Peirce Sec 4E and 5NA Science Chemistry SA2/prelim **Mark Scheme**

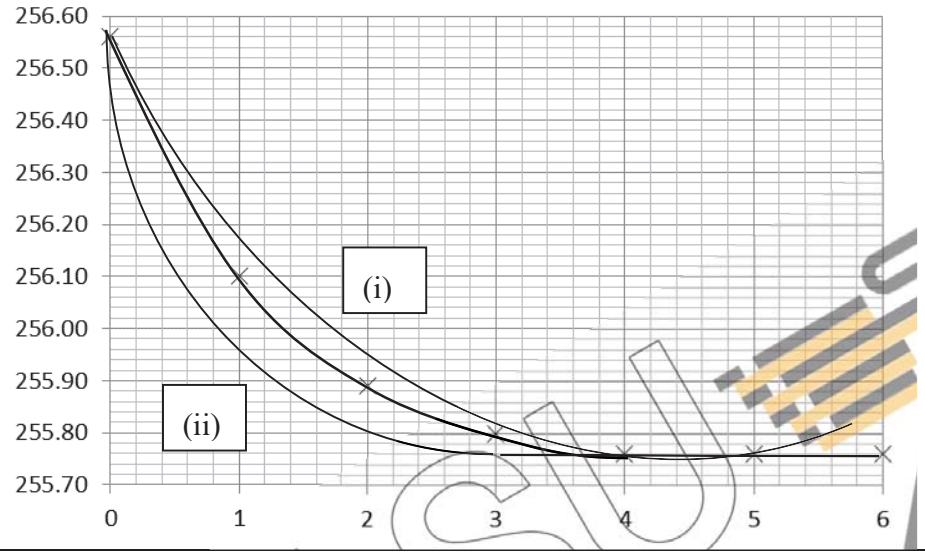
Paper 1: MCQ

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

Paper 3

Section A : 45 marks				**Marks**	**Marker's comments**
A1	**(a)**		Aluminium oxide	1	
	(b)		Group 0 elements have **fully filled valence shell** that makes them stable and will not form compounds.	1	
	(c)	**(i)**	Na_2O: 1m for correct dot and cross for ions 1m for balancing charges Cl_2O: 1m for correct sharing 1m for correct valence electrons	2 2	

		(ii)	Sodium oxide is an ionic compound with **strong electrostatic forces of attraction holding sodium ions and oxide ions** together. While Cl_2O is a covalent molecule with **weak intermolecular forces of attraction holding molecules** together. Thus, **more energy** is needed to overcome the strong electrostatic forces of attraction in sodium oxide as compared to weak intermolecular forces of attraction in Cl_2O.	1 1 1	
				Total:	**9 marks**
A2	**(a)**		Any molecule that **contains carbon-carbon double bonds** is unsaturated.	1	
	(b)		*Functional group 1*: carbon-carbon double bond *Functional group 2*: carboxyl	1 1	
	(c)	**(i)**	**Reddish brown bromine water decolourises** quickly.	1	
		(ii)	Colour of universal indicator turns from **green to orange/pink**	1	
				Total: 5 marks	
A3	**(a)**		**Carbon dioxide is given off** during the reaction.	1	
	(b)		**Rate of reaction decreases** [1] as time increases, because **reactants are being used up, resulting in less reacting particles in the reaction mixture**.[1] When marble chips have fully reacted, the reaction stops.	2	

	(c)			2	
	(d)		When the concentration of hydrochloric acid decreases, the **amount of particles per unit volume decreases**. This results in **decrease in the frequency of effective collisions between reacting particles**, thus rate of reaction decreases.	2	
	(e)		Mass of CO_2 = 256.56 – 255.76 = 0.8 g No. of mol = 0.8/44 = 0.0182 mol (3s.f.)	1	
				Total: 8 marks	
A4	**(a)**		**A** iron(II) sulfate **B** barium sulfate **C** Iron(II) chloride **D** iron(II) hydroxide **E** iron (III) hydroxide	5	Chemical formulae are accepted.

	(b)		Ba^{2+} (aq) + SO_4^{2-} (aq) → $BaSO_4$ (s)	1	
	(c)		**Oxidation**. Fe^{2+} **loses one electron** to produce Fe^{3+}.	2	
				Total: 8 marks	
A5	**(a)**		Fractional distillation	1	
	(b)		From **particles spaced far apart** and **moving at high speeds in all directions**,[1] particles loses kinetic energy and are **quite closely packed**, **sliding pass each other** at --200 °C [1]	2	
	(c)		Take a sample of the gas **and do a glowing splint test. If glowing split relights, the tank contains oxygen**. If the **glowing splint is extinguished, the gas is nitrogen.**	1 1	
				Total: 5 marks	
A6	**(a)**		Reaction is **exothermic** [1] as the **a lot of heat is produced**.[1]	2	
	(b)	**(i)**	+7	1	
		(ii)	Chlorine is **reduced** as its **oxidation state decreases from +7 in NH_4ClO_4 to -1 in $AlCl_3$**	1 1	
				Total: 5 marks	
A7	**(a)**		4% of carbon monoxide was produced in the the car exhaust.	1	

<table>
<tr><td></td><td>(b)</td><td>(i)</td><td>Temperature is very high in the car exhaust.
Nitrogen combines with oxygen in the air to form nitrogen oxides.</td><td>1
1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Reacts with water in the air to form acid rain,
Which corrodes buildings and harm aquatic life and plants.</td><td>1
1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Total: 5 marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="4">Section B: 20 marks</td><td></td><td></td></tr>
<tr><td>B8</td><td>(a)</td><td></td><td>
<table>
<tr><th>substance</th><th>chemical formula</th><th>solubility in water</th><th>pH</th></tr>
<tr><td>Potassium sulfate</td><td>K_2SO_4</td><td>soluble</td><td>7.0</td></tr>
<tr><td>Nitric acid</td><td>HNO_3</td><td>soluble</td><td>1.0</td></tr>
<tr><td>silver chloride</td><td>AgCl</td><td>Insoluble</td><td></td></tr>
<tr><td>Barium hydroxide</td><td>$Ba(OH)_2$</td><td>soluble</td><td>13.0 or 14.0</td></tr>
<tr><td>Cacium carbonate</td><td>$CaCO_3$</td><td>insoluble</td><td></td></tr>
</table>
</td><td>4</td><td>No half mark. Every 2 answers 1 mark</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Titration</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Add 25.0 cm^3 of sulfuric acid using a pipette into a conical flask.
Fill a burette with potasisum hydroxide. Add methyl orange indicator.</td><td>1</td><td></td></tr>
</table>

			Slowly add potassium hydroxide into sulfuric acid until sulfuric acid is completely neutralised. Repeat the titration without the methyl orange indicator to produce potassium sulfate solution.	1 1	
	(c)		$2HNO_3$ (aq) + $CaCO_3$ (s) → $Ca(NO_3)_2$ (aq) + H_2O(l) + CO_2 (g) 1 mark for state symbols	2	
				Total: 10 marks	
B9	**(a)**		D, B, A, C	1	
	(b)	**(i)**	A	1	
		(ii)	Mg + H_2O → MgO + H_2	1	
		(iii)	No. Of mol of Mg = 2.4/24 = 0.1 mol [1] No of mol of H_2 = 0.1 mol Volume of H_2 = 0.1 X 24 = 2.4 dm^3[1]	2	
	(c)	**(i)**	C	1	
		(ii)	Low density, Low melting and boiling point, Soft, can be cut with a knife	2 Any 2	
		(iii)	Down the group, **reactivity increases** [1] as the atomic size of atoms increases, thus **valence electrons are further away** from positively	2	

			charged nucleus, making it **easier for atoms to lose the valence electron**. [1]		
				Total: 10 marks	
B10	**(a)**		Chemical feedstock for industries.	1	
	(b)	**(i)**	Petrol	1	
		(ii)	Catalytic cracking. Note: cracking also accepted	1	
	(c)	**(i)**	200°C, Nickel catalyst	1	
		(ii)		2	
	(d)		$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ Glucose solution is mixed with yeast and mixture is kept at about 37°C. The apparatus is kept air tight with a rubber bung and delivery tube that connects to limewater. A dilute solution of ethanol is produced. Ethanol is obtained by fractional distillation.	1 1 1 1	