Paper 1 marking scheme

1. Copper (II) sulphate;
Reject formula.

2 (a). Switching off the gas from the main source / tank while the Bunsen burner is still on;

(b) (i). Non-luminous flame;

(ii). The un burnt middle part – the middle region containing un burnt gases hence less hot;
The part parts – the pale blue region with complete combustion hence hottest part;

(iii). Not easily visible and may easily cause accidents; ✓ 1

3. Bubble the gas into a test tube containing lead (II) ethanoate / lead (II) nitrate✓ 1; formation of a black precipitate confirms presence of hydrogen sulphide✓ 1;

4. From products, elements in compound are Al and C (from products of burning the gas)
Moles of CO_2 produced:
24 000 cm^3 = 1 mole;
72 cm^3 = $\frac{72 \times 1}{24000}$ = 0.003 moles; ✓ ½
Mass of CO_2 = 0.003 x 44 = 0.132; ✓ ½
Mass of carbon = $^{12}/_{44}$ x 0.132 = 0.036g; ✓ ½
Mass of aluminium = 0.144 – 0.036 = 0.108✓ ½
Mole ratio of Al : C
$\frac{0.108}{27} : \frac{0.036}{12}$
0.004: 0.003✓ ½
Formula: Al_4C_3; ✓ ½

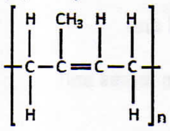
5. Methane is made of larger molecules than neon✓ ½; so higher number of Van der Waals forces which require more heat to break✓ ½;

6. Uses of bromine.
- Making flame retardants;
- Making compounds that are used in water treatment;
- Making light sensitive photographic emulsions e.g. silver bromide;
- Bromine compounds are used in making drugs in pharmaceutical industries;

7 (a). Ethylbutanoate;

(b) (i). 2-methyl – 1, 3- diol;

(ii). Polymer:



8. Using mole ratio:
Moles of bleach used = 0.035 moles;
This if 25 cm^3 = 0.035 moles;
1000 cm^3 = $\frac{1000 \times 0.035}{25}$
= 1.4 Moles per litre;

9. - Add water to sodium carbonate and stir to make sodium carbonate solution;
- Heat the lead metal in air to form lead (II) oxide;
- Add excess lead (II) oxide into dilute nitric acid to form lead (II) nitrate;
- Filter off excess lead (II) oxide to obtain lead (II) nitrate solution as filtrate;
- Add lead (II) nitrate solution to the sodium carbonate solution (to form lead (II) carbonate and sodium nitrate);
- Filter to obtain lead (II) carbonate residue;
- Rinse with water;
- Heat to dry;

10 (a). Increase the surface area for the reactions in the Solvay tower;

(b). $NH_{3(g)} + CO_{2(g)} + NaCl_{(aq)} + H_2O_{(l)} \rightarrow NaHCO_{3(s)} + NH_4Cl_{(aq)}$;

11 (a). $Pb(NO_3)_{2(s)} \rightarrow PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$;

(b). Concentrated sulphuric (VI) acid is reacted with ethanedioic acid in a flask; to produce carbon (IV) oxide, carbon (II) oxide and [redacted]; the gases are passed through sodium hydroxide; to absorb carbon (II) oxide; then through concentrated sulphuric (VI) acid; to dry carbon (IV) oxide; which is then collected by downward deliver / into a gas syringe;

12 (a). Enthalpy change when one mole of a crystal solid lattice if browken down into its constituent gaseous atoms / formed from its constituent gaseooues atoms;

(b). $\Delta H_{sol} = \Delta H_{latt} + \Delta H_{hydr}$.
-154 = 2493 + (-363 + x), where x = Hhydr of magnesium ions;
Thus x = -154 – 2493 + 363
= -2284kJ $mole^{-1}$;

13 (a). $CH_3COOCH_2CH_3$;
Accept any ester containing CH_3COO……(i.e. the constituent alkanol does not matter)

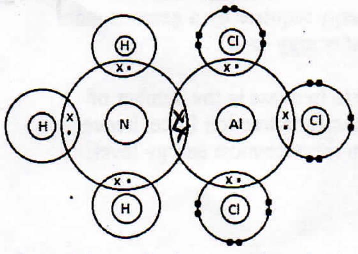
(b). Mg^{2+} and Ca^{2+};

(c). $2C_{17}H_{35}COO^-_{(aq)} + Ca^{2+}_{(aq)} \rightarrow (C_{17}H_{35}COO)_2Ca_{(s)}$;

14 (a). The average mass of an atom of the element compared with a twelfth ($^1/_{12}$) of an atom of carbon-12;

(b). The number of neutrons / both have 2 neutrons in the nucleus;

15. Dot and cross diagram.



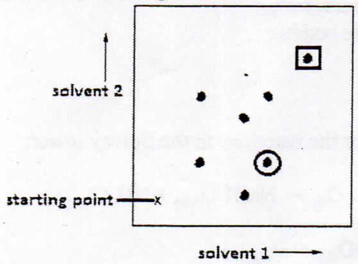
16. Boiling point increase from hydrogen chloride to hydrogen iodide; as the size of the molecules increase due to increasing atomic radius of the halogens; the number of van der waals increase; leading to increase in amount of energy needed for bond breakage;

17 (a). $Mg^+_{(g)} \rightarrow Mg^{2+}_{(g)} + e$;

(b). Second ionization energy is higher than the first; after loss of first electron the nuclear attraction of the valence electrons increases; thus increasing the energy required for electron loss;

18 (i). 4;

(ii) and (iii). Diagram:



19 (i). $Mg_3N_{2(s)} + 6H_2O_{(l)} \rightarrow 3Mg(OH)_{2(aq)} + 2NH_{3(g)}$;

(ii). ON in Mg_3N_2:
$(3 \times 2) + 2N = 0$
$2N = -6$
$N = -3$;
Oxidation number of N in NH_3:
$N + (3 \times +1) = 0$
$N = \cancel{+3}$ -3
It is a not redox reaction since oxidation number of nitrogen ~~increases~~ remains -3 from -3 ~~to +3~~; implying it undergoes reduction;

20. The 0.05 molar $Na_2S_2O_3$ has a higher concentration than the 0.02 molar hence a higher number of reacting particles; which leads to more effective collisions hence faster reaction rate;

21 (a). The oxygen in the hot air reacts with the impurities in the iron oxidizing them to gaseous oxide/ oxidizing carbon to carbon (IV) oxide; which escapes leaving iron at a higher percentage purity;

(b) (i). $Fe_2O_3.2H_2O$;

(ii). - In A magnesium undergoes oxidation at the expense of iron so no oxidation of iron to Fe^{2+}; thus no blue colour with indicator;
- In B iron undergoes oxidation at the expense of copper so undergoes oxidation to form Fe^{2+}; turning indicator blue;

22. - Increase the volume of hydrogen peroxide;
- ~~Increase~~ decrease the concentration of hydrogen peroxide; and increase the volume of H_2O_2

23 (a). The minimum amount of energy required by a gaseous atom to gain an electron into its outermost energy level;

(b). Decreases down the group; due to increase in the number of energy levels which decreases the nuclear attraction force; hence increasing ease of electron loss from the outermost energy level;
Owtte;

24 (a). A: $CuSO_{4(aq)}$;
B: $CuCl_{2(aq)}$;
C: $Cu(OH)_{2(s)}$;
D: $[Cu(NH_3)_4]^{2+}$;

(b). $Cu(OH)_{2(s)} + 4NH_{3(aq)} \rightarrow [Cu(NH_3)_4]^{2+}_{(aq)} + 2OH^-_{(aq)}$;

25. $4Al_{(s)} + 3O_{2(g)} \rightarrow 2Al_2O_{3(s)}$;
Then $Al_2O_{3(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(aq)} + 3H_2O_{(l)}$;
Moles of aluminium oxide = 0.01 moles (reaction ratio).
Moles of acid needed = 0.01 x 6 = 0.06 moles (reaction ratio)
If 2 moles = 1000 cm^3
Then 0.06 moles = $\frac{0.06 \times 1000}{2} = 30\ cm^3$;

26. R: Giant molecular structure; low melting and boiling point and does not conduct electricity;
S: Giant covalent / atomic structure; high melting and boiling point and does not conduct electricity;
T: Giant metallic structure; high melting and boiling point and conducts electricity in solid state;

27 (a). Cracking / Thermal cracking / catalytic cracking;

(b). $C_2H_5OH_{(l)} + .2[O] \rightarrow CH_3CO_2H + H_2O_{(l)}$;
Reject if $H^+/KMnO_{4(aq)}$ or $H+/K_2Cr_2O_{7(aq)}$ is not on the arrow.

28 (i). $H_2SO_{4(aq)} + 2NaI_{(aq)} \rightarrow Na_2SO_{4(aq)} + I_{2(g)} + H_{2(g)}$;

(ii). Conc $H_3PO_{4(l)}$ is a stronger oxidizing agent; it oxidizes the iodide ions into hydrogen iodide; unlike conc. H_2SO_4 so that iodide ions form iodine gas;

29. $\Delta H = MC\Delta T$
$= 50 \times 4.2 \times 14$;
$= -2940J$;
Moles of Zn = $^3/_{65}$ = 0.0461 moles;
Moles of Copper (II) sulphate:
1000 cm^3 = 2 moles
50 cm^3 = $\frac{50 \times 2}{1000}$ = 0.1 moles;
Thus if 0.0461 moles = -2940 kJ;
1 mole = $\frac{1 \times 2940}{0.0461}$ = -63774.4034K/mol-1 or 63.7744kJ/mol;

30 (a). Higher volume with hydrochloric acid; it is a strong acid thus ionizes fully to release a larger number of hydrogen ions;

(b). $NaCl_{(aq)} + AgNO_{3(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$;
Moles of AgCl = $\frac{2.360}{143.5}$ = 0.01644 moles;
Using mole ratio, moles of NaCl = 0.01644;
Mass of NaCl = 0.01644 x 58.5 = 0.96174g
Thus mass of water = 2.63 – 0.96174 = 1.66826g;
If 1.66826g = 0.96174
Then 100g = $\frac{100 \times 0.96174}{1.66826}$ = 57.6493g/100g of water;

31. - Chlorine dissolves in water to form chloric (I) acid and hydrochloric acid;
- The unstable chloric (I) acid dissociates to give oxygen atoms and hydrochloric acid;
- The oxygen oxidizes the dye causing bleaching;
Accept correct equations up to a maximum of 2 marks;