**Chemical equations to know**

 Complete and balance the following equations: (Include states)

1. Fermentation of glucose: C6H12O6 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Complete combustion of butane: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Incomplete combustion of butane to CO and water:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Complete combustion of the fatty acid C17H35COOH:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Sodium hydroxide and carbon dioxide: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Oxalic acid (HOOCCOOH) and NaOH:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Ethanoic acid and NaOH:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Two half equations for a hydrogen fuel cell in acid conditions

 anode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cathode: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Ethanol and propanoic acid: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Pollutants in coal: formation of CO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 formation of SO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ formation NO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Reaction between haemoglobin and oxygen: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 haemoglobin and CO: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Half-equations for a lead-acid battery: Pb(s) 🡪

 PbO2(s) 🡪

**Solutions**

1. Fermentation of glucose: C6H12O6(aq) 🡪 2CH3CH2OH(aq) + 2CO2(g)
2. Complete combustion of butane: 2C4H10(aq) + 13O2(g) 🡪 8CO2(g) + 10H2O(g)
3. Incomplete combustion of butane to CO and water:

2C4H10(aq) + 9O2(g) 🡪 8CO(g) + 10H2O(l)

1. Complete combustion of the fatty acid C17H35COOH:

C17H35COOH + 26O2(g) 🡪 18CO2(g) + 18H2O(l)

1. Sodium hydroxide and carbon dioxide: 2NaOH(aq)+ CO2(g) 🡪 Na2CO3(aq)+ H2O(l)
2. Oxalic acid (HOOCCOOH) and NaOH:

 HOOCCOOH(aq) + 2NaOH(aq) 🡪 Na2OOCCOO(aq) + 2H2O(l)

1. Ethanoic acid and NaOH:

 CH3COOH(aq) + NaOH(aq) 🡪 NaCH3COO(aq) + H2O(l)

1. Two half equations for a hydrogen fuel cell in acid conditions

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 anode: H2(g) 🡪 2H+(aq) + 2e cathode: O2(g) + 4H+(aq) + 4e 🡪 2H2O(l)

1. Ethanol and propanoic acid:CH3CH2COOH(aq) + CH3CH2OH(aq) 🡪 CH3CH2OOCCH2CH3(aq) + H2O(l)
2. Pollutants in coal: formation of CO2 C(s) + O2(g) 🡪 CO2(g)

 formation of SO2: S(s) + O2(g) 🡪 SO2(g) formation N2(g) + O2(g) 🡪 2NO(g)

1. Reaction between haemoglobin and oxygen: Hb4(aq) + 4O2(g) ⇄Hb4(O2)4(aq)

 haemoglobin and CO: Hb4(aq) + 4CO(g) ⇄Hb4(CO)4(aq)

1. Half-equations for a lead-acid battery: Pb(s) + SO42-(aq) 🡪PbSO4(s) + 2e

 PbO2(s) +4H+(aq) + 2e + SO42-(aq) 🡪 PbSO4(s) +2H2O(l)