

ConcepTest on Enthalpy:

This is a series of ConcepTest questions on enthalpy, heat transfers, heat of reaction. It is best to present them (or at least a section of them) in sequence.

Enthalpy, H , is often referred to as “heat content”.

If an object feels hot, it means...

1. it has a large enthalpy.
2. it has a low enthalpy.
3. Whether the object feels hot or not is unrelated to its enthalpy.
4. I don't know.

Correct Answer: 3. Whether the object feels hot is unrelated to its enthalpy.

Comment to Instructor: Students tend to think that a high heat content must mean the object is hot. They are confusing heat with temperature. Explain to the students that enthalpy is the potential to give off heat. It does not mean the object is hot. Then go on to the next question.

ΔH is defined as $H_{\text{final}} - H_{\text{initial}}$.

If an object feels hot, it means it is undergoing a change with a ΔH that is...

1. positive.
2. negative.
3. Whether the object feels hot or not is unrelated to its ΔH .
4. I don't know.

Correct Answer: #2. negative.

Comment to Instructor: Students who choose #1 are probably thinking that if the object feels hot, it must be absorbing heat, and so H_{final} would be larger than H_{initial} . Explain to the students that if the object feels hot, it is giving off heat, and so its enthalpy will become smaller in the process. Thus H_{final} would be less than H_{initial} , and ΔH would be negative. Then go on to the next question.

If the object feels hot, it means it is undergoing...

1. an endothermic change.
2. an exothermic change.
3. Whether it feels hot or not is unrelated to whether it is undergoing endo- or exothermic change.

Correct Answer: #2

Comment to Instructor: Some students may select #3 thinking that there is no change involved. Clarify that change does not necessarily mean a chemical reaction. It can be simply a transfer of heat from the object, such as a hot cup of coffee cooling down. Then explain that if it is giving off heat, it is an exothermic change (#2.) Then go on to the next question.

Consider a reaction between two aqueous solutions taking place in an insulated cup, equipped with a thermometer (usually referred to as a “coffee cup calorimeter”.) ΔT is defined as $T_{\text{final}} - T_{\text{initial}}$. If the temperature of the solution rises, ΔT of the solution would be...

1. positive.
2. negative.

Correct Answer: 1. positive.

Comment to Instructor: Students probably will select the correct response. The few who select #2 may be thinking erroneously that if the temperature rises, it must be absorbing heat to make it hotter, and they remember that exothermic means “negative”. Go on to the next question.

$q = s \times m \times \Delta T$ where q is the heat transfer, s is the specific heat, m is the mass and ΔT is the change in temperature. Since s and m must be positive, if ΔT is positive, then q must be positive.

In the previous question, if the temperature of the solution rises, then q must be...

1. positive.
2. negative.

Correct Answer: 1. positive.

In these reactions, $\Delta H = q$ essentially. In the previous question, we established that q is positive, so the reaction must be...

1. endothermic because q is positive.
2. exothermic because q is positive.
3. endothermic because q is actually negative.
4. exothermic because q is actually negative.

Correct Answer. 4. exothermic because q is actually negative.

Comment to Instructor: Explain that q in the previous question referred to q of the solution, not q of the reaction. The temperature we are measuring is the temperature of the surroundings, not the system itself. A rise in temperature of the surroundings means heat is transferred out of the system into the surroundings. So q of the surroundings is indeed positive (it is absorbing heat), while q of the system is negative (it is losing heat).