Cambridge International AS & A Level

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CHEMISTRY **9701/34**

Paper 3 Advanced Practical Skills 2 **October/November 2019**

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	Mark
1(a)	**I Clear presentation** of unambiguous readings of time and volume with correct units.	**1**
	II Award if volume after 4 minutes is within 0.75–1.25 range.	**1**
	III Award if volume after 4 minutes is within 0.9–1.1 range.	**1**
1(b)(i)	**Correct expression** Moles oxygen = $\frac{\text{correct volume after 4 mins}}{24\,000}$	**1**
1(b)(ii)	**Correct use** of moles of oxygen: Moles H_2O_2 = moles oxygen $\times$ 2 Working and answer may be credited from answer in **(i)**.	**1**
	Correctly uses: Conc H_2O_2 = $\frac{\text{Moles } H_2O_2}{0.03}$ **and** both final answers (if given) in **(b)** to 2–4 sf	**1**
1(c)	(Not correct) reaction (starts fast and then) slows **OR** volume of gas collected in 2nd minute is less than in the 1st minute Allow sketch of suitable volume of gas against time with 1 and / or 2 minutes marked on time axis and tangent to curve drawn. Reject answer based on consumption of **FB 2**.	**1**
	Greater **concentration** so greater rate / frequency of **collision** at start	**1**
1(d)	Rate: Greater volume at **specified time** as greater surface area **OR** reaction complete sooner as greater surface area **OR** **Final** volume: No effect as manganese(IV) oxide is the catalyst Reject MnO_2 is in excess Reject has no effect on reaction	**1**

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Question	Answer	Mark
2(a)	**I** All the following data recorded • two burette readings and titre for the rough titration • initial and final burette readings for **two** (or more) accurate titrations	**1**
	II Titre values shown, for accurate titrations, **and** appropriate headings and units in the accurate titration table • initial / start **and** (burette) reading / volume • final / end **and** (burette) reading / volume • titre **or** volume / **FB 4 and** used/added unit: / cm^3 **or** (cm^3) **or** in cm^3 (for each heading) **or** cm^3 unit given for each volume recorded	**1**
	III All accurate burette readings are recorded to the nearest 0.05 cm^3.	**1**
	IV The final accurate titre recorded is within 0.10 cm^3 of any other accurate titre.	**1**
	Award **V** if $\delta \leqslant 0.50\ cm^3$ (Where δ is difference to the supervisor's value)	**1**
	Award **VI** if $\delta \leqslant 0.30\ cm^3$	**1**
	Award **VII** if $\delta \leqslant 0.20\ cm^3$	**1**
2(b)	**Correctly calculates** mean titre from two (or more) accurate titres where the **total** spread is $\leq 0.20\ cm^3$. **AND** Answer is given to 2 dp **AND** Working must be shown or ticks must be put next to the two (or more) accurate titres selected.	**1**
2(c)(i)	**Correctly calculates** $\frac{0.02 \times \mathbf{(b)}}{1000}$ **and** answer to 3 or 4 sf	**1**
2(c)(ii)	**Correct use** of $\frac{\mathbf{(c)(i)} \times 5}{2}$ **and** answer to 3 or 4 sf	**1**

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Question	Answer	Mark
2(c)(iii)	**Correct use** of **(ii)** × 40 **and** answer to 3 or 4 sf	**1**
2(d)	**Two from** Vol gas not measured at R.T.P. (as given) / molar volume of gas not 24 dm^3 under conditions used **and** need to measure temperature (and calculate actual molar volume) Reaction not gone to completion (after 4 mins) / reaction still fizzing after 4 minutes / assumption about completion (made in **1(b)(ii)**) is not valid **and** leave until no increase in volume / no fizzing Gas / oxygen escapes (before bung replaced) **and** practical method e.g. small tube with catalyst / float catalyst in a boat / use a divided flask Error in volume of **H_2O_2** / **water** or **50** cm^3 measuring cylinder used **and** use a burette or **graduated** pipette Air gap in measuring cylinder does not reach scale **and** use gas syringe / allow more air to enter measuring cylinder to reach scale Allow: If candidate's gas volume is < 100 cm^3 **or** < 50 cm^3 then allow Error in volume measured **and** use a gas syringe **or** use a burette (respectively) as **finer calibration**.	**2**
2(e)	(Statement is not correct as) acid is in excess	**1**
2(f)(i)	**Correctly calculates** % = 0.037/0.833 or [1 – 0.796/0.833] × 100 = 4.442% **and** answer given to 2 or more sf	**1**
2(f)(ii)	Hydrogen peroxide decomposes (slowly) when left	**1**

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Question	Answer	Mark
	FB 6 is $FeSO_4$; **FB 7** is Na_2SO_3; **FB 8** is $NaNO_3$	
3(a)(i)	Expected observations are in the table below. Award 1 mark for every two correct observations (*)	**8**

test	*observations*		
	FB 6	**FB 7**	**FB 8**
+ $H^{\pm}$ MnO_4^-	(from) purple to colourless / yellow **or** $KMnO_4$ / MnO_4^- decolourised *	Purple to colourless **or** $KMnO_4$ / MnO_4^- decolourised *	No effect / no (colour) change / no reaction **or** solution (in test tube) **becomes** pink/purple or solution/$KMnO_4$/ MnO_4^- **stays** purple*
+ NaOH	Green ppt **and** insoluble in excess / turns brown *	No effect / no (visible) reaction/ (solution) stays colourless / no ppt *	No effect / no (visible) reaction/ (solution) stays colourless / no ppt *
+ warm	Ignore	no effect/ no gas (formed on heating) *	
+ H_2O_2 & OH^-	(Yellow solution and) Brown / red-brown / orange-brown / rust ppt **and** insoluble in excess/ bubbling *	No effect / no (visible) reaction / (solution) stays colourless *	No effect/no (visible) reaction/ (solution) stays colourless **and**
+ Ba^{2+}	White ppt *	White ppt *	No effect / no (visible) reaction/ no ppt *
+ *Al* & NaOH		Fizzing / bubbling / effervescence *	Fizzing / bubbling effervescence *
		Gas / H_2 pops with a lighted splint * litmus turns blue is CON	Gas / NH_3 turns litmus blue. *

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Question	Answer	Mark
Reagent(s) must be stipulated in parts **(ii)**, **(iii)**, **(iv)** & **(v)** The reasons in **(ii)**, **(iii)** & **(v)** must refer to observations in **(i)** The formula or name of the **ion** must be correct but allow bod for an error in the reagent formula.		
3(a)(ii)	Fe^{2+} / iron(II) because green ppt formed with NaOH / OH^- Allow from grey-green ppt turning brown / black	**1**
3(a)(iii)	Two of SO_3^{2-}, SO_4^{2-}, CO_3^{2-} because white ppt with Ba^{2+}	**1**
3(a)(iv)	Any cation from QA notes with suitable reason *For NH_4^+ the reason must include no ammonia / litmus turning blue with **warm / hot** with NaOH*	**1**
3(a)(v)	NO_3^- or NO_2^- because forms NH_3 / red litmus turned blue with NaOH(aq) and A*l* (foil)	**1**

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Question	Answer	Mark
3(b)	Table (rows or columns) to show test, space for expected results for both liquids with at least one entry attempted.	**1**
	Test and positive result for each organic chemical **Ethanoic acid** Add named carbonate / named reactive metal **and** fizzing / positive gas test **or** Add ethanol / other named alcohol + conc H_2SO_4 / warm **and** sweet / fruity smell / ester formed **or** Use named pH indicator **and** appropriate final colour given	**1**
	Propan-1-ol (Acidified) potassium / sodium manganate(VII) / $KMnO_4$ / $NaMnO_4$ **and** decolourised/ purple to colourless Allow (acidified) potassium/sodium dichromate / $K_2Cr_2O_7$ / $Na_2Cr_2O_7$ **and** orange to green **or** ethanoic acid / other named carboxylic acid + conc H_2SO_4 / warm **and** sweet / fruity smell / ester formed	**1**

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