1. (a) Valency 3  1
   (b) Group 3  1

2. (a) Wire gauze  1
   (b) Sodium chloride solution (or any named slat solution)  1

   (c) Evaporation  1

3. (a) Sublimation.  1
   (b) Bleaching  1
   (c) Polymerisation  1

4. (a) (i) X  1
       (ii) W  1
   (b) V  1

5. Insoluble Lead (II) sulphate is formed preventing any further reaction.  1

6. (a) $3Mg_{(s)} + N_{2\,(g)} \rightarrow Mg_3N_{2(s)}$  1
   (b) Argon  1
      - It is inert  1

7. - Water rose up the test-tube to occupy the space of active air or oxygen $^{\checkmark½}$ which has been
      used in rusting. $^{\checkmark½}$
   - Iron wool turned red−brown $^{\checkmark½}$ due formation of hydrated iron (III) oxide $^{\checkmark½}$.

8. (a) $N_2O$  1 or Nitrogen (I) oxide
   (b) $K_2O$  1 (Potassium oxide)
   (c) $Al_2O_3$  1 (Aluminium oxide)

9. (a) Hydrogen is above Cu $^{\checkmark½}$ and below Al in the reactivity series $^{\checkmark½}$ of elements.
   (b) (i) The reaction is too exothermic that a lot of heat is produced causing ignition of
         hydrogen in presence of oxygen.
      (ii) $H_{2\,(g)} + O_{2\,(g)} \rightarrow H_2O_{\,(g)}$

10. $Na_2CO_{3\,(aq)} + 2HNO_{3\,(aq)} \rightarrow 2NaNO_{3\,(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
      Mole ratio $Na_2CO_3:HNO_3 = 1:2^{\checkmark½}$
      Moles of $HNO_3$ in 20 $cm^3$ = 20/1000 × 0.25 = 0.005 $moles^{\checkmark½}$
      Moles of $Na_2CO_3$ in 25 $cm^3$ = ½ of 0.005 = 0.0025 $moles^{\checkmark½}$
      If 25$cm^3$ = 0.0025 moles
      in 250$cm^3$ = ?
            $\dfrac{250 \times 0.0025}{25}$ = 0.025 $moles^{\checkmark½}$

$RFM$ of $Na_2CO_3 = 106^{\checkmark\frac{1}{2}}$

$I$ mole of $Na_2CO_3 = 106$ g

$0.025$ moles $=?$

$$\frac{0.025 \times 106}{1} = 2.65g \text{ of } Na_2CO_3^{\checkmark\frac{1}{2}}$$

11. $\dfrac{63 x + 65 (100 - x)}{100} = 63.55^{\checkmark\frac{1}{2}}$

$63x + 6500 - 65x = 6355$

$2x = 6355 - 6500 = 145$

$x = 72.5^{\checkmark\frac{1}{2}}$

% abundance of $^{63}M = 72.5\%^{\checkmark\frac{1}{2}}$

$^{65}M = 100 - 72.5 = 27.5\%^{\checkmark\frac{1}{2}}$

12. Silicon (IV) Oxide has giant atomic structure$^{\checkmark\frac{1}{2}}$ with strong covalent bond$^{\checkmark\frac{1}{2}}$ holding the

atom together. These require a lot of energy to break, hence it has high melting point.

Carbon (IV) Oxide has simple molecular structure$^{\checkmark\frac{1}{2}}$ with weak Van Der Waals forces$^{\checkmark\frac{1}{2}}$

holding the molecules together which require little energy to break, hence is a gas at room

temperature and pressure.


13. (a) Number of protons

T = 11 protons

Z = 16 protons

Formula of compound $= T_2Z^{\checkmark\frac{1}{2}}$

Mass number of T $= 11+ 12 = 23^{\checkmark\frac{1}{2}}$

Mass number of Z $= 16+16 = 32^{\checkmark\frac{1}{2}}$

Formula Mass of $T_2Z = (23\times 2) + 32 = 78^{\checkmark\frac{1}{2}}$

(b) - When molten$^{\checkmark\frac{1}{2}}$

- When in aqueous solution$^{\checkmark\frac{1}{2}}$

14. The oxide ions has 2 extra electrons $^{\checkmark\frac{1}{2}}$ that causes greater electron repulsion than in oxygen atom$^{\checkmark\frac{1}{2}}$


15. $HCl_{(g)}$ is polar. It ionizes/dissociates in water which is a polar solvent to produce $H^+_{(aq)}$ that gives the solution acidic properties. 1mk. $HCl_{(g)}$ does not ionize/dissociate in methylbenzene which is a non-polar solvent. It remains as molecules hence no $H^+$ ions. 1mk
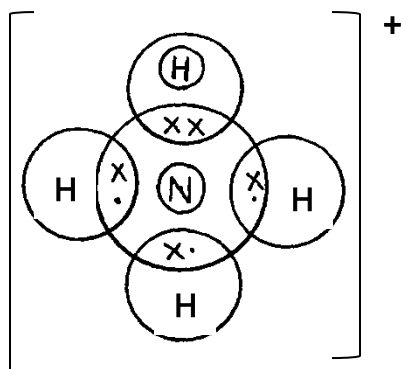

16. - Add dilute nitric acid to lead (II) carbonate.$^{\checkmark\frac{1}{2}}$

$PbCO_3(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(aq) + CO_2(g) + H_2O(l)$ $^{\checkmark\frac{1}{2}}$
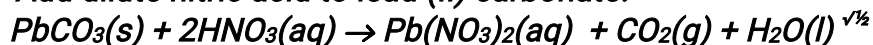
- React the resulting solution with solution of sodium sulphate$^{\checkmark\frac{1}{2}}$ or dilute sulphuric acid.

$Na_2SO_4(aq) + Pb(NO_3)_2(aq) \rightarrow PbSO_4(s) + 2NaNO_3(aq)$ $^{\checkmark\frac{1}{2}}$
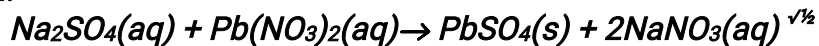
- Filter to obtain lead (II) sulphate as residue. $^{\checkmark\frac{1}{2}}$ Dry the salt of lead (II) sulphate in between the filter papers or in sunshine.$^{\checkmark\frac{1}{2}}$

**17. (a)**



- award 1mk if one Hydrogen has two electrons donated by Nitrogen
- 0mk if all hydrogen atoms

1

**(b)**
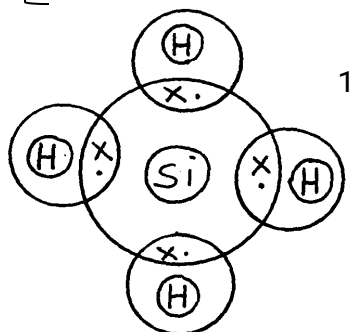


- award full mark if Silicon and Hydrogen contributes shared electrons equally

1

18. (a) They became covered with a white powder  1
    (b) Efflorescence  1

19. (a) This  is  the  maximum mass of a salt  that will dissolve in 100 g of  water at a given temperature√1
    (b) 15 g dissolve in 25 cm³ water
       x g dissolve  in $\underline{(15x100)}^{√½}$ = 60g/100g water$^{√½}$
                          25

20. (a) Grahams law states;
        Under the same conditions of pressure and temperature, the rate of diffusion of a
        gas is inversely proportional to the square root of its density. √

   b) $\dfrac{Time\ CO_2}{Time\ NO_2} = \dfrac{√ M CO_2}{√ M NO_2}$

      Where 100cm$^3$ of $CO_2$ takes 30 seconds
      ∴ 150cm$^3$ of $CO_2$ takes $^{30}/_{100}$ x 150 = 45 seconds $^{√½}$

      $\dfrac{45}{TNO_2} = \dfrac{√44}{√46}$

      $\dfrac{45}{TNO_2}$ = 0.975

   $TNO_2 = \underline{45}^{√½}$ = 46 sec $^{√½}$
              0.97

OR

$$\underline{RCO_2} = \frac{\sqrt{MNO_2}}{\sqrt{MCO_2}}$$
$$RNO_2$$

But $RCO_2 = \underline{100cm^3} = 3.33\ cm^3\ per\ sec^{\sqrt{½}}$
           30 s

$\underline{3.33}\quad = \sqrt{46}^{\ \sqrt{½}}\quad = 1.0225$
$RNO_2\qquad \sqrt{4}$

$RNO_2 = \underline{3.33}^{\sqrt{½}}$
        1.0225

$= 3.26\ cm^3\ per\ second$

Time for No $= \underline{150\ cm^3}$
$\qquad\qquad\quad 3.26cm\ sec^{-1}\quad = 46\ sec^{\sqrt{½}}$

21. (a) Drying agent ✓ ½ which must be CaO

Method of collection ✓ 1 - upward delivery

Workability✓ ½

(b) $2NH_4Cl_{(g)} + Ca(OH)_{2(s)} \rightarrow CaCl_{2(g)} + H_2O_{(l)} + 2NH_{3(g)}$ ✓
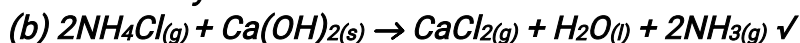
22. - At $113^{o}C$ consists of $S_8$ rings that flow easily;

- Darkens due to breaking of $S_8$ rings and forming long chains consisting of thousands of

atoms. The chains also entangle;

- The long chains consisting of thousands of atoms. The chains also entangle;

- The long chains break near b.p. to form shorter one;

23. Moles $C_4H_{10} = \underline{1.12} = 0.05\ mol^{\sqrt{½}}$
                22.4

Heat produced $\quad 0.05 \times 3000 = 150\ kJ^{\sqrt{½}}$

Useful heat $= \underline{75 \times 150} = 112.5\ kJ^{\sqrt{½}}$
                100

Let mass of water $\qquad\qquad = m$

Room temperature $\qquad\qquad = 25\ ^{o}C$

Boiling point $\qquad\quad = 100\ ^{o}C$

Change in temperature, $\Delta T = 100\text{-}25 = 75^{\sqrt{½}}$

$\Delta H = \Delta T \times m \times C$

$\underline{75 \times m \times 4.2} = 112.5^{\sqrt{½}}$
     1000

$315m = 112500$

$m = 35Kgm^{-3\sqrt{½}}$

Volume $= 357m^{3\sqrt{½}}$

24 (a) Formula: $CH_3CH = CHCH_3$✓ ½

Name: But-2-ene✓ ½

(b)    H    $CH_3$

$$Cl - \overset{\displaystyle |}{\underset{\displaystyle |}{C}} - \overset{\displaystyle |}{\underset{\displaystyle |}{C}} - CH_3$$
$$\quad\quad H \quad CH_3$$
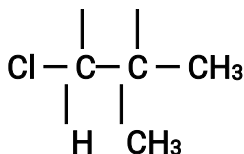
25. % of $H_2O$ lost = 14.5%

    5 of anhydrous $Na_2CO_3$ = 85.5%     ½

    R.F.M of $Na_2CO_3$ = 106  ½

    RMM of $H_2O$ = 18    ½mk

| $NaCO_3$ | $H_2O$ |
|---|---|
| $\dfrac{85.5}{106}$ | $\dfrac{14.5}{18}$  ½ |
| $\dfrac{0.8066}{0.8055}$ = 1 | $\dfrac{0.8055}{0.8055}$ = 1  ½ |

    n = 1 $(Na_2CO_3.H_2O)$   ½

26. (a) Sample 3√ 1

    (b) Sample 2 contained ions that caused temporary hardness$^{\checkmark½}$, therefore required large

       volume of soap solution before boiling, but after boiling the temporary hardness was

       removed$^{\checkmark½}$ thus required very little volume of soap solution to lather.

27. (a) Sodium chlorite(I)/Sodium hypochlorite  1

    (b) $4HCl_{(aq)} + MnO_2 \rightarrow MnCl_{2\,(aq)} + Cl_{2\,(g)} + 2H_2O_{(l)}$   1

       Penalize ½mk if state symbols are not correct;

       Penalize fully if the balancing is incorrect.
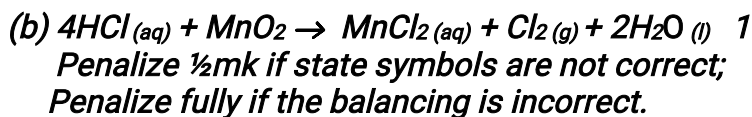
    (c) Potassium manganate (VII)/$KMnO_4$ or lead (IV) oxide/$PbO_2$

28. (a) Any suitable metal sulphide e.g. FeS rej. PbS

    (b) $FeS_{(s)} + H_2SO_{4\,(aq)} \rightarrow FeSO_{4\,(aq)} + H_2S_{(g)}$

    (c) Hydrogen sulphide is less soluble in warm water compared to cold water

29. (a) Elements K and N  1

    (b) Element L is a non-metal  ½ and reacts by gaining an electron  ½.

    (c) Element M  1

30. (a) $HCl_{(g)}$ is extremely soluble in water  1mk. Inverted funnel provides a large surface area for the gas to dissolve in water and prevent suck-back.  1mk

    (b) Ammonia gas  1mk

31 (a) $2Fe_{(s)} + 3Cl_{2(g)} \rightarrow 2FeCl_{3\,(g)}$ √ 1mk

$Fe_{(s)} + 2HCl_{(g)} \rightarrow FeCl_{2(g)} + H_{2(g)}$ ✓ 1mk

   N.B: Must be balanced

            State symbol must be correct

            Chemical symbols must be correct

(b) In the absence of moisture, chlorine cannot form HOCl, chloric (I) acid solution, responsible for its bleaching property.✓1mk