Name __________________________________________________

1. The thermal expansion of a solid is caused by:
   a. the breaking of bonds between atoms.
   b. increasing the amplitude of the atoms vibration.
   c. increasing the distance between equilibrium positions for the vibrating atoms.
   d. all of the above.

2. Which best expresses the value for the coefficient of volume expansion, \( \beta \), for given material as a function of its corresponding coefficient of linear expansion, \( \alpha \)?
   a. \( \beta = \alpha^3 \)
   b. \( \beta = 3\alpha \)
   c. \( \beta = \alpha^2 \)
   d. \( \beta = 2\alpha \)

3. An ideal gas is confined to a container with constant volume. The number of moles is constant. By what factor will the pressure change if the absolute temperature triples?
   a. 1/9
   b. 1/3
   c. 3.0
   d. 9.0

4. As I use sandpaper on some rusty metal, the sandpaper gets hot because:
   a. Heat is flowing from the sandpaper into the metal.
   b. Heat is flowing from the metal into the sandpaper.
   c. Friction is creating the heat.
   d. Heat is flowing from my hand into the sandpaper.

5. Which best describes the relationship between two systems in thermal equilibrium?
   a. no net energy is exchanged
   b. volumes are equal
   c. masses are equal
   d. pressures are equal

6. A steel plate has a hole drilled through it. The plate is put into a furnace and heated. What happens to the size of the inside diameter of a hole as its temperature increases?
   a. increases
   b. decreases
   c. remains constant
   d. becomes elliptical
7. A temperature change from 15°C to 35°C corresponds to what incremental change in °F?
   a. 20  
   b. 40  
   c. **36**  
   d. 313

8. In a greenhouse, electromagnetic energy in the form of visible light enters through the glass panes and is absorbed and then reradiated. What happens to this reradiated electromagnetic radiation from within the greenhouse?
   a. 100% returns to the atmosphere.  
   b. **It’s blocked by glass.**  
   c. It’s transformed into ultraviolet upon striking the glass.  
   d. It’s reflected as visible light upon striking the glass.

9. Carl places one end of a steel bar in a Bunsen flame and the other end in an ice cube. By what factor is the rate of heat flow changed when the bar’s cross-sectional area is doubled?
   a. 2  
   b. 1/2  
   c. 4.0  
   d. 1/4

10. The surfaces of a Dewar flask are silvered for the purpose of minimizing heat transfer by what process?
    a. conduction  
    b. **radiation**  
    c. convection  
    d. vaporization

11. Sea breezes that occur near the shore are attributed to a difference between land and water with respect to what property?
    a. mass density  
    b. coefficient of volume expansion  
    c. **specific heat**  
    d. emissivity

12. What happens to a given mass of water as it is cooled from 4°C to zero?
    a. **expands**  
    b. contracts  
    c. vaporizes  
    d. neither expands, contracts, nor vaporizes