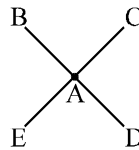
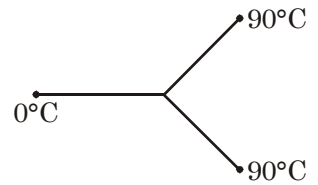


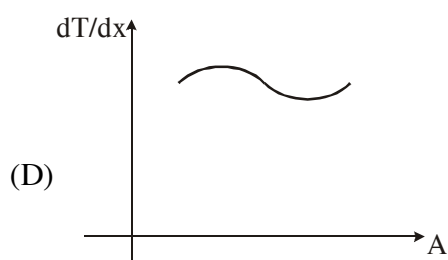
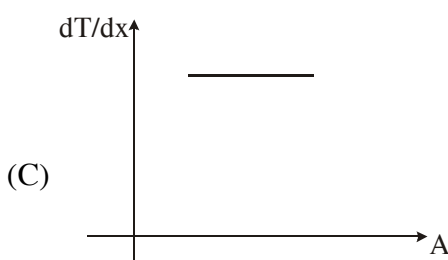
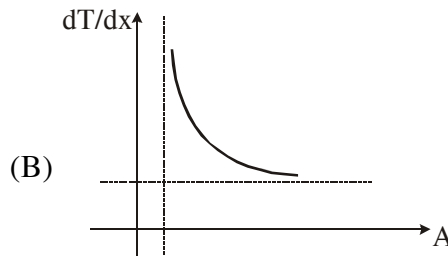
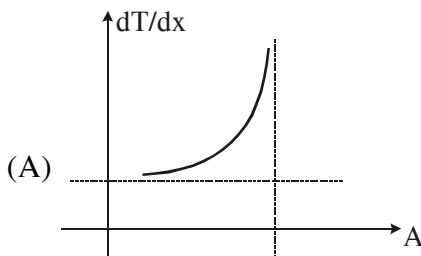
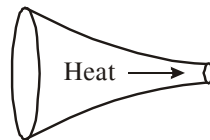
RACE # 67 (CONDUCTION)

PHYSICS

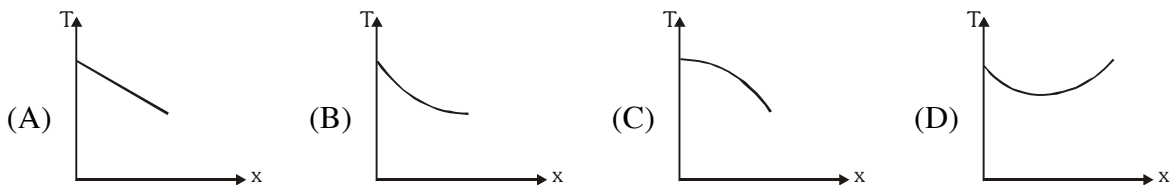
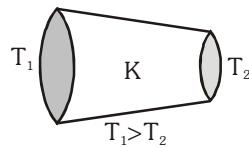
- Two plates of equal areas are placed in contact with each other. Their thickness are 2.0 cm and 5.0 cm respectively. The temperature of the external surface of the first plate is maintained at -20°C and that of the external surface of the second plate is maintained at 20°C . What will be the temperature of the contact surface in steady state if the plates have thermal conductivities in the ratio 2 : 5.
(A) 0°C (B) 4°C (C) $420/29^{\circ}\text{C}$ (D) -4°C
- Two rods of equal length and diameter but of thermal conductivities 2 unit and 3 unit respectively are joined in parallel. The thermal conductivity of a rod of geometrical dimension equal to either of the rod, which can conduct the same heat is :-
(A) 1 unit (B) 1.5 unit (C) 2.5 unit (D) 5 unit
- Three rods made of same material & having the same cross section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at 0°C & 90°C respectively. The temperature of the junction of the three rods will be :
(A) 45°C (B) 60°C
(C) 30°C (D) 20°C
- 4 similar rods which are thermally insulated are joined at point A. If heat flows in from point B at rate of 1W and from point C at 3W inside, flows out from D at 5W, which relation is correct for temperatures of these points?



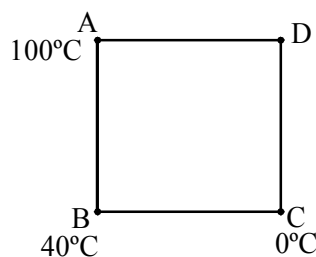
- (A) $T_A = T_E$ (B) $T_B = T_C$ (C) $T_C = T_D$ (D) $T_B = T_E$
- An irregular rod of same uniform material as shown in figure is conducting heat at a steady rate. The temperature gradient at various sections versus area of cross section graph will be



6. Two identical blocks of metal are at 20°C and 80°C respectively. The specific heat of the material of the two blocks increases with temperature. Which of the following is true about the final temperature T_f when the two blocks are brought into contact (Assuming that no heat is lost to the surrounding) :-
- (A) T_f will be 50°C
 (B) T_f will be more than 50°C
 (C) T_f will be less than 50°C
 (D) T_f can be either more than or less than 50°C depending on the precise variation of the specific heat with temperature
7. If there is no heat loss in the body shown and only heat transfer due to conduction take place then which graph is most appropriate in case of steady state ($T_1 > T_2$). (Given : Thermal conductivity $K = \text{constant}$)

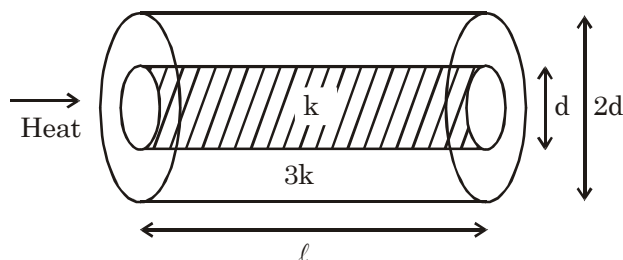


8. A brass boiler has a base area of 0.15 m^2 and thickness 1.0 cm . It boils water at the rate of 6.0 kg/min when placed on a gas stove. The temperature (approximately) of the part of the flame in contact with the boiler is (Thermal conductivity of brass = $107.4\text{ Js}^{-1}\text{ m}^{-1}\text{C}^{-1}$, Heat of vaporization of water = $2256 \times 10^3\text{ J}\cdot\text{kg}^{-1}$)
- (A) 2400 K (B) 240°C (C) 2400°C (D) 24000°C
9. Four conducting rods are joined to make a square. All rods are identical and ends A, B and C are maintained at given temperatures. Choose **INCORRECT** statement for given arrangement in steady state. (value of $\frac{KA}{L}$ is $1\frac{\text{J}}{\text{S}^\circ\text{C}}$, symbols have their usual meaning).

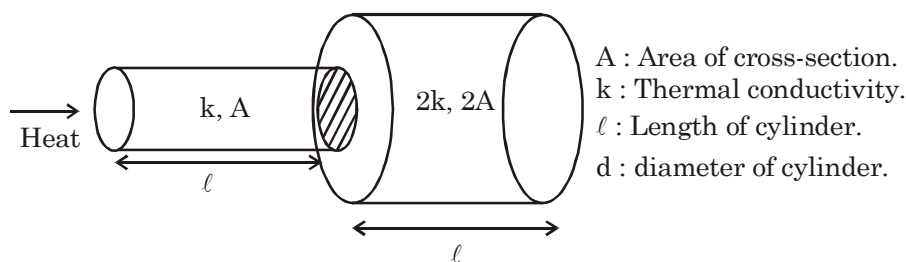


- (A) Heat current in AB is equal to 1.5 times of heat current in BC.
 (B) Temperature of end D is 50°C .
 (C) Heat current in AB is equal to heat current in BC.
 (D) Heat current withdrawn at end B is $20\frac{\text{J}}{\text{S}}$.
10. A cuboidal slab has square faces of area A and a width d . Across the square faces a temperature of T is maintained. The conductivity of the material varies linearly with the distance from each face from K to $2K$ at the middle. The rate of heat flow is
- (A) $\frac{KAT}{d \ln 2}$ (B) $\frac{KAT \ln 2}{d}$ (C) $\frac{3KAT}{2d}$ (D) $\frac{3KAT}{d}$

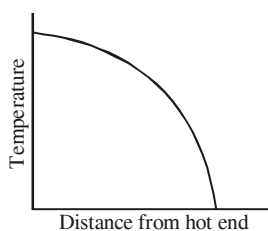
11. One end of a uniform rod is placed in boiling water and the other end in melting ice. After a long time:
(Assume temperature of boiling water and melting ice is constant)
(A) temperature of each point of rod will become same
(B) temperature of each cross-section of rod will become constant
(C) temperature difference is same for any two equidistant cross-sections
(D) temperature of mid point of the rod is simple average of temperature of ends of rod
12. Different combination of cylinder are shown in the figure. Select the correct alternatives for the thermal resistance of the following combinations :



A thin cylinder of diameter 'd' is surrounded by another cylinder.



- (A) Thermal resistance of '1' combination is $\frac{2\ell}{5k\pi d^2}$.
- (B) Thermal resistance of '2' combination is $\frac{4\ell}{5kA}$
- (C) Thermal resistance of '1' combination is $\frac{5\ell}{2k\pi d^2}$
- (D) Thermal resistance of '2' combination is $\frac{5\ell}{4kA}$
13. The ends of a long bar are maintained at different temperatures and there is no loss of heat from the sides of the bar due to conduction or radiation. The graph of temperature against distance of the bar when it has attained steady state is shown here. The graph shows

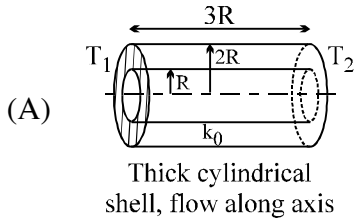


- (A) the temperature gradient is not uniform.
(B) the bar has uniform cross-sectional area
(C) the cross-sectional area of the bar increases as the distance from the hot end increases.
(D) the cross-sectional area of the bar decreases as the distance from the hot end increases

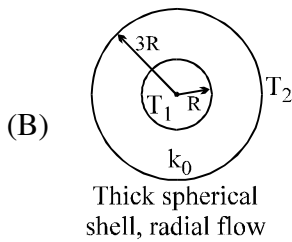
14. Entries in column I consists of diagrams of thermal conductors. The type of conductor & direction of heat flows are listed below. Entries in column II consists of the magnitude of rate of heat flow belonging to any of the entries in column I. If temperature difference in all the cases is $(T_1 - T_2)$, then match column

Column I

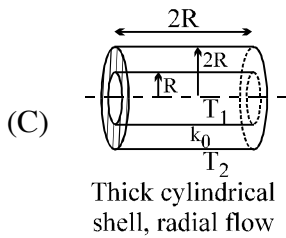
Column II



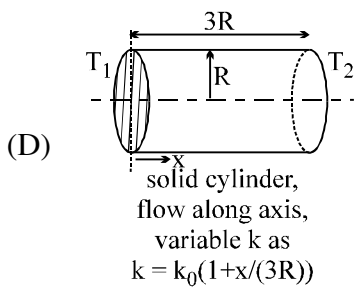
(P) $6\pi k_0 R(T_1 - T_2)$



(Q) $\frac{\pi k_0 R}{3 \ln 2}(T_1 - T_2)$



(R) $\pi k_0 R(T_1 - T_2)$



(S) $\frac{4\pi k_0 R}{\ln 2}(T_1 - T_2)$

N_Race # 67**Answer key****1. Ans. (A)****2. Ans. (D)****3. Ans. (B)****4. Ans. (D)****5. Ans. (B)****6. Ans. (B)****7. Ans. (C)****8. Ans. (B)****9. Ans. (C)****10. Ans. (A)****11. Ans. (B, C, D)****12. Ans. (A,D)****13. Ans. (A,D)****14. Ans. (A) R; (B) P ; (C) S; (D) Q**