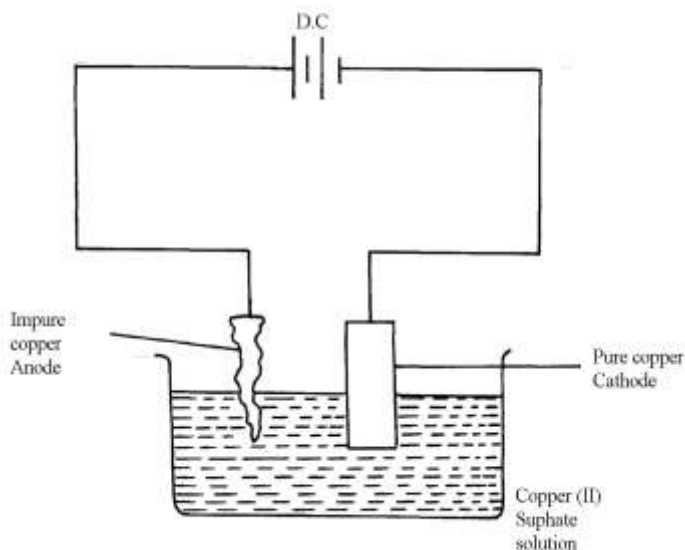


Metals

- chlorine gas would react with steel anode
 - Hood and steel gauze prevent chlorine sodium, from anode and cathode from mixing and reacting. Na
 - Sodium metal is less dense, floats on mottten brine where it is siphoned out.
- $SO_{2(g)}$ is produced as a by- product, this mixes with rain water producing acid rain which may corrode buildings and affect plants $O \frac{1}{2}$
 $SO_{2(g)}$ is poisonous when inhaled $O \frac{1}{2}$
 - H_2SO_4 manufacture – to make use of $SO_{2(g)}$
 - Manufacture of dry cells – make use of zinc
 - Production of iron sheets which are galvanized using zinc (Any one with an explanation)
 - Low density, does not corrode easily, ductile, malleable (Any 2 each $\frac{1}{2}$ mark)
- Aluminium is lighter/low density. (any)
It is a good conductor of electricity
- Stage 1 – oxidation; Coke is oxidized to CO P $\frac{1}{2}$
 - Stage 2 – Reduction: zinc is reduced to Zinc metal $\frac{1}{2}$
 - Stage 3;- Recycling stage; CO_2 is reduced to regenerate CO $\frac{1}{2}$
- Q is sulphur (IV) oxide $SO_2(g)$. \checkmark

b)



- Impure copper is the while pure copper is cathode. During electrolysis impure copper is purified and pure copper deposited on the cathode as shown in the half electrode reaction below;

CATHODEEQUATION:

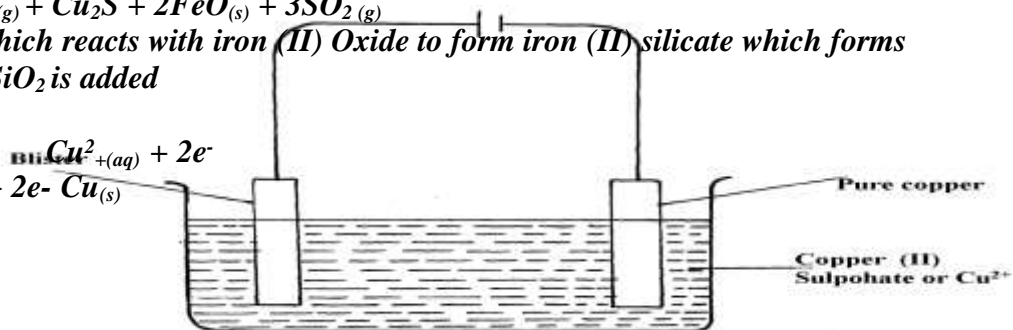


- The cathode is therefore removed and replaced after an interval.

6. (i) *I-I-I-tetrachloromethane /Tetrachloromethane*
(ii) *Chloric (I) acid*
7. *Oxide of W has simple molecular structure while that of Z has giant ionic structure*
8. (a) *Froth floatation.* $\sqrt{1}$ (1 mk)
(b) $PbCO_{3(s)} \rightarrow PbO_{(s)} + CO_{2(g)}$ (1 mk)
(c) *Making of pipes/lead acid accumulators.* $\sqrt{1}$ (any one) 3

9. a) *bauxite* ✓
 b) *Copper pyrites* ✓
10. i)
 ii) I *It's uneconomic// Expensive// a lot of energy is required to produce this high temperature*
 II *Addition of cryolite* Ö ½ mark
 iii) *The melting point is below 800 C* Ö ½ mark
11. (a) (i) *Bauxite*
 (ii) *Iron (III) Oxide* 1
Silica (any one)
 (b)(i) *On the diagram*
 (ii) *It is expensive /a lot of energy will be used* P 1
 (iii) *The ore is dissolved in cryolite (NaAlF₆)* P 1
12. (i) *Bauxite – Al₂O₃, H₂O*
 (ii) *Iron II oxide*
 - *Silica*
 (iii) *Being ionic, it is only an electrolyte in its molten state. Heating helps to melt it.*
 (iv) (a) – *The two rods represent the anode.*
 - *Cathode is the inner lining of the wall.*
 (b) *As an impurity, lowering the melting point of aluminium oxide.*
 (c) *Anode 2O₂(l) O₂(g) + 4e⁻*
Cathode Al³⁺ + 3e⁻ Al(l)
 d) – *manufacture of household utensils*
 - *making cables for electricity transmission*
 - *making foils used as wrappers*
 - *extraction of some metals e.g. manganese*
 - *Making aeroplane parts*

- Describe how you would establish the presence of copper in the ore
13. (a) *CuFeS₂*
 (b) *Froth floatation*
 (c) *2CuFeS_(s) + 4O₂ (g) + Cu₂S + 2FeO_(s) + 3SO₂ (g)*
 (d) *Silica is added which reacts with iron (II) Oxide to form iron (II) silicate which forms part of slag or SiO₂ is added*
 (e) *Anode Cu_(s)*
Cathode Cu²⁺_(aq) + 2e⁻ Cu_(s)

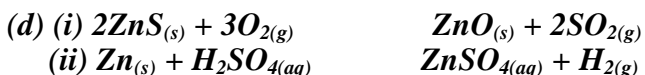


- (g) – *Add HNO_3 to the ore*
– *Filter and place small portion of the filtrate into a test tube*
Add NH_4OH until in excess – deep blue solution confirms the presence of Cu^{2+} ions
14. (a) (i) *Gas Q- Carbon (II) Oxide*

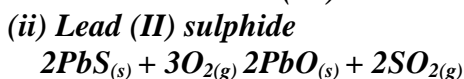
- (ii) Liquid R- dilute sulphuric acid
- (iii) Residue S – excess Zinc metal

(b) Zinc blende

- (c) (i) To increase percentage of Zinc in the ore
- (ii) The ore is crushed, mixed with water and oil and then air is blown into the mixture.



(e) (i) - Lead (II) sulphate //Pbs
 - Silica //silicon (IV) oxide// SiO2



(f) (i) $\frac{45}{100} \times 250000$
 $= 112,500\text{g of ZnS}$

(ii) Rmm of ZnS = (65.4 + 32) – 97.4g
 From the equation
 The mole ration of Zn of ZnS: SO₂ = 1:1
 97.4g of ZnS = 24dm³ of SO₂ at r.t.p
 112,500g of ZnS = $\frac{112,500}{97.4} \times 24$
 $= 27,720.73920\text{dm}^3 \text{ of SO}_2$

15. a) i) Zinc Blende (Penalize for formula only)
 ii) Lead II Sulphide

b) It is concentrated by froth floatation where the ore is crushed or ground, a detergent added and the mixture agitated. Zinc sulphide floats and is collected



d) Zinc oxide is reduced by both carbon and carbon (ii) Oxide to zinc vapour. Lead (ii) Oxide is also reduced by both carbon and carbon (ii) Oxide to lead liquid

Accept equations





e) W = Sulphur (vi) Oxide // $SO_{3(g)}$
M = Conc. Sulphuric (Vi) acid // $H_2SO_{4(L)}$



- g) *The process is highly exothermic and heat produced boils the acid leading to acid mist which cannot be condensed easily because it is highly unstable*
 h) *The sulphur (iv) Oxide dissolves in water to form acid rain which corrodes buildings and affects aquatic life*

16. (a) *Purification and concentration.*
 (b) (i) *Bauxite*
 (ii) *Iron (III) Oxide /Silicon (IV) Oxide*
 (c) *On diagram*
 (d) *Lowers the melting point of the ore from 2015^oc – 900^oc.*

17.) $Q = It = 3 \times 10 \times 60 = 1800$
 $3F = 3 \times 96500c = 27g$
 $\frac{1800c}{3 \times 96500} = \frac{1800 \times 27}{3 \times 96500}$
 $= \underline{0.16788g}$

18. a) *Zinc blende*

- b) i)
 I- *carbon IV oxide*
 II – *Dil sulphuric acid*
 III – *unreacted zinc*

ii) *To reduce zinc oxide to zinc metal*

iii) *Silica*

iv)



vi) $\frac{45}{100} \times 250 = 112.5 \times 1000 = 112500g$
 $= 112.5 Kg$

- vii) – *Used to make brass*
 - *Used to make electrodes in dry cells*
 - *Galvanize iron sheets*

19. a) i) - *Effervescence, a colorless gas is produced*
 - *Grey solid dissolves, a colorless solution is formed*

ii) Nitric acid is a strong oxidizing agent. It will oxidize the hydrogen gas formed to form water instead



II Moles of Zn = $\frac{0.5g}{65.0} = 0.007692$

Moles of HCL = $0.007692 \times 2 = 0.015384$

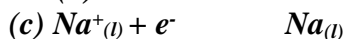
3 moles of HCL has 1000 cm^3

0.015384 moles has $0.015384 \times 1000 \text{ cm}^3$

$$= 5.182\text{cm}^3$$

20. (a) P – Chlorine (1/2)
Q – Sodium (1/2)

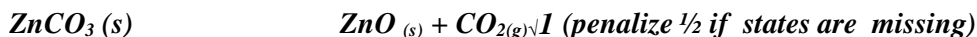
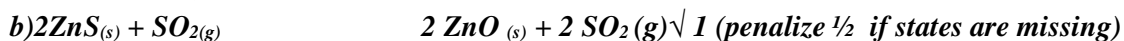
(b) Prevent reaction between sodium and chlorine



21. (a) B.E P 1/2
(b) $\text{Pb}^{2+}(\text{l}) + 2e^- \rightarrow \text{Pb}(\text{s})$ S.S P 1/2
(c)

P1

22. a) zinc blende ✓ 1/2
Calcium ✓ 1/2



23. a) Iron III hydroxide
b) Concentrated sodium hydroxide is added at 4 atm pressure to the Bauxite at 160C
 Al_2O_3 dissolves in the sodium hydroxide leaving the iron III oxide as a solid
24. a) i) The oxygen produced at the anode reacts with hot carbon to form carbon (iv) oxide hence corrodes it therefore needs replacement
ii) Graphite is inert and a poor conductor of heat hence helps to conserve heat
b) Aluminum has more number of valency electrons which are delocalized