

Heat and Thermodynamics Assignment 2

Question 1:

A composite slab is prepared by pasting three slab of thickness L_1, L_2, L_3 and thermal conductivity K_1, K_2, K_3 . The slab have equal cross-sectional area. Find the equivalent thermal conductivity

- a. $K_1 K_2 K_3 (L_1 + L_2 + L_3) / (K_2 K_3 L_1 + K_1 K_3 L_2 + K_1 K_2 L_3)$
- b. $K_2 K_3 L_1 + K_1 K_3 L_2 + K_1 K_2 L_3 / (K_1 + K_2 + K_3)$
- c. $K_1 + K_2 + K_3 / (L_1 + L_2 + L_3)$
- d. $L_1 + L_2 + L_3 / (K_1 + K_2 + K_3)$

Question 2:

Three black bodies are such that higher intensity wavelengths are in the ratio

$$\lambda_{m1} : \lambda_{m2} : \lambda_{m3} = 1 : (21)^{1/2} : (3)^{1/2}$$

which of these is true for the temperatures

- a, $T_1 > T_3 > T_2$
- b, $T_1 > T_2 > T_3$
- c, $T_3 > T_2 > T_1$
- d, $T_3 > T_1 > T_2$

Question 3:

The tungsten element of the electric lamp has as surface area A and Power is P and emissivity is 0.4

- a. Find the temperature of the filament
- b. if the tungsten filament behave like blackbody, find the % increase in power required to maintain the same temperature.

Question 4:

A Rod is initially at a uniform temperature at T_1 . One end is kept at T_1 and other end is kept in a furnace maintained at temperature at T_2 . ($T_2 > T_1$). The Surface of the rod is insulated so that heat can flow lengthwise along the rod. Length of the Rod is L , area A and thermal conductivity of the Rod is K . Consider a short cylindrical element of the rod of unit length. If the temperature gradient at the one end of the element is K . Find the rate of flow across the element.

Question 5:

A gas mixture consist of molecules of type A, B, C, D with molecular masses $M_a > M_b > M_c > M_d$

Two statement are drawn from it

A, Average kinetic energy of four type of gases in the mixture are in the ratio

$$E_a/1 = E_b/1 = E_c/1 = E_d/1$$

B, Rms speed of molecules of the four types are in the order if V is the rms speed

$$V_D > V_C > V_B > V_A$$

which one of following is true

- a, Only A correct
- b, Only B correct
- c, A & B both are correct
- d, A & B both are wrong

Question 6:

Calculate the variation of atmospheric pressure with elevation of the earth atmosphere. Considering the temperature to be uniform throughout (which is not the actual case)

Question 7:

An ideal gas sample of .203 gm occupies 1000cm^3 at STP. Calculate the RMS speed of the molecules

Question 8:

How will the rate of collision of a rigid diatomic molecules against the vessel will change ,if the gas is expanded adiabatically η times

Question 9:

Which one of the following statement is true about a gas undergoing isothermal change

- a) The temperature of the gas is constant
- b) The pressure of the gas remains constant
- c) the volume of the gas remains constant
- d) The gas is completely insulated from the surrounding's

Question 10:

Which of the following devices is used to detect thermal radiation?

- a) Thermopile
- b) Constant volume air thermometer
- c) Liquid thermometer
- d) Six Maximum and minimum thermometer