Province of the
EASTERN CAPE
EDUCATION

OR TAMBO INLAND DISTRICT

GRADE 12

PHYSICAL SCIENCES CONTROLLED TEST

TERM 1

MARCH 2023

MARKS: 100
DURATION: 2 HOURS

This question paper consists of 13 pages including cover page.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of TEN questions. Answer ALL the questions in the 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 2.2. and 2.3.

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 (Start on a new page)

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A-D) next to the question number (1.1 - 1.7) on the answer sheet e.g.; 1.8 A.

1.1 A box is at rest on a horizontal desk. The name of the force that will form an action reaction pair with gravitational force is…….

A The force that the earth exerts on the box

B The force that the box exerts on the earth.

C The normal force acting on the box

D The force that the desk exerts on the box (2)

1.2 A ball of mass 2 kg is projected vertically upwards. At the highest point of its motion… ignore air friction.

i. Acceleration of the ball is zero
ii. Net force acting on the ball is 19.6 N
iii. Velocity of the ball is zero
iv. Net force acting on the ball is zero

Which of the above statement(s) is/are CORRECT?

A (i) and (iii) only

B (iii), (iv) and (i) only

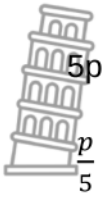
C (iv) only

D (ii) and (iii) only (2)

1.3 An object is dropped from rest and after falling a distance d, its momentum is p. Ignore the effect of air friction.

The momentum of the object after it has fallen a distance of 5d is…..

A 5p



B $\frac{p}{5}$

C P

D $\sqrt{5}p$ (2)

1.4 Which ONE of the following compounds is UNSATURATED

A Chloroethane

B Propan–1–ol

C Ethene

D Ethane (2)

1.5 The name of the functional group of an ALCOHOL is…

A Carboxyl group

B Carbonyl group

C Hydroxyl group

D Formyl group (2)

1.6 The type of intermolecular force that is responsible for the difference in boiling point of butan-1-ol and its CHAIN isomer is..

A London forces.

B Hydrogen bonds.

C Ion-dipole force.

D Dipole-dipole force (2)

1.7 Dilute solution of a strong base and mild heat are reaction conditions for…

A Hydrolysis reaction

B Hydration reaction

C Dehydrohalogenation reaction

D Hydrohalogenation reaction (2)

1.8 Which ONE of the following compounds has the LOWEST melting point?

A Hexanal

B Ethanal

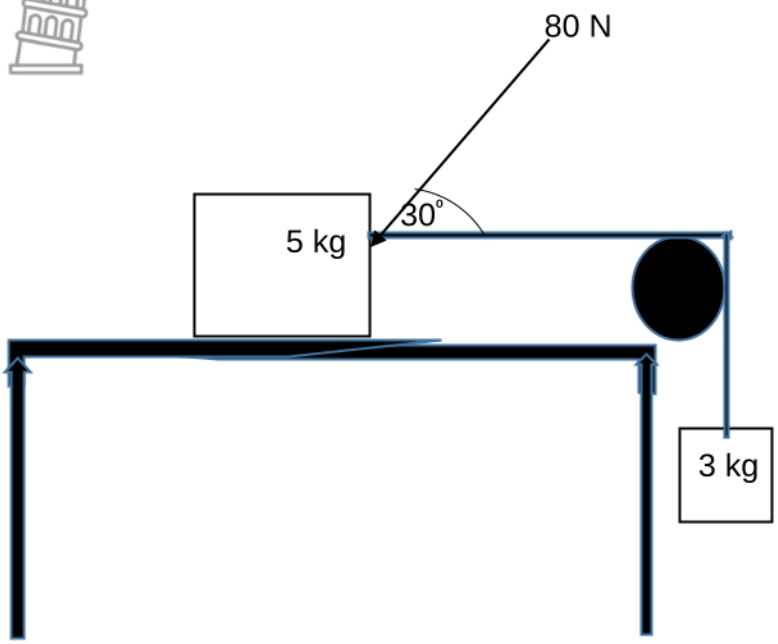
C Butanal

D Octanal

[16]

QUESTION 2 (Start on a new page)

A 5 kg block is connected to a 3 kg block by a light inextensible string through a frictionless pulley as shown in the diagram below. A force, F of magnitude 80 N force is applied on the 5 kg block at an angle of 30° to the horizontal and the system accelerates to the left at 2,2 $m.s^{-2}$ on a rough horizontal surface.



2.1 Draw a labelled free body diagram indicating all the HORIZONTAL forces acting on the 5 kg block. (3)

2.2 Calculate the:

2.2.1 magnitude of the tension in the string. (3)

2.2.2 coefficient of kinetic friction acting on the 5 kg block. (5)

2.3 How will each of the following be affected if the angle between the surface and the force **F** increases? Choose from INCREASE, DECREASE or REMAIN THE SAME. Give a reason for your answer.

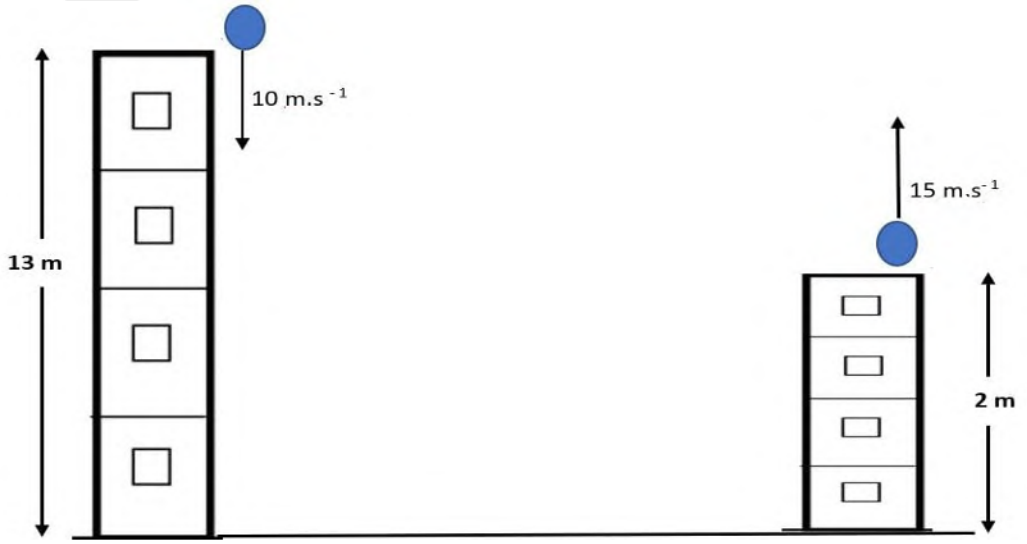
2.3.1 Kinetic frictional force (2)

2.3.2 Coefficient of kinetic friction (2)

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QUESTION 3 (start each question on a new page)

Ball A of mass 200 g is thrown vertically down with velocity of 10 $m.s^{-1}$ from a cliff of 13 m above the ground.
When ball A hits the ground, it is in contact with the ground for 0.3 s and it then bounces back with a velocity of 24 $m.s^{-1}$ until it reaches a MAXIMUM height of 30m after the first bounce. See the diagram below**. Ignore the effects of air friction.**



3.1 Define the term *projectile.* (2)

3.2 Calculate the….

3.2.1 The velocity at which the Ball A hits the ground. (3)

3.2.2 Magnitude of the average net force exerted by the ground on the ball while it is in contact with it. (4)

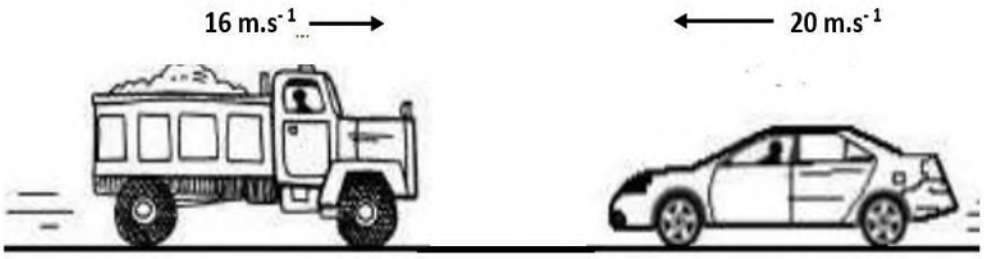
At the same instant that Ball A is at its **maximum height after the first bounce,** a similar Ball B is projected vertically upwards from a point of 2m above the ground with a velocity of 15 $m.s^{-1}$.

3.3 Calculate the time it takes for Ball **A** and Ball **B** to pass each other (5)

3.4 Draw a velocity vs time graph for Ball **A** from the moment it is projected down until it reaches maximum height after first bounce. (2)
[16]

QUESTION 4 (start on a new page)

A 1500 kg car is travelling west at 20 $m.s^{-1}$ on a horizontal frictionless track. It collides with a 2600 kg truck travelling at 16 $m.s^{-1}$ east. After the collision, the car travels at 5,2 $m.s^{-1}$ east. See the diagram below.



4.1 State the *principle of conservation of linear momentum* in words. (2)

4.2 Calculate the velocity of the truck immediately after the collision. (4)

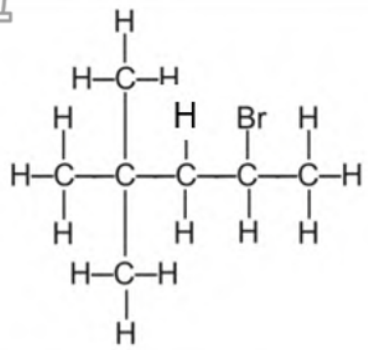
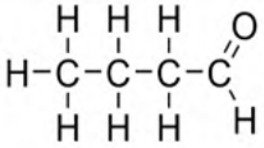
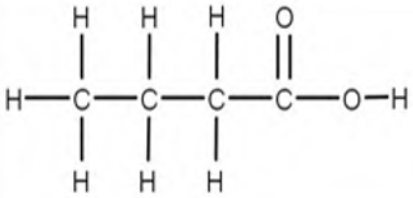
4.3 Determine by means of relevant calculations whether the collision is ELASTIC or INELASTIC. (5)

4.4 Which ONE of the vehicles (CAR or TRUCK) that will experience a greater amount of damage during collision? Explain your answer. (2)

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QUESTION 5 (Start on a new page)

Molecules containing carbon atoms are listed in the table below.

A	C_2H_5OH	B	CH_2CH_2
C		D	
E	Propyl Methanoate	F	

5.1 Give one word for the underlined phrase. (1)

5.2 Write down the LETTER that represents the following:

5.2.1 A haloalkane (1)

5.2.2 A carboxylic acid (1)

5.2.3 A compound with a general formula C_nH_{2n}. (1)

5.2.4 A compound which has the formyl group as its functional group (1)

5.2.5 Functional isomer of F. (1)

5.3 Consider compound **E**, Write down the: (2)

5.3.1 Structural formula of its functional group. (1)

5.3.2 IUPAC name of the alcohol used to prepare this compound. (2)

5.4 Write down the IUPAC name of compound C. (3)

5.5 Is compound a PRIMARY, SECONDARY or TERTIARY alcohol? Give a reason for your answer. (2)

Compound G is formed when compound B undergoes HYDROGENATION reaction in the presence of nickel (Ni).

5.6 Use MOLECULAR FORMULAE and write down a balanced equation for the complete combustion of compound G. (3)

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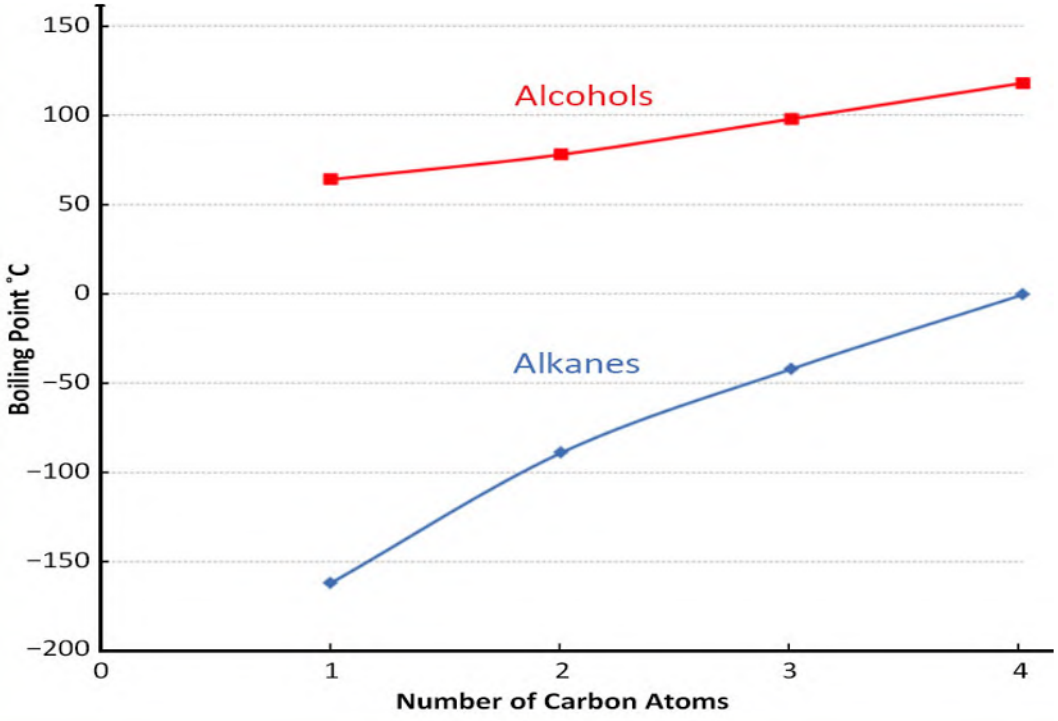


QUESTION 6 (start on a new page)

Two groups of compounds were investigated viz: Alkanes and alcohols

The graph below is obtained after learners conducted an investigation on the factors affecting boiling point.

Variation of Boiling Points of straight chained Alcohols and Alkanes with Number of Carbon



Experiment 1 is for straight chain alkanes while experiment 2 is for straight chain alcohols.

6.1 Define the term *boiling point*. (2)

6.2 For experiment **1**, write down the:

6.2.1 Independent variable. (1)

6.2.2 Investigative question (2)

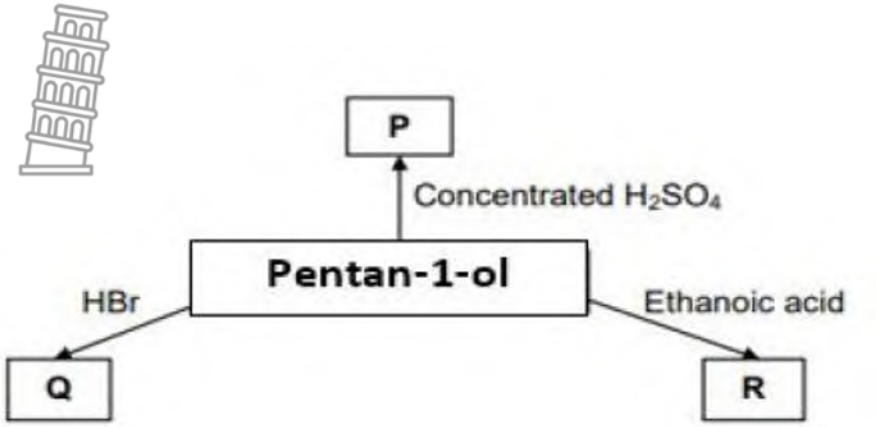
6.2.3 Conclusion that can be drawn from graph of alkanes only (2)

6.3 Explain why the boiling points of alkanes differ from those of alcohols. Refer to the (TYPE OF INTERMOLECULAR FORCES,STRENGTH OF INTERMOLECULAR FORCES AND ENERGY) (4)

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QUESTION 7 (start on a new page)

Some of the reactions of Pentan-1-ol are represented in the flow diagram below. **P**, **Q** and **R** represent the organic products formed.



7.1 Product P is formed when Pentan-1-ol is heated in the presence of concentrated sulphuric acid.

Write down the:

7.1.1 Name of the type of reaction that takes place. (1)

7.1.2 Balanced equation for the reaction that takes place using STRUCTURAL FORMULAE. (5)

7.2 Product **R** is formed when Pentan-1-ol reacts with ethanoic acid in the presence of an acid catalyst.

7.2.1 Name of the type of reaction that takes place. (1)

7.2.2 Structural formula of the organic product formed (2)

7.3 When HBr reacts with Pentan-1-ol, compound **Q**, a haloalkane is formed.

Write down the:

7.3.1 Name of the type of reaction that takes place. (1)

7.3.2 IUPAC name of the haloalkane formed. (2)

7.4 Draw the structural formulae of two positional isomers of pentan-1-ol. (2)

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TOTAL [100]

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9{,}8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of the Earth *Radius van die Aarde*	R_E	$6{,}38 \times 10^{6}\ m$
Mass of the Earth *Massa van die Aarde*	M_E	$5{,}98 \times 10^{24}\ kg$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6{,}63 \times 10^{-34}\ J{\cdot}s$
Coulomb's constant *Coulomb se konstante*	k	$9{,}0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$

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*

$F_{net} = ma$	$p = mv$
$f_s^{\,max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$