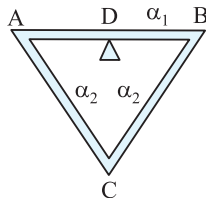


MISCELLANEOUS EXERCISE

Choose the correct options for each of the following questions. Questions marked with * may have more than one correct options.

1. Three rods of equal length are joined to form an equilateral triangle ABC . D is the midpoint of AB . The coefficient of linear expansion is α_1 for AB , and α_2 for AC and BC . If the distance DC remains constant for small changes in temperature :

- (A) $\alpha_1 = \alpha_2$
 (B) $\alpha_1 = 2\alpha_2$
 (C) $\alpha_1 = 4\alpha_2$
 (D) $\alpha_1 = \frac{1}{2} \alpha_2$



2. A solid whose volume does not change with temperature floats in a liquid. For two different temperatures t_1 and t_2 of the liquid, fraction f_1 and f_2 of the volume of the solid remain submerged in the liquid. The coefficient of volume expansion of the liquid is equal to :

- (A) $\frac{f_1 - f_2}{f_2 t_1 - f_1 t_2}$ (B) $\frac{f_1 - f_2}{f_1 t_1 - f_2 t_2}$
 (C) $\frac{f_1 + f_2}{f_2 t_1 + f_1 t_2}$ (D) $\frac{f_1 + f_2}{f_1 t_1 + f_2 t_2}$

3. The volume of the bulb of a mercury thermometer at 0°C is V_0 and cross-section of the capillary is A_0 . The coefficient of linear expansion of glass is α_g per $^\circ\text{C}$ and the cubical expansion of mercury γ_m per $^\circ\text{C}$, what is the length of mercury column in capillary at $T^\circ\text{C}$?

- (A) $\frac{V_0 T (\gamma_m + 3\alpha_g)}{A_0 (1 + 2\alpha_g T)}$ (B) $\frac{V_0 T (\gamma_m - 3\alpha_g)}{A_0 (1 + 2\alpha_g T)}$
 (C) $\frac{V_0 T (\gamma_m + 2\alpha_g)}{A_0 (1 + 3\alpha_g T)}$ (D) $\frac{V_0 T (\gamma_m - 2\alpha_g)}{A_0 (1 + 3\alpha_g T)}$

4. In a 10-metre-deep lake, the bottom is at a constant temperature of 4°C . The air temperature is constant at -4°C . The thermal conductivity of ice is 3 times that of water. Neglecting the expansion of water on freezing, the maximum thickness of ice will be :

- (A) 7.5 m (B) 6 m
 (C) 5 m (D) 2.5 m

5. The isothermal bulk modulus of a perfect gas at atmospheric pressure is:

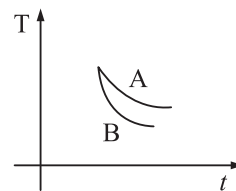
- (A) $1.03 \times 10^5 \text{ Newton/m}^2$
 (B) $1.03 \times 10^4 \text{ Newton/m}^2$
 (C) $1.03 \times 10^{10} \text{ Newton/m}^2$
 (D) $1.03 \times 10^{11} \text{ Newton/m}^2$

6. Two black plane surfaces are placed parallel to each other in vacuum. The surfaces are maintained at constant temperatures $2T$ and T respectively. In order to reduce the heat flow due to radiation, a heat shield consisting of a thin black plate is placed parallel to plane surfaces. All the surfaces and heat shield has same area. Temperature of the heat shield and factor by which heat flow is reduced between the plane surfaces is :

- (A) $\frac{3T}{2}, \frac{1}{3}$ (B) $\left(\frac{15}{2}\right)^{1/4} T, \frac{1}{2}$
 (C) $\left(\frac{17}{2}\right)^{1/4} T, \frac{1}{2}$ (D) $\left(\frac{13}{2}\right)^{1/4} T, \frac{1}{3}$

7. Two bodies A and B have same surface area and heat capacity. They are allowed to cool from same initial temperature. Variation of temperature of the two bodies with time is shown in figure.

If e and a represent emissivity and absorptive power of the two bodies, then select the correct choice :



- (A) $a_A > a_B$ and $e_A < e_B$
 (B) $a_A < a_B$ and $e_A > e_B$
 (C) $a_A < a_B$ and $e_A < e_B$
 (D) $a_A > a_B$ and $e_A > e_B$
8. A calorimeter contains 100 gm of water at 40°C . The temperature falls to 35°C in 20 min. When the calorimeter contains 150 gm of water at 40° , it takes 25 min for the temperature to fall to 35°C . Water equivalent if the calorimeter is :

- (A) 50 gm (B) 100 gm
 (C) 150 gm (D) 200 gm