Year 12 Science: Energy changes in reactions

Name: _____ Date: _____

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

Practice

1. Is ice melting endothermic or exothermic?

2. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$, $\Delta rH = -890$ kJ mol^{-1}. How much energy is released by burning 4.00 g of methane? $M(CH_4) = 16.0$ g mol^{-1}.

3. Using the same equation, what mass of methane must burn to release 1780 kJ?

4. Use the bond enthalpy table to calculate ΔrH for $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$.

5. $N_2 + 3H_2 \rightarrow 2NH_3$ has $\Delta rH = -92$ kJ mol^{-1}. What is ΔrH for $2NH_3 \rightarrow N_2 + 3H_2$?

Exam-style question: hydrogen as a fuel

Hydrogen can power vehicles, either burned in an engine or in a fuel cell, and the only product is water. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$, $\Delta rH = -572$ kJ mol^{-1}. $M(H_2) = 2.0$ g mol^{-1}.

6. State whether the reaction is exothermic or endothermic, and explain your choice in terms of bonds.

7. Calculate the energy released when 1.00 kg of hydrogen reacts.

8. Calculate the mass of hydrogen that must react to release 2000 kJ.

9. When the water forms as a gas, $\Delta rH = -484$ kJ mol^{-1}. Use this and H–H = 436 and O=O = 498 kJ mol^{-1} to calculate the average O–H bond enthalpy.

10. Explain why ΔrH is more negative when liquid water forms than when water vapour forms.

Fix the mistake

11. Correct this statement: "Breaking bonds releases energy, which is why fuels give out heat."

12. Correct this statement: "ΔrH = bonds formed − bonds broken."

13. Correct this statement: "For $N_2 + 3H_2 \rightarrow 2NH_3$, bonds formed = 3 × N–H."

14. Correct this statement: "An endothermic reaction feels hot, because it takes in heat."