Year 13 Science: Thermochemistry and Hess's law

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. How much energy is needed to heat 500 g of water from 18.0 °C to 100.0 °C?

2. 50.0 mL of 1.00 mol L^{-1} HCl and 50.0 mL of 1.00 mol L^{-1} NaOH are mixed and warm by 6.7 °C. Take the mass as 100 g and c = 4.18 J g^{-1} $°C^{-1}$. What is ΔrH per mole of water formed?

3. Write the equation for the standard enthalpy of formation of ethanol, $C_2H_5OH(l)$.

4. A substance has ΔfusH = 15.5 kJ mol^{-1} and ΔvapH = 41.6 kJ mol^{-1} at the same temperature. What is ΔsubH?

5. Use the ΔfH table to calculate ΔcH of methanol: $CH_3OH(l) + 1½O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$.

Exam-style question: fuels from Taranaki gas

Methanol is made from natural gas in Taranaki. Use the ΔfH table where needed.

6. Calculate ΔfH of ethyne, $C_2H_2(g)$, given ΔcH(C_2H_2) = −1300 kJ mol^{-1}, ΔcH(C) = −394 kJ mol^{-1} and ΔcH(H_2) = −286 kJ mol^{-1}.

7. Calculate ΔrH for making liquid methanol: $CO(g) + 2H_2(g) \rightarrow CH_3OH(l)$.

8. Burning 1.20 g of methanol (M = 32.0 g mol^{-1}) heats 250 g of water from 19.5 °C to 34.0 °C. Calculate the experimental ΔcH of methanol.

9. Explain why ΔcH of methanol is less negative when the water formed is a gas, and calculate its value, using ΔvapH(H_2O) = +44.0 kJ mol^{-1}.

Fix the mistake

10. Correct this statement: "q = 0.920 × 4.18 × 21.5, using the mass of ethanol burned."

11. Correct this statement: "ΔcH = q ÷ n = +899 kJ mol^{-1}."

12. Correct this statement: "ΔrH = ΣΔfH(reactants) − ΣΔfH(products)."

13. Correct this statement: "When I reversed the methane combustion equation I kept $\Delta H = -890.3\ kJ\ mol^{-1}$."