



- 12) Heat energy is measured in units of  
 A) calories. B) joules. C) *both of these*
- 13) Aluminum has a specific heat capacity more than twice that of copper. Place equal masses of aluminum and copper wire in a flame and the one to undergo the fastest increase in temperature will be  
 A) aluminum. B) *copper.* C) both the same
- 14) As a system becomes more disordered, entropy  
 A) *increases.* B) decreases. C) remains the same.
- 15) When an iron ring is heated, the hole becomes  
 A) *larger.* B) smaller. C) neither smaller nor larger.
- 16) A substance can absorb heat energy by the process of  
 A) convection. B) conduction. C) radiation. D) *all of these*
- 17) The higher the temperature of an object, the  
 A) *shorter the wavelengths it radiates.* B) longer the wavelengths it radiates.
- 18) An object will normally be a net radiator of energy when its temperature is  
 A) *higher than its surroundings.* B) lower than its surroundings. C) neither of these
- 19) The silver coating on the glass surfaces of a Thermos bottle reduces energy that is transferred by  
 A) convection. B) *radiation.* C) friction.  
 D) conduction. E) none of these
- 20) A good reflector of radiation is a  
 A) good absorber of radiation. B) *poor absorber of radiation.*  
 C) good emitter of radiation. D) none of these
- 21) The planet Earth loses heat mainly by  
 A) convection. B) conduction. C) *radiation.*  
 D) all of these
- 22) When heat is added to boiling water, the water temperature  
 A) increases. B) decreases. C) *stays the same.*
- 23) When a gas is changed to a liquid phase, the gas  
 A) *releases energy.* B) absorbs energy.  
 C) neither releases nor absorbs energy.
- 24) What prevents satellites such as the space shuttle from falling?  
 A) centripetal force B) centrifugal force C) the absence of air drag  
 D) gravity E) *Nothing, they continually fall all around the earth.*
- 25) The buoyant force on an object is least when the object is  
 A) submerged near the surface. B) *partly submerged.*  
 C) submerged near the bottom. D) none of these

Questions (5 points each)

1. A 6 kg piece of metal displaces 1 liter of water when submerged. What is its density?

$$\begin{aligned} D &= \frac{\text{mass}}{\text{volume}} \\ &= \frac{6\text{kg}}{1\text{L}} \\ &= 6\text{kg} / \text{L} \\ &\text{or} \end{aligned}$$

$$\begin{aligned} D &= \frac{\text{mass}}{\text{volume}} \\ &= \frac{6000\text{g}}{1000\text{mL}} \\ &= 6\text{g} / \text{mL} \end{aligned}$$

2. Air in a cylinder is compressed to 1/10 its original volume with no change in temperature. What happens to its pressure?

$$\begin{aligned} P_1V_1 &= P_2V_2 \\ P_1(1) &= P_2(0.1) \\ P_2 &= \frac{P_1(1)}{(0.1)} \\ P_2 &= 10P_1 \\ &\text{or } 10x \text{ increase in pressure} \end{aligned}$$

3. If you wish to warm 100kg of water by 20°C for your bath, how much energy (in calories) is required?  
( $c_{\text{water}} = 1.000\text{cal/g}^\circ\text{C}$ )

$$\begin{aligned} q &= cm(\Delta t) \\ &= (1.0\text{cal} / \text{g}^\circ\text{C})(100,000\text{g})(20^\circ\text{C}) \\ &= 2,000,000\text{cal} \text{ or } 2000\text{kcal} \end{aligned}$$

4. The heat of vaporization of ethyl alcohol is 200 cal/g. If 2 kg of ethyl alcohol were allowed to vaporize in the refrigerator, how many calories are used?

$$\begin{aligned}q &= \Delta H_{\text{vap}} (\text{mass}) \\ &= (200 \text{ cal} / \text{g})(2000 \text{ g}) \\ &= 400,000 \text{ cal or } 400 \text{ kcal}\end{aligned}$$

5. In the power plant of a nuclear submarine, the temperature of the water in the reactor is above 100°C. How is this possible?

*The water is under pressure, boiling point is directly proportional to pressure.*