St. Joseph's Institution 2022 Year 4 OP Preliminary Exam Answer Scheme

Paper 3 Question 1

Qn	Suggested answers	Mark
1a	record temperatures to 1 d.p., correct trend	1
	correct calculation of temperature rise	1
1b	record temperature to 1 d.p., correct trend (temperature increases more than Expt 1)	1
	correct calculation of temperature rise	1
1c	all points plotted correctly for both experiments	1
	2 straight lines of best fit which intersects	1
	lines passes through origin	1
	appropriate scale chosen, graphs are labelled clearly	1
1di	correct reading from the graph with units, working shown clearly on graph	1
1dii	No. of moles of acid	1
	$= x / 1000 \times 1.00$	
	= y mol	
	No. of moles of alkali	
	= y mol	
	Concentration of sodium hydroxide	1
	= y / (25.0 / 1000)	
	$= z \text{ mol/dm}^3$	
10		1
11	The burette is rinsed with acid B to remove traces of water / prevent acid B from being	1
	diluted	
1g	Experiment 2	
	Acid B is a dibasic acid / stronger acid / more acidic / has a lower pH.	1
1h	Heat loss to the surroundings.	1
	Place a lid over the Styrotoam cup to reduce heat loss.	1
	TOTAL	16

Paper 3 Question 2

Test no.	Test	Observations
1	Place one spatula of solid W into a test tube. Add about 2 cm ³ of dilute hydrochloric acid to solid W .	Effervescence of colourless gas [1] White ppt formed when gas is bubbled into limewater [1] Gas is carbon dioxide [1] White solid dissolves to form a colourless solution [1]
2	 Place one spatula of solid W into a test tube. Add about 5 cm³ of aqueous copper(II) sulfate and heat the mixture gently. Leave the test tube to stand. 	Green solid / ppt formed [1] Blue solution turns colourless [1]

3	Place one spatula of solid W into a test tube.	Colourless droplets of liquid formed along sides of test tube [1]
	Add one spatula of ammonium	Pungent gas evolved [1]
	test tube. Heat the mixture gently.	Moist red litmus turns blue [1]
		Gas is ammonia [1]

[10 observations, maximum 8 marks] [8]

Qn	Suggested answers		Mark	Markers' Comments
2a	Solid W contains carbonate ion and is		1	
	basic.		1	
		TOTAL	12	

Paper 3 Question 3

Qn	Suggested answers	Mark
3a	all points plotted correctly	1
	smooth curves for Experiments 1 and 2	1
3bi	correct reading from the graph with units	1
	accept: 30 – 34 cm ³	
3bii	correct working with units	1
	accept: 10 – 14 cm ³	
3c	copper(II) oxide acts as a catalyst.	1
3d	Potassium(V) chlorate has decomposed completely. / All potassium(V) chlorate has	1
	decomposed.	
3e	No. of moles of O ₂	1
	= 72/24000	
	= 0.00300 mol	
	No. of moles of KC/ O_3	1
	$= 0.00300 / 3 \times 2$	
	Mass of KCIO	1
	-0.00200×122.5	1
	$= 0.00200 \times 122.3$	
3f	Suggested answer:	5
01	 Measure the initial mass of the solid mixture (m₁) using an electronic balance. 	Ŭ
	 Place the mixture into a conical flask, then add excess acid. 	
	• Immediately stopper the conical flask with a delivery tube connected to a calibrated	
	gas svringe.	
	• Measure the volume of carbon dioxide gas (V cm ³) in the gas syringe after there is no	
	more effervescence / the reaction is complete.	
	Calculate the mass of copper(II) carbonate:	
	\circ No. of moles of CO ₂ = V / 24000 mol	
	\circ No. of moles of CuCO ₃ = V / 24000 mol	
	 Mass of CuCO₃, m₂ = V / 24000 x 124 g 	
	• The percentage by mass of copper(II) carbonate can be found using: $[(m_1 - m_2) / m_1]$	
	x 100%	
	• Assumption: The solid mixture does not contain any other impurities that can react	
	with the acid to produce a gas.	
	TOTAL	14