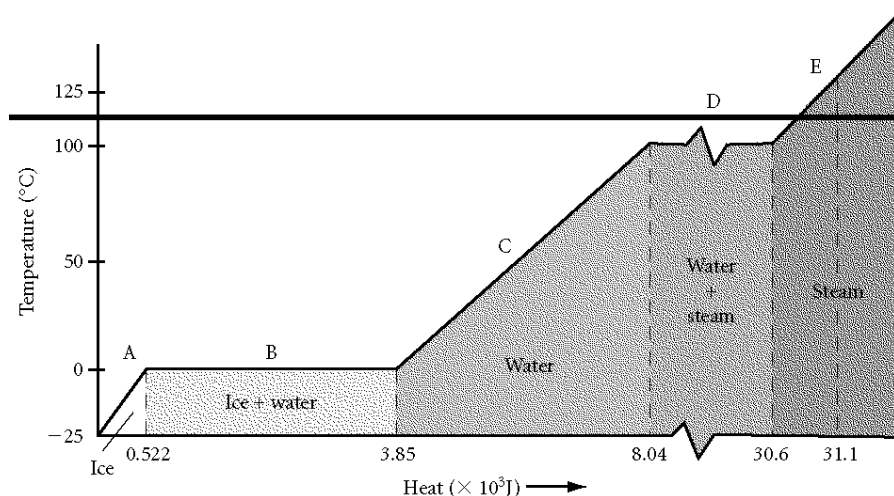


Heat and Thermodynamics - Sample Test

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- Which of the following is a direct cause of a substance's temperature increase?
 - Energy is removed from the particles of the substance.
 - Kinetic energy is added to the particles of the substance.
 - The number of atoms and molecules in a substance changes.
 - The volume of the substance decreases.
- As the temperature of a substance increases, its volume tends to increase due to
 - thermal equilibrium.
 - thermal energy.
 - thermal expansion.
 - thermal contraction.
- What is the temperature of a system in thermal equilibrium with another system made up of ice and water at 1 atm of pressure?
 - 0°F
 - 273 K
 - 0 K
 - 100°C
- Energy transferred as heat occurs between two bodies in thermal contact when they differ in which of the following properties?
 - mass
 - specific heat
 - density
 - temperature
- If there is no temperature difference between a substance and its surroundings, what has occurred on the microscopic level?
 - Energy has been transferred from lower-energy particles to higher-energy particles.
 - Energy has been transferred from higher-energy particles to lower-energy particles.
 - No energy has been transferred between the substance and its surroundings.
 - Heat has been flowing back and forth.
- What three properties of a substance affect the amount of energy transferred as heat to or from the substance?
 - volume, temperature change, specific heat capacity
 - density, temperature change, specific heat capacity
 - mass, temperature change, specific heat capacity
 - mass, temperature change, latent heat
- A slice of bread contains about 4.19×10^5 J of energy. If the specific heat capacity of a person is 4.19×10^3 J/kg•°C, by how many degrees Celsius would the temperature of a 70.0 kg person increase if all the energy in the bread were converted to heat?
 - 2.25°C
 - 1.86°C
 - 1.43°C
 - 1.00°C
- What are the energies associated with atomic motion called?
 - kinetic energy
 - potential energy
 - bond energy
 - internal energy
- The use of fiberglass insulation in the outer walls of a building is intended to minimize heat transfer through what process?
 - conduction
 - radiation
 - convection
 - vaporization
- If two small beakers of water, one at 70°C and one at 80°C, are emptied into a large beaker, what is the final temperature of the water?
 - The final temperature is less than 70°C.
 - The final temperature is greater than 80°C.
 - The final temperature is between 70°C and 80°C.
 - The water temperature will fluctuate.
- Which of the following describes a substance in which the temperature and pressure remain constant while the substance experiences an inward transfer of energy?
 - gas
 - liquid
 - solid
 - substance undergoing a change of state



12. The figure above shows how the temperature of 10.0 g of ice changes as energy is added. Which of the following statements is correct?
- The water absorbed energy continuously, but the temperature increased only when all of the water was in one phase.
 - The water absorbed energy sporadically, and the temperature increased only when all of the water was in one phase.
 - The water absorbed energy continuously, and the temperature increased continuously.
 - The water did not absorb energy.
13. Using the figure above, determine which value equals the latent heat required to change the liquid water into steam.
- $8.04 \times 10^3 \text{ J}$
 - $22.6 \times 10^3 \text{ J}$
 - $30.6 \times 10^3 \text{ J}$
 - $31.1 \times 10^3 \text{ J}$
14. At what point on the figure above is the amount of energy transferred as heat approximately $4.19 \times 10^3 \text{ J}$?
- A
 - B
 - C
 - D
15. Why does sandpaper get hot when it is rubbed against rusty metal?
- Energy is transferred from the sandpaper into the metal.
 - Energy is transferred from the metal to the sandpaper.
 - Friction between the sandpaper and metal increases the temperature of both.
 - Energy is transferred from a hand to the sandpaper.
16. Which of the following is a set of particles or interacting components to which energy is added or from which energy is removed?
- an ideal gas
 - an engine
 - a system
 - an environment
17. An ideal gas system is maintained at a constant volume of 4 L. If the pressure is constant, how much work is done by the system?
- 0 J
 - 5 J
 - 8 J
 - 30 J
18. Air cools as it escapes from a diver's compressed air tank. What kind of process is this?
- isovolumetric
 - isobaric
 - adiabatic
 - isothermal
19. Which thermodynamic process takes place at a constant temperature so that the internal energy of a system remains unchanged?
- isovolumetric
 - isobaric
 - adiabatic
 - isothermal
20. In an isovolumetric process for an ideal gas, the system's change in the energy as heat is equivalent to a change in which of the following?
- temperature
 - volume
 - pressure
 - internal energy
21. How is conservation of internal energy expressed for a system during an adiabatic process?
- $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
 - $Q = 0$, so $\Delta U = -W$
 - $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
 - $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
22. An ideal gas system undergoes an adiabatic process in which it expands and does 20 J of work on its environment. What is the change in the system's internal energy?
- 20 J
 - 5 J
 - 0 J
 - 20 J

23. Which of the following is *not* a way in which a cyclic process resembles an isothermal process?
- Energy can be transferred as work.
 - Energy can be transferred as heat.
 - The temperature of the system remains constant throughout the process.
 - There is no net change in the internal energy of the system.
24. The requirement that a heat engine must give up some energy at a lower temperature in order to do work corresponds to which law of thermodynamics?
- first
 - second
 - third
 - No law of thermodynamics applies.
25. An electrical power plant manages to transfer 88 percent of the heat produced in the burning of fossil fuel to convert water to steam. Of the heat carried by the steam, 40 percent is converted to the mechanical energy of the spinning turbine. Which best describes the overall efficiency of the heat-to-work conversion in the plant?
- greater than 88 percent
 - 88 percent
 - 40 percent
 - less than 40 percent

Problem

26. The temperature of an object is measured as 500.0 K. What is this temperature in degrees Celsius?
27. A metal cube with a mass of 8.50×10^{-2} kg and a temperature of 85.0°C is placed in a container of water. The mass of the water is 0.150 kg, and its temperature is 25.0°C. What is the specific heat capacity of the bolt if the final temperature of the bolt and water is 28.4°C? ($c_{p,w} = 4186 \text{ J/kg}\cdot^\circ\text{C}$)
28. A gas compressed within a cylinder with a piston with a radius of 5.0 cm is displaced 8.0 cm. What is the net pressure on the gas if the work done on the gas equals -360 J ?
29. A total of 165 J of work is done on a gaseous refrigerant as it undergoes compression. If the internal energy of the gas increases by 123 J during the process, what is the total amount of energy transferred as heat?
30. An engine adds 75 000 J of energy as heat and removes 15 000 J of energy as heat. What is the engine's efficiency?