Exercise - II (Multiple Choice Problems)

1. From a black body, radiation is not :

(A) emitted (B) absorbed

(C) reflected (D) refracted

2. In accordance with Kirchhoff's law :

(A) bad absorber is bad emitter
(B) bad absorber is good reflector

(C) bad reflector is good emitter
(D) bad emitter is good absorber

3. The energy radiated by a body depends on :

(A) area of body (B) nature of surface

(C) mass of body (D) temperature of body

4. A hollow and a solid sphere of same material and identical outer surface are heated to the same temperature :

(A) in the beginning both will emit equal amount of radiation per unit time.

(B) in the beginning both will absorb equal amount of radiation per unit time

(C) both spheres will have same rate of fall of temperature (dT/dt)

(D) both spheres will have equal temperatures at any moment.

5.The rate of cooling of a body by radiation depends on :

(A) area of body

(B) mass of body

(C) specific heat of body

(D) temperature of body and surrounding.

6. A polished metallic piece and a black painted wooden piece are kept in open in bright sun for a long time :

(A) the wooden piece will absorbs less heat than the metallic piece

(B) the wooden piece will have a lower temperature than the metallic piece

(C) if touched, the metallic piece will feel hotter than the wooden piece

(D) when the two pieces are removed from the open to a cold room, the wooden piece will lose heat at a faster rate than the metallic piece

7. An experiment is perfomed to measure the specific heat of copper. A lump of copper is heated in an oven, then dropped into a beaker of water. To calculate the specific heat of copper, the experimenter must know or measure the value of all of the quantities below EXCEPT the

(A) heat capacity of water and beaker

(B) original temperature of the copper and the water

(C) final (equilibrium) temperature of the copper and the water

(D) time taken to achieve equilibrium after the copper is dropped into the water

8. One end of a conducting rod is maintained at temperature 50ºC and at the other end, ice is melting at 0ºC. The rate of melting of ice is doubled if :

(A) the temperature is made 200ºC and the area of cross-section of the rod is doubled

(B) the temperature is made 100ºC and length of rod is made four times

(C) area of cross-section of rod is halved and length is doubled

(D) the temperature is made 100ºC and the area of cross-section of rod and length both are doubled.

9. Two metallic sphere A and B are made of same material and have got identical surface finish. The mass of sphere A is four times that of B. Both the spheres are heated to the same temperature and placed in a room having lower temperature but thermally insulated from each other.

(A) The ratio of heat loss of A to that of B is $2^{4/3}$

(B) The ratio of heat loss of A to that of B is $2^{2/3}$

(C) The ratio of the initial rate of cooling of A to that of B is $2^{-2/3}$

(D) The ratio of the initial rate of cooling of A to that of B is $2^{-4/3}$

10. Two bodies A and B have thermal emissivities of 0.01 and 0.81 respectively. The outer surface areas of the two bodies are the same. The two bodies radiate energy at the same rate. The wavelength λ_B, corresponding to the maximum spectral radiancy in the radiation from B, is shifted from the wavelength corresponding to the maximum spectral radiancy in the radiation from A by 1.00 μm. If the temperature of A is 5802 K,

(A) the temperature of B is 1934 K

(B) $\lambda_B = 1.5\ \mu m$

(C) the temperature of B is 11604 K

(D) the temperature of B is 2901 K

11. Three bodies A, B and C have equal surface area and thermal emissivities in the ratio $e_A : e_B : e_C = 1 : \frac{1}{2} : \frac{1}{4}$. All the three bodies are radiating at same rate. Their wavelengths corresponding to maximum intensity are λ_A, λ_B and λ_C respectively and their temperature are T_A, T_B and T_C on kelvin scale, then select the incorrect statement.

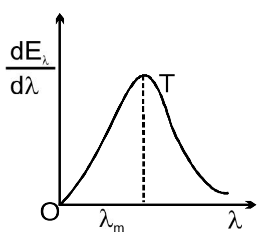
(A) $\sqrt{T_A T_C} = T_B$ (B) $\sqrt{\lambda_A \lambda_C} = \lambda_B$

(C) $\sqrt{e_A T_A}\ \sqrt{e_C T_C} = e_B T_B$

(D) $\sqrt{e_A \lambda_A T_A . e_B \lambda_B T_B} = e_C \lambda_C T_C$

Question No. 12 to 14 (3 questions)

The figure shows a radiant energy spectrum graph for a black body at a temperature T.



12. Choose the correct statement(s)

(A) The radiant energy is not equally distributed among all the possible wavelengths

(B) For a particular wavelength the spectral intensity is maximum

(C) The area under the curve is equal to the total rate at which heat is radiated by the body at that temperature

(D) None of these

13. If the temperature of the body is raised to a higher temperature T,' then choose the correct statement(s)

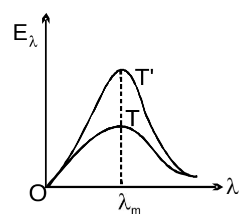
(A) The intensity of radiation for every wavelength increases

(B) The maximum intensity occurs at a shorter wavelength

(C) The area under the graph increases

(D) The area under the graph is proportional to the fourth power of temperature

14. Identify the graph which correctly represents the spectral intensity versus wavelength graph at two temperatures T′ and T(T < T′)

(A)


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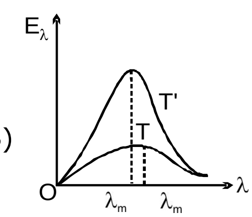

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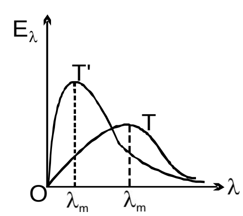

(D) none of these