



2016 O level Science CHEMISTRY 5076/ 5077/ 5078 Paper 3 Suggested Answers

- 1**
- i** Filter funnel (1m)
 - ii** Burette (1m)
 - iii** Gas syringe (1m)
 - iv** Pipette (1m)
 - v** Simple distillation (1m)
 - vi** 100°C (1m, must include units)
 - vii** To provide a cool surface to condense the vapour into liquid. (1m)
 - viii** A contains sodium chloride (salt) solution as only the white sodium chloride will be left behind after all water has evaporated. (1m)
B contains pure water as the water will all evaporate upon heating, leaving no residue behind. (1m)
- 2**
- i** G (1m)
 - ii** E (1m)
 - iii** D (1m)
 - iv** F & G (1m)
 - v** H (1m)
- 3a** Elements in the periodic table are arranged in increasing atomic number/proton number. (1m)
- 3b**
- i** Within a group, the number of valence/outermost shell electrons will always be constant. (1m)
 - ii** Within a period, the number of electron shells will always be constant. (1m)
- 3c** All the elements in Group II contain 2 valence electrons and valence electrons are the ones responsible for their chemical properties.
- 3d** Group VI: Oxygen Group I: Lithium Group II: Magnesium
Lithium oxide (Li₂O) (1m, accept any other compounds containing Group I and Group VI elements)
Magnesium oxide (MgO) (1m, accept any other compounds containing Group II and Group VI elements)
- 4**
- a** Add each metal into a beaker of sulphuric acid separately. The beaker in which the most vigorous effervescence is observed would be the most reactive metal. (1m)
 - b** Test for copper (II) ions:
Add aqueous sodium hydroxide (1m). If a blue precipitate which is insoluble in excess is observed, we can conclude that that solution contains copper (II) ion (1m).
OR
Add aqueous ammonia solution (1m). If blue precipitate formed is soluble in excess aqueous ammonia forming a dark blue solution, copper (II) ion is present (1m).

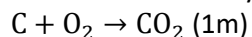


- 5a** i $\text{Conc. of J} = \frac{196}{200 \div 1000} = 980 \text{ g/dm}^3$
ii $\text{Conc. of J} = \frac{980}{98} = 10 \text{ mol/dm}^3$
- 5b** i Acid J is sulphuric acid, H_2SO_4 and does not contain carbonate anions (1m).
Sulphuric acid will react with barium nitrate to form barium sulphate, not barium carbonate.
ii Barium sulphate (1m)
iii $\text{H}_2\text{SO}_4(\text{aq}) + \text{Ba}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HNO}_3(\text{aq})$
(1m – Correct chemical formula)
(1m – Balanced equation)
(1m – Correct state symbols)
- 6a** An exothermic reaction means that heat energy is released (1m) during the reaction process as the energy level of reactants is higher than that of the products. Enthalpy is negative.
- 6b** Clean energy refers to energy produced from renewable resources without producing air pollutants (1m). Thus, it will not cause harm to the environment and human health (1m).
- 6c** i Mr of $\text{Fe}_2\text{SiO}_4 = 2(56) + 28 + 4(16) = 204$ (1m)
ii $n(\text{H}_2) = \frac{1000}{2} = 500 \text{ mol}$ (1m)
 $\text{H}_2 : \text{Fe}_2\text{SiO}_4 = 2 : 3$
 $n(\text{Fe}_2\text{SiO}_4) = \frac{500}{2} \times 3 = 750 \text{ mol}$
Mass of $\text{Fe}_2\text{SiO}_4 = 750 \times 204 = 153000 \text{ g}$ (1m)
iii Vol. of $\text{H}_2 = 500 \times 24$ (1m) = 12000 dm^3 (1m)
- 7a** i Ethene, C_2H_4 (1m)
ii Methane, CH_4 (1m)
iii Dibromoethane, $\text{C}_2\text{H}_4\text{Br}_2$ (1m)
iv Chloromethane, CH_3Cl (1m)
v Carbon dioxide, CO_2
Water, H_2O (1m)
- 7b** $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$; or
 $\text{C}_2\text{H}_4 + \text{Br}_2 \rightarrow \text{C}_2\text{H}_4\text{Br}_2$
(1m – Correct chemical formula)
(1m – Balanced equation)

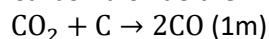


8a Steel (1m). Steel is preferred in comparison with pure iron as it is stronger (1m).

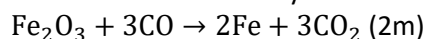
8b i Coke reacts with oxygen in hot air to form carbon dioxide.



Carbon dioxide then reacts with more coke to form carbon monoxide.



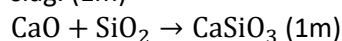
Haematite is reduced by carbon monoxide to form pure molten iron.



ii Limestone undergoes decomposition to form calcium oxide. (1m)



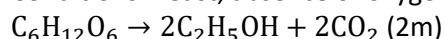
Calcium oxide then reacts with the acidic impurities, such as sand, to form molten slag. (1m)



9a i Fermentation (1m)

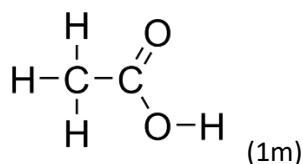
Reactant: Glucose

Conditions: Yeast, absence of oxygen, calcium hydroxide/limewater (2m)



ii If temperature is higher than 45°C, the enzymes in the yeast will denature, causing the reaction process to slow down to a stop. (1m)

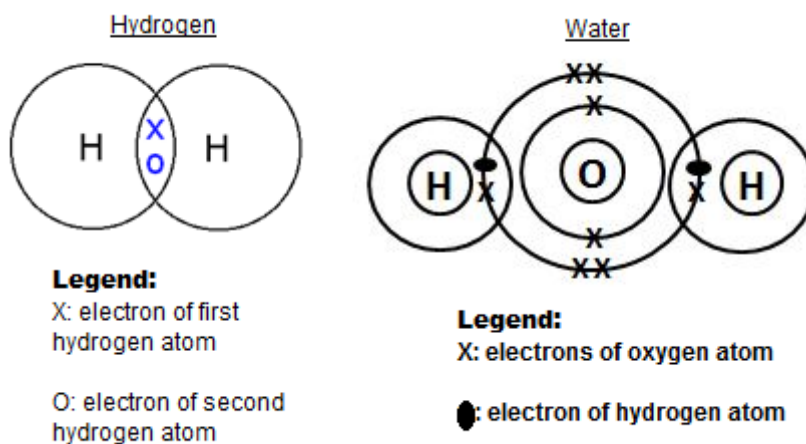
9b



Propanol has been oxidised (1m) due to a gain in oxygen atom to form ethanoic acid (1m).



10a i



(1m – Correct diagram)

(1m – Legend/key)

- ii In both hydrogen and water, the hydrogen and oxygen atoms share their valence electrons (1m) to achieve the full electronic configuration which is similar to that of helium and neon respectively (1m).

10b

- i H^+ and Cl^- (1m)
pH1 (strong acid) (1m)
- ii An aqueous solution of hydrogen chloride contains hydrogen ions and is thus, acidic. Conversely, an aqueous solution of sodium hydroxide contains hydroxide ions. Hence, it is alkaline. The hydrogen ions will then react with the hydroxide ions (1m) to form water (1m), a neutralised product.