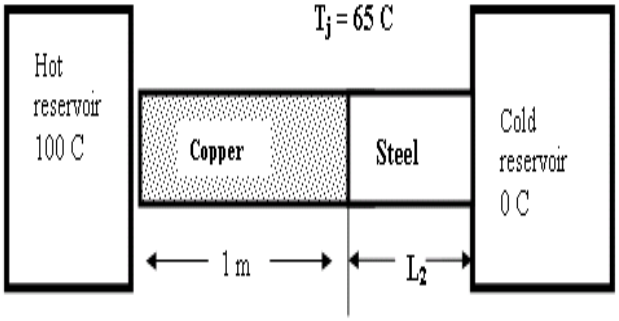
Old-Exam-Questions-Ch.18

T081

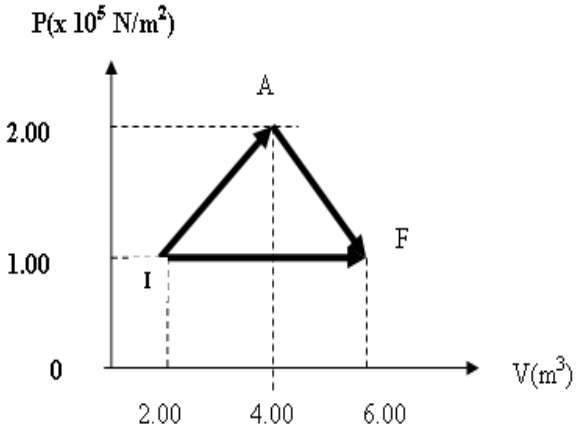
Q9. The volume of 1.00 kg water is 958.38 mm^3 at a temperature of 10.0 °C and 999.73 mm^3 at temperature of 100.0 °C. Calculate coefficient of volume expansion for water in that range of temperature. (Ans: 4.79×10^{-4}/ C°)

Q10. An isolated rod is in thermal contact with hot reservoir at one end and with cold reservoir at other end (Fig. 1). The rod consists of a 1.00 m section of copper joined by a section of length L_2 of steel. Both rods have the same cross section area of 4.00 cm^2. The temperature of copper-steel junction Tj is 65 °C. Find L_2. (k_{steel} = 14 W/m.K; k_{cu} = 401 W/m.K) (Ans: 0.065 m)



Q11.How much ice at -20.0 °C must be mixed with 0.25 kg of water, initially at 20.0 °C to obtain a final temperature of mixture of 0.0°C with all ice melted. (c_{ice} = 2220 J/kg K) (Ans: 56 g)

Q12. A gas expands from a volume of 2.00 m^3 to a volume of 6.00 m^3 along two different paths as shown in Fig 2. The heat added to the gas along path IAF equals 1.68×10^6 J. Find the heat added during path IF. (Ans: 1.48×10^6 J)



T072

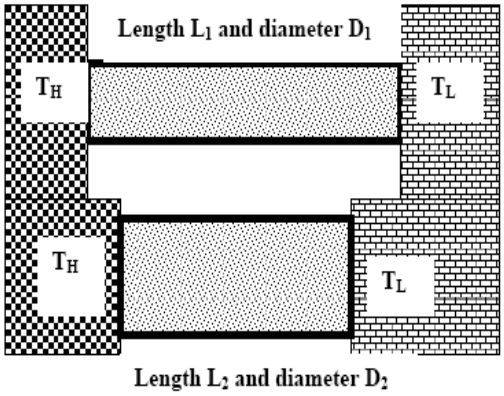
Q10. A square hole 8.00 cm along each side is cut in a sheet of metal. If the temperature of the sheet is increased by 50 K, the area of the hole increases by 0.11 cm2. Find the coefficient of **linear expansion** α of the metal (Ans:17.2 $x10^{-6}$ $^oC^{-1}$)

Q11. Helium condenses into the liquid phase at approximately 4 K. What temperature in degrees Fahrenheit, does this correspond to? (Ans: –452)

Q12. A gas is compressed from 600 cm^3 to 200 cm^3 at a constant pressure of 400 kPa. At the same time, 100 J of heat energy is transferred out of gas. What is change in the internal energy of the gas during this process? (Ans:60 J

Q13. A 15 g ice cube at 0 °C is placed in an aluminum cup whose initial temperature is 70 ^oC. The system comes to an equilibrium temperature of 20 °C. What is the mass of the cup? (c_{Al} = 900 J/kg.K; Lfusion-ice= 333 kJ/kg.K) (Ans: 140 g)

Q14. Two cylindrical copper rods with different length L_1 and L_2 and different diameters D_1 and D_2 are connected across two heat reservoirs with temperatures T_L= 0 °C and T_H=100 °C. In the steady state the heat conduction rate through the rod L1 is half of that through L_2. If L_1=40 cm and D_2.= 1.2 D_1 , the length L_2 is: (κ_{copper} = 385 W/m.K) (Ans: 29 cm)



T071:

Q9. A glass flask with volume 250 cm^3 is filled with mercury at 25 ^0C. How much mercury overflows when the temperature of the system is raised to 105 ^oC (the coefficient of linear expansion of glass is 4.0 $\times 10^{-6}$ K^{-1} and coefficient of volume expansion of mercury is 1.82 $\times 10^{-4}$ K^{-1}). (Ans: 3.4 cm^3)

Q10. How much ice at -10.0 ^oC must be added to 4.0 kg of water at 20.0 ^oC to cause the resulting mixture to be liquid water at 0 ^oC ? (c_{ice} = 2220 J/kg.K) (Ans: 0.94 kg)

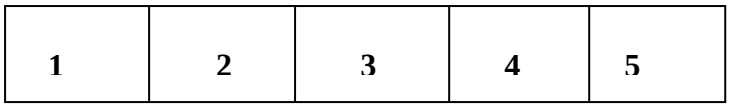
Q11. One end of a steel bar is welded to one end of a copper bar. Both bars have the same length and cross sectional area. The free end of the steel bar is maintained at 100 ^oC and free end of the copper bar is maintained at 0.0 ^oC. Find the temperature of the junction at steady state.(k_{steel} = 50.2 W/m.K; k_{copper} = 385 W/m.K) (Ans: 11.5 °)

T062:

Q10. A metal rod has a length of 7.30 m at 15 °C and a length of 7.40 m at 95 °C. What is the temperature of the rod when its length is 7.21 m? **(Ans: -57 °C)**

Q11. 100 g of ice at 0 °C is mixed with 100 g of water at 70 °C, what is the final temperature of the mixture? (0 ^{o}C)

Q12. The Figure shows five slabs of different materials with equal thickness and same cross sectional area, placed side by side. Heat flows from left to right and steady state temperatures are given at the interfaces. Which slab has largest thermal conductivity? (Ans: 3)



28°C **24**°C **17**°C **14** °C **5**°C **-2** °C

Q13. A temperature difference of 25 K is equal to: (Ans: a difference of 45 on the Fahrenheit Scale.)

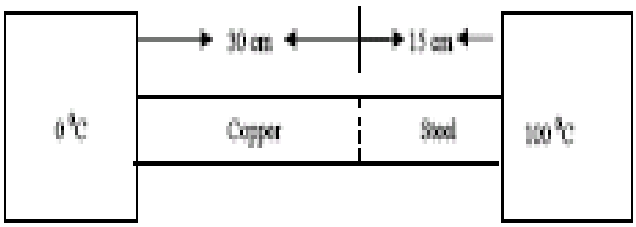
T061:

Q9. A steel rod is 4.000 cm in diameter at 35 ^{o}C. A brass ring has an inner diameter of 3.992 cm at 35 ^{o}C. At what common temperature will the brass ring slide onto steal rod? $\alpha_{steel}= 11 \times 10^{-6} / K^{-1}$; $\alpha_{brassl}= 19 \times 10^{-6} / K^{-1}$ (Ans 286 ^{0}C)

Q10. What mass of steam initially at 100 ^{o}C should be mixed with 160 g of ice at 0 ^{o}C in a thermally insulated container to produce liquid water at 40 ^{o}C. ***(Ans: 32 g)***

Q11. A 20-kg block of copper is dropped and falls 122 m. Calculate the raise in the temperature of the block if all the potential energy lost in the fall is converted to heat. [The specific heat of copper = 386 J/kg.K] (Ans: 3.1 K)

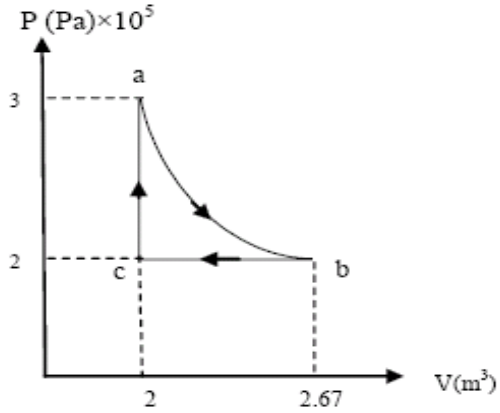
Q12. The following figure shows a steel bar 15 cm long welded end to end to a copper bar 30 cm long. Each bar has a square cross section of 2.2 cm^2 on a side. The free end of steel is maintained at 100 ^oC and the free end of copper is maintained at 0.0 ^oC. Find the temperature at the junction of the two bars? *Ksteel*= 50.2 W/m.K; *Kcopper* =385 W/m.K] (Ans: 21 °C)



T052:

Q6. A 2.0-cm diameter cylinder contains 50 mL of water at 10.0 ^oC. What is the change in the water level when the temperature rises to 80 ^oC? Ignore the change in the volume of the tube. The coefficient of volume expansion of water is 2.1×10^{-4} /^oC, and 1 mL = 1 cm^3. (Ans: 0.23 cm)

Q7. Consider one mole of a monatomic gas taken through the cycle shown in the figure 2. Find the change in internal energy of the system for the adiabatic process a → b. (Ans: –100 kJ)



Q8. 500 g of steam at 100 ^oC lose 1.180×10^6 J of heat. Calculate the final temperature? Heat of vaporization of water is 2.256×10^6 J/kg, heat of fusion is 333 kJ/kg, and the specific heat of water = 4.19 kJ/kg K. (Ans:75 ^oC)

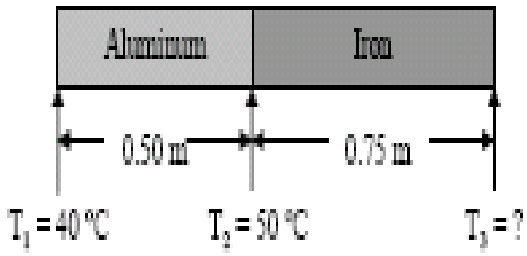
Q12. The temperature of one side of 8.0-mm thick glass window is maintained at 45 ^oC while the other side is maintained at 25 ^oC. If the area of the window is 2.0 m^2, how much energy is transferred through the window in 5 hours? The thermal conductivity of glass is 1.0 W/m·K. (Ans: 90×10^6 J)

T051:

Q9. 500 g of water at 100 ^{o}C is converted to steam at 100 ^{o}C by heating at constant pressure of 1.01×10^{5} Pa. The volume of the water is 0.5×10^{-3} m^3 and the volume of steam is 0.83 m^3. Calculate the change in the internal energy of the system.(Ans: 1044 kJ)

Q10. What mass of steam initially at 100 ^{o}C that can be mixed with 160 g of ice at 0 ^{o}C in a thermally insulated container to produce liquid water at 40 ^{o}C. (Ans: 32 g)

Q12. The figure 1 below shows an aluminum and iron rods joint together. The rods have the same cross section and their sides are insulated. In the steady state, find the temperature T_3 at the far end of the iron rod. The thermal conductivity of aluminum is 235W/mK and for iron is 14 W/mK.(Ans:302 ^{o}C)



T042:

Q10. A bottle of soft drink is placed in a refrigerator and left there until its temperature drops by 15 K from its original value. What is the corresponding change in temperature on the Fahrenheit scale**?**(Ans: 27 F^0)

Q11. An iron ball has a diameter of 6.00 cm and is 0.01 cm larger than the diameter of a brass ring. Both are at a temperature of 20 degrees Celsius. To what temperature should the brass ring be heated so that the ball just passes through the hole? [The coefficient of linear expansion of brass = $1.9\text{x}10^{-5}$ K^{-1}] [Ans: 108 ^{0}C].

Q12. A person wants to cool 0.3-kg of water that is initially at 30 degrees Celsius by adding ice initially at -25 degrees Celsius. How much ice should he add so that the final temperature will be 0 degrees Celsius with all the ice melted? [For ice, use the specific heat = $2.1\text{x}10^{3}$ J/ (kg.K), and heat of fusion = $3.3\text{x}10^{5}$ J/kg]. [Ans: 99 g.]

Q13. In a PV diagram, a system of an ideal gas goes through the process shown in Figure 3. How much heat is absorbed after the system goes through this cycle 10 times. [Take P= 1.0 Pa and V= 1.0 m^3].[Ans: 20 J]

T041:

Q1. It is recommended to use a new temperature scale called Z. On Z scale, the boiling point of water is 65.0 ^{0}Z and the freezing point is -15.0 ^{0}Z. To what temperature on the Fahrenheit scale would a temperature of -100 degrees correspond? [Note: both scales are linear] (Ans: –159 ^{0}F)

Q2. Fifty grams of ice at zero degrees Celsius is placed in a thermos bottle containing 100 grams of water at 6.0 ^{0}C. How many grams of ice will melt? (Ans: 7.5 grams)

Q3. A cylinder with a frictionless piston contains 0.2 kg of water at 100 ^{0}C. What is the change in internal energy of water when it is converted to steam at 100 ^{0}C at constant pressure of 1 atm. [Density of steam = 0.6 kg/m^3, water = 10^3 kg/m^3] (Ans: 418 kJ.)