Bukit View Secondary School
PRELIM 2024 – Chemistry
4 E Pure Chemistry Mark Scheme

P1

Qns	1	2	3	4	5	6	7	8	9	10
Ans	B	D	B	A	B	C	B	A	A	C
Qns	11	12	13	14	15	16	17	18	19	20
Ans	B	C	A	B	C	D	D	C	B	D
Qns	21	22	23	24	25	26	27	28	29	30
Ans	C	A	D	B	C	D	C	C	C	C
Qns	31	32	33	34	35	36	37	38	39	40
Ans	C	A	A	B	D	C	C	B	B	B

MCQ analysis:

1	*Qn did not mention speed of reaction or loss of mass to record volume of gas*
2	*Liquids – no need mp,*
3	*A, C and D wrong from graph*
4	*Solid sodium chloride is soluble, filtration is for insoluble solid*
5	*Bp of water 100 deg, anything above cannot be boiled to vapour*
6	*Mr NH_3:17, Mr N_2:28,*
7	*1 X: 19 p 18 e 21 n* *2 Y: 19 p 19 e 20 n* *3 Z: 16 p 18 e 18 n*
8	*Since only part of the substance reacts with acid, it must be a mixture. Iron would completely react with acid, given enough time.* *Since the entire substance conducts electricity, it must be a mixture of metals. Brass is the best answer.*
9	*R+ : Q-* *8 : 4* *2 : 1*
10	*Graphite – only 3 bonds occupied, Graphene – all bonds occupied – no delocalised e, Graphene – layered structure similar to graphite – soft than diamond*
11	*Y from group 16 – proton numbers in group 16*
12	*Co: NH_3* *36.6/59 : 63.4/17* *1 : 6*
13	*Convert to mol → multiply 6.02 x 10^23* *H_2: 1 mol, Ne: 0.2 mol, O_2:0.25 mol, CO_2:0.5 mol*
14	*20 dm^3 H_2 needs only 20 dm^3 Cl_2, hence 10 dm^3 Cl_2 excess + 40 dm^3 HCl*
15	*Mol water = 27/18 = 1/5 mol* *Mol pure NH_4NO_3 = 0.75 mol , mass NH_4NO_3 = 0.75 X 80 = 60.0 g*
16	*80% - 60* *100% -75 g calculated mass* *Mol urea – 75/60 = 1.25 mol, mol NH_3 = 2.5 mol , mass NH_3 = 42.5 g*

17	Max temp reached is where acid has been neutralised. Take volumes from this temp. Mol H_2SO_4 = 0.03 mol, mol NaOH reacted = 2 x 0.03 = 0.06 mol, conc NaOH = 3mol/dm^3
18	Strong acid, completely ionise – A,B wrong, D- depends on amount of water
19	Sulfur dioxide formed dissolves in water for form acidic solution.
20	Acidic and amphoteric oxides react with bases
21	Conductance depends on mobile ions, K has high conductance, temperature change same – both neutralise sodium hydroxide, K reacts rapidly with Mg
22	$Zn + Cu(NO_3)_2 \rightarrow Zn(NO_3)_2 + Cu$ [displacement], B,C & D no reactions
23	White ppt with aq ammonia soluble – Zinc Blue ppt forming dark blue sol with aq ammonia – Cu^{2+}
24	Cl (0) in Cl_2 to Cl (-1) in NaCl and Cl (+1) in NaOCl
25	A: H^+ and Cl^- discharged, NaOH – more alkaline B: Cu^{2+} and OH^- discharged , H_2SO_4 – more acidic C: Cu^{2+} discharged and released from electrode – no change D : H^+ and OH^- discharged, becomes more conc NaCl
26	Need mobile ions/ electrons/ more & less reactive metals connected
27	$Zn^{2+} + 2e \rightarrow Zn(s)$ 1 mol 0.5 mol $Cr^{x+} + xe \rightarrow Cr(s)$ 1mol 0.2 mol 1/0.2 = 5
28	Most reactive: U, V, Fe, W Least reactive
29	P>Q
30	Charge from group no., acidic / basic from LHS/RHS of PT
31	Excess bromine, KBr, I_2, unreacted KCl
32	Pb> D, D > Cu, Pb> Cu
33	More energy released in forming bonds than breaking bonds
34	Hydrogen as fuel, oxygen as oxidiser, pure water is the product, oxygen is reduced
35	Endothermic → energy from surr
36	Increase speed and amount of reactants
37	M: $C_3H_8 + F_2 \rightarrow C_3H_7F$
38	20.32 g Iodine → 20.32/ 254 =0.08 mol I_2 0.08/0.02 = 4 mol C=C
39	CH_3 and Cl on diff C atom
40	propanoic acid-$C_3H_7CO_2C_2H_5$ – ETHANOL

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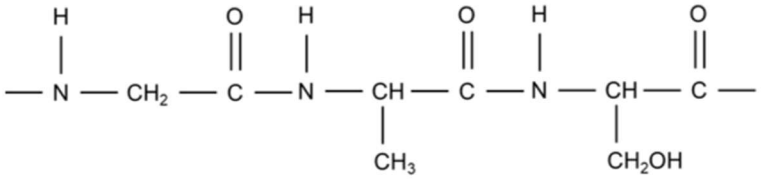
P2 Section A

A1 **(a)** Any two from: 1
Glycine/ alanine/ serine

(b) (8400/42) x 3= 600 1

(c)  2

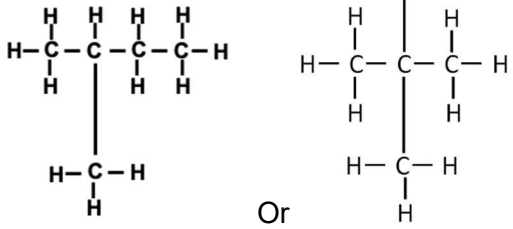
1 correct amide linkage

1 correct sequence

(d) Calculate Rf value of current substance and compare with known value 1

A2 **(a)** pentene 1

(b) Compound 2 and 3 have the same molecular formula of C_5H_{10} but different structural formula. 1

(c)  2

(d) divide by relative atomic mass / calculated mole ratio 1
C : H : O
5.175. : 10.3 : 1.725

divide by smallest number to get ratio C_3H_6O 1

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A3 **(a)** experiment 1:
positive electrode : $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$ 1
negative electrode: $Na^+(aq) + e^- \rightarrow Na(l)$ 1

experiment 2:
positive electrode: $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$ 1
negative electrode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ 1

(b) hydrochloric acid 1

As the copper and hydroxide ions are preferentially discharged, the remaining ions are hydrogen and chloride ions. 1

(c) The electrode at positive terminal dissolves and decreases in mass/ colour of solution remains unchanged/ blue. 1

Copper being reactive oxidises to form copper(II) ions. 1

A4 **(a)** To reuse the unused reactants to minimise cost of production 1

To increase the rate of reaction to produce ammonia/ increase yield of ammonia 1

(b) Nitrogen / hydrogen can oxidise to form oxides of nitrogen/ water 1

(c) As pressure increases, rate of reaction increases, increasing the amount of ammonia produced 1

At higher pressure, there are more nitrogen and hydrogen molecules per unit volume/ molecules are closer together 1

increasing the frequency of effective collisions. 1

A5 **(a)** $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2CO_2$ 1

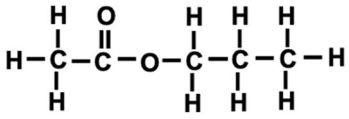
1

(b) Yeast, 37°C , Absence of oxygen 1(ALL)

(c) Ethene obtained from crude oil/ fossil fuel is a finite resource/ run out/ non-renewable 1

Glucose obtained from plants so continuous supply/ renewable/ will not run out 1

(di) Ethanoic acid 1

(dii)  1

A6 **(a)** $2NaClO_3 + (COOH)_2 + H_2SO_4 \rightarrow 2ClO_2 + Na_2SO_4 + 2CO_2 + 2H_2O$ 1

(b) Mol NaOH = 14/1000 x 0.100 =0.00140 mol 1

Mol $(COOH)_2$ =

In 25.0 cm^3 : 0.000700 mol

In 1 dm^3. : 0.028 mol 1 (1 dm^3)

Mass of hydrated oxalic acid = 0.028 x (90+36) =3.528 g

% purity= 3.528/5.00 x 100% =**<u>70.6 %</u>** 1

(c) **Repeat** experiment without indicator 1

Using **same volume of acid** to neutralise the alkali. 1

A7 **(a)** Mass of iron decreases as reaction proceeds 1

Solid iron reacts with bromine to form aqueous iron(II) bromide 1 (mention change in solid to aq)

(b) Increases the frequency of collision between particles 1

Hence increases rate of reaction 1

(c) Mol Fe = 8.4/ 56 =0.15 mol

Mol Br = 4/1000 x 0.05 = 0.0002 mol 1 – calc mol

Fe : Br

1 : 1

For 0.0002 mol of Br, only 0.0002 mol of Fe is required. 1 – limiting

Enthalpy change per mol = - 250 kJ

Enthalpy change 0.0002 mol = - 0.05kJ 1 - enthalpy

A8 **(a)** Lithium loses 1 electron to form positively charged lithium ion & Chlorine gains 1 electron form negatively charged chloride ion 1

To obtain noble gas configuration 1

(b) Radius of lithium atom decreases when it forms ion 1

Lithium loses 1 electron shell when it forms an ion 1

(c) No visible reaction/ Solution remains red-brown/ reddish brown. 1

Bromine is less reactive than chlorine. 1

A9 **(a)** More energy is given out when bonds are formed in NO and H_2O in stage 1 compared to energy given out for bond formation of HNO_3 in stage 2 — 1

OR

More energy taken in to break bonds in stage 2 for NO, H_2O, O_2 than energy taken in when bonds are broken in stage 1 for NH_3 and O_2.

(b) Nitric acid gas molecules diffuse — 1

from a higher concentration to a lower concentration where the blue litmus is located turning the damp blue litmus red — 1

(ci) When air/petrol ratio increases, concentration of CO decreases as — 1

More complete combustion takes place when more oxygen is available — 1

(cii) $2NO + 2CO \rightarrow N_2 + 2CO_2$ — 1

(d) 2 ozone molecules can be destroyed when one NO reacts in eqn 1 through — 1

formation of NO_2 which regenerates NO and repeats the depletion process of the next ozone molecule — 1

A10 **(a)** The oxidation state of iron increases from (+2) in Fe^{2+} to (+3) in Fe^{3+} — 1

AND

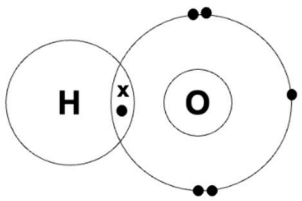
The oxidation state of oxygen decreases from (-1) in H_2O_2 to (-2) in OH^- .Since both oxidation and reduction takes place at same time, initiation step is redox reaction. — 1

(b) Highest Mr

= 18 x 1 + 3 x 1

= 21 — 1

(c)



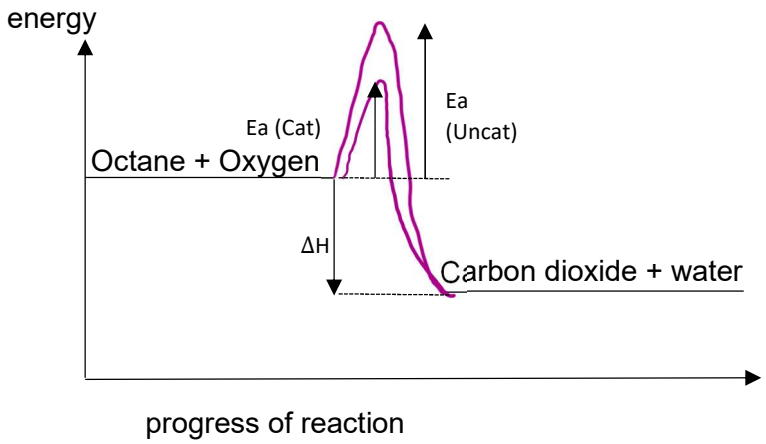
1 – drawing

Has an unpaired electron which makes the molecule unstable/ wants to obtain 1 more electron to achieve noble gas configuration — 1

(d) Under alkaline conditions, iron(II) reacts with hydroxide ion to precipitate $Fe(OH)_2$ which — 1

minimises amount of Fe^{2+} ions available for initiation reaction. — 1

(e)



1 reactant & product

energy of prod<react

1 Ea for cat & 1 Ea uncat

(arrow up from reactant)

1 enthalpy change (arrow down from reactant)

(f) beneficial:

all toxic organic pollutants can be oxidised and removed — 1 (toxic)

harmful:

non selective so useful organic substances will also be destroyed affecting the living things/ ecosystem in the ocean. — 1 (non-selective)

11 **(a)** X, Y, Cu — 1

Boat 2 does not show any changes in mass as oxide of Y stable and cannot be reduced by hydrogen and hence is more reactive than hydrogen and other metals. — 1

Boat 1 and contents changes the most as CuO is less stable hence CuO can be reduced by hydrogen to form Cu, Cu is least reactive amongst the metals — 1

/

Boat 3 shows changes in mass more than 2 and less than 1. Hence Oxide of Y is less stable than X and more stable than Cu as oxide of Y can be reduced by hydrogen.

$CuO + H_2 \rightarrow Cu + H_2O$ — 1

(bi) Mass of Y_2O_3 = 22.35 – 16. 35 = 6 g

Mass of O = 22.35 – 20.55 = 1.8 g — 1

Mass of Y = 6 -1.8 = 4.2 g — 1

(bii) Using empricial formula:

Y	:	O
2	:	3

		4.2/Ar : 1.8/ 18 3units = 0.1125 mol 2/3 x 0.1125 = 4.2/Ar Ar = 56	1
		Y = Iron	1
	(c)	Metallic oxide – presence of ionic bonding	1
		Large amount of energy required to overcome strong electrostatic forces of attraction between oppositely charged ions	1
B12	**(a)**	SiO_2 + 2C → Si + 2CO	1
	(b)	Silicon, Carbon, Aluminium	1
		Silicon dioxide is less stable hence can be reduced by carbon hence it is less reactive than carbon, aluminium oxide is more stable hence cannot be reduced by carbon hence aluminium is more reactive than carbon.	1
	(c)	Carbon monoxide is a simple covalent molecule. It has low melting and boiling point as it requires less energy to overcome the weak intermolecular forces of attractions between molecules.	1
		Silicon dioxide has a giant covalent structure. It has high melting and boiling points as large amount of energy is required to overcome the strong covalent bonds between atoms.	1
		Aluminium oxide has a giant ionic lattice structure. A large amount of energy is required to overcome the strong electrostatic forces of attraction between the oppositely charged ions. Hence it has high melting and boiling points.	1
		Both silicon dioxide and carbon monoxide is unable to conduct electricity as they do not have any mobile charge carriers. Alumnium oxide has mobile ions that allow it to carry electric current.	1
	(d)	Mass of aluminium present = 2.8 x 27 = 75.6 g % impurities = 100 – 95.85 – 0.40 = 3.75% 95.85% - 75.6 g 3.75 %. – **<u>2.96 g</u>**	1(mass Al) 1(equate correct mass to %) 1