

India's Number 1 Education App

### PHYSICS

## BOOKS - CBSE COMPLEMENTARY MATERIAL PHYSICS (HINGLISH)

## **PROPERTIES OF MATTER**

Very Short Answer Questions 1 Mark

**1.** Why a spring balance does not give correct measurements when it has been used for a



**2.** Why is a spring made of steel, not of copper?

- A. Because steel is cheaper than copper
- B. Because steel is more elastic than

copper

- C. Because steel is less elastic than copper
- D. Because steel is in abundance on earth



4. How are we able to break a wire by repeated

bending?

#### A. It is an easy process

B. Repeated bending cause elastic fatigue

C. It is a wrong question.

D. None

Answer: B

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**5.** The bulk modulus for an incompresssible liquid is



8. Why is it easier to swim in sea water than in

the river water ?

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9. Railway tracks are laid on large sized

wooden, iron or cement sleepers. Why?

10. The dams of water reservoir are made thick

near the bottom. Why?

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11. It is difficult to stop bleeding from a cut in

human body at high altitude. Why?

12. The blood pressure in human is greater at

the feet than at the brain. Why?

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**13.** What is viscosity and coefficient of viscosity? What are SI units of coefficient of viscosity?

14. Machine parts are jammed in winter. Why?



**15.** The cloud's are seen floating in the sky. Why?

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16. Antiseptics have low surface tension. Why?

**17.** What are the effects of (1) temperature on the angle of contact (2) impurity on the surface tension ?

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**18.** For solids with elastic modulus of rigidity, the shearing force is proportional to shear strain. On what factor does it depend in case of fluids ?





19. How does rise in temperature effect (i)

viscosity of gases (ii) viscosity of liquids ?



20. As a result of addition of detergent to a

liquid the angle of contact .

21. Write the dimensions of coefficient of

viscosity and surface tension.



**23.** A parachute is advised to be used by a person, while jumping out of an aeroplane.



25. A molecule of a liquid which reaches the

surface from interior gains energy because

**26.** It is easy to wash clothes in hot water because its :-



### 27. Mercury does not wet glass. This is the

property of liquid known as

28. The end of a glass tube becomes round on

heating due to

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**29.** The' raincoats are made water proof by

coating with a material, which

**30.** What happens when a capillary tube of insufficient length is dipped in a liquid?

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**31.** Does it matter if one uses gauge instead of absolute pressures in applying Bernoulli's equation. Explain.

32. State Wein's displacement law for black

body radiation.

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33. State Stefan-Boltzmann law. Write the CGS

and SI units of Stefan-Boltzmann constant.

34. Name two physical changes that occur on

heating a body.





temperature.



36. Which thermometer is more sensitive a

mercury or gas thermometer ?

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37. A metal disc has a hole in it. When the disc

is heated, the size of the hole \_\_\_\_\_

38. The substance which contracts on heating

is



## **39.** A gas is free to expand what will be its specific heat ?



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

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**41.** What is the absorptive power of a perfectly

black body ?



42. At what temperature does a body stop radiating ?Watch Video Solution

**43.** If Kelvin temperature of an ideal black body is doubled, what will be the effect on energy radiated by it ?

44. In which method of heat transfer does gravity not play any part ?Watch Video Solution

**45.** Give a plot of Fahrenheit temperature versus Celsius temperature.



**46.** Why in winters birds swell their feathers?



**47.** A brass disc fits snugly in a hole in a steel plate. Should you heat or cool this system to losen the disc from the hole ? given that  $\alpha_h > \alpha_F e$ .

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Short Answer Type Questions 2 Marks

**1.** A wire of length L and area of cross section A is made of a material of Young's modulus Y. If it is stretched by an amount x, the work done is given by



2. what is meant by elastic potential energy? Deerive an expression for the elastic potential energy of streched wire. Prove that its elasic energy density is equal to  $\frac{1}{2}$  x stress x strain



**3.** Define the term bulk modulus. Give its SI unit. Give the relation between bulk modulus and compressibility.

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**4.** Define shear modulus. With the help of a diagram explain how shear modulus can be calculated.

**5.** Which one is more elastic rubber or steel? Explain.



**6.** Two wires P and Q of same diameter are loaded as shown in the figure. The length of wire P is L m and its young's modulus is Y N/ $m^2$  while length of wire Q is twice that of P and its material has young's modulus half that

of P. Compute the ratio of their elongation.





7. In an emergency, the vacuum brake is used

to stop , the high speed train. How does this

vacuume brake work?



8. Define surface tension and surface energy.

Obtain a relation between them.





# **11.** The fig (a) & (b) refer to the steady flow of a non-viscous liquid which of the two figures is

incorrect ? Why ?





12. The fig. below shows a thin liquid supporting a small weight  $4.5 imes 10^{-2}$  N. What

is the weight supported by a film of same

liquid at the same temperature in fig. (b) & (c).

Explain your answer.





**13.** Two soap bubbles of different deameters are in contact with a certain portion common to both the bubbles. What will be the shape of the common boundary as seen from inside the smaller bubble? Support your answer with a

neat diagram. Give reason for your answer.



14. During blood transfusion the needle is inserted in a vein where gauge pressure is  $p_g$ and atmospheric pressure is p. At what height must the blood container be placed so that blood may just enter the vein. Given density of blood is p. **15.** Explain why we cannot remove a filter paper from a funnel by blowing air into its narrow end.



**16.** On a hot day, a car is left in sunlight with all the windows closed. After sometimes, it is found that air inside the car is considerably warmer than the air outside. Explain why?



**17.** If a capillary tube is immersed at first in cold water and then in hot water, the height of capillary rise will be smaller in the second case. How can this be explained?



18. If a drop of water falls on a very hot iron, it

does not evaporates for a long time. Give

reason.



**20.** The coolant in a chemical or nuclear plant (i.e. the liquid used to prevent different parts of a plant from getting too hot) should have hight specific heat, comment?



**21.** A sphere, a cube and a disc made of same material and of equal masses heated to same temperature of  $200^{\circ}$  C. These bodies are then kept at same lower temperature in the surrounding, which of these will cool (i) fastest, (ii) slowest, explain.


22. Why do the pendulum clocks go slow in

summer and fast in winter?

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**23.** Why do the brake drums of a car get heated, when the car moves down a hill at a constant speed?

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**24.** The plots of intensity versus wavelength for three black bodies at temperature  $T_1, T_2$ and  $T_3$  respectively are shown.



Arrange the temperature in decreasing order.

Justify your answer



**25.** The triple point of water is a standard fixed point in modern thermometry. Why ? Why

melting point of ice or boiling point of water not used as standard fixed points.(as was originally done in celsius scale)

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### Short Answer Type Questions 3 Marks

**1.** The knowledge of elasticity useful in selecting metal ropes show its use, in cranes for lifting heavy loads, when rope of steel is used (Elastic limit  $30 \times 10^7 Nm^{-2}$ ) if load of

100000 kg is to be lifted.

What should be the radius of steel rope ? What should we do to increase flexibility of such wire ?



2. Stress-strain curve for two wires of material

A and B are as shown in Fig.



which material in more ductile ?

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**3.** Stress-strain curve for two wires of material A and B are as shown in Fig.



which material has greater value of young modulus ?

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4. Stress-strain curve for two wires of material

A and B are as shown in Fig.



### which of the two is stronger material?



5. Stress-strain curve for two wires of material

A and B are as shown in Fig.



which material is more brittle ?

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6. State Pascal's law.Give the construction and

working of Hydraulic brakes.

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7. A manometer reads the pressure of a gas in an enclosure as shown in the fig. (a) when some of the gas is removed by a pump, the manometer reads as in fig (b). The liquid used in manometer is mercury and the atmospheric pressure is 76 cm of mercury, (i) Give absolute and gauge pressure of the gas in the

enclosure for cases (a) and (b).



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8. Define Capillarity and angle of contact. Derive an expression for the ascent of a liquid in a capillary tube.

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**9.** The terminal velocity of a tiny droplet is v. N number of such identical droplets combine together forming a bigger drop. Find the terminal velocity of the bigger drop.

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**10.** Two spherical soap bubble coalesce. If  $\nu$  be the change in volume of the contained air, A is the change in total surface area then show

that 3PV + 4AT = 0 where T is the surface

tension and P is atmospheric pressure.



**11.** Give the principle of working of venturimeter. Obtain an expression for volume of liquid flowing through the tube per second.



12. A big size balloon of mass M is held stationary in air with the help of a small block of mass M/2 tied to it by a light string such that both float in mid air. Describe the motion of the balloon and the block when the string is cut. Support your answer with calcutations



**13.** Two vessels have the same base area but differnent shapes. The first vessel takes twice

the vloume of water that the second vessel requires to fill up to a paricular common height . Is the force exerted by water on the base of the vessel the same in the two case? If so, why do the vessels filled with water to that same height give different reading on a weighting scale ?

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14. A liquid drop of diameter D breaks up into27 tiny drops. Find the resulting change in

energy. Take surface tension of the liquid as  $\sigma$ 



**15.** Define the coefficients of linear expansion. Deduce relation between it and coefficient of superficial expansion and volume expansion.

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16. Two rods of different metals of coefficient

of linear expansion  $lpha_1$  and  $lpha_2$  and initial

length  $l_1$  and  $l_2$  respectively are heated to the same temperature. Find relation in  $\alpha_1, \alpha_2, l_1$ and  $l_2$ such that difference between their lengths remain constant.



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**17.** Explain why : (a) A body with large reflectivity is a poor emitter. (b) A brass tumbler feels much colder then a wooden tray on a chilly day. (c ) an optical pyrometer (for measuring high temperatures) calibrated for

an ideal black body correct value for the temperature when the same piece is in the furnace. (d) The earth without its atmosphere would be inshospitably cold. (e) Heating system based on circulation of steam are more effecient in warming a building than those based on circulation of hot water.



18. Explain why a brass tumbler feels much

colder than a wooden tray on a chilly day.



**19.** Draw a graph to show the anomalous behaviour of water. Explain its importance for sustaining life under water.

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**20.** A brass wire 1.8m long at  $27^{\circ}C$  is held taut with little tension between two rigid supports. If the wire cooled to a temperature of  $-39^{\circ}C$ , what is the tension developed in the wire, if its diameter is 2.0mm? Coefficient

of linear expansion of brass

 $=2.0 imes10^{\,-5}\,/^{\,\circ}\,C$ , Young's modulus of brass

 $= 0.91 imes 10^{11} Pa.$ 

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**21.** Define (i) Specific heat capacity (ii) Heat capacity (iii) Molar specific heat capacity at constant pressure and at constant volume and write their units.



**22.** What is latent heat ? Give its units. With the help of a suitable graph, explain the terms latent heat of fusion and latent heat of vaporisation.

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**23.** State and explains the three modes of transfer of heat. Explains how the loss of heat due to these three modes is minimised in a thermos flask.

24. Define coefficient of thermal conductivity. Two metal slabs of same area of cross-section, thickness  $d_1$  and  $d_2$  having thermal conductivities  $K_1$  and  $K_2$  respectively are kept in contact. Deduce expression for equivalent thermal conductivity.

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Long Answer Type Questions 5 Marks

1. On what factors does the rate of heat conduction in a metallic rod in the steady state depend? Write the necessary expression and hence define the coefficient of thermal conductivity. Write its units and dimensions also.

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**1.** An aluminium wire 1 m in length and radius 1 mm is loaded with a mass of 40 kg hanging vertically. Young's modulus of Al is  $7.0 \times 10^{10} N/m^2$ . Calculate (a) tensile stress (b) change in length (c) tensile strain and (d) the force constant of such a wire.

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2. The average depth of ocean is 2500 m. Calculate the fractional compression  $\left(\frac{\Delta V}{V}\right)$ 

of water at the bottom of ocean, given that

the bulk modulus of water is  $2.3 imes 10^9 N/m^2.$ 



**3.** A force of  $5 \times 10^3$  N is applied tangentially to the upper face of a cubical block of steel of side 30 cm. Find the displacement of the upper face relative to the lower one, and the angle of shear. The shear modulus of steel is  $8.3 \times 10^{10}$  pa. 4. How much pressure should be applied on a

litre of water if it is to be compressed by 0.1%?

(Bulk modulus of water= 2100 MPa)



5. Calculate the pressure at a depth of 10 m in an Ocean. The density of sea water is  $1030kg/m^3$ . The atmospheric pressure is  $1.01 \times 10^5$  pa.

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6. In car lift compressed air exerts a force  $F_1$ on a small piston having a radius of 5 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car to be lifted is 1350 kg, what is  $F_1$ ? What is the pressure necessary to ac complish this task ?



7. How much pressure will man of weight 80kgf exert on the ground when (i) he is lying and (ii) he is standing on his feet ? Given that the area of the body of the man is  $0.6m^2$  and that of a foot is  $80cm^2$ .

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**8.** The menual of a car instructs the owner to inflate the tyres to pressure of 200 kPa. (a) What is the recommended gauge pressure ?

(b) What is the recommended absolute pressure ? (c) If after the required inflation of the tyres, the car is driven to a mountain peak. where the atmospheric pressrre is 10 % below that at sea level, what will be the tyre gauge read ? Atmospheric pressure  $= 1.01 \times 10^5 Pa$ .

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**9.** Calculate excess pressure in an air bubble of radius 6 mm. Surface tension of liquid is 0.58



10. Terminal velocity of a copper ball of radius 2 mm through a tank of oil at  $20^\circ$  C is 6.0 cm/s. Compare coefficient of viscosity of oil. Given $p_{cu}=8.9 imes103kg/m^3, 
ho_{oil}=1.5 imes103kg/m^3$ 

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**11.** Calculate the velocity with which a liquid emerges from a small hole in the side of a tank of large cross-sectional area if the hole is 0.2 m below the surface liquid (g =  $10 \text{ ms}^{-2}$ .



**12.** A soap bubble of radius 1 cm expands into a bubble of radius 2 cm. Calculate the increase in surface energy if the surface tension for soap is 25 dyne/cm.



**13.** A glass plate of 0.2  $m^2$  in area is pulled with a velocity of 0.1 m/s over a larger glass plate that is at rest. What force is necessary to pull the upper plate if the space between them is 0.003 m and is filled with oil of  $\eta$  0.01 Ns/ $m^2$ .



14. The cross-sectional area of water pipe entering the basement is 4 x  $10^{-4}m^2$ . The pressure at this point is 3 x  $10^5 Nm^{-2}$  and the speed of water is 2  $ms^{-1}$ . This pipe tapers to a cross-sectional area of 2 x  $10^{-4}m^2$  when it reaches the second floor 8 m above. Calculate the speed and pressure at the 2nd floor

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**15.** A large bottle is fitted with a siphon made of capillary glass tubing. Compare the times taken to empty the bottle when it is filled. (i) with water (ii) with petrol of density 0.8 cgs units. The viscosity of water and petrol are 0.1 and 0.2 cgs units repectively.



16. The breaking stress for a metal is  $7.8 imes 10^9 Nm^{-2}$ . Calculate the maximum

length of the wire of this metal which may be suspended breaking. The density of the metal = $7.8 imes 10^3 kgm^{-3}$ . Take g = $10Nkg^{-1}$ 

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17. Two stars radiate maximum energy at wavelength  $3.6 \times 10^{-7}m$  and  $4.8 \times 10^{-7}m$  respectively. What is the ratio of their temperature?



**18.** Find the temperature of  $149^{\circ}$  F on kelvin

scale.



**19.** A metal piece of 50 g specific heat 0.6 cal/  $g^{\circ}C$  initially at  $120^{\circ}$ C is dropped in 1.6 kg of water at  $25^{\circ}$ C. Find the final temperature or mixture.

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**20.** A blacksmith fixes iron ring on the rim of the wooden wheel of a bullock cart. The diameter of the rim and the ring are 5.243mand 5.231m respectively at  $27^{\circ}C$ . To what temperature should the ring be heated so as to fit the rim of the wheel ? Coefficient of linear expansion of iron = $1.20 \times 10^{-5}K^{-1}$ 

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**21.** 100 g of ice at  $0^{\circ}$ C is mixed with 100 g of water at  $80^{\circ}$ C. The resulting temperature is

 $6^{\circ}$  C. Calculate heat of fusion of ice.



22. Calculate heat required to convert 3 kg of water at 0°C to steam at 100°C. Given specific heat capacity of  $H_2O=4186 {
m J \, kg^{-1} \, k^{-1}}$  and latent heat of steam =  $2.256 imes 10^6 {
m J/kg}$ .



23. Calculate the stress developed inside a tooth cavity that filled with copper. When hot tea at temperature  $57^{\circ}$ C is drunk. You can take body (tooth) temperature to be  $37^{\circ}$ C and  $\alpha = 1.7 \times 10^{-5/\circ} C$  bulk modules for copper =  $140 \times 10^9 Nm^{-2}$ .

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**Multiple Choice Questions Mcqs**
**1.** A spring is stretched by applying a load to its free end. The strain produced in the spring is

A. Volumetric

B. Shear

C. Longitudinal & Shear

D. Longitudinal & Shear

#### Answer:

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2. The maximum load a wire can withstand without breaking, when its length is reduced to half of its original length, will

A. be double

B. be half

C. be for times

D. remain same

#### Answer:

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**3.** A rigid bar of mass M is supported symmetrically by three wires each of length I. Those at each end are of copper and the middle one is of iron. The ratio of their diameters, if each is to have the same tension, is equal to

A. 
$$\frac{\text{Ycopper}}{\text{Yiron}}$$
B. 
$$\sqrt{\frac{\text{Yiron}}{\text{Ycopper}}}$$
C. 
$$\frac{Y^2 \text{iron}}{Y^2 \text{copper}}$$
D. 
$$\frac{\text{Yiron}}{\text{Ycopper}}$$

#### Answer: B



**4.** A mild steel wire of Length 2L and cross sectional Area A is stretched well within elastic limit, horizontally between two pillars. A man m is suspended from the mid point of the wire strain in the wire is

A. 
$$\frac{x^2}{2L^2}$$
  
B.  $\frac{x}{L}$ 

C. 
$$rac{x^2}{L}$$
  
D.  $rac{x^2}{2L}$ 

#### Answer:



5. For an ideal liquid : (More than one option

may be correct)

A. the bulk modulus is infinite

B. the bulk modulus is zero

C. the shear modulus is infinite

D. the shear modulus is zero

#### Answer:



6. The stress strain graph for this materials are

shown figure. (assume scale is same for both graph)



A. Material (ii) is more elastic than material

(i) and hence material (ii) is more brittle.

B. Material (i) & (ii) have the same elasticity

and the same brittleness.

C. Material (ii) is elastic over the larger

region of strain as compared to (i)

D. Material (ii) is more brittle than material

(i)

#### Answer:

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7. A tall cylinder is filled with viscous oil. A round pebble is dropped from the top with zero initial velocity. From the plot shown in figure, indicate the one that represents the velocity (v) of the pebble as a function of time (t)





#### Answer:

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**8.** An ideal fluid flows through a pipe of circular cross-section made of two sections with diameters 2.5*cm* and 3.75*cm*. The ratio of the velocities in the two pipes is

A. 9:4

B. 3:2

## $\mathsf{C}.\sqrt{3}:\sqrt{2}$

# D. $\sqrt{2}$ : $\sqrt{3}$

#### Answer:

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**9.** The angle of contact at the interface of water glass is  $0^{\circ}$  ethylalcohol-glass is  $0^{\circ}$  mercury glass is  $140^{\circ}$  and methyliodide-glass is  $30^{\circ}$  A glass capillary is put in a through

containing one of these four liquids. It is observed that the meniscus is convex. The liquid in the through is

A. Water

- B. Ethylalcohol
- C. Mercury
- D. Methyl iodide

#### Answer:

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10. A bimetallic strip is made of aluminum & steel  $(lpha_{AI} > lpha_{
m steel})$  . 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:**

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**11.** A Uniform Metallic Rod rotates about its perpendicular bisector with constant angular speed. If it is heated uniformly to raise its temperating slightly

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 decreases.

#### Answer:



**12.** As the temperating is increases, the time period of pendulum

A. increases as its effective length

increases even though its centre of man

(CM) still reaming at the centre of the

bob

B. decreases as its effective length increases even though its CM still remains at the centre of the bob C. increases as its effective length increases due to shifting of CM below the centre of the bob D. decreases as its effective length remains same but the CM shifts above the centre of the bob.

Answer:



**13.** Refer to the plot of temperating versus time showing the changes in the state of ice on heating (not of scale)



Which of the following is correct :

A. The region AB represents ice & water in

thermal equilibrium

B. At B water stats boiling

C. At C all the water gets converted into

steam

D. C-D represents water & steam in

equilibrium at boiling point.

**Answer:** 

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**14.** A student records the initial length l, change in temperature  $\Delta T$  and change in length  $\Delta l$  of a rod as follows :



# If the first observation is correct. Choose the

correct answer about  $2^{\mathrm{nd}}, 3^{\mathrm{rd})\,\&\,4^{\hat{}}(th)$ 

observations

- A.  $2^{\mathrm{nd}}$  observation correct
- B.  $3^{rd}$  observation correct
- C.  $4^{th}$  observation correct
- D. 4<sup>th</sup> observation incorrect

#### Answer:



**15.** The approximate depth of an ocean is 2700 m. The compressibility of water is  $45.4 \times 10^{-11} Pa^{-1}$  and density of water is  $10^3 kg/m^3$ . What fractional compression of water will be obtained at the bottom of the ocean?

- A.  $1.0 imes10^{-2}$
- B.  $1.2 imes10^{-2}$
- C.  $1.4 imes 10^{-2}$

D.  $0.8 imes10^{-2}$ 

#### Answer:



**16.** The Young's Modulus of steel is twice that of brass. Two wires of same length and of same area of cross-section, one of steel and another of brass are suspended from the same roof. If then the weights added to the steel and brass wires must be in the ratio of

A. 1:1

B. 1:2

C. 2: 1

D. 4:2

#### Answer: C

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**17.** Two rods of different materials having coefficients of thermal expansion  $\alpha_1$ ,  $\alpha_2$  and Young's Moduli  $Y_1$ ,  $Y_2$  respectively are fixed between two rigid massive walls. The rods are

heated such that they undergo the same increase in temperature. There is no bending of the rods. If  $\alpha_1: \alpha_2 = 2:3$ , the thermal stresses developed in the two rods are equal provided  $Y_1: Y_2$  is equal to

A. 2:3

**B**. 1:1

C. 3:2

D. 4:9

#### Answer:



**18.** In the given figure, if the dimension of the two wires are the same and materials are different. Young's modulus is

A. More for A than B

B. More for B than A

C. Equal for A & B

D. None of these

#### Answer:



**19.** The two ends of a metal rod are maintained at temperatures  $100^{\circ}C$  and  $110^{\circ}C$ . The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are now maintained at temperatures  $200^{\circ}C$  and  $210^{\circ}$  C, the rate of flow of heat will be

#### A. 16.8 j/s

B. 8.0 J/s

#### C. 4.0 J/s

D. 44.8 J/s

#### Answer:

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**20.** Steam at  $100^{\circ}C$  is passed into 20 g of water at  $10^{\circ}$ C, then water acquires a temperating of  $80^{\circ}$ C, the man of water present will be [Take specific heat of water = 1

cal  $g^{-1} \circ C^{-1}$  and Latent heat of steam = 540 cal  $g^{-1}$ ]

- A. 24 g
- B. 31.5 g
- C. 42.5 g
- D. 22.5 g

#### Answer:

