**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the May/June 2012 question paper

# for the guidance of teachers

## 9701 CHEMISTRY

**9701/32** Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

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.

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| Question | Sections | Indicative material | Mark |
|---|---|---|---|
| 1 (a) | PDO layout | **I** Constructs a table for results (minimum of 3 results). | 1 |
| | PDO recording | **II** Appropriate headings and units for data given. Volume/V in $cm^3$ or / $cm^3$ or ($cm^3$) Time/t in seconds or / s or (s) | 1 |
| | PDO recording | **III** All times recorded to the nearest second. | 1 |
| | MMO decision | **IV** 3 additional volumes chosen with intervals not less than 2.00 $cm^3$ and all volumes of **FB 1** greater than or equal to 6.00 $cm^3$ | 1 |
| | MMO collection | **V** In all 3 additional experiments water is added to make a total of 20.00 $cm^3$ | 1 |
| | MMO quality | Round times to nearest second.<br>**VI + VII** Compare time for 20.00 $cm^3$ of **FB 1** with that of supervisor. | 2 |
| | | **VIII + IX** Compare time for 10.00 $cm^3$ of **FB 1** with that of supervisor.<br>The range for award of 1 or 2 depends on the supervisor value. | 2 |
| | | Supervisor value:<br>< or = 15 $\delta$ for 2 is 2 and for 1 is 4<br>16 to 30 $\delta$ for 2 is 3 and for 1 is 6<br>31 to 45 $\delta$ for 2 is 4 and for 1 is 8<br>46 to 60 $\delta$ for 2 is 5 and for 1 is 10<br>> 60 $\delta$ for 2 is 6 and for 1 is 12 | [9] |
| (b) | PDO display | **(i)** Working to show ans = $1 \times 10^{-4}$ mol. Expression and answer. | 1 |
| | ACE interpretation | **(ii)** 0.5 × ans to **(i)** = $5 \times 10^{-5}$ mol<br>AND<br>**(iii)** 2 x ans to **(ii)** = $1 \times 10^{-4}$ | 1 |
| | PDO display | **(iv)** $(1 \times 10^{-4}) / 0.060 = 1.67 \times 10^{-3}$ mol $dm^{-3}$. | 1<br>[3] |
| (c) | ACE interpretation | Minimum of 4 results – rate correctly calculated in each case using<br>ans **(b)(iv)** × $10^6$ / time (or $2.25 \times 10^{-3}$). Min 2 s.f. rounded correctly. | 1 |
| | PDO recording | Units for rate given as mol $dm^{-3}s^{-1}$ | 1<br>[2] |

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| Question | Sections | Indicative material | Mark |
|---|---|---|---|
| **(d)** | PDO layout | **I** Rate on *y*-axis and volume on *x*-axis. Axes clearly labelled | 1 |
| | | **II** Linear scale chosen to use at least half of each axis (need not include 0,0)<br>If no point at 0, 0 cannot count for > half. | 1 |
| | | **III** Plotting of points.<br>Minimum of 3 readings. | 1 |
| | | **IV** Draws a line of best fit.<br>Minimum of 4 readings including 0, 0 (if plotted). | 1 |
| **(e)** | ACE conclusion | Rate is (directly) proportional to $Fe^{3+}$ **concentration.**<br>Rate increases as concentration (volume) increases would score one | 2 [2] |
| **(f)** | ACE | **(i)** 2 × 0.05 / 0.1 | 1 |
| | | 0.10 / 20.00 × 100 = 0.5%<br>0.25 scores 1 mark. No ecf. | 1 |
| | | **(ii)** Difficult to judge colour change / measurement of reaction time / some thiosulfate reacting with acid / formation of (S) ppt / variation in T. | 1 |
| | ACE improvement | **(iii)** Investigate reaction between $Fe^{3+}$ and $S_2O_3^{2-}$ | 1 [4] |
| **(g)** | ACE conclusion | **(ii)** Thiosulfate concentration / number of moles / volume is halved (1)<br>Time is shorter / reaction is faster with less thiosulfate (1) ora. | 2 [2] |
| | | | **[Total: 26]** |

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| Question | Sections | Indicative material | | | Mark |
|---|---|---|---|---|---|
| **FB 5** = $H_2SO_4$; **FB 6** = $K_2CrO_4$; **FB 7** = $BaCl_2$; **FB 8** = $Pb(NO_3)_2$; **FB 9** = $NaNO_2$ | | | | | |
| **2 (a)** | MMO collection | Orange **solution** (1) | White ppt **and** (white ppt in RH column)<br><br>Yellow/cream ppt (1) | White ppt (1)<br><br>Yellow ppt (1)<br><br>White ppt (1) | [5] |
| Ignore excess of any reagent. | | | | | |
| **(b)** | ACE conclusion | $Pb^{2+}$ in **FB 8** **AND** $Ba^{2+}$ in **FB 7**<br><br>$H^+$ in **FB 5** **AND** $CrO_4^{2-}$ in **FB 6**<br><br>$SO_4^{2-}$ in **FB 5** **AND** $Cl^-$ in **FB 7** | | | 1<br><br>1<br><br>1 [3] |
| **(c)** | MMO decision | **I** **Warms** with NaOH and $Al$ in **(i)**. | | | 1 |
| | MMO decision | **II** Adds named (dilute) acid in **(ii)**. | | | 1 |
| | PDO recording | **III** Presents observations in a single table – no extra reagents in **(iii)**. | | | 1 |
| | MMO collection | **IV** Ammonia / gas turns litmus blue in **(iii)**. If ammonia mentioned first, assume it is the gas that affects the litmus. | | | 1 |
| | MMO collection | **V** Brown fumes (of $NO_2$) / gas that turns blue litmus red in **(iii)**. | | | 1 |
| | ACE conclusion | **VI** nitrite (needs evidence). | | | 1 [6] |
| | | | | | **[Total: 14]** |

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