

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) ⁺ (1)
C		10(1)		16(1)	
D	13 (1)		15 (1)		

[7]

[Total:9]

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- 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 OR / high pressure
favours reaction which produces fewer molecules or moles or volume [1]
(ii) particles / molecules closer / 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) $2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ [2]

Formula of (NH₄)₂SO₄ (1)
The rest (1)

[Total:18]

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- 4 (a) (i) 82.76/12 and 17.2(4)/(1)
or evaluation: 6.89 / 6.9(0) and 17.2(4) [1]
- C₂H₅ [1]
- OR**
82.76/100 × 58 = 48 and 17.24/100 × 58 = 10
or evaluation i.e. 48 and 10 [1]
- C₂H₅ [1]
- (ii) (C₂H₅ =) 29 [1]
- (58/29 = 2) C₄H₁₀ [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) C₄H₁₀ [1]
- (b) (i) C_nH_{2n} [1]
- (ii) CH₂ [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.
- The diagram shows the structural formula of butane, CH₃CH₂CH₂CH₃. The first two carbon atoms and their attached groups are enclosed in a rectangular box. The first carbon atom is bonded to a C₂H₅ group and a hydrogen atom. The second carbon atom is bonded to a hydrogen atom and another hydrogen atom. The third carbon atom is bonded to a C₂H₅ group and a hydrogen atom. The fourth carbon atom is bonded to a hydrogen atom and another hydrogen atom.
- (ii) CH₃CH₂CH=CH₂ / C₂H₅CH=CH₂ (double bond must be shown) [1]
- butene / but-1-ene [1]

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(iii) $(\text{CH}_3)_2\text{C}=\text{CH}_2 / \text{CH}_3\text{CH}=\text{CHCH}_3 / (\text{CH}_2)_2\text{CHCH}_3 / (\text{CH}_2)_4$ [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: $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^- / 2\text{O}^{2-} - 4\text{e}^- \rightarrow \text{O}_2$ [1]

cathode: $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al} / \text{Al}^{3+} \rightarrow \text{Al} - 3\text{e}^-$ [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) $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ [1]

(ii) $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$ [1]

(iii) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2 / \text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO} /$
 $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$ [1]

(iv) $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3 / \text{CaCO}_3 + \text{SiO}_2 \rightarrow \text{CaSiO}_3 + \text{CO}_2$ [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]

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

- (d) (i) $\text{Cu}(\text{OH})_2(\text{s}) \rightarrow \text{CuO}(\text{s}) + \text{H}_2\text{O}(\text{g})$
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) $M_r = 180 (1) (30/180) = 0.167 (1)$ [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) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH} / \text{CH}_3\text{CH}_2\text{OH}$ [1]

[Total:9]