

Cambridge International Examinations Cambridge International General Certificate of Secondary Education

CHEMISTRY

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Paper 4 Theory Extended MARK SCHEME Maximum Mark: 80

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Question					Answer	Marks
1(a)	proton n	<i>umber</i> : the nu	mber of prote	ons		1
	nucleon	number: the t	otal number o	of protons an	d neutrons	1
	nucleon	number: in the	e nucleus/nu	ıclei (of an at	om)	1
1(b)	(hydroge	en is the only a	atom to have) no neutrons	3	1
1(c)						<u>.</u>
		number of protons	number of neutrons	number of electrons		
	¹⁹ F	9	10	9		
	²⁶ Mg	12	14	12		
	³¹ P ^{3–}	15	16	18		
	⁸⁷ Sr ²⁺	38	49	36		
	fluorine	protons AND	neutrons corr	rect		1
	magnes	ium neutrons A	AND electror	is correct		1
	phosphorus protons AND neutrons correct				1	
	phospho	orus electrons	correct			1
	strontiur	n protons ANI	D neutrons co	orrect		1
	strontiur	n electrons co	rrect			1
1(d)(i)	MgF ₂					1
1(d)(ii)	Sr ₃ P ₂					1

Question	Answer	Marks
2(a)(i)	SO ₂	1
2(a)(ii)	Na ₂ O	1
2(a)(iii)	Cr ₂ O ₃	1
2(a)(iv)	SiO ₂	1
2(a)(v)	Al_2O_3/Cr_2O_3	1
2(a)(vi)	CO	1
2(b)(i)	an amphoteric oxide will react with acids AND with bases	1
2(b)(ii)	a neutral oxide will not react with acids or with bases	1

Question	Answer	Marks
3(a)(i)	no (more) effervescence	1
3(a)(ii)	magnesium carbonate	1
3(a)(iii)	(a solution in which) no more solute will dissolve	1
	at that temperature	1
3(a)(iv)	the solubility deceases as the temperature decreases	1
3(b)(i)	moles of water = 2.52/18 = 0.14 (mol)	1
3(b)(ii)	moles of anhydrous magnesium sulfate = 0.02 (mol)	1
3(b)(iii)	ratio = 0.02/0.02 : 0.14/0.02 = 1 : 7	1

Question	Answer	Marks
3(b)(iv)	MgSO ₄ .7H ₂ O	2
	M1 MgSO₄ M2 rest of the formula correct	
3(c)	mix and stir the two solutions	1
	filter (to obtain residue)	1
	wash (the residue) using water	1
	dry the residue between filter papers / in a warm place	1
3(d)	$Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$	2
	M1 correct species M2 correct state symbols	

Question	Answer	Marks
4(a)(i)	roast in air	1
4(a)(ii)	$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$	2
	M1 correct species M2 correct balancing	
4(b)(i)	coke	1
4(b)(ii)	zinc is vaporised / boiled	1
	and is condensed	1

Question	Answer	Marks
4(c)(i)	$Zn \rightarrow Zn^{2+} + 2e^{-}$	2
	M1 correct species M2 correct balancing	
4(c)(ii)	$2H^+ + 2e^- \rightarrow H_2$	2
	M1 correct species M2 correct balancing	
4(c)(iii)	change: (the intensity would) decrease	1
	reason: the difference in reactivity between zinc and iron is less than the difference in reactivity between zinc and copper	1

Question	Answer	Marks
5(a)	(stop-) watch AND syringe	1
5(b)	graph starts at X and is a curve with a decreasing gradient	1
	graph hits zero rate at 114 ± 6 seconds	1
5(c)	M1 moles of carbon dioxide = 180/24 000 = 0.0075	1
	M2 molar mass of barium carbonate = 197	1
	M3 mass of barium carbonate = M1 × M2 = 1.48 (g)	1
5(d)	curve starts from (0,0) and has a lower gradient than the original curve	1
	because lumps have a lower surface area	1

Question	Answer	Marks
5(e)	curve starts from (0,0) and has a steeper gradient than the original curve	1
	finishes at the same volume of gas	1
	because there are more particles per unit volume/dm ³ /cm ³	1
	because there are more collisions per second / unit time OR a greater collision rate	1
5(f)	360 (cm ³)	1

Question	Answer	Marks
6(a)	(compound that) contains carbon and hydrogen	1
	and no other elements / only	1
6(b)	 any 3 from: same/similar chemical properties (same) general formula (consecutive members) differ by CH₂ same functional group common (allow similar) methods of preparation physical properties vary in predictable manner/show trends/gradually change/example of a physical property variation 	3
6(c)	propene	1
	structure correctly shown	1
6(d)	steam	1
	catalyst	1

Question	Answer	Marks
6(e)(i)	butanoic acid	1
		1
6(e)(ii)	acidified	1
	(potassium) manganate(VII)	1
6(e)(iii)	oxidation	1
6(f)	methanol	1
	ethanoic acid	1
	catalyst	1
	heat	1
	$CH_{3}COOH + CH_{3}OH \rightarrow CH_{3}COOCH_{3} + H_{2}O$	1