education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: (P2)

CHEMISTRY

COMMON TEST

SEPTEMBER 2019

MARKS: 150

TIME: 2 hours

This question paper consists of 14 pages, including data page and a Periodic Table.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of ELEVEN questions. Answer ALL the questions in The ANSWER BOOK.

2. Number the answers correctly according to the numbering system used in this question paper.

3. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.

4. You may use a non-programmable calculator.

5. You may use appropriate mathematical instruments.

6. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEET.

7. Show ALL formulae and substitutions in ALL calculations.

8. Round off your FINAL numerical answers to a minimum of TWO decimal places.

9. Give brief motivations, discussions, et cetera where required.

10. Write neatly and legibly.

QUESTION 1: MULTIPLE- CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.10) in the answer book,
for example: 1.11 D.

1.1 Which one of the following DOES NOT define the properties of a metal? (2)

A Brittle
B Ductile
C Malleable
D Good conductor

1.2 Liquids which dissolve in all proportions are said to be … (2)

A Mixture
B Miscible
C Immiscible
D Suspension

1.3 The formula NO^{2-} represents a ...

A nitride ion
B nitrite ion
C nitrate ion
D nitrogen oxide

1.4 The process whereby a substance changes from a gas to a liquid, by removal of heat energy is called… (2)

A Boiling
B Evaporation
C Sublimation
D Condensation

1.5 The bond whereby there is a complete transfer of electron to form cation and anion that attract each other to form a formula-unit is called…. (2)

A Ionic
B Dative
C Metallic
D Covalent

1.6 Which one of the following correctly describes the trend in the electronegativity and first ionization energy going down the group 2 elements?

	Electronegativity	First ionization energy
A	Increase	Increase
B	Decrease	Increase
C	Decrease	Decrease
D	Increase	Decrease

(2)

1.7. Solid sodium hydroxide was added into a beaker with distilled water. After few seconds an observed rise in temperate was recorded.
Which of the following describes this process?

	Change	Type of reaction
A	Physical	Exothermic
B	Chemical	Endothermic
C	Chemical	Exothermic
D	Physical	Endothermic

(2)

1.8 A specific name given to an atom or molecules with additional electron(s) is called a/an ... (2)

A Ion
B Atom
C Anion
D Cation

1.9 Which of the following has the same electronic configuration as that of neon atom. (2)

A Si^{2+}
B Mg^{2+}
C C
D Si

1.10 Which one of the following reactions can be classified as redox reaction?

A $Mg^{2+}(aq) + O^{2-}((aq) \rightarrow 2MgO(s)$
B $Cu^{2+}(aq) + O^{2-}(aq) \rightarrow CuO(s)$
C $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
D $ZnCl_2(aq) + CaSO_4(aq) \rightarrow ZnSO_4(aq) + CaCl_2(aq)$ (2)

[20]

QUESTION 2

It is sometimes necessary to separate a mixture into its components. Four separation methods are summarized in the table below.

A	Filtering of a muddy-water mixture.
B	Distillation of water-ethanol to remove water. Ethanol boils at 78°C and water boils at 100°C at sea level.
C	Separation of salt and iron fillings by using a magnet.
D	Separation of water – sunflower oil mixture by using separating funnel.

2.1 Classify the following as HETEROGENEOUS **OR** HOMOGENEOUS

2.1.1 Muddy-water mixture. (1)

2.1.2 Ethanol and water. (1)

2.2 Name the physical property used in each of the following separation methods:

2.2.1 **C** (2)

2.2.2 **D** (2)

2.3 Now consider method **B**

2.3.1 Which phase change takes place when water boils? (2)

2.3.2 Which one of water and ethanol has weaker forces of attraction between their molecules? Give a reason for the answer. (2)

2.4 Now, consider method **D**.

2.4.1 Which liquid forms the top layer in the water-sunflower oil mixture? Give a reason for the answer. (2)

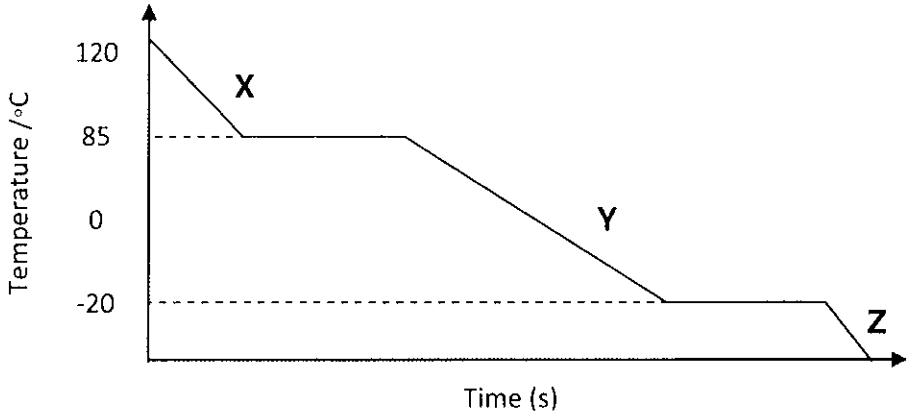
2.4.2 Equal volume of water and sunflower oil have been placed in two separate beakers.
Which liquid will have the greater mass? Give a reason for the answer. (3)
[15]

QUESTION 3

3.1 Define ***sublimation***. (2)

3.2 When you take a block of margarine out of the fridge, it is hard. However, after 30 minutes at room temperature it is soft enough to spread.
Use kinetic molecular theory to explain this observation? (2)

The diagram below, not drawn to scale, shows the physical changes of a substance at atmospheric pressure.



3.3 Is the diagram above showing a COOLING or HEATING curve? (1)

3.4 Name phase(s) of the substance at:

3.4.1 Point **X** (1)

3.4.2 -20 °C. (2)

3.5 Write down the stage of this substance at 85 °C. (1)

3.6 Write down the particle arrangement of this substance at:

3.6.1 Point **Z** (2)

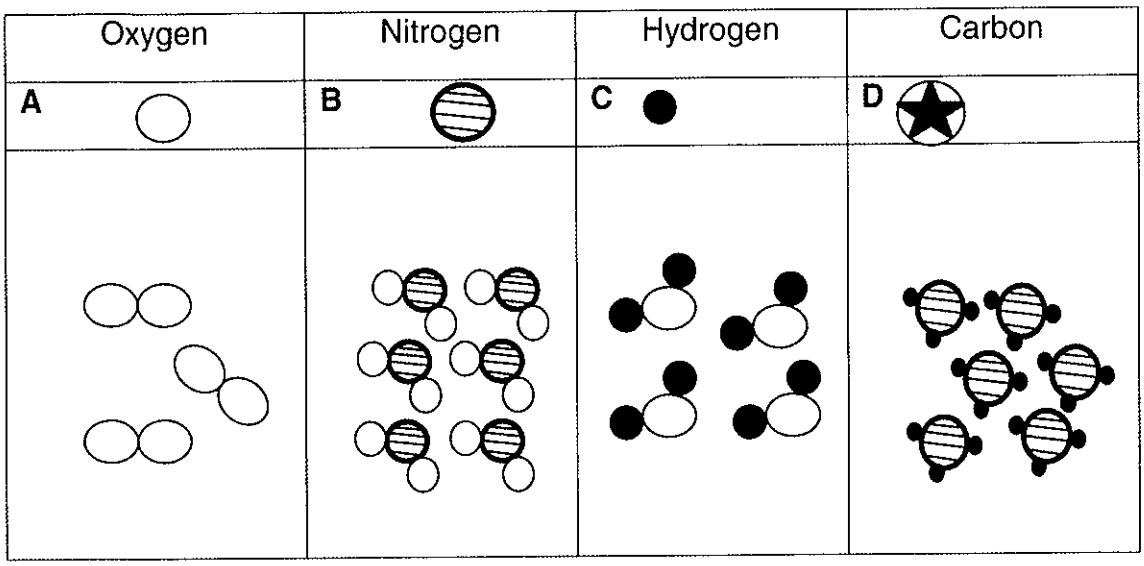
3.6.2 Point **Y** (2)

3.7 The above substance is not water. By referring to the diagram, explain why this curve does not represent water? (2)

3.8 What happens to the temperature of the substance during a PHASE CHANGE?
Write down only INCREASES, DECREASES or REMAINS THE SAME.
Give a REASON for the answer.
(2)
[17]

QUESTION 4

Study the following diagrams and then answer the questions set.



4.1 Name the substance in **B**. (2)

4.2 What type of bond exists between atoms in substance A? Explain the answer. (3)

4.3 Name a giant molecule that has carbon atoms ONLY. (1)

4.4 Draw a Lewis dot diagram for:

4.4.1 Substance **C** (2)

4.4.2 Substance **D** (2)

4.5 Write down the balanced equation for the formation of substance in **D**. (3)

[13]

QUESTION 5

5.1 Name the following compounds.

5.1.1 $Ca(NO_3)_2$ (2)

5.1.2 $MgBr_2$ (2)

5.2 Write down the chemical formulae for each of the following substances.

5.2.1 Perchlorate ion (2)

5.2.2 Ammonium Sulphate (2)

5.3 Balance the following equations:

5.3.1 $Al\ (s) + O_2\ (g) \rightarrow Al_2O_3\ (s)$ (2)

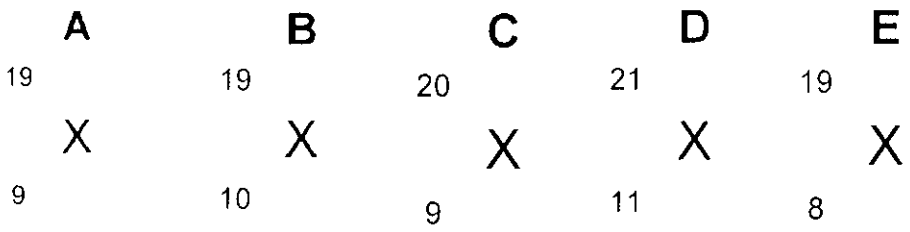
5.3.2 $C_3H_8\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (g)$ (2)

[12]

QUESTION 6

6.1 Define ***isotopes***. (2)

6.2 Study the unknown elements A to E:



6.2.1 Write down the letter(s) that represent(s) isotopes. (1)

6.2.2 Identify the element represented by this isotope. (2)

6.3 Complete the following table:
Write down the question number in your answer book, next to it, your answer.

Substance	Atomic number	Atomic mass	Number of protons	Number of neutrons	Number of electrons
Potassium	19	**6.3.1** ___	**6.3.2** ___	20	19
Sulphide ion	16	32	16	**6.3.3** ___	**6.3.4** _

(4)

6.4 Consider the chlorine element.

6.4.1 Write down the valency of chlorine element. (1)

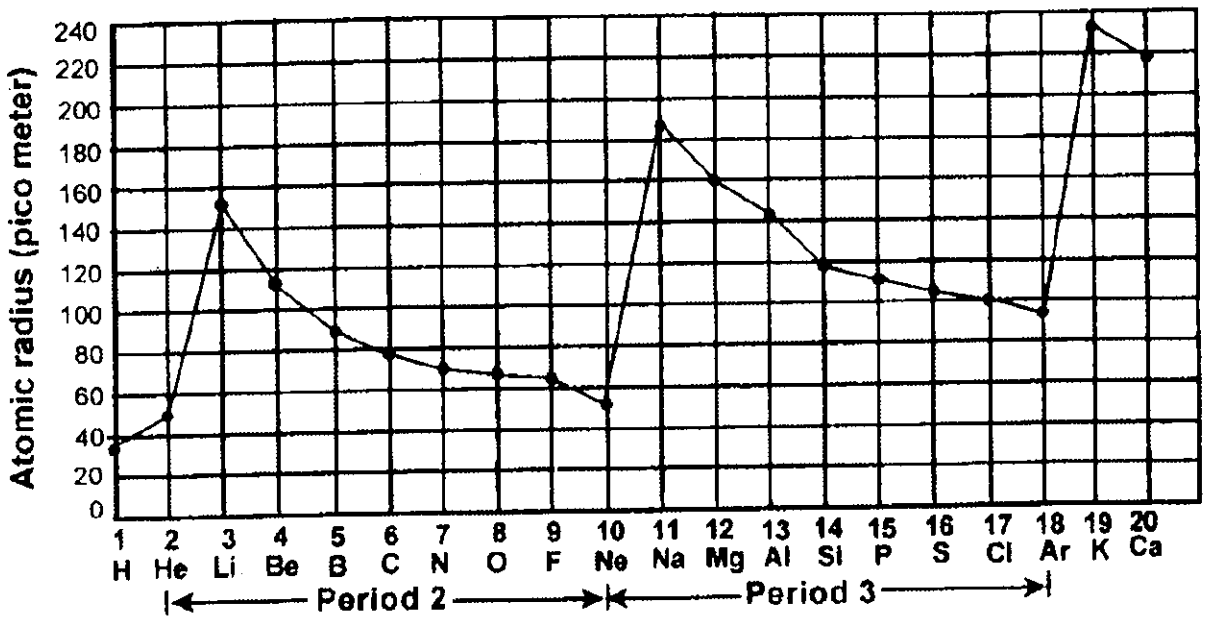
6.4.2 Draw an Aufbau diagram for chlorine element. (2)

6.4.3 Write down the name of the group where chlorine is found. (2)

[14]

QUESTION 7

The graph below shows the atomic radii for the first 20 elements.



Graph of atomic radius to atom number

7.1 Define *atomic radius*. (2)

7.2 By referring to the atomic radii from lithium to neon.

7.2.1 State the general trend (1)

7.2.2 Explain the trend (2)

7.3 What is the relationship between atomic radius and electronegativity moving across the period? (2)

[7]

QUESTION 8

8.1 Define electrical conductivity. (2)

8.2 Concentrated NaOH was added dropwise into distilled water and conductivity was recorded.

Drops of NaOH	Ammeter reading (mA)
0	0,00
1	7,50
2	15,00
3	22,25
4	30,00

8.2.1 Why does the ammeter read zero when 0 drops were added? (1)

Write down the following for the above investigation

8.2.2 Investigative question. (2)

8.2.3 Dependent variable. (1)

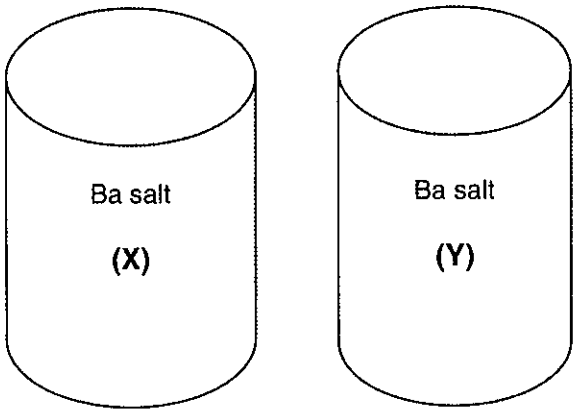
8.2.4 Draw conclusion about the relationship between number of drops and electrical conductivity. (2)

8.3 Which other physical property of solution would be dependent upon the number of drops? (1)

[9]

QUESTION 9

Each of the test tubes **X** and **Y** contains unknown precipitate of barium salts. One of the salts has carbonate ions and the other one has sulphate ions.



The following observations were made during a practical investigation to identify solutions in the test tubes

When nitric acid was added to each of the test tubes, the following observations were made.
The precipitate in test tube **X** dissolved and effervescence was seen in the test tube.
The precipitate in test tube **Y** did not dissolve.

9.1 Using the above information identify salt in test tube:

9.1.1 **X** (1)

9.1.2 **Y** (1)

9.2 Name the type of reaction that took place in test tubes **X** and **Y** before the addition of nitric acid. (1)

9.3 Now, consider test tube **X**

9.3.1 Name the substance responsible for effervescence in test tube X. (1)

9.3.2 Write down a balanced equation for the reaction taking place after the addition of nitric acid. (3)

[7]

QUESTION 10

10.1 An x g of Zinc granules was allowed to react with 25 cm^3 of 0,12 $mol \cdot dm^{-3}$ hydrochloric acid solution as shown in the equation below:
$2HCl\ (aq) + Zn\ (s) \longrightarrow ZnCl_2\ (aq) + H_2\ (g)$

10.1.1 Define *concentration*. (2)

10.1.2 Name the type of the above reaction. (1)

10.1.3 Calculate number of moles of hydrochloric acid. (3)

10.1.4 5 dm^3 of hydrogen gas was collected after the reaction was complete. Calculate the mass of zinc used in the reaction. (5)

10.2 Study the following reaction, and answer the questions that follow.
$2SO_2(g) + O_2(g) \longrightarrow 2SO_3\ (g)$

10.2.1 Define the Law of Conservation of mass. (2)

10.2.2 Is the above reaction a synthesis or decomposition reaction? Give a reason. (2)

10.2.3 By means of calculation, show that the above reaction as written obeys the law as stated in question 10.2.1 above. (3)

[18]

QUESTION 11

11.1 Define a ***Compound*** (2)

11.2 Calculate the percentage of chromium in $K_2Cr_2O_7$. (3)

11.3 An inorganic substance was analysed and found to be containing 65,31% of oxygen, 32,65% of Sulphur and **x** amount of hydrogen.

11.3.1 Define an ***empirical formula.*** (1)

11.3.2 Calculate the percentage of hydrogen element in the substance. (2)

11.3.3 Determine the empirical formula for the compound. (4)

11.4 6,257 g of hydrated copper sulphate was heated, and during heating the mass was recorded. The mass of the content was decreasing and after a while the mass remained unchanged at 4 g.

11.4.1 Give a reason why the mass decreased. (2)

11.4.2 Calculate the number moles of water in the original hydrated salt. (4)

[18]

TOTAL MARKS: [150]

FOR PHYSICAL SCIENCES
PAPER 2 (CHEMISTRY)
DATA SHEET

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Avogadro's constant	N_A	$6,02 \times 10^{23}$ mol^{-1}
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg
Molar gas volume at STP	V_m	22,4 dm^3·mol^{-1}
Standard temperature	T^θ	273 K
Standard pressure	p^θ	$1,013 \times 10^5$ Pa

TABLE 2: FORMULAE

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

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

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 **H** 1																	2 **He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**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**

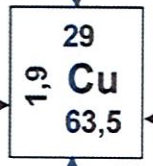
KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa



PHYSICS P2 Grades 10 & 11

education

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SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P2
(CHEMISTRY)

COMMON TEST

SEPTEMBER 2019

MARKING GUIDELINE

MARKS: 150

TIME : 2 hours

This marking guideline consists of 8 pages.

SECTION A

QUESTION 1

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 A ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

1.8 C✓✓ (2)

1.9 B ✓✓ (2)

1.10 C ✓✓ (2)

[20]

QUESTION 2

2.1.1 Heterogeneous mixture ✓ (1)

2.1.2 Homogeneous mixture ✓ (1)

2.2.1 Magnetism ✓✓ (2)

2.2.2 Density ✓✓ (2)

2.3.1 Liquid changes into gas ✓✓ (2)

2.3.2 Ethanol ✓ (2)
Ethanol boils first, therefore its forces of attraction need less energy✓.

2.4.1 Sunflower oil ✓, Less dense than water✓ (2)

2.4.2 Water ✓ (3)
Mass is directly proportional to the density✓, therefore water with higher density will have greater mass✓.

[15]

QUESTION 3

3.1 Sublimation is the change during which a solid changes directly into a gas without passing through an intermediate liquid phase.✓✓ (2)

3.2 Margarine absorbs (heat) energy✓, and forces of attraction within margarine will weaken/break. ✓ (2)

3.3 Cooling curve ✓ (1)

3.4.1 - Gaseous phase ✓ (1)

3.4.2 Liquid ✓
Solid ✓ (2)

3.5 Condensation ✓ (1)

3.6.1 - Closely packed ✓
- Regular shaped ✓ (2)

3.6.2 - irregular shaped✓
- closely packed but able to flow ✓ (2)

3.7 Boiling point and freezing point values are different to those of water ✓✓ (2)

3.8 Remains the same ✓
Energy absorbed is used to overcome forces of attraction ✓
Or No energy is available to increase kinetic energy (2)

[17]

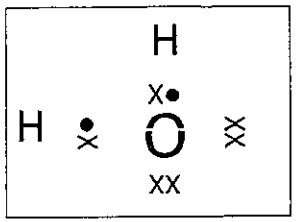
QUESTION 4

4.1 Nitrogen dioxide ✓✓ (2)

4.2 Covalent bonds ✓, oxygen atoms have the same electronegativity ✓ therefore share bonding electron pair equally. ✓ (3)

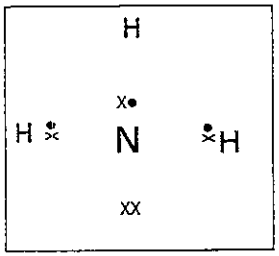
4.3 Diamond ✓ or graphite (1)

4.4.1 (2)



✓✓

4.4.2 (2)



✓✓

4.5 $3H_2 + N_2$ ✓→ $2NH_3$ ✓ Bal: ✓ (3)
[13]

QUESTION 5

5.1.1 Calcium nitrate ✓✓ (2)

5.1.2 Magnesium bromide ✓✓ (2)

5.2.1 ClO^-_4 ✓✓ (2)

5.2.2 $(NH_4)_2SO_4$✓✓ (2)

5.3.1 $4Al + 3O_2 \rightarrow 2Al_2O_3$ ✓✓ (2)

5.3.2 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ ✓✓ (2)

[12]

QUESTION 6

6.1 Atoms of the same element having the same number of protons, but different number of neutrons. ✓✓ (2)

6.2.1 A and C✓ (1)

6.2.2 Fluorine ✓✓ (2)

6.3.1 39 ✓ (1)

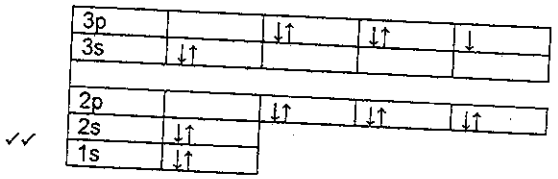
6.3.2 19 ✓ (1)

6.3.3 16 ✓ (1)

6.3.4 18 ✓ (1)

6.4.1 1 (one)✓

6.4.2



✓✓ (2)

6.4.3 Halogens ✓✓ (2)
[14]

QUESTION 7

7.1 Atomic radius is the distance from the centre of nucleus to the outermost shell. ✓✓ (2)

7.2.1 Atomic radius decreases ✓ (1)

7.2.2 The charge of nucleus (number of protons) increases ✓
The force of attraction between the nucleus and electrons increases. ✓ (2)

7.3 Electronegativity increases ✓whereas atomic radius decreases ✓ (2)
[7]

QUESTION 8

8.1 Electrical conductivity is the ability of material to conduct electricity. ✓✓ (2)

8.2.1 No ions in solution ✓ (1)

8.2.2 How does a change in the number of drops of NaOH affect electrical conductivity? ✓✓ (2)

8.2.3 electrical conductivity ✓ (1)

8.2.4 As the number of drops increases, the electrical conductivity of solution also increases. ✓✓ (2)

8.3 Concentration. ✓ (1)
[9]

QUESTION 9

9.1.1 $BaCO_3$ / Barium Carbonate✓ (1)

9.1.2 $BaSO_4$ / Barium sulphate ✓ (1)

9.2 Precipitate forming reaction ✓ (1)

9.3.1 Carbon dioxide ✓ (1)

9.2.3 $BaCO_3 + 2HNO_3$ ✓ $\rightarrow Ba(NO_3)_2 + H_2O + CO_2$ ✓ Bal: ✓ (3)
[7]

QUESTION 10

10.1.1 Concentration is the number of moles of solute per cubic decimeter of solution. ✓✓ (2)

10.1.2 Gas forming reaction / Metal-Acid reaction✓ (1)

10.1.3

$C = \frac{n}{V}$ ✓

$0,12 = \frac{n}{0,025}$ ✓

$n = 3,00\times10^{-3}\ mol$ ✓ (3)

10.1.4

$n = \frac{V}{V_M}$

$n = \frac{5}{22,4}$ ✓

$n = 0,2232\ mol$

$1mol\ H_2 : 1mol\ Zn$ ✓ ✓ BOTH

$n = \frac{m}{M_r}$

$0,2232 = \frac{m}{65}$ ✓

$m = 14,51g$ ✓ (5)

10.2.1 Law of conservation of mass states that in an isolated system mass cannot be created or destroyed, but changes from one form to another. ✓✓ (2)

10.2.2 Synthesis✓, two reactants combined to form one products✓ (2)

10.2.3 Mass of reactants = 2x32 +2x2x16 + 2x16 = 160 g•mol^{-1} ✓
Mass of products = 2x32 +3x2x16 = 160 g•mol^{-1} ✓
Mass of reactants = Mass of products, therefore law of mass is conserved ✓ (3)
[18]

QUESTION 11

11.1 Compound is a group of two or more different atoms that attract each other by relatively strong forces or bonds. The atoms combine in definite proportions. . ✓✓ (2)

11.2

$\%Cr = \frac{MrCr_2}{MrK_2CrO_7} \times 100\%$

$\%Cr = \frac{104}{294}$ ✓ $\times 100\%$ ✓

$\%Cr = 35,37\%$ ✓ (3)

11.3.1 The simplest whole-number ratio of atoms in a compound. ✓ (1)

11.3.2 %H = 100 – 65,31 – 32,65 = 2,04% ✓✓ (2)

11.3.3

	H	S	O	
Mass (g)	2,04	32,65	65,31	
M (g/mol)	1	32	16	
Mole = m/M	2,04	1.02	4,08	✓✓
Ratio	2	1	4	✓
	Empirical formula = H_2SO_4✓			

(4)

11.4.1 Water changes into gas ✓ and leaves the (system) ✓ (2)

11.4.2

	$CuSO_4$	H_2O	
Mass (g)	4	2,257	✓
M (g/mol)	159,50	18	
Mole = m/M	0,0251	0,125	✓✓
Ratio	1	5	✓

(4)
[18]

TOTAL MARKS: [150]