LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF
EDUCATION

CAPRICORN NORTH DISTRICT

GRADE 11

PHYSICAL SCIENCES

CONTROLLED TEST 2

SEPTEMBER 2023

Stanmorephysics

MARKS: 100

TIME: 2 HOURS

THIS PAPER CONSISTS OF 10 PAGES INCLUDING THE INFORMATION SHEETS

INSTRUCTIONS

1. Write your name and surname on the answer sheet
2. This question paper consists of SEVEN Questions. Answer all the questions in your answer book.
3. Start every new question on a new page.
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 Question 2.1 and Question 2.2.
6. You may use a non-programmable calculator.
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 TWO decimal places.
10. Write neatly and legibly.

QUESTION1

Four 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 number (1.1–1.6) in the ANSWER BOOK, e.g 1.1 A

1.1 Two moles of H_2 gas at STP occupy a volume of ...

A. 2 dm^3
B. 11,2 dm^3
C. 22,4 dm^3
D. 44,8 dm^3 (2)

1.2 X g of Mg reacts with 2x g of HCl according to the following balanced equation:
$Mg + 2HCl \rightarrow MgCl_2 + H2$
Which one of the following statements is CORRECT

A. x g of H_2 is formed.
B. 2x g of $MgCl_2$ is formed.
C. Mg is the limiting reagent.
D. HCl is a limiting reagent. (2)

1.3 Which ONE of the following statements CORRECTLY describes the characteristics of an endothermic reaction?

A. ΔH is positive and the products have less potential energy than the reactants
B. ΔH is positive and the products have more potential energy than the reactants.
C. ΔH is negative and the products have less potential energy than the reactants.
D. ΔH is negative and the products have more potential energy than the reactants. (2)

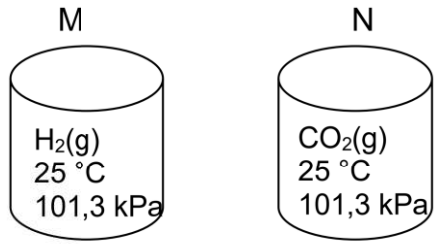
1.4 Bromothymol Blue turns _____ in acids and _____ in bases.

A. red; blue
B. yellow; red
C. orange ; yellow
D. Colourless; reddish pink (2)

1.5 Bronsted-Lowrey acid is

A. an electron Donor
B. an electron acceptor
C. a proton donor
D. a proton acceptor (2)

1.6 Two identical containers, M and N, are shown below. Container M contains $H_2(g)$ and container N contains $CO_2(g)$. Both gases are at a temperature of 25 °C and a pressure of 101,3 kPa.



Consider the following statements:

(i) The average kinetic energy of the molecules is the same in both containers.
(ii) Container M contains more gas molecules than container N.
(iii) The mass of the gas in container N is greater than the mass of the gas in container M.

Which of the above statements is/are CORRECT?
A. (i) only
B. (iii) only
C. (i) and (ii) only
D. (i) and (iii) only (2)

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QUESTION 2 (start on a new page)

Fructose is a type of sugar that is present in many plants. It consists of 40% carbon 6.67% hydrogen and 53.33% oxygen.

2.1 Define the term empirical formula. (2)

2.2 Determine the empirical formula of fructose. (7)

2.3 If the molar mass of fructose is 180g.mol^{-1} determine the molecular formula of fructose. (3)

[12]

QUESTION 3 (start on a new page)

A learner finds 7.00g of shells on a school field trip. She is curious about the amount of calcium carbonate present in the shells. She adds 1350cm^3 sulfuric acid with a concentration of 0.05mol.dm^{-3}. The unbalanced equation for the reaction is:

$$CaCO_{3(s)} + H_2SO_{4(aq)} \rightarrow CaSO_{4(aq)} + H_2O_{(l)} + CO_{2(g)}$$

3.1 Define one mole of a substance. (2)

3.2 The learner then neutralizes the unreacted acid with 3.00g of NaOH according to the following reaction.

$$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$$

3.2.1 Calculate the volume of excess sulfuric acid which was neutralized. (6)

3.2.2 Calculate the mass of calcium carbonate that was present in the shells. (6)

3.2.3 Calculate the percentage purity of the calcium carbonate in the shells. (3)

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QUESTION 4 (Start on a new page)

The following equation shows the formation of silver from silver oxide.

$$Ag_2O_{(s)} + C_{(s)} \rightarrow Ag_{(s)} + CO_{2(g)}$$

4.1 Balance the given chemical reaction equation. (2)

4.2 151.91g of silver oxide is added to 3g of carbon.

4.2.1 Determine the limiting reagent in the reaction. (4)

4.2.2 Calculate the theoretical yield of silver. (4)

4.2.3 Calculate the percentage yield if the actual yield is 92g. (3)

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QUESTION 5 (Start on a new page)

The combustion of natural gas (methane) produces carbon dioxide and water according to the given equation

$$CH_{4(g)} + 2O_{2(g)} \rightarrow 2H_2O_{(g)} + CO_{2(g)} \quad \Delta H < 0$$

5.1 Define the term activation energy. (2)

5.2 Is the above reaction endothermic or exothermic? Give a reason for your answer. (2)

5.3 Draw a sketch of the potential energy vs course of the reaction for the reaction above.

Clearly indicate the following on the graph

- Activation energy
- Heat of reaction
- Reactants and Products (3)

[7]

QUESTION 6 (start on a new page)

When sulfuric acid reacts with water it ionizes in two steps as shown in the balanced equation below.



1: $H_2SO_{4(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + HSO^-_{4(aq)}$

2: $HSO^-_{4(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + SO_4^{2-}{}_{(aq)}$

6.1 What do you understand by the term ampholyte? (2)

6.2 Write down the FORMULA for

6.2.1 the conjugate base of HSO^-_4 (1)

6.2.2 the conjugate acid of HSO^-_4 (1)

6.2.3 a substance that acts as an Ampholyte in these reactions. (1)

6.3 $20cm^3$ of HCl of concentration $0.5mol.dm^{-3}$ is dissolved in water.

6.3.1 Define an acid according to the Arrhenius theory (2)

6.3.2 Write the balanced equation for the above reaction (3)

6.3.3 Calculate the volume of the new solution if the concentration is $0.015mol.dm^{-3}$. (3)

6.4 6 g of KOH are dissolved in 200ml of water to make a standard solution You are asked to determine the concentration of $150cm^3$ of a HCl solution.

$$KOH_{(aq)} + HCl_{(aq)} \rightarrow KCl_{(aq)} + H_2O_{(aq)}$$

If $20cm^3$ of the standard solution neutralizes $25cm^3$ of the acid, calculate

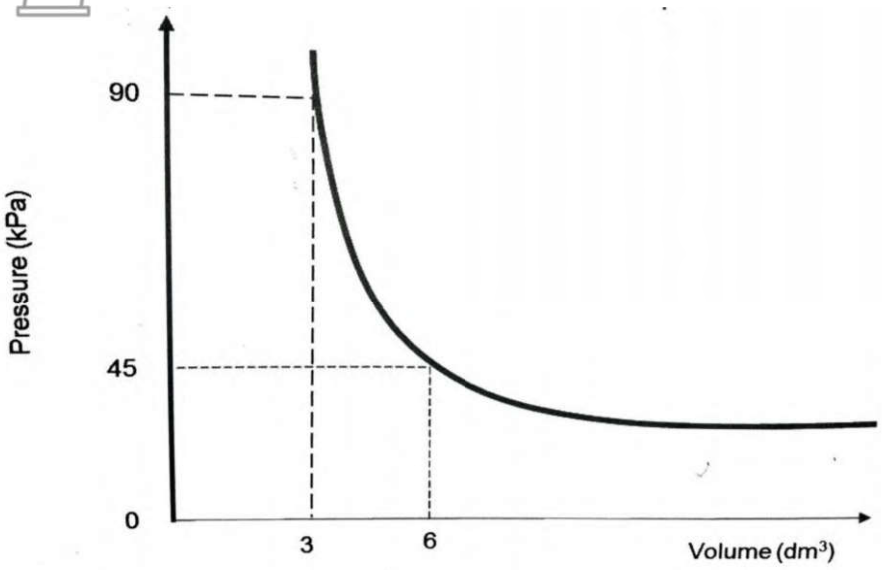
6.4.1 The concentration of the HCl solution. (6)

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QUESTION 7 (start on a new page)

The graph below represents the relationship between the pressure and the volume of oxygen gas at constant temperature.



7.1 State Boyle's law in words. (2)

7.2 Write down the mathematical expression, in symbols, for the relationship between the variables on the graph. (1)

7.3 Write down two variables that must be kept constant during this investigation. (2)

7.4 Define the Pressure exerted by a gas. (2)

7.5 Calculate the Pressure, in kPa, exerted on the gas when it is compressed to 5dm^3. (4)

7.6 State the conditions under which real gases approach ideal gas behavior. (2)

7.7 Tabulate the difference between ideal gases and real gases. (6)

7.8 Give a reason why oxygen gas deviates from ideal gas behavior at low temperatures. (1)

[20]

4.3 Information sheets – Paper 2 (Chemistry)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J{\cdot}K^{-1}{\cdot}mol^{-1}$
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5\ Pa$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3{\cdot}mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^θ	273 K

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1}=\frac{p_2V_2}{T_2}$	$pV=nRT$
$n=\frac{m}{M}$	$n=\frac{N}{N_A}$
$n=\frac{V}{V_m}$	$c=\frac{n}{V}$ OR/*OF* $c=\frac{m}{MV}$

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

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 **Cu**
63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa