

MARK SCHEME for the May/June 2015 series

5070 CHEMISTRY

5070/21

Paper 2 (Theory), maximum raw mark 75

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A1 (a) Butanoic acid / propanoic acid (1) [1]

(b) Propanol (1) [1]

(c) Ethanol / methanol / propanol [1]
AND
 Butanoic acid / propanoic acid (1)

(d) Ethyl butanoate (1) [1]

(e) Propane / propanoic acid (1) [1]

[Total: 5]

A2 (a) $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$ (1) [1]

(b) Calcium hydroxide is a base / calcium hydroxide is an alkali / calcium hydroxide contains OH^- (1)

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

(c) Reacts (with ammonium nitrate) to give ammonia (1)

Reduces nitrogen content of soil / ammonia escapes into the air (1) [2]

(d)

	Ca	H	P	O
Mole ratio	$\frac{17.1}{40} /$ 0.4275	$\frac{1.7}{1} /$ 1.7	$\frac{26.5}{31} /$ 0.8548	$\frac{54.7}{16} /$ 3.419
Simplified ratio	$\frac{0.4275}{0.4275}$ / 1	$\frac{1.7}{0.4275}$ / 4	$\frac{0.8548}{0.4275}$ / 2	$\frac{3.419}{0.4275}$ / 8

Mole ratio line (1) Simplified ratio line (1)

Empirical formula $\text{CaH}_4\text{P}_2\text{O}_8$ (1)

Anion $\text{H}_2\text{PO}_4^- / \text{H}_4\text{P}_2\text{O}_8^{2-} / \text{PO}_4^{3-}$ (1)

[4]

[Total: 9]

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- A3 (a) (i)** Bond breaking absorbs energy **and** bond making releases energy / bond breaking is endothermic **and** bond making is exothermic (1)
- Less energy absorbed than released / more energy released than absorbed / endothermic energy change is less than exothermic energy change / exothermic energy change is more than endothermic energy change (1) [2]
- (ii)** Moles of oxygen = 1.5 (1) [2]
Energy released = 588 (1)
- (b)** CFC / oxides of nitrogen / nitric oxide (1) [1]
- (c) (i)** Moves to the left / moves to reactants / moves to ozone / backward reaction favoured (1)
More moles (of gas) on right / fewer moles (of gas) on left / more molecules on right / more volume (of gas) on right (1) [2]
- (ii)** Moves to the left / moves to reactants / moves to ozone / backward reaction favoured (1)
(Forward) reaction is endothermic / reverse reaction is exothermic (1) [2]
- (iii)** Reaction is slower because particles are moving slower / rate decreases because particles have less energy (1)
- There are fewer successful collisions / fewer particles have energy above the activation energy (1) [2]
- [Total: 11]**
- A4 (a)** Atoms with same number of protons and different number of neutrons / atoms with same atomic number and different mass number (1) [1]
- (b)** number of neutrons **17** (1)
number of protons **16** (1)
electronic configuration **2.8.6** (1) [3]
- (c)** S₈ (1) [1]
- (d) (i)** Weak intermolecular forces / weak attraction between molecules (1) [1]
- (ii)** No free electrons / no delocalised electrons / all electrons used in bonding / no mobile electrons (1) [1]
- (e)** K⁺ and 2.8.8 (1)
S²⁻ and 2.8.8 (1) [2]

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(f) Both shared pairs between H and S (1)
Rest of structure correct (1) [2]

(g) $2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 3\text{S} + 2\text{H}_2\text{O}$ (1) [1]

[Total: 12]

A5 (a) (i) B is O_2 (1) [1]

(ii) $2\text{Cu}(\text{NO}_3)_2 \rightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$

Identification of NO_2 as a product (1)
Balanced equation (1) [2]

(b) **C** is ammonia (1)
D is copper(II) hydroxide (1) [2]

(c) Any soluble carbonate e.g. sodium carbonate/potassium carbonate/ammonium carbonate (1)

$\text{Cu}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CuCO}_3(\text{s})$

Correct formulae (1)
State symbols – dependent on formulae (1) [3]

[Total: 8]

B6 (a) Add sodium hydroxide (and warm) (1)
Ammonia formed/gas that turns moist red litmus paper blue (1) [2]

(b) Moles of $\text{NH}_4\text{NO}_2 = 0.025 \times 0.500$ **OR** 0.0125 (1)
Moles of $\text{N}_2 = 0.0125$ (1)
Volume of $\text{N}_2 = 0.3 \text{ dm}^3 / 300 \text{ cm}^3$ (1) [3]

(c) N_2O and H_2O (1) [1]

(d) Use of ammonia/ammonium carbonate (1)
Use titration/add acid or alkali via a burette to other chemical (1)
Note volume of acid or alkali used / find reacting volume/find the end-point (1)
Repeat without the use of an indicator (using the same volumes)/heat neutralised solution with carbon and then filter (1) [4]

[Total: 10]

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B7 (a) $\text{MoO}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + \text{Mo}$ (1) [1]

(b) Reduction since MoO_3 loses oxygen **AND**
Oxidation since Al gains oxygen (1) [1]

(c) M_r of $\text{MoO}_3 = 144$ (1)
Moles of MoO_3 is 0.868 (1)
Mass of $\text{Mo} = 83.3(\text{g})$ (1) [3]

(d) Molybdenum because aluminium can displace it (1) [1]

(e) (i) Closely packed metal ions (1)
Delocalised electrons/free electrons/sea of electrons (1) [2]

(ii) ANY TWO FROM
(Much) strong(er) attraction between electrons and positive ions (1)
Needs more energy to break the attraction/needs more heat to overcome the attraction (1)
Greater charge on cation (1)
More delocalised electrons (1) [2]

[Total: 10]

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B8 (a) Fractional distillation (1)

Cracking (1) [2]

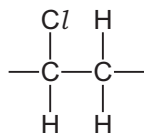
(b) $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ (1) [1]

(c)



(d) Hydrogen chloride (1) [1]

(e)



Correct repeat unit (1)

Free bonds at the end (1) [2]

(f) (i) Maximum mass = 2250 (tonnes) (1) [1]

(ii) $\% \text{ yield} = \frac{2175}{2250} \times 100$ (1)

$\% \text{ yield} = 96.7$ (1) [2]

[Total: 10]

B9 (a) Melting point below 25 °C (1)

Boiling point above 25 °C (1) [2]

(b) Particles' movement changes from vibrating to (translational) movement/
gain kinetic energy/particles move faster (1)

Arrangement of particles becomes random/intermolecular forces are overcome (1) [2]

(c) Volume is decreased (1)

Particles become closer together/space between particles decreases (1) [2]

(d) Fractional distillation

AND

Have different boiling points (1) [1]

