**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

**CHEMISTRY** **0620/43**

Paper 4 Theory (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 80

**Published**

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**Abbreviations used in the Mark Scheme**

- ; separates marking points
- / separates alternatives within a marking point
- **OR** gives alternative marking point
- **R** reject
- **I** ignore mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **COND** indicates mark is conditional on previous marking point
- owtte or words to that effect (accept other ways of expressing the same idea)
- max indicates the maximum number of marks that can be awarded
- ecf credit a correct statement that follows a previous wrong response
- ( ) the word / phrase in brackets is not required, but sets the context
- ora or reverse argument

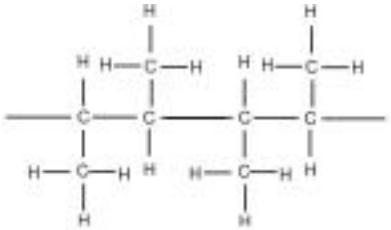
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| Question | Answer | Marks |
|---|---|---|
| 1(a)(i) | A; | **1** |
| 1(a)(ii) | B; | **1** |
| 1(a)(iii) | D; | **1** |
| 1(a)(iv) | C; | **1** |
| 1(a)(v) | C; | **1** |
| 1(b)(i) | (hot) air; | **1** |
| 1(b)(ii) | (molten) iron; | **1** |
| 1(b)(iii) | any 2 from:<br>carbon dioxide;<br>carbon monoxide;<br>nitrogen; | **2** |
| 1(c)(i) | as the percentage of carbon increases, so the malleability decreases; | **1** |
| 1(c)(ii) | **M1** oxygen (gas) blown in;<br>**M2** carbon dioxide formed / $C + O_2 \rightarrow CO_2$; | **2**<br>1<br>1 |

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| Question | Answer | Marks |
|---|---|---|
| 2(a) | butane; | **1** |
| 2(b) | compounds: E **and** F;<br>general formula: $C_nH_{2n+2}$;<br>**OR**<br>compounds: A **and** B;<br>general formula: $C_nH_{2n}$; | **2**<br>1<br>1<br><br>1<br>1 |
| 2(c) | compounds: E **and** F;<br>explanation: same molecular formula / contain the same number of atoms each element; different structures / different structural formulae / different arrangement of atoms; | **3**<br>1<br>2 |
| 2(d) | contains a double bond / not all bonds are single bonds;<br>C and H only; | **2**<br>1<br>1 |
| 2(e) | $C_2H_4 + H_2O \rightarrow C_2H_5OH$;<br><br>any 2 from:<br>high temperature / 220 °C–350 °C;<br>high pressure / 60 atm–70 atm;<br>phosphoric acid catalyst; | **3**<br>1<br><br>2 |

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| Question | Answer | Marks |
|---|---|---|
| 2(f) | <br>**M1** correct carbon structure with only single bonds;<br>**M2** continuation bonds; | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 3(a) | any 2 from:<br>carbon dioxide;<br>nitrogen;<br>any named noble gas; | **2** |
| 3(b) | any 6 from:<br><br>carbon monoxide;<br>from incomplete combustion (of carbon-containing fuel);<br><br>sulfur dioxide;<br>from burning fossil fuels / roasting ores which contain sulphur / volcanoes;<br><br>oxides of nitrogen;<br>nitrogen reacting with oxygen in car engines / lightning;<br><br>methane;<br>from anaerobic decomposition / anaerobic decay; | **6** |

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| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | **M1** movement of electron(s) from potassium to iodine;<br>**M2** one electron transferred; | **2**<br>1<br>1 |
| 4(a)(ii) | **M1** regular arrangement / (giant) lattice of alternating;<br>**M2** positive potassium ions / $K^+$ **and** negative iodide ions / $I^-$; | **2**<br>1<br>1 |
| 4(a)(iii) | **M1** strong (forces of) attraction (between oppositely charged ions) / ionic bonds are strong;<br>**M2** which require lots of energy to overcome / break; | **2**<br>1<br>1 |
| 4(b)(i) | **M1** dissolve solids (in water) and mix / combine / add;<br>**M2** filter;<br>**M3** wash the residue (with water);<br>**M4** leave to dry / place in oven / dry between filter papers; | **4**<br>1<br>1<br>1<br>1 |
| 4(b)(ii) | $Pb^{2+} + 2I^- \rightarrow PbI_2$<br>formulae of ions correct; rest correct; | **2** |
| 4(c)(i) | start colour: colourless;<br>end colour: brown; | **2**<br>1<br>1 |
| 4(c)(ii) | **M1** iodide / $I^-$;<br>**M2** it is oxidised **OR** it loses electrons / it increases oxidation number / it reduces the chlorine; | **2**<br>1<br>1 |

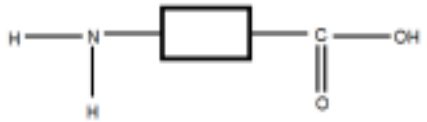
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| Question | Answer | Marks |
|---|---|---|
| 5(a) | carbon dioxide / a gas is made; | **1** |
| 5(b)(i) | red; | **1** |
| 5(b)(ii) | 0.001; | **1** |
| 5(b)(iii) | 0.0005; | **1** |
| 5(b)(iv) | 0.031 (2 marks)<br>**M1 (iii)** / 0.0162; | **2** |
| 5(c) | 0.48 ($dm^3$)<br>**M1** moles carbon dioxide = 0.02;<br>**M2** volume carbon dioxide = 0.02 × 24;<br>**M3** = 0.48 ($dm^3$); | **3**<br>1<br>1<br>1 |

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| Question | Answer | Marks |
|---|---|---|
| 6(a)(i) | $NH_3 + HCl \rightarrow NH_4Cl$; | **1** |
| 6(a)(ii) | diffusion; | **1** |
| 6(a)(iii) | solid forms at: A;<br>explanation: ammonia molecules / particles have a smaller mass; (and so) move / diffuse faster; | **3**<br>1<br>2 |
| 6(a)(iv) | **M1** solid forms in less time / faster / quicker;<br>**M2** particles / molecules have more energy;<br>**M3** (and so) move faster / diffuse faster; | **3**<br>1<br>1<br>1 |
| 6(b)(i) | test: add sodium hydroxide (solution and warm);<br>result: test gas / ammonia with (red) litmus / Universal Indicator / pH paper; indicator turns blue / ammonia produced; | **3**<br>1<br>2 |
| 6(b)(ii) | test: add silver nitrate (solution);<br>result: add (dilute) nitric acid; white precipitate; | **3**<br>1<br>2 |

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| Question | Answer | Marks |
|---|---|---|
| 6(c)(i) | covalent; | **1** |
| 6(c)(ii) | **M1** one shared pair of electrons between each N and H;<br>**M2** one shared pair of electrons between the N atoms;<br>**M3** one lone pair on each N and no additional electrons anywhere; | **3**<br>1<br>1<br>1 |
| 6(d)(i) | amide; | **1** |
| 6(d)(ii) | proteins are made from more than two monomers;<br>**OR**<br>nylon is made from 1 or 2 monomers (only); | **1** |
| 6(d)(iii) | amino acids; | **1** |
| 6(e) | ; | **1** |

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