UCE 2019
545/2 CHEMISTRY
MARKING SCHEME, NOV/DEC 2019

NB. ALLOW IONIC EQUATIONS IN ALL CASES

QN	CORRECT ANSWER(S) / MARKS ALLOWED	SCORE
1	(a) Hydrated iron(III) oxide. ✓ rej: hydrated ferric oxide; hydrated ferrous oxide, hydrated … Hydrated iron (III) oxide; Rej: iron (III) oxide; A formula	1
	(b) • Oxygen ✓ Acc: Air for Oxygen; damp oxygen.	2
	• Water ✓ Moisture for water	
	Acc: Moist air (for two ticks) Damp air (" ") Rej formula;	
	(c) Water. ✓ rej: dump for damp; dump water. Acc: Moisture	1
	(d)(i) It destroys tools made of Iron. (OR EQUIVALENT) ✓ Corrodes the tools, Changes appearance of tools. Acc: Wears out tools made of Iron; Weakens tools; Makes tools blunt, Reduces efficiency or effectiveness of objects;	1
	(ii) Galvanisation. (OR EQUIVALENT) ✓ Greasing/oiling/Alloying/stainless steel. Acc Zinc plating; Painting; Coating with enamel; Electroplating; Rusting-proofing cars; sacrificial protection; Cathodic protection.	1
	TOTAL Rej: Keeping iron in dry places; Keeping iron clean; Sharpening; plating	06
2	(a)(i) 19 ✓ Acc: Nineteen, XIX	1
	(ii) 20 ✓ Acc Twenty, XX	1
	(b) 2:8:8 ✓ Acc: 2,8,8 or 2.8.8 or 2)8)8 Rej: 288 / 2 8 8 or 2/8/8	1
	(c) 5 ✓ or V or five	1
	(d) Ionic ✓ (OR EQUIVALENT) Acc: Electrovalent	1
	TOTAL	05

NO 1 d(i) rej: Contaminates water; stains clothes; Causes tetanus;

QN	CORRECT ANSWER(S) / MARKS ALLOWED	
3	(a)(i) 2 ✓ Acc: Two or II	½
	(ii) $T_{(s)} + Cl_{2(g)} \rightarrow TCl_{2(s)}$ ✓✓	1½
	Consider case of symbols; allow correct states	
	(b) Moles of nitrogen that reacted $= \frac{600}{22400}$ ✓	
	Moles of T that reacted $= \left(\frac{600}{22400} \times 3\right)$ ✓	
	$\Rightarrow \left(\frac{600 \times 3}{22400}\right)$ moles of T weigh 3.2g	2
	∴ 1 mole of T weighs $\left(\frac{22400 \times 3.2}{600 \times 3}\right)$ g ✓	
	∴ Atomic mass of T = 39.8g ✓	
	Rej. R.A.M with units	
	Allow ≈ 40	
	TOTAL	04

- Award for units
- rej. equations

Qn 4 (c) ... reducing agent

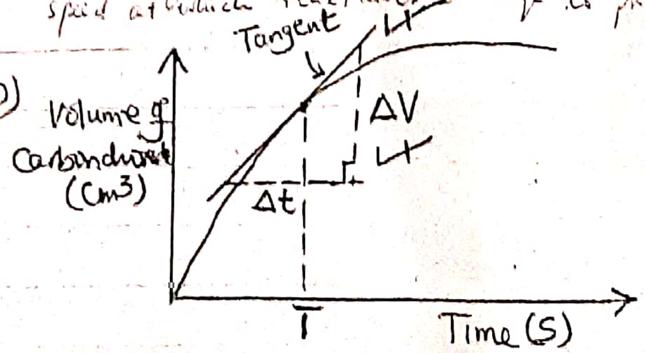
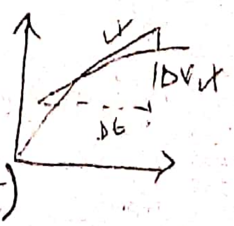
Qn ... Rej. foam for effervescence

... rej. The ...

CORRECT ANSWER(S) / MARKS ALLOWED	SCORE
(a) Blue solution turned colourless. Reddish-brown solid was formed. Heat was evolved. (Allow: Any three) Reject: Colour disappear. Acc: Decolourised for colourless; discharged; brown for reddish-brown; Acc reddish solid for brown; the solution became warm. Rej: faded for colourless, disappear	1½
(b) Zinc is higher than copper in the reactivity series. Therefore, it displaces copper from the blue copper(II) sulphate solution forming zinc sulphate solution as the colourless solution and copper as the brown solid. The reaction is exothermic. Acc: Zinc is more reactive than copper; zinc reduces copper(II) ions to copper, itself oxidised to zinc (II) which is colourless	2
(c) $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ $Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$	1½
TOTAL	05
(5) (a) Effervescence. Rej: Colourless gas alone. Acc: Bubbles, fizzing, hissing sound	1
(b) The resultant solution formed is acidic because sulphuric acid is a strong acid while ammonium hydroxide is a weak base. The sulphuric acid reacts with sodium hydrogencarbonate solution to give carbon dioxide gas. Rej: forming / form for reacts $2NaHCO_3(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2CO_2(g) + 2H_2O(l)$ Acc: $HCO_3^-(aq) + H^+(aq) \rightarrow CO_2(g) + H_2O(l)$	4
TOTAL Allow: $2HCO_3^-(aq) + 2H^+(aq) \longrightarrow 2CO_2(g) + 2H_2O$	05

Allow: Correct explanation mixed with observation but score only for explanation.

QN	CORRECT ANSWER(S) / MARKS ALLOWED	
6	(a) (i) Silvery deposit on the fork surface.	
	Silvery coating, silvery layer, silvery solid, shiny grey solid, increase in size	
	Rej: shiny solid, silver mirror, white grey solid. Acc: grey solid.	
	(ii) It reduces in size.	1
	- It dissolves	
	(b) (i) $Ag^{+}(aq) + e \rightarrow Ag(s)$ State wrong deduct ½	1
	(ii) $Ag(s) \rightarrow Ag^{+}(aq) + e$.	1
	Acc: $Ag(s) - e \longrightarrow Ag^{+}(aq)$.	
	(C) (i) Electroplating with silver.	½
	Acc: Electroplating alone. Silver plating. Rej: plating alone	
	(ii) Prevents rusting. (OR. EQUIVALENT)	½
	Acc: Prevents corrosion; Rej: electroplating; improves appearance; improve appearance; increases durability; increases the strength; increases toughness;	
	Rej: improves quality if the student does not complete the definition	
	TOTAL	05
7	(a) White powder turned reddish-brown when hot and yellow on cooling.	1½
	Allow: Brown for reddish brown, red brown	
	Rej: reddish and orange	
	(b) $Mg(s) + PbO(s) \rightarrow MgO(s) + Pb(s)$	1½
	(C) (i) No observable change.	1
	Allow yellow remains yellow and reddish brown remains reddish brown; No observation; No change	
	(ii) Copper is less reactive than lead, so it does not reduce the oxide.	1
	Alternative: Copper is less. Does not displace the oxide.	
	TOTAL Rej: c(ii) if no answer in c(i)	05
	Allow Consequential error marking	

CORRECT ANSWER(S) / MARKS ALLOWED	SCORE
8 (a) $NH_4Cl(s) + KOH(s) \rightarrow NH_3(g) + KCl(s) + H_2O(l)/(g)$ Acc: (aq) for KOH and NH_4Cl and KCl, NH_3 $NH_4^+(aq) + OH^-(aq) \rightarrow NH_3(g) + H_2O(l)$	$1\frac{1}{2}$
(b) (i) A white precipitate was formed that dissolves in excess ammonia solution to form a colourless solution. A white precipitate turned to a colourless solution	$1\frac{1}{2}$
(ii) White precipitate formed is Zinc hydroxide which is insoluble in water. In excess ammonia solution, Zinc hydroxide forms a complex cation which is soluble and colourless. Reject: Zinc hydroxide is amphoteric; Acc: tetra amine zinc(II) for a complex. Deny if the name of complex is wrong.	2
TOTAL	05
9 (a) Rate of reaction is the change in the concentration of a given reactant or product during the course of reaction per unit time. Acc: Volume, mass, colour for concentration; Amount of products formed per unit time; reactants used up per unit time speed at which reactants change to products	1
(b)  $Rate = \frac{\Delta V}{\Delta t} cm^3s^{-1}$  $Rate = \frac{\Delta V}{\Delta t} cm^3s^{-1}$	2
(c) • Surface area (OR EQUIVALENT) • Catalyst.	2
TOTAL	05

speed at which reactants are converted/change to products.

• Acc: Particle size

• Light, Concentration, pressure

Rej: powder from surface area or granules

QN	CORRECT ANSWER(S) / MARKS ALLOWED

(10) (a) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ ✓✓

(b) 393KJ of heat are produced by 12g of Carbon
∴ 163,750KJ of " " " $\left(\frac{12 \times 163{,}750}{393}\right)$g ✓
= 5,000g (= 5Kg) ✓

80Kg of Charcoal Cost 20,000F
∴ 5Kg " " $\frac{5}{80} \times 20{,}000$F ✓
= 1,250F ✓

(C) De-Odourant. ✓

- Give marks for: Decolonizer / Absorbing colouring matter / Absorbent for (poisonous) gases
- Electrical cutting
- Making charcoal tablets
- Purification of sugar
- Project water purification

Rej: Adsorption, Used as a coolant

TOTAL

(11) (a) Miscible liquids are liquids that can mix to form a homogeneous (uniform) mixture whereas immiscible liquids form a heterogeneous mixture when intermixed. ✓✓

Miscible	Immiscible
No liquid junction	Liquid junction
Distillation	Separating funnel
No layers	Layers

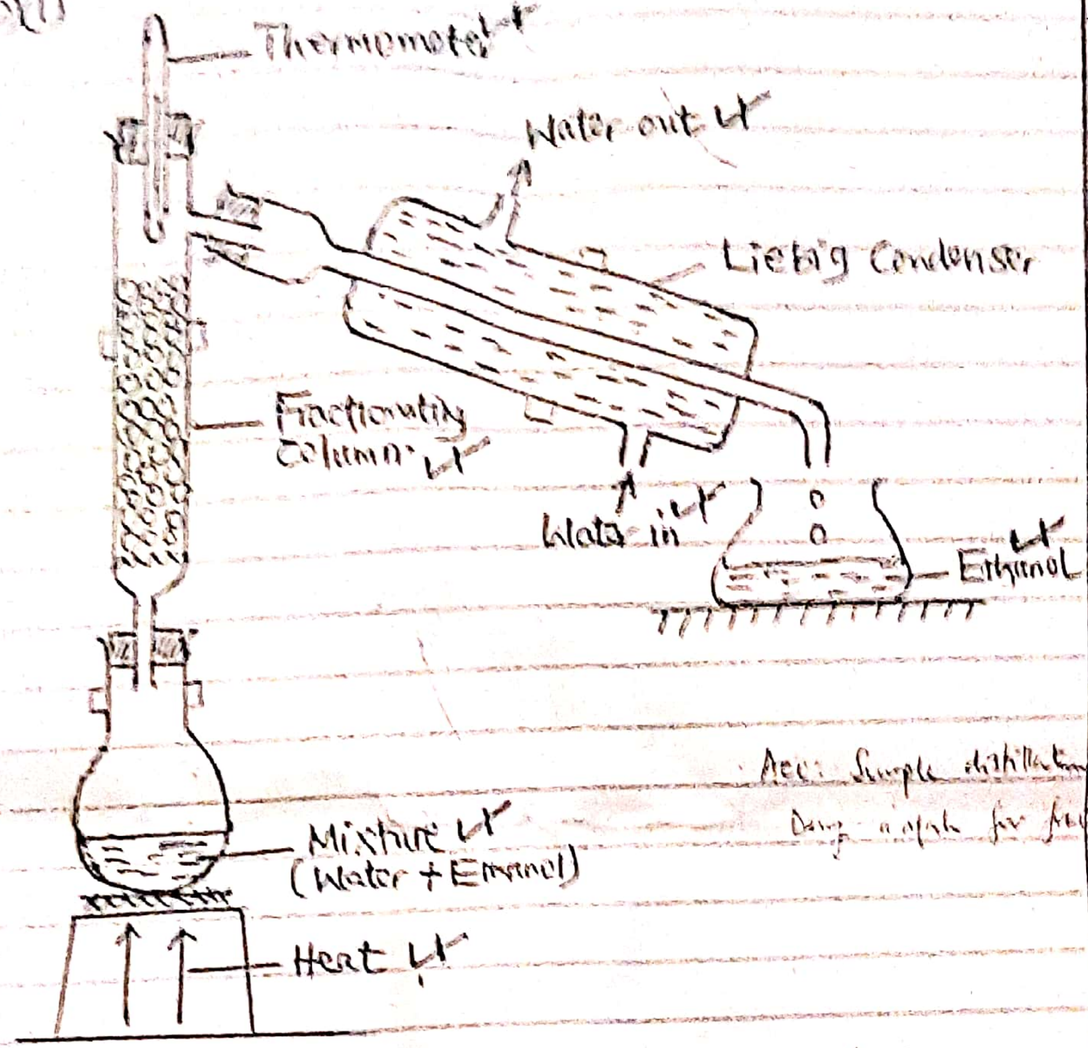
(b)(i) Water and ethanol ✓ (OR EQUIVALENT)

- Water and methanol
- Water and propanol
- Water and alcohols
- Kerosene and petrol

Rej: liquid air, nitrogen & oxygen

Rej: One liquid ... uniform mixture

CORRECT ANSWER(S) / MARKS ALLOWED	SCORE
1 (b)(i)	



Acc: Simple distillation

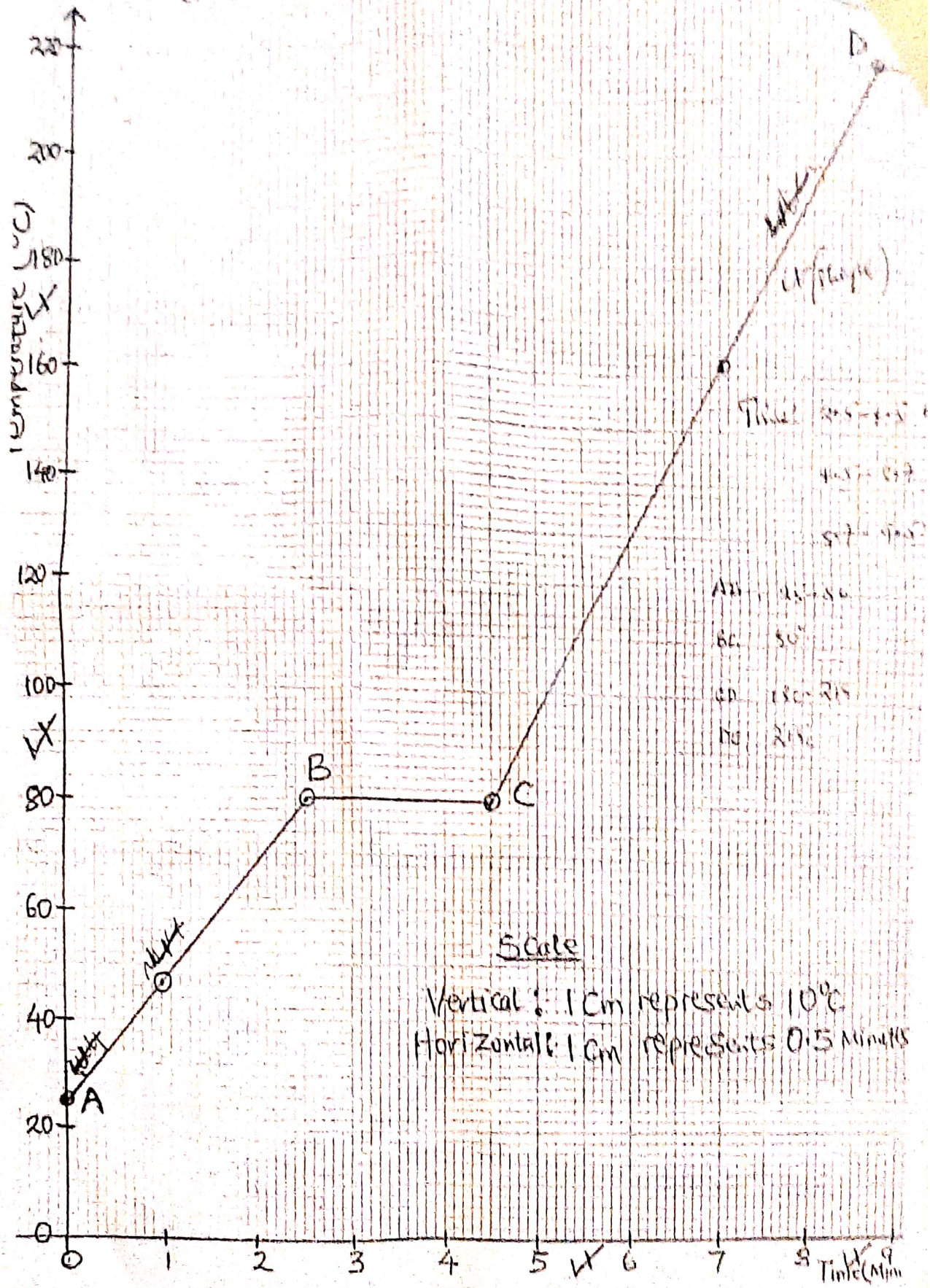
3½

(ii) By determining their boiling points. (OR EQUIVALENT) — 1

(C)(i) See the graph paper.
- Title
- Axes ½ for each axis
- Scale
- Plotting
- Shape

4

Q 11(c)(i) GRAPH OF TEMPERATURE AGAINST



	CORRECT ANSWER(S)/MARKS ALLOTTED	SCORE
11 (contd)	(c)(ii) AB - Solid X warms up as it is heated until up to point B. BC - At point B, X melts and the temperature remains constant until all the solid has melted up to point C. CD - All the X is in liquid state. Further heating of X after point C causes a rise in temperature until point D when the liquid start boiling. DE - At point D, the liquid boils and turns into vapour at constant temperature.	4
	TOTAL	15
12	(a)(i) Manganese(IV) oxide (OR EQUIVALENT) Lead(IV) oxide, Potassium manganate(VII) / Permanganate	1
	(ii) Add concentrated hydrochloric acid from a (tap) funnel onto manganese(IV) oxide in a flask fitted with a delivery tube. Heat the mixture. Chlorine is produced according to the equation: $MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + Cl_2(g) + 2H_2O(l)$ Pass the gas formed through water in a wash bottle to absorb hydrogen chloride gas, and dry the gas by bubbling it through concentrated sulphuric acid. Collect the gas by downward delivery.	6

Acc. Anhydrous calcium chloride, Silicon (IV) oxide, Phosphorus (V) oxide } Drying agents

- Wrong reagent used only other aspects for apparatus.

Using $2KMnO_4(s) + 16HCl(aq) \rightarrow 2KCl(aq) + 2MnCl_2 + 8H_2O + 5Cl_2$

QN	CORRECT ANSWER(S) / MARKS ALLOWED	S
12 Contd	(b) In limited supply of Chlorine, Phosphorous reacts to form phosphorous (III) chloride. $P_4(s) + 6Cl_2(g) \rightarrow 4PCl_3(g)$ $2P + 3Cl_2(g) \rightarrow 2PCl_3(g)$ Rej solid In excess chlorine, Phosphorous reacts to form Phosphorous(V) chloride. $P_4(s) + 10Cl_2(g) \rightarrow 4PCl_5(g)$ $2P + 5Cl_2(g) \rightarrow 2PCl_5(s)/(l)$ rej (l)	4
	(C) Chlorine is a stronger oxidising agent than bromine. More reactive / active It will therefore displace bromine from its aqueous solution forming potassium chloride and bromine. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$. $2Br^-(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$	4
	TOTAL	15
13	(a)(i) Through: • Sewage disposal. • Industrial discharges. (OR EQUIVALENT) • oil spills • garbage disposal • addition of ... • herbicides • pesticides • insecticides • pollutant gases • detergents	2
	(ii) The water is passed through screens to remove large debris and other big insoluble materials. sieves The water then goes through a sedimentation process where potassium aluminium sulphate (Potash alum) is added. The alum helps in binding fine particles in water which sink down as a sludge. Alum sulphate / flocculant / coagulant / precipitating	$6\frac{1}{2}$

QN	CORRECT ANSWER(S) / MARKS ALLOWED	Sc
(13) Cont'd	(a)(ii) The water is then passed through sand and gravel to remove any other suspended fine particles. Rej: Destroy for killing. Thereafter, Chlorine is added to kill germs like bacteria. disinfect. Acc: Soda Ash. Sodium carbonate is then added to the water to remove hardness and to adjust the pH of chlorinated water. correct/raise. Rej: sewage treatment; Acc: Addition ...	
	(b) The precipitation was because the water was hard. Such water probably contained Calcium hydrogencarbonate (OR EQUIVALENT) / Magnesium hydrogen carbonate which reacted with soap to form insoluble Calcium stearate as the white precipitate. Acc: scum	
	$Ca^{2+}(aq) + 2St^{-}(aq) \rightarrow CaSt_2(s)$ (OR EQUIVALENT)	
	After boiling, the hardness is removed which means it was temporary such that Calcium hydrogencarbonate decomposes on heating to form insoluble calcium carbonate. This renders the water free of Calcium ions. Rej: destroyed	
	$Ca(HCO_3)_2(aq) \rightarrow CaCO_3(s) + CO_2(g) + H_2O(l)$.	
	$2HCO_3^{-}(aq) \rightarrow CO_3^{2-}(s) + CO_2 + H_2O$	
	TOTAL	15

QN	CORRECT ANSWER(S) / MARKS ALLOWED	
14	(a) • $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(l)$ ✓✓	
	Acc: Simplified balancing	
	• $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$ ✓✓	4½
	Acc: Full solid arrow	
	• $4NO_2(g) + 2H_2O(l) + O_2(g) \rightarrow 4HNO_3(aq)$ ✓✓	
	Weak: $NO_2(g) + H_2O(l) \longrightarrow HNO_3(aq) + HNO_2(aq)$ } Both must be correct.	
	$HNO_2(g) + O_2(g) \longrightarrow HNO_3(aq)$ ✓	
	(b)(i) Yellow solid dissolved. Reddish-brown fumes were given off and an oily liquid formed. (Allow: Any three observations)	1½
	(ii) $S(s) + 6HNO_3(aq) \rightarrow H_2SO_4(aq) + 6NO_2(g) + 2H_2O(l)$ ✓✓	1½
	(c) $NH_3(g) + HNO_3(aq) \rightarrow NH_4NO_3(aq)$ ✓✓	1½
	Allow: $NH_4OH(aq) + HNO_3(aq) \longrightarrow NH_4NO_3(aq) + H_2O(l)$	
	(d) The ammonium hydroxide formed is a weak/mild base and is partially ionised to give few hydroxide ions compared to the high number of hydrogen ions formed from the complete ionisation of the strong nitric acid. Hence the excess hydrogen ions makes the soil acidic.	2½
	(e)(i) $2AgNO_3(s) \rightarrow 2Ag(s) + 2NO_2(g) + O_2(g)$ ✓✓	1½

	CORRECT ANSWER(S) / MARKS ALLOWED	SCO
(14) cont'd	(e) (ii) $2KNO_3(s) \rightarrow 2KNO_2(s) + O_2(g)$ ✓✓	1½
	(f) Manufacture of dyes. ✗ OR EQUIVALENT	½
	: Manufacture of explosives / gun powder / TNT	
	: Testing the purity of acid.	
	Rej Paints for dyes	
	TOTAL	(15)

TOTAL MARKS
FOR THE PAPER = 80.