# Water and hydrogen

1. *(a) Aluminium is above hydrogen in the reactivity series of elements*
   *(b) (i) The reaction is too exothermic that alot of heat is produced causing ignition of hydrogen in presence of oxygen*

   *(ii)* $K_{(s)} + H_2O_{(g)} \quad KOH_{(aq)} + H_{2(g)}$
   $H_{2(g)} + O_{2(g)} \quad H_2O_{(g)}$

2.

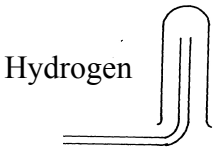
3. *a) Calcium chloride*
   *Drying agent*

   *b)* $2H_{2(g)} + O_{2(g)} \_\_\_\_\_ 2H_2O_{(g)}$

4. *(i) Steam*
   *(ii)* $Mg_{(s)} + H_2O_{(g)}\ MgO_{(s)} + H_{2(g)}$ ✓ 1
   *(iii) Gas P is passed through the combustion tube before heating is commenced*

5. *a)* $2H_{2(g)} + O_{2(g)} \quad 2H_2O_{(l)}$ ✓4
   *b) – Turns anhydrous white paper ✓½ copper (II) sulphate into blue. ✓½ Or*
   *- Turns anhydrous blue ✓½ cobalt (II) chloride into pink. ✓½*

***6.*** ***a)***



*b)reverse steam√1*

*7.* *(a) N*

*(b)* $4H_2O_{(g)} + 3Fe_{(s)} \quad Fe3O4_{(s)} + 4H_{2(g)}$ *(Not balanced 0mk)*

*8.* *(a)*

*(b)* $Pb^{2+(l)} + 2e^- \quad Pb_{(s)}$ B.E ✓ ½ S.S ✓ ½

*(c)*

✓1

*9.* *(a)* $Zn(s) + 2HCl(aq) \quad ZnCl_2(aq) + H_2(g)$ *✓1*

*(b) Concentrated sulphuric (IV) acid or anhydrous calcium chloride. ✓1*

*(c) Copper cannot displace hydrogen from its solution. ✓1*

*(d) (i)* $2H_2(g) + O_2(g) \quad 2H_2O(l)$ *✓1*

*(ii) Before: Pass hydrogen / through the tube before lighting ✓1 to drive off air.*
*End: There should be a continuous flow of hydrogen after / putting off the flame to avoid an explosion. ✓1*

*(e) – Filling balloons ✓1*
*- Manufacture of margarine.*
*- Manufacture of ammonia.*
*- Conversion of coal to synthetic petrol.*

*(f)* $Zn(s) + H_2O(g) \quad ZnO(s) + H_2(g)$ *✓1*

*(g) S, ✓½ P, ✓½ Q, ✓½ R, ✓½*

*(h) It adds to unsaturated oils and hardens them. ✓1*

*10.* *a)* *i) Heating of copper (ii) Oxide to be shown on the diagram*

*ii) To drive out air because mixture of air and hydrogen is explosive when lit*

*iii)* $CuO_{(g)} + H2_{(g)} \_\_\_\_\_ Cu_{(g)} + H2O_{(g)}$
*(penalize ½ mark for wrong S.S)*

*iv) To prevent re-oxidation of hot copper by the atmospheric oxygen*

*v) Reducing agent*

*vi) Black copper (ii) Oxide turns to brown showing that copper (ii) Oxide has been reduced to copper*

*vii) Zinc is more reactive than hydrogen and therefore cannot be reduced by hydrogen*

*11.* *(a) Hydrogen gas*

*(b) - Calcium react with water forming calcium hydroxide solution*
*– Calcium hydroxide solution dissociates to produce calcium ion ($Ca^{2+}$ions) and hydroxide ($OH^-$) ions responsible for basic properties.*