
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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This document consists of **10** printed pages.

PUBLISHED**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.

PUBLISHED**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 <ul style="list-style-type: none"> • initial temperature (owtte) • final temperature • mean temperature • time • rate 	1
	II Headings unambiguous and units correct for all data recorded: ($^{\circ}\text{C}$), / 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 $> 75^{\circ}\text{C}$.	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 <i>y</i> -axis and temperature on <i>x</i> -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 <i>x</i> -axis. Points in 6 large squares on <i>y</i> -axis and <i>y</i> -axis must not go below 0	1
	II All points from data recorded (minimum 4 experiments carried out) accurately plotted (within ½ small square) <i>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.</i>	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 $32.8 / 180(.0) = 0.182 / 0.1822 \text{ mol dm}^{-3}$ and answer to 3 or 4 sf	1
1(e)(ii)	Correctly uses $n(\text{glucose}) = \mathbf{(e)(i)} \div 40$ (= 0.00455 / 0.00456 mol)	1
	Correctly uses $n(\text{KMnO}_4) = \text{ans} \times 2 / 5$ (= 0.00182 mol)	1
	Correctly uses $V(\text{KMnO}_4) = \text{ans} \times 1000 / 0.01$ (= 182 cm^3) or $\text{ans} \div 0.01$ (= 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 $\text{C} = \text{O}$ any combination of the above	1
1(f)(i)	Correct expression $1 \times 100 / \text{time for Experiment 1}$ 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 <ul style="list-style-type: none">• 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

Question	Answer			Marks
FB 4 = starch(aq); FB 5 = glucose(aq); FB 6 = sucrose(aq); FB 7 = CuSO₄(aq); FB 8 = NaOH(aq)				
2(a)(i)	3 asterisks (*) = 1 mark			3
	<i>test</i>	FB 4	FB 5	FB 6
	+ I ₂	blue-black / black / dark blue*	no reaction / no change / yellow / brown*	no reaction / no change / yellow / brown*
	+ H ⁺ / MnO ₄ ⁻	no reaction / no change / (turns / remains) purple / pink*	purple / pink / KMnO ₄ / MnO ₄ ⁻ to colourless*	no reaction / no change / (turns / remains) purple / pink*
	+ Sandell's	no reaction / no change / blue / green*	(blue / green to) brick red / orange / red-brown / orange-brown / yellow-brown / green-brown / brown ppt*	no reaction / no change / blue / green*

Question	Answer		Marks																												
2(a)(ii)	FB 4 = starch and FB 5 = aldehyde		1																												
2(a)(iii)	<p>Either selects Tollens' (reagent) and silver (mirror / ppt / solid) / black ppt / dark grey ppt</p> <p>or selects acidified potassium dichromate / H^+ / $K_2Cr_2O_7$, (warm) and orange to green solution</p>		1																												
2(b)(i)	<p>2 asterisks (*) = 1 mark</p> <table border="1" data-bbox="338 676 1503 1441"> <thead> <tr> <th data-bbox="338 676 488 740"><i>test</i></th> <th data-bbox="488 676 824 740">FB 7</th> <th colspan="2" data-bbox="824 676 1503 740">FB 8</th> </tr> </thead> <tbody> <tr> <td data-bbox="338 740 488 876">+ Ag^+</td> <td data-bbox="488 740 824 876">no reaction / no change / no ppt* allow paler (blue)</td> <td colspan="2" data-bbox="824 740 1503 876">brown ppt * (ppt dissolves in excess is CON)</td> </tr> <tr> <td data-bbox="338 876 488 1011">+ Ba^{2+}</td> <td data-bbox="488 876 824 1011">white ppt*</td> <td data-bbox="824 876 1238 1011">Either no ppt / no change / no reaction*</td> <td data-bbox="1238 876 1503 1011">or (faint) white ppt*</td> </tr> <tr> <td data-bbox="338 1011 488 1147">+ H^+</td> <td data-bbox="488 1011 824 1147">Insoluble / no change / white ppt (remains)*</td> <td data-bbox="824 1011 1238 1147">no change / no reaction*</td> <td data-bbox="1238 1011 1503 1147">ppt soluble*</td> </tr> <tr> <td data-bbox="338 1147 488 1243">+ I_2</td> <td data-bbox="488 1147 824 1243">ppt in green-yellow-brown-grey range*</td> <td colspan="2" data-bbox="824 1147 1503 1243">decolourises / solution paler (yellow)*</td> </tr> <tr> <td data-bbox="338 1243 488 1378">+ Fe^{2+}</td> <td data-bbox="488 1243 824 1378">no reaction / no change*</td> <td colspan="2" data-bbox="824 1243 1503 1378">green ppt* turns brown (at surface) / brown ppt*</td> </tr> <tr> <td data-bbox="338 1378 488 1441">+ FB 8</td> <td data-bbox="488 1378 824 1441">blue ppt *</td> <td colspan="2" data-bbox="824 1378 1503 1441"></td> </tr> </tbody> </table>		<i>test</i>	FB 7	FB 8		+ Ag^+	no reaction / no change / no ppt* allow paler (blue)	brown ppt * (ppt dissolves in excess is CON)		+ Ba^{2+}	white ppt*	Either no ppt / no change / no reaction*	or (faint) white ppt*	+ H^+	Insoluble / no change / white ppt (remains)*	no change / no reaction*	ppt soluble*	+ I_2	ppt in green-yellow-brown-grey range*	decolourises / solution paler (yellow)*		+ Fe^{2+}	no reaction / no change*	green ppt* turns brown (at surface) / brown ppt*		+ FB 8	blue ppt *			6
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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