

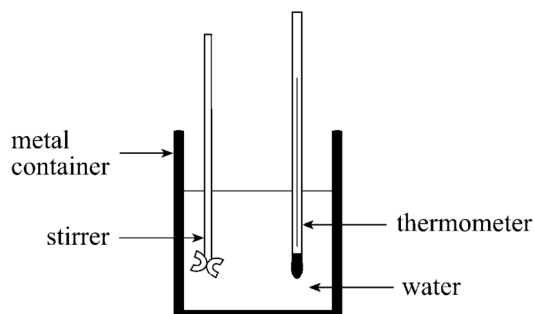
Year 12 Chemistry

Using and Controlling Reactions

Formative Test 1

Subtopics: Measuring Energy Changes, Fuels, and Electrochemical Cells

1. State, of the following, which reactions release energy: combustion, respiration, photosynthesis. /1
2. When sodium hydroxide is dissolved in water, the water becomes warmer. /1
 - (a) State whether the reaction between water and sodium hydroxide is endothermic or exothermic. /1
 - (b) In one particular experiment the temperature change was measured by adding lumps of sodium hydroxide to the calorimeter shown below:



- (i) The mass of sodium hydroxide was 2.0 g, the volume of water was 100 mL, and the measured temperature change was 4.3 °C. Show that according to the experiment, the enthalpy of solution of sodium hydroxide is 36 kJ mol⁻¹. The specific heat capacity of water is 4.18 J g⁻¹ °K⁻¹. /3
- (ii) Write a thermochemical equation for the solution of sodium hydroxide. /3
- (iii) Explain why the solution must be stirred while the reaction is taking place. /2
- (iv) State and explain one change that could be made to the experiment that would increase accuracy. /2

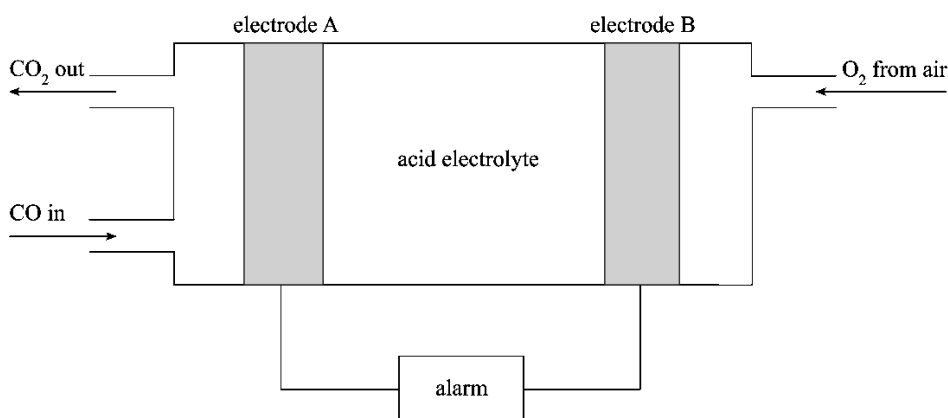
3.

- (a) Some information about ethanol (a biofuel) and petrol (a mixture of fossil fuels) is given below:

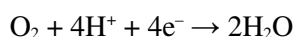
| Fuel | Boiling-point (°C) | Mass of 1 litre (g) | Heat generated from burning 1 litre (kJ) |
|---------|--------------------|---------------------|--|
| ethanol | 78 | 785 | 23000 |
| petrol | 40-70 | 700 | 81000 |

- (i) State why ethanol and petrol can be described as fuels /1
 - (ii) Explain one advantage of using petrol rather than ethanol as a fuel for a motor vehicle. /2
 - (iii) State one advantage of using ethanol rather than petrol as a fuel for a motor vehicle. /1
 - (iv) Using the data in the table, calculate the enthalpy of combustion of ethanol, in kJ mol⁻¹ (the molar mass of ethanol is M = 46.0 g mol⁻¹). /2
 - (v) Write a thermochemical equation for the combustion of ethanol (C₂H₅OH). /4
- (b) State two products of incomplete combustion and briefly describe an undesirable consequence of each. /4

4. Electrochemical devices are often used to detect harmful levels of CO in rooms. High concentrations of CO will cause the detection cell below to sound an alarm.



- (a) The half-equation for the reaction at electrode B is shown below:



- State whether electrode B is the anode or the cathode. Use the half-equation above to explain your answer. /3
- (b) Write a half-equation for the conversion of CO into CO₂ at electrode A. /2
- (c) On the diagram above, show the direction of the electron flow through the alarm. /1
- (d) On the diagram above, show the direction of movement of the hydrogen ions in the electrolyte. /1
- (e) State whether electrode A is the positive or the negative electrode. /1
- (f) State whether the detection cell is a galvanic cell or electrolytic cell. /1
- (g) Explain whether or not the detection cell is a fuel cell. /2
- (h) State one advantage and one disadvantage of fuel cells (compared to other galvanic cells). /2

TOTAL /39

