1. - Add water to the mixture
   - Sodium chloride dissolves
   - Copper (II) oxide does not
   - Filter
   - Heat the filtrate to dryness to obtain sodium chloride

2. a) K^+ three energy levels while Na^+ has only two
   b) Mg^{2+} nucleus has more protons than Na^+
   Mg^{2+} has a higher nuclear charge than Na^+

3. $2Al_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow Al_2O_{3(s)}$; $\Delta H_1 = -1673.6kJmol^{-1}$
   $FeO_{3(s)} \rightarrow 2Fe_{(s)} + O_{2(g)}$; $\Delta H_2 = 836.8kJmol^{-1}$
   $2Al_{(s)} + Fe_2O_{3(s)} \rightarrow Al_2O_{3(s)} + 2Fe_{(s)}$; $\Delta H_2 = 4 - 1673.6kJmol^{-1}$

   Alternative
   $\Delta H_1 - \Delta H_2 = \Delta H_3$
   - $1673.6kJmol^{-1} - (-836kJmol^{-1})$ $= \Delta H_1$
   - $1673.6 + 836.8kJmol^{-1}$ $= \Delta H_2$
   - $836.8kJmol^{-1}$ $= \Delta H_3$

4. a) Rhombic or monochronic
   b) Vulcanization
      - Preparation of calcium hydrogen sulphite
      - Manufacture of sulphuric acid
      - Gun powder
      - Drugs

5. H $H^+ + e^- \rightarrow \frac{1}{2}\Delta H = +VE$
   H + E $H^- \rightarrow \frac{1}{2}\Delta H = -VE$

6. $Na_2SO_{3(s)} + 2HCl \rightarrow 2NaCl + SO_{2(g)} + H_2O$
   Moles of $SO_2 = 960$
   Mass of $Na_2SO_3 = 0.04 \times 126 = 5.04g$
   Moles of $Na_2SO_3 = 0.04$

7. - HCl is a strong
   - Ionises fully/produces a large number of $H^+_{(aq)}$ ions
   - Ethanoic acid is a weak acid
   - Partially ionises/produces fewer number of $H^+_{(aq)}$ ions

8 a) The heat absorbed by a mole of substance of charge from liquid state to gaseous constant temperature
   b) - Boiling point increases with increase in molecular mass
      - Increase in the number of carbon atoms

9. a) A condenser
   b) To show when the various liquids/fraction are distilling
   c) liquid

10. a) 5
    b) 5

11. - The yellow liquid in PCL_3
- The PCL_3 is hydrolysed in air to form HCl which fumes

12. a) $H_2O_{(g)} + C_{(s)} \rightarrow CO_{(g)} + H_{2(g)}$
- Panelise for states

b) - Reduction
- Fuel

13. - Form acid
- Corrode buildings
- Pollute the air/poisonous
- Nitrate the soil (nitrogen fixing)
- Acidity the soil

14. - The entire solution turns pink
- Potassium permanganate particles diffused into the water molecules

15. a) Water is carefully added to oleum

b) - Making fertilizers, esters
- Manufacture of paints, explosives, detergents, HCl, HNO_3
- Drying agent for gases
- Pickling of metals

16. a) $3Mg_{(s)} + N_{2(g)} \rightarrow Mg_3N_{2(s)}$

b) - Argon, neon (name of a rare gas)
- They are inert/unreactive

17. Chemical - Insert glowing splint, it relights
- Shake with alkaline pyrogallol, if absorbed, it is not N_2O

Physical - Invert a gas jar of NO. If it turns brown it is not N_2O
- Invert gas jar of G over cold water, if the level rises it is N_2O
- Has a sweat smell

18. a) SO_4^{2-}/Sulphate ion

b) $Ba^{2+}_{(aq)} + SO_4^{2-} \rightarrow BaSO_{4(s)}$

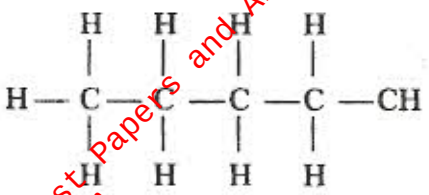
c) $[Zn[NH_3]_4]^{2+}$

19. a) - The yield of ammonia decreases
- At high temperatures ammonia decomposes
- Equilibrium moves to the left

b) - Manufacture of fertilizers, smelling salts, sodium carbonate
- Removed of stains
- As refrigerants
- Softening temporary hardness of water

20. - Coinage, ornaments, soldering
- Making plumbing joints/musical instruments/casing for bullets and bombs

21. a)



b) Alkanol/Alcohols

c) $2C_4H_9OH_{(l)} + 2K_{(s)} \rightarrow 2C_4H_{10}OK_{(s)} + H_{2(g)}$

22. a) FeCl$_2$ or Iron (II) Chloride

b) The solution was basic, hence a pH of 14.0
- Excess HCl neutralised the alkaline and the solution became acidic, as HCl is acidic

23. a) Bromine is decolourized

b) 1, 2 - Dibromopentane or 2,3 Dibromopentane

24. - Group 7 elements react by gaining electrons
- Fluorine has the smaller atomic radius since atomic radius increases down the group
- The smaller the atom, the greater the electron attraction, hence the ease of electron gain decreases down the group.

25. a) At constant temperature, the volume is inversely proportional to the pressure

b) $P_1V_1 = P_2V_2$

$3 \times 1 = 2\ V_2$

$V2 = \dfrac{3 \times 1}{2}$

26. a) Ammonia, being a basic gas, dissolved in water forming a basic solution

b) To prevent sucking back

27. $63.5g = 2 \times 96500C$

$1.48g = \dfrac{2 \times 96500 \times 1.48C}{63.5}$

Therefore $= \dfrac{2 \times 96500 \times 1.48 \times 2}{5 \times 60 \times 60 \times 63.5}$

$= 0.4998amps$