IITIAN'S SPECTRUM
Prudent Minds, Promising Path
IIT JEE/NEET FOUNDATION
Founder-Director
Er. Satya Prakash
B.Tech (IIT)

PHYSICS

DPS-8

DAILY PRACTICE SHEET

Class XI

Thermal Properties of Matter

INSTRUCTIONS

- DPS contains 45 topicwise questions and 5 exam section questions.
- Each question has four options out of which only one option is correct.
- Mark the correct answer in the OMR Sheet given at the end of the DPS.
- Each question carries 4 marks.
- For every incorrect answer deduct 1 mark.

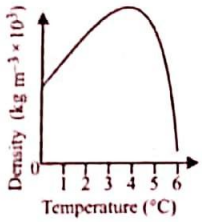
Time : 50 minutes
Marks : 200

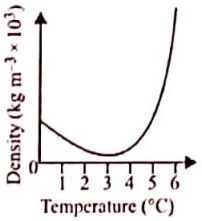
Date: .....

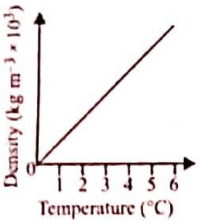
Heat and Temperature

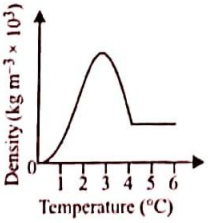
1. The reading of centigrade thermometer coincides with that of Fahrenheit thermometer in a liquid. The temperature of the liquid is
(a) – 40°C (b) 313°C (c) 0°C (d) 100°C

2. Which of the following graph shows the variation of density of water with increase in temperature?

(a) 

(b) 

(c) 

(d) 

3. The quantities of heat required to raise the temperatures of two copper spheres of radii r_1 and r_2 ($r_1 = 1.5r_2$) through 1 K are in the ratio of
(a) $\frac{27}{8}$ (b) $\frac{9}{4}$ (c) $\frac{3}{2}$ (d) 1

4. When a thermometer is taken from the melting ice to a warm liquid, the mercury level rises to $\left(\frac{2}{5}\right)^{th}$ of the distance between the lower and the upper fixed points. The temperature of liquid in K is
(a) 217.15 (b) 313.15 (c) 220 (d) 330

5. In a mercury thermometer the ice point (lower fixed point) is marked as 10° and the steam point (upper fixed point) is marked as 130°. At 40°C temperature, what will this thermometer read?
(a) 78° (b) 66° (c) 62° (d) 58°

6. Two temperature scales A and B are related by $\frac{A-42}{110} = \frac{B-72}{220}$. At which temperature two scales have the same reading?
(a) – 42° (b) – 72° (c) +12° (d) – 40°

7. For measurements of very high temperature say around 5000°C (of sun), one can use
(a) gas thermometer.
(b) platinum resistance thermometer.
(c) vapour pressure thermometer.
(d) pyrometer (Radiation thermometer).

8. A scientist proposes a new temperature scale in which the ice point is 25 X (X is the new unit of temperature) and the steam point is 305 X. The specific heat capacity of water in this new scale is (in J kg^{-1} X^{-1})
(a) 4.2×10^3 (b) 3.0×10^3 (c) 1.2×10^3 (d) 1.5×10^3

9. A 10 kW drilling machine is used to drill a bore in a small aluminium block of mass 8 kg. Find the rise in temperature of the block in 2.5 minutes, assuming 50% power is used up in heating the machine itself or lost to the surroundings. (Specific heat of aluminium = 0.91 J $g^{-1}°C^{-1}$)
(a) 100 °C (b) 103 °C (c) 150 °C (d) 155 °C

10. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39°W and 239°W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39°C on the Celsius scale ?
(a) 200°W (b) 139°W (c) 78°W (d) 117°W

Thermal Expansion

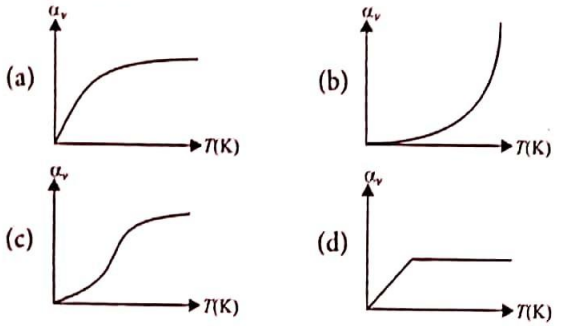
11. The value of coefficient of volume expansion of glycerine is $5 \times 10^{-4}\ K^{-1}$. The fractional change in the density of glycerine for a rise of 40°C in its temperature, is
(a) 0.025 (b) 0.010 (c) 0.015 (d) 0.020

12. Length of a wire at room temperature is 4.55 m, when the temperature increases upto 100°C then its length becomes 4.57 m. The coefficient of linear expansion (α) of the given wire is
(a) $5.021 \times 10^{-5}\ K^{-1}$ (b) $6.021 \times 10^{-5}\ K^{-1}$
(c) $7.021 \times 10^{-5}\ K^{-1}$ (d) $8.021 \times 10^{-5}\ K^{-1}$

13. When the temperature of a rod increases from t to $t + \Delta t$, its moment of inertia increases from I to $I + \Delta I$. If α be the coefficient of linear expansion of the rod, then the value of $\frac{\Delta I}{I}$ is
(a) $2\alpha\Delta t$ (b) $\alpha\Delta t$ (c) $\frac{\alpha\Delta t}{2}$ (d) $\frac{\Delta t}{\alpha}$

14. A one litre flask contains certain quantity of mercury. If the volume of air inside the flask remains the same at all temperatures then the volume of mercury in the flask is (volume expansion coefficient of mercury is 20 times that of flask)
(a) 100 cc (b) 50 cc (c) 200 cc (d) 150 cc

15. Which of the following graphs correctly shows variation of coefficient of volume expansion of copper as a function of temperature?



16. A brass wire 1.8 m long at 27°C is held taut with negligible tension between two rigid supports. Diameter of the wire is 2 mm, its coefficient of linear expansion, $\alpha_{Brass} = 2 \times 10^{-5}\ °C^{-1}$ and its Young's modulus, $Y_{Brass} = 9 \times 10^{10}\ N\ m^{-2}$. If the wire is cooled to a temperature of – 39 °C, tension developed in the wire is
(a) 2.7×10^2 N (b) 3.7×10^2 N
(c) 4.7×10^2 N (d) 5.7×10^2 N

17. The pressure that has to be applied to the ends of a steel wire of length 10 cm to keep its length constant when its temperature is raised by 100°C is
(For Steel, Young's modulus is $2 \times 10^{11}\ N\ m^{-2}$ and coefficient of thermal expansion is $1.1 \times 10^{-5}\ K^{-1}$)
(a) 2.2×10^6 Pa (b) 2.2×10^8 Pa
(c) 2.2×10^9 Pa (d) 2.2×10^7 Pa

18. Two uniform brass rods A and B of length l and $2l$ and radii $2r$ and r respectively are heated to the same temperature. The ratio of the increase in the volume of A to that of B is
(a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 1 : 4

19. If the temperature of a liquid is increased
(a) volume increases but density decreases
(b) volume decreases but density increases
(c) volume and density increase
(d) volume and density decrease

20. A thin copper wire of length L increases its length by 1% when heated from temperature T_1 to T_2. What is the percentage change in area when a thin copper plate having dimensions $2L \times L$ is heated from T_1 to T_2?
(a) 0.5% (b) 1% (c) 2% (d) 4%

Change of State

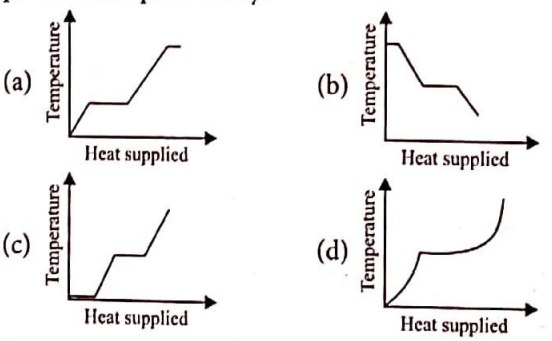
21. An experiment takes 10 minutes to raise temperature of water from 0°C to 100°C and another 55 minutes to convert it totally into steam by a stabilized heater. The latent heat of vaporization comes out to be
(a) 530 cal g^{-1} (b) 540 cal g^{-1} (c) 550 cal g^{-1} (d) 560 cal g^{-1}

22. 19 g of water at 30°C and 5 g of ice at –20°C are mixed together in a calorimeter. What is the final temperature of the mixture? Given, specific heat of ice = 0.5 cal $g^{-1}\ °C^{-1}$ and latent heat of fusion of ice = 80 cal g^{-1}.
(a) 0°C (b) –5°C (c) 5°C (d) 10°C

23. 10 g of ice at 0°C is mixed with 100 g of water at 50°C in a calorimeter. The final temperature of the mixture is [Specific heat of water = 1 cal $g^{-1}\ °C^{-1}$, latent heat of fusion of ice = 80 cal g^{-1}]
(a) 31.2°C (b) 32.8°C (c) 36.7°C (d) 38.2°C

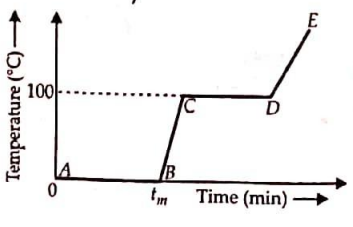
24. The change from solid state to vapour state without passing through the liquid state is called
(a) conduction (b) convection
(c) vaporisation (d) sublimation

25. A block of ice at –8°C is slowly heated and converted to steam at 100°C. Which of the following curves represents the phenomena qualitatively?



26. Two absolute scale A and B have triple points of water defined to be at 200 A and 350 B. The relation between T_A and T_B is
(a) $T_A = \frac{4}{7} T_B$ (b) $T_B = \frac{4}{7} T_A$
(c) $T_A = \frac{2}{7} T_B$ (d) $T_B = \frac{2}{7} T_A$

27. Refer to the plot of temperature versus time showing the changes in the state of ice on heating (not to scale). Which of the following is correct?



(a) AB represents ice and water are not in the thermal equilibrium.
(b) At B water starts boiling.
(c) At C all the water gets converted into steam.
(d) CD represents water and steam in equilibrium at boiling point.

28. Which of the following statements is correct?
(a) The triple point of water is 253.16 K.
(b) Burns from steam are less severe than those from boiling water.
(c) Ethyl alcohol expands less than mercury for the same rise in temperature.
(d) When fully inflated balloon is immersed in cold water, it will contract.

29. Match the following.

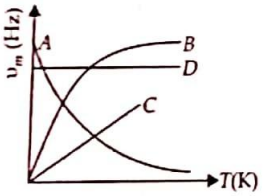
Column I	Column II
(A) Conversion of a liquid into solid is	(p) Regelation
(B) Conversion of a liquid into vapour is	(q) Sublimation
(C) Conversion of solid into vapour directly	(r) Fusion
(D) Melting of ice caused by pressure is	(s) Vaporisation

(a) A - r, B - q, C - p, D - s (b) A - r, B - s, C - q, D - p
(c) A - q, B - p, C - s, D - r (d) A - p, B - q, C - r, D - s

30. Rays from the sun are focused by a lens of diameter 5 cm on to a block of ice and 10 g of ice is melted in 20 min. Therefore the heat from the sun reaching the earth per min per square centimetre is
(Latent heat of ice $L = 80$ cal g^{-1})
(a) 2.04 cal (b) 0.51 cal
(c) 4.08 cal (d) 3.02 cal

Heat Transfer

31. Which one of the following is $\upsilon_m - T$ graph for perfectly black body? υ_m is the frequency of radiation with maximum intensity. T is the absolute temperature.



(a) A (b) B
(c) C (d) D

32. Two slabs are of the thicknesses d_1 and d_2. Their thermal conductivities are K_1 and K_2 respectively. They are in series. The free ends of the combination of these two slabs are kept at temperatures θ_1 and θ_2. Assume $\theta_1 > \theta_2$. The temperature θ of their common junction is

(a) $\dfrac{K_1\theta_1 + K_2\theta_2}{\theta_1 + \theta_2}$ (b) $\dfrac{K_1\theta_1 d_1 + K_2\theta_2 d_2}{K_1 d_2 + K_2 d_1}$

(c) $\dfrac{K_1\theta_1 d_2 + K_2\theta_2 d_1}{K_1 d_2 + K_2 d_1}$ (d) $\dfrac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$

33. Two rods of equal length and diameter have thermal conductivities 3 and 4 units respectively. If they are joined in series, the thermal conductivity of the combination would be
(a) 3.43 (b) 3.5 (c) 3.4 (d) 3.34

34. The wavelength of maximum intensity of radiation emitted by a star is 289.8 nm. The radiation intensity of the star is (Stefan's constant = 5.67×10^{-8} W m^{-2} K^{-4}, Wien's constant $b = 2898$ μm K)
(a) 5.67×10^{5} W m^{-2} (b) 5.67×10^{12} W m^{-2}
(c) 10.67×10^{7} W m^{-2} (d) 10.67×10^{14} W m^{-2}

35. Same quantity of ice is filled in each of the two metal containers P and Q having the same size, shape and wall thickness but made of different materials. The containers are kept in identical surroundings. The ice in P melts completely in time t_1, whereas that in Q takes a time t_2. The ratio of thermal conductivities of the materials of P and Q is
(a) $t_2 : t_1$ (b) $t_1 : t_2$ (c) $t_1^2 : t_2^2$ (d) $t_2^2 : t_1^2$

36. Two stars A and B radiate maximum energy at the wavelengths of 360 nm and 480 nm respectively. Then the ratio of the surface temperatures of A and B is
(a) 3 : 4 (b) 81 : 256 (c) 4 : 3 (d) 256 : 81

37. A partition wall has two layers of different materials A and B in contact with each other. They have the same thickness but the thermal conductivity of layer A is twice that of layer B. At steady state if the temperature difference across the layer B is 50 K, then the corresponding temperature difference across the layer A is
(a) 50 K (b) 12.5 K (c) 25 K (d) 60 K

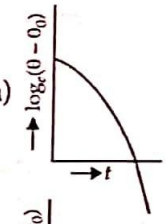
38. Two spheres of the same material have radii 1 m and 4 m and temperatures 4000 K and 2000 K respectively. The energy radiated per second by the first sphere is
(a) greater than that by the second
(b) less than that by the second
(c) equal in both cases
(d) the information is incomplete to draw any conclusion

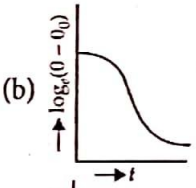
39. The rate of cooling at 600 K, if surrounding temperature is 300 K is H. The rate of cooling at 900 K is
(a) $\dfrac{16}{3}H$ (b) $2H$ (c) $3H$ (d) $\dfrac{2}{3}H$

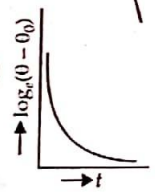
40. If the temperature of hot black body is raised by 5%, rate of heat energy radiated would be increased by how much percentage?
(a) 12% (b) 22% (c) 32% (d) 42%

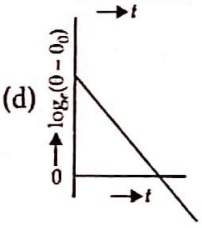
Newton's Law of Cooling

41. A liquid in a beaker has temperature $\theta(t)$ at time t and θ_0 is temperature of surroundings, then according to Newton's law of cooling the correct graph between $\log_e(\theta - \theta_0)$ and t is

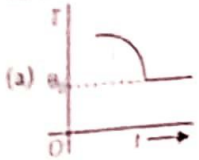
(a) 

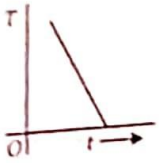
(b) 

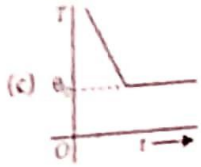
(c) 

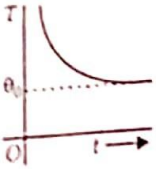
(d) 

42. If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0, the graph between the temperature T of the metal and time t will be closed to

(a) 

(b) 

(c) 

(d) 

43. The rate of loss of heat of a body is directly proportional to the difference of temperature of the body and the surroundings. This statement is known as

(a) Stefan's law (b) Newton's law of cooling

(c) Wien's law (d) Kirchoff's law

44. A hot body is allowed to cool. The surrounding temperature is constant at 30°C. The body takes time t_1 to cool from 90°C to 89°C and time t_2 to cool from 60°C to 59.5°C. Then,

(a) $t_2 = 2t_1$ (b) $t_2 = t_1/2$ (c) $t_2 = 4t_1$ (d) $t_2 = t_1$

45. A body cools from 70°C to 50°C in 5 minutes. Temperature of surroundings is 20°C. Its temperature after next 10 minutes is

(a) 25°C (b) 30°C (c) 35°C (d) 45°C

EXAM SECTION

46. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100 °C, while the other one is at 0 °C. If the two bodies are brought into contact, then, assuming no heat loss, the final common temperature is

(a) 50 °C

(b) more than 50 °C

(c) less than 50 °C but greater than 0 °C

(d) 0 °C

(NEET Phase II 2016)

47. A body cools from a temperature $3T$ to $2T$ in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be

(a) $\frac{7}{4}T$ (b) $\frac{3}{2}T$ (c) $\frac{4}{3}T$ (d) T

(NEET Phase II 2016)

48. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, $b = 2.88 \times 10^6$ nm K. Which of the following is correct?

(a) $U_1 > U_2$ (b) $U_2 > U_1$

(c) $U_1 = 0$ (d) $U_3 = 0$

(NEET Phase I 2016)

49. A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is [Latent heat of ice is 3.4×10^5 J kg^{-1} and $g = 10$ N kg^{-1}]

(a) 136 km (b) 68 km

(c) 34 km (d) 544 km

(NEET Phase I 2016)

50. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good?

(a) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (b) $\alpha_1 l_1 = \alpha_2 l_2$

(c) $\alpha_1 l_2 = \alpha_2 l_1$ (d) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

(NEET Phase I 2016)

OMR SHEET

Use HB pencil only and darken each circle completely.
Mark only one choice for each question as indicated.

Correct marking ● ⓑ ⓒ ⓓ
Wrong marking ⊗ ⓐ ◑ ⊙

1. ⓐ ⓑ ⓒ ⓓ	7. ⓐ ⓑ ⓒ ⓓ	13. ⓐ ⓑ ⓒ ⓓ	19. ⓐ ⓑ ⓒ ⓓ	25. ⓐ ⓑ ⓒ ⓓ	31. ⓐ ⓑ ⓒ ⓓ	37. ⓐ ⓑ ⓒ ⓓ	43. ⓐ ⓑ ⓒ ⓓ	49. ⓐ ⓑ ⓒ ⓓ
2. ⓐ ⓑ ⓒ ⓓ	8. ⓐ ⓑ ⓒ ⓓ	14. ⓐ ⓑ ⓒ ⓓ	20. ⓐ ⓑ ⓒ ⓓ	26. ⓐ ⓑ ⓒ ⓓ	32. ⓐ ⓑ ⓒ ⓓ	38. ⓐ ⓑ ⓒ ⓓ	44. ⓐ ⓑ ⓒ ⓓ	50. ⓐ ⓑ ⓒ ⓓ
3. ⓐ ⓑ ⓒ ⓓ	9. ⓐ ⓑ ⓒ ⓓ	15. ⓐ ⓑ ⓒ ⓓ	21. ⓐ ⓑ ⓒ ⓓ	27. ⓐ ⓑ ⓒ ⓓ	33. ⓐ ⓑ ⓒ ⓓ	39. ⓐ ⓑ ⓒ ⓓ	45. ⓐ ⓑ ⓒ ⓓ	
4. ⓐ ⓑ ⓒ ⓓ	10. ⓐ ⓑ ⓒ ⓓ	16. ⓐ ⓑ ⓒ ⓓ	22. ⓐ ⓑ ⓒ ⓓ	28. ⓐ ⓑ ⓒ ⓓ	34. ⓐ ⓑ ⓒ ⓓ	40. ⓐ ⓑ ⓒ ⓓ	46. ⓐ ⓑ ⓒ ⓓ	
5. ⓐ ⓑ ⓒ ⓓ	11. ⓐ ⓑ ⓒ ⓓ	17. ⓐ ⓑ ⓒ ⓓ	23. ⓐ ⓑ ⓒ ⓓ	29. ⓐ ⓑ ⓒ ⓓ	35. ⓐ ⓑ ⓒ ⓓ	41. ⓐ ⓑ ⓒ ⓓ	47. ⓐ ⓑ ⓒ ⓓ	
6. ⓐ ⓑ ⓒ ⓓ	12. ⓐ ⓑ ⓒ ⓓ	18. ⓐ ⓑ ⓒ ⓓ	24. ⓐ ⓑ ⓒ ⓓ	30. ⓐ ⓑ ⓒ ⓓ	36. ⓐ ⓑ ⓒ ⓓ	42. ⓐ ⓑ ⓒ ⓓ	48. ⓐ ⓑ ⓒ ⓓ	

SELF CHECK

No. of questions attempted .....

No. of questions correct .....

Marks scored in percentage .....

Check your score! If your score is

> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
90-75%	GOOD WORK !	You can score good in the final exam.
74-60%	SATISFACTORY !	You need to score more next time.
< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.