Suggested problems
Chapter 18

The quiz questions will be same or very similar to the following text-book problems.
Refer to the course website for the latest version of this document.
You are encouraged to seek the help of your instructor during his office hours.

5. At what temperature is the Fahrenheit scale reading equal to (a) twice that of the Celsius scale and (b) half that of the Celsius scale?

Answer: (a) 320 °F; (b) −12.3 °F

15. A steel rod is 3.000 cm in diameter at 25.00°C. A brass ring has an interior diameter of 2.992 cm at 25.00°C. At what common temperature will the ring just slide onto the rod?

Answer: 360.5°C

24. A certain substance has a mass per mole of 50.0 g/mol. When 314 J is added as heat to a 30.0 g sample, the sample’s temperature rises from 25.0°C to 45.0°C. What are the (a) specific heat and (b) molar specific heat of this substance? (c) How many moles are in the sample?

Answer: (a) 523 J/kg.K; (b) 26.2 J/mol.K; (c) 0.600 mol

28. How much water remains unfrozen after 50.2 kJ is transferred as heat from 260 g of liquid water initially at its freezing point?

Answer: 109 g

46. Suppose 200 J of work is done on a system and 70.0 cal is extracted from the system as heat. In the sense of the first law of thermodynamics, what are the values (including algebraic signs) of (a) W, (b) Q, and (c) \( \Delta E_{int} \) ?

Answer: −200 J; (b) −70.0 cal = −293 J; (c) −93.0 J

51. A sphere of radius 0.500 m, temperature 27.0°C, and emissivity 0.850 is located in an environment of temperature 77.0°C. At what rate does the sphere (a) emit and (b) absorb thermal radiation? (c) What is the sphere’s net rate of energy exchange?

Answer: (a) 1.23 kW; (b) 2.28 kW; (c) 1.05 kW

55. A cylindrical copper rod of length 1.2 m and cross sectional area 4.8 cm² is insulated to prevent heat loss through its surface. The ends are maintained at a temperature difference of 100 C° by having one end in a water–ice mixture and the other in a mixture of boiling water and steam. (a) At what rate is energy conducted along the rod? (b) At what rate does ice melt at the cold end?

Answer: (a) 16 J/s kW; (b) 0.048 g/s

60. Figure 18-45 shows the cross section of a wall made of three layers. The layer thicknesses are \( L_1 \), \( L_2 =0.700 L_1 \), and \( L_3 =0.350L_1 \). The thermal conductivities are \( k_1 \), \( k_2 = 0.900 k_1 \), and \( k_3=0.800 k_1 \). The temperatures at the left and right sides of the wall are \( T_{left}=30.0°C \) and \( T_{right} =−15.0°C \), respectively. Thermal conduction is steady. (a) What is the temperature difference \( \Delta T_2 \) across layer 2 (between the left and right sides of the layer)? If \( k_2 \) were, instead, equal to 1.1 \( k_1 \), (b) would the rate at which energy is conducted through the wall be greater than, less than, or the same as previously, and (c) what would be the value of \( \Delta T_2 \)?

Answer: (a) 15.8 C°; (b) greater; (c) 13.8 C°