What is Enthalpy?

Worksheet

Enthalpy is the sum of internal energy and the work done by/on the system at constant pressure: H = U + PV. The change in enthalpy H determines if a reaction is exothermic (H < 0, releases heat) or endothermic (H > 0, absorbs heat).

H = H_products - H_reactants

Questions

1. Which reaction is exothermic?

A) H = +45 kJ/mol
B) H = 78 kJ/mol
C) H = +120 kJ/mol
D) H = +30 kJ/mol

2. A reaction has H = 150 kJ/mol. How much heat is released?

A) 150 kJ/mol absorbed
B) 150 kJ/mol released
C) 0 kJ/mol
D) 300 kJ/mol released

3. Reactants = 210 kJ/mol, Products = 180 kJ/mol. Calculate H.

A) 30 kJ/mol
B) +30 kJ/mol
C) +390 kJ/mol
D) 390 kJ/mol

4. Melting and boiling are endothermic. Why?

A) Energy is released
B) Energy must be absorbed to break bonds
C) Temperature decreases
D) Reactants disappear

5. The combustion of methane: CH + 2O CO + 2HO. Reactants = 50 kJ/mol, Products = 200 kJ/mol. Calculate H.

6. Melting ice: HO(s) HO(l). Solid = 300 kJ/mol, Liquid = 250 kJ/mol. Find H.

7. A reaction has reactants at 180 kJ/mol and products at 140 kJ/mol. Is it exothermic or endothermic?

8. Define: What is enthalpy?

9. Define: What does H < 0 mean?

10. Define: What does H > 0 mean?

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Answer Key

1. B) H = 78 kJ/mol - Exothermic means H < 0 (negative). Only 78 kJ/mol is negative.
2. B) 150 kJ/mol released - Negative H means heat is released. Magnitude = 150 kJ/mol.
3. A) 30 kJ/mol - H = 180 210 = 30 kJ/mol (exothermic).
4. B) Energy must be absorbed to break bonds - Phase changes require energy input to overcome intermolecular forces.
5. H = H_products H_reactants H = (200) (50) = 250 kJ/mol Negative H exothermic (releases heat)
6. H = (250) (300) = +50 kJ/mol Positive H endothermic (absorbs heat)
7. H = 140 180 = 40 kJ/mol Negative value exothermic (releases 40 kJ/mol)
8. The total heat content of a system; change in enthalpy H tells you if heat is released or absorbed.
9. Exothermic reaction - heat is released to surroundings.
10. Endothermic reaction - heat is absorbed from surroundings.

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