



Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES: CHEMISTRY (P2)

COMMON TEST

JUNE 2016

**NATIONAL SENIOR
CERTIFICATE**

GRADE 10

TIME: 2 hours

MARKS: 100

This question paper consists of 9 pages including 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. You may use a non-programmable calculator.
3. You may use appropriate mathematical instruments.
4. Number the answers correctly according to the numbering system used in this question paper.
5. A periodic table is attached for your use.
6. Give brief motivations, discussions, et cetera where required.
7. Round off your final numerical answers to a minimum of TWO decimal places.

QUESTION 1: MULTIPLE CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 – 1.7) in the ANSWER BOOK, for example 1.4 D.

1.1 Which ONE of the following is a homogeneous mixture?

- A Oil in water.
- B Sugar in water.
- C Salad dressing.
- D Mealie meal in water. (2)

1.2 Which one of the following describes the ability of an atom to form a negative ion?

- A Ionisation energy
- B Electronegativity
- C Electron affinity
- D Bond energy (2)

1.3 The number of neutrons in ${}_{12}^{26}\text{Mg}$ is:

- A 12
- B 14
- C 26
- D 38 (2)

1.4 The chemical name for SO_4^{2-} is ...

- A Sulphite ion
- B sulphide ion
- C sulphate ion
- D sulphur trioxide (2)

- 1.5 Which ONE of the following solids does NOT have a covalent network structure?
- A Diamond
 - B Iodine
 - C Graphite
 - D Silicon dioxide
- (2)
- 1.6 The solution that is most likely to conduct electricity...
- A Aluminium nitrate in water.
 - B Milk.
 - C Sugar solution.
 - D Petrol.
- (2)
- 1.7 Elements in a group on the Periodic Table have similar chemical properties. This similarity is most closely related to the ...
- A atomic masses.
 - B atomic numbers.
 - C number of energy levels.
 - D number of valence electrons.
- (2)

[14]

C

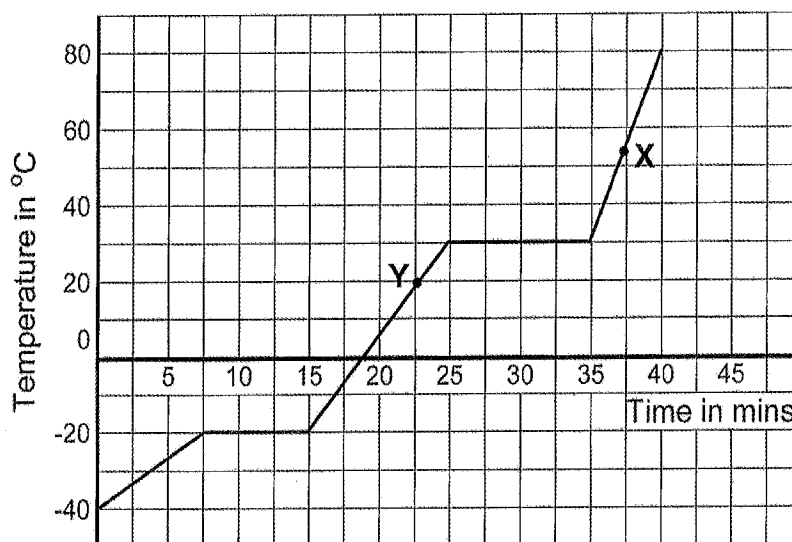
QUESTION 2

2.1 Classify each of the following as either a pure substance or a mixture.

2.1.1 Brass (1)

2.1.2 Copper (1)

2.2 The graph below represents the heating curve of a pure substance at sea level.



2.2.1 Define melting point. (2)

2.2.2 What is the boiling point of this substance? (2)

2.2.3 At which point, X or Y, are the molecules of this substance closer together? Give an explanation for your answer. (3)

2.2.4 At $-20\text{ }^{\circ}\text{C}$ there is no temperature change although heat is being added to the substance. Give an explanation for this observation. (3)

2.2.5 What is the phase of this substance at $80\text{ }^{\circ}\text{C}$? (1)

2.3 Classify each of the following as either a physical change or a chemical change.

2.3.1 Table salts dissolved in water (1)

2.3.2 The manufacture of glucose by plants during photosynthesis. (1)

2.4 Some iron filings and sugar are mixed together. Describe fully how you would determine the mass of the sugar present in the mixture. (5)

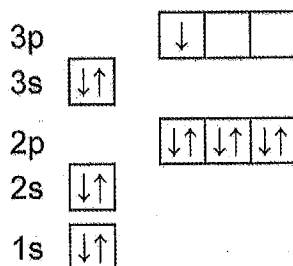
[20]

QUESTION 3

3.1 Chlorine atoms exist naturally as $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$.

- 3.1.1 What are such atoms called? (1)
- 3.1.2 Besides their masses, how else do these atoms differ? (1)
- 3.1.3 The relative atomic mass of chlorine is 35,5. Determine the percentage abundance of each of these atoms. (5)

3.2 The following is an aufbau diagram of an atom, X.

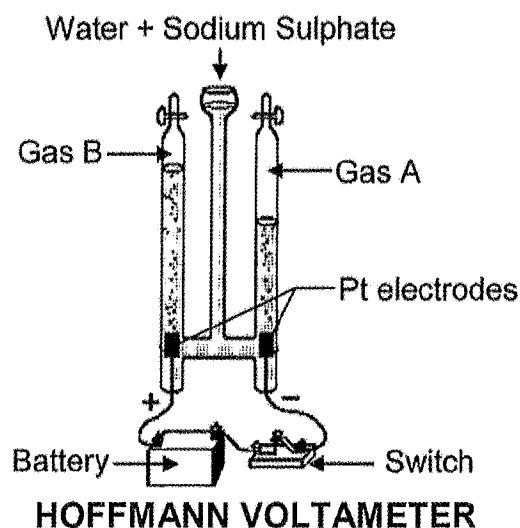


- 3.2.1 State Pauli's exclusion principle. (2)
- 3.2.2 What is the name given to the electrons in the third (3rd) energy level? (1)
- 3.2.3 Write down the formula of X when it forms an ion. (2)
- 3.3 Write down the name for each of the following chemical substances.
- 3.3.1 FeCl_3 (2)
- 3.3.2 NaHCO_3 (2)
- 3.4 Write down the chemical formula for each of the following substances.
- 3.4.1 calcium phosphate (2)
- 3.4.2 aluminium oxide (2)
- 3.4.3 ammonium sulphate (2)

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QUESTION 4

- 4.1 The potassium and chloride ions attract each other to form a solid crystal lattice.
- 4.1.1 Is energy taken in or given off during the formation of the crystal lattice? (1)
- 4.1.2 Name the force of attraction that holds the ions together the crystal lattice. (1)
- 4.1.3 Explain why potassium chloride does not conduct electricity in its solid state but is a good conductor in its molten state. (3)
- 4.2 Nitrogen and hydrogen combine to form ammonia.
- 4.2.1 Define electronegativity. (2)
- 4.2.2 Use Lewis dot structures to show how nitrogen and hydrogen combine to form an ammonia molecule. (3)
- 4.3 Tabulate two (2) differences between covalent and ionic bonding. (4)
- 4.4 The following apparatus (called the Hoffmann Voltmeter) shows the decomposition of a solution of sodium sulphate in water.



- 4.4.1 What is the name given to this process? (2)
- 4.4.2 Identify gas A.
Give a reason for your answer. (2)
- 4.4.3 Write a balanced equation for the reaction that takes place. (3)
- 4.4.4 Explain how we can test for hydrogen gas. (2)

[23]

QUESTION 5

5.1 A piece of magnesium is burnt in pure oxygen to produce magnesium oxide.

5.1.1 State the law of conservation of mass. (2)

5.1.2 Write a balance equation for the reaction that takes place. (3)

5.1.3 Use this reaction to prove the law of conservation of mass. (4)

5.1.4 If 6g of magnesium was completely burnt, determine how much oxygen gas was used and how much product was formed. (4)

5.1.5 Is this reaction a physical or a chemical change?
Give a reason for your answer. (2)

5.2 Balance each of the following reactions and state if the reaction is a decomposition, synthesis or combustion reaction. ()

5.2.1 $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$ (3)

5.2.2 $KClO_3 \rightarrow KCl + O_2$ (3)

[21]

TOTAL MARKS: [100]

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	(I)	(II)		(IV)	(V)	(VI)	(VII)	(VIII)					(III)	(IV)	(V)	(VI)	(VII)	(VIII)	
1	H 1,01																		2 He 4
3	Li 7,0	4 Be 9,0														8 O 16,0	9 F 19,0	10 Ne 20,0	
11	Na 23,0	12 Mg 24,0														16 S 32,0	17 Cl 35,5	18 Ar 40,0	
19	K 39,1	20 Ca 40,1	21 Sc 45,0	22 Ti 48,0	23 V 51,0	24 Cr 52,0	25 Mn 55,0	26 Fe 56,0	27 Co 59,0	28 Ni 59,0	29 Cu 63,5	30 Zn 65,0	31 Ga 70,0	32 Ge 73,0	33 As 75,0	34 Se 79,0	35 Br 80,0	36 Kr 84,0	
37	Rb 86,0	38 Sr 88,0	39 Y 89,0	40 Zr 91,0	41 Nb 92,0	42 Mo 96,0	43 Tc 98,0	44 Ru 101,0	45 Rh 103,0	46 Pd 106,0	47 Ag 108,0	48 Cd 112,0	49 In 115,0	50 Sn 119,0	51 Sb 122,0	52 Te 128,0	53 I 127,0	54 Xe 131,0	
55	Cs 133,0	56 Ba 137,0	57 La 139,0	58 Ce 140,0	59 Pr 141,0	60 Nd 144,0	61 Pm 145,0	62 Sm 150,0	63 Eu 152,0	64 Gd 157,0	65 Tb 159,0	66 Dy 163,0	67 Ho 165,0	68 Er 167,0	69 Tm 169,0	70 Yb 173,0	71 Lu 175,0		
87	Fr 223,0	88 Ra 226,0	89 Ac 227,0	90 Th 232,0	91 Pa 231,0	92 U 238,0	93 Np 237,0	94 Pu 242,0	95 Am 243,0	96 Cm 247,0	97 Bk 247,0	98 Cf 251,0	99 Es 252,0	100 Fm 257,0	101 Md 288,0	102 No 289,0	103 Lr 260,0		

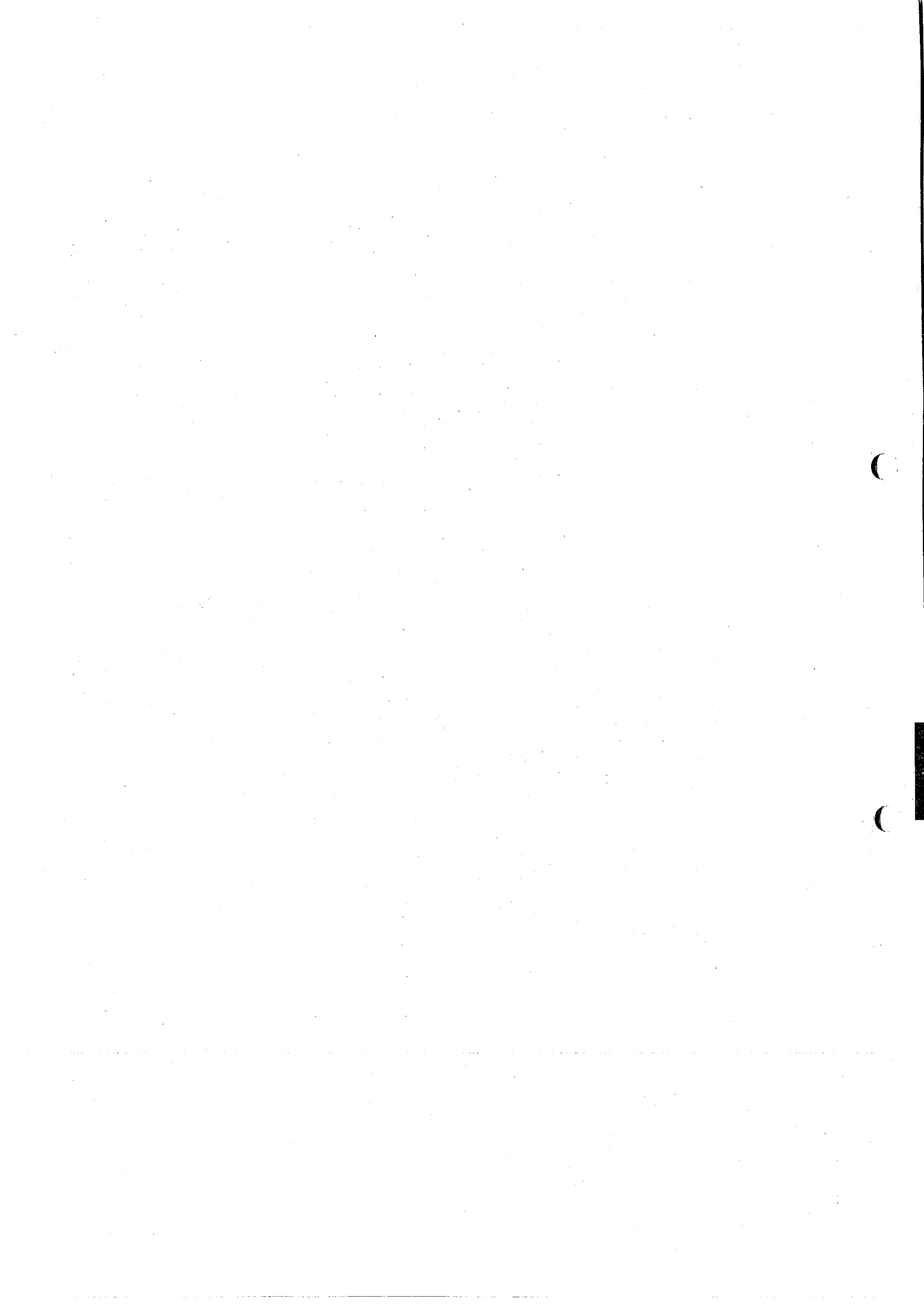
29	Cu	63,5
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Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa





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MEMORANDUM

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QUESTION 1

- 1.1 B ✓✓ (2)
1.2 C ✓✓ (2)
1.3 B ✓✓ (2)
1.4 C ✓✓ (2)
1.5 D ✓✓ (2)
1.6 A ✓✓ (2)
1.7 D ✓✓ (2) [14]

QUESTION 2

- 2.1 2.1.1 Mixture ✓ (1)
2.1.2 Pure Substance ✓ (1)
2.2 2.2.1 Melting point is the temperature at which a solid changes to a liquid. ✓✓ (2)
2.2.2 30 °C ✓✓ (2)
2.2.3 Y ✓
At Y the intermolecular forces between the particles are stronger than at X. ✓
Some of the molecules are still in the liquid phase. ✓ (3)
2.2.4 The heat added is used to overcome the forces of attraction ✓ between the particles of the solid causing the particles to move further apart. ✓ Hence, changing its phase from solid to liquid. ✓ (3)
2.2.5 Gaseous phase ✓ (1)
2.3 2.3.1 Physical change ✓ (1)
2.3.2 Chemical change ✓ (1)
2.4 * Weigh the mixture. ✓
* Add sufficient water to dissolve all the sugar. ✓
* Filter the solution to separate the iron from the solution. ✓
* Dry the iron filings to remove all the water. ✓
* Weigh the iron filings and subtract this value from the mass of the original mixture to get the mass of the sugar. ✓ (5)

[20]

QUESTION 3

3.1 3.1.1 Isotopes ✓ (1)

3.1.2 Their number of neutrons differs. ✓ (1)

3.1.3 Let the % abundance of $^{35}\text{Cl} = x$
 $35,5 = \left(\frac{x}{100}\right)(35) + \left(\frac{100-x}{100}\right)(37)$
 $x = 75,00\%$

∴ % abundance $^{35}\text{Cl} = 75,00\%$ ✓
 ∴ % abundance $^{37}\text{Cl} = 25,00\%$ ✓

Let the % abundance of $^{37}\text{Cl} = x$
 $35,5 = \left(\frac{x}{100}\right)(37) + \left(\frac{100-x}{100}\right)(35)$
 $x = 25,00\%$
 ∴ % abundance $^{37}\text{Cl} = 25,00\%$ ✓
 ∴ % abundance $^{35}\text{Cl} = 75,00\%$ ✓

3.2 3.2.1 A maximum of two electrons can occupy an orbital provided they spin in opposite direction. ✓✓ (2)

3.2.2 Valence electrons ✓ (1)

3.2.3 X^{3+} ✓✓ (2)

3.3 3.3.1 iron (III) chloride ✓✓ (2)

3.3.2 sodium hydrogen carbonate ✓✓ (2)

3.4 3.4.1 $\text{Ca}_3(\text{PO}_4)_2$ ✓✓ (2)

3.4.2 Al_2O_3 ✓✓ (2)

3.4.3 $(\text{NH}_4)_2\text{SO}_4$ ✓✓ (2)

[22]

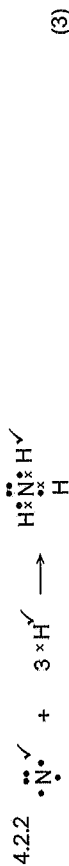
QUESTION 4

4.1 4.1.1 Given off ✓ (1)

4.1.2 Electrostatic or Coulombic Force ✓ (1)

4.1.3 In its solid state the ions are not free to move ✓ but in its molten state the ions are free to move ✓ and act as charge carriers. ✓ (3)

4.2 4.2.1 The ability of an atom to attract a shared pair of electrons in a covalent bond. ✓✓ (2)



COVALENT BONDING	IONIC BONDING
Formation of molecules	Formation of ions ✓✓
Sharing of electrons	Transfer of electrons ✓✓

4.3 4.4 4.4.1 Electrolysis ✓✓ (2)

4.4.2 Hydrogen ✓
 Hydrogen gas forms in a greater amount. ✓ (2)

4.4.3 $2\text{H}_2\text{O} \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$ ✓ (3)
 ✓ correct reactants
 ✓ correct products
 ✓ balancing

4.4.4 Hold a burning splinter at the end of the tube marked Gas A and open the tap. ✓ A popping sound will be heard ✓ (2)
 [23]

QUESTION 5

5.1 5.1.1 The total mass of the reactants used in a chemical reaction is equal to the total mass of the products formed. ✓✓ (2)

5.1.2 $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$ ✓ (3)

5.1.3 $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}(\text{s})$ ✓ (4)
 $(2)(24) + (16)(2) \rightarrow (2)(24+16)$
 $80 \rightarrow 80$ ✓

5.1.4 $\text{Mg}: 6\text{g} = \frac{48\text{g}}{8}$

$\text{O}_2: \frac{6 \times 32\text{g}}{48} = 4\text{g}$ ✓

$\text{MgO}: \frac{6 \times 80\text{g}}{48} = 10\text{g}$ ✓ (4)

5.1.5 Chemical change ✓
 A new substance with different chemical properties is formed. ✓ (2)



Combustion reaction ✓

(3)



Decomposition reaction ✓

(3)

[21]

100

Total Marks:

