2020 SNGS Sec 4 OP Prelim

2020 Sec 4 Prelim P1 Answers

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

2020 Sec 4 Prelim P2 Answers

Section A

A1	**(a)**	**(i)**	brass	[1]
		(ii)	nitrogen monoxide	[1]
		(iii)	Aluminium/ Ammonium chloride	[1]
		(iv)	Ammonium chloride	[1]
		(v)	water	[1]
	(b)		Mix aqueous sodium carbonate and aqueous silver nitrate. [1] Filter the mixture [0.5] to obtain residue.[0.5] Wash with plenty of water [0.5] and dry between sheets of filter paper. [0.5] Wrong reagent max 1m	[3]
A2	**(a)**		Closely together , disorderly [0.5] Slide over each other [0.5] Unacceptable : closely packed	[1]
	(b)		R : Group II [1] Q : Group VI [1]	[2]
	(c)		RCl_2 has a giant ionic structure [0.5] The electrostatic forces of attraction between oppositely chargely ions are weakened [1] The ions are mobile for the conduction of electricity.[0.5] QCl_2 has a simple covalent/molecular structure [0.5m] consisting discrete molecules [0.5m] which are electrically neutral. [0.5m] There are no mobile electrons/ions for the conduction of electricity.	[4]
	(d)		Dilute/aqueous hydrochloric acid [1]	[1]
	(e)		Any macromolcules	[1]

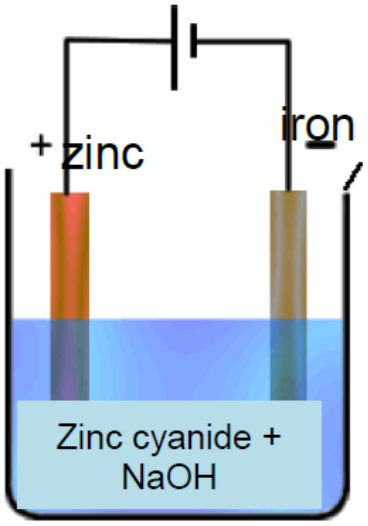
<table>
<tr><td>A3</td><td>(a)</td><td>
<table>
<tr><th>name of halogen</th><th>Melting point /^{o}C</th><th>Boiling point /^{o}C</th></tr>
<tr><td>bromine</td><td>-7.2</td><td>58.8</td></tr>
<tr><td>chlorine</td><td>-100.9</td><td>-34.7</td></tr>
<tr><td>Iodine</td><td>113.8</td><td>184.5</td></tr>
</table>
</td><td>[1]</td></tr>
<tr><td></td><td>(b)</td><td>Reactivity decreases down the group [0.5]
atomic size / electron shell /radius increases down the Group [0.5] OR
distance between nucleus and valence shell increases [0.5]
electrostatic forces of attraction between nucleus and electron decreases [0.5]
gains electron less easily[0.5]</td><td>[2]</td></tr>
<tr><td></td><td>(c)</td><td>(i) seawater turns reddish brown/orange[1]
Chlorine is more reactive than bromine. [0.5]
Chlorine displace bromine from its solution [0.5]</td><td>[2]</td></tr>
<tr><td></td><td></td><td>(ii) Add dilute nitric acid followed by aqueous barium nitrate [1]
white precipitate observed.[1]</td><td>[2]</td></tr>
<tr><td></td><td>(d)</td><td>Chlorine is oxidised [0.5] as the oxidation state of chlorine increases from 0 in Cl_2 to +3 in ClF_3. [1m]
reducing agent [0.5]</td><td>[2]</td></tr>
<tr><td>A4</td><td>(a)</td><td>carbon dioxide / CO_2</td><td>[1]</td></tr>
<tr><td></td><td>(b)</td><td>Zinc ion [0.5] and copper(II) ion[0.5]
When aqueous ammonia is added, precipitate is formed and dissolves in excess aqueous ammonia.[1]</td><td>[2]</td></tr>
<tr><td></td><td>(c)</td><td>$ZnCO_3 \rightarrow ZnO + CO_2$
Or
$CuCO_3 \rightarrow CuO + CO_2$</td><td>[1]</td></tr>
<tr><td></td><td>(d)</td><td>$Ag^+ + Cl^- \rightarrow AgCl$ [1]</td><td>[1]</td></tr>
<tr><td></td><td>(e)</td><td>All the chloride ion have been precipiated/reacted[1]</td><td>[1]</td></tr>
<tr><td>A5</td><td>(a)</td><td>Concentrated [0.5] copper(II) bromide [0.5]/ Concentrated $CuBr_2$</td><td>[1]</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Electrode C : $2H^+ + 2e \rightarrow H_2$ [1]
Electrode D : $4OH^- \rightarrow O_2 + 2H_2O + 4e$ [1]</td><td>[2]</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Haber process/ rocket fuel/fuel cell</td><td>[1]</td></tr>
<tr><td></td><td>(c)</td><td colspan="2">Mole of H_2 = 0.084/24 = 0.0035 mol [0.5]
Mol of copper = 0.0035 mol[0.5]
Mass of copper = 0.0035x64= 0.224g [1]</td><td>[2]</td></tr>
</table>

	(d)	Universal indicator change from green to blue/purple [1] Chloride ions are selectively discharged [0.5] Potassium hydroxide is formed which is alkaline [0.5] OR Universal indicator change from green to colourless. [1] Chloride ions are selectively discharged [0.5] Chlorine gas is formed [0.5] at the anode	[2]

A6	**(a)**	It consists of atoms [0.5] of different sizes. [0.5] The orderly arrangement of atoms is disrupted. [0.5] The layers of atoms cannot slide over each other easily when a force is applied. [0.5]	[2]
	(b)	Iron in steel is more reactive than copper [1] Iron displace copper from its solution [1]	[2]
	(c)	blue [0.5] solution turns green [0.5] reddish brown/pink solid formed. [1]	[2]
	(d)	Calcium reacts with water in copper (II) sulfate solution [0.5] to form hydrogen gas [0.5] $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ [1]	[2]
	(e)	Write the ionic equations at anode and cathode. Anode : $Fe \rightarrow Fe^{2+} + 2e$ [1] cathode : $2H^+ + 2e \rightarrow H_2$ [1]	[2]

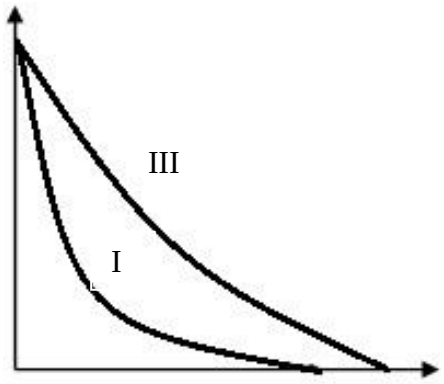
Section B

B7	**(a)**	Zinc is more reactive than iron. [0.5] Zinc will lose electron more easily than iron [1] Thus Zinc corrodes in place of iron. [0.5]	[2]
	(b)	Carbon dioxide is an acidic oxide / acidic gas [1], and thus zinc oxide reacts with it as a base.	[1]

	(c)	High cost of electricity [1] Zinc cyanide is toxic/harmful [1]	[2]
	(d)	 Correct electrodes and terminal of battery [1] Correct electrolyte [0.5] Fully submerged [0.5]	[2]
	(e)	For hot dip galvanisation, the hot zinc reacts more easily with oxygen to form the oxide layer[1]. The zinc layer coated using electro galvanisation is at room temperature thus may not react easily with oxygen to form oxides. [1]	[2]
	(f)	Chemical reduction of metal oxide using CO/C. Unacceptable : electrolysis	[1]
B8	**(a)**	Nitrogen [1]	[1]
	(b)	Catalytic converter [1]	[1]
	(c)	The temperature of lean engine is lower than normal engine.[0.5] Nitrogen reacts with oxygen in air to form nitrogen oxides slowly at lower temperature. [0.5]	[1]
	(d)	Form a very stable/process is irreversible[1] compound carboxyhaemoglobin[0.5] Prevent the transport of oxygen around the human body[0.5]	[2]

	e)	Lightning/ forest fire	[1]
	(f)	(i) Mol of CO_2 = 137500/5500 x 8 =200mol [1] Volume of CO_2 = 200 x 24 =4800dm^3[1]	[2]
		(ii) Correct reactant and product and exo [1] Label Ea and arrow[0.5] Label ΔH and arrow[0.5] Unacceptable : endo	[2]
			[Total: 10 marks]
E B9	**(a)**	$PbCO_3 + 2HNO_3 \rightarrow CO_2 + H_2O + Pb(NO_3)_2$ [1]	[1]
	(b)	Mole of CO_2 = 0.1/24 = 0.004167 mol [0.5] Mol of $PbCO_3$ = 0.004167 mol [0.5] Mass of $PbCO_3$ = 0.004167 x 267 =1.11g [1]	[2]
	(c)	An <u>insoluble layer [0.5] of lead(II) sulfate</u> [0.5]will form /<u>coat around</u> lead(II) carbonate, preventing further reaction. [1]	[2]

(d) [4]



Initial mass for both experiments [0.5]
Final mass for both experiments [0.5]
Rate for both experiments [1]

Wrong shape –1 m

Ethanoic acid is a weak acid [0.5]

there are less H^+ ions per unit volume/concentration [0.5m]

leading to lesser frequency of collision between H^+ ions and Mg [0.5m]

resulting in lesser frequency of effective collision. [0.5m]

(e) **[1]**

carbonate used	time taken for white precipitate to form in limewater/ s
Iron(II) carbonate	50
Lead(II) carbonate	30

O B9 **(a)** So that the concentration of thiosulfate is proportional to volume of thiosulfate solution [1] [1]

(b) **(i)** 40[0.5], 10[0.5], 10[0.5]

14 [0.5] [2]

(ii) The speed increases [0.5]
concentration of thiosulfate increases[0.5]
increase in the frequency of collisions between reactant particles [0.5]
increase in frequency of effective collisions [0.5] [2]

	(c)	The time taken for the cross to disappear in a smaller beaker will be shorter [1] as a smaller amount of sulfur is needed to cover the cross [1] as its base is smaller	[2]
	(d)	When the temperature is increased, the particles gain kinetic energy/ move faster. [0.5] There is also an increase in the proportion of particles having energy equal or more than the activation energy.[0.5] Frequency of collision increases [0.5] Hence chances of effective collisions increase [0.5]	[2]
	(e)	Acidified potassium manganate (VII) turns from purple [0.5] to colourless.[0.5]	[1]