Cambridge International AS & A Level

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CHEMISTRY **9701/34**

Paper 3 Advanced Practical Skills 2 **May/June 2017**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)	**I** Mass (of Mg) with correctly displayed unit and all temperatures recorded Initial T must be between 10–45 °C	**1**
	II All temperature readings to .5 ºC with at least one ending in .0 °C and at least one ending in .5 °C	**1**
	Round any thermometer readings to the nearest .5 °C Calculate ΔT from T at 2 minutes to T max from the table. Compare with supervisor ΔT. Award **III** if ΔT within 2 °C of supervisor Award **III** and **IV** if ΔT within 1 ºC of supervisor	**2**
1(b)	**I** Axes labelled (T on *y*-axis & t on *x*-axis). Scale chosen so that plotted points (and 10 °C extra on *y*-axis) occupy more than half the available space in both directions.	**1**
	II Points plotted to within half a small square. Points that should be on lines must be on the line and points that should not be on lines must not be on lines.	**1**
	III Two lines of best fit drawn – one up to 2 minutes and the other after the reaction has occurred.	**1**
	IV Both lines extrapolated to 2½ minutes and vertical line drawn at 2½ minutes	**1**
	V Examiner to calculate ΔT from candidate graph and award mark if within 0.5 °C of candidate's ΔT	**1**
1(c)(i)	Correctly calculates energy evolved = **25** × 4.2 × ΔT **and** answer to 2 – 4 sf.	**1**
1(c)(ii)	Correct use of moles of magnesium = $^{\text{mass Mg from (a)}}/_{24.3}$	**1**
	Correct use of $\Delta H = \frac{(\mathbf{i})}{\text{n(Mg)} \times 1000}$ **and** answer must be negative	**1**
1(d)	2 masses, 4 thermometer readings and 2 temperature rises with correct units and unambiguous headings shown	**1**
	Examiner to calculate $^{\Delta T \text{ longer piece}}/_{\Delta T \text{ shorter piece}}$ to 2 dp Award 2 marks if 1.80 to 2.20 Award 1 mark if 1.70 to 2.30	**2**

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Question	Answer	Marks
1(e)	• correct (larger) ΔT from thermometer readings **and** correct (larger) mass (from balance readings) • correct expression of 25 × 4.2 × ΔT • correct expression for division by number of moles of Mg • answer with negative sign **and** evidence of division by 1000 **and** answer to 2 – 4 sf ΔH = – 25 × 4.2 × ΔT × 24.3 ÷ [m(Mg) × 1000] 3 points correct = 1 mark 4 points correct = 2 marks	**2**
1(f)(i)	**Either** yes **because** the reaction is faster so less heat is lost **or** no **because** a catalyst does not alter ΔH / ΔT	**1**
1(f)(ii)	No effect **because** the acid is in excess / magnesium is the limiting reagent / **all** the Mg reacts **or** ΔT would be larger because the reaction is **faster** as acid is **diprotic** (*owtte*) so **less heat lost**	**1**

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Question	Answer	Marks
1(g)(i)	$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$ Chemical symbols = 1 mark Correct balancing and state symbols = 1 mark	**2**
1(g)(ii)	Answer = + 1.9 = 2 marks Answer = – 1.9 / 1.9 / + 3.8 = 1 mark Some working must be shown to score both marks	**2**
1(h)(i) and 1(h)(ii)	**(i)** & **(ii)** together Allow any two correct statements • a stronger acid or correct identification provides a greater concentration of H^+ / more hydrogen ions (*ora*) • (some) energy required to break O–H bond (allow OH bond) • –I effect/increased electronegativity of C*l* increases strength of (trichloroethanoic) acid / makes it easier to release H^+ (compared to ethanoic acid)	**2**
	Total:	**25**

Question	Answer	Marks
	FB 5 is HC*l*; **FB 6** is H_2SO_4; **FB 7** is HNO_3; **FB 8** is KI(aq)+Na_2CO_3(aq)	
2(a)(i)	$AgNO_3$ observations correct	**1**
	$Ba(NO_3)_2$ observations correct	**1**
	Na_2CO_3 observations correct	**1**
	Gas / CO_2 / fizz turned limewater milky / chalky / cloudy white / formed white ppt with limewater in at least one box	**1**

Test	**FB 5**	**FB 6**	**FB 7**
$AgNO_3$	White ppt	No reaction / no change / no ppt	No reaction / no change / no ppt
NH_3	(ppt) soluble	No reaction / no change / no ppt	No reaction / no change / no ppt
		(*not 'no observation' or '–'*)	
$Ba(NO_3)_2$	No reaction / no change / no ppt	White ppt	No reaction / no change / no ppt
HNO_3	No reaction / no change / no ppt	(ppt) insoluble	No reaction / no change / no ppt
Na_2CO_3	Effervescence / fizz / bubbles	Effervescence / fizz / bubbles	Effervescence / fizz / bubbles
	Positive limewater test – see above		

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Question	Answer	Marks
2(a)(ii)	H^+ / hydrogen **ion**	**1**
2(a)(iii)	Adds **named** reactive metal (or symbol) (Mg or Zn, *allow* A*l, Fe*) / named suitable acid-base indicator	**1**
	Effervescence / fizz / bubbles / gas / H_2 pops with lighted splint / correct final colour (chosen indicator must change colour in the pH range < 7)	**1**
2(a)(iv)	**FB 5** Cl^- **FB 6** SO_4^{2-} **FB 7** unknown Allow names of ions 3 correct scores 2 2 correct scores 1	**2**
2(a)(v)	Test: Name / correct formula of strong acid (and warm) **or** (acidified) potassium manganate(VII) / $KMnO_4$ No (brown) gas **or** not decolourised Conclusion: **FB 7** is NO_3^- / nitrate	**1**
2(b)	see expected observations table	**4**
	Ions present I^- **and** CO_3^{2-}	**1**
	Total:	**15**

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Expected observations

Test	*Observation*
HC*l*	Fizz / etc. **or** gas / CO_2 turns limewater milky / etc. **and**
H_2O_2	Brown / yellow (darker yellow if yellow with HC*l*) / red-brown / orange-brown / yellow-brown (solution) **and**
Starch	Blue-black / black / **dark** blue (not purple) colour [1]
NaOH	No reaction / no ppt / solution remains colourless [1]
$CuSO_4$	Blue/green/brown range of coloured **ppt and**
HC*l*	Brown colour [1]
$Na_2S_2O_3$	White / cream / off-white / pale grey **and** solid / residue / ppt [1]

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