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UPDATED Memo chemistry 2019 prelim

<u>Q1</u>		
1.1	B	
1.2	B	
1.3	C	
1.4	A	
1.5	D	
1.6	C	
1.7	A	
1.8	B	
1.9	A	
1.10.	C	[20]
<u>QUESTION 2</u>		
2.1.1	Sodium thiosulfate	1
2.1.2	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	1
2.1.3	<i>a measure of the tendency of an atom to attract a bonding pair of electrons</i>	2
2.2.1	Kr	1
2.2.2	KBr	1
2.2.3	PH_3 or C diamond	1
2.2.4	Na or C (graphite)	1
2.2.5	C(s) diamond	1
2.2.6	HF	1
2.2.7	KBr	1
2.2.8	HF accept PH_3	1
2.3.1	(non-polar) Covalent (pure)	1
2.3.2	VD Waals forces/London forces	1
2.3.3.	Weak London forces that are overcome with low energy ✓ so solid will change directly to gas ✓ But strong enough to hold molecules together in solid due to large number of electrons/ ability to be polarized. ✓	3
2.3.4	No free ions/electrons	1
		[18]

QUESTION 3

3.1	the minimum energy required to start a chemical reaction OR the energy required to form the activated complex	2
3.2.1	To avoid loss of gas or any other suitable answer	1
	graph showing relationship between total volume and time. graph showing relationship between total volume and time. Total volume of oxygen (cm³) time (min) change 6 + 2	
3.2.2	Heading ✓ Y axis (total volume of oxygen (cm ³)) and x axis (time min) } ✓ suitable scale with 0 at origin ✓ two plotted points correct (3, 42 and 7, 64) ✓ ✓ line of best fit ✓	6
3.2.3	Average rate = gradient	3

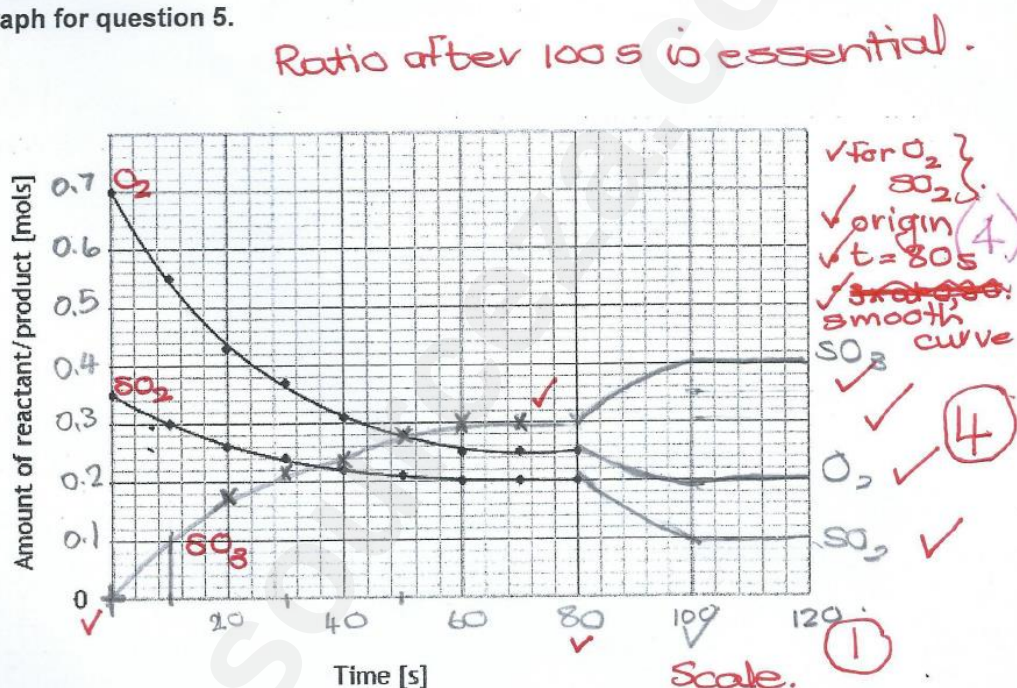
	$\frac{\text{final-initial}}{\text{change in time}} = \frac{50-0}{4-0} \checkmark \checkmark$ $= 12,5 \text{ cm}^3 \cdot \text{min}^{-1} \checkmark$	
3.2.4	2,7 minutes=162 sconds	1
3.3.1	1% produces 3.3 volumes of oxygen 20% (19.39%) volume of peroxide✓✓	2
3.3.2	Greater number of H ₂ O ₂ molecules per unit volume✓ increased number of effective collisions✓[with catalyst] per unit time✓	3
3.3.3	<i>substance that increases the rate of the reaction but remains unchanged at the end of the reaction</i>	2
3.3.4	On graph	2
(change) Steeper gradient Start + end at 64. at 0		
3.3.5	No change	(1)
		[23]
QUESTION 4		

4.1	A reversible reaction is one in which products can be converted back into products	2																																								
4.2.1	$n = \frac{m}{M}$$\frac{1.12}{28} \checkmark$$= 0.04 \text{ mol}$ <table><tr><td></td><td>COBr₂</td><td>CO</td><td>Br₂</td><td></td></tr><tr><td>Initial moles</td><td></td><td>0</td><td>0</td><td></td></tr><tr><td>Change moles</td><td></td><td>-0.04</td><td>+0.04</td><td>+0.04</td></tr><tr><td>Moles at equm</td><td></td><td></td><td>0.04 ✓</td><td></td></tr><tr><td>Conc at equm</td><td></td><td></td><td>0.02 ✓</td><td>[div by 2]</td></tr><tr><td colspan="5">Kc = $\frac{[\text{CO}][\text{Br}_2]}{[\text{COBr}_2]}$ ✓</td></tr><tr><td colspan="5">$0.19 \checkmark = \frac{(0.02)^2 \checkmark}{[\text{COBr}_2]}$</td></tr><tr><td colspan="5">$[\text{COBr}_2] = 2.11 \times 10^{-3} \text{ mol.dm}^{-3} \quad \checkmark$</td></tr></table>		COBr ₂	CO	Br ₂		Initial moles		0	0		Change moles		-0.04	+0.04	+0.04	Moles at equm			0.04 ✓		Conc at equm			0.02 ✓	[div by 2]	Kc = $\frac{[\text{CO}][\text{Br}_2]}{[\text{COBr}_2]}$ ✓					$0.19 \checkmark = \frac{(0.02)^2 \checkmark}{[\text{COBr}_2]}$					$[\text{COBr}_2] = 2.11 \times 10^{-3} \text{ mol.dm}^{-3} \quad \checkmark$					7
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4.2.2	At equilibrium: $n(\text{COBr}_2) = cV$$= 2.11 \times 10^{-3} \times 2 \checkmark$$= 4.22 \times 10^{-3} \text{ mol}$ Initial moles: $= 0.04 + 4.22 \times 10^{-3}$$= 0.044 \text{ mol} \checkmark$ % decomposition $= \frac{0.04}{0.044} \times 100 \checkmark$$= 90.46\% \checkmark$	$m(\text{COBr}_2) \text{ initial}$$m - nM = 0.044 \times 188 = 8.27 \text{ g}$ $m(\text{COBr}_2) \text{ reacted} = 0.04 \times 188 = 7.52 \text{ g}$$\frac{7.52}{8.27} \times 100 \checkmark = 90.9\% \checkmark$	4																																							
4.3	Kc > 0.19 (accept greater than 0.19 in words) Higher temperature favours the endothermic Forward is endothermic More products formed	1																																								
		[14]																																								

QUESTION 5

5.1	Scale on graph:	1
5.2	On graph: Label both O ₂ and SO ₂	1
5.3	On graph: ✓ start at origin ✓ final time at 80 ✓ smooth curve	3

Graph for question 5.



5.4	When an external stress (change in pressure, temperature or concentration) is applied to a system in dynamic chemical equilibrium, the equilibrium point will change in such a way as to counteract the stress'	2
5.5	SO ₃ increase ✓ two units	4
	SO ₂ down two units ✓	
	O ₂ down one unit. ✓	
	✓ constant after 100 s	[11]

QUESTION 6

6.1	a base that only dissociates/ionises partially in an aqueous solution	2
6.2.1	$K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]}$ ✓	2

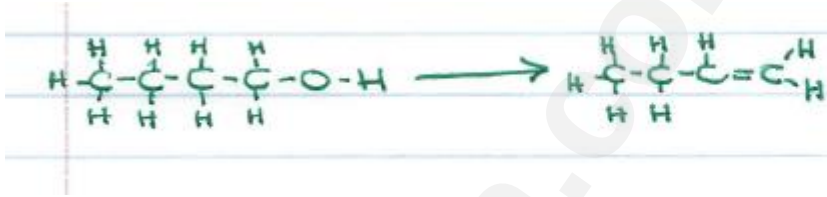
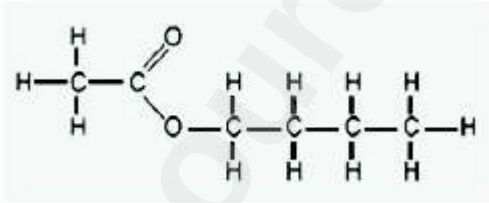
QUESTION 7

QUESTION 8

QUESTION 9

9.1.4	$2\text{Cl}^- + 2\text{H}_2\text{O} \rightarrow \text{H}_2 + 2\text{OH}^- + \text{Cl}_2$	2
9.1.5	$E^\theta = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}}$ $= (-0.83) - (+1.36) \checkmark$ $= -2.19\text{V} \checkmark$	2
9.1.6	E^θ of the oxide of H_2O is more negative than Cl^- - H_2O is stronger RA $\checkmark$ than Cl^- and will be oxidized $\checkmark$ (more easily)	2
9.2.1	Pt gauze	1
9.2.3	$n = \frac{V}{V_o}$ $= \frac{440 \times 10^{-3}}{22.4} \checkmark = 0.0196 \text{ mol} \checkmark$	2
9.2.4	Mol ratio: metal X 2: 1 oxygen 0.0392 : 0.0196 $\checkmark$ $n = \frac{m}{M}$ $M = \frac{m}{n} = \frac{2.49}{0.0392} \checkmark$ $= 63.52 \text{ g.mol}^{-1} \checkmark$	3
9.2.5	X is likely to be copper ($A=63.55$)	1
9.2.6	$q = nF$ mole ratio is 2(electrons): X $\checkmark$ $q = 0.0392 \times 2 \times 96500 \checkmark$ $= 3782.8 \times 2 = 0,0784 \text{ C} \checkmark$ $t = \frac{q}{I}$ $\frac{3782.8 \times 2}{1.5} \checkmark$ $= 5043,73 \text{ s}$	4
		[23]

10.1.1	$\text{R}-\overset{\overset{\text{O}}{\parallel}}{\text{C}}-\text{O}-\text{H}$	1
10.1.2	a weak force of attraction between molecules, ions, or atoms of noble gases	2
10.1.3	Both have (two) hydrogen bonds between molecules And London/dispersion forces✓ But heptanoic acid has a longer chain/surface area✓ More/stronger London forces✓ More energy required to overcome✓	4
10.2.1	✓Double bond ✓Br/Cl ✓methyl	3
10.2.2	<u>Two halogen atoms</u> ✓ on a <u>hydrocarbon chain with a double bond</u> ✓	2
10.3.1	Cracking/elimination	1
10.3.2	Long chains can be broken down into shorter more reactive chains	1
10.3.3	If unsaturated Bromine water is added✓ (brown)✓ Loses colour/fades/changes to colourless✓	3
10.4	Hydrogenation.	1
		[18]

QUESTION 11		
11.1	Hydroxyl	1
11.2	Butan-2-ol✓✓ $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$ ✓	3
11.3.1	Dehydration	1
11.3.2		3
11.3.3	Alkene	1
11.4.1	Esterification	1
11.4.2	Butyl ethanoate 	4
11.4.3	Flavours /fragrance (bananas or apples)	1
11.5.1	substitution	1
11.5.2	1-bromobutane✓✓ and water✓	3
		[19]