

Concept Items

12.1 Zeroth Law of Thermodynamics: Thermal Equilibrium 1.

When are two bodies in thermal equilibrium?

- a. When they are in thermal contact and are at different pressures
- b. When they are not in thermal contact but are at the same pressure
- c. When they are not in thermal contact but are at different temperatures
- d. When they are in thermal contact and are at the same temperature

2.

What is thermal contact?

- a. Two objects are said to be in thermal contact when they are in contact with each other in such a way that the transfer of energy by heat can occur between them.
- b. Two objects are said to be in thermal contact when they are in contact with each other in such a way that the transfer of energy by mass can occur between them.
- c. Two objects are said to be in thermal contact when they neither lose nor gain energy by heat. There is no transfer of energy between them.
- d. Two objects are said to be in thermal contact when they only gain energy by heat. There is transfer of energy between them.

3.

To which mathematical property is the zeroth law of thermodynamics similar?

- a. Associative property
- b. Commutative property
- c. Distributive property
- d. Transitive property

12.2 First law of Thermodynamics: Thermal Energy and Work 4.

Why does thermal expansion occur?

- a. An increase in temperature causes intermolecular distances to increase.
- b. An increase in temperature causes intermolecular distances to decrease.
- c. An increase in temperature causes an increase in the work done on the system.
- d. An increase in temperature causes an increase in the work done by the system.

5.

How does pressure-volume work relate to heat and internal energy of a system?

- a. The energy added to a system by heat minus the change in the internal energy of that system is equal to the pressure-volume work done by the

system.

- b. The sum of the energy released by a system by heat and the change in the internal energy of that system is equal to the pressure-volume work done by the system.
- c. The product of the energy added to a system by heat and the change in the internal energy of that system is equal to the pressure-volume work done by the system.
- d. If the energy added to a system by heat is divided by the change in the internal energy of that system, the quotient is equal to the pressure-volume work done by the system.

6.

On what does internal energy depend?

- a. The path of energy changes in the system
- b. The state of the system
- c. The size of the system
- d. The shape of the system

7.

The first law of thermodynamics helps us understand the relationships among which three quantities?

- a. Heat, work, and internal energy
- b. Heat, work, and external energy
- c. Heat, work, and enthalpy
- d. Heat, work, and entropy

12.3 Second Law of Thermodynamics: Entropy 8.

Air freshener is sprayed from a bottle. The molecules spread throughout the room and cannot make their way back into the bottle. Why is this the case?

- a. The entropy of the molecules increases.
- b. The entropy of the molecules decreases.
- c. The heat content (*enthalpy*, or total energy available for heat) of the molecules increases.
- d. The heat content (*enthalpy*, or total energy available for heat) of the molecules decreases.

9.

Give an example of entropy as experienced in everyday life.

- a. rotation of Earth
- b. formation of a solar eclipse
- c. filling a car tire with air
- d. motion of a pendulum bob

12.4 Applications of Thermodynamics: Heat Engines, Heat Pumps, and Refrigerators 10.

What is the quality by which air conditioners are judged?

- a. The amount of energy generated by heat from a hot environment, compared with the required work input
- b. The amount of energy transferred by heat from a cold environment, compared with the required work input
- c. The amount of energy transferred by heat from a hot environment, compared with the required work output
- d. The amount of energy transferred by heat from a cold environment, compared with the required work output

11.

Why is the efficiency of a heat engine never 100 percent?

- a. Some energy is always gained by heat from the environment.
- b. Some energy is always lost by heat to the environment.
- c. Work output is always greater than energy input.
- d. Work output is infinite for any energy input.

12.

What is a cyclic process?

- a. A process in which the system returns to its original state at the end of the cycle
- b. A process in which the system does not return to its original state at the end of the cycle
- c. A process in which the system follows the same path for every cycle
- d. A process in which the system follows a different path for every cycle