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

**CHEMISTRY** **0620/32**

Paper 3 Core Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

**Published**

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

| Question | Answer | Mark |
|---|---|---|
| 1(a)(i) | K / potassium | 1 |
| 1(a)(ii) | Cu / copper | 1 |
| 1(a)(iii) | C / carbon | 1 |
| 1(a)(iv) | He / helium | 1 |
| 1(a)(v) | Fe / iron | 1 |
| 1(b) | *number of protons:* 47 and 47<br>*number of electrons:* 47 and 47<br>*number of neutrons:* 60 and 62 | 1<br>1<br>1 |

| Question | Answer | Mark |
|---|---|---|
| 2(a)(i) | any 2 from:<br>• more $Cl^-$ in **A ORA**<br>• more $HCO_3^-$ in **A ORA**<br>• more $Ca^{2+}$ in **A ORA**<br>• more $Na^+$ in **B ORA**<br>• more $K^+$ in **B ORA**<br>• more $SiO_3^{2-}$ in **B ORA**<br>• more $Mg^{2+}$ in **B ORA** | 2 |
| 2(a)(ii) | $Ca^{2+}$ | 1 |

| Question | Answer | Mark |
|---|---|---|
| 2(a)(iii) | 1.5 mg = [2]<br><br>$\frac{100}{1000} \times (15)$ = [1]<br>**OR**<br>0.1 × (15) = [1] | **2** |
| 2(b) | *test:* add (nitric acid and) silver nitrate<br>*result:* white precipitate | **1**<br>**1** |
| 2(c) | the random movement of particles in a suspension | **1** |
| 2(d) | silicon is a non-metal / silicon is on the right-hand side of the Periodic Table | **1** |
| 2(e)(i) | decreases (as temperature increases) | **1** |
| 2(e)(ii) | 11.5 (mg / $dm^3$) | **1** |
| 2(e)(iii) | increases because chemical reaction(s) are faster at higher temperatures / reactions with iron are faster at higher temperatures / reactions with metals are faster at higher temperatures<br>**OR**<br>decreases because less oxygen is dissolved at higher temperatures | **1** |
| 2(f) | filtration<br>treatment with chlorine / chlorination | **1**<br>**1** |
| 2(g)(i) | any suitable source, e.g. car (exhausts) / lightning / furnaces / | **1** |
| 2(g)(ii) | breathing difficulties / irritation to nose (**OR** lungs **OR** eyes **OR** throat or skin) | **1** |

| Question | Answer | Mark |
|---|---|---|
| 3(a) | water<br>(water) is losing oxygen | **1**<br>**1** |
| 3(b)(i) | rock from which metal is extracted / rock containing (high proportion of) a metal (compound) | **1** |
| 3(b)(ii) | to burn the coke / to form carbon monoxide | **1** |
| 3(b)(iii) | calcium silicate | **1** |
| 3(b)(iv) | **S** on or in 2nd pipe from the bottom on the right / just outside this pipe | **1** |
| 3(c) | *impurities named* (max = [1])<br>• e.g. carbon / sulfur / phosphorous / silicon<br><br>*removal of impurities* (max = [1])<br>• oxygen blown into iron / oxygen blast<br>• calcium oxide added / lime added<br>• sulfur oxidised to sulfur dioxide<br>• sulfur dioxide escapes as gas<br>• carbon oxidised to carbon dioxide<br>• carbon dioxide escapes as a gas<br>• phosphorous oxidised to phosphorous oxide<br>• silicon oxidised to silicon dioxide<br>• slag formed / calcium silicate formed<br>• slag floats on surface of steel<br><br>*relevant word equation* (max = [1])<br>• e.g. sulfur + oxygen → sulfur dioxide<br>• carbon + oxygen → carbon dioxide<br><br>*one other relevant piece of information about impurities / reaction* (max = [1]) | **4** |

| Question | Answer | Mark |
|---|---|---|
| 4(a) | the sample is impure | **1** |
| 4(b) | any 3 from:<br>• diffusion<br>• particles move / motion of particles<br>• (movement is) random / in any direction / in all directions<br>• particles spread out / particles mix<br>• particles move from high to low concentration | **3** |
| 4(c) | red | **1** |
| 4(d)(i) | (metal) salt<br>water | **1**<br>**1** |
| 4(d)(ii) | filtration / filter | **1** |
| 4(d)(iii) | **E**, **B**, **C**, **A**, **D** | **2** |

| Question | Answer | Mark |
|---|---|---|
| 5(a)(i) | CaO<br>$CO_2$ | **1**<br>**1** |
| 5(a)(ii) | (thermal) decomposition | **1** |
| 5(a)(iii) | 100 = [2]<br>$A_r$ = 40 (Ca), 12 (C),16 (O) = [1] | **2** |
| 5(b) | any 2 from:<br>• compound has a fixed composition / mixture has not got a fixed composition<br>• (components of) compound cannot separated (by physical means) / (components of) mixture can be separated (by physical means)<br>• compound has different properties from the elements it has been made from / substances in a mixture have the same properties as those used to make the mixture | **2** |
| 5(c) | concrete is weaker / steel is stronger | **1** |
| 5(d) | oxygen / air<br>water | **1**<br>**1** |

| Question | Answer | Mark |
|---|---|---|
| 6(a)(i) | *hydrocarbon*: (compounds which) contain carbon and hydrogen only<br>*fraction*:<br>• molecules with certain number(s) of carbon atoms / molecules with (limited) range of carbon atoms **OR**<br>• (limited) range of boiling points **OR**<br>• molecules of certain sizes / (limited) range of sizes | **1**<br>**1** |
| 6(a)(ii) | *naphtha:* making chemicals / making alkenes<br>*kerosene:* fuel for planes / fuel for heating / making alkenes | **1**<br>**1** |
| 6(b) | *comment on alkenes* (max = [1])<br>• alkenes have C=C / are unsaturated<br><br>*reference to homologous series* (max = [3])<br>• family of similar carbon compounds / similar organic compounds<br>• (same) functional group<br>• similar chemical properties<br>• trend in physical properties<br>• (same) general formula / $C_nH_{2n}$<br>• differ by $CH_2$ | **4** |
| 6(c)(i) | (yes) there is general trend from propene to hexane / (yes) the numbers go up in both columns | **1** |
| 6(c)(ii) | any value between 35 (°C)–85 (°C) inclusive | **1** |

| Question | Answer | Mark |
|---|---|---|
| 6(c)(iii) | liquid<br>–60 °C is between the melting and boiling point / the melting point is lower than –60 °C but the boiling point is higher (than –60 °C) | **1**<br>**1** |
| 6(d) | correct structure of ethane showing all of the atoms and all of the bonds | **1** |
| 6(e) | $C_4H_8$<br>$C_8H_{18}$ | **1**<br>**1** |

| Question | Answer | Mark |
|---|---|---|
| 7(a) | air would react with sodium / argon is unreactive / argon makes the atmosphere inert / sodium does not react with argon | **1** |
| 7(b) | **D–E** | **1** |
| 7(c)(i) | any 2 from:<br>• gas spreads everywhere / liquid spreads over a surface<br>• gas has no fixed volume / liquid has fixed volume<br>• gas has no surface / liquid has (definite) surface<br>• gas can be compressed / liquid cannot be compressed | **2** |
| 7(c)(ii) | *arrangement:* no (fixed) arrangement / random / irregular<br>*motion:* slow / sliding over each other / slipping over each other | **1**<br>**1** |

| Question | Answer | Mark |
|---|---|---|
| 7(d)(i) | any 2 from:<br>• high melting point / high boiling point<br>• high density<br>• catalytic activity<br>• has several oxidation states<br>• forms coloured compounds<br>• hard / strong | **2** |
| 7(d)(ii) | $Nb_2Cl_{10}$ | **1** |
| 7(d)(iii) | any 2 from:<br>• does not conduct electricity / heat<br>• has a low melting point / has a low boiling point<br>• insoluble in water / soluble in organic solvent | **2** |