CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2015 series

0620 CHEMISTRY

0620/32 Paper 3 (Extended Theory), maximum raw mark 80

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1 **(a)** chlorine / argon [1]

(b) chlorine [1]

(c) magnesium [1]

(d) argon [1]

(e) aluminium [1]

(f) sodium [1]

[Total:6]

2 **(a)** Atoms of the same element / atoms with same proton number / atoms with same atomic number [1]

different neutron number / nucleon number / mass number [1]

(b)

particle	number of protons	number of electrons	number of neutrons	nucleon number	symbol or formula
A					
B				23 (1)	Na^{+} (1)
C		10(1)		16(1)	
D	13 (1)		15 (1)		

[7]

[Total:9]

3 **(a)** (making) fertilisers / nitric acid / nylon / explosives / urea
(for) cleaning products (allow oven cleaner) / refrigeration [1]

(b) equilibrium / reversible [1]

(c) (nitrogen)air / atmosphere [1]

(hydrogen) methane / water / steam / alkane / named alkane / hydrocarbon / crude oil or petroleum / natural gas [1]

(d) iron [1]

(e) **(i)** rate increases / faster [1]

More (effective) collisions [1]

(ii) yield decreases [1]

(forward reaction) exothermic / reverse reaction endothermic / high temp favours endothermic reaction [1]

(f) **(i)** yield increases [1]

less / fewer molecules or moles or volume on RHS ORA / high pressure favours reaction which produces fewer molecules or moles or volume [1]

(ii) particles / molecules clos**er** / more particles per unit area or volume / more molecules per unit area or volume / more concentration / particles have less space between them **and** more collisions [1]

(iii) safety issues / higher cost [1]

(g) 3 bond pairs between N & H [1]

Lone pair on N [1]

(h) **(i)** proton / H^+ acceptor [1]

(ii) $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ [2]

Formula of $(NH_4)_2SO_4$ (1)
The rest (1)

[Total:18]

4 (a) (i) 82.76/12 and 17.2(4)(/1)
or evaluation: 6.89 / 6.9(0) and 17.2(4) [1]

C_2H_5 [1]

OR
82.76 / 100 × 58 = 48 and 17.24 / 100 × 58 = 10
or evaluation i.e. 48 and 10 [1]

C_2H_5 [1]

(ii) (C_2H_5 =) 29 [1]

(58 / 29 =2) C_4H_{10} [1]

OR:
82.76 / 100 × 58 = 48 and 17.24 / 100 × 58 = 10
or evaluation i.e. 48 and 10 [1]

48 / 12 = 4 10 / 1 = 10 (therefore) C_4H_{10} [1]

(b) (i) C_nH_{2n} [1]

(ii) CH_2 [1]

(c) (contains) double bond / triple bond / multiple bond(s) / not all bonds are single [1]

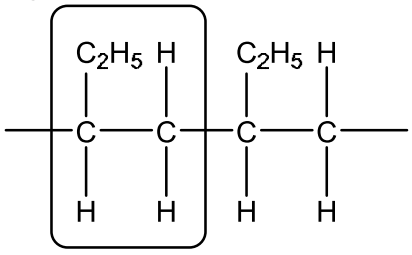
(contains) carbon and hydrogen **only** [1]

(d) bromine / bromine water [1]

no change / stays brown / orange / yellow / red-brown or only changes in UV [1]

(brown / orange / yellow) to colourless / decolourised [1]

(e) (i) circle / brackets around any 2 consecutive carbon atoms in the main chain and all attached atoms [1]
e.g.



(ii) $CH_3CH_2CH=CH_2$ / $C_2H_5CH=CH_2$ (double bond must be shown) [1]

butene / but-1-ene [1]

(iii) $(CH_3)_2C=CH_2$ / $CH_3CH=CHCH_3$ / $(CH_2)_2CHCH_3$ / $(CH_2)_4$ [1]

[Total:15]

5 **(a)** Bauxite [1]

(b) carbon / graphite [1]

(c) improves conductivity / better conductor [1]

Lower (operating) temperature / save energy / saves electricity / saves heat [1]

(d) anode: $2O^{2-} \rightarrow O_2 + 4e^-$ / $2O^{2-} - 4e^- \rightarrow O_2$ [1]

cathode: $Al^{3+} + 3e^- \rightarrow Al$ / $Al^{3+} \rightarrow Al - 3e^-$ [1]

(e) **(i)** Iron carbon aluminium / Fe, C, Al [1]

(ii) Aluminium oxide is not reduced by carbon but iron(III) oxide is [1]

(f) haematite / hematite [1]

(g) **Allow:** multiples in **(i)** to **(iv)**

(i) $C + O_2 \rightarrow CO_2$ [1]

(ii) $CO_2 + C \rightarrow 2CO$ [1]

(iii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ / $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ / $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ [1]

(iv) $CaO + SiO_2 \rightarrow CaSiO_3$ / $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$ [1]

[Total:13]

6 **(a)** Any **two** from:

- bubbles / effervescence / fizzing
- (some of the) solid / copper carbonate dissolves / disappears **or** some (brown) solid seen (undissolved)
- (colourless) solution or liquid turns blue [2]

(b) filter / centrifuge / decant [1]

wash with (distilled) water [1]

(dry with) filter paper / tissues / warm windowsill / in sun / oven / fan / heat [1]

(c) (i) Blue precipitate / ppt [1]

(ii) $Cu^{2+} + 2OH^{-} \rightarrow Cu(OH)_2$ [1]

(d) (i) $Cu(OH)_2\,(s) \rightarrow CuO\,(s) + H_2O\,(g)$

Equation [1]

State symbols of correct chemical equation [1]

(ii) carbon / hydrogen [1]

[Total:10]

7 (a) Any **two** from:
yeast / 20–40 °C / anaerobic or without oxygen or without air / (aqueous) solution or water or aqueous [2]

(b) (i) Mr = 180 (1) (30/180) = 0.167 (1) [2]

(ii) 2×0.167 or 2×46 or 0.333 or 92 [1]

$(2 \times 0.167 \times 46) = 15.3(33)$ (g) [1]

(iii) $(2 \times 0.167 \times 24) = 8\ (dm^3)$ [1]

(c) (i) Crude oil / petroleum [1]

(ii) $C_2H_4 + H_2O \rightarrow C_2H_5OH$ / CH_3CH_2OH [1]

[Total:9]