

Exercise 4.17 – Experimental data

Q417-01 The heat produced when 0.01 mol of ethanol was burned raised the temperature of 100g of water by 20°C. The specific heat capacity of water is $4.2 \text{ J g}^{-1} \text{ K}^{-1}$. Which is the correct expression for the magnitude of the enthalpy of combustion of ethanol in J mol^{-1} ?

- A. $(100 \times 4.2 \times 20)/0.01$
 - B. $(100 \times 4.2 \times 0.01)/20$
 - C. $(100 \times 20 \times 0.01)/100$
 - D. $(20 \times 100 \times 0.01)/4.2$
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Q417-02 In an experiment to determine the enthalpy of displacement of copper by zinc, 5 g of zinc powder were added to 50 cm^3 of 1 mol dm^{-3} copper sulphate solution and the temperature change recorded. If the temperature increased by 23°C calculate the enthalpy change per mole of copper ions displaced. (shc of the solution = $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$, relative atomic mass of zinc = 64)

Q417-03 An experiment was carried out to determine a value for the enthalpy of combustion of liquid methylbenzene using the apparatus shown in the diagram. Burning 2.5 g of methylbenzene caused the temperature of 250 g of water to increase by 60°C. Use this information to calculate a value for the enthalpy of combustion of methylbenzene, C_7H_8 . (The specific heat capacity of water is $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$. Ignore the heat capacity of the container.)

Q417-04 In an experiment, an excess of solid magnesium oxide was added to 50 cm^3 of 3.0 mol dm^{-3} hydrochloric acid. The initial temperature of the solution was 21 °C. After reaction, the temperature had risen to 53 °C. (The specific heat capacity of the solution is $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$) Use this information to calculate the enthalpy change for the reaction of one mole of magnesium oxide with hydrochloric acid. For your calculation you should assume that no heat is lost to the surroundings.

Q417-05 Magnesium will displace copper from copper (II) sulphate solution. If an excess of magnesium is added to 100 cm^3 of 1.0 mol dm^{-3} copper(II) sulphate, the temperature increases by 46.3 °C.

- a) Calculate the molar enthalpy change for the reaction
 - b) Calculate the minimum quantity of magnesium required to ensure it is in excess.
 - c) Calculate the temperature change if only 0.8 g of magnesium is added.
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Q417-06 An experiment was carried out to measure the heat change of solution of sodium hydroxide when a small amount of it is dissolved in water. x g of sodium hydroxide was dissolved in y g of water giving a temperature rise of z °C. The specific heat capacity of water is $c \text{ J g}^{-1} \text{ K}^{-1}$. Which expression should be used to calculate the heat change in J?

- A. $cxyz$
 - B. cxy
 - C. cyz
 - D. cxz
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Q417-07 When 5.73 g of sodium chloride (NaCl) dissolves in 100 cm^3 of water, the temperature of the water fell from 22.4 °C to 19.8 °C. Calculate the enthalpy change of the reaction.

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Q417-08 If 50 cm³ of 1.0 mol dm⁻³ NaOH is added to 25 cm³ of 2.0 mol dm⁻³ CH₃COOH, the temperature rose by 8.3 °C. Calculate the molar enthalpy change for the reaction.

Q417-09 When 0.01 mol of solid NaOH is added to 100cm³ of 1.0 mol dm⁻³ HCl, the temperature increases by ΔT₁. What would be the temperature change, ΔT₂, for a second experiment in which the amount of NaOH and the volume of 1.0 mol dm⁻³ HCl are each doubled?

- A. ΔT₂ = ΔT₁
 - B. ΔT₂ = ½ΔT₁
 - C. ΔT₂ = 2ΔT₁
 - D. ΔT₂ = 4ΔT₁
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Q417-10 When 50cm³ of 1 mol dm⁻³ HCl is mixed with 50cm³ of 1 mol dm⁻³ NaOH, the temperature of the resulting solution increases by 6°C. What will be the temperature change when 100cm³ of each of these solutions is mixed.

- A. 3°C
 - B. 6°C
 - C. 12°C
 - D. 24°C
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