underlined phrases must be in the correct context.

(3)

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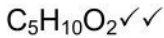
(3)

5.1.4



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

(3)

5.2.1

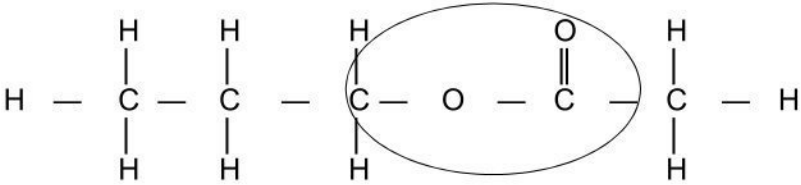|  |  | H | O | C |
|---|---|---|---|---|
| % |  | 9,80 | 31,38 | 58,82 |
| m |  | 9,80 | 31,38 | 58,82 |
| $n = \dfrac{m}{M}$ |  | $\dfrac{9,80}{1}$ ✓ | $\dfrac{31,38}{16}$ ✓ | $\dfrac{58,82}{12}$ ✓ |
|  |  | = 9,80 | = 1,96 | = 4,902 |
| Ratio |  | 5 | 1 | 2,5 ✓ |

$C_5H_{10}O_2$✓✓

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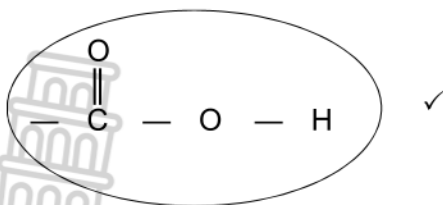> - Correct ratio✓
> - Correct empirical formula ✓✓

(6)

5.2.2



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

(3)

5.2.3

$$O$$
$$\parallel$$
$$— C — O — H$$    ✓

(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 <u>temperature</u> at which the <u>vapour pressure</u> of a substance <u>equals</u> <u>atmospheric pressure.</u> ✓✓

(2)

6.2.1    Boiling point. ✓    (1)

6.2.2    Molecular mass. ✓    (1)

6.3    Carboxyllic acid✓
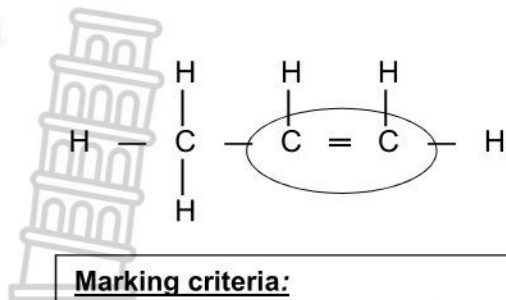      Ester ✓    (2)

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]**

**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**