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Cambridge International General Certificate of Secondary Education

CHEMISTRY

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Paper 3 Theory (Core)

May/June 2017

MARK SCHEME

Maximum Mark: 80

Published

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This document consists of **7** printed pages.

| Question | Answer | Marks |
|-----------|--|----------|
| 1(a)(i) | A | 1 |
| 1(a)(ii) | E | 1 |
| 1(a)(iii) | C | 1 |
| 1(a)(iv) | B | 1 |
| 1(a)(v) | C | 1 |
| 1(b) | number of electrons in $\text{Br}^- = 36$ | 1 |
| | number of neutrons in $\text{Cl} = 18$ | 1 |
| | number of protons in $\text{Cl} = 17$ AND number of protons in $\text{Br}^- = 35$ | 1 |

| Question | Answer | Marks |
|-----------|---------------------------|----------|
| 2(a)(i) | Na^+ / sodium | 1 |
| 2(a)(ii) | sulfite / sulfate(IV) | 1 |
| 2(a)(iii) | 3 (mg) | 1 |
| 2(a)(iv) | 36.3 (mg) | 1 |
| 2(a)(v) | calcium hydrogencarbonate | 1 |
| 2(b) | flame test | 1 |
| | yellow | 1 |
| 2(c) | MgCl_2 | 1 |

| Question | Answer | Marks |
|----------|--|-------|
| 2(d) | negative electrode: calcium / Ca | 1 |
| | positive electrode: chlorine / Cl ₂ | 1 |

| Question | Answer | Marks |
|----------|--|-------|
| 3(a) | <p>any 5 of:</p> <p>X has covalent bonding</p> <p>X particles are randomly arranged / irregularly arranged</p> <p>X particles are moving rapidly / freely / randomly / irregularly</p> <p>Y has ionic bonding / ionic</p> <p>Y particles are regularly arranged / lattice / in rows / uniformly arranged</p> <p>Y particles (only) vibrate / do not move from place to place</p> <p>Z has covalent bonding</p> <p>Z particles are regularly arranged / lattice / in a tetrahedral shape</p> <p>Z particles (only) vibrate / do not move from place to place</p> | 5 |
| 3(b) | volume gets smaller | 1 |
| | particles get closer together | 1 |
| 3(c) | drill tips / drills / cutting (tools) | 1 |
| 3(d) | A / substance Y dissolves easily in water | 1 |
| | C / substance Y melts (at 8015 °C) | 1 |
| | the change can be reversed by altering the conditions | 1 |

| Question | Answer | Marks |
|-----------|---|-------|
| 4(a) | has two atoms in a molecule/two atoms combined | 1 |
| 4(b)(i) | the chlorine has displaced/replaced the bromine (in KBr) | 1 |
| 4(b)(ii) | (from green / colourless) to orange | 1 |
| 4(b)(iii) | I ₂ | 1 |
| | KBr | 1 |
| 4(c) | add (nitric acid then aqueous) silver nitrate | 1 |
| | yellow precipitate | 1 |
| 4(d)(i) | water purification / water treatment / killing bacteria / in (swimming) pools / disinfectant | 1 |
| 4(d)(ii) | breaking down of a compound / breaking down of a substance | 1 |
| | (using) heat | 1 |
| 4(d)(iii) | any 2 distinct pollution problems: <ul style="list-style-type: none"> • litter OR eyesore • sticks in gullets OR throats of birds / animals • blocking of drains OR watercourses • animals gets trapped OR tangled (in plastic) • poisonous vapours when burned • fills landfill sites | 2 |

| Question | Answer | Marks |
|-----------|--|-------|
| 5(a) | circle drawn around the OH group | 1 |
| 5(b) | 20 | 1 |
| 5(c) | C=C double bond | 1 |
| 5(d)(i) | increases with an increasing number of carbon atoms ORA | 1 |
| 5(d)(ii) | any value between -88 and 0 ($^{\circ}\text{C}$) (exclusive of these values) | 1 |
| 5(d)(iii) | there is no (clear) trend/the numbers go down and up | 1 |
| 5(d)(iv) | liquid | 1 |
| | 30°C is between melting and boiling point/ 30°C is above the melting point and below the boiling point | 1 |
| 5(d)(v) | substance containing carbon and hydrogen | 1 |
| | only / and no other element | 1 |
| 5(d)(vi) | $ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ | 1 |
| 5(d)(vii) | 3 (CO_2) | 1 |
| | 5 (O_2) | 1 |

| Question | Answer | Marks |
|-----------|---|-------|
| 6(a)(i) | aluminium | |
| | low density | 1 |
| | good electrical conductivity | 1 |
| 6(a)(ii) | iron is cheap(er)/tungsten is (too) expensive OR iron is strong(er)/tungsten is weaker | 1 |
| 6(a)(iii) | tungsten because it has a (very) high melting point | 1 |
| 6(b) | any 2 properties: <ul style="list-style-type: none"> • high melting point / high boiling point • high density • hard/strong • sonorous/rings (when hit) • ions are coloured/compounds are coloured | 2 |
| 6(c) | 2 (W) | 1 |
| | 3 (O ₂) | 1 |
| 6(d) | tungsten < cobalt < iron < magnesium IF full credit is not awarded, allow 1 mark for either a correct sequence apart from a consecutive pair reversed OR for the whole sequence reversed | 2 |
| 6(e)(i) | the more concentrated the acid, the greater the rate ORA | 1 |
| 6(e)(ii) | nitric (acid) | 1 |
| 6(e)(iii) | any value between 19 and 39 hours (exclusive of these values) | 1 |
| 6(e)(iv) | pH 4 | 1 |

| Question | Answer | Marks |
|----------|---|----------|
| 7(a) | the energy of the reactants is greater than the energy of the products / the product has less energy than the reactants / the arrow is going down (from reactants to product) | 1 |
| 7(b) | any 2 sources: <ul style="list-style-type: none"> • carbon monoxide from incomplete combustion of fossil fuels / named fossil fuel / named carbon-containing fuel • carbon dioxide from combustion of fossil fuels / respiration • methane from animal flatulence / rice paddy fields / bacteria / decomposition of vegetation / decomposition of animals any 3 effects: <ul style="list-style-type: none"> • carbon dioxide: global warming / greenhouse effect / acidification of oceans • methane: global warming / greenhouse effect • carbon monoxide: poisonous / toxic | 5 |
| 7(c)(i) | making mortar / whitewash / neutralising (acidic) soils / neutralising acidic lakes / flue gas desulfurisation / steelmaking / glassmaking / making plaster | 1 |
| 7(c)(ii) | 100 IF full credit is not awarded, allow 1 mark for (Ca =) 40, (C =) 12 and (O =) 16 | 2 |
| 7(d) | add hydrochloric acid to the mixture | 1 |
| | filter off the carbon | 1 |
| | wash carbon (with water or other solvent) AND dry in an oven / air dry / leave in air / leave to dry | 1 |