

Suggested Answers to 2019 O level Science Chemistry 5076/5078 Paper 3

Section A

1a) carbon monoxide

1b) calcium hydroxide/calcium oxide

1c) yeast

1d) hydrogen

2)

Property	Proton	Neutron	Electron
Relative mass	1	1	1/1840
Relative charge	+1	No charge	-1

3a) Boiling point

3b) The water in the outer jacket of the condenser keeps the condenser cool so that vapour that travels down the condenser can condense back into liquid and be collected.

3c) Petrol fraction consists of a mixture of hydrocarbons. Hence, it boils over a range of temperature.

3d) 1. Naphtha

2. kerosene

Accept any liquid fractions

3e) (i) Chloride ion

(ii) Water

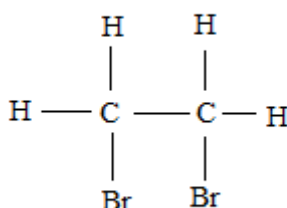
4a)

Particle	Number of		
	Protons	Neutrons	Electrons
A chlorine atom ^{37}Cl	17	20	17
A chlorine ion $^{35}\text{Cl}^-$	17	18	18

- 4b) 1. When chlorine is above its boiling point, the molecules are far apart. However, when chlorine is below its melting point, the molecules are closely packed in a regular arrangement.
2. When chlorine is above its boiling point, the molecules are moving randomly in all directions at high speed. However, when chlorine is below its melting point, the molecules can only vibrate about their fixed positions.

- 5a) (i) A: Ethene, C_2H_4
 B: Ethane, C_2H_6
- (ii) $\text{C}_2\text{H}_4\text{Br}_2$
- (iii) Polyethene
- (iv) Polyethene is a plastic which is non-biodegradable. Hence, disposal of D involves incineration which would cause poisonous gas to be emitted to the surrounding, causing pollution problem.

5b) (i)



- 5b) (ii) $\text{C}_2\text{H}_4 (\text{g}) + \text{H}_2 (\text{g}) \rightarrow \text{C}_2\text{H}_6 (\text{g})$ OR
 $\text{C}_2\text{H}_4 (\text{g}) + \text{Br}_2 (\text{aq}) \rightarrow \text{C}_2\text{H}_4\text{Br}_2 (\text{l})$

6a) 12

6b) Group II

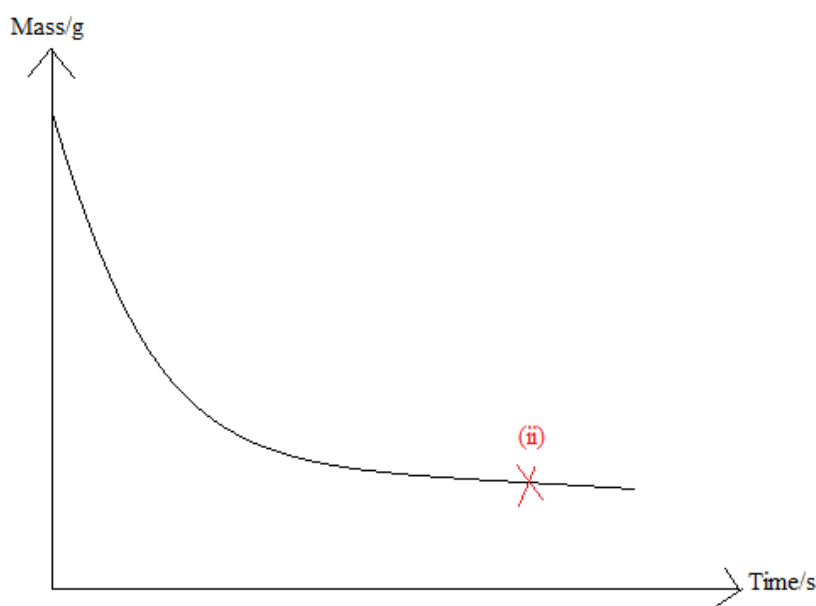
Period 3

6c) (i) Elements in the same group have the same number of valence electrons. The number of valence electrons determine the chemical properties of an element. Thus, members of the same group have similar chemical properties.

6c) (ii) Chloride: ZCl_2

Sulfate: ZSO_4

7a)



7b) (i) The speed of reaction is the fastest at the start of the reaction as seen by the steepest gradient of the graph as the reacting particles are present in highest concentration. The speed of reaction slows down as the reaction proceeds as seen by the gentler gradient of the graph. This is because some reacting particles get used up. The reaction stops when hydrochloric acid is used up and this is seen by a horizontal line (plateau) in the graph.

7c) Calculate the total mass lost from the reaction and divide it by the total time taken for the reaction. We will get the average speed in g/s.

Section B

- 8a) (i) Nickel is a good conductor of heat and is ductile.

Accept any 2 physical properties of metals: Malleable, high melting and boiling point, good conductor of heat, etc

- 8a) (ii) Test for hydrogen: Place a lighted splint at the mouth of the test tube. If hydrogen is present, the lighted splint will extinguish with a pop sound.

Test for oxygen: Place a glowing splint into the test tube containing the gas. If oxygen is present, it will relight the glowing splint.

- 8b) In the Mond process, only pure nickel would react with carbon monoxide to produce nickel carbonyl, leaving the impurities behind. Pure nickel is obtained from the decomposition of nickel carbonyl and the carbon monoxide impurities that are produced escaped into the air, thus separating pure nickel from its impurities.

- 8c) (i) No. of moles of $\text{Ni}(\text{CO})_4 = 1000 / (59 + 12 \times 4 + 16 \times 4) = 5.8479 \text{ mol}$

No. of moles of Ni = No. of moles of $\text{Ni}(\text{CO})_4 = 5.8479 \text{ mol}$

Mass of Ni = $5.8479 \times 59 = 345.029\text{g}$

$\approx 345\text{g}$

- 8c) (ii) No. of moles of CO = $4 \times$ No. of moles of Ni = $5.8479 \times 4 = 23.3916 \text{ mol}$

Vol. of CO = 23.3916×24

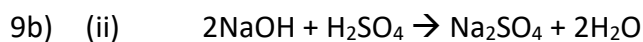
= 561.3984 dm^3

$\approx 561 \text{ dm}^3$

- 9a) 1. Acids react with reactive metal to form salt and hydrogen gas.
2. Acids react with carbonate to form salt, carbon dioxide and water.

Accept: Acids react with base to form salt and water

- 9b) (i) Pipette 25.0cm³ of sodium hydroxide into a conical flask and add one or two drops of phenolphthalein indicator into the flask. Solution should turn pink. Fill a burette with sulfuric acid. Carefully titrate the sodium hydroxide with sulfuric acid until the one drop of sulfuric acid changes the solution colour from pink to colourless permanently. Record the volume of sulfuric acid needed for neutralisation. Repeat the titration without the indicator, adding this volume of sulfuric acid to the sodium hydroxide to obtain pure sodium sulfate solution.



- 9c) (i) No. of moles of NaOH = 3 x 4
= 12 mol

$$\text{Mass of NaOH} = 12 \times (23 + 16 + 1) = 480\text{g}$$

- 9c) (ii) No. of moles of H₂SO₄ = 12/2 = 6 mol

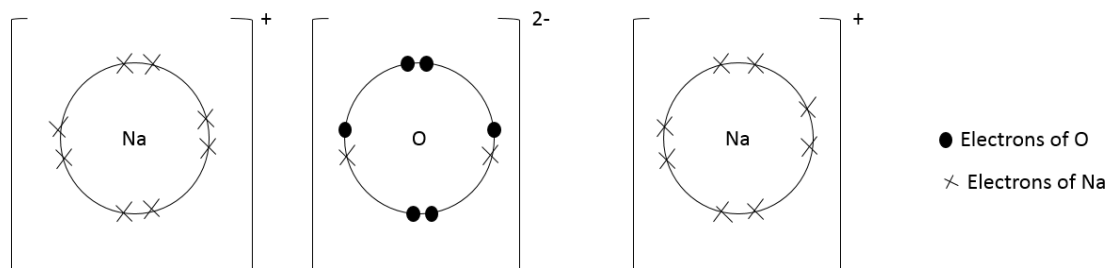
10a) 1. A mixture does not have fixed composition of substances but a compound has a fixed composition of substances.

2. A mixture can be separated by physical means but a compound can only be separated by chemical means.

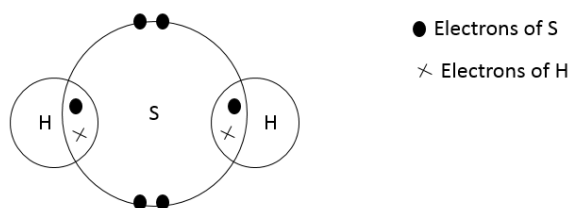
Accept: A mixture has same properties as its constituents but a compound has different properties from its constituents OR

A mixture is made up of two or more substances physically combined but a compound is made up of two or more elements chemically combined.

10b) Sodium oxide



Hydrogen sulfide



10c) (i) Solid sodium oxide has a giant lattice structure with strong electrostatic forces of attraction between the ions. The ions are held in fixed position and there are no free moving ions that can act as charge carrier to conduct electricity. Gaseous hydrogen sulfide has a simple molecular structure and there are no mobile ions or electrons that can act as charge carrier to conduct electricity.

10c) (ii) In the molten state, the giant lattice structure is broken down, the ions are free to move to act as charge carrier to conduct electricity.