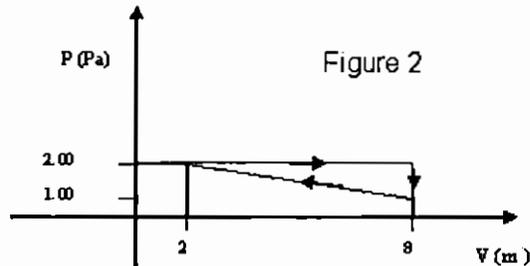


Question 25119-10
0.43-25%

In a P-V diagram, a system of an ideal gas goes through the process shown in figure 2. How much heat is absorbed after the system goes 100 times through the cycle?



- (a) 500 J.
- (b) 300 J.
- (c) zero.
- (d) 730 J.
- (e) 355 J.

Question 25219-10
0.14-77%

A cylinder with a frictionless piston contains 0.2 kg of water at 100 degrees Celsius. What is the change in internal energy of water when it is converted to steam at 100 degrees Celsius at constant pressure of 1 atm. [Density of steam = 0.6 kg/m^3 , water = 10^3 kg/m^3]

- (a) 418 kJ.
- (b) 452 kJ.
- (c) 226 kJ.
- (d) 113 kJ.
- (e) 333 kJ.

Question 25319-10
0.22-85%

Air is injected from a cylinder of compressed air into a spherical balloon of initial volume V , causing its diameter to double. What is the work done at constant pressure P ?

- (a) $7.0 \cdot P \cdot V$.
- (b) $4.0 \cdot P \cdot V$.
- (c) $3.0 \cdot P \cdot V$.
- (d) $8.0 \cdot P \cdot V$.
- (e) $1.0 \cdot P \cdot V$.

19-11 Heat Transfer Mechanisms

Question 254

19-11

Calculate the rate of heat flow through a glass window, $2.0 \text{ m} \times 1.5 \text{ m}$ in area and 3.3 mm in thickness, if the temperature of the outer and inner surfaces are 5.0 degrees C and -5.0 degrees C , respectively. [Thermal conductivity of glass = 0.84 J/(s.m. K)]

- (a) 3006 W.
- (b) 0303 W.
- (c) 1071 W.
- (d) 7636 W.
- (e) 8930 W.

19-11

Question 255

A glass window has an area of 0.50 m^2 and a thickness of 0.60 cm . If the rate of heat flow between the faces is 500 kJ/hour , find the temperature difference between the window's faces.

$K(\text{glass}) = 0.80 \text{ W/m C-degrees}$.

- (a) 3.5 C-degrees
- (b) 2.1 C-degrees
- (c) 1.2 C-degrees
- (d) 45 C-degrees
- (e) 12 C-degrees

19-11

Question 256

Q 50-43%

An insulated aluminum rod has a length of 2.0 m and a diameter of 2.0 cm . The ends of the rod are maintained at a temperature difference of 200 degrees-C . Find the heat transferred along the rod in one minute. (Thermal conductivity of Al = $238 \text{ W/m}^{\circ}\text{K}$.)

- (a) 1062 J
- (b) 732 J
- (c) 160 J
- (d) 1796 J
- (e) 449 J

19-11

Question 257

What is the outside temperature if $4.0 \times 10^6 \text{ cal}$ of heat is lost through 4.0 m^2 window of 0.3 cm thick glass in one hour from a house kept at $20 \text{ degrees Celsius}$? (For glass $k = 0.2 \text{ cal/s}^{\circ}\text{m}^{\circ}\text{C}$.)

- (a) 13 degrees Celsius.
- (b) 8 degrees Celsius.
- (c) 16 degrees Celsius.
- (d) 32 degrees Celsius.
- (e) 24 degrees Celsius.

19-11

Question 258

A solid aluminum rod, of length 1.60 m and cross-sectional area of $3.14 \times 10^{-4} \text{ m}^2$, has one end in boiling water and the other end in ice. How much ice melts in one minute? [The thermal conductivity of aluminum is $205 \text{ Watts/(m}^{\circ}\text{K)}$ and the heat of fusion of water is $3.35 \times 10^5 \text{ J/kg}$.] (neglect any heat loss, by the system, to the surrounding)

- (a) $3.2 \times 10^{-3} \text{ kg}$.
- (b) $7.2 \times 10^{-4} \text{ kg}$.
- (c) $5.8 \times 10^{-4} \text{ kg}$.
- (d) $6.3 \times 10^{-4} \text{ kg}$.
- (e) $7.9 \times 10^{-2} \text{ kg}$.

19-11

Question 259

Q 28-68%

By what factor does the rate of radiant emission of heat, from a heating element, increase when the temperature of a heating element increases from $27 \text{ degrees Celsius}$ to $327 \text{ degrees Celsius}$?

- (a) 2.
- (b) 8.
- (c) 64.
- (d) 4.
- (e) 16.

Question 26019-11
0.18-76%

A closed cubical box (60 cm on edge and 5 cm on thickness) contains ice at zero degrees Celsius. When the outside temperature is 20 degrees Celsius, it is found that 250 grams of ice melt each hour. What is the value of the thermal conductivity of the walls of the box?

- (a) 0.01 Watts/(m*K).
- (b) 3.21 Watts/(m*K).
- (c) 0.03 Watts/(m*K).
- (d) 0.07 Watts/(m*K).
- (e) 1.02 Watts/(m*K).

Question 261

19-11

A cylindrical copper rod of length 1.5 m and cross section 6.5 cm^2 is insulated to prevent heat loss through its surface. The ends are maintained at a temperature difference of 100 C deg by having one end in a water-ice mixture and the other in boiling water and steam. How much ice is melted per hour at the cold end? (thermal conductivity of copper, κ , = 401 W/(m.K); heat of fusion of ice, L_f , = $333 \cdot 10^3 \text{ J/kg}$)

- (a) 281 g
- (b) 980 g
- (c) 469 g
- (d) 188 g
- (e) 330 g

Question 26219-11
0.59-33%

A room has a window made of two layers of glass separated by an air layer as in figure 4. Each of the 3 layers has a thickness of 0.50 mm and an area of 1.0 square meter. The temperature outside the room is - 20 degrees-C, while the temperature inside the room is + 20 degrees-C. What is the rate of heat transfer by conduction through the window ? Assume steady state.



Figure 4

- (a) 1.2 kW
- (b) 2.0 kW
- (c) 1.4 kW
- (d) 0.90 kW
- (e) 1.0 kW

Question 26319-11
0.26-33%

On a cold winter day, metallic objects generally feel cooler to the touch than wooden objects. This is because:

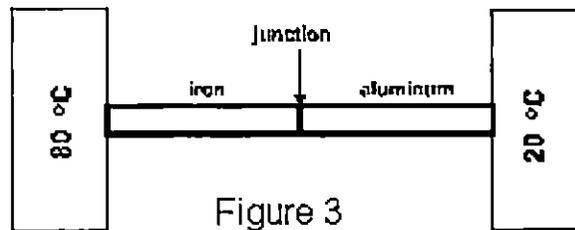
- (a) heat tends to flow from metal to wood.
- (b) the mass density of wood is less than the mass density of metals.
- (c) metals conduct heat better than wood.
- (d) the equilibrium temperature of metal is lower than that of wood.
- (e) a given mass of wood contains more heat than the same mass of metal.

19-11

0.51-54%

Question 264

An aluminum rod and an iron rod, each of length 20.0 cm and radius 1.00 cm, are placed end to end, as in figure 3. The sides of the rods are insulated. The outer end of iron is at 80.0 degrees-C and that of aluminum is at 20.0 degrees-C. In steady state, what is the temperature at the junction of the two rods? [The thermal conductivity of aluminum = 235 W/m.K and the thermal conductivity of iron = 14.0 W/m.K].

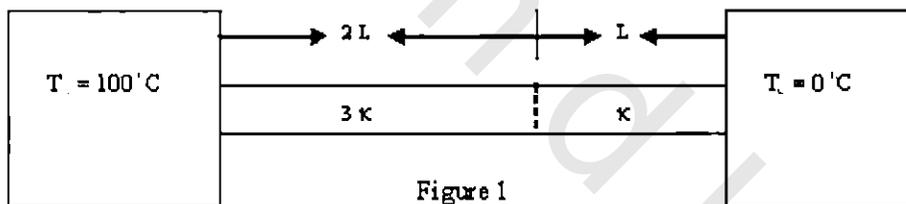


- (a) 15.7 degrees-C
 (b) 50.0 degrees-C
 (c) 85.6 degrees-C
 (d) 76.6 degrees-C
 (e) 23.4 degrees-C

19-11

Question 265

A rod is made of two different metals, one piece has length L and thermal conductivity K and the other piece has a length $2L$ and thermal conductivity $3K$. The rod is situated between two heat reservoirs as shown in Fig. 1. What is the steady state temperature at the interface of the two pieces?



- (a) 0 Kelvin.
 (b) 60 Kelvin.
 (c) 35 Kelvin.
 (d) 68 Kelvin.
 (e) 333 Kelvin.

19-11

0.34-18%

Question 266

Consider a copper slab of thickness L and area of 5.0 m^2 . If the conduction rate through the copper slab is $1.2 \times 10^6 \text{ J/s}$ and the temperature on the left of the slab is 102 degree-C while on the right of the slab it is -12.0 degree-C, what must be the thickness of the slab? [Take the coefficient of thermal conductivity of copper as 400 W/(m K)].

- (a) 32 cm.
 (b) 29 cm.
 (c) 19 cm.
 (d) 15 cm.
 (e) 25 cm.

Question 26719-11
0.32-18%

Heat is conducted by two cylindrical rods with identical cross sectional area and length (see figure 6). The temperature difference between the ends of each rod is the same. One of the rods is made of carbon, while the other is made of silver. What is the ratio of the conduction rate of the silver rod to the conduction rate of the carbon rod? Thermal conductivity of silver = 435 W/m.K . Thermal conductivity of carbon = 1100 W/m.K .



Figure 6

- (a) 2.5
- (b) 0.40
- (c) 0.48
- (d) 1.5
- (e) 0.67

Question 26819-11
0.26-68%

The wall of a home is 0.2 m thick, 2.0 m high, 10 m wide and has a thermal conductivity of 0.4 watt/m.K . If the inside temperature is $15 \text{ degrees Celsius}$ and the outside temperature is $-5.0 \text{ degrees Celsius}$, how much energy is lost in 12 hours?

- (a) $4.5 \cdot 10^{**6} \text{ J}$.
- (b) $4.5 \cdot 10^{**5} \text{ J}$.
- (c) $4.5 \cdot 10^{**6} \text{ J}$.
- (d) $2.7 \cdot 10^{**7} \text{ J}$.
- (e) $3.4 \cdot 10^{**7} \text{ J}$.

Question 26919-11
0.49-31%

A box has a total surface area of 1.2 m^{**2} and a wall thickness of 4.0 cm and is made of an insulating material. A 10-W electric heater inside the box maintains the inside temperature steady at $45 \text{ degrees Celsius}$. If the outside temperature is $30 \text{ degrees Celsius}$, find the thermal conductivity of the insulating material.

- (a) $3.1 \cdot 10^{**(-4)} \text{ W/(m.K)}$.
- (b) $4.5 \cdot 10^{**(-2)} \text{ W/(m.K)}$.
- (c) $3.6 \cdot 10^{**(-3)} \text{ W/(m.K)}$.
- (d) $2.2 \cdot 10^{**(-2)} \text{ W/(m.K)}$.
- (e) $1.7 \cdot 10^{**(-3)} \text{ W/(m.K)}$.