### DPP 02

Q.1 Assuming the sun to be a spherical body of radius R at a temperature of TK, evaluate the total radiant power, incident on earth, at a distance r from the sun.

(A) $\dfrac{R^2 \sigma T^4}{r^2}$ 　　　　(B) $\dfrac{4\pi r_0^2 R^2 \sigma T^4}{r^2}$ 　　　　(C) $\dfrac{\pi r_0^2 R^2 \sigma T^4}{r^2}$ 　　　　(D) $\dfrac{r_0^2 R^2 \sigma T^4}{4\pi r^2}$

where r_0 is the radius of the earth and σ is Stefan's constant.

Q.2 The figure shows a system of two concentric spheres of radii r_1 and r_2 and kept at temperatures T_1 and T_2, respectively. The radial rate of flow of heat in a substance between the two concentric spheres is proportional to
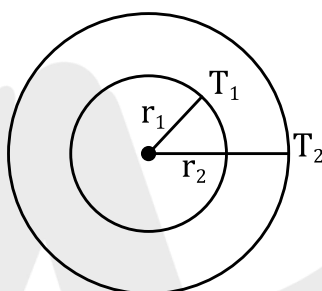
(A) $\dfrac{r_1 r_2}{(r_2 - r_1)}$ 　　　　(B) $(r_2 - r_1)$ 　　　　(C) $\dfrac{(r_2 - r_1)}{r_1 r_2}$ 　　　　(D) $\ln\left(\dfrac{r_2}{r_1}\right)$

Q.3 A spherical body of area A and emissivity $e = 0.6$ is kept inside a perfectly black body. Energy radiated per second by the body at temperature T is

(A) $0.4\sigma AT^4$ 　　　　(B) $0.8\sigma AT^4$ 　　　　(C) $0.6\sigma AT^4$ 　　　　(D) $1.0\sigma AT^4$.

Q.4 In which of the following processes, convection does not take place primarily?

(A) sea and land breeze 　　　　　　(B) boiling of water

(C) heating air around a furance 　　　(D) warming of glass of bulb due to filament.

Q.5 Variation of radiant energy emitted by sun, filament of tungsten lamp and welding arc as a function of its wavelength is shown in figure.
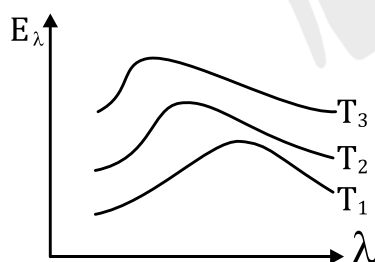
Which of the following option is the correct match?

(A) Sun- T_3, tungsten filament- T_1, welding arc $- T_2$

(B) Sun- T_2, tungsten filament $-T_1$, welding arc $-T_3$

(C) Sun- T_3, tungsten filament $-T_2$, welding arc $-T_1$

(D) Sun- T_1, tungsten filament $-T_2$, welding arc $- T_3$.

Q.6 If the temperature of the sun were to increase from T to 2T and its radius from R to 2R, then the ratio of the radiant energy received on earth to what it was previously will be

(A) 4   (B) 16   (C) 32   (D) 64

Q.7 Three discs A, B and C having radii 2,4 , and 6 cm respectively are coated with carbon black. Wavelengths for maximum intensity for the three discs are 300,400 and 500 nm respectively. If Q_A, Q_B and Q_C are powers emitted by A, B and C respectively, then

(A) Q_A will be maximum   (B) Q_B will be maximum

(C) Q_C will be maximum   (D) $Q_A = Q_B = Q_C$

Q.8 According to Newton's law of cooling, the rate of cooling of a body is proportional to $(\Delta\theta)^n$, where $\Delta\theta$ is the difference of the temperature of the body and the surroundings, and n is equal to

(A) two   (B) three   (C) four   (D) one

Q.9 The earth radiates in the infra-red region of the spectrum. The wavelength of the maximum intensity of the spectrum is correctly given by

(A) Rayleigh Jeans law   (B) Planck's law of radiation

(C) Stefan's law of radiation   (D) Wien's law

Q.10 The graph, shown in the adjacent diagram, represents the variation of temperature (T) of two bodies, x and y having same surface area, with time (t) due to the emission of radiation.
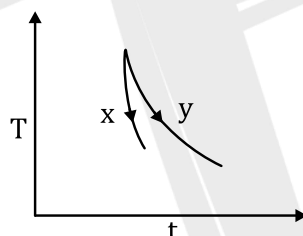
Find the correct relation between the emissivity and absorptivity powers of the two bodies

(A) $E_x > E_y$ and $a_x < a_y$ (B) $E_x < E_y$ and $a_x > a_y$

(C) $E_x > E_y$ and $a_x > a_y$ (D) $E_x < E_y$ and $a_x < a_y$

Q.11 Two spheres of the same material have radii 1 m and 4 m and temperatures 4000 K and 2000 K respectively. The ratio of the energy radiated per second by the first sphere to that by the second is

(A) 1 : 1   (B) 16 : 1   (C) 4 : 1   (D) 1 : 9

Q.12 Which of the following is more close to a black body?

(A) Black board paint   (B) Green leaves

(C) Black holes   (D) Red roses

ANSWER KEY

1.	(C)	2.	(A)	3.	(C)	4.	(D)	5.	(A)	6.	(D)	7.	(B)
8.	(D)	9.	(D)	10.	(C)	11.	(A)	12.	(A)				