

Properties of Matter

Date Planned : __ / __ / __	CBSE PATTERN	Duration : 3 Hours
Actual Date of Attempt : __ / __ / __	Level - 0	Maximum Marks : 70

VSA: Very Short Answer Type

(1 mark)

1. Give a relation between Celsius and Kelvin scale of temperature.
2. Define deforming force.
3. What is elastic limit?
4. Define heat with its S.I Unit.
5. State Hooke's law.

SA-I: Short Answer Type - I

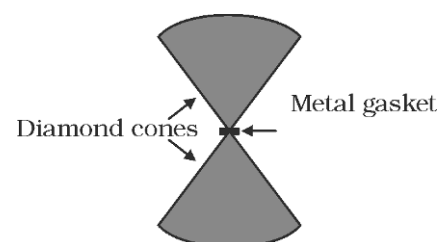
(2 marks)

6. Define the term strain and stress.
7. Explain 'elastomers' with example.
8. Explain anomalous behaviour of water. Write its effect in lakes and ponds.
9. Define triple point of a substance. Write its value of temperature and pressure for water.
10. What will happen if we keep a piece of ice at moon? Explain.
11. Explain why cooking is difficult on hills and at high altitudes.
12. Thermos bottle or Dewar flask consists of a double walled glass vessel with inner and outer walls coated with silver. Give reason.

SA-II: Short Answer Type - II

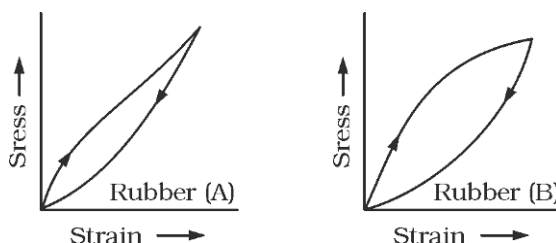
(3 marks)

13. Anvils made of single crystals of diamond, with the shape as shown in figure, are used to investigate behaviour of materials under very high pressures. Flat faces at the narrow end of the anvil have a diameter of 0.50 mm, and the wide ends are subjected to a compressional force of 50,000 N. What is the pressure at the tip of the anvil?

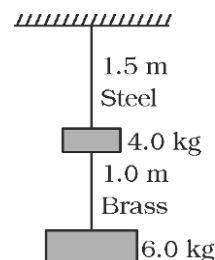


14. If an isotropic solid has coefficients of linear expansion, α_x , α_y and α_z for three mutually perpendicular directions in the solid, what is the coefficient of volume expansion for the solid?
15. A sphere of aluminium of 0.047 kg is placed for sufficient time in a vessel containing boiling water, so that the sphere is at 100°C. It is then immediately transferred to 0.14 kg copper calorimeter containing 0.25 kg of water at 20°C. The temperature of water rises and attains a steady state at 23°C. Calculate the specific heat capacity of aluminium. (Given specific heat of copper = $0.386 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$).

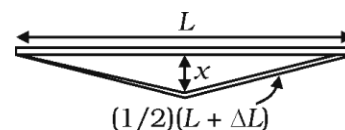
16. Three discs A, B and C having radii 2 m, 4m, and 6 m, respectively are coated with carbon black on their outer surfaces. The wavelengths corresponding to maximum intensity are 3 m, 4 m and 5 m respectively. The power radiated by them are P_A , P_B and P_C respectively. Find the ratio of powers emitted by the three discs.
17. State Newton's law of cooling and draw the graph showing cooling of hot water with temperature.
18. Two bodies of specific heats c_1 and c_2 having same heat capacities are combined to form a single composite body. What is the specific heat of the composite body?
19. (i) Give reason for using dark coloured clothes in winter and bottom of utensils used for cooking food being black.
(ii) Draw a table to compare the Kelvin, Celsius and Fahrenheit scales of temperature (steam point, ice point, absolute zero).
20. Two different types of rubber are found to have the stress-strain curves as shown in figure :



- (i) In which significant ways do these curves shown in figure differ from the stress-strain curve of a metal wire.
- (ii) A heavy machine is to be installed in a factory. To absorb vibrations of the machine, a block of rubber is placed between the machinery and the floor. Which of the two rubbers A and B would you prefer to use for this purpose? Why?
- (iii) Which of the two rubber materials would you choose for a car tyre?
21. Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in figure. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0 m. Compute the elongations of the steel and the brass wires.



22. (i) Explain why should the beams used in the construction of bridges have large depth and small breadth.
(ii) Why are girders given I shape?
23. 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°C , it is deformed as shown in figure. Find x (displacement of the centre) if coefficient of linear expansion of steel is. $\alpha_{\text{steel}} = 1.2 \times 10^{-5} \text{ } ^\circ\text{C}^{-1}$.

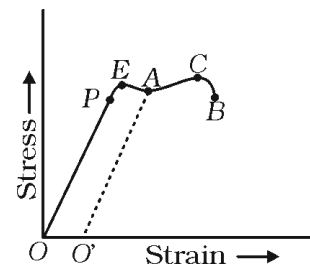


- 24.** Rekha went to her grandfather's village for vacation. She saw bullock cart got stuck in wet mud and the driver was not able to push it out by himself. Rekha ran to his help and together they pushed it out, but the iron rim of the wheel came out. They tried to put it on the wheel but it was smaller than the diameter of wheel. Suddenly she collected some wood and set them on fire and heated the rim and it slipped on the wheel.
- What nature is shown by Rekha ?
 - Name the property of solid used here ?
 - To what temperature had Rekha heated the rim so as to fit the rim of the wheel if the diameter of the rim and ring were 6.243 m and 6.231 m respectively at 27°C. [Coefficient of linear expansion $\alpha = 1.20 \times 10^{-5} K^{-1}$].

LA: Long Answer Type

(5 marks)

- 25.** The stress-strain graph for a metal wire is shown in figure up to point E, the wire returns to its original state O along the curve EPO when it is gradually unloaded. Point B corresponds to the fracture of the wire.



- Up to which point on the curve is Hooke's law obeyed? This point is sometimes called "proportionality limit".
 - Which point on the curve corresponds to yield point of the wire ?
 - Indicate the elastic and plastic regions of the stress-strain graph.
 - Describe what happens when the wire is loaded up to a stress corresponding to the point A on the graph, and then unloaded gradually. In particular, explain the dotted curve.
 - What is peculiar about the portion of the stress-strain graph from C to B? Up to what stress can the wire be subjected without causing fracture?
- 26.** According to Stefan's 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 detonated, it reaches temperature of $10^6 K$ and can be treated as a black body.
- Estimate the power it radiates.
 - If surrounding has water at 30°C, how much water can 10% of the energy produced, evaporate in 1s? [$s_w = 4186.0 J kg^{-1}$, $L_v = 22.6 \times 10^5 J kg^{-1}$]
 - 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 ?
- 27.** A bar of cross-section A is subjected to equal and opposite tensile forces at its ends. Consider a plane section of the bar whose normal makes an angle θ with the axis of the bar.
- What is the tensile stress on this plane?
 - What is the shearing stress on this plane?
 - For what value of θ is the tensile stress maximum?
 - For what value of θ is the shearing stress maximum?

