Chapter 12 Open Book group activity. Do not talk to other groups!

True/False
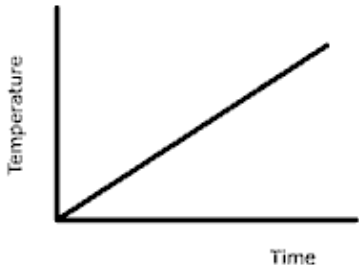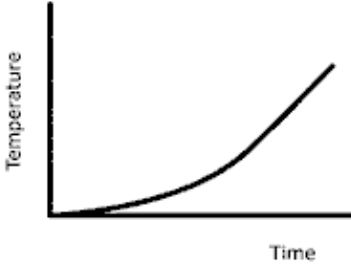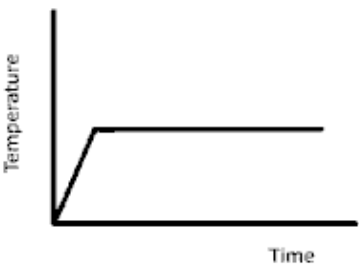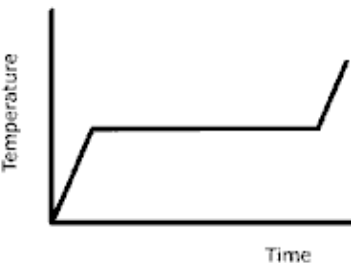*Indicate whether the statement is true or false.*

_____ 1. In a gas kept at a constant temperature, all molecules move with the same speed.

_____ 2. The thermal energy of the particles in a gas is related to the temperature of the gas.

_____ 3. In a vacuum flask, the vacuum helps in reducing heat loss due to radiation.

_____ 4. The volume of a gaseous system increases when it does positive work in a thermodynamic process.

_____ 5. The temperature of a system must increase when heat energy is added.

_____ 6. It is not possible to have a process in which the entropy of an isolated system decreases.

_____ 7. Absolute zero is defined as the zero point on the Celsius scale.

_____ 8. When heat flows into an object, its temperature and thermal energy increase.

_____ 9. The amount of thermal energy transferred between objects depends only on their masses and initial and final temperatures.

_____ 10. The magnitude of one degree Celsius is the same as one Kelvin.

_____ 11. A machine can never be 100 percent efficient because some energy is lost as waste heat.

_____ 12. Refrigerators work because the heat flows spontaneously from warmer food to the colder air inside the refrigerator.

_____ 13. A heat pump works because it does not have to obey the second law of thermodynamics.

_____ 14. Entropy is the amount of work done in the absence of friction.

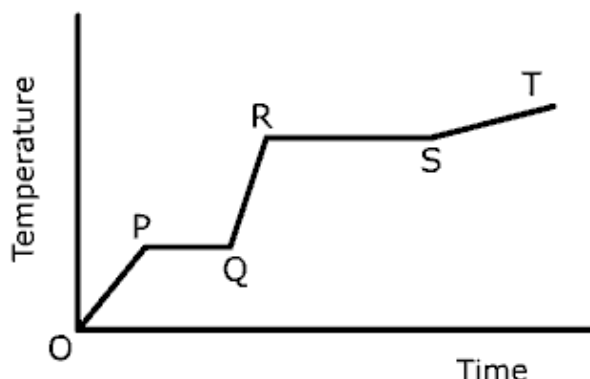_____ 15. During melting or vaporization, particles increase in potential energy but not in kinetic energy.

Multiple Choice
Identify the choice that best completes the statement or answers the question.

_____ 16. Which of the following physical properties can be used to measure temperature using a thermometer?
  a. volume
  b. pressure
  c. density
  d. viscosity

_____ 17. When a closed tin is heated, the pressure inside it increases. This happens because:
  a. The number of molecules increases on heating.
  b. The molecules move faster and each molecule strikes the walls of the tin more often.
  c. The molecules become heavier and strike the walls of the tin harder.
  d. The molecules now collide more with the walls of the tin than amongst themselves.

_____ 18. To melt 4 kg of a solid, 10^6 J of heat is required. Which of the following expressions gives the heat of fusion of the solid?

  a. $4 \times 10^6 \text{ J} \cdot \text{kg}$

  b. $\dfrac{4 \times 10^6}{25} \text{ J} \cdot \text{kg}$

  c. $\dfrac{10^6}{4} \text{ J/kg}$

  d. $\dfrac{25 \times 10^6}{4} \text{ J/kg}$

_____ 19. 5000 J of heat is supplied in one minute to 0.06 kg of a liquid at its boiling point of 85°C to convert it completely to vapor. Which of the following expressions gives the heat of vaporization of the liquid?

a. $\dfrac{5000}{0.06}$ J/kg

c. $\dfrac{5000 \times 85}{0.06}$ J°C/kg

b. $\dfrac{0.06}{5000 \times 85}$ kg/J°C

d. $\dfrac{5000 \times 60}{0.06 \times 85}$ J/kg

_____ 20. 50 g of ice at 0°C is dropped in a beaker containing 100 g of water at 0°C. What will be the contents of the beaker after 5 hours? Assume that the room temperature is 0°C.

a. 150 g of water

c. 75 g of ice and 75 g of water

b. 25 g of ice and 125 g of water

d. 50 g of ice and 100 g of water

_____ 21. Heat is added to an open container of a liquid. The liquid is brought to its boiling point and half the liquid boils away. Which of the following graphs shows how the temperature changes with time in this period?

a.

c.

b.

d.

_____ 22. What happens when water at its melting point solidifies to ice without any change in temperature?

a. Latent heat is emitted.

b. Specific heat is emitted.

c. Latent heat is absorbed.

d. Both latent heat and specific heat are emitted.

_____ 23. The melting point of a solid is 90.0°C. What is the heat required to change 2.5 kg of this solid at 40.0°C to a liquid? The specific heat of the solid is 390 J/kg·K and its heat of fusion is 4000 J/kg.

a. 4.9 × 10⁴ J

c. 5.9 × 10⁴ J

b. 1.0 × 10⁴ J

d. 5.0 × 10⁵ J

_____ 24. A solid is heated at a constant rate until it reaches the vapor state. The temperature of the substance changes with time as shown in the graph below. Which part(s) of the graph indicate(s) that the substance exists in solid-liquid and liquid-vapor state?

     a. OP   c. PQ, RS
     b. OP, QR, ST   d. OP, ST

_____ 25. Which is an example of heating through conduction?
     a. a ceiling fan pushes warm air downwards in winter
     b. touching a hot stove
     c. using a greenhouse to grow plants in winter
     d. The sun heats up the inside of a car

_____ 26. Which is an example of heating through convection?
     a. warm air rising toward the ceiling
     b. touching a hot stove
     c. using a greenhouse to grow plants in winter
     d. The sun heats up the inside of a car

_____ 27. Which is the transfer of thermal energy through direct contact of particles?
     a. conduction   c. convection
     b. radiation   d. specific heat

_____ 28. Which is the transfer of thermal energy through the motion of particles caused by temperature differences?
     a. conduction   c. convection
     b. radiation   d. specific heat

_____ 29. The specific heat of copper is 385 J/kg·K. If a 2.6 kg block of copper is heated from 300 K to 450 K, how much thermal energy is absorbed?
     a. 22,000 J   c. 58,000 J
     b. 1000 J   d. 150,000 J

_____ 30. A 2.15 kg block of aluminum (specific heat = 897 J/kg·K) is at an initial temperature of 300 K. What will its final temperature be if 335,000 J of thermal energy are added?
     a. 474 K   c. 803 K
     b. 174 K   d. 447 K

_____ 31. A total of 95,000 J of thermal energy are added to 2.81 kg of lead (specific heat = 130 J/kg·K) to reach a final temperature of 642 K. What was the initial temperature of the lead?
     a. 260 K   c. 299 K
     b. 382 K   d. 369 K

_____ 32. What is the specific heat of a substance that requires 99,100 J of thermal energy to heat 3.47 kg of this substance from 11°C to 45°C?
   a. 634 J/kg·K   c. 695 J/kg·K
   b. 2600 J/kg·K   d. 840 J/kg·K

_____ 33. A block of copper (specific heat = 385 J/kg·K) requires 635,000 J of thermal energy to change in temperature from 17°C to 139°C. What is the mass of this copper block?
   a. 13.5 kg   c. 5.68 kg
   b. 11.9 kg   d. 4.00 kg

_____ 34. Which is <u>not</u> a correct temperature equivalent?
   a. 1177°C = 1450 K   c. 289°C = 552 K
   b. 65°C = 338 K   d. 350°C = 623 K

_____ 35. Which is not associated with an increase in entropy?
   a. spontaneous processes   c. an increase in thermal energy
   b. an inefficient engine   d. a more orderly arrangement of particles

_____ 36. Which type of change requires more energy for the same substance?
   a. changing temperature by 1 Kelvin   c. vaporizing into a gas
   b. melting into a liquid   d. All three processes take the same
                                                    energy.

_____ 37. Thermodynamic values for water:
   heat of fusion = 3.34×10^5 J/kg
   heat of vaporization = 2.26×10^6 J/kg
   specific heat = 4180 J/kg K

   How much thermal energy is required to completely boil 2.83 kg of water from an initial temperature of 50°C?
   a. 3.20×10^5 J   c. 5.80×10^6 J
   b. 6.99×10^6 J   d. 4.73×10^7 J

_____ 38. Thermodynamic values for water:
   heat of fusion = 3.34×10^5 J/kg
   heat of vaporization = 2.26×10^6 J/kg
   specific heat = 4180 J/kg K

   A 50.0 g ice cube is at its melting point. How much thermal energy is absorbed for it to become water at room temperature (17°C)?
   a. 13,100 J   c. 2.03×10^4 J
   b. 2.00×10^6 J   d. 2.33×10^5 J

_____ 39. Thermodynamic values for water:
   heat of fusion = 3.34×10^5 J/kg
   heat of vaporization = 2.26×10^6 J/kg
   specific heat = 4180 J/kg K

   How much thermal energy is released when 2.75 kg of steam is completely condensed?
   a. 6.22×10^6 J   c. 8.22×10^8 J
   b. 8.22×10^5 J   d. 6.22×10^3 J