Thermal Properties of Matter

1. **Assertion (A):** As the temperature of the blackbody increases, the wavelength at which the spectral intensity (E_λ) is maximum decreases.
Reason (R): The wavelength at which the spectral intensity will be maximum for a black body is proportional to the fourth power of its absolute temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** Two metallic spheres of same size, one of copper and the other of aluminium, heated to the same temperature, will cool at the same rate when they are suspended in the same enclosure.
Reason (R): The rate of cooling of a body depends only on the excess of temperature of the body over the surroundings.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. **Assertion (A):** Colour of a glowing black body changes on increasing its temperature.
Reason (R): Spectral emissive power associated with each wavelength does not increase in same proportion on increasing temperature of the Black Body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

4. **Assertion (A):** Specific heat capacity of a substance in cal/g°C is greater than its specific heat capacity in cal/g°F.
Reason (R): Magnitude (temperature difference) of 1°C is greater than the magnitude of 1°F.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5. **Assertion (A):** Water is considered unsuitable for use in thermometers.
Reason (R): Thermal Expansion of water is non-uniform.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** The temperature of a metallic rod is raised by a temperature Δt so that its length becomes double. The value of α (coefficient of linear expansion) is given by $\frac{\log_e(2)}{\Delta t}$.
Reason (R): Coefficient of linear expansion is defined as $\frac{1}{\ell}\frac{d\ell}{dt}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** Liquids usually expand more than solids.
Reason (R): The intermolecular forces in liquids are weaker than in solids.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Temperature of a rod is increased and again cooled to same initial temperature then its final length is equal to original length.
Reason (R): For a small temperature change, length of a rod varies as $\ell = \ell_0(1+\alpha\Delta T)$ provided $\alpha\Delta T << 1$. Here symbol have their usual meaning.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** When you touch two bodies, the body which is felt warmer must be of higher temperature than the other one.
Reason (R): The heat flows from lower temperature to higher temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** High thermal conductivity of metals is due to presence of free electrons.
Reason (R): Electrons at same temperature have very high average velocity than atoms.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. A solid sphere of copper of radius R and a hollow sphere of the same material of inner radius r and outer radius R are heated to the same temperature and allowed to cool in the same environment.
Assertion (A): Hollow sphere cools faster than solid sphere.
Reason (R): $\left(-\frac{d\theta}{dt}\right) \propto \frac{1}{m}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** A sphere, a cube and a thin circular plate made of same material and of same mass are initially heated to 200°C, the plate will cool at fastest rate.
Reason (R): Rate of cooling = $\frac{\rho A\sigma}{ms}(T^4 - T_0^4) \propto$ surface area. Surface area is maximum for circular plate.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** A body is emitting primarily red light. As the temperature of body is increased it may emit primarily yellow light.
Reason (R): Rate of radiation emitted by a body increases as the temperature increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** A hot iron bar placed under a running tap loses heat by convection.
Reason (R): Convection involves flow of matter within a fluid due to unequal temperature of its parts.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** A temperature change which increases the length of a steel rod by 1% will increase its volume by 3%.
Reason (R): The coefficient of volume expansion is nearly three times the coefficient of linear expansion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Latent heat of vaporization is more than the latent heat of fusion.
Reason (R): When a substance gets converted from liquid to vapour, there is large increase in volume. Hence more amount of heat is required.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** The coefficients of expansion are not constant for a given solid. Their values depend on the temperature range in which they are measured
Reason (R): Values of α, β, γ are independent of the of length, area and volume respectively.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** All substances expand on increasing the temperature.
Reason (R): Energy of molecules may decrease on increasing the temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** Radiation of longer wavelengths are predominant at lower temperature.
Reason (R): When a body is heated, only radiation of wavelength corresponding to infrared waves are emitted.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** If two bodies are in thermal equilibrium in one frame, they will be in thermal equilibrium in all frames.
Reason (R): The transfer of energy from a hot body to a cold body is a non-mechanical process.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** Specific heat of substance is property of material.
Reason (R): Specific heat also depends on the condition of the experiment. The way in which heat is supplied to the body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** When hot water is suddenly poured in cold beaker of thick glass, the beaker cracks.
Reason (R): Glass is bad conductor of heat and outer surface of the beaker does not expand.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** Ice is placed at top of the bucket to cold the water.
Reason (R): Heat transfer by convection takes place in upward direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Snow is better insulator than ice.
Reason (R): Snow contain air packet and air is bad conductor of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Specific heat for melting Ice is infinite.
Reason (R): In isothermal process specific heat of substance is infinite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** For small temperature difference between body and surrounding, the rate of cooling directly proportional to the difference in temperature, known as Newton's law of cooling.
Reason (R): Newton's law of cooling is valid for heat transfer by radiation mode only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** Two bodies at different temperatures, if brought in contact do not necessary settle to the mean temperature.
Reason (R): The two bodies may have different thermal capacities.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** During phase change temperature of the substance remains constant.
Reason (R): Internal energy of the substance during change of phase remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** The land surfaces get heated and cooled quickly compared to oceans.
Reason (R): Land surfaces are practically opaque to solar radiation and only few inches of the ground is affected.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Woolen clothes keep the body warm in winter.
Reason (R): Woolen fibres enclose a large amount of air in them & both air and wool are the bad conductors of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

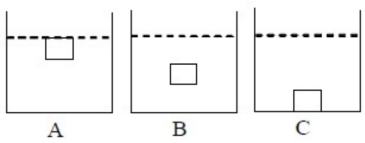
31. **Assertion (A):** Salt is mixed with ice in an ice-cream box.
Reason (R): Salt lowers the temperature of ice.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** An ice skater can slide over ice smoothly if the skate blades are sharp.
Reason (R): Melting point of ice decreases with increase in pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** On the sea shore, cool breeze flows in the evening.
Reason (R): Convection currents are set up from sea to the land since land cools slower than water.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** Two thin blankets put together are less warmer than a single blanket of double the thickness.
Reason (R): Thickness increases because of vacuum layer enclosed between the two blankets.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** Water in a container is to be cooled by putting an ice cube in it. Water will get cooled fastest in case 'A'.



Reason (R): Water is cooled mostly through convection currents and it is highest in case A.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** Density of humid air is less then density of dry air at the same temperature and pressure.
Reason (R): Mass of humid air is more than mass of dry air.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** Temperature near the sea-coast are moderate.
Reason (R): Water has a high thermal conductivity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** Bodies radiate heat at all temperature.
Reason (R): Rate of radiation of heat is proportional to the fourth power of absolute temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** For an ideal black body, both absorption coefficient and reflection coefficient are one.
Reason (R): Perfect absorbers are perfect reflectors.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** Heat radiations and light have identical properties.
Reason (R): A cold body does not radiate heat to the hotter surroundings.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** A body with large reflectivity is a poor emitter of heat radiations.
Reason (R): A body with large reflectivity is a poor absorber of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** If temperature of any body is increased by 10%, then there will be 40% increase in amount of radiation from its surface.
Reason (R): Equation $\frac{\Delta E}{E} = 4\frac{\Delta T}{T}$ also the for large percentage increase where $E \propto T^4$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** A hot body is kept in surrounding. As it cools, its temperature falls from 80°C to 78°C in a time duration t_1 and from 50°C to 48°C in time duration t_2. The temperature of surrounding is constant 20°C, then $t_1 > t_2$.
Reason (R): According to Newton's law of cooling, rate of cooling depends only on the difference of temperature of the body and the surrounding.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

44. **Assertion (A):** Most of the heat transfer that is taking place on earth is by convection.
Reason (R): Mostly heat radiation from sun are obtained in infrared region.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

45. **Assertion (A):** Conduction usually takes place in solids, convection in liquids and gases and no medium is required for radiation.
Reason (R): In conduction and convection, heat is transferred from one place to other by actual motion of heated material.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** The equivalent thermal conductivity of two plates of same thickness in contact (series) is less than the smaller value of thermal conductivity.
Reason (R): For two plates of equal thickness in contact (series), the equivalent thermal conductivity is given by $\frac{1}{K} = \frac{1}{K_1} + \frac{1}{K_2}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** The amount of radiation from sun's surface varies as the fourth power of its absolute temperature.
Reason (R): The sun is a black body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** Two spheres of same material have radius r_1 and r_2 respectively and temperature 4000K and 2000K respectively. The energy radiated per second by first sphere is more than second sphere.
Reason (R): In thermal conduction, energy is transferred by transference of particles of conducting body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

49. **Assertion (A):** When temperature difference across the two sides of a wall is increased, its thermal conductivity increases.
Reason (R): Thermal conductivity depends upon the temperature difference across the two sides of a wall.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

50. **Assertion (A):** Specific heat of a body may be greater than its thermal capacity.
Reason (R): Mass of a body may be less than unity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

51. **Assertion (A):** Melting of solid causes no change in internal kinetic energy.
Reason (R): Latent heat is the heat required to melt a unit mass of solid.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

52. **Assertion (A):** If one gram of ice at 0°C is mixed with one gram of water at 80°C, then the final temperature of mixture will be 0°C.
Reason (R): Latent heat of ice is 540 cal/g.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

53. **Assertion (A):** Water can be made to boil without heating.
Reason (R): Boiling point of water is lowered by decreasing pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

54. **Assertion (A):** When a hot liquid is mixed with a cold liquid, the temperature of the mixer is undefined for some time and then becomes nearly constant.
Reason (R): If two bodies at different temperature are mixed in a calorimeter, the total energy of the two bodies remains conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

55. **Assertion (A):** A bottle is filled with water at 40°C on opening it at moon, water will boil.
Reason (R): Atmospheric pressure on the surface of moon is zero and boiling point is proportional to pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

56. **Assertion:** The expanded length ℓ of a rod of original length ℓ_0 is not correctly given by (assuming α to be constant with T)
$\ell = \ell_0 (1 + \alpha \Delta T)$, if $\alpha \Delta T$ is large.
Reason: It is given by $\ell = \ell_0 e^{\alpha \Delta T}$, which cannot be treated as being approximately equal to $\ell_0 (1 + \alpha \Delta T)$ for large value of $\alpha \Delta T$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

ANSWER KEY																				
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	3	4	2	1	1	1	1	2	4	3	1	1	2	4	1	1	2	4	3	1
Que.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans.	2	1	4	1	1	3	1	3	1	1	1	1	3	4	1	3	3	1	4	3
Que.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**				
Ans.	1	4	4	2	3	4	1	4	4	1	2	3	1	2	1	1				