METALS MARKING SCHEME

1. 1995 Q4 P2

(a) (i) Sulphur (iv) oxide (1 mark)

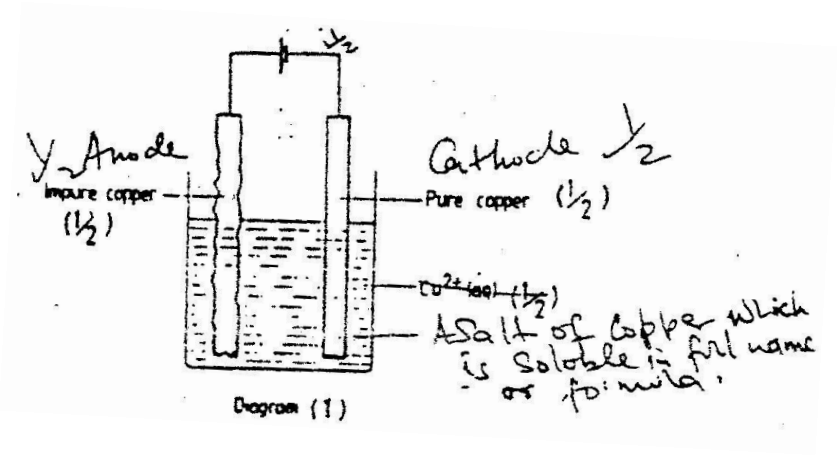
(ii) $2\ cuFeS_2(s) + 4O_2\ (g) \rightarrow 2FeO(s) + Cu_2\ S(s) + 3SO_2(g)$ (1 mark)

(iii) Fe^2 (1 mark)

(iv) P is carbon (iv) oxide/carbon monoxide (1 mark)

(v) Reduction – oxidation (Redox) reaction because Cu_2O is reduced to Cu while coke to $CO_2(g)$ (2 marks)

(b)



(c) 1 mole of CuFeS = 1 mole Cu

210kg Cu = OR $\frac{210}{63.5} \times \frac{183.5}{810} \times 100$ or mass Cu in cores = $\frac{810 \times 63.6}{183.5}$ = 80.3Kg

$\%Cu = \frac{210}{280} \times 100 = 74.9\%$

3.3 moles of Cu(s) = 3.3 moles $CuFeS_2$

$CuFeS_2 = 63.5 + 56 + 64 = 183.5$ g

$= 183.5 \times 3.3 = 605.6 \times 10^3$g

$\text{Purity} = \frac{605.6 \times 1000 \times 100}{810 \times 1000} = 74.75\%$

(d) Acid rain may from due to presence of SO_2 (g) and CO_2 (g) dumping of the waste like the slag prevent vegetation growth large gullies left after the ore is excavated destroys the environment (Do not accept presence of heat) (1 mark)

2. 1998 Q3 P1

Advantage

- Prevents knocking engines
- Prevent premature ignition
- Increase the Octane rating (Number)

Disadvantage

- Poisonous lead or lead compounds are released into the environment/ pollutes the atmospheres

3. 2000 Q3 P2

a) i) - Galena (reject PbS on its own)
ii) - Some of the sulphide is converted into oxide.(PbO orSO_2
iii) - Carbon monoxide (CO) or carbon dioxide (CO_2)
i) - $PbO_{(l)} + C_{(s)}$ Pb + $CO_{(g)}$
v) - To reduce unreacted PbS to Pb
vi) -SO_2 cause acid rain 3. Lead is poisonous / a pollutant
SO_2 is poisonous 4. CO is poisonous
(any two @ 1mark = 2marks

b) -Hard water contains Mg^{+2} /Ca^{2+}
- These ions form a protective layers of $CaCO_3$/ $CaSO_4$ Mg CO_3 on the lead
- Soft water does not form these deposits

c) Radiactive shielding

- Lead accumulators / batteries
- Making roofs
- Making Alloys e.g. soldering wire
- Manufacture of anti – knock additives
- Manufacture of paints
- Manufacture of ball bearings.

4. 2002 Q14 P1

(a) Fe_2O_3, Fe_3O_4 (l)

(b) CaO (s) + SiO_2(s) →$CaSiO_3$(s)

5. 2003 Q20 P1

- Door handles
- Coinage
- Soldering bits
- Padlocks
- Musical instruments
- Ornaments
- Making plumbing joints
- Cartridges for bullets and bombs.

6. 2003 Q5 P2

a) Electrolysis // Hall/ Heroult cell

b) Al_2O_3 . Al_2O_3. H_2O /Al_2O_3. $2H_2O$

c) i) Iron (iii) Oxide Fe_2O_3 silica

Silica SiO_2

ii) Add hot cone. NaOH /KOH_2, silca and AlO_3 dissolves. Filter iron(iii) oxide. Bubble CO_2 through filtrate/ add water/ add $Al(OH)_3$ to precipitate. $Al(OH)_3$. Filter al $(OH)_3$ / silca remain in solution.

d) Lower melting point of Aluminum oxide/Acts as an electrolyte.

e) The oxide ion (O^{2-}) is discharged at the graphite to form carbon dioxide

f) The reaction of aluminium with oxygen forms a firm layer of aluminium oxide. This layer prevents aluminium metal from further attack.

7. 2005 Q12 P1

(a) Coke reduces lead (II) oxide to lead metal

$Pb(s) + C(s) \rightarrow Pb(s) + CO(g)$

(b) Limestone (calcium oxide) combine with Silica to form Calcium Silicate

$CaO(s) + SiO_2(s) \rightarrow CaSiO_3$

(c) Scrap iron reduces any remaining lead sulphide to lead metal

$Fe(s) + PbS(s) \rightarrow FeS(s) + Pb(s)$

8. 2005 Q7 P2

(a) (i) graphite or titanium. They do not react with chlorine gas
(ii) A steel diaphragm is suspended between the electrodes
(iii) $2Cl^-(aq) \longrightarrow 2Cl_2(g) + 2e$

(b) (i) calcium chloride ($CaCl_2$)
(ii) It is economical i.e reducing cost of production

(c) hydrogen is preferentially discharged at the expense of sodium.
At the anode, hydroxyl ions will be prefentially discharged at expense of chlorine gas.

(d) $2Na(s) + O_2(g) \xrightarrow{\text{Limited}} Na_2O_2(s)$

$Na(s) + O_2(g) \xrightarrow{\text{Excess}} Na_2O$

9. 2006 Q21 P1

a) They have delocalized valency electrons (1 mark)
b) Aluminium has three delocalized electrons.
It is resistant to corrosion (2 marks)

10. 2006 Q6 P2

a) i) Calcium silicate / calcium aluminate (1 mark)
ii) Magnetite,Fe_3O_4
Siderite,$FeCO_3$ / Iron pyrites / iron limonite
Accept both the name and or a correct formula (1 mark)
iii) Carbon dioxide,CO_2 /Carbon (IV)oxide (1 mark)

b) Air reacts with carbon (coke) to form carbon dioxide(CO_2).Carbon dioxide reacts with coke to form carbon monoxide. The carbon monoxide reacts with Fe_2O_3 to form iron. (3 marks)

c) To produce calcium oxide which reacts with silica to form slag. (1 mark)

d) Cast iron is impure. (1 mark)
(e) Manufacture of
- Rails.
- Drainage pipes
- Engine blocks / Utensils / nails / cutlery / surgical instruments/bridges/ cars / iron sheets etc. (2 marks)

11. 2007 Q19 P1

(a) Froth Floatation
(b) $ZnCO_3(g) \rightarrow ZnO_{(s)} + CO_2(g)$
(c) Manufacture of dry cells. Zinc casing forms the anode of dry cells

12. 2008 Q28 P1

(a) (i) Cryolite
(ii) Electrolysis
(b) Good conductor does not rust
Malleable
Light
High m.p
Does not corrode easily

13. 2009 Q7 P2

(a) Coke/ coal/ Charcoal/ Carbon
(b) $C_{(s)} + CO_2(g) \rightarrow 2\,CO_{(g)}$
(c) The reaction between coke/ coal and the hot air is highly exothermic
(d) Slog is immiscible with molten iron
(e) Nitrogen (iv) oxide gas forms acid rain. Which corrodes metallic materials and destroys vegetation the environment.

(f) (i) By passing/ blowing oxygen into molten iron which converts carbon into carbon (IV) Oxide

(ii) To increase the tensile strength/ making the iron less brittle/ making it more malleable / making it more ductile.

14. 2010 Q6 P2

a) i) ZnS

ii) So as to obtain ZnO which is easily reduced by CO to Zn

$2ZnS_{(s)} + 3O_{2(g)} \longrightarrow 2ZnO_{(g)} + 2SO_{2(g)}$

b) i) coke

Limestone

ii) $2C_{(s)} + O_{2(g)} \longrightarrow 2CO_{(g)}$

$CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$

Rej ; $C_{(s)} + O_{2(g)} \longrightarrow CO_{2\,(g)}$

iii) vapour / gaseous state. The temperature is above boiling point of Zinc

iv) 420 – 906 Temperature is below boiling point of Zinc

v) SO_2 produced is poisonous/ forms acid rain

vi) Making brass

Used as a negative terminal in dry cells

Galvanization of iron

Rej: manufacture of dry cells

15. 2011 Q27 P1

(a) Zinc blende or calamine /Zinc Sulphide/Zns

(b) $2ZnO_{(s)} + C_{(s)} \longrightarrow 2Zn_{(S)} + CO_{2(g)}$

$ZnO_{(S)} + C_{(s)} \longrightarrow Zn_{(S)} + CO_{(g)}$

$3ZnO_{(s)} + 2\,C_{(s)} \longrightarrow 3Zn_{(l)} + CO_{2(g)} + CO_{(g)}$

$ZnO_{(s)} + C_{(g)} \longrightarrow Zn_{(s)} + CO_{2(g)}$

(c) -Dry cells

- Galvanising iron sheets
- As electrodes
- Making of alloys e.g Brass

14. 2012 Q22 P1

(a) (i) malleable Can be hammered rocket into sheets

(ii) ductile

can be drawn into wires

(b) (i) –making of sufurias /motorcycle parts / aeroplane window/door frames, cups, plates packaging materials, pans, making sheets / roof

(ii) Electricity cables/wires