# EXERCISE – II MULTIPLE CHOICE QUESTIONS

**1. C,D**
Not Reflected and Not Refracted.

**2. A,B,C**
Good Absorbers are good emitters.

**3. A,B,D**

$\frac{dQ}{dt} = e\,A\,\sigma T^4$ So, $\frac{dQ}{dt} \propto A$

$\propto e$ (nature of surface)
$\propto T$ (temprature)
But independent of mass.

**4. A,B**

**(A)** $\frac{dQ}{dt} = e\,A\,\sigma T^4$
(Rate of emission is same initially)

**(B)** $\frac{dQ_a}{dt} = e\,A\,\sigma T_0^4$
(Rate of obsorption is same always)

**(C)** $\frac{-dT}{dt} = \frac{eA\sigma(T^4 - T_0^4)}{ms}$
(Due to lesser mass of hollow sphere it cools fast.) (wrong)

**(D)** Since hollow sphere cools fast ; hollow will have smaller temperature at any moment.(wrong)

**5. A,B,C,D**

$\left(-\frac{dT}{dt}\right) = \frac{eA\sigma}{mc}\left(T^4 - T_0^4\right)$

**6. C,D**
**(A)** Heat absorption is surface phenomena hence wooden (Black surface) absorbs more.(wrong)
**(B)** After long time both will have temperature of surroundings.(wrong)
**(C)** Because metal is better conductor it feels hotter.
**(D)** Because emission depend on surface (i.e. more for black surface)

**7. D**
Loss(copper) = gain (water + beaker)
$m_{CH}s_{CH}(T_{CH}-T) = m_W s_W (T-T_W) + m_b s_b (T-T_W)$
Hence final temperature T can be calculated.
Naturally all variables are regd. except time taken.

**8. D**
Rate of melting is doubled if Rate of heat flow is doubled and Rate $\frac{dQ}{dt} = \frac{KA(T-0)}{\ell}$
in (D) T is doubled (50 to 100°C)
and area and length are also doubled hence $\frac{dQ}{dt}$ doubles.

**9. AC**

$m_A = 4m_B$, $\rho \times \frac{4}{3}\pi r_A^3 = \rho \times \frac{4}{3}\pi r_B^3 \times 4$

$\Rightarrow \frac{r_A}{r_B} = 4^{1/3} = 2^{2/3}$

Rate of heat loss $= \frac{dQ}{dt} = eA\sigma(T^4 - T_0^4)$

Ratio $\frac{(dQ/dt)_A}{(dQ/dt)_B} = \frac{A_A}{A_B} = \left(\frac{r_A}{r_B}\right)^2 = 2^{4/3}$

Rate of cooling $\frac{-dT}{dt} = \frac{dQ/dt}{ms}$

Ratio $\frac{(-dT/dt)_A}{(-dT/dt)_B}$

$= \frac{(dQ/dt)_A}{(dQ/dt)_B} \times \frac{m_B}{m_A}$, $= 2^{4/3} \times \frac{1}{4} = 2^{-2/3}$

**10. A,B**

$\frac{dQ}{dt} = eA\sigma T^4 = \text{same}$
$\Rightarrow e_A T_A^4 = e_B T_B^4$
$\Rightarrow 0.01 \times (5802)^4 = 0.81 \times (T_B)^4$
$\Rightarrow T_B = 1934$ K
$\lambda_A T_A = \lambda_B T_B$

$\Rightarrow \frac{\lambda_B}{\lambda_A} = \frac{T_A}{T_B} = \frac{5802}{1934} = 3$

$\lambda_B - \lambda_A = 1\ \mu m$

$\Rightarrow \lambda_B - \frac{\lambda_B}{3} = 1$ $\Rightarrow \lambda_B = 1.5\ \mu m$.

**11. D**

$e_A : e_B : e_C = 1 : \frac{1}{2} : \frac{1}{4}$

Rate of emission : $\frac{dQ}{dt} = eA\sigma T^4$ is same
So, $eT^4$ is same

$\Rightarrow T_A^4 : T_B^4 : T_C^4 = \frac{1}{e_A} : \frac{1}{e_B} : \frac{1}{e_C}$
= 1 : 2 : 4
as $\lambda T = b$ = constant

So, $\lambda_A^4 : \lambda_B^4 : \lambda_C^4 = \frac{1}{T_A^4} : \frac{1}{T_B^4} : \frac{1}{T_C^4}$

$= 1 : \frac{1}{2} : \frac{1}{4}$
Now solve yourself

**12. A,B**
**(A)** emitted energy is very less for longer and shorter wavelength
**(B)** From fig. at $\lambda_m$ intensity is maximum
**(C)** Area under the curve shows amount of energy emitted.

**13. A,B,C,D**
When T↑ curve shifts towards shorter wavelength
hence curve spreads i.e. Area increases.

**14. B**

$\lambda_m \propto \frac{1}{T}$, T' > T So, option B is correct.