

1. (a) $\text{Zn(s)} + 2\text{HCl(aq)} \longrightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ ✓1
 (b) Concentrated sulphuric (IV) acid or anhydrous calcium chloride. ✓1
 (c) Copper cannot displace hydrogen from its solution. ✓1
 (d) (i) $2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \longrightarrow 2\text{H}_2\text{O(l)}$ ✓1
 (ii) Before: Pass hydrogen / through the tube before lighting ✓1 to drive off air.
 End: There should be a continuous flow of hydrogen after / putting off the flame to avoid an explosion. ✓1

 (e) – Filling balloons ✓1
 - Manufacture of margarine.
 - Manufacture of ammonia.
 - Conversion of coal to synthetic petrol.
 (f) $\text{Zn(s)} + \text{H}_2\text{O(g)} \longrightarrow \text{ZnO(s)} + \text{H}_2\text{(g)}$ ✓1
 (g) S, ✓^{1/2} P, ✓^{1/2} Q, ✓^{1/2} R, ✓^{1/2}
 (h) It adds to unsaturated oils and hardens them. ✓1

2. I (i) C
 (ii) D or E
 ✓ (iii) F
 (iv) D or E
 ✓ (v) A
 ✓ (vi) D

I(a) (i) Atomic radius of M is smaller than that of X. The effective nuclear charge in M is greater than in X hence outer electrons strongly^{✓^{1/2}} pulled to the centre reducing the radius.

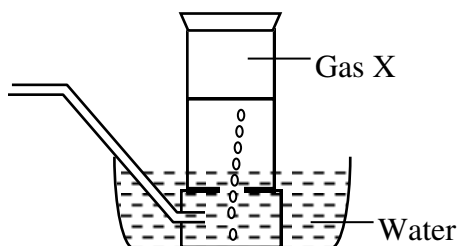
(ii) Radius of Q is greater than that of U because Q has more energy levels than U
 (b) J because it loses energy more easily due to the bigger atomic radius of J

(c) (i)

(ii) Period – 3 Group – VI

- (d) (i) On the grid (period 2 Group 7)
 ✓ (ii) Halogen
 (iii) – Used in hospitals with patients with breathing difficulties
 - Used by mountain climbers and deep sea divers
 (iv) Basic oxide

3. (a) (i) Carbon (II) Oxide or CO – (reject Carbon monoxide)
 (ii) Combines with haemoglobin to form carboxyhaemoglobin which prevents carrying of oxygen
 (b) (i) $\text{CO(g)} + \text{C(s)} \longrightarrow 2\text{CO(g)}$
 (ii) $\text{ZnO(s)} + \text{CO(g)} \longrightarrow \text{Zn(s)} + \text{CO}_2\text{(g)}$
 (iii) $\text{KOH(aq)} + \text{CO}_2\text{(g)} \longrightarrow \text{K}_2\text{CO}_3\text{(aq)} + \text{H}_2\text{O(l)}$
 (c) Orange/yellow Lead (II) Oxides turns grey
 (d) $\text{CaCO}_3\text{(s)} + 2\text{HCl(aq)} \longrightarrow \text{CaCl}_2\text{(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$
 (e) Methanoic acid and concentrated sulphuric acid

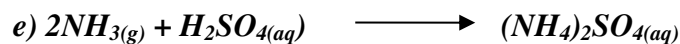


4. a) i) *Fractional distillation of liquid air*
ii) *Argon*

- b) A *Sulphur*
B *Ammonia gas*
C *Oleum*
D *Amonium sulphate*

c) i) *Finely divided iron*
ii) *Vanadium (v) Oxide*

d) *Speeds up the rate of reaction by lowering the activation energy*



f) *R.M.M of (NH₄) = 132*

Mass of N = 28

% N = $\frac{28}{132} \times 100 = 21.212\%$

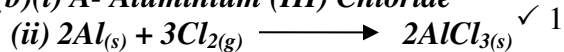
g) *Used as a fertilizer*

5. (a) (i) $\text{MnO}_2(\text{s}) + 4\text{HCl}(\text{l}) \longrightarrow \text{MnCl}_2(\text{aq}) + 2\text{H}_2\text{O} + \text{Cl}_2(\text{g})$
Penalize 1/2mk if state symbols are not correct

(ii) *KMnO₄ or PbO₂ ✓ 1*

(iii) *The Chloride gas can be dried by passing it through a wash-bottle of concentrated sulphuric acid and is then collected by downward delivery. ✓ 1*

(b)(i) *A- Aluminium (III) Chloride*



Penalize 1/2mk for wrong state symbols

(iii)

6. a) i) *They are different physical/ structural forms of an element in the same physical state.*

ii) *Trausition temperature*

b) i) *X - Diluter*

Y- Heat exchanger

Z- Roaster/ Burner

ii) *Catalyst- Vanadium (v) Oxide, V₂O₅*

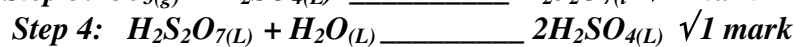
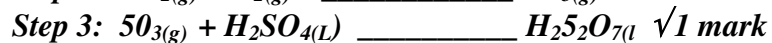
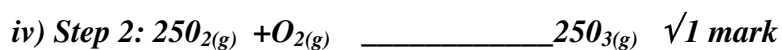
Temperature – 450C

Pressure – 1 atmosphere

iii) *I - They are purified not to poison the catalyst*

II - The reaction in the convertor/ production of sulphur (vi) Oxide is exothermic/

heat is produced. Chamber Y is used to ensure temperature does not rise above 450°C



7. (a) *B – ammonia gas ✓1*
C - nitrogen (II) oxide (NO) ✓1
E – water ✓1
F – unreacted gases ✓1
- (b) *The mixture of ammonia and air is passed through heated/ catalyst where ammonia (II) is oxidized to nitrogen (IV) oxide. ✓1*
- (c) *Gases are cooled and air passed through heated/ catalyst where ammonia is further oxidized to nitrogen(IV) oxide. ✓1*
- (d) *Fractional distillation, ✓*
Water with a lower boiling point ✓ than nitric (V) acid, distills left leaving the concentrates acid.
- (e) *HNO_3 decomposes when exposed to light*
- (f) *HNO_3 is an oxidizing agent hence able to oxidizes copper to Cu^{2+}*
HCl on the other hand doesn't react with copper because copper is less reactive and can not displace hydrogen from its acid.