

PRACTICE Questions for Thermochemistry Note #1

1. Identify each of the following as a physical, chemical or nuclear change, with reasons for your choice.
  - a. A gas barbecue operating  
**Chemical (propane + oxygen → water + carbon dioxide)**
  - b. An ice cube melting in someone's hand  
**Physical (water(s) → water(l))**
  - c. White gas burning in a camping lantern  
**Chemical (combustion produces water + carbon dioxide)**
  - d. Wax melting on a hot stove  
**Physical (melting just changes the state of the substance)**
  - e. Zinc metal added to an acid solution in a beaker  
**Chemical (hydrogen gas is produced)**
  - f. Ice applied to an athletic injury  
**Physical (ice → water; same substance in different state)**

2. Identify the system and surroundings in each of the examples in the previous question.

Question	System	Surroundings
a.	<b>Gas and oxygen</b>	<b>Outside the barbecue</b>
b.	<b>Ice</b>	<b>Hand</b>
c.	<b>Gas and oxygen</b>	<b>Outside the lantern</b>
d.	<b>Wax</b>	<b>Stove, air</b>
e.	<b>Zinc and acid in container</b>	<b>Outside container</b>
f.	<b>Ice</b>	<b>Body part and beyond</b>

3. Identify the following as examples of open or isolated systems and explain your identification:

- a. Gasoline burning in an automobile engine
- b. Snow melting on a lawn in the spring
- c. A candle burning on a restaurant table
- d. The addition of baking soda to vinegar in a beaker
- e. A gas barbecue operating

**All of these systems can be seen as open because energy and/or matter can escape from the system especially in the form of gases.**

4. A thimbleful of water at 100°C has a higher temperature than a swimming pool full of water at 20°C, but the pool has more thermal energy than the thimble. Explain.

**The thimbleful of water has a greater average thermal energy per molecule but the pool has a greater thermal energy because the pool has more water molecules. If you add up each molecule's thermal energy in the pool, it will add up to a larger value than if you added up the thermal energy of the smaller number of water molecules in the thimble.**

5. Identify each of the following as an exothermic or endothermic reaction:

- a. Hydrogen undergoes nuclear fusion in the Sun to produce helium atoms  
**exothermic**
- b. The butane in a lighter burns  
**exothermic**
- c. The metal on a safety sprinkler on the ceiling of an office melts when a flame is brought near it  
**endothermic**