GCE O' LEVEL COMBINED SCIENCE (CHEMISTRY) (5076/03)
Suggested Answers for 2016 O Level
Combined Science (Chemistry) Paper 3

Section A (45 M)

1a)	i)	Filter funnel	1
	ii)	Burette	1
	iii)	Gas syringe	1
	iv)	Pipette	1
b)	i)	Simple Distillation	1 No marks awarded for fractional distillation or distillation
	ii)	100^oC	1
	iii)	To absorb heat from the water vapor so that the water vapor can condense.	1
	iv)	The sample from A is sea water and after evaporating to dryness will leave behind salt as the white solid.	1
		The sample from B is pure water and as a result leaves behind no residue when evaporated completely.	1
2a)	G		1
b)	E		1
c)	D		1
d)	F and G		1
e)	H		1
A3a)	They are arranged in increasing proton number		1
b)	i)	They have the same number of valence electrons	1
	ii)	They have the same number of electron shells.	1
c)	Elements in group II have all have 2 electrons in its outer shell and hence has the same chemical properties.		1
d)	i)	Sodium oxide, Na_2O (or other relavant group I and group VI compound with the formula X_2Y)	1
	ii)	calcium oxide, CaO (or other relavant group II and group VI compound with the formula XY)	1

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4a) Add each of these metals into 3 different beakers of dilute sulfuric acid. The most reactive of these 3 metals will show an effervescence of hydrogen gas. 1

b) Add aqueous sodium hydroxide drop-wise into each of the 3 metal nitrate solutions until no further change is seen. 1
A blue precipitate that does not dissolve in excess sodium hydroxide is seen in the nitrate solutions containing copper(II) ions 1

5a) i) Mass concentration = $\frac{196}{200/1000}$ = 980g/dm^3 1

ii) Mol concentration = $\frac{980}{98}$ = 10 mol/dm^3 1

b) i) Any barium carbonate formed will be reacted away by the acid added. 1

ii) Barium sulfate 1

iii) $H_2SO_4(aq) + Ba(NO_3)_2(aq) \rightarrow BaSO_4(s) + 2\ HNO_3(aq)$

1m for identifying sulfuric acid
1m for balanced equation
1m for state symbols

6a) A reaction in which the amount of energy released in forming bonds is more than the amount of energy absorbed when breaking bonds. 1

b) Clean energy refers to energy that comes from a source that does not produce any air pollutants or 1
greenhouse gases such as carbon dioxide. 1

c) i) Relative formula mass = 2(56) + 28 + 4(16) = 204 1

ii) No of moles of hydrogen = $\frac{1000}{2}$ = 500 mol 1

No of moles of fayalite = $\frac{500}{2} \times 3$ = 750 mol

Mass of fayalite = 750 x 204 = 153 000g or 153 kg 1

iii) Volume of hydrogen = 500 x 24 1

= 12 000 dm^3 1

7a) L : Ethene
M: Methane
N: Dibromo-ethane
O: chloro-methane
P: carbon dioxide and water

1m each

b) $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$
$CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$
$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$
$C_2H_4 + 3\ O_2 \rightarrow 2\ CO_2 + 2\ H_2O$

Any 1
1m for equation
1m for balancing

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Section B (20M)

8a) Steel. 1

Steel is harder and stronger than iron as the different size atoms in steel disrupt the orderly arrangement and prevent layers from sliding past one another. 1

b) i) Coke, haematite and limestone are added into the blast furnace.

$C + O_2 \rightarrow CO_2$ 1

Firstly, coke burns in oxygen to form carbon dioxide

$CO_2 + C \rightarrow CO$ 1

Carbon dioxide then burns in more coke to form carbon monoxide

$Fe_2O_3 + CO \rightarrow Fe + CO_2$ 1

Iron(III) oxide in haematite is **reduced** by carbon monoxide to form molten iron and carbon dioxide. The **molten iron** is then removed from the blast furnace at the bottom. 1

ii) $CaCO_3 \rightarrow CaO + CO_2$ 1

Limestone which is calcium carbonate **decomposes** into calcium oxide and carbon dioxide. 1

$CaO + SiO_2 \rightarrow CaSiO_3$ 1

Basic calcium oxide reacts with **acidic impurities** such as silicon dioxide found in haematite to form calcium silicate which is **molten slag.** 1

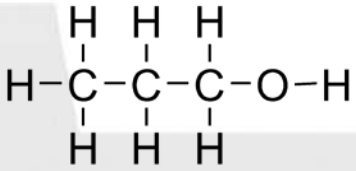
9a) i) Fermentation 1

Substances needed: Glucose, yeast 2

$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$

1m for equation
1m for balancing

ii)



1

C_2H_5COOH 1

The propanol has been oxidised 1

because it gains an oxygen to form propanoic acid 1

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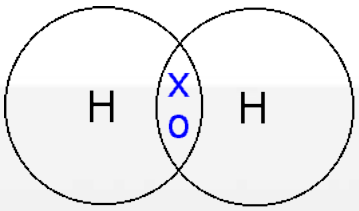
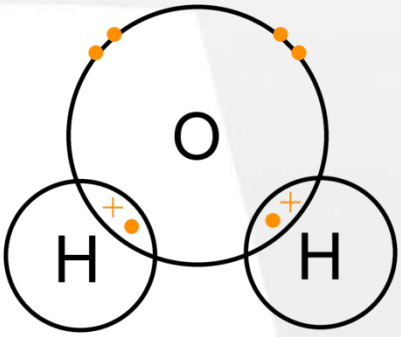
10a) i) Hydrogen



1m for shared electrons
1m for unshared electrons

Water



1m for shared electrons
1m for unshared electrons

ii) Helium and Neon have <u>stable noble gas electronic structures</u> and when drawing the 'dot and cross' diagrams of hydrogen and water, the <u>hydrogen atom will share electrons to achieve the stable noble gas structure of helium</u> while <u>oxygen atoms</u> in water will <u>share electrons with hydrogen to achieve the stable noble gas structure of neon</u>. 1 1

b) i) H^+ and Cl^- 1
pH: 1 or 2 1

ii) Sodium hydroxide <u>dissociates</u> into <u>sodium and hydroxide ions</u> when dissolved in water. 1
The <u>hydrogen ions</u> from hydrogen chloride are then neutralised by the <u>hydroxide ions</u> from sodium hydroxide to form a <u>neutral substance which is water.</u> 1

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