PEARSON EDEXCEL IGCSE CHEMISTRY · 4CH1

CHEMISTRY



MARK SCHEME

SECTION 3: PHYSICAL CHEMISTRY (PACK 4)

SCORE	PERCENTAGE
/42	%

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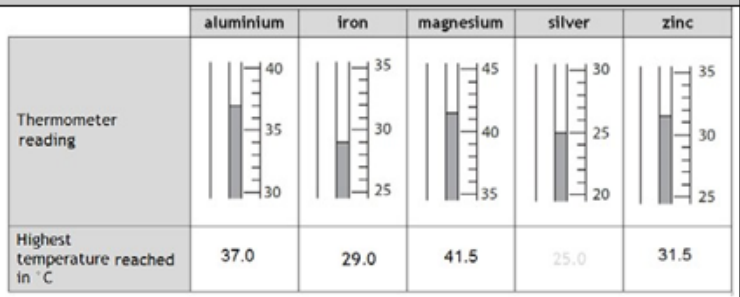
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Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a)	heat (energy) is given out OWTTE	**ACCEPT** thermal energy is given out **ACCEPT** thermal energy store of mixture decreases	1
(b) (i)	**C** displacement A is incorrect as it is not a combustion reaction B is incorrect as it is not a decomposition reaction D is incorrect as it is not a neutralisation reaction		1
(ii)	**M1** the (blue) colour fades/ solution turns (from blue) to colourless **M2** pink-brown/pink coating (on zinc)	 **ALLOW** any combination of pink, orange, brown	2
(iii)	silver is less reactive/ lower in the reactivity series than copper ORA	**ALLOW** silver cannot displace copper	1
(c)	**M1** temperature change = 37.0 – 20.5 **OR** 16.5 (°C) **M2** $Q = 50.0 \times 4.2 \times 16.5$ **M3** 3465 (J) **M4** 3.465 (kJ)	correct answer without working scores 4 **ALLOW** ECF on **M1** **ALLOW** ECF on **M3** **ALLOW** any number of sig figs except 1	4
			Total 9

Q2.

Question number	Answer	Additional guidance	Marks
(a)	 all 4 correct 2 marks 2 or 3 correct 1 mark	Penalise missing 0 once only	2
(b) (i)	magnesium is the most reactive (metal/element used) OR magnesium is higher in the reactivity series /more reactive than the other metals (used)	**ALLOW** references to generates more thermal energy/heat (energy)	1
(ii)	An explanation that links together **two** of the following points: **M1** silver/it does not react (with copper(II) sulfate solution) **M2** silver/it is less reactive than copper / silver/it is below copper in the reactivity series **M3** (and therefore silver/it) does not displace copper	**ALLOW** silver is the least reactive (metal /element used) **ACCEPT** does not reduce copper(II) ions	2

Question number			
(c)	An explanation that links together the following two points: **M1** the temperature rise will be smaller (than with 25 cm^3) **M2** because the same amount of thermal energy/heat (energy) is being used to heat a larger volume of solution	**ACCEPT** less than 16.5 (°C) **ACCEPT** lower than the value given in the table in (a) **ALLOW** as there is a larger volume of /a larger amount of /more solution to heat up	2

(d)	**M1** $Q = mc\Delta T$ **M2** $45 \times 4.2 \times 15.0$ **M3** = 2835 (J)	 **M2** subsumes **M1** **ALLOW** ECF for **M3** and **M4** on incorrect values in **M2**	4
	M4 = 2.8(35) (kJ)	**ACCEPT** answers correctly rounded to two or more significant figures Correct answer without working scores 4 2835, 2840, 2800 all score 3 **ALLOW** use of 4.18 which gives an answer of 2.8(215)	
		Total	**11**

Q3.

Question number	Answer	Notes	Marks
a	An explanation that links together **M1** the reaction is endothermic and either of the following points: **M2** it takes in thermal energy/heat (from the surroundings) **OR** **M3** as shown by the decrease in temperature (of the reaction mixture)	 **REJECT** exothermic for both marks **ALLOW** references to cooling No M2 or M3 if the statements contradict each other	**2**

b	• calculation of temperature change • substitution into $Q = mc\Delta T$ • evaluation Example calculation **M1** 14.2 – 20.0 = (-)5.8 **M2** $Q = 100 \times 4.18 \times (–)5.8$ **M3** = (–)2420 (J)	100 x 4.18 x (20 – 14.2) scores **M1** and **M2** **ACCEPT** any number of sig figs greater than 2 Calculator answer is 2424.4 Negative sign not required If answer in kJ unit must be given. Use of 108 can score **M1** and **M3** (= 2618) 2400 alone scores 0 **ALLOW** use of 4.2 for all 3 marks (= 2436)	**3**

c	• calculation of moles (*n*) of ammonium nitrate • division of *Q* by *n* • conversion of J to kJ • answer given with + sign Example calculation **M1** $n[NH_4NO_3] = 8.00 \div 80$ **OR** 0.1(00) (mol) **M2** $\frac{Q}{n}$ **OR** $\frac{2420}{0.1(00)}$ **OR** $\frac{\text{answer to b}}{\text{answer to M1}}$ **M3** ΔH = (+)24.2 (kJ/mol) **M4** positive sign included	**ACCEPT** any number of sig figs in the numerator except 1 **ACCEPT** any number of sig figs except 1 **ALLOW** ecf from M2 correct answer with no working and no sign or incorrect sign scores 3 correct answer with no working and correct sign scores 4	**4**

Q4.

Question number	Answer	Notes	Marks
(a)	M1 red lead oxide → lead(II) oxide + M2 oxygen	must have (II) ACCEPT answers in either order If formulae given allow 1 mark for O_2 even if formula for lead(II) oxide is incorrect	2 grad
(b)	• dividing percentages by A*r* • correct results of divisions • divide by smallest to obtain correct ratio/EF Example of calculation: Pb O M1 86.6÷207 13.4÷16 M2 0.42 0.84 M3 (0.42÷0.42 =)1 (0.84÷0.42 =) 2	0 marks if division by atomic numbers or calculation upside down ACCEPT alternative methods	3 exp

(c) (i)	M1 Pb_3O_4 (s) + $4HNO_3$ (aq) M2 $2Pb(NO_3)_2$(aq) + $2H_2O$	both state symbols required ALLOW upper case letters for state symbols both numbers required	2 grad

(c) (ii)	description that makes reference to the following three points: M1 warm/heat (nitric) acid M2 add/mix/react (red) lead oxide (and stir) M3 filter to obtain lead(II) nitrate solution	 REJECT boil IGNORE references to adding excess(red) lead oxide ALLOW to remove lead(IV) oxide/PbO_2 ALLOW to remove (unreacted/excess) red lead oxide/Pb_3O_4	6 exp

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	AND three of the following points: M4 heat/boil (lead(II) nitrate) solution/filtrate M5 until crystals form in a cooled sample/on a glass rod OWTTE M6 leave solution to cool / leave solution for more crystals to form M7(and then) filter off crystals/lead nitrate M8 suitable method of drying the crystals eg using filter paper/using paper towel/in a warm oven	If heat to dryness only M4 can be scored ACCEPT to crystallisation point/to form a saturated solution /until crystals start to form /to remove some of the water M5 DEP M4 ACCEPT decant off the solution M7 DEP M6 IGNORE references to washing REJECT hot oven or any method of direct heating eg Bunsen ALLOW leave to dry but not just dry the crystals No M8 if crystals are washed after drying	
		Total for Q = 13 marks	