Cambridge International AS & A Level

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CHEMISTRY **9701/34**

Paper 3 Advanced Practical Skills 2 **May/June 2018**

MARK SCHEME

Maximum Mark: 40

Published

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 International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	**I** Table(s) to show data for 5 experiments on pages 2, 3 and / or 4 • initial temperature (owtte) • final temperature • mean temperature • time • rate	**1**
	II Headings unambiguous and units correct for all data recorded: (°C), / s, in s^{-1}	**1**
	III All thermometer readings recorded to .0 or .5 **and** all times as integers.	**1**
	IV Selects initial temperatures in experiments 3, 4 & 5 that are at least 5 °C apart from any other **and** none > 75 °C.	**1**
	V All mean temperatures correctly calculated to 1 dp	**1**
	VI All rates correctly calculated to 2–4 sf	**1**
	Award **VII** if **all** rates increase with increase in temperature or **all** times decrease with increase in temperature	**1**
	Award **VIII** from graph if all results give an increasing gradient.	**1**

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Question	Answer	Marks
1(b)	**I** Axes correctly labelled Rate on *y*-axis and temperature on *x*-axis (average temperature must have been plotted) Linear scales chosen so graph occupies more than half the available length for both axes including 15 °C on *x*-axis. Points in 6 large squares on y-axis **and** *y*-axis must not go below 0	**1**
	II All points from data recorded (minimum 4 experiments carried out) accurately plotted (within ½ small square) *Any point that is supposed to be on a line must be on the line, and any point that is supposed to be inside a small square must not be on a boundary line.*	**1**
	III Line of best fit drawn	**1**
	IV Curved line extrapolated to 15.0 °C	**1**
1(c)	2 construction lines correct to within a small square shown at 52.5 °C	**1**
	Rate correctly read (from candidate's construction line) to half a small square **and** correctly calculates time to nearest second from 1000 / rate	**1**

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Question	Answer	Marks
1(d)	Rate of reaction increases with increase in temperature **or** rate is proportional to temperature	**1**
	Rate of rate of reaction increases because gradient increases with temperature / rate of reaction increases more / at a greater rate than increase in temperature as gradient increases / graph is exponential / acceleration of rate with temperature increase	**1**
1(e)(i)	Correctly calculates 32.8 / 180(.0) = 0.182 / 0.1822 mol dm^{-3} **and** answer to 3 or 4 sf	**1**
1(e)(ii)	Correctly uses n(glucose) = **(e)(i)** ÷ 40 (= 0.00455 / 0.00456 mol)	**1**
	Correctly uses n($KMnO_4$) = ans × 2 / 5 (= 0.00182 mol)	**1**
	Correctly uses V($KMnO_4$) = ans × 1000 / 0.01 (= 182 cm^3) **or** ans ÷ 0.01 (= 0.182 dm^3) Correct units required.	**1**
1(e)(iii)	Allow terminal CHO oxidised to COOH, terminal CH_2OH oxidised to CHO or COOH any CHOH oxidised to C = O any combination of the above	**1**
1(f)(i)	Correct expression 1 × 100 / time for **Experiment 1 and** answer to 2–4 sf	**1**
1(f)(ii)	Identifies no anomaly as all points are near line of best fit **or** Identifies one anomaly as point is too far from line of best fit If 2 or more anomalies, then the one furthest from the line must be selected. **or** Highest temperature experiment as shortest time so largest / large (%) error in timing **or** Lowest temperature experiment as difficult to judge the end point (owtte)	**1**

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Question	Answer	Marks
1(g)	Any **two** of • Use thermostatically controlled water bath (to heat both reagents / keep reagents at const T). • Take the temperature on initial mixing (and the temperature as soon as the mixture turns colourless and calculate a mean T). • Use more precisely calibrated thermometer (allow more precise but not more accurate or more sensitive) not 'use a digital thermometer' • Use light sensor / colorimeter (to avoid subjective judgement of colour fade). • Use (graduated) pipette / burette / measuring cylinders calibrated to greater precision (to measure volumes of **FB 2** and **FB 3**).	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td colspan="3">FB 4 = starch(aq); FB 5 = glucose(aq); FB 6 = sucrose(aq); FB 7 = $CuSO_4$(aq); FB 8 = NaOH(aq)</td></tr>
<tr><td>2(a)(i)</td><td>3 asterisks (*) = 1 mark
<table>
<tr><th>test</th><th>FB 4</th><th>FB 5</th><th>FB 6</th></tr>
<tr><td>+ I_2</td><td>blue-black / black / dark blue*</td><td>no reaction / no change / yellow / brown*</td><td>no reaction / no change / yellow / brown*</td></tr>
<tr><td>+ H^+ / MnO_4^-</td><td>no reaction / no change / (turns / remains) purple / pink*</td><td>purple / pink / $KMnO_4$ / MnO_4^- to colourless*</td><td>no reaction / no change / (turns / remains) purple / pink*</td></tr>
<tr><td>+ Sandell’s</td><td>no reaction / no change / blue / green*</td><td>(blue / green to) brick red / orange / red-brown / orange-brown / yellow-brown / green-brown / brown ppt*</td><td>no reaction / no change / blue / green*</td></tr>
</table></td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(ii)</td><td>FB 4 = starch and FB 5 = aldehyde</td><td>1</td></tr>
<tr><td>2(a)(iii)</td><td>Either
selects Tollens’ (reagent)
and
silver (mirror / ppt / solid) / black ppt / dark grey ppt

or
selects acidified potassium dichromate / H^+ / $K_2Cr_2O_7$, (warm)
and
orange to green solution</td><td>1</td></tr>
<tr><td>2(b)(i)</td><td>2 asterisks (*) = 1 mark
<table>
<tr><th>test</th><th>FB 7</th><th colspan="2">FB 8</th></tr>
<tr><td>+ Ag^+</td><td>no reaction / no change / no ppt*
allow paler (blue)</td><td colspan="2">brown ppt * (ppt dissolves in excess is CON)</td></tr>
<tr><td>+ Ba^{2+}</td><td>white ppt*</td><td>Either
no ppt / no change / no reaction*</td><td>or
(faint) white ppt*</td></tr>
<tr><td>+ H^+</td><td>Insoluble / no change / white ppt (remains)*</td><td>no change / no reaction*</td><td>ppt soluble*</td></tr>
<tr><td>+ I_2</td><td>ppt in green-yellow-brown-grey range*</td><td colspan="2">decolourises / solution paler (yellow)*</td></tr>
<tr><td>+ Fe^{2+}</td><td>no reaction / no change*</td><td colspan="2">green ppt*
turns brown (at surface) / brown ppt*</td></tr>
<tr><td>+ FB 8</td><td>blue ppt *</td><td colspan="2"></td></tr>
</table></td><td>6</td></tr>
</table>

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Question	Answer	Marks
2(b)(ii)	**FB 7** cation Cu^{2+} / copper(II)* anion SO_4^{2-} / sulfate* **FB 8** cation unknown* anion OH^- / hydroxide* 2 asterisks (*) = 1 mark	**2**
2(b)(iii)	Correct ions for precipitation reaction observed in **(i)** and correct product **and** no spectator ions	**1**
	Equation balanced **and** correct state symbols	**1**

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