1. An exothermic reaction has a ΔH that is...

   ☐ always zero

   ☐ positive

   ☐ negative

2. On an energy diagram, products below reactants means the reaction is...

   ☐ exothermic

   ☐ at equilibrium

   ☐ endothermic

3. Heat flows from...

   ☐ hot to cold

   ☐ high to low pressure

   ☐ cold to hot

4. Heat 100 g of water ($c = 4.18\ \frac{\text{J}}{\text{g}\cdot\text{K}}$) by 5 K. The heat (in J)?

   _____ J

5. A pure substance at fixed pressure stays at constant temperature while melting with solid and liquid both present.

   ☐ True ☐ False

6. If burning 1 mol releases 500 kJ, how much does burning 3 mol release (in kJ)?

   _____ kJ

7. Bonds broken total 600 kJ; bonds formed total 700 kJ. Estimate ΔH (in kJ).

   _____ kJ

8. Products' $\sum \Delta H_f = -300$; reactants' $= -100$. Find ΔH_{rxn} (in kJ).

   _____ kJ

9. Two steps have $\Delta H = -120$ kJ and $+30$ kJ. Their sum (in kJ)?

   _____ kJ

10. A reaction that makes its container feel cold is...

    ☐ exothermic

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☐ endothermic

1. **negative**

   Releasing heat makes ΔH negative.

2. **exothermic**

   Lower products mean energy was released – exothermic.

3. **hot to cold**

   Net heat flows spontaneously from the hotter object to the colder one.

4. **2090 J**

   $q = mc\Delta T = 100 \times 4.18 \times 5 = 2090$ J.

5. **True**

   Energy overcomes some attractions while both phases coexist, rather than increasing average kinetic energy.

6. **1500 kJ**

   ΔH scales with amount, so $3 \times 500 = 1500$ kJ.

7. **-100 kJ**

   $\Delta H \approx 600 - 700 = -100$ kJ (exothermic).

8. **-200 kJ**

   $\Delta H_{rxn} = -300 - (-100) = -200$ kJ.

9. **-90 kJ**

   Add the adjusted reaction enthalpies, $\Delta H = -120 + 30 = -90$ kJ; the net process is exothermic.

10. **endothermic**

    Absorbing heat from your hand feels cold – endothermic.

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