MATIGO EXAMINATIONS BOARD

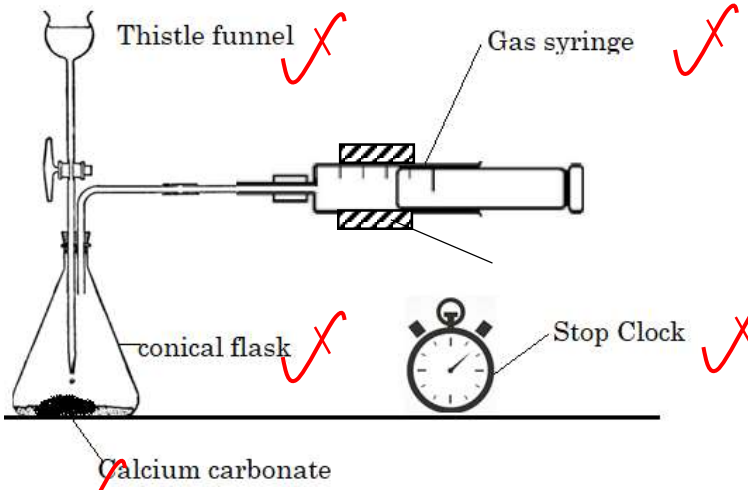
545/2
CHEMISTRY
MARKING GUIDE 2023
PAPER 2

Qn	Answer	Marks
1(a)	At: 8:00Am *No colour change* because cobolt (II) chloride is still a solid *and has not dissolved.* *Acc: No observable change* 10:00Am: The bottom is more coloured *because the concentration of cobalt* (II) Chloride molecules are *high at the bottom.* *acc: continous random* After 2days. The pink colour is uniformly distributed because the water molecules are in *constant random motion* thus move the cobalt (II) Chloride *particles are evenly spread.*	03
(b)	A *reversible chemical* reaction. (reversible reaction) Blue to pink	
2	(i) R (ii) S (iii) T (iv) Q (v) S	
3(a)	$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$ *reject: if not balanced* *reject* $\frac{1}{2}$ *if no states*	
(ii)	(i) Addition of Manganese (IV) oxide catalyst.	

	(ii) Increasing temperature for the reaction. (iii) Using more concentrated hydrogen peroxide.	
(b) (i)	It continued to burn with a white *bright flame* to form a *white ash (solid)*	
(ii)	$2Mg_{(s)} + O_{2(s)} \longrightarrow 2MgO_{(s)}.$	
4(a)	$2Cu_{(s)} + O_{2(s)} \longrightarrow 2CuO_{(s)}$	
(b)	$KNO_{3(s)} \longrightarrow KNO_{2(s)} + O_{2(g)}$	
(c)	$2NaHCO_{3(s)} \longrightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(l)}$	
(d)	$2Zn(NO_3)_{2(s)} \longrightarrow 2ZnO_{(s)} + 4NO_{2(s)} + O_{2(s)}$	
(e)	$2Mg_{(s)} + O_{2(g)} \longrightarrow 2MgO_{(s)}$	
5(a)	Isotopes are atoms of the same element with same atomic number but different mass number	
(b)(i)	${}^{12}_{6}C$ and ${}^{14}_{6}C$	
(ii)	${}^{12}_{6}C$ *acc:* $C-12$	
(iii)	Hydrogen ,Oxygen, magnesium, sodium any 1	
(iv)	${}^{16}_{8}O$ ${}^{18}_{8}O$	
6(a)	Elements: Fe S O H2O. Percentage composition: 20.2 11.5 23 45.3 Moles: $\frac{20.2}{56}$ $\frac{11.5}{32}$ $\frac{23}{16}$ $\frac{45.3}{18}$ 0.3607 0.3594 1.4375 2.517 Mole ratio $\frac{0.3607}{0.3594}$ $\frac{0.3594}{0.3594}$ $\frac{1.4375}{0.3594}$ $\frac{2.517}{0.3594}$ 1 : 1 : 4 : 7 Therefore; Empirical formula of T is $FeSO_4.7H_2O$.	

(b)	Molecular formula = (Empirical formula)n 278 = ($FeSO_4.7H_2O$)n 270 = (56 + 32 + 16 x 4 + 7 x 18)n 278 = 278n n = $^{278}/_{278}$ = 1. Therefore; molecular formula of T is $FeSO_4.7H_2O$	
(c)	$Fe^{2+}_{(aq)} \longrightarrow Fe^{3+}(aq) + e.$	05
7(a) (i)	The *black solid* turns to a *brown residue* *reject: black precipitate*	
(ii)	It's a reducing agent *reject: reduction reaction.*	
(b)	R. F. m of CuO = 64 + 16 = 80 *3 moles CuO reacted with 2 mole* NH_3 $3 \times 80g$ *CuO reacted with* $2 \times 22.4dm^3$ $14.4g$ *CuO reacted with* $\frac{14.4 \times 2 \times 22.4}{80 \times 3} = 2.688dm^3$	05
8(a)(i)	Fermentation Enzyme zymase is required Heat energy produced does not go beyond 60°C Combustion No enzyme is required. Heat energy produced goes beyond 60°C.	
(ii)	• Used in the manufacture of medicine. • Used as a disinfectant in hand washing. • Used to sterilize surgical equipment in any hospital • It's used as a beverage.	
(b)	Photosynthesis. R.F.M of $C_6H_{12}O_6$ = 12 x 6 + W2 + 6 x 16 = 180.	
(c)	$2800J$ *of heat were produced by* $180g$. $14{,}000\ x\ 1000J$ *of heat produced by* $\frac{180 \times 14{,}000 \times 1000}{2800}\ g$ $= 900{,}000g$. $1000g$ *is equivalent to* $1kg$.	

	$900{,}000g\ is\ equivalent\ to\ \frac{900{,}000\times1}{1000}\ kg$ $=\ 900kg.$ $Therefore;\ 900kg\ of\ sugar\ would\ produce 14{,}000KJ.$	
9(a)(i)	**Cathode.** Bubbles of a colorless gas that burns with a pop – sound. *reject: glowing splint*	
(ii) (iii)	**Anode;** A green – yellow gas that turns a blue litmus paper red then bleaches it. 1:1	
(b)(i)	$2Cl^-_{(aq)} \longrightarrow Cl_{2(g)} + 2e$	
(ii)	$Cl_2 + 2KBr_{(aq)} \longrightarrow 2KCl_{(aq)} + Br_{2(aq)}$.	
(iii)	Graphite is cheap and ***not easily attacked by chlorine***. *Emphasize this*	
10	(i) Haematite *acc: Magnetite* (ii) Hot air (iii) wrought iron/ pig iron (iv) -Cheap -It's a strong reducing agent.	
	SECTION B	
11(a)	Name: Sodium Carbonate. Formulae: Na_2CO_3	
(b)	Compounds: Na_2CO_3 H_2O Mass composition 2.7 4.59 Moles $^{27}/_{106}$ $^{4.59}/_{18}$ 0.025 0.255 Mole ratio $\frac{0.025}{0.025}$ $\frac{0.255}{0.255}$	

	1 : 10 X is 10.	
(ii)	Sodium Carbonate decahydrated. *reject: formula*	
(c)(i)	Sodium Carbonate and Zinc nitrate.	
(ii)	$Na_2CO_{3(aq)} + Zn(NO_2)_{(aq)} \longrightarrow ZnCO_{3(s)} + 2NaNO_{3(aq)}$	
(d)	A white solid decomposes to give a yellow residue when hot and white on cooling. e.g. $ZnCO3_{(s)} \longrightarrow ZnO_{(s)} + CO_{2(g)}$	
(e)(i)	Reagent: Ammonia solution. Observations: Zinc ions: a white precipitate soluble in excess to form a colourless solution. Lead (II) ions: A white precipitate insoluble in excess.	15
12(a)(i)	Thermal decomposition is the heating of a substance to decompose to simpler stable substances. $CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$	
(ii)	To a solution containing calcium ions, add a few drops of ammonia solution. Observation: No observable change.	
(b)(i)	 *W/A = 1* *Reject; for poor diagram* *No clamp on the syringe*	
(c)	(i) The rate of reaction decreases. (ii) The rate of reaction increases.	
(d)	(i) A hydrocarbon is a compound which consists of carbon and hydrogen atoms only. (ii) Alkane. (iii) Carbon monoxide and water.	

(e)	(i) Used in the preservation of fizzy drinks. (ii) Used in the manufacture of fire extinguishers. (iii) Used as a refrigerate	
13(a)	(i) Soap is sodium or potassium salt of a long chain carboxylic acid. (ii) Saponification.	
(b)	(i) Sim sim, G/nuts, coconut, maton fat. (ii) Sodium hydroxide or potassium hydroxide. *Any 1*	
(c)(i)	A fixed volume of a *known concentration* of *sodium hydroxide* is mixed with a fixed volume of sim sim oil. The mixture is stirred *and heated* on fire until frothing stops. $NaOH_{(aq)} + RCOOR^1 \longrightarrow RCOONa_{(aq)} + R^1OH$ Concentrated sodium chloride solution is added to precipitate soap out. The soap solid formed is filtered off and purified then treated with perfumes and dyes. **OR** Solid soap is filtered off from excess solution and heat in an oven.	
(ii)	• Rain water: lather was easily formed. • A white precipitate was formed. $Ca^{2+}_{(aq)} + 2St^{-}_{(aq)} \longrightarrow CaSt_{2(s)}$	
(d)	• Temporary hard water	
14(a)	(i) Molarity is the number of moles of a substance contained in one litre of solution. (ii) Standard solution is a solution of a known concentration. (iii) Primary standard: is a compound used to prepare a standard solution.	
(b)(i)	$1000cm^3$ HCl contains 0.12moles. $20.8cm^3$ HCl contains $\frac{20.8 \times 0.12}{1000}$ 2.496×10^{-3} moles. Mole ratio: $Na_2CO_{3(s)} + 2HCl(aq) \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$ Mole ratio A : B 2 : 1 2 Moles HCl react with 1 mole Na_2CO_3	

	2.496 x 10^{-3} moles HCl react with $\frac{2.496 \times 10^{-3}}{2}$ $= 1.248 \times 10^{-3}$ moles 25cm^3 Na_2CO_3 contains 1.248 x 10^{-3} moles 1000cm^3 Na_2CO_3 contains $\frac{1.248 \times 1000 \times 10^{-3}}{25}$ moles = 0.04992M *rej: without units* ii). 500cm^3 of solution contains 2.75g Na_2SO_3. 1000cm^3 of solution contains $\frac{2.75 \times 1000}{500}$ g. = 5.5gl^{-1} R.F.M of Na_2CO_3 = 23 x 12 + 16 x 3 = 106. I mole Na_2CO_3 contains 106g. 0.04992 moles Na_2CO_3 contains 106 x 0.04992 = 5.29152g. Percentage purity = $\frac{Mass\ pure}{impure\ mass} \times 100\%$ $= \frac{5.29152}{5.5} \times 100\%$ = 96.21%	
(c)	$2NaNO_{3(s)} \longrightarrow 2Ag(s) + 2NO_2 + O_{2(s)}$ R.F.M of $AgNO_3$ = 107 + 14 + 16 x 3. = 169. 2 moles $AgNO_3$ produced 3 moles gases. 2 x 169 Ag NO_3 produced 3 x 22.4 dm^{-3}	

	2.5g $AgNO_3$ produces $\frac{3 \times 22.4 \times 2.5}{2 \times 169}$ $= 0.4970 dm^3$. *Reject without units*	

END

(+256780413120)