education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12



PHYSICAL SCIENCES

MARCH 2025

CONTROL TEST

MARKS: 100

TIME: 2 hours

This paper consists of 16 pages including DATASHEET and the PERIODIC TABLE

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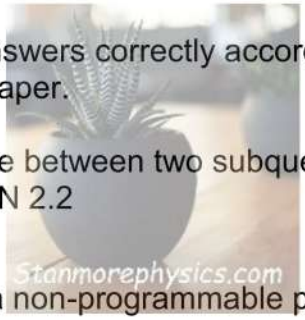
INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of SEVEN questions. Answer ALL questions 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 subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2



5. You may use a non-programmable pocket calculator.

6. Show ALL formulae and substitutions in ALL calculations.

7. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.

8. Give brief motivationa, discussions,etc. where required.

9. You are advised to use the attached DATA SHEETS.

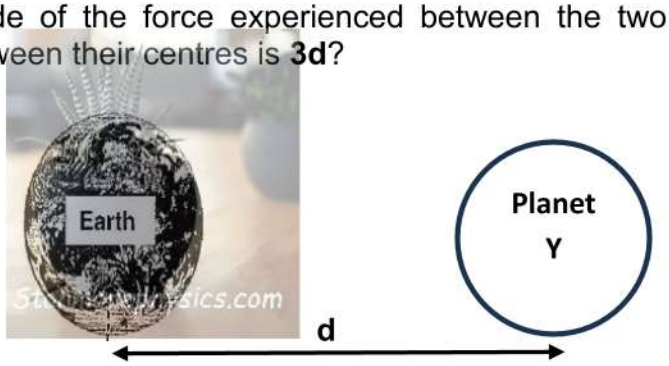
10. Write neatly and legibly.

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QUESTION 1

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 1.16) in the ANSWER BOOK, e.g. **1. 11 D.**

1.1 The gravitational force that the earth and Planet Y exerts on each other is **F** when there is a distance **d** between their centres. What would be the magnitude of the force experienced between the two when the distance between their centres is **3d**?



A 9F.

B $\frac{1}{3}$ F.

C $\frac{1}{9}$ F.

D 3 F. (2)

1.2 The change in momentum of an object can be equated to its…

A change in velocity.

B product of mass and velocity.

C change in kinetic energy.

D product of net force and change in time. (2)

1.3 A hot air balloon is descending at a velocity of 7,5 $m \cdot s^{-1}$ when a boy throws a plastic disc upwards at a velocity of 4 $m \cdot s^{-1}$. What is the initial velocity of plastic disc?



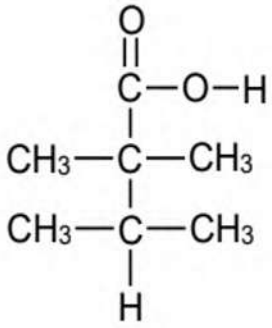
A 11,5 $m \cdot s^{-1}$ downwards.

B 3,5 $m \cdot s^{-1}$ downwards.

C 4 $m \cdot s^{-1}$ downwards.

D 7,5 $m \cdot s^{-1}$ downwards. (2)

1.4 The condensed structural formula of a compound is shown below.



Which one of the following is the correct IUPAC name for this compound?

A 2,2,1,1-tetramethylpropanoic acid

B 2,2,3- trimethylbutanoic acid

C 1,1,2,2-tetramethylpropanoic acid

D 3,2,2-trimethylbutanoic acid (2)

1.5 Which one of the following *functional groups* has the strongest intermolecular forces.

A Hydroxyl and Formyl

B Formyl and Carbonyl

C Hydroxyl and Carboxyl

D Carboxyl and Carbonyl (2)

1.6 The following cracking reaction takes place in high temperatures and pressures.

Pentane ⟶ X + Y

Which of the following compounds are likely to be the products of the above reaction?

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A Ethene + propane

B Ethane + propane

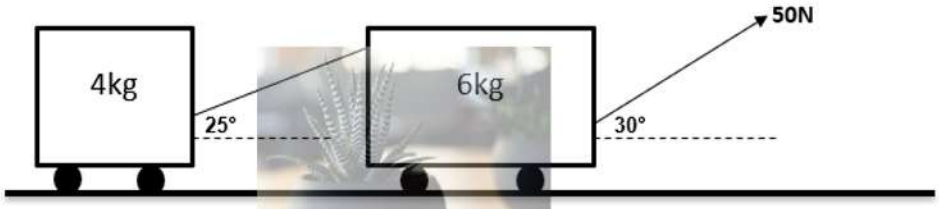
C Propene + ethene

D Ethanol + propanol (2)

[12]

QUESTION 2

Two toy cars of mass 4kg and 6kg respectively are connected by a light inextensible rope inclined at 25° to the horizontal as shown. The 6kg toy car is pulled by a 50N applied force inclined at 30° to the horizontal. The kinetic frictional force experienced by the 4kg and 6 kg toy cars are 10 N and 15 N respectively.



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

2.2 Draw a labelled free-body diagram showing all forces acting on the 6kg toy car. (5)

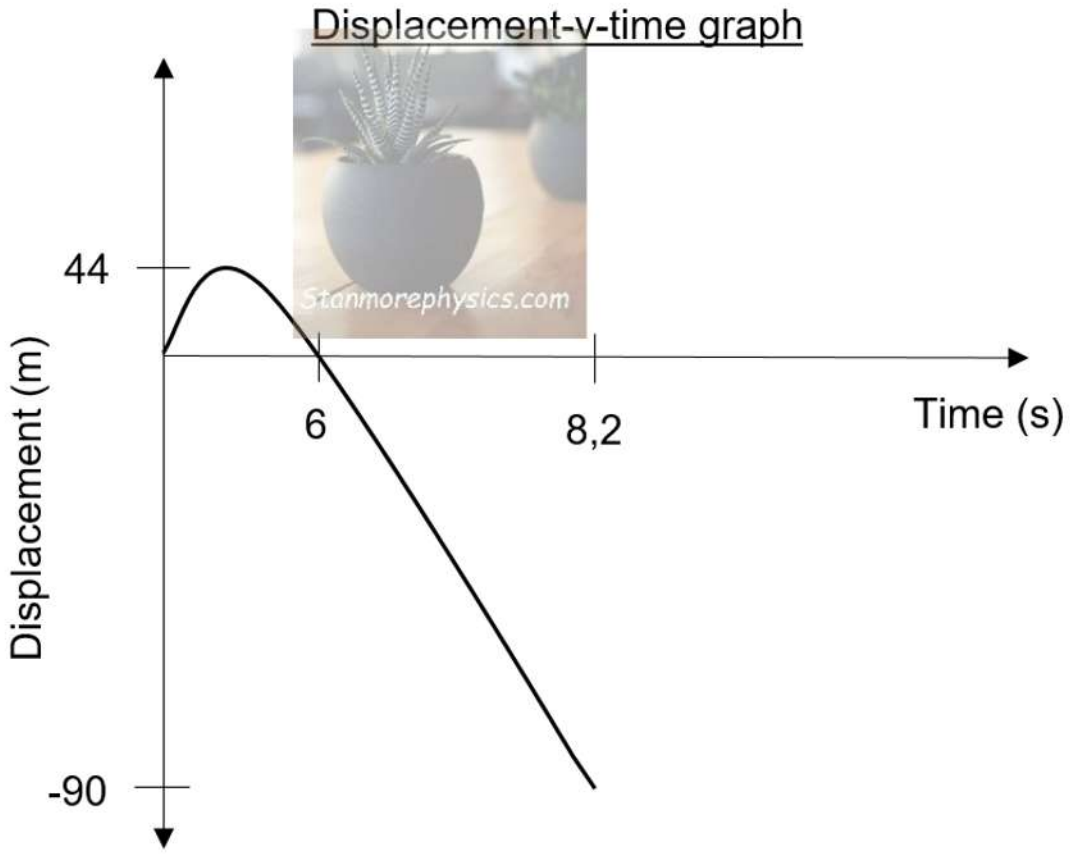
2.3 Calculate the acceleration experienced by the toy cars. (6)

2.4 Calculate the tension on the rope. (2)
[15]

QUESTION 3

A girl was standing on top of a hotel building playing with a ball of mass 1,2 kg. She projected the ball upwards and failed to catch it on its way down. The ball fell to the ground.

The position versus time graph below shows the motion of the ball from the moment it was projected until it reached the ground.



3.1 Define the term Free *fall*. (2)

3.2

3.2.1 What is the height of the building from which the ball was thrown? (1)

3.2.2 What is the acceleration of the ball at maximum height? (1)

3.3 Using equations of motion only, Calculate the:

3.3.1 Initial velocity of the ball. (3)

3.3.2 Velocity with which the ball hits the ground. (3)

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3.3.3 While the ball is in contact with the ground, it experiences a Net force of 130 N and then bounces off the ground with a velocity of 16,5 $m.s^{-1}$.
Calculate the time the ball was in contact with the ground. (4)

3.4 Draw a velocity versus time graph for the motion of the ball from the moment it was thrown until it strikes the ground.
On the graph show the following:

- Velocity at which the ball was thrown and
- Velocity at which the ball hits the ground. (3)

[17]



QUESTION 4

A group of learners were investigating the *rate of change in momentum* using two trolleys, Trolley **A** with mass 2 kg and Trolley **B** with a mass of 5 kg were placed on a flat frictionless surface. Trolley **A** moves easterly towards a stationery trolley **B**, the two trolleys collide and move together after the collision.
The table below shows the initial velocities of trolley **A** and the collision time for two collision trails that took place between the trolleys.

Trolley A	Initial velocity ($m \cdot s^{-1}$)	Contact time(s)
Trail 1	1,5	0.4
Trail 2	2	0.25

4.1 State the term represented by the words in italics in the above statement. (1)

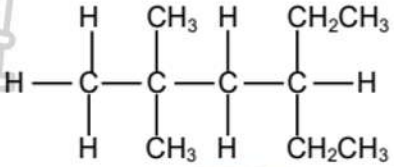
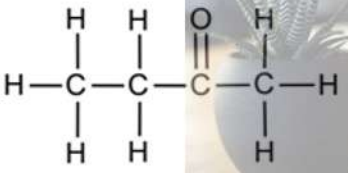
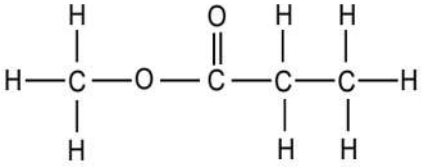
4.2 Calculate the magnitude of the velocity of the two trolleys after collision in **trail 1**. (4)

4.3 Calculate the net force experienced by trolley **B** in **trial 2**. (5)

4.4 Will the magnitude of the forces that the trolleys exert on each other in trial 1 be EQUAL to the magnitude of the forces in Trail 2? Choose from YES or NO. Give a reason for the answer. (2)
[12]

QUESTION 5

Consider organic compounds represented by letters **A** to **F** in the table below.

A		**B**	Butanoic acid
C		**D**	$CH_3CH(CH_3)CH_2CHClCH_3$
E	$CH_3CH_2CH_2COH$	**F**	

Use the information in the table to answer the questions that follow.

5.1 Write down a letter that represents the following.

5.1.1 A Haloalkane. (1)

5.1.2 A compound that has a Carboxyl group as a functional group. (1)

5.2 Write down the :

5.2.1 IUPAC name of compound **A**. (3)

5.2.2 General formula of compound **A.** (1)

5.2.3 IUPAC name of compound **E**. (2)

5.2.4 Structural formula of compound **D** . (3)

5.3 Compound **C** and **E** are isomers.

5.3.1 Define the term *structural isomer*. (2)

5.3.2 Identify the type of Isomerism between the two compounds? (1)

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5.4 Compound **F** is an ester. Write down the…

5.4.1 IUPAC name of this ester. (2)

5.4.2 structural formula of the alcohol that was used to produce this ester. (2)

5.4.3 inorganic compound that is produced in the process of producing the ester. (1)

[19]



QUESTION 6

Learners use the following compounds to investigate the factors that affect the vapour pressure of organic compounds.

	COMPOUND	VAPOUR PRESSURE (kPa at 25°C)
A	2-methly propane	150
B	Butane	83
C	Propan-1-ol	54
D	Ethanoic acid	26

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6.1 Define the term *Vapour pressure*. (2)

6.2 Which compound **A** or **B** has a higher boiling point?

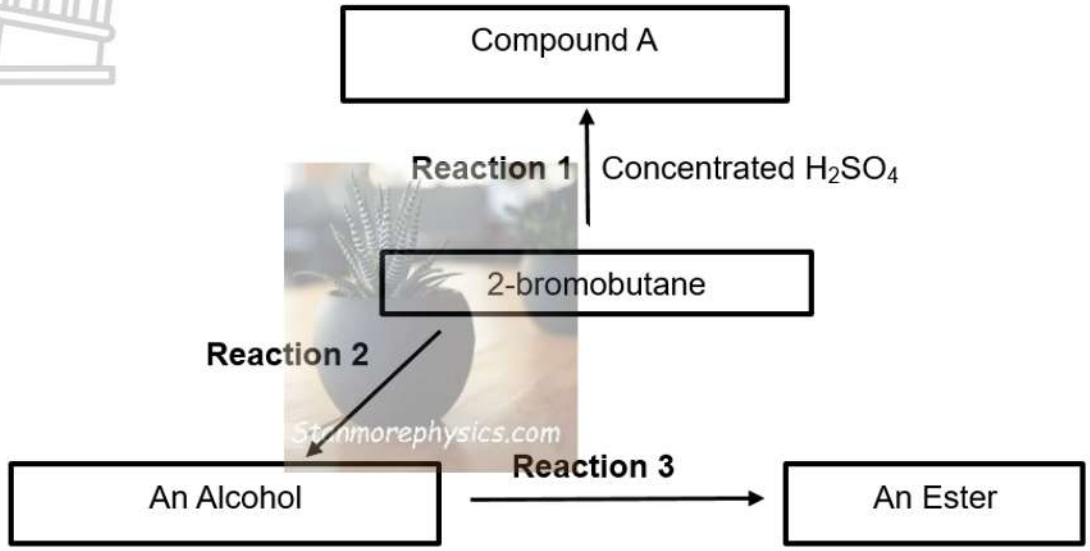
Explain your answer. (4)

6.3 Explain the difference in vapour pressures of compound **C** and **D** by referring to the TYPE OF INTERMOLECULAR FORCES present in each compound. (4)

[10]

QUESTION 7

In the flow diagram below 2-bromobutane undergoes different reactions as illustrated. Answer the questions that follow.



7.1 Consider **reaction 1**, write down the:

7.1.1 Type of reaction that takes place. (1)

7.1.2 IUPAC name of compound A which is a major product. (2)

7.2 Consider **reaction 2**, write down the:

7.2.1 Type of reaction that takes place. (1)

7.2.2 Structural formula of the alcohol. (2)

7.2.3 Reaction conditions (2)

7.3 Consider **reaction 3**

7.3.1 Write down the homologous series to which the OTHER organic reactant in this reaction belongs. (1)

7.3.2 The ester contains 6,6% of Hydrogen(H), 40% of Carbon(C) and 53,33% of Oxygen (O). The molar mass of the ester is $150 g \cdot mol^{-1}$. Use a calculation to determine its molecular formula. (6)

[15]

TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 12
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} $N \cdot m^2 \cdot kg^{-2}$
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
Mass of the Earth	M	5,98 x 10^{24} kg
Radius of the Earth	R_E	6,38 x 10^6 m

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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 $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ OR $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE

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

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CHEMISTRY

$n = \frac{m}{M}$			$n = \frac{N}{N_A}$
$c = \frac{n}{V}$	or/*of*	$c = \frac{m}{MV}$	$n = \frac{V}{V_m}$



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TABLE 3: PERIODIC TABLE



KEY

Atomic number

Electronegativity — 29 Cu 1,9 63,5 — Symbol

Approximate relative atomic mass

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

												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				