

- 1.a)i Halogens
 ii) Ionic radius increases from D to I this is due to increase in number of energy.
 iii) Reactivity reduces from D to I due to increase in atomic radius down the group which leads to a decrease in the strength of nuclear force of attraction.
- b) i) 2.8.7
 ii) 2.8
- c)i) F – S – Sulphur
 ii) A molecule of sulphur is made of packed ring of 8 atoms joined by strong covalent bonds while a molecule of oxygen has weak van der Waals forces hence higher B.P of sulphur than oxygen.
 iii) $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$
 iv) Below 7 because SO_2 dissolves in water to form acidic solution of sulphurous acid.
- 2i) Heating
 ii) M – sodium carbonate/ potassium carbonate
 S – oxygen
 T – nitric (v) acid
 V – nitric (III) acid
- iii) $[Cu(NH_3)_4]^{2+}$
 iv) I) $2Cu(NO_3)_{2(s)} \rightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_2$
 II) $NO_{2(g)} + H_2O(l) \rightarrow HNO_{2(aq)} + HNO_{3(aq)}$
- 3.a) i) Water
 ii) Any pH between 4 - 7 – due to presence of carbonic acid
 iii) $2Na_2O_{2(aq)} + 2H_2O(l) \rightarrow 2NaOH_{(aq)} + O_{2(g)}$
 b) Brown solution change to pale green solution. This is due to Fe^{3+} reduced to Fe^{2+} by H_2S
 c.i) When CO_2 is bubbled in lime water white precipitate is formed while NO_2 white precipitate formed with CO .
 ii) Extraction of metals, used as fuel
 d) CO_2 is highly soluble in sodium hydroxide to form Na_2CO_3 while is slightly soluble in water.
- 4a)i) Ethanoic acid
 ii) Gas V – carbon (IV) oxide
 b) i) hydrogenation
 ii) halogenation
 c.i) oxidation
 ii)
- Q.
- $$\begin{array}{c}
 \text{H} \quad \quad \text{H} \\
 | \quad \quad | \\
 \text{H} - \text{C} - \text{C} - \text{H} \\
 | \quad \quad | \\
 \text{Cl} \quad \quad \text{Cl}
 \end{array}$$
- I, 2 – dichloroethane
- $$\begin{array}{c}
 \boxed{ \begin{array}{c} \text{H} \\ | \\ -\text{C}- \\ | \\ \text{H} \end{array} } - \boxed{ \begin{array}{c} \text{H} \\ | \\ -\text{C}- \\ | \\ \text{H} \end{array} } \\
 \text{P} \quad \quad \quad \text{n}
 \end{array}$$
- Poly – ethene
 d) $CH_2CH_2 + Cl_2 \rightarrow CH_2ClCH_2Cl$
- 5.a)
 i) limestone
 ii) hot air
 iii) ore/ iron oxide
 iv) coke/C (2mks)
 b) $C_{(s)} + CO_{2(g)} \rightarrow 2CO_{(g)}$ (1mk)
 c) The reaction between coke/coal and the hot air is highly exothermic. (1mk)
 d)i) Slag is immiscible with molten iron/insoluble
 ii) Slag is less denser than molten iron. (2mks)
 e)i) By passing/ blowing oxygen into molten iron which converts carbon into carbon (IV) oxide.
 ii) To increase the tensile strength/ making iron less brittle, more malleable, more ductile. (2mks)
 f) It contains impurities eg carbon and manganese which lowers the melting point. (2mks)

g) Construction of bridges/ ship/ buildings/car bodies, nails railway lines, pipes, spoons, pressure cookers, horse shoe magnet. $\sqrt{1/2}$ (2mks)

6.a) i) Wrong method of collection. $\sqrt{1/2}$ (3mks)

- ammonia is less denser than air. $\sqrt{1/2}$
- (ii) - Flask should be slanting downwards left to right. $\sqrt{1/2}$
- Water produced may run back & break the flask. $\sqrt{1/2}$
- Moist reactants should not be used. $\sqrt{1/2}$
- ammonia gas dissolves in water. $\sqrt{1/2}$

ii) Anhydrous calcium oxide

iii) $2\text{NH}_4\text{Cl}_{(s)} + \text{Ca}(\text{OH})_{2(s)} \rightarrow 2\text{NH}_{3(g)} + 2\text{H}_2\text{O}_{(l)} + \text{CaCl}_{2(s)}$

(iv) Deep a glass rod in conc. HCl and bring it into contact with ammonia in a test tube. White fumes formed.

b.i) Unit 1

ii) X – nitrogen (II) oxide (NO)

Y – nitrogen (IV) oxide (NO₂)

iii) NH₃

$$x + (+1 \times 3) = 0$$

$$x = -3 \quad \sqrt{1}$$

HNO₃

$$+1 + x + (-2 \times 3) = 0$$

$$+1 + (-6) + x = 0$$

$$-5 + x = 0$$

$$x = +5 \quad \sqrt{1}$$

Nitrogen in NH₃ has an oxidation state of -3 while in HNO₃ has oxidation state of +5. Increase in oxidation state is oxidation. $\sqrt{1}$

iv) NH₄NO₃

N = 28

H = 4

$$\text{O} = \frac{48}{80} \times 100 = 35.0\%$$

7a) I – 0.8M

III – 0.1M

b)i) State of balance where forward reaction takes place at the same rate as reverse reaction.

ii) Yellow colour intensifies

Addition of KOH favours forward reaction since conc. Of OH⁻ increases $\therefore$ reaction proceeds in the forward direction to react the increased OH⁻

c) i) in the table

$1/t$	0.114	0.1	0.085	0.085	0.074	0.057	0.055	0.029	0.014	2 mks
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ii) Graph

Scale - 1

Plotting – all 2

≥ 5 1

≤ 5 0

Curve 1

iii) $1/15 = 0.67\text{sec}^{-1}$ value from the graph. $\sqrt{1/2}$