education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING

NKANGALA DISTRICT

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GRADE 12

[PHYSICAL SCIENCES]

MARCH 2025

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CONTROLLED TEST

MARKS:100

TIME:2 HOURS

This question paper consists 10 of pages

INSTRUCTIONS AND INFORMATION

1. Write your examination number and centre number in the appropriate spaces on the ANSWER BOOK
2. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER BOOK
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper
5. Leave ONE line between two sub questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments
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, etc. where required
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

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QUESTION 1 MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 The tendency of an object to remain at rest or to continue in its uniform motion in a straight line is known as …

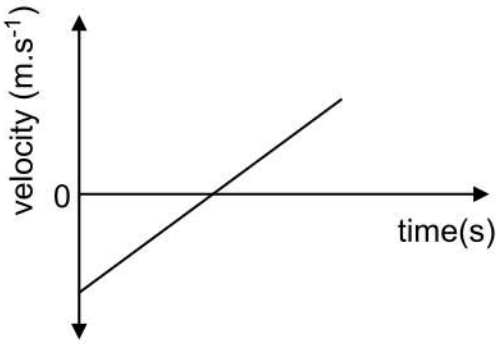
A Inertia

B Newton's Second Law

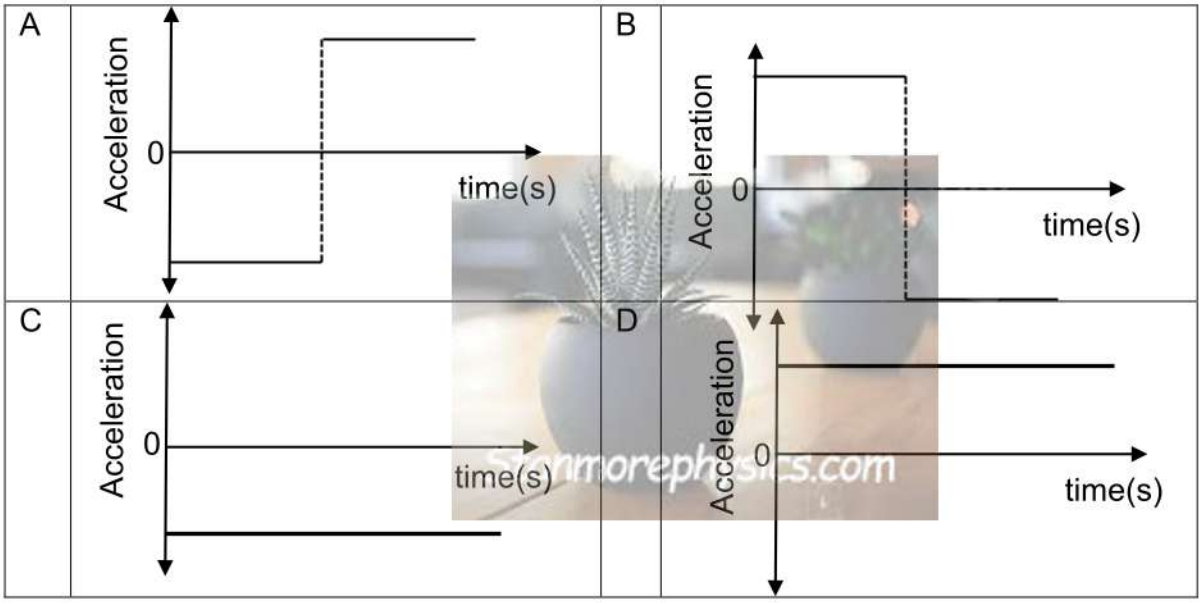
C Acceleration

D Newton's third law (2)

1.2 The velocity-time graph below represents the motion of an object.



Which ONE of the following graphs represents the corresponding acceleration-time graph for the motion of this object?



(2)

1.3 A ball of mass **m** strikes a wall perpendicularly at a speed **v**. Immediately after the collision the ball moves in the opposite direction at the same speed **v**. Which of the following is the correct change in momentum of the ball?

A mv

B 0

C 3mv

D 2mv (2)

1.4 Which ONE of the following compounds CANNOT be an alkene?



A C_2H_4

B C_3H_8

C C_3H_6

D C_4H_8 (2)

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

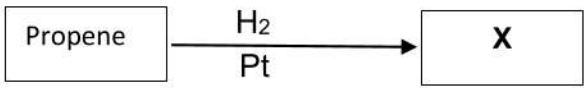
A Ethane

B Ethanoic acid

C Ethanol

D Bromoethane (2)

1.6 Consider the flow diagram below:



Compound **X** is:

A Propyne

B Propan-1-ol

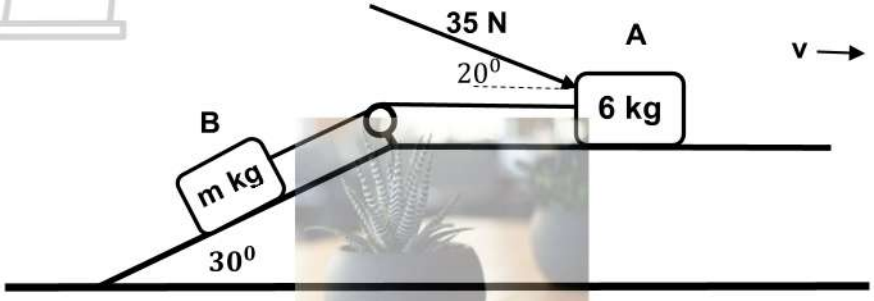
C Propane

D Propan-2-ol (2)

[12]

QUESTION 2

Block A with a mass of 6 kg on a horizontal rough surface is connected to block B with an unknown mass along a rough inclined plane at an angle of 30^0 by means of an inextensible string passing over a frictionless pulley. A constant force of 35 N is applied on block A at an angle of 20^0 to the horizontal causing the two blocks to move with a CONSTANT VELOCITY as indicated below.



The coefficient of kinetic friction on block **A** is 0,2 and 0,15 for block **B** respectively.

2.1 State Newton's *second law* of motions in words. (2)

2.2 Draw a labelled free body diagram indicating ALL the forces acting on block the 6 kg block (5)

2.3 Calculate the magnitude of:

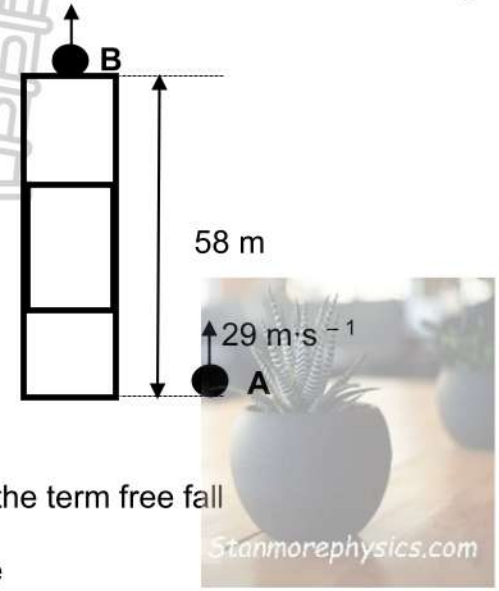
2.3.1 Tension between the two blocks (4)

2.3.2 Mass of block B (4)

[15]

QUESTION 3

Ball **A** is thrown vertically upwards from the GROUND of a tall building of height of 58 m with a speed of 29 m·s $^{-1}$ as shown in the diagram. Ignore the effects of air friction.



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3.1 Define the term free fall (2)

Calculate the

3.2 Maximum height reached by ball **A**. (3)

3.3 Total time that ball **A** is in the air. (4)

ONE SECOND after ball **A** was thrown vertically upwards, ball **B** is also thrown vertically upwards from the **TOP OF THE ROOF** of the building as shown in the diagram. Both balls reach the ground at the **SAME instant**. Ignore the effects of air friction.

3.4 Calculate the speed at which ball B is projected upwards from the roof. (4)

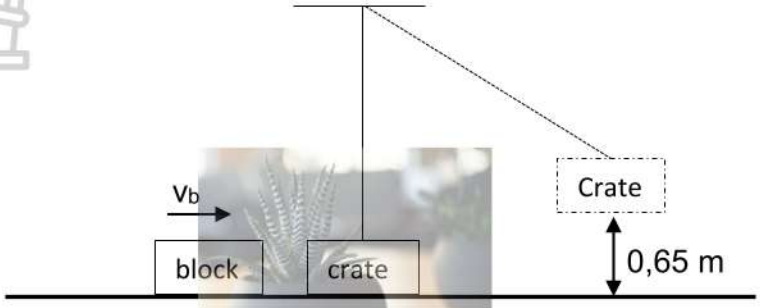
3.5 Sketch velocity-time graphs for the motion of both balls on the same set of axes. Clearly label the graphs for A and B. Indicate the following on the graphs: (4)

- Initial velocities of ball A and B
- Time taken by both balls A and B to reach the ground.

[17]

QUESTION 4

A 1,2 kg crate is attached to a long string as shown in the diagram below. A block of mass 0,4 kg collides with the stationary crate with a velocity v_b and rebounds with a velocity of 0,36 $m \cdot s^{-1}$ causing the crate to swing up through a vertical height of 0,65 m. Frictional forces are ignored.



4.1 State the principle of conservation of mechanical energy. (2)

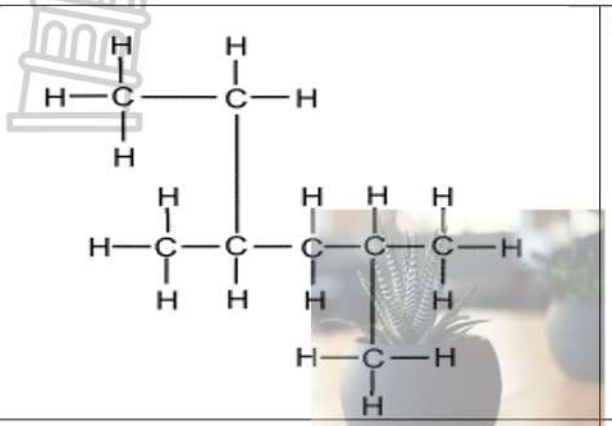
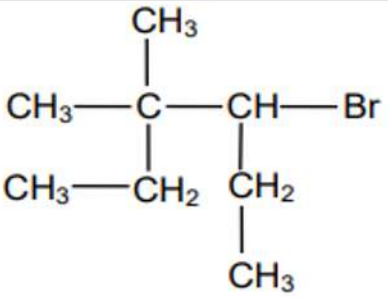
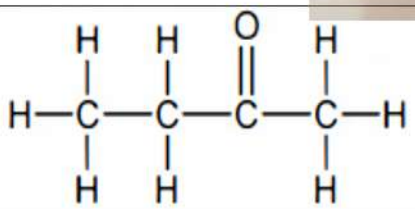
4.2 Calculate the magnitude of the velocity of the crate immediately after the block collided with the crate. (4)

4.3 State the law of conservation of linear momentum. (2)

4.4 Calculate the velocity of the block, v_b, just before it collides with the crate. (4)
[12]

QUESTION 5

Consider the six organic compounds (**A - F**) given in the table below and answer the questions that follows

A		B	
C	$CH_3CH_2CHCHCH_3$	D	C_XH_YO
E		F	C_4H_8O

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5.1 Define *functional group* (2)

5.2 Write down the following:

5.2.1 The letter/s that represent hydrocarbons (2)

5.2.2 Homologous series to which compound **E** belongs (1)

5.2.3 IUPAC name for compound **B** (3)

5.2.4 General formula to which compound **C** belongs (1)

5.2.5 IUPAC name for compound **C** (2)

5.3 Compound **E** and **F** are <u>functional isomers</u>

5.3.1 Explain what is meant by the underlined phrase above. (2)

5.3.2 Write down the name of the functional group of compound **E.** (1)

5.3.3 Write down the structural formula and IUPAC name for compound **F.** (3)

[17]

QUESTION 6

A group of learners conducted an experiment to evaluate the effect of CHAIN LENGTH on the boiling points of 3 straight chain alcohols **(A - C)**. The results of the experiment are indicated on the table below.

Compound	Condensed structural formula	Boiling point (C^0)
A	CH_3OH	64.7
B	CH_3CH_2OH	78.37
C	$CH_3CH_2CH_2OH$	97

6.1 Define boiling point. (2)

6.2 Write down the investigative question. (2)

6.3 Explain the trends on the boiling point of the three Organic compounds. (3)

6.4 Compound C is compared to Propanoic acid under the same conditions and their vapour pressures were recorded.

6.4.1 Which organic compound will have the highest vapour pressure between Compound C and Propanoic Acid? (1)

6.4.2 Fully explain the answer in QUESTION 6.4.1 by referring to the TYPE OF INTERMOLECUALR FORCES, STRENGTH and ENERGY. (4)

[12]

QUESTION 7

7.1 Consider the cracking reaction below.

$$C_8H_{18} \rightarrow C_2H_4 + A$$

7.1.1 Define cracking. (2)

7.1.2 Write down the molecular formula of compound A. (1)

Compound A undergoes a complete combustion.

7.1.3 Using **molecular formula** write the balanced equation for this reaction. (3)

7.2 Consider the equations for reactions **I** to **II**

A represent organic compound and **X** is an inorganic product.

I	$CH_3CH_2CHCH_2 + HBr \rightarrow$ **A**
II	**A** + $H_2O \rightarrow CH_3CH_2CH(OH)CH_3$+**X**
III	$CH_3CH_2CH_2CH_2(OH)+CH_3COOH \rightarrow P + H_2O$

Write down the:

7.2.1 Type of reaction represented by reaction **I**. (1)

7.2.2 STRUCTURAL formula of compound A. (2)

7.2.3 Type of reaction represented by reaction **II** (1)

7.2.4 Formula of compound **X** (1)

For **reaction III,** write down the:

7.2.5 Type of reaction represented by reaction **III** (1)

7.2.6 The reaction condition other than heat. (1)

7.2.7 IUPAC name of compound P. (2)

[15]

TOTAL: 100

4.2 Information sheets – Paper 1 (Physics)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
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 $m \cdot s^{-1}$
Planck's constant	h	6,63 x 10^{-34} J·s
Coulomb's constant	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	-1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg

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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

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{Gm}{r^2}$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$

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 $W_{nc} = \Delta E_k + \Delta E_p$	
$P = \frac{W}{\Delta t}$	$P = Fv$

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4.3 Information sheets – Paper 2 (Chemistry)

TABLE 1: PHYSICAL CONSTANTS

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

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TABLE 2: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ $E^\theta_{cell} = E^\theta_{oxidisingagent} - E^\theta_{reducingagent}$	