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INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination 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, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEET.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions et cetera where required.
12. 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 According to Newton's Second Law of Motion, the acceleration of an object is ...

- A always equal to its mass.
 B inversely proportional to its mass.
 C directly proportional to its mass.
 D independent of its mass.

(2)

1.2 A ball, moving horizontally, hits a wall with a speed $2v$. The ball then bounces back horizontally with a speed v , as shown in the diagram below.



Which ONE of the following combinations regarding the linear momentum and the total kinetic energy of the ball for the collision above is CORRECT? Assume that the ball-wall system is isolated.

	LINEAR MOMENTUM	KINETIC ENERGY
A	Conserved	Conserved
B	Conserved	Not conserved
C	Not conserved	Conserved
D	Not conserved	Not conserved

(2)

1.3 An object falls freely in a vacuum near the surface of the Earth. Which ONE of the following statements regarding the motion of the object is CORRECT?

- A The rate of change of velocity of the object will remain constant.
 B The rate of change of velocity of the object will increase uniformly.
 C The velocity of the object will decrease uniformly.
 D The velocity of the object will remain constant.

(2)

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education

Department:
Education
PROVINCE OF KWAZULU-NATAL



**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES

COMMON TEST

MARCH 2022

This marking guideline consists of 7 pages.

MARKS : 100

QUESTION 1

- 1.1 B ✓✓
 1.2 B ✓✓
 1.3 A ✓✓
 1.4 C ✓✓
 1.5 B ✓✓
 1.6 D ✓✓

(6 x 2) = 12

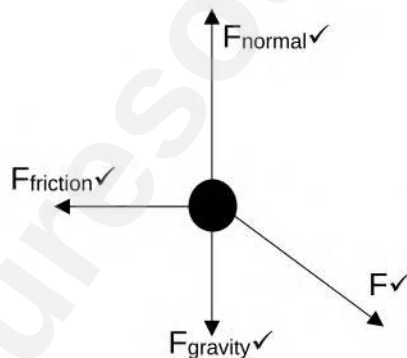
QUESTION 2

- 2.1.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

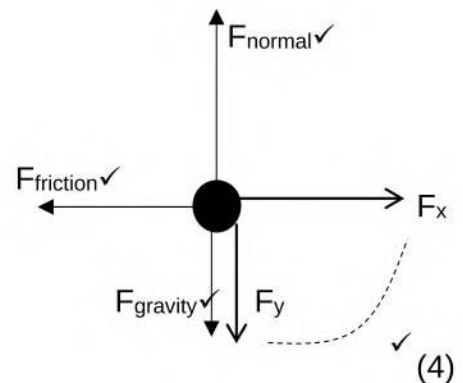
OR

The resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force. ✓✓ (2 or 0) (2)

2.1.2



OR



- 2.1.3 $F_{\text{net}} = ma$
 $N = F_g + F_v$ } ✓
 $N = ((4 \times 9,8) + 10 \sin 30^\circ)$ ✓
 $N = 44,20 \text{ N}$ ✓

(3)

- 2.1.4 $F_{\text{net}} = ma$
 $F_h - F_f = ma$ } ✓
 $10 \cos 30^\circ - 2 = 4a$ ✓
 $a = 1,67 \text{ m} \cdot \text{s}^{-2}$ ✓

(4)

2.1.5 DECREASES ✓ (1)

2.1.6 INCREASES ✓

The horizontal component of the applied force increases ✓ and the frictional force decreases. ✓ (2)

2.2.1 State Newton's Law of Universal Gravitation: Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres. ✓ (2)

Note: Underlined phrases must be in context of the law

$$\begin{aligned}
 2.2.2 \quad g &= G \frac{M}{r^2} \quad \checkmark \\
 &= \frac{6,67 \times 10^{-11} \cdot 5,98 \times 10^{24}}{(6,38 \times 10^6)^2} \quad \checkmark \\
 &= 9,799 \text{ N} \cdot \text{kg}^{-1} (\text{m} \cdot \text{s}^{-2}) \quad \checkmark (9,8 \text{ m} \cdot \text{s}^{-2})
 \end{aligned}$$

Note: if only $9,8 \text{ m} \cdot \text{s}^{-2}$ written then 1/4 marks (4)

[22]

QUESTION 3

3.1 In an isolated system, ✓ the total linear momentum remains constant (is conserved). ✓ (2)
[first mark awarded only if it is in context of momentum conservation]

$$\begin{aligned}
 3.2 \quad \Sigma p_i &= \Sigma p_f \\
 m_1 v_{i1} + m_2 v_{i2} &= m_1 v_{f1} + m_2 v_{f2} \quad \checkmark \\
 (1500)(0) + (2000)(20) &\checkmark = (1500)(12) + (2000)v_{f2} \quad \checkmark \\
 v_{f2} &= 11 \text{ m} \cdot \text{s}^{-1} \quad \checkmark (4)
 \end{aligned}$$

$$\begin{aligned}
 \text{OR } (1500)(0) + (2000)(-20) &\checkmark = (1500)(-12) + (2000)v_{f2} \quad \checkmark \\
 v_{f2} &= -11 \text{ m} \cdot \text{s}^{-1} \quad \text{Hence speed} = 11 \text{ m} \cdot \text{s}^{-1} \quad \checkmark
 \end{aligned}$$

3.3 The driver moves (momentarily) forward. ✓ (1)

3.4 Newton's first Law ✓ OR Inertia (1)

[8]

QUESTION 4

4.1 Motion during which the only force acting on an object is the gravitational force. ✓✓ (2)

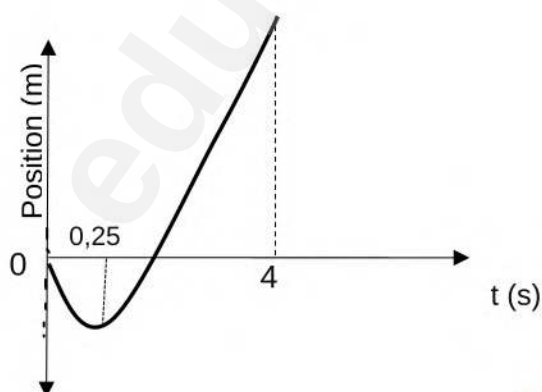
4.2 The object is projected upwards from above the ground ✓ / the top of a building. It then moved downwards ✓ below the starting position / top of the building. ✓ (3)

4.3	<u>OPTION 1</u>	<u>OPTION 2</u>	<u>OPTION 3</u>	
	$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓	$\text{Grad} = 9,8 \checkmark = \frac{0 - v_i}{0,25 - 0}$ ✓	
	$0 = v_i + (9,8)(0,25)$ ✓	$0 = v_i + (-9,8)(0,25)$ ✓	$v_i = -2,45 \text{ m}\cdot\text{s}^{-1}$	
	$v_i = 2,45 \text{ m}\cdot\text{s}^{-1}$ upwards ✓	$v_i = -2,45 \text{ m}\cdot\text{s}^{-1}$	$v_i = 2,45 \text{ m}\cdot\text{s}^{-1}$ upwards ✓	(3)
		$v_i = 2,45 \text{ m}\cdot\text{s}^{-1}$ upwards ✓		

4.4 **POSITIVE MARKING FROM Q 4.3**

	<u>OPTION 1</u>	<u>OPTION 2</u>	<u>OPTION 3</u>	
	$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓	$\text{Grad} = 9,8 \checkmark = \frac{v_f - 0}{4 - 0,25}$ ✓	
	$v_f = 0 + (9,8)(4 - 0,25)$ ✓	$v_f = -2,45 + (9,8)(4)$ ✓	$v_i = 36,75 \text{ m}\cdot\text{s}^{-1}$ downward ✓	(3)
	$v_i = 36,75 \text{ m}\cdot\text{s}^{-1}$ downward ✓	$v_i = 36,75 \text{ m}\cdot\text{s}^{-1}$ downward ✓		

4.5



CRITERIA	MARK
Correct shape	✓
Indications of the times	✓
Graph starts from origin	✓



(3)

[14]

QUESTION 5

5.1.1. ester✓; accept alkyl alkanoate (1)

5.1.2 Propyl✓ butanoate✓ (2)

5.1.3 Carboxylic acid✓; accept alkanoic acid (1)

5.2 A bond or an atom or a group of atoms✓ that determine(s) the physical and chemical properties of a group of organic compounds. ✓ (2)

5.3 Carboxyl (group) ✓ (1)

5.4

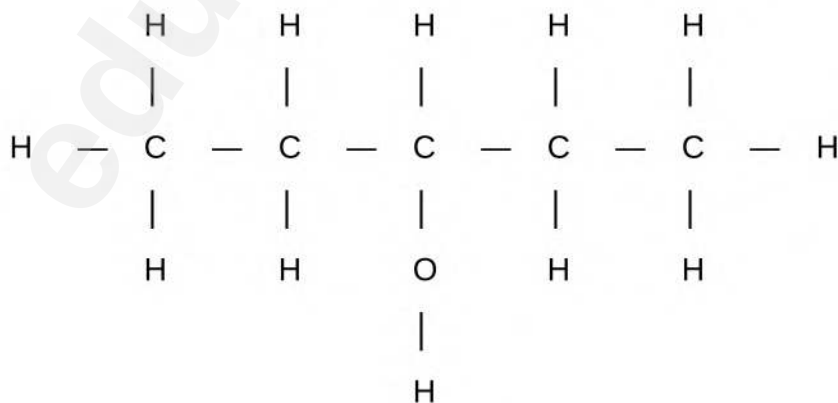
$$\begin{array}{ccccccc} & | & & | & & & \\ - & C & = & C & - & & \checkmark \end{array}$$

(1)

5.5 Organic molecules with the same molecular✓ formula but different structural formula. ✓ (2)

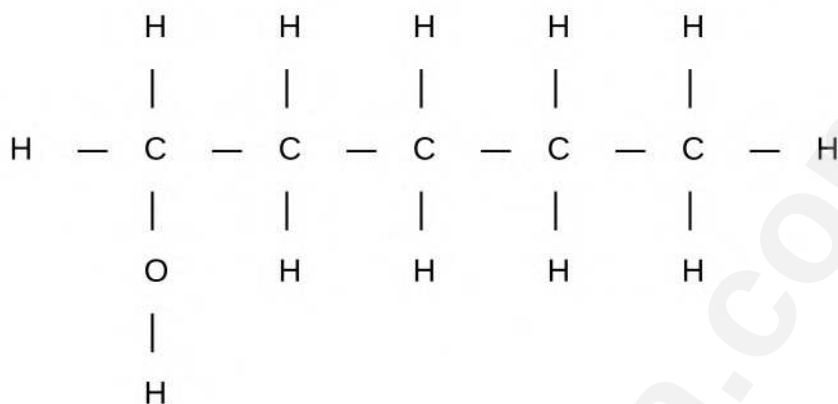
5.6.1 Secondary ✓
The carbon to which the hydroxyl group is bonded, is bonded to TWO other carbons✓ (2)

5.6.2



Functional group on correct carbon✓

Whole structure correct✓

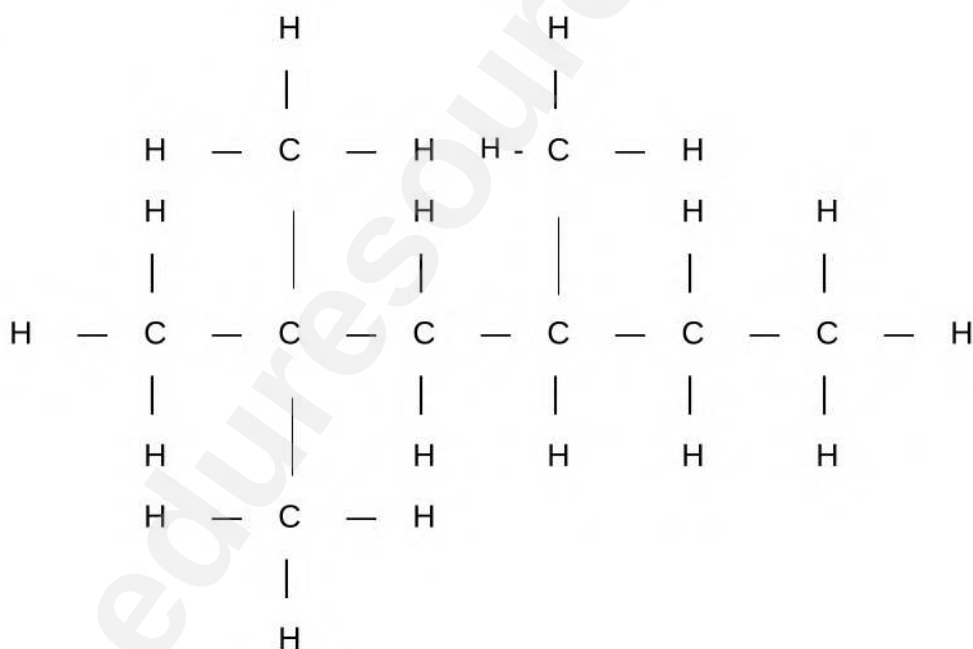


(2)

5.7.1 Organic compounds that consist of carbon and hydrogen✓ ONLY✓

(2)

5.7.2



MARKING CRITERIA	
• 6 Carbon parent chain	✓
• 3 methyl groups on parent chain	✓
• Whole structure correct	✓

(3)

[19]**QUESTION 6**

- 6.1 The temperature at which the vapour pressure equals atmospheric/external pressure. ✓✓ (2 or 0) (2)
- 6.2 Z ✓
Z has the highest boiling point. ✓ (2)
- 6.3 X ✓ (1)
- 6.4 What is the relationship between boiling point and type of functional group/homologous series?
Identify dependent variable ✓
Identify independent variable ✓ (If answer not stated as question -1 mark) (2)
- 6.5 To ensure a fair test. / to control the variable (1)
/ to ensure there is only one independent variable ✓
- 6.6.1 (DO NOT MARK)
- 6.6.2 (DO NOT MARK)

UPSCALE MARKS TO BE OUT OF 13 USING TABLE:

Mark out of 8	Conversion out of 13
1	2
2	3
3	5
4	7
5	8
6	10
7	11
8	13

[13]**QUESTION 7**

- 7.1.1 Addition/hydrogenation ✓ (1)
- 7.1.2 Elimination/dehydrohalogenation ✓ (1)
- 7.2.1 Dehydration ✓ (1)
- 7.2.2 Hydrohalogenation ✓ (1)
- 7.3.1 Hydrolysis ✓ (1)
- 7.3.2 (Mild) heat ✓

Dilute strong base/NaOH/KOH ✓

(2)

7.4 Concentrated strong base/NaOH/KOH ✓

(1)

7.5 $\text{CH}_3\text{CHCHCH}_3$ ✓ + H_2O ✓ $\longrightarrow$ $\text{CH}_3\text{CHOHCH}_2\text{CH}_3$ ✓ BAL ✓

OR

 $\text{CH}_2\text{CHCH}_2\text{CH}_3$ ✓ + H_2O ✓ $\longrightarrow$ $\text{CH}_3\text{CHOHCH}_2\text{CH}_3$ ✓ BAL ✓

(4)

[12]