

What is Thermochemistry?

Worksheet

Thermochemistry studies heat flow in reactions; the enthalpy change $H = H(\text{products}) - H(\text{reactants})$ tells you whether a reaction releases heat (exothermic, $H < 0$) or absorbs heat (endothermic, $H > 0$).

$$\Delta H = H_{\text{products}} - H_{\text{reactants}}$$

Questions

1. A reaction has $H = 92 \text{ kJ/mol}$. What type of reaction is it?
A) Endothermic
B) Exothermic
C) Non-spontaneous
D) Isothermal
2. 50 g of water is heated by 10C. How much heat is absorbed? ($c=4.18 \text{ J/gC}$)
A) 209 J
B) 2090 J
C) 41.8 J
D) 418 J
3. What is the SI unit of enthalpy change?
A) Watt
B) Joule or kJ/mol
C) Kelvin
D) Pascal
4. Which best describes Hess's Law?
A) Enthalpy depends on reaction pathway
B) Total H is independent of the path taken
C) Only exothermic reactions have H
D) Heat capacity never changes
5. How much heat is released when 50 g of water cools from 80C to 20C? ($c_{\text{water}} = 4.18 \text{ J/gC}$)
6. Calculate the heat absorbed when 25 g of iron is heated from 20C to 100C. ($c_{\text{iron}} = 0.45 \text{ J/gC}$)
7. A reaction releases 250 kJ of heat while producing 2 mol of product. What is H per mole?
8. Define: What is enthalpy (H)?
9. Define: What does $H < 0$ mean?
10. Define: What does $H > 0$ mean?

Answer Key

1. B) Exothermic - Negative H means heat is released - exothermic.
2. B) 2090 J - $q = 504.1810 = 2090$ J.
3. B) Joule or kJ/mol - Enthalpy change is energy, measured in J or kJ/mol.
4. B) Total H is independent of the path taken - Hess's Law: total enthalpy change is path-independent since enthalpy is a state function.
5. $T = 20\ 80 = 60\text{C}$ $q = mcT = 50\ 4.18\ (60) = 12,540$ J The negative sign shows heat is released (exothermic).
6. $T = 100\ 20 = 80\text{C}$ $q = mcT = 25\ 0.45\ 80 = 900$ J Iron absorbs 900 J of heat.
7. Total heat released = 250 kJ (exothermic) H per mole = 250 kJ 2 mol = 125 kJ/mol
8. A measure of the total heat content of a system at constant pressure.
9. The reaction is exothermic - it releases heat to the surroundings.
10. The reaction is endothermic - it absorbs heat from the surroundings.

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