PHYSICS

BOOKS - NCERT PHYSICS (HINGLISH)

THERMAL PROPERTIES OF MATTER

Mcqs

1. A bimetallic strip made of aluminum and steel $(\alpha_{Al} > \alpha_{steel})$ on heating the strip will

A. remain straight

B. get twisted

C. will bend with aluminum on concave side

D. will bend with steel on concave side

Answer: D

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2. A uniform metallic rod rotates about its perpendicular bisector with constant angualr speed. If it is heated uniformly to raise its temperature slightly, then

A. its speed of rotation increases

B. its speed of rotation decreases

C. its speed of rotation remains same

D. its speed increases because its moment of inertia increases

Answer: B

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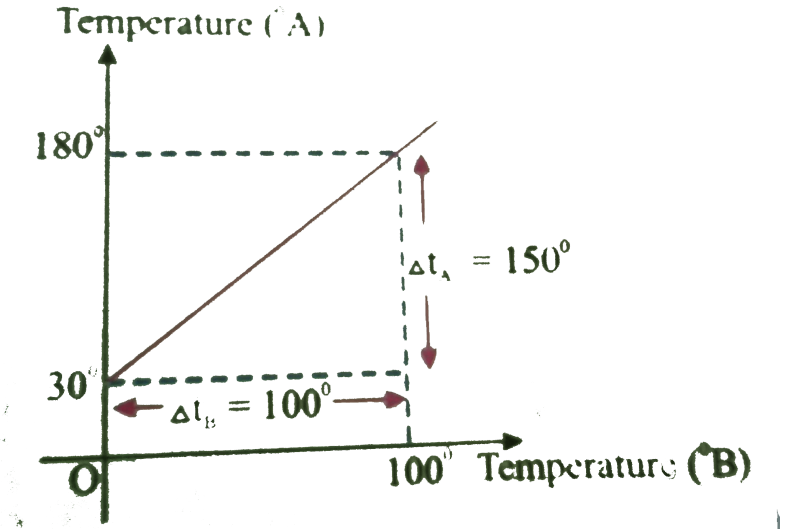
3. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions

on scales A and 100 on scale B. The relation between the temperature in two scales is given by_



A. $\frac{t_A - 180}{100} = \frac{t_B}{150}$

B. $\frac{t_A - 30}{150} = \frac{t_B}{100}$

C. $\frac{t_B - 180}{150} = \frac{t_A}{100}$

D. $\frac{t_B - 40}{100} = \frac{t_A}{180}$

Answer: B

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4. An alminium sphere is dipped into water. Which of the following is true ?

A. Buoyancy will be less in water at $0^\circ C$ than that in water at $4^\circ C$

B. Buoyancy will be more in water at $0^\circ C$ than that in water at $4^\circ C$

C. Buoyancy in water at $0^\circ C$ will be same as that in water at $4^\circ C$

D. Buoyancy may be more or less in water at $4^\circ C$ depending on the radius of the shpere.

Answer: A

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5. As the temperature is increased, the period of a pendulum

A. increases as its effective length increases even though its centre of mass still remains at the centre of the bob

B. decreases as its effective length increases even though its centre of mass still remains at the centre of the bob

C. increases as its effective increases due to shifting to centre of mass below the centre of the bob

D. decreases as its effective length remains same but the centre of mass shifts above the

centre of the bob

Answer: A

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6. Heat given to a system can be associated with

A. kinetic energy of random motion of molecules

B. kinetic energy of orderly motion of molecules

C. total kinetic energy of random and orderly motion of molecules

D. kinetic energy of random motion in some case and kinetic energy of orderly motion in other

Answer: A

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7. The radius of a metal sphere at room temperature T is R, and the coefficient of linear expansion of the metal is α. The sphere is heated a little by a temperature ΔT so that its new

temperature is $T + \Delta T$. The increase in the volume of the sphere is approximately

A. $2\pi R\alpha\Delta T$

B. $\pi R^2\alpha\Delta T$

C. $4\pi R^3\alpha\Delta T/3$

D. $4\pi R^3\alpha\Delta T$

Answer: D

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8. A sphere, a cube and a thin circular plate, all of same material and same mass are initially heated to same high temperture.

A. Plate will cool fastest and cube the slowest

B. Sphere will cool fastest and cube the slowest

C. Plate will cool fastest and sphere the lowest

D. Cube will cool fastest and plate the slowest

Answer:

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9. Mark the correct options

A. A system X is in thermal equilibrium with Y but not with Z. The systems Y and Z may be in thermal equilibrium with each other.

B. A system X is in thermal equilibrium with but not with Z. The system Y and Z are not in thermal equilibrium with each other.

C. A system X is neither in thermal equilibrium with Y nor with Z. The system Y and Z must be in thermal equilibrium with each other.

D. A system X is neither in thermal equilibrium with Y nor with Z. The system Y and Z may be in thermal equilibrium with each other.

Answer: B::D

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10. Gulab jamuns (assumed to be spherical) are to be heated in on oven They are available in two sizes, one twice bigger (in radius) than the other Pizzas (assumed to discs) are also to be heated ibn oven They are also in two sizes, one twice bigger (in

radius) than the other All four are put together to be heated option to oven temperature. Choose the correct option from the following .

A. Both size gulab jamuns will get heated in the same time

B. Smaller gulab jamuns are heated before bigger ones

C. Smaller pizzas are heated before bigger ones

D. Bigger pizzas are heated before smaller

Answer: B::C

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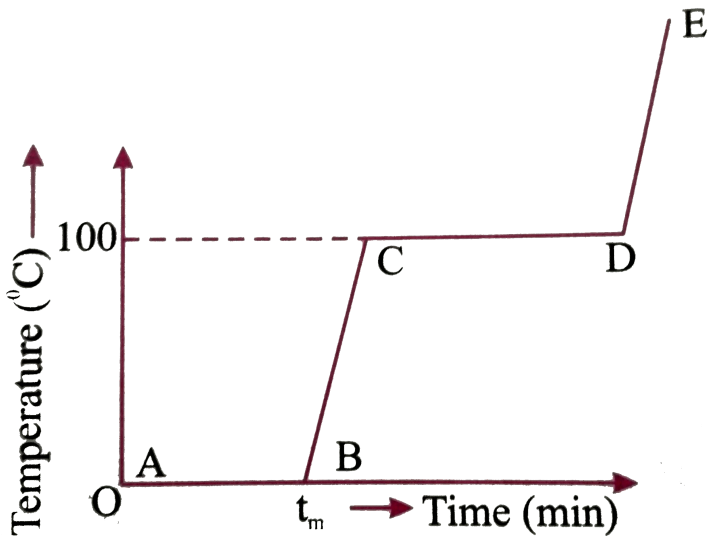
11. Refer to the plot of temperature versus time (figure) showing the changes in the state if ice on heating (not to scale). Which of the following is correct ?



A. The region AB represent ice and water in thermal equilibrium

B. At B water starts boiling

C. At C all the water gets converted into steam

D. C to D represents water and steam in equilibrium at boiling point

Answer:

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12. A glass full of hot milk is poured in the table. It begins to cool gradually.

Which of the following is incorrect?

A. The rate of cooling is constant till milk attains the temperature of the surrounding

B. The temperature of milk falls off exponentially with time

C. While colling, there is a flow of heat from milk to the surrounding as well as from surrounding to the milk but the net flow of heat is from milk to the surrounding and that is why it cools

D. All three phenomenon, conduction, convention and radiation are responsible for

the loss of heat from milk to the surroundings

Answer: B::C::D

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Very Short Answer Type Questions

1. Is the bulb of a thermoeter made of diathermic or adiabatic wall ?

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2. A student records the initial length l, change in temperature ΔT and change in length ΔT of a rod as follows

S.No.	$l(\mathrm{m})$	$\Delta T(.^{\circ} C)$	$\Delta l(m)$
1.	2	10	4×10^{-4}
2.	1	10	4×10^{-4}
3.	2	20	2×10^{-4}
4.	3	10	6×10^{-4}

If the first observation is correct, what can you say about observation 2, 3 and 4.

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3. Why does a metal bar appear hotter than a wooden bar at the same temperature? Equivalently

it also appears cooler than wooden bar if they are both colder than room temperature.

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4. Calculate the temperature which has same number value on Celsius and Fahrenheit scale.

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5. These days people use steel utensiles with copper bottom. This is supposed to be good for

uniform heating of food. Explain this effect using the fact tha copper is the better conductor.

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6. find out the increase in moment of inertia I of a uniform rod (coefficient of linear expansion α) about its perpendicular bisector when its temperature is slightly increased by ΔT.

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7. During summers in india, one of the common practice to keep cool is to make ice balls of crushed ice, dip it in flavored sugar syrup and sip it. For this a stick is inserted into crushed ice and is squeezed in the palm to make it into the ball. Equivalently in winter in those areas where it snows, people make snow balls and throw around. Explain the formation of ball out of crushed ice or snow in the light of P - T diagram of water.

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8. 100 g of water is supercooled to - $10^{\circ}C$. At this point, due to same disturbance mechanised or otherwise some of it suddenly freezes to ice. What will be the temperautre of the resultant mixture and how much mass would freeze ? $\left[s_w = 1cal/g/.^{\circ}C \text{ and } L^w_{Fusion} = 80cal/g\right]$

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9. One day in the morning, Ramesh filled up 1//3 bucket of hot water from geyser, to take bath, Remaining 2//3 was to be filled by cold water (at room temperature) to bring mixture to a

comfortable temperature. Suddenly Ramesh had to attend to something which would take some times, say 5 -10 minutes before he could take bath. Now he had two options : (i) fill the remaining bucket completely by cold water and then attend to the work, (ii) first attend to the work and fill the remaining bucket just before taking bath. Which option do you think would have kept water warmer ? Explain.

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10. We would like to perpare a scale whose length does not change with temperature. It is proposed

to prepare a unit scale f this type whose length remains, say 10 cm. We can use a bimetallic strip made of brass and iron each of different length (both components) would change in such a way that differnece between theri lenght rermain constant. If $\alpha_{iron} = 1.2 \times 10^{-5}/K$ and $\alpha_{brass} = 1.8 \times 10^{-5}/K$, what should we take as lenght of each strip ?

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11. We would like to make a vessel whose volume does not change with temperature . We can use brass and iron

$\left(\beta_{brass} = 6 \times 10^{-5} / K \text{ and } \beta_{iron} = 3.55 \times 10^{-5} / K\right)$ at create a volume of 100 c c. How do you think you can achieve this.

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12. Calculate the stress developed inside a tooth cavity filled with copper when hot tea at temperature of $57^{\circ} C$ is drunk. You can take body (tooth) temperature to be $37^{\circ} C$ and $\alpha_{Cu} = 1.7 \times 10^{-5} /^{\circ} C$ bulk modulus for copper $B_{Cu} = 140 \times 10^{9} N / m^{2}$.

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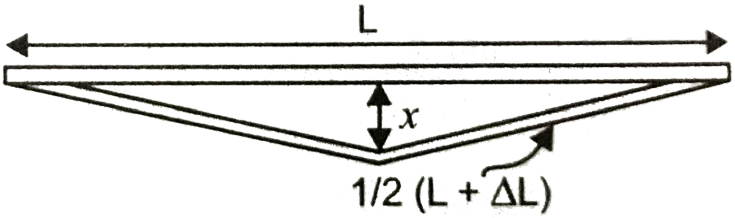
13. A rail track made of steel having length 10 m is clamped on a railway line at its two ends



on a summer day due to rise in temperature by $20^{\circ}C$, it is deformed as shown in fig. Find x (displacement of the centre) if $\alpha_{steel} = 1.2 \times 10^{-5}/^{\circ}C$.

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14. A thin rod, length L_0 at $0^\circ C$ and coefficient of linear expansion α has its two ends mintained at temperatures θ_1 and θ_2 respectively Find its new length .

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15. Ac cording to Stefan' law of radiation, a black body radiates energy σT^4 from its unit surface area every second where T is the surface temperature of the black body and $\sigma = 5.67 \times 10^{-8} W/m^2 K^4$ is known as Stefan's constant. A nuclear weapon may be thought of as a

ball of radius 0.5 m When detoneted, it reachs temperature of $10^6 K$ and can be treated as a black body. (a) Estimate the power it radiates. (b) if surrounding has water at $30^\circ C$ how much water can 10% of the energy produced evaporate in 1s ? $\left[s_w = 4186.0 J/KgK \text{ and } L_v = 22.6 \times 10^5 J/kg\right]$ (c) If all this energy U is in the form of radiation, corresponding momentum is $p = U/c$. How much momentum per unit time does it impart on unit area at a distance of 1 km ?

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