

**BEDOK GREEN SECONDARY SCHOOL  
SCIENCE DEPARTMENT  
MARKING SCHEME  
YEAR (2020)**

**SUBJECT:** Chemistry 6092 Paper 1  
**SETTER:** Mdm Nadiah  
**LEVEL:** 4E

**EXAM:** Prelim

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

**BEDOK GREEN SECONDARY SCHOOL  
SCIENCE DEPARTMENT  
MARKING SCHEME  
YEAR (2020)**

**SUBJECT: Chemistry 6092 Paper 2**

**SETTER: Mdm Nadiah**

**EXAM: Prelim**

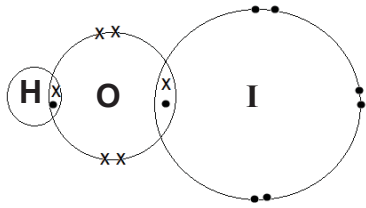
**LEVEL: 4E**

**Paper 2**

**Section A: 50 marks**

<b>Qn. No.</b>	<b>Scoring Points</b>				<b>Marks</b>	<b>Max. Marks</b>
A1 (a)	name of salt	method	name of reactant 1	name of reactant 2	4  1 m for every 2 correct answers	6
	barium sulfate	<b>B</b>	<b>Barium nitrate</b>  <b>Or any soluble barium salt</b>	sulfuric acid		
	magnesium chloride	<b>A</b>	<b>magnesium magnesium oxide</b> <b>magnesium hydroxide</b> <b>magnesium carbonate</b>	<b>Hydrochloric acid</b>		
	potassium nitrate	<b>C</b>	<b>Potassium hydroxide</b>	<b>Nitric acid</b>		
(b)	<p>1. <b>aq. barium nitrate and sulfuric acid</b> are thoroughly mixed together in a beaker.</p> <p>2. The resulting mixture is <b>filtered</b> and the <b>residue, barium sulfate</b> is collected.</p> <p>3. The residue is <b>washed</b> with distilled water and <b>pat dry</b> between pieces of filter paper.</p> <p>Point 1 and 2 – 1 m Point 3 – 1 m <b>No marks awarded if reactants are wrong.</b></p>				2	
A2	<p>(a) K</p> <p>(b) D</p> <p>(c) A</p> <p>(d) G</p> <p>(e) J, I or H</p>				1 1 1 1 1	5

A3	(a) $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$	1	8
(b)	Because of the reactive nature of aluminium, the aluminium would have reacted with oxygen in the air and formed a coat of aluminium oxide around the aluminium metal before putting into the acid.	1	
	Hydrochloric acid reacted initially with the aluminium oxide to produce aluminium salt and water. Thus no hydrogen gas is produced.	1	
c	Copper does not react with hydrochloric acid and therefore not produce any hydrogen gas.	1	
d	Use equal number of moles of metals rather than equal masses of metals.	1	
	The number of moles will determine how much hydrogen gas is produced. And since 10 g of barium has a lesser number of moles, the volume of $\text{H}_2$ produced is also lesser. Therefore it is unfair to compare the two metals as their rate of reaction will be different due to the number of moles of reactant available.  OR  Make hydrochloric acid as the limiting reactant. That will ensure that the volume of hydrogen gas produced should be the same.	1  OR  1 1	
e	Zinc in compound assumes an oxidation state of +2, which is not typical of transition metals.	1	
	Compounds of zinc are white in solid state or colourless in solutions, while transition metals generally forms coloured compounds.	1	
A4	(i) Oxygen in the air will react with the heated iron to form iron(II) oxide / iron (III) oxide.	1	8
(a)	(ii) Iron wool acts as a catalyst for the reaction by providing an alternative reaction pathway with a lower activation energy. This increases the frequency of effective collisions between hydrogen and nitrogen molecules, hence increasing the rate of reaction.	1	
		1	
(b)	(i) fractional distillation of air / liquid air catalytic cracking of petroleum	1 1	
	(ii) advantage of higher pressure: increased yield / increase rate of reaction disadvantage of higher pressure: Higher cost of equipment to maintain a high pressure	1 1	
(c)	-196 °C < temperature < -33 °C	1	

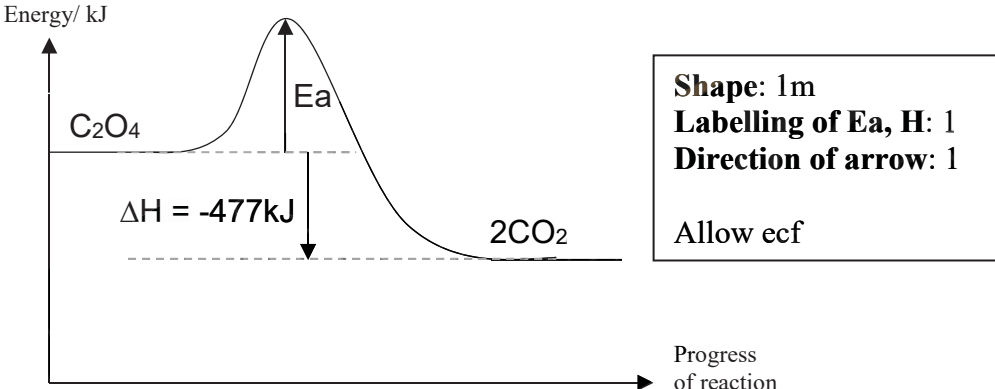
A5	(a) (i) zinc hydroxide (ii) Zinc (iii) Zinc nitrate	3	10												
(b)	(i) $M_r = (1.28 \text{ g} + 2.93 \text{ g}) / 0.0915$ $= 46$ (round off to whole number)	2													
	(ii) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>N</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>mass</td> <td>1.28</td> <td>2.93</td> </tr> <tr> <td>mol</td> <td><math>1.28 / 14 = 0.09143 \text{ mol}</math></td> <td><math>2.93 / 16 = 0.183125</math></td> </tr> <tr> <td>ratio</td> <td>1</td> <td>2</td> </tr> </tbody> </table> <p>Empirical formula : <math>\text{NO}_2</math>  <math>M_r</math> of empirical formula = <math>14 + 32</math>  <math>= 46</math>  <math>N = 1</math>  Molecular formula: <math>\text{NO}_2</math></p>			N	O	mass	1.28	2.93	mol	$1.28 / 14 = 0.09143 \text{ mol}$	$2.93 / 16 = 0.183125$	ratio	1	2	1  1  1  1
	N	O													
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(c)	Place a damp blue litmus paper near a sample of gas Z. The litmus paper will turn red.	1													
A6	(a) Source: Incomplete combustion in car engines/ of hydrocarbon fuels  Impact: Carbon monoxide reacts with haemoglobin in blood and reduces the ability of haemoglobin to transport oxygen around the body.	1  1	6												
(b)	Platinum & rhodium	1													
(c)	1. In the catalytic converter, harmful CO is oxidized to form $\text{CO}_2$ which has lesser impact on the environment and human health.  2. Oxides of nitrogen are reduced to form $\text{N}_2$ , a component of clean air.	1  1													
(d)	The amount of $\text{CO}_2$ released may lead to an <b>increase in greenhouse gases</b> . This in turn will cause <b>global warming</b> .	1													
A7	(a) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>name of oxyacid</th> <th>chemical formula</th> <th>oxidation state of iodine</th> </tr> </thead> <tbody> <tr> <td>periodic acid</td> <td><math>\text{HIO}_4</math></td> <td><b>+7</b></td> </tr> <tr> <td>iodic acid</td> <td><math>\text{HIO}_3</math></td> <td><b>+5</b></td> </tr> <tr> <td>hypoiodous acid</td> <td><math>\text{HIO}</math></td> <td><b>+1</b></td> </tr> </tbody> </table>	name of oxyacid	chemical formula	oxidation state of iodine	periodic acid	$\text{HIO}_4$	<b>+7</b>	iodic acid	$\text{HIO}_3$	<b>+5</b>	hypoiodous acid	$\text{HIO}$	<b>+1</b>	2  3 correct 2 m  2 correct 1 m 1 1 correct 0 m	7
name of oxyacid	chemical formula	oxidation state of iodine													
periodic acid	$\text{HIO}_4$	<b>+7</b>													
iodic acid	$\text{HIO}_3$	<b>+5</b>													
hypoiodous acid	$\text{HIO}$	<b>+1</b>													
	(b) $\text{IO}_4^-$	1													
	(c) <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> 1 m – no. of correct atoms  1 m – correct number of electrons </div> </div>	2													

	<p>(d) 1. Iodine was oxidised as its oxidation state has increased from 0 in <math>I_2</math> to +5 in <math>HIO_3</math>.</p> <p>2. Chlorine was reduced as its oxidation state has decreased from 0 in <math>Cl_2</math> to -1 in <math>HCl</math>.</p> <p>1 m for point 1 and 2.</p>	2	
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Paper 2  
Section B: 30 marks

Qn. No.	Scoring Points	Marks	Max. Marks
<b>B8 (a)</b>	The electronegativity of the elements increases from 0.9 for Na to 3.2 for Cl	1	11
	Neon and argon are noble gases / have already achieved a stable octet configuration, hence they <b>have no tendency to attract electrons toward itself / they do not form bonds with other elements.</b>	1	
<b>(b)</b>	<b>I do not agree fully with statement for oxides/ generally true for oxides.</b>	*0.5	
	The $\Sigma$ for Na <sub>2</sub> O and MgO is 2.5 and 2.1 respectively, which is more than 2.0, and their bonding is ionic.	1	
	However, the $\Sigma$ for Al <sub>2</sub> O <sub>3</sub> is 1.8, which is less than 2.0, so the chemical bond formed should be covalent, but its bonding is ionic .	1	
	<b>I do not agree fully with statement for chlorides.</b>	*0.5	
	The $\Sigma$ for NaCl is 2.3, which is more than 2.0, and the bonding is ionic.	1	
	However, the $\Sigma$ for MgCl <sub>2</sub> is 1.9, which is less than 2.0, so the chemical bond formed should be covalent, but the bonding is ionic.	1	
	<b>*State agree/disagree for both points to obtain 1 m.</b>		
<b>(c)</b>	As the bond lengths between atoms increase, the bond energies decrease or vice versa.  OR As the number of bonds between atoms increase, the bond lengths decreases/the bond energies increase.	1	
<b>d</b>	As the number of bonds increases, the bond energy increases, and hence, the bond strength increases. This is seen when C–C bond has a bond energy of 348 kJ /mol, C=C has bond energy of 614 kJ /mol and C≡C has bond energy of 839 kJ/mol.	1	
		1	
<b>e</b>	No I do not agree. C-C bond bond energy is 348 kJ / mol while Cl–Cl has a lower bond energy of 243 kJ / mol.  Accept other possible comparisons of single bonds except S-Cl and Cl-Cl (as values very close).  Actual B.E must be quoted.	1	

Qn. No.	Scoring Points	Marks	Max. Marks
<b>B9 (a)</b>	<p>When temperature is decreased, the average (kinetic) energy and speed of reacting particles decreases.</p> <p>Thus, there is a decrease in the number of effective collision of reacting particles, hence slower rate of reaction.</p> <p>Hence, a longer time is needed for all the reactants to completely react, resulting in a longer glow.</p>	<p>1</p> <p>1</p>	
<b>bi</b>	<p>enthalpy change = <math>2(326) + 2(803) + 331 + 146 - 4(803)</math>  <math>= -477 \text{ kJ}</math></p>	<p>1</p> <p>1</p>	
<b>bii</b>	<p>The glow stick will become <b>hotter</b>.</p> <p>The <b>energy absorbed during breaking</b> of <b>C-O, C=O, C-C, O-O</b> bonds in <b>C<sub>2</sub>O<sub>4</sub></b> is <b>lesser</b> than the <b>energy released during the formation of C=O</b> bonds in carbon dioxide.</p>	<p>1</p> <p>1</p>	9
<b>biii</b>		3	

Either

<b>Qn. No.</b>	<b>Scoring Points</b>	<b>Marks</b>	<b>Max. Marks</b>
B10 (a)	Anode. $2Cl(aq) \rightarrow Cl_2(g) + 2e^-$	1 1	10
(b)	<b>Bubbles</b> of gas / <b>Effervescence</b> . $H^+$ will be discharged at the electrode 1 to form hydrogen gas.	1 1	
(c)	The colour of the electrolyte (universal indicator) changes from <b>green</b> to <b>purple/blue</b> . <b><math>H^+</math> and <math>Cl^-</math> are being discharged</b> , leaving behind $Cs^+$ and $OH^-$ . This results in the formation of <b>caesium hydroxide which is an alkali</b> which turns universal indicator purple/blue.	1 1	
d	(i) $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ (ii) Copper is reduced in the experiment. Copper is reduced as $Cu^{2+}$ in solution gains 2 electrons to form Cu.	1 1 1	
e	<b>Bubbles of colourless gas</b> would be observed at electrode 2 instead of 1 OR <b>Pale greenish-yellow gas</b> would be observed at electrode 1 instead of 2.	1	

OR

<b>Qn. No.</b>	<b>Scoring Points</b>	<b>Marks</b>	<b>Max. Marks</b>
<b>B10</b>	<b>(a)</b> AFCs are easily poisoned by carbon dioxide which reacts with the electrolyte potassium hydroxide. In space, carbon dioxide is absent and carbon dioxide poisoning is not an issue.	<b>1</b> <b>1</b>	<b>10</b>
	<b>(b)</b> The operation of AFC requires non-precious metal as catalyst in contrast to PEMFC which requires expensive platinum catalysts.	<b>1</b>	
	<b>(c)</b> $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$	<b>1</b>	
	<b>(d)</b> The source of hydrogen comes from reforming hydrocarbons or methane which give rise to greenhouse gases to begin with.  OR  The source of hydrogen is from the cracking of hydrocarbon / electrolysis of water using electricity/ Any production of electricity involves the burning of fossil fuels which releases greenhouse gases.	<b>1</b>	
	<b>(e)</b>	(i) $CH_4 + H_2O \rightarrow CO + 3H_2$ (correct chemical formula =1m balanced equation = 1m) (ii) Mass of $H_2 = 1000\text{ g}$ Moles of $H_2 = 1000 \div 2 = 500\text{ mol}$ Vol. of $H_2 = 500 \times 24 = 12000\text{ dm}^3$ Vol. of $CH_4 = 12000 \div 3 = 4000\text{ dm}^3$ Vol. of natural gas = $4000 \div 0.95 = 4210\text{ dm}^3$ (3s.f.) or 4211 $\text{dm}^3$	