MULTIPLE CHOICE (3 points each).

1) The circular orbit of a satellite orbiting the earth is characterized by a constant
   A) speed. B) radial distance. C) acceleration. D) all of these E) none of these

2) An Earth satellite is in an elliptical orbit. The satellite travels fastest when it is
   A) it travels at a constant speed everywhere in orbit. B) farthest from the earth. C) nearest the earth.

3) The space shuttle orbits at altitudes greater than 150 km so as to be above Earth's
   A) atmosphere. B) gravitational field. C) both.

4) A completely submerged object always displaces its own
   A) weight of fluid. B) density of fluid. C) volume of fluid. D) all of these E) none of these

5) What is the weight of water displaced by a 100-ton floating ship?
   A) 100 tons B) 100 cubic meters C) less than 100 tons D) more than 100 tons E) depends on the ship's shape

6) A rock suspended by a weighing scale weighs 5 N out of water and 3 N when submerged in water. What is the buoyant force on the rock?
   A) 8 N B) 5 N C) 2 N D) 3 N E) none of these

7) A boat loaded with scrap iron floats in a swimming pool. When the iron is thrown overboard, the pool level will
   A) fall. B) remain unchanged. C) rise.

8) Atmospheric pressure is caused by the
   A) weight of the atmosphere. B) density of the atmosphere. C) temperature of the atmosphere. D) effect of the Sun's energy on the atmosphere.

9) A bubble of air released from the bottom of a lake
   A) becomes smaller as it rises. B) becomes larger as it rises. C) alternately expands and contracts as it rises. D) rises to the top at constant volume. E) none of these

10) Airplane flight is best illustrated by

11) Heat energy travels from an object with a high
    A) temperature to an object with a lower temperature. B) thermal energy to an object with a lower thermal energy. C) both of these, for they say essentially the same thing.
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?

\[
D = \frac{\text{mass}}{\text{volume}} = \frac{6\text{kg}}{1\text{L}} = 6\text{kg} / \text{L}
\]

or

\[
D = \frac{\text{mass}}{\text{volume}} = \frac{6000\text{g}}{1000\text{mL}} = 6\text{g} / \text{mL}
\]

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

\[
P_1V_1 = P_2V_2
\]

\[
P_1(1) = P_2(0.1)
\]

\[
P_2 = \frac{P_1(1)}{0.1}
\]

\[
P_2 = 10P_1
\]

or 10x increase in pressure

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

\[
q = cm(\Delta t)
\]

\[
= (1.0\text{cal/g}°\text{C})(100,000\text{g})(20°\text{C})
\]

\[
= 2,000,000\text{cal or 2000kcal}
\]
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?

\[ q = \Delta H_{\text{vap}} \cdot \text{mass} \]

\[ = (200 \text{ cal/g}) (2000 \text{ g}) \]

\[ = 400,000 \text{ cal or 400 kcal} \]

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.*