St. Joseph's Institution
2021 Year 4 OP Preliminary Exam Answer Scheme

Paper 3 Question 1

Qn	Suggested answers	Mark
1a & 1b	**Skills: MMO & PDO** **Results table:** **For experiments 1 & 2**: Records correct headings and units in the table. **For experiment 1**: All readings of volume are recorded to nearest 0.5 cm^3 All readings of volume show an increasing trend. **For experiment 2**: All readings of volume are recorded to nearest 0.5 cm^3. All readings of volume show an increasing trend.	 1 1 1 1 1
1c	**Skills: PDO** **Graph** A smooth curve is drawn (for both graphs) Points are plotted correctly Graphs are labelled & axes are labelled with units Suitable scale is used	 1 1 1 1
1di	Experiment 1 [must state but no mark] Experiment 1 has a **steeper initial gradient** than Experiment 2. **(the gradient indicates the rate of reaction)**	 1
1dii	Acid **X** has **double the concentration** (or higher concentration) **of hydrogen ions** compared to acid **Y** / Acid **X** is dibasic while acid **Y** is monobasic.	1
1diii	Calculations to be shown clearly i.e. volume at 30 seconds indicated on the graph and answer given to 3 s.f. Units correctly indicated	1 1
1e	To **remove the oxide layer**, enabling the reaction between the metal and acid to occur directly.	1
1f	The acids can be run into the conical flask directly from burettes, which measure volume to an accuracy of +/- 0.05 cm^3. / Burette should be used to measure volume instead of measuring cylinder	1
1g	The **carbon dioxide** gas formed in the reaction is **soluble in water**, causing the **volume of gas measured to be lower** than expected. A **gas syringe** should be used to collect and measure the volume of carbon dioxide gas instead of using collection over water.	1 1
	TOTAL	**17**

Paper 3 Question 2

Qn	Suggested answers	Mark
2ai	**White ppt** formed	1
2aii	**Ppt is soluble in excess aqueous NaOH,** forming **a colourless solution**.	1 1
2b	**White ppt** formed which is **insoluble in excess aqueous NH_3**.	1 1
2c	**White ppt** is formed. Ppt is **insoluble in dilute nitric acid**.	1 1
2d	Aluminium sulfate	1
2e	**Green solid turns black**	1
2f	**Effervescence** of colourless gas observed Gas evolved **forms a white ppt with limewater** Presence of **carbon dioxide.**	1 1 1
2gi	**Blue ppt** formed. The **ppt is insoluble in excess aqueous NaOH.**	1 1
2gii	**Blue ppt** formed. The **precipitate is soluble in excess aqueous NH_3,** forming **a dark blue solution.**	1 1 1
2h	copper(II) carbonate	1
	TOTAL	**18**

Paper 3 Question 3

Qn	Suggested answers	Mark
3	**Procedure:** 1. Measure the mass of the rusty nail using an electronic balance, M g. 2. Add the rusty nail into a conical flask and add **excess** dilute acid to the conical flask. 3. Stopper the conical flask immediately with a delivery tube connected to a calibrated gas syringe. 4. Measure the maximum volume of gas collected in the syringe, V cm^3. 5. Calculate the mass of rust using the following method: $Fe + 2H^+ \rightarrow Fe^{2+} + H_2$ No. of moles of hydrogen = (V/24000) mol No. of moles of iron = (V/24000) mol Mass of iron = (V/24000) x 56 = (7V/3000) g Mass of rust = M – (7V/3000) g **Assumption:** Only iron in the rusty nail reacts with the acid to form hydrogen gas. / The rusty nail does not contain any other substance that reacts with the acid to produce a gas, causing the volume of gas collected to be higher than expected.	5
	TOTAL	**5**