Bukit Merah Secondary School
Preliminary Examination 2024
Chemistry 6092

Paper 1

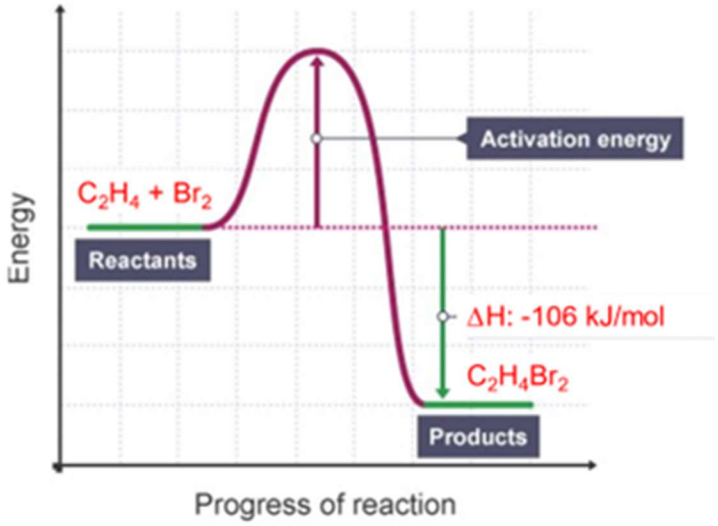
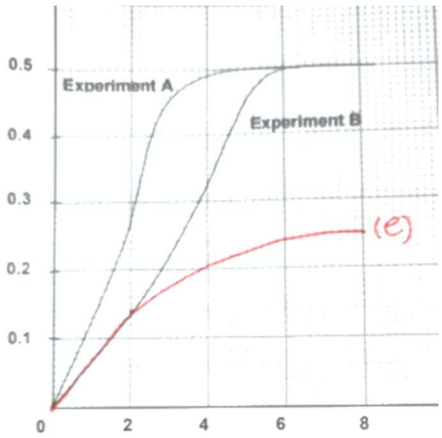
1	D	6	C	11	B	16	B
2	C	7	B	12	C	17	C
3	B	8	A	13	A	18	C
4	A	9	C	14	C	19	C
5	A	10	D	15	B	20	A

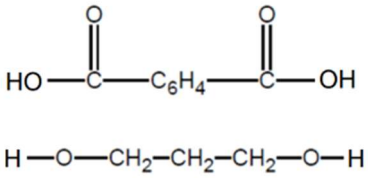
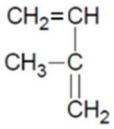
21	D	26	C	31	C	36	B
22	B	27	D	32	C	37	B
23	B	28	A	33	A	38	C
24	D	29	D	34	D	39	C
25	C	30	D	35	A	40	C

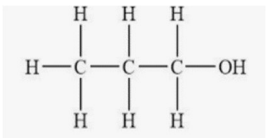
Paper 2

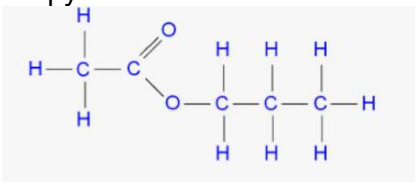
Qn	Suggested Answers	Remarks
1	(a) potassium manganate (VII) (b) methane (c) potassium iodide (d) calcium oxide (e) ethene (f) aluminium oxide	[1] each
2	(a) 0.5 (b) Yellow: remains in middle; Blue: Furthest from middle; Red: In between yellow and blue (c) At 80% alcohol, all 3 dyes have the same Rf values of 0.4, which shows up as one spot on the chromatogram.	[1] [1]-Y [1]-B&R [1]
3	(a) (i) 14, 14 14, 15 14,16 (ii) Ar = 28.11 (2 dp) (b) Silicon dioxide has giant molecular structure. Large amount of heat energy is needed to overcome the strong covalent bonds between the atoms. Hence it has high melting point (heat-resistant). As there is no free moving electrons / ions available, it is electrically insulator.	[1] [1] [1] – structure [1] – energy/bond [1]

4	(a) $C_6H_8N_2Pb$ (b) Anion: $PbCl_6^{2-}$ Cation: NH_4^+ (c) +4	[1] - mol [1] – final [1] each [1]
5	(a) $\frac{volume\ of\ NaOH}{volume\ of\ H_3PO_4} \times 100\%$ (b) NaH_2PO_4 (c) Phenolphthalein The equivalence point for stage B is within the pH range where phenolphthalein changes colour.	[1] [1] [1] [1]
6	(a) Lower the ionisation energy, the more reactive the Group 1 metal is. This is because, as atomic size increases, the valence electron is further away from the nucleus (protons), requiring lesser amount of energy to remove. (b) Accept any value more than 0.526 Fluorine (2,7) has more protons as compared to lithium (2,1) hence requires more energy to remove one valence electron.	[1] – trend [1]- explanation [1] [1]
7	(a) Energy taken in during bond breaking = 602 + 193 = 795 kJ/mol Energy release during bond forming = 349 + 2(276) = 901 kJ/mol dH = 795 – 901 = -106 kJ/mol. (b) Correct shape (exothermic) Correctly label with correct arrows	[1] [1] [1] [1] [1]

		
8	(a) Experiment A as the initial gradient is steeper (indicating faster reaction). At higher temperature, particles gain energy and move faster resulting in higher rate of effective collisions. (b) Rate = 0.135 / 2 = 0.0675 g/min (c) carbon dioxide is released. (d) mol of CO_2 = 0.5 / 44 = 0.0113636 mass of $PbCO_3$ = 0.0113636 x 267 = 3.03 g (e) use of catalyst (must be named) / higher concentration of nitric acid / finer particle size of lead carbonate (f)  Must end at 0.25 g	[1] [1] [1] [1] [1] [1] [1] [1] [1]

9	(a) Experiment 1: White solid formed Mg + H2O → MgO + H2 Experiment 2: Reddish-brown solid formed (from black solid). (Good to have) Water droplets on side of test tube CuO + H2 → Cu + H2O (b) To prevent hot copper metal from oxidising / forming back copper(II) oxide / reacting with oxygen in air. (c) (i) Experiment 1: copper is too unreactive / low in reactivity series, will not react with steam. Experiment 2: magnesium is more reactive / higher in reactivity series than H2, Mg in MgO will not be reduced by H2. (ii) Silver is less reactive than copper, hence silver(I) oxide is less (thermally) stable than copper(II) oxide.	[1] [1] [1] [1] [1] [1] [1]
10	(a) ***Monomers for PTT:***  ***Monomer for poly(isoprene):***  (b) No. of moles of repeating units in PTT = 1000 ÷ [11(12) + 10(1) + 4(16)] = 4.85437 mol = 4.85 mol (to 3 s.f.) No. of moles of repeating units in poly(isoprene) = 1000 ÷ [5(12) + 8(1)] = 14.7059 mol = 14.7 mol (to 3 s.f.) (c) No. of moles of CO2 formed from burning 1.0 kg of poly(isoprene) = 14.7059 x 5 = 73.5 mol (to 3 s.f.)	[1] each [1] each [1] for both calculations

	No. of mol of CO2 formed from burning 1.0 kg of PTT = 4.85437 x 11 = 53.4 mol (to 3 s.f.) Burning 1.0 kg of poly(isoprene) produces more carbon dioxide than burning 1.0 kg of PTT. Carbon dioxide is a greenhouse gas which contributes to global warming. (d) (i) Adding water in presence of acid catalyst. (ii) recycling	 [1] [1] [1]
11	(a) Anode: $Ag(s) \rightarrow Ag^+(aq) + e^-$ Cathode: $2H^+(aq) + 2e^- \rightarrow H_2(g)$ (b) oxidation state of Ag increases from 0 in Ag to +1 in AgCl hence Ag is oxidised. Oxidation state of O decreases from 0 on O2 to -2 in H_2O hence O is reduced. Since oxidation and reduction occur simultaneously, it is a redox reaction. (c) Ensure O_2 is continuously dissolve in the water for more accurate reading / even distribution of water sample. (d) Silver; silver chloride is formed. (e) D as it has the lowest ammeter reading indicating low concentration of oxygen in blood. With intake of carbon monoxide, haemoglobin will bind to CO to prevent further intake of oxygen gas in the body. (f) Manganese is not used up in the experiment, exhibiting the use of catalyst behavior / multiple oxidation states of Mn (g) Mol of sodium thiosulfate = 0.01 x 0.0112 = 0.000112 mol ratio of I_2 = 0.000112 / 2 = 0.000056 mol of $Mn(OH)_3$ = 0.000056 x 2 = 0.000112 mol of O_2 = 0.000112 / 4 = 0.000028 Concentration of O_2 = 0.000028 / 0.1 = 0.00028 mol/dm3	[1] [1] [1] [1] [1] [1] each [1] – trend [1] – reason [1] [1] [1] [1]
12	(a) (i) methoxybutane, $CH_3\text{-}O\text{-}C_4H_9$ (ii) Propanol, 	[1] each [1] each

	(iii) Propyl ethanoate  (b) (i) A: Isomerisation because it has same number of carbon and hydrogen atoms as octane. B & D: Cracking because octane is broken down into smaller molecule (lesser carbon and hydrogen atoms). C: Substitution because one of the hydrogen in octane is replaced with bromine. (ii) B reacted with steam under 300 °C, 60 atm and phosphoric acid catalyst.	[1] each [1] [1] [1] [1]
13	(a) (i) alkene C_nH_{2n} (ii) Any isomer (b) (i) Test: Bubble into bromine solution Isobutylene: Turns brown bromine solution to colourless. X: Brown bromine solution remains brown. Or use any acid reactions (ii) Isobutylene can be added to steam under 300 °C, 60 atm and phosphoric acid catalyst to form isobutanol which is further oxidised by adding acidified potassium manganate (VII) to form X. (c) Isobutylene has simple molecular structure with small amount of heat energy needed to overcome the weak intermolecular forces of attraction between the molecules. After polymerization, many small molecules of isobutylene joined together to form a macromolecule (polymer). Hence more energy is now required to over the stronger intermolecular forces of attraction between the molecules.	[1] [1] [1] [1] [1] [1] [1] [1] [1]

Paper 3

Qn	Skill	Suggested Answers	Remarks
1(a)(i)	PDO	Results table: - Records initial burette readings, final burette readings and volume added with correct headings and units in a titration table. - All burette readings for all accurate titres in titration table are recorded to nearest 0.05 cm^3. Titration results: - *accuracy* for the average titre (of consistent readings) within 0.20 cm^3 of Supervisor's average value score 2 marks. for the average titre (of consistent readings) within 0.30 cm^3 of Supervisor's average value score 1 mark - *concordance* at least two titre values are within 0.20 cm^3 Teacher's result: 21.40 cm^3	[1] [1] [2] [1]
(ii)	MMO	Appropriate average volume in 2 d.p. from the closest titre values (should be identified either in the table by a tick or in a calculation)	[1]
(b)(i)	ACE	number of moles of sodium hydroxide = 0.150 x 0.025 = 0.00375 mol	[1]
(ii)	ACE	Concentration of Q = 12 / 192 = 0.0625 mol/dm^3	[1]
(iii)	ACE	Number of moles of Q in XX cm^3 = 0.0625 x XX/1000 (titration result) = A (3 sf)	[1]
(iv)	ACE	A mol of Q requires 0.00375 mol of NaOH to react Hence, 1 mol of Q requires 0.00375/A = B (whole number)	[1]
(v)	ACE	$3NaOH + C_6H_8O_7 \rightarrow Na_3C_6H_5O_7 + 3H_2O$	[1]
(c)	P	Description on the method e.g. - measure the mass of empty boiling tube using electronic balance - place 5g (any reasonable mass) of solid into the boiling tube and measure the mass of the boiling tube and solid - heat the solid strongly	[1] [1]

		- allow to cool before measuring the mass of the solid and boiling tube - repeat till the mass remains unchanged - Difference in mass before and after heating in mass lost is water - By comparing mole of water and acid, we can check the if the ratio is 1:1.	 [1] [1]
2(a)	MMO MMO MMO	The gas forms white ppt in limewater. The gas is carbon dioxide. On strong heating, solid (X) turned from white to yellow. When cooled, solid (Y) turned from yellow to white.	[1] [1] [1]
(b)	MMO MMO MMO	White ppt formed, soluble in excess aqueous ammonia to give a colourless solution. No ppt formed / No visible change (Accept faint white ppt formed) White ppt formed.	[1] [1] [1]
(c)	ACE	Acid A is H_2SO_4 Salt X is $ZnCO_3$	[1] [1]
(d)(i)	MMO	Universal indicator turned from green to purple then violet to green upon gentle heating.	[1]
(d)(ii)	ACE	Y is amphoteric oxide. From 2(d)(i), when Y is heated with calcium hydroxide solution, the Universal Indicator turned from purple to green. This indicates that Y is a metal oxide that can neutralise alkaline calcium hydroxide in 2(d)(i).	[1] [1]
3(a)	MMO PDO	Tabulation - total volume of water and K is 50 cm^3 - Time recorded to nearest second - Time show decreasing trend - all 1/time values are correctly calculated to 3 sf	 [1] [1] [1] [1]
(b)	PDO	Graph - both axes are labelled with units - correct appropriate scale chosen for both axes so that plots cover at least half of grid for both axes (origin can be considered a “point” if graph is drawn from origin) - all 5 points are correctly plotted points to ½ of small box - best fit straight line drawn starting (from origin if axes starts from origin)	 [1] [1] [1] [1]

		○ each of at least 4 (correctly plotted) out of the 5 points need to lie within a distance of 2 small boxes from the line	
(c)	ACE	Correct rate of reaction values obtained from graph (must indicate in graph) Time taken = 1/ rate of reaction = XXX s (3sf)	[1] [1]
(d)	ACE	When volume of sulfuric acid increases, 1/time (or rate) increases. As volume of sulfuric acid increases, concentration of sulfuric increases. Number of (reacting) particles per unit volume increases. Hence, frequency of effective collisions increases.	[1] [1] [1]
(e)	ACE	Any possible improvement: - use burette to measure volume instead of measuring cylinder (since burette is more precise / has higher precision than measuring cylinder) - use sandpaper to remove possible oxide layer on the surface of magnesium - use a magnetic stirrer to ensure constant rate of stirring	[1]