WHITLEY SECONDARY SCHOOL
SCIENCE DEPARTMENT
PRELIMINARY EXAMINATIONS 2024

CHEMISTRY PAPER 2 (6092/02)

SECONDARY 4 EXPRESS

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Answers

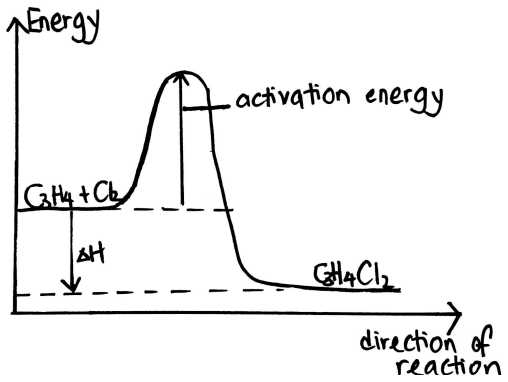
Qn		Answers	Marks / Remarks
1	**(a)**	F	[1] each
	(b)	B	
	(c)	A	
	(d)	D	
	(e)	E	
2	**(a)**	A: Iron (II) carbonate B: Iron (II) oxide C: carbon dioxide D: sulfuric acid	[1] each
	(b)	$FeO + 2H^+ \rightarrow Fe^{2+} + H_2O$	[1]
	(c)	The iron (II) hydroxide was oxidised to form iron (III) hydroxide which is brown in colour	[1]
3	**(a)**	Non-metal. Boron shares electrons with fluorine to form covalent bonds.	[1]
	(b)	Boron does not have stable noble gas configuration It has only 6 electrons around it even after forming covalent bonds with fluorine	[1] [1]
	(c)	Low melting point. Boron trifluoride is a simple covalent molecule with weak intermolecular forces of attraction (or van der waals forces) which requires only a small amount of energy to be overcome.	[1] [1]
4	**(a)**	+3 +5 +2 +4	All correct: [2] 3 or 2 correct: [1] 1 correct: [0]
	(b)	(i) $Mn(NO_3)_2 \rightarrow MnO_2 + 2NO_2$	[1]
		(ii) Manganese is oxidised and nitrogen is reduced As the oxidation state of Mn increases from +2 in $Mn(NO_3)_2$ to +4 in MnO_2As the oxidation state of N is decreased from +5 in $Mn(NO_3)_2$ +4 in NO_2. Hence it is a redox reaction.	[1] [1] [1]

5	**(a)**	The higher the air : fuel ratio, the lower is the concentration of carbon monoxide emitted by the car; When the air : fuel ratio is high, there are more oxygen available for complete combustion to take place; Thus more carbon dioxide is produced instead of carbon monoxide;	[1] [1] [1]
	(b)	More complete combustion takes place when the air : fuel ratio increases; More heat is produced causing the temperature to be very high; This causes more reaction between nitrogen and oxygen to take place to form oxides of nitrogen;	[1] [1] [1]
	(c)	Carbon dioxide is a greenhouse gas; and contributes to global warming. This has led to climate change resulting in: (any 2) • changes in rainfall patterns • heat waves • tropical storms • melting of polar ice caps	[1] [1] [2]

6	**(a)**	Monoatomic refers to a substance that consists of single atoms, not bonded to each other.	[1]
	(b)	Atoms of noble gases have a **complete valence shell/stable electronic configuration** and do not need to **gain, lose or share** electrons.	[1]
	(c)	Each of the noble gas have different boiling points.	[1]
	(d)	Neon has the smallest (relative) atomic mass / atoms have the smallest masses	[1] [1]
	(e)		

7	**(a)**	Manganese, chromium, iron; Manganese is the most reactive as it displaces both iron and chromium from their compounds; Chromium is more reactive than iron as it displaces iron from its compound OR Iron is the least reactive as it is unable to displace both manganese and chromium from its compounds.	[1] [1] [1]
	(b)	Mn (s) + Fe^{2+}(aq) → Mn^{2+}(aq) + Fe (s)	1] for correct equation [1] for correct state symbols
	(c)	Red-brown solid forms; Blue solution turns purple;	[1] [1]

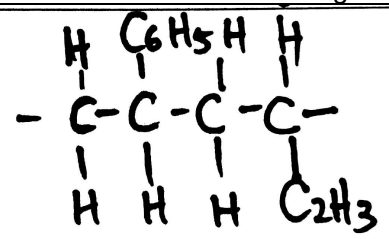
8	**(a)**	C_3H_4 + Cl_2 → $C_3H_4Cl_2$	[1]
	(b)	Energy taken in during bond breaking = (4x413) + (2x348) + (614) + (243) = 3205 kJ Energy given out during bond formation = (4x413) + (3x348) + (2x330) = 3356 kJ ΔH = Energy taken in - Energy given out = 3205 – 3356 = - 151 kJ	[1] [1] [1]

	(c)		[1] correct axis, shape [1] correct labelling of products, reactants, ΔH and activation energy

9	**(a)**	(i) A	[1]
		(ii) D	[1]
	(b)	(i) Cu (s) → Cu^{2+} (aq) + + $2e^-$	[1]
		(ii) Ag^+ (aq) + e^- → Ag (s)	[1]
	(c)	No of moles of copper deposited = 2.56 /64 = 0.0400 mol For the deposition of copper: Cu^{2+} + $2e^-$ → Cu Thus 0.04000 moles of Cu is discharged by 0.0800 moles of electrons Ag^+ (aq) + e^- → Ag (s) 0.0800 moles of electrons will discharge 0.0800 moles of Ag Mass of Ag = 0.0800 x 108 = 8.64 g	[1] [1] [1]
	(d)	Number of moles of X deposited = 1.04 /52 = 0.0200 0.0200 moles of X is discharged by 0.0800 moles of electrons 1 mole of X will be discharged by 4 moles of electrons Thus the charge of ion X is +4 X^{4+} (aq) + $4e^-$ → X (s)	[1] [1] [1]

10	**(a)**	The equivalence points do not always coincide with neutral pH. It only coincides for titrations 1 and 4.	[1] [1]
	(b)	HCl + NaOH → NaCl + H_2O No of moles of NaOH = No of moles of HCl $C_{NaOH} \times V_{NaOH} = C_{HCl} \times V_{HCl}$ Thus $V_{NaOH} = V_{HCl} = 25.0\ cm^3$	[1] [1]
	(c)	Bromothymol blue starts to change colour at pH6 Volume of NH_3(aq) added to reach pH 6 = 22.5 cm^3 Volume of NH_3(aq) added to reach pH 7 = 25.0 cm^3 Difference in volume of NH_3(aq) = 2.5 cm^3	[1] [1]
	(d)	(i) NaOH (aq) + NaH_2PO_4 (aq) → Na_2HPO_4 (aq) + H_2O (l)	[1]
		(ii) pH 5 pH 9	[1] for both
		(iii) Methyl orange can be used to find the first equivalence point. Phenolphthalein can be used to find the second equivalence point The third equivalence point occurs at pH above 12 while the three indicators change colours below pH 12;	[1] [1]

11	**(a)**	(i) No of moles of Mg = 0.120 / 24 = 0.005 No of moles of HCl (80/1000) x 1 = 0.08 $Mg + 2\ HCl \rightarrow MgCl_2 + H_2$ Max volume of hydrogen gas is dependent on the Mg 0.005 moles of H_2 will be produced Vol of H_2 = 0.005 x 24 = 120 cm^3	[1] [1]
		(ii) total volume of hydrogen will decrease As magnesium is more reactive than copper, it will displace copper from copper (II) sulfate solution. Thus less Mg will react with the acid to produce the hydrogen gas	[1] [1]
		(iii)Higher concentration of acid Higher temperature	[1] [1]
	(b)	Aluminium is covered by a layer of aluminium oxide which the acid must react with first before the metal can react and produce the hydrogen gas	[1] [1]
	(c)	Initial rate of reaction will be faster Sulfuric acid is a dibasic acid where the concentration of hydrogen ions will be double for the same concentration of acid. Results in a higher frequency of effective collisions	 [1] [1]

12	**(a)**	Addition polymerisation Both the monomers contain the carbon-carbon double which will break to allow the monomers to undergo addition reaction	[1] [1]
	(b)		[1]
	(c)	When polymerisation takes place, two more styrene molecules may join together and two or more butadiene may join together The units may join together forming a variety of polymers	[1] [1]
	(d)	(i) $C_4H_{10} \rightarrow C_4H_6 + 2\ H_2$	[1]
		(ii) hydrogenation of oil to form margarine To manufacture ammonia in haber process As an alternate fuel	Any one
	(e)	No of moles of butane = 2900 / 58 = 50 No of moles of butadiene to be formed according to the equation = 50 Mass of butadiene to be formed according to the equation = 50 x 54 = 2700 kg Percentage yield = (2.16 / 2.7) x 100 = 80%	[1] [1] [1]