Physicsaholics

DPP – 2

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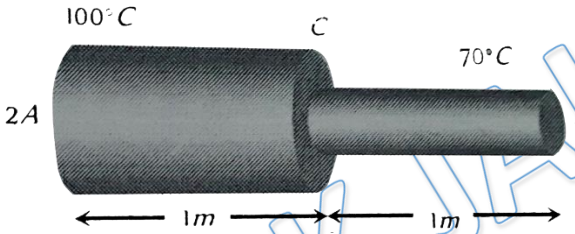
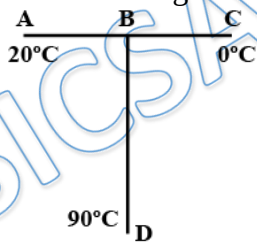
Q 1. A metal rod of length 2m has cross sectional areas 2A and A as shown in figure. The ends are maintained at temperatures 100°C and 70°C. The temperature at middle point C is



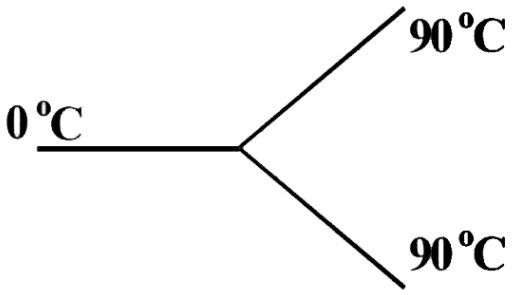
(a) 80 °C (b) 85 °C
(c) 90 °C (d) 95 °C

Q 2. Three conducting rods of same material and cross-section are connected as shown in figure. Temperatures of A, D and C are maintained at 20°C, 90°C and 0°C. If there is no flow of heat in AB, then ratio of the lengths of BC and BD is



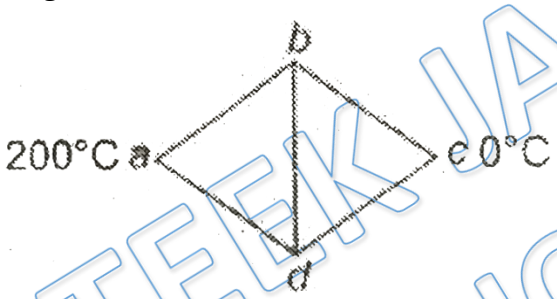
(a) 2/9 (b) 9/2
(c) 2/7 (d) 7/2

Q 3. Three rods made of the same material and 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 and 90°C respectively. The temperature of junction of the three rods will be



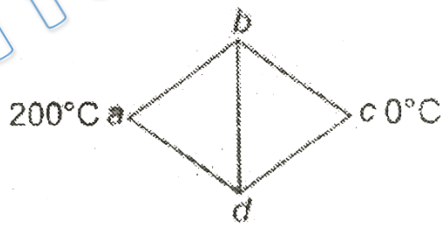
(a) 45 °C (b) 60 °C
(c) 30 °C (d) 20 °C

Q 4. Five rods of same material and same cross-section are joined as shown. Lengths of rods ab, ad and bc are l, $2l$ and $3l$ respectively. Ends a and c are maintained at temperatures 200°C and 0°C respectively. For what length x of rod dc there will be no heat flow through rod bd?



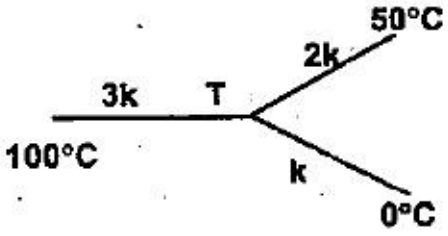
(a) $4l$ (b) $2l$
(c) $6l$ (d) $9l$

Q 5. Five rods of same material and same cross-section are joined as shown. Lengths of rods ab, ad, bc and dc are l, 2l, 3l and 6l respectively. Ends a and c are maintained at temperatures 200°C and 0°C respectively. Temperature of point b will be:



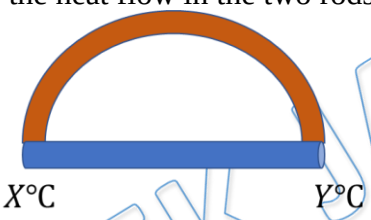
(a) 120 °C (b) 160 °C
(c) 150 °C (d) 90 °C

Q 6. Find the temperature T of the junction shown in the figure for three rods; identical in dimensions:



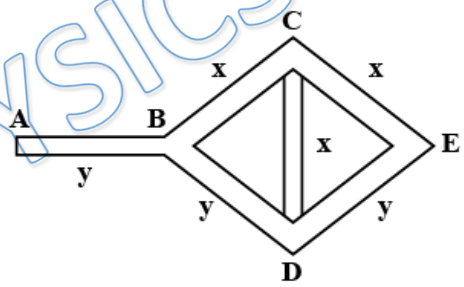
(a) $\frac{100}{3}$ °C
(b) $\frac{200}{3}$ °C
(c) 100 °C
(d) $\frac{50}{3}$ °C

Q 7. Two rods of same material and thickness are joined as shown below(one is semicircular and other is straight). The ends X and Y are maintained at X°C and Y°C respectively. The ratio of the heat flow in the two rods is –



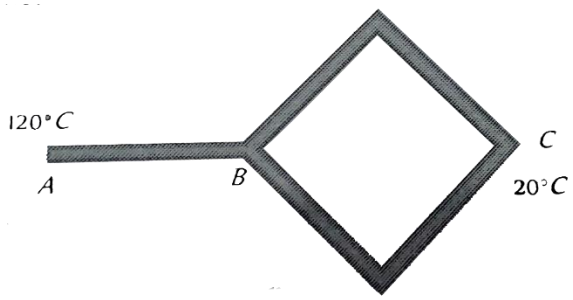
(a) 0.36
(b) 0.64
(c) 0.18
(d) 0.06

Q 8. Three rods of material x and three rods of material y are connected as shown in the figure. All rods are of identical length and cross-section. If the end A is maintained at 60°C and the junction E at 10°C, find the effective Thermal Resistance. Given the length of each rod = l, area of cross-section = A, conductivity of x = K and conductivity of y = 2K.



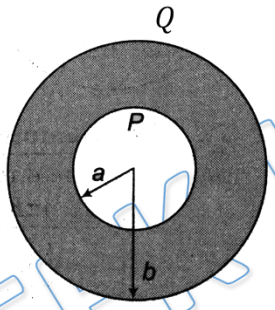
(a) $\frac{2l}{3KA}$
(b) $\frac{7l}{6KA}$
(c) $\frac{4KA}{3l}$
(d) $\frac{7KA}{3l}$

Q 9. Five identical rods are joined as shown in figure. Point A and C are maintained at temperature 120 °C and 20 °C respectively. The temperature of junction B will be



(a) 100℃ (b) 80 ℃
(c) 70 ℃ (d) 0 ℃

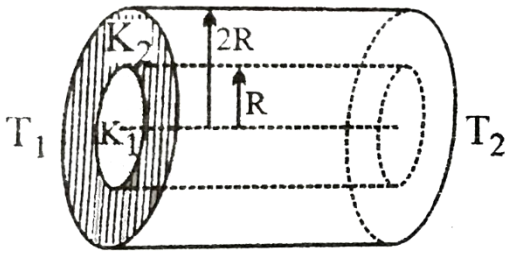
Q 10. A spherical body of radius 'b' has a concentric cavity of radius 'a' as shown. Thermal conductivity of the material is K. Find thermal resistance between inner surface P and outer surface Q.



(a) $\frac{1}{4\pi K}\left(\frac{1}{a}-\frac{1}{b}\right)$ (b) $\frac{1}{4\pi K}\left(\frac{1}{a}+\frac{1}{b}\right)$

(c) $\frac{1}{4\pi K}\left(\frac{ab}{\ln\frac{b}{a}}\right)$ (d) $\frac{1}{4\pi K}\left(\frac{\ln\frac{b}{a}}{ab}\right)$

Q 11. A composite cylinder is made of two materials having thermal conductivities K_1 and K_2 as shown. Temperature of the two flat faces of cylinder are maintained at T_1 and T_2. For what ratio $\frac{K_1}{K_2}$ the heat current throught the two materials will be same. Assume steady state and the rod is lagged (insulated from the curved surface).



(a) 1 (b) 2
(c) 3 (d) 4

Q 12. The thickness of ice in a lake is 5cm and the atmospheric temperature is -10°C. Calculate the time required for the thickness of ice to grow to 7cm. Thermal

conductivity for ice = $4 \times 10^{-3}\ cal\ cm^{-1}\ s^{-1}\ ^{\circ}C^{-1}$, density of ice = 0.92 g/cc and latent heat of fusion of ice = 80 cal/gm.

(a) 6.6 Hr (b) 3.5 Hr
(c) 1.02 Hr (d) 9.12 Hr

Q 13. Ice starts forming in lake with water at 0℃ and when the atmospheric temperature is -10℃. If the time taken for 1cm of ice be 7 hours. Find the time taken for the thickness of ice to change from 1cm to 2cm

(a) 11 hours (b) 6 hours
(c) 16 hours (d) 21 hours

Answer Key

Q.1 c	**Q.2 c**	**Q.3 b**	**Q.4 c**	**Q.5 c**
Q.6 b	**Q.7 b**	**Q.8 b**	**Q.9 c**	**Q.10 a**
Q.11 c	**Q.12 a**	**Q.13 d**		