HARRISON UWATA GIRLS SECONDARY SCHOOL

FORM TWO EXAMINATION

032

CHEMISTRY

ANSWER

April, 2024

A student required to answer **all** questions from all sections **A, B** and **C**.

SECTION A: (15 Marks)

1. **Answers**

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
A	D	C	C	B	B	C	C	D	C

(10 marks)

2. **Answers**

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	E	D	G	A	C

(05 marks)

SECTION B: (70 Marks)

3. (a) Magnesium metal. **(02 marks)**

   (b) Magnesium oxide. **(02 marks)**

   (c) Magnesium + Oxygen gas $\xrightarrow{\text{heat}}$ Magnesium oxide **(03 marks)**

   (d) If white powdered material (magnesium oxide) will be dissolved in water will form magnesium hydroxide solution. Magnesium hydroxide solution is a basic solution which will turn red litmus paper to blue, and will have no action on blue litmus paper.

(03 marks)

4. (a) Zinc is the most preferred metal over other metals (like sodium, potassium) because it is less expensive and the evolution of hydrogen gas is easily controlled since the reaction is less explosive. **(02 marks)**

   (b) This is because the hydrogen gas produced contains impurities such as arsine, phosphine, hydrogen sulphide, sulphur dioxide, carbon dioxide, nitrogen dioxide and water vapour. **(02 marks)**

   (c) Limitations of hydrogen as a major source of energy.

   Storage: It is difficult to store hydrogen using simple containers since it may escape easily. The apparatus for storing hydrogen gas must be airtight. **(02 marks)**

   Safety: Hydrogen gas is a flammable gas. It should be kept away from open flames and high temperature. **(02 marks)**

   Production: The production of hydrogen gas in large scale is expensive. The raw materials and equipments can't be afforded easily. **(02 marks)**

5. (a) Impurities like common salt in water increase the boiling point of water to above $100\,^{\circ}$C. This happens because the presence of impurities decreases the number of water molecules available to be vaporized during boiling. **(03 marks)**

   (b) Two reasons for why people prefer potable water over distilled water for drinking are;

      - The salts present in our body could dissolve in distilled water and causing health problem.

      - Unlike distilled water, potable water has a pleasant taste and odour.

      - Potable water has dissolved matter like air, carbon dioxide and minerals which are absent in distilled water. **(@02 = 04 marks)**

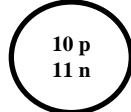   (c) Because pure water is neutral; it is neither acidic nor basic. **(03 marks)**

6. (a) Without controlling the entry, enough air will cause burning of wood and results into formation of ashes and not charcoal. **(02 marks)**

   (b) (i) Biogas is gaseous fuel derived from decomposing biological wastes. It mainly made of methane and carbon dioxide. **(02 marks)**

     (ii) Domestic and industrial wastes such as agricultural waste, sewage and animal waste. **(02 marks)**

     (iii) Biogas is produced by fermentation of organic matter including manure and other wastes. **(02 marks)**

     (iv) • It keeps the environment clean

        • It is a renewable energy source.

        • Helps in control of air pollution by decomposing sewage, animal dung and human excrete.

        • The waste from the biogas digester has high nutrient content, making it an ideal fertilizer. **(@01 = 02 marks)**

7. (a) (i) 10 electrons (ii) 10 protons (iii) 11 neutrons (iv) $_{10}^{21}$Ne (v) (⊙ 10 p / 11 n) **(05 marks)**

   (b) **DATA**

      ➢ Isotopes of hydrogen; Protium ($_1^1$H), Deuterium ($_1^2$H) and Tritium ($_1^3$H).

      ➢ The percentage abundance of Protium = 98.9 %.

      ➢ The percentage abundance of Deuterium = ten times that of Tritium.

      ➢ The relative atomic mass of hydrogen = Required **(01 mark)**

   First step: To find the percentage abundance of Deuterium and Tritium

   The percentage abundance of Deuterium and Tritium = 100% - 98.9% = 1.1%

   But; D = 10 T …………………………………………… (i)

   D + T = 1.1 ………………………………………….... (ii) **(01 mark)**

   Solving equation (i) and (ii) simultaneously, we have D = 1 and T = 0.1

   The percentage abundance of Deuterium (D) and Tritium (T) are respectively 1% and 0.1 %. **(01 mark)**

Second step: To find the relative atomic mass of hydrogen.

From the formula:

Relative atomic mass, R.A.M = Sum of isotopic mass x Percentage abundance

(01 mark)

$$R.A.M = [\ 1 \ x \ \frac{98.9\%}{100\%}\ ] + [\ 2 \ x \ \frac{1\%}{100\%}\ ] + [\ 3 \ x \ \frac{0.1\%}{100\%}\ ]$$

$$R.A.M = \frac{98.9 + 2 + 0.3}{100} = \frac{101.2}{100} = 1.012$$

Therefore, the relative atomic mass of hydrogen = 1.012 **(01 mark)**

8. (a) Below are the reasons on how hydrogen resembles with group VII elements.
   - Like group VII elements, hydrogen combines with metals
   - Like group VII elements, hydrogen forms uni-negative ion.
   - Like group VII elements, hydrogen gains one electron to become stable.
   - Like group VII elements, the valency of hydrogen is 1.   **(@01 = 03 marks)**

   (b) (i) A cation has small size than its parent atom because when electrons are
   removed the remaining fewer electrons in a cation experience stronger
   nuclear attractive forces due to weaker electron-electron repulsion.   **(02 marks)**

   (ii) An anion has large size than its parent atom because the addition of electron
   increases the size of the electron cloud and hence the electron-electron
   repulsion increases.   **(02 marks)**

   (c) (i) Metallic character decrease across the period from left to right. Because, the number
   of electrons in the valence shell increases. Therefore, the tendency of atoms to gain
   electrons and fill the valence shell increases.   **(01 mark)**

   (ii) Electronegativity increases from left to right across the period.
   Because, the effective nuclear charge increases across the period due to
   increase in the number of protons across the period.   **(01 mark)**

   (iii) Ionization energy decrease down the group.
   Because; the atomic size increases caused by increase in the number of
   shells. Hence the electron distance from the nucleus increase, this lowers
   the attraction for the electrons.   **(01 mark)**

9. (a)

(i) $Al_2(\underline{S}O_4)_3$	(ii) $Ca_3(\underline{P}O_4)_2$

3S + (+3 x 2) + (-2 x 12) = 0
 3S + (+6) + (-24) = 0
 3S + 6 - 24 = 0
 3S = +18
  S = +6   **(03 marks)**
	2P + (+2 x 3) + (-2 x 8) = 0
	 2P + 6 – 16 = 0
	 2P – 10 = 0
	 2P = +10
	  P = +5 **(03 marks)**

(b)

S/N	Valency	Oxidation state
(i)	It is the combining power of an atom	It is the total number of electrons that an atom either gains, shares or loses in forming a compound
(ii)	It is fixed value	It is arbitrary assigned value (it may vary).
(iii)	It is not assigned with charge	It is assigned with charge (positive or negative).
(iv)	A free element has valency which is not zero	A free element has zero oxidation state.
(v)	It does not change relative to each other	It changes relative to other elements in a compound.
(vi)	Always whole numbers. Cannot be fraction.	Fraction values are possible. *Example;* oxidation state of oxygen in superoxides (hyperoxides) KO_2, RbO_2, CsO_2 and FrO_2 is $-\frac{1}{2}$

(@01 = 04 marks)

SECTION C: (15 Marks)

10. (a) Because distilled water (deionized water) it does not contain impurities like dissolved ions. The impurities interferes different chemical tests via side reactions.   **(03 marks)**

(b) **1st stage: Coagulation and flocculation**
Chemicals such as aluminium sulphate, iron(III) sulphate, or sodium aluminate are added in water to bind together small particles in water and form flocs.

2nd stage: Sedimentation
It involves settling of flocs (large solid clusters) to the bottom of the reservoir by gravity due to its weight.

3rd stage: Filtration
Very small and dissolved particles such as bacteria, other organisms, dust, and some of the chemicals are removed after water passes through the filter.

4th stage: Disinfection
Disinfectants such as chlorine, sodium hypochlorite, or ozone are added in water so as to kill any remaining microorganisms such as bacteria, hence protect the water from germs when is piped/pumped for consumption.

5th stage: Storage: After disinfection, water is stored in tanks.

6th stage: Supply: Water is supplied to consumers ready for being used for different purposes; domestically, in recreation and economic activities.   **(@02 = 12 marks)**