**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**Cambridge International Advanced Subsidiary and Advanced Level**

# MARK SCHEME for the October/November 2014 series

## 9701 CHEMISTRY

**9701/21** Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2014 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

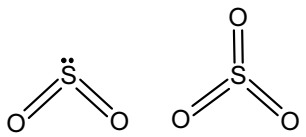
CAMBRIDGE
International Examinations

| Question | Mark Scheme | Marks | Total |
|---|---|---|---|
| 1 (a) (i) | increasing **distance** of (outer) electron(s) from nucleus<br>OR increasing distance of outer / valence shell from nucleus | 1 | |
| | increased **shielding** / screening (from inner shells) | 1 | |
| | reduces **attraction** | 1 | [3] |
| (ii) | ($3^{rd}$ electron for each in) inner / lower energy level / **shell** / closer to nucleus<br>(than first two) / less shielding | 1 | |
| | (large) increase in nuclear attraction | 1 | [2] |
| (b) (i) | ($1s^2$ $2s^2$ $2p^6$) $3s^2$ $3p^6$ $3d^{10}$ $4s^2$ $4p^6$ $5s^2$ | 1 | [1] |
| (ii) | four isotopes owtte | 1 | [1] |
| (iii) | $\frac{(84 \times 0.56) + (86 \times 9.86) + (87 \times 7) + (88 \times 82.58)}{100}$ | 1 | |
| | = 87.7 (must be 3 sig figs) | 1 | [2] |
| (c) (i) | (a species that) gains / takes electron(s) | 1 | [1] |

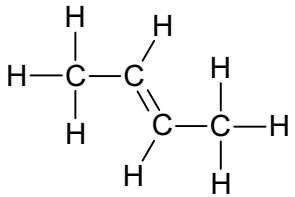
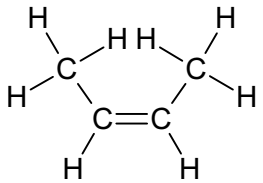
© Cambridge International Examinations 2014

| Question | Mark Scheme | Marks | Total |
|---|---|---|---|
| (ii) | Ba Cl O<br><br>$\frac{45.1}{137}$ $\frac{23.4}{35.5}$ $\frac{31.5}{16}$<br><br>$\frac{0.329}{0.329}$ $\frac{0.659}{0.329}$ $\frac{1.969}{0.329}$<br><br>1.00 2.00 5.98 / 6<br><br>emp form = $BaCl_2O_6$ | 1<br><br>1<br><br>1 | [3] |
| (d) (i) | **X** = $Mg(OH)_2$<br>**Y** = MgO<br>**Z** = $Mg(NO_3)_2$ | 1<br>1<br>1 | [3] |
| (ii) | reagent = nitric acid<br><br>$MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$ | 1<br><br>1 | [2] |
| (iii) | Heat / thermal decomposition | 1 | [1] |
| (iv) | $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$<br><br>$2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$ | 1<br><br>1 | [2] |
| | | | **[21]** |

© Cambridge International Examinations 2014

| Question | Mark Scheme | Marks | Total |
|---|---|---|---|
| 2 (a) | $4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$ | 1<br>1 | [2] |
| (b) (i) | Very exothermic / gets very hot<br>OR creates (acid / $H_2SO_4$) spray / mist / fog / fumes | 1 | 1 |
| (ii) | $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$<br><br>$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$ | 1<br><br>1 | [2] |
| (c) (i) | <br>M1 $SO_2$ correct M2 $SO_3$ correct | 1+1 | [2] |
| (ii) | 115–120° bent / non-linear<br>120° trigonal planar | 1<br>1 | [2] |
| (d) (i) | Advantage = higher rate<br>Greater KE / energy / speed / collision frequency / proportion of successful collisions / more particles with E>Ea<br><br>Disadvantage – reduced yield / less product<br><br>(Forward reaction) **exothermic AND** (hence in accordance with LCP) equilibrium / reaction **shifts left** (to counteract inc T) ora | 1<br>1<br><br>1<br><br>1 | [4] |
| (ii) | $K_p = \frac{pSO_3^{\,2}}{pSO_2^{\,2} \times pO_2}$ | 1 | [1] |

© Cambridge International Examinations 2014

| Question | Mark Scheme | Marks | Total |
|---|---|---|---|
| (iii) | $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$<br>2 2 0<br>(–1.8) (–0.9)<br>0.2 1.1 1.80<br><br>$xSO_3 = 1.8/3.1 = 0.581$<br>$xSO_2 = 0.2/3.1 = 0.065$<br>$xO_2 = 1.1/3.1 = 0.355$<br><br>$K_p = \frac{0.581^2 \times \cancel{(2 \times 10^5)^2}}{0.065^2 \times \cancel{(2 \times 10^5)^2} \times 0.355 \times 2 \times 10^5} = 1.13 \times 10^{-3}\ Pa^{-1}$ | 1<br><br>1<br><br>1<br><br>1+1 | [5] |
| | | | **[19]** |
| **3 (a)** | **P**; $CH_2 = C(CH_3)_2$<br>**Q**; $CH_3CH_2CH = CH_2$<br>**R**; $CH_3CH = CHCH_3$<br>**S**; $(CH_3)_2CO$ | 1<br>1<br>1<br>1 | [4] |
| **(b) (i)** | (Different molecules with) the same (molecular and) structural formula<br><br>different arrangements of atoms (in space) / different displayed formula | 1<br><br>1 | [2] |
| **(ii)** | <br>trans-but-2-ene<br><br>cis-but-2-ene | 1<br><br>1 | [2] |

© Cambridge International Examinations 2014

| Question | Mark Scheme | Marks | Total |
|---|---|---|---|
| (c) | reagent; $NaBH_4$ or $LiA/H_4$ or names | 1 | |
| | product; propan-2-ol | 1 | [2] |
| | | | **[10]** |
| **4** (a) | $CH_3CH_2CO_2H + 4[H] \rightarrow CH_3CH_2CH_2OH + H_2O$ | 1+1 | [2] |
| (b) (i) | Oxidation | 1 | [1] |
| (ii) | Sodium / potassium dichromate or correct formula | 1 | |
| | $H^+$ / acidified and (heat under) reflux | 1 | [2] |
| (c) | $2\ CH_3CH_2CO_2H + CaCO_3 \rightarrow (CH_3CH_2CO_2)_2Ca + H_2O + CO_2$ | 1+1 | [2] |
| (d) (i) | $CH_3CO_2H$ | 1 | |
| | warm / hot / high temperature / heat / reflux **AND** concentrated sulfuric acid | 1 | [2] |
| (ii) | water (or hydrogen chloride or ethanoic acid) | 1 | [1] |
| | | | **[10]** |

© Cambridge International Examinations 2014