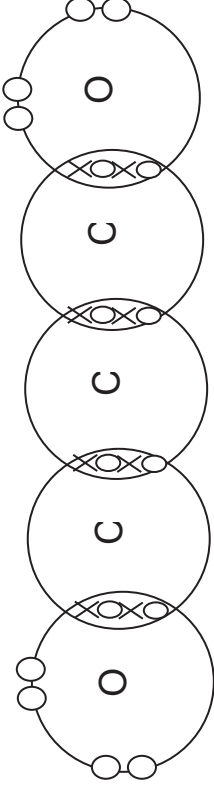


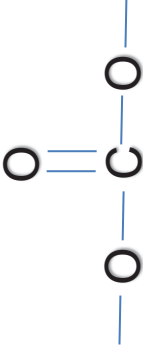
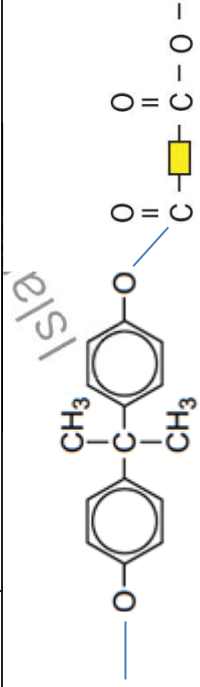
2019 Sec 4EX Prelims Pure Chem MS

MCQ												
1	D	11	D	21	B	31	D					
2	C	12	D	22	D	32	A					
3	D	13	C	23	C	33	B					
4	A	14	A	24	C	34	A					
5	B	15	D	25	D	35	B					
6	D	16	C	26	D	36	B					
7	A	17	B	27	B	37	D					
8	D	18	C	28	C	38	B					
9	A	19	A	29	B	39	A					
10	A	20	C	30	A	40	B					
Section A								Marks	Markers report			
A1	(a)	hydrogen									[1]	
	(b)	sulfur dioxide									[1]	
	(c)	propane									[1]	
	(d)	nitrogen									[1]	
	(e)	ammonia									[1]	
	(f)	(i)	N ₂ + 3H ₂ ⇌ 2NH ₃					[1]	[2 for 1m, 3 for 2m]			
	(ii)	450 – 500 °C 200 – 250 atm Powdered iron as catalyst										
A2	(a)	(i)	H ⁺ + H ₂ O ⇌ OH ⁻ + H ₂					[1]				
		(ii)	Hydrogen has been reduced as the oxidation state of hydrogen decreases from +1 to 0 while Hydrogen ion has been reduced as the oxidation state of hydrogen increases from -1 to 0.					[0.5] [1] [0.5] [1]				
	(b)	(i)	Nickel has a much higher density compared to sodium					[1]				
			Nickel has a much higher melting point compared to sodium					[1]				
		(ii)	For the hydrogenation of vegetable oil to margarine.					[1]				
		(iii)	Since an alloy of nickel and copper consist of atoms of different					[1]				

[Turn over

			sizes, Therefore, this disrupts the regular arrangement of the pure metal, making it harder to slide when a force is applied As a result, this causes it to be less malleable.	[1]	
A3	(a)	Z, W, X, Y		[1]	
	(b)	(i) hydrogen gas (ii) iron (iii) lead / copper / silver		[1] [1] [1]	
A4	(a)	(i) It has a functional group of CHO / it has a general formula of $C_nH_{2n+1}CHO$. (ii) Propanal has a higher melting / boiling point than ethanal Propanal has a higher viscosity than ethanal Propanal has a lower flammability than ethanal		[1] [2 for 1m, 3 for 2m] [1] [1]	
	(b)	(i) $C_2H_5OH + CuO \rightarrow CH_3CHO + Cu + H_2O$ (ii) Mole of ethanal = $11 / 44 = 0.25$ mol Mole ratio of ethanal: ethanal = 1:1 = 0.25:0.25 Mass of ethanal = $0.25 \times 46 = 11.5g$ Therefore, % purity of ethanal = $11.5 / 15 = 76.7\%$		[1] [1] [1]	
	(c)	Comparing relevant example (e.g ethanol and ethanal) with the same number of carbon atoms, the number of hydrogen atoms are different. Therefore, they are not isomers as this will result in different molecular formula.		[1] [1]	
A5	(a)	It should be a gas at room temperature. This is because it exists as a simple molecular structure in which molecules are held by weak intermolecular forces.		[1] [1]	

	(b)		[1m for the correct number of sharing electrons, 1m for correct number of unshared valence electrons]	
	(c)	(i) Addition polymerisation (ii)	[1m for 2 repeat units, 1m for correct arrangement of a repeat unit]	
A6	(a) (b) (c)	Calcium sulfate Magnesium sulfate To make sure all the acid has been reacted. Heat until a saturated solution is formed Cool the solution, crystallisation takes place Filter the crystals to remove left over solution / Dry crystals between filter paper	[1] [1] [1] [1] [1]	
A7	(a)	(i) $E_2 - E_1$: enthalpy change/ ΔH $E_3 - E_1$: activation energy for backward reaction $E_3 - E_2$: activation energy for forward reaction.	[1] [1] [1]	
	(b)	(i) Bond breaking: (1 x 612) + (4 X 412) + (2 x 463) = +3186 kJ	[1]	

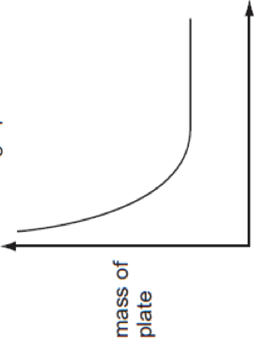
Section B				
B8	(a)		[1]	
	(b)	Disposal of polycarbonates results in the formation of BPA and carbon dioxide. Carbon dioxide is a greenhouse gas which will result in global warming. In addition, BPA is non-biodegradable and can leach into water bodies which could cause harm to marine life. It leaches more over time as it ages in the landfills	[1] [1] [1]	
	(c)	(i) It is acting as a catalyst for the reaction. It is not used up over time. (ii) $94 - 16 - 6(12) - 12 = 4$ Therefore, $x = 4$. (iii) n for the polycarbonate = $18\,000 / (4 \times 76 + 4 \times 12 + 3 \times 16 + 6) = 44.33 \approx 45$ 45 moles of diphenyl carbonate is required to form the poly carbonate. Therefore, 90 moles of phenol is required. Mass of phenol required = $90 \times 94 = 8460$ g.	[1] [1] [1] [1] [1] [1]	
	(d)		[1m for correct formula, 1m for n]	

[Turn over]

B9	(a)	X: $4\text{OH}^-(\text{aq}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^-$	[1]	
		Y: $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	[1]	
	(b)	The overall equation of the electrolysis: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ Therefore, 1 mole of oxygen is formed at X for every moles of hydrogen formed at Y.	[1] [1]	
		/		
		For every 4 moles of electrons, 1 mole of oxygen gas is formed at X while 2 moles of hydrogen are formed at Y.	[1] [1]	
	(ii)	Since oxygen is more soluble than hydrogen, less oxygen will be collected at X. Therefore, the ratio of hydrogen collected compared to oxygen will be greater than 2:1	[1] [1]	
	(c)	The universal indicator will turn purple at Y The is because there is a reduction in H^+ ions, resulting in a decrease in acidity / increase in alkalinity	[1] [1]	
B10	(a)	The amounts of CO , SO_2 and PM10 emissions are lower when using biodiesel than fossil diesel. [1] On the contrary, the amount of NO_x exhaust emission is higher when burning biodiesel than fossil diesel. [1]	[1] [1]	
	(ii)	There is more amount of CO produced. CO is a pollutant which binds irreversibly with haemoglobin in red blood cell to form carboxyhaemoglobin, impairing its ability to transport oxygen causing breathing difficulties and death. There is more SO_2 produced. SO_2 irritate the eyes and lungs and causes breathing difficulties	[1] [1]	
	(b)	Burning of biodiesel releases CO_2 to the atmosphere. Biodiesel is formed from plants which absorb CO_2 in the atmosphere during photosynthesis.	[1]	

[Turn over]

		Hence there is no net increase of CO ₂ in the atmosphere.	[1]																					
	(c)	(i) One molecule of CFCl ₃ produces a Cl atom under UV light which reacts with one molecule of O ₃ to form one molecule of C/O Another Cl atom is regenerated when one molecule of C/O reacts with an O atom.	[1]																					
	(ii)	From graph, <table><tr><td></td><td>C</td><td>F</td><td>Cl</td></tr><tr><td>moles</td><td>2</td><td>4</td><td>2</td></tr><tr><td>simplest ratio</td><td>1</td><td>2</td><td>1</td></tr></table> The empirical formula is CF ₂ Cl. From graph, <table><tr><td></td><td>C</td><td>F</td><td>Cl</td></tr><tr><td>Mass of 1 mole of compound/g</td><td>24</td><td>76</td><td>71</td></tr></table> Mr of CFCs = 171 n = 2 Molecular formula is C ₂ F ₄ Cl ₂		C	F	Cl	moles	2	4	2	simplest ratio	1	2	1		C	F	Cl	Mass of 1 mole of compound/g	24	76	71	[1]	
	C	F	Cl																					
moles	2	4	2																					
simplest ratio	1	2	1																					
	C	F	Cl																					
Mass of 1 mole of compound/g	24	76	71																					
Or																								
B10	(a)	zinc	[1]																					

	(b)	(i)	graph 1	[1]	
			 mass of plate time	[1]	
	(c)	(ii)	Gradient is less steep as the concentration of iodine is halved, resulting in a slower speed of reaction. Half the mass of zinc reacted since only half the number of mole of the limiting reagent, iodine is present. At 15 °C, the zinc atoms and iodine molecules have lower kinetic energy. Hence, less particles have energy greater or equal to the activation energy. The frequency of effective collisions between the zinc atoms and iodine molecules decreases. Hence, speed of reaction decreases.	[1] [1] [1]	
	(d)	(i)	$\text{ZnI}_2 + \text{Cl}_2 \rightarrow \text{ZnCl}_2 + \text{I}_2$	[1]	
		(ii)	I^- loses electrons to form I_2 while Cl_2 gains electrons to form Cl^- ions Therefore, I^- has being oxidised while Cl_2 is reduced	[1] [1]	

