# Jupiter Academy

Subjects : Physics

PRACTICE PAPER 07

Total Marks : 180

( Solutions )

## Physics - Section A ( MCQ )

**1.** Certain substance emits only the wavelengths $\lambda_1$, $\lambda_2$, $\lambda_3$ and $\lambda_4$ when it is at a high temperature. When this substance is at a colder temperature, it will absorb only the following wavelengths

A) $\lambda_1$
B) $\lambda_2$
C) $\lambda_1$ and $\lambda_2$
D) $\lambda_1$, $\lambda_2$, $\lambda_3$ and $\lambda_4$

**Solution : (Correct Answer: D )**

(d)According to Kirchoff’s law in spectroscopy.

If a substance emit certain wavelengths at high temperature, it absorbs the same wavelength at comparatively lower temperature.

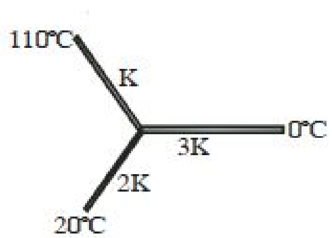
**2.** A black body at a temperature of $1640\ K$ has the wavelength corresponding to maximum emission equal to $1.75\ \ \mu m$. Assuming the moon to be a perfectly black body, the temperature of the moon, if the wavelength corresponding to maximum emission is $14.35\ \mu m$ is.......$K$

A) $100$ B) $150$ C) $200$ D) $250$

**Solution : (Correct Answer: C )**

$\frac{T_2}{T_1} = \frac{\lambda_{m_1}}{\lambda_{m_2}} = \frac{1.75}{14.35} \Rightarrow T_2 = \frac{1.75}{14.35} \times 1640 = 200\,K$

**3.** Three rods of equal length and cross sectional area and coefficient of thermal conductivities $K, 2K$ and $3K$ are joined as shown in figure temperature of their ends are $110\ ^oC, 20\ ^oC$ and $0\ ^oC$ respectively then temperature of junction will be ......... $^oC$




A) $15$ B) $25$ C) $30$ D) $35$

**Solution : (Correct Answer: B )**

**4.** A composite rod made of three rods of equal length and cross-section as shown in the fig. The thermal conductivities of the materials of the rods are $K/2, 5K$ and $K$ respectively. The end $A$ and end $B$ are at constant temperatures. All heat entering the face Agoes out of the end $B$ there being no loss of heat from the sides of the bar. The effective thermal conductivity of the bar is


A) $15K/16$ B) $6K/13$
C) $5K/16$ D) $2K/13.$

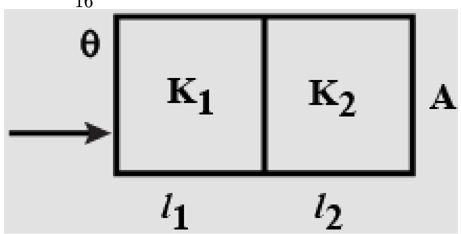
**Solution : (Correct Answer: A )**

by given concept

$\frac{3l}{K} = \frac{l}{k/2} + \frac{l}{5k} + \frac{l}{k}$

$\frac{3l}{K} = \frac{2l}{k} + \frac{l}{5k} + \frac{l}{k} = \frac{10l+l+5l}{5k} = \frac{16l}{5k}$

$K = \frac{15k}{16}$




**5.** The length of the two rods made up of the same metal and having the same area of cross-section are $0.6m$ and $0.8m$ respectively. The temperature between the ends of first rod is $90^oC$ and $60^oC$ and that for the other rod is $150^oC$ and $110^oC$. For which rod the rate of conduction will be greater

A) First B) Second
C) Same for both D) None of the above

**Solution : (Correct Answer: C )**

(c) $\frac{Q_1}{t} = \frac{KA(90-60)}{0.6} = 50\ KA$

and $\frac{Q_2}{t} = \frac{KA(150-110)}{0.8} = 50\ KA$

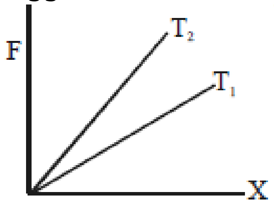
**6.** Newton's law of cooling is a special case of

A) Stefan's law B) Kirchhoff's law
C) Wien's law D) Planck's law

**Solution : (Correct Answer: A )**

(a)For small difference of temperature, it is the special case of Stefan’s law.

7. The diagram below shows the change in the length $X$ of a thin uniform wire caused by the application of stress $F$ at two different temperatures $T_1$ and $T_2$. The variation shown suggests that




A) $T_1 > T_2$ B) $T_1 < T_2$
C) $T_2 > T_1$ D) $T_1 \geq T_2$

**Solution : (Correct Answer: A )**

When same stress is applied at two different temperatures, the increase in length is more at higher temperature. Thus $T_1 > T_2$.

8. $1\ kg$ of ice at $-10^oC$ is mixed with $4.4\ kg$ of water at $30^oC$. The final temperature of mixture is ........ $^oC$ (specific heat of ice is $2100\ J/kg/k$)

A) $2.3$ B) $4.4$ C) $5.3$ D) $8.7$

**Solution : (Correct Answer: D )**

Heat released by water to reach $0^\circ\mathrm{C}$ is $Q_1 = mc\Delta T$ $= 4.4 \times 4200 \times 30 = 55440\mathrm{J}$

heat absorbed by ice to melt is $Q_2 = 2100 \times 1 \times 10 + 1 \times 336 \times 10^3 = 347000J$

extra heat, $Q_1 - Q_2 = 197400J$

$(m_1 + m_2)\, C\Delta T = 197400$

$\Rightarrow (T-0) = \frac{197400}{(4.2+1)\times 4200}$

so, $T = 8.7^\circ\mathrm{C}$

9. The coefficient of apparent expansion of a liquid when determined using two different vessels $A$ and $B$ are $\gamma_1$ and $\gamma_2$ respectively. If the coefficient of linear expansion of vessel $A$ is $\alpha$, the coefficient of linear expansion of vessel $B$ is

A) $\frac{\alpha\gamma_1\gamma_2}{\gamma_1+\gamma_2}$ B) $\frac{\gamma_1-\gamma_2}{2\alpha}$
C) $\frac{\gamma_1-\gamma_2+\alpha}{3}$ D) $\frac{\gamma_1-\gamma_2}{3}+\alpha$

**Solution : (Correct Answer: D )**

$\gamma_{\text{real}} = \gamma_{\text{app}} + \gamma_{\text{vessel}}; \gamma_{\text{vessle}} = 3\alpha$

$For vessel A = \gamma_{\text{real}} = \gamma_1 + 3\alpha$

$For vessel B = \gamma_{\text{real}} = \gamma_2 + 3\alpha_B$

Hence, $\gamma_1 + 3\alpha = \gamma_2 + 3\alpha_B$

$\Rightarrow \alpha_B = \frac{\gamma_1-\gamma_2}{3} + \alpha$

10. A thin walled cylindrical metal vessel of linear coefficient of expansion $10^{-3}\ ^oC^{-1}$ contains benzenr of volume expansion coefficient $10^{-3}$ $^oC^{-1}$. If the vessel and its contents are now heated by $10^oC$, the pressure due to the liquid at the bottom.

A) increases by $2\%$
B) decreases by $1\%$
C) decreases by $2\%$
D) remains unchanged

**Solution : (Correct Answer: C )**

$\gamma_{\text{vessel}} = 3\alpha_{\text{vessel}} = 3 \times 10^{-3}$

$\gamma_{liquid} = 10^{-3}$

When the liquid is heated, the level of liquid falls which will result in decrease of pressure.

Change in volume of liquid:

$\Delta V = V\left(\gamma_{\text{vexsel}} - \gamma_{\text{liguid}}\right) \times \Delta T = V \times 2 \times 10^{-3} \times (10-0)$ $= 0.02$

$\therefore \frac{\Delta V}{V} = 0.02$

$\Rightarrow \frac{\Delta h}{h} = 0.02$

$\Rightarrow$ decrease in pressure is $0.02 \times 100\% = 2\%$

Hence, decrease in pressure at bottom of the vessel is $2\%$

11. $0.93\ watt - hour$ of energy is supplied to a block of ice weighing $10\, gm$. It is found that

A) Half of the block melts
B) The entire block melts and the water attains a temperature of $4^\circ C$
C) The entire block just melts
D) The block remains unchanged

**Solution : (Correct Answer: C )**

(c) Energy supplied $= 0.93 \times 3600\, joules = 3348\, joules$

Heat required to melt $10\, gms$ of ice

$= 10 \times 80 \times 4.18 = 3344\, joules$

Hence block of ice just melts.

12. Which of the following material is used to make calorimeter?

A) Glass B) Ebonite C) Metal D) Superconduct

**Solution : (Correct Answer: C )**

(c)

Metal is used (copper)

13. Fire is extinguished more effectively by

A) Hot water B) Cold water
C) Equally by both D) Ice

**Solution : (Correct Answer: A )**

(a) Fire is extinguished by the vaporisation do water which lowers the temperature of the burning body. Further, the water vapour envelops the body, keeping oxygen away. Hot water evaporates more than cold water as

**14.** A $2\ kg$ copper block is heated to $500^o\ C$ and then it is placed on a large block of ice at $0^o\ C$. If the specific heat capacity of copper is $400\ J/kg/^o\ C$ and latent heat of fusion of water is $3.5\ \times 10^5$ $J/kg$, the amount of ice, that can melt is :-

**A)** $(7/8)\,kg$ **B)** $(7/5)\,kg$
**C)** $(8/7)\,kg$ **D)** $(5/7)\,kg$

**Solution : (Correct Answer: C )**

Heat gained by ice $=$ heat lost by copper

$m \times 3.5 \times 10^5 = 2 \times 400 \times (500 - 0)$

where, $m$ is the mass of ice melts

Thus, $\mathrm{m} = \frac{2\times400\times500}{3.5\times10^5} = \frac{8}{7}\mathrm{kg}$

**15.** When a copper ball is heated, the largest percentage increase will occur in its

**A)** Diameter **B)** Area
**C)** Volume **D)** Density

**Solution : (Correct Answer: C )**

(c) When a copper ball is heated, it's size increases.

As Volume $\propto (radius)^3$ and Area $\propto ((radius)^2$, so percentage increase will be largest in it's volume.

Density will decrease with rise in temperature.

**16.** A razor-blade floats on the surface of water contained in a glass. When the glass is gently shaken, the razor-blade sinks. Mark the incorrect statement

**A)** Volume of displaced water is lesser than blades own volume
**B)** When the razor-blade sinks, the height of the water decreases.
**C)** For a floating body of greater density than water its weight is balanced by the compressive forces of the water below it.
**D)** Weight of razor-blade is equal to the weight of the displaced water due to volume occupied by the razor-blade and some additional region affected by surface tension.

**Solution : (Correct Answer: C )**

Force is developed due to property of liquid called surface tension.

**17.** Two soap bubbles of radii $2\ cm$ and $4\ cm$ join to form a double bubble in air, then radius of curvature of interface is .......... $cm$

**A)** $2\sqrt{5}$ **B)** $2$ **C)** $4$ **D)** $2\sqrt{3}$

**Solution : (Correct Answer: C )**

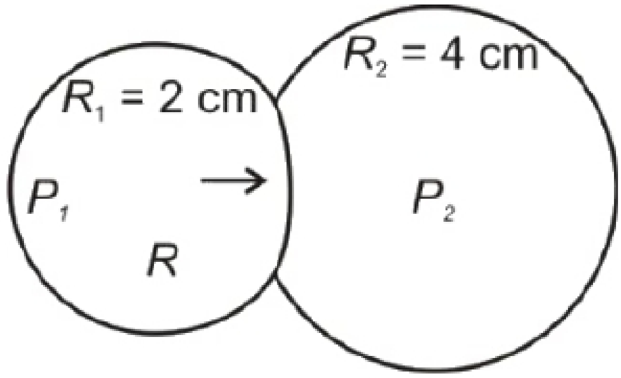
$P_1 - P_0 = \frac{4T}{R_1}; P_2 - P_0 = \frac{4T}{R_2}$

$P_1 - P_2 = 4T\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{4T}{R}$

$\frac{1}{R} = \frac{1}{R_1} - \frac{1}{R_2} = \frac{1}{2} - \frac{1}{4}$

$\frac{1}{R} = \frac{2-1}{4} = \frac{1}{4}$

$R = 4\,Cm$




**18.** Water rises in a capillary tube to a certain height such that the upward force due to surface tension is balanced by $75\ \times 10^{-4}\ N$ force due to the weight of the liquid. If the surface tension of water is $6\ \times 10^{-2}\ Nm^{-1}$, the inner circumference of the capillary must be

**A)** $1.25 \times 10^{-2}\,m$ **B)** $0.50 \times 10^{-2}\,m$
**C)** $6.5 \times 10^{-2}\,m$ **D)** $12.5 \times 10^{-2}\,m$

**Solution : (Correct Answer: D )**

(d) $6\ \times\ 10^{-2}\times$Circumference = Force

$\therefore$ Circumference $= \frac{75\times10^{-4}}{6\times10^{-2}} = 12.5 \times 10^{-2}\,m$

**19.** When there is no external force, the shape of a liquid drop is determined by

**A)** Surface tension of the liquid
**B)** Density of liquid
**C)** Viscosity of liquid
**D)** Temperature of air only

**Solution : (Correct Answer: A )**

(a)The shape of the liquid drop is determined by the surface tension.

**20.** The water rises in the capillary to a height of $10$ $cm$. If the surface tension of water is $73\ \times 10^{-3}$ $N/m$, density is $10^3\ kg/m^3$ and $g\ = 9.8\ m/sec^2$, then find radius of capillary

**A)** $0.02\,cm$ **B)** $0.015\,cm$
**C)** $0.05\,cm$ **D)** $0.08\,cm$

**Solution : (Correct Answer: B )**

$\mathrm{h} = \frac{2\mathrm{T}}{\mathrm{r}\rho\mathrm{g}} \Rightarrow \mathrm{r} = \frac{2\mathrm{T}}{\mathrm{h}\rho\mathrm{g}}$

$r = \frac{2\times73\times10^{-3}}{10\times10^{-2}\times10^3\times9.8} = 0.015\mathrm{cm}$

**21.** If the diameter of a capillary tube is doubled, then the height of the liquid that will rise is

**A)** Twice **B)** Half
**C)** Same as earlier **D)** None of these

**Solution : (Correct Answer: B )**

(b) $h \propto \frac{1}{r}$

**22.** If pressure at half the depth of a lake is equal to $2/3$ pressure at the bottom of the lake then what is the depth of the lake...... $m$

A) $10$ B) $20$ C) $60$ D) $30$

**Solution : (Correct Answer: B )**

(b) Pressure at half the depth $= P_0 + \frac{h}{2}dg$

Pressure at the bottom $= P_0 + h\rho g$

According to given condition

$P_0 + \frac{h}{2}dg = \frac{2}{3}(P_0 + hdg)$

$\Rightarrow 3P_0 + \frac{3h}{2}dg = 2P_0 + 2hdg$

$\Rightarrow h = \frac{2P_0}{dg} = \frac{2\times10^5}{10^3\times10} = 20\ m$

**23.** One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

A) $1000:1$ B) $1:1000$
C) $10:1$ D) $1:10$

**Solution : (Correct Answer: D )**

(d) As volume remain constant therefore $R = n^{1/3}r$

$\frac{\text{surface energy of one big drop}}{\text{surface energy of } n\text{drop}} = \frac{4\pi R^2 T}{n\times 4\pi r^2 T}$

$\frac{R^2}{nr^2} = \frac{n^{2/3}r^2}{nr^2} = \frac{1}{n^{1/3}} = \frac{1}{(1000)^{1/3}} = \frac{1}{10}$

**24.** What is the pressure in $atm$ on a swimmer $10\ m$ below the surface of a lake?

A) $1$ B) $2$ C) $3$ D) $4$

**Solution : (Correct Answer: B )**

$h = 10m$ and $\rho = 1000kgm^{-3}$. Take $g = 10ms^{-2}$

$P = P_a + \rho gh$

$= 1.01\times10^5 Pa + 1000kgm^{-3}\times 10ms^{-2}\times 10m$

$= 2.01\times10^5 Pa$

$\approx 2\,atm$

**25.** Different heads are in Column - I and its formulas are given in Column - II. Match them appropriately.

| Column - I | Column - II |
|---|---|
| $(a)$ Velocity head | $(i)\ \frac{P}{\rho g}$ |
| $(b)$ Pressure head | $(ii)\ h$ |
| | $(iii)\ \frac{v^2}{2g}$ |

A) $(a-i),(b-iii)$ B) $(a-iii),(b-ii)$
C) $(a-iii),(b-i)$ D) $(a-ii),(b-i)$

**Solution : (Correct Answer: C )**

$(a-iii),(b-i)$

**26.** Water is flowing with a velocity of $2\ m/s$ in a horizontal pipe where cross-sectional area is $2\times10^{-2}\ m^2$ at pressure $4\times10^4\ pascal$. The pressure at cross-section of area $0.01\,m^2$ in pascal will be

A) $32$ B) $3.4$ C) $3.4\times10^4$ D) $3.4\times10^5$

**Solution : (Correct Answer: C )**

$A_1V_1 = A_2V_2$

$(2)\ (2\times10^{-2}) = \mathrm{V}_2(0.01)$

$\mathrm{V}_2 = 4\mathrm{m/s}$

$4\times10^4 + \frac{1}{2}(10^3)(2)^2 = P + \frac{1}{2}(10^3)(4)^2$

$P = 4\times10^4 - 6\times10^3$

**27.** There is a $1\,mm$ thick layer of glycerine between a flat plate of area $100\ cm^2$ and a big plate. If the coefficient of viscosity of glycerine is $1.0\ kg\ (m-s)$, then ....... $N$ force is required to move the plate with a velocity of $7\,cm/s$ .

A) $0.7$ B) $0.1$ C) $0.2$ D) $0.6$

**Solution : (Correct Answer: A )**

To move the plate with a constant velocity, the necessary force will be equal to the viscosity force

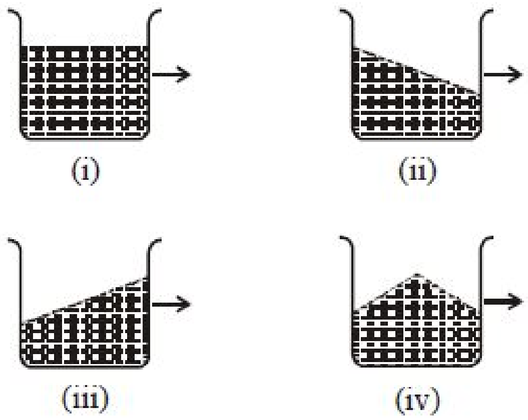
$\mathrm{F}(\text{ say })$. Now $\mathrm{F} = \eta \mathrm{A}\frac{\Delta \mathrm{V_x}}{\Delta \mathrm{z}}$

Here $\eta = 1.0\mathrm{kg/(m-s)}, \mathrm{A} = 100\mathrm{cm}^2 = 10^{-2}\mathrm{m}^2$

$\Delta v_x = 7\times10^{-2}\mathrm{m/sec}$ and $\Delta z = 1\mathrm{mm} = 10^{-3}\mathrm{m}$

$\mathrm{F} = \frac{1.0\times10^{-2}\times(7\times10^{-2})}{10^{-3}} = 0.7\mathrm{N}$

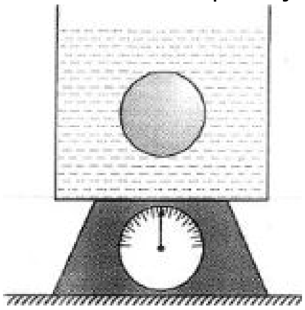
**28.** A vessel containing water is moving with a constant speed towards right along a straight horizontal path. if the vessel is given a constant retardation towards the right along a straight line, which of the above diagram represents the surface of the liquid?




A) $(i)$ B) $(ii)$ C) $(iii)$ D) $(iv)$

**Solution : (Correct Answer: C )**

29. A container of mass $M$ containing liquid of mass $m_0$ is kept on weighing machine. A ball of mass $m$ is released from rest from given position. Then choose correct option just after ball is released



A) Reading of weighing machine must be equal to $(M+m+m_0)g$
B) Reading of weighing machine $> (M+m + m_0)g$ only if density of ball $<$ density of liquid
C) Reading of weighing machine $> (M+m + m_0)g$ if density of ball $\neq$ density of liquid
D) Reading of weighing machine $< (M+m + m_0)g$ if density of ball $\neq$ density of liquid

**Solution : (Correct Answer: D )**

$\mathrm{d_{liquid}} > \mathrm{d_{ball}}$

or $\mathrm{d_{ball}} > \mathrm{d_{liquid}}$

$\mathrm{cm}$ will move downward.

$Normal < weight$

30. An ice block contains a glass ball when the ice melts within the water containing vessel, the level of water

A) Rises
B) Falls
C) Unchanged
D) First rises and then falls

**Solution : (Correct Answer: B )**

(b) When ice block contains a glass ball, it displaces some amount of water. But when the ice melts, then glass ball displaces amount of water less than its weight and so less from previous case. Hence, water level falls.

31. The coefficient of viscosity for hot air is

A) Greater than the coefficient of viscosity for cold air
B) Smaller than the coefficient of viscosity for cold air
C) Same as the coefficient of viscosity for cold air
D) Increases or decreases depending on the external pressure

**Solution : (Correct Answer: A )**

Cold air is significantly more viscous, but the viscosity of air is so low that you'd really never notice it anyway.Hot air feels more viscous, it's probably because hot air tends to have more water vapor in it, and humid air tends to feel thicker.

32. A cylindrical tank has a hole of $1 cm^2$ in its bottom. If the water is allowed to flow into the tank from a tube above it at the rate of $70 cm^3/sec$. then the maximum height up to which water can rise in the tank is .......... $cm$

A) $2.5$ B) $5$ C) $10$ D) $0.25$

**Solution : (Correct Answer: A )**

(a)The height of water in the tank becomes maximum when the volume of water flowing into the tank per second becomes equal to the volume flowing out per second.

Volume of water flowing out per second

= Av $= A\sqrt{2gh}...(i)$

Volume of water flowing in per second

$= 70\, cm^3/sec...(ii)$

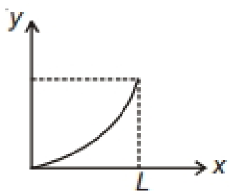
From $(i)$ and $(ii)$ we get

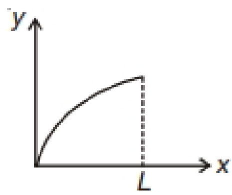
$A\sqrt{2gh} = 70 \Rightarrow 1 \times \sqrt{2gh} = 70$

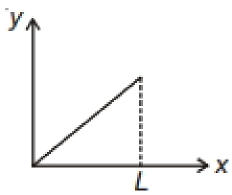
$\Rightarrow 1 \times \sqrt{2 \times 980 \times h} = 70$

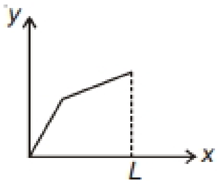
$\therefore h = \frac{4900}{1960} = 2.5\, cm.$

33. Which of the following curve represents the correctly distribution of elongation $(y)$ along heavy rod under its own weight $L \rightarrow$ length of rod, $x \rightarrow$ distance of point from lower end?

A) 


B) 


C) 


D) 


**Solution : (Correct Answer: A )**

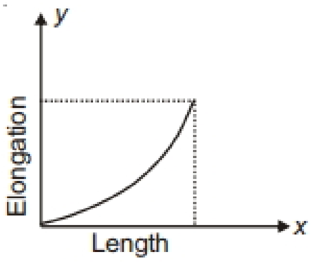
For elongation of rod under its own weight

We know $\Delta x = \frac{\rho g x^2}{2Y}$

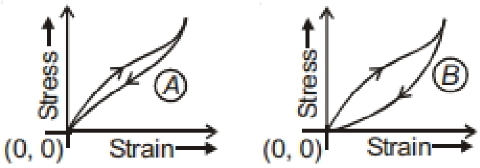
$$\left\{ \begin{array}{l} \text{Where,} \\ \Delta x = \text{ Elongation} \\ \rho = \text{ Density of rod} \\ Y = \text{ Young's modulus} \\ L = \text{ Length} \\ g = \text{ Acceleration due to gravity} \\ x = \text{ Distance of point from lower end} \end{array} \right.$$

We can clearly see that elongation $\propto (x^2)$

So graph of $\Delta x$ vs $x$ should be a upward parabola.




**34.** Two different types of rubber are found to have the stress-strain curves as shown. Then




A) $A$ is suitable for shock absorber
B) $B$ is suitable for car tyres
C) $B$ is suitable for shock absorber
D) None of these

## Solution : (Correct Answer: C )

One with higher hysterysis loss suitable for shock absorber because high hysterysis loss will lead to dampen shocks in a easy manner.

One with lower hysterysis loss suitable for types because it will have low relaxation time.

Area between loop gives amount of hysterysis loss. More area more loss, less area less.

Therefore, $B$ is suitable for shock absorber and $A$ for types.

**35.** A steel wire is $1\ m$ long and $1\ mm^2$ in area of cross-section. If it takes $200\ N$ to stretch this wire by $1\ mm$, how much force will be required to stretch a wire of the same material as well as diameter from its normal length of $10\ m$ to a length of $1002\ cm$ is ........ $N$

A) $1000$ B) $200$ C) $400$ D) $2000$

## Solution : (Correct Answer: C )

(c)

$\frac{FL}{AY} = \Delta x$

Since $A, Y$ remain constant in given case We can say

$FL \propto \Delta x$

or $\frac{F_1 L_1}{F_2 L_2} = \frac{\Delta x_1}{\Delta x_2}$

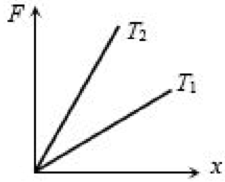
$$\begin{cases} F_1 = 200\,N \\ \Delta x_1 = 1\,mm \\ \Delta x_2 = 10.02\,m - 10\,m = 0.02\,m = 20\,mm \\ L_1 = 1\,m \\ L_2 = 10\,m \end{cases}$$

Substitute the values

$\frac{200 \times 1}{F_2 \times 10} = \frac{1\,mm}{20\,mm}$

$F_2 = 400\,N$

**36.** The diagram shows the change $x$ in the length of a thin uniform wire caused by the application of stress $F$ at two different temperatures $T_1$ and $T_2$. The variations shown suggest that




A) $T_1 > T_2$
B) $T_1 < T_2$
C) $T_1 = T_2$
D) None of these

## Solution : (Correct Answer: A )

Elasticity of wire decreases at high temperature i.e. at higher temperature slope of graph will be less.

So we can say that $T_1 > T_2$

**37.** Young's modulus of perfectly rigid body material is

A) Zero
B) Infinity
C) $1 \times 10^{10}\ N/m^2$
D) $10 \times 10^{10}\ N/m^2$

## Solution : (Correct Answer: B )

(b) From Hooke's law, Young modulus $Y = \frac{Stress}{Strain}$

The Strain produced in a perfectly rigid body is zero i.e Strain$= 0$

$\therefore Y = \frac{Stress}{0} \quad \Longrightarrow Y = \infty$

Thus the Young's modulus of perfectly rigid body material is infinite.

**38.** On applying a stress of $20 \times 10^8 N/m^2$ the length of a perfectly elastic wire is doubled. Its Young's modulus will be

A) $40 \times 10^8 N/m^2$ B) $20 \times 10^8 N/m^2$
C) $10 \times 10^8 N/m^2$ D) $5 \times 10^8 N/m^2$

## Solution : (Correct Answer: B )

(b) Young's modules $= \frac{\text{stress}}{\text{strain}}$

As the length of wire get doubled therefore strain $= 1$

$Y =$ strain $= 20 \times 10^8 N/m^2$

**39.** A rubber ball is taken to a $100\,m$ deep lake and its volume changes by $0.1\%$. The bulk modulus of rubber is nearly

A) $1 \times 10^{-6}\ N/m^2$ B) $1 \times 10^{-8}\ N/m^2$
C) $1 \times 10^{7}\ N/m^2$ D) $1 \times 10^{9}\ N/m^2$

## Solution : (Correct Answer: D )

$\beta = \frac{\Delta \mathrm{P}}{\left(\frac{-\Delta \mathrm{V}}{\mathrm{V}}\right)} = \frac{\mathrm{h}\rho\mathrm{g}}{\frac{-\Delta \mathrm{V}}{\mathrm{V}}} = \frac{100 \times 10^3 \times 10}{10^{-3}} = 10^9 \mathrm{N/m^2}$

**40.** If the length of a wire is reduced to half, then it can hold the ......... load

A) Half B) Same C) Double D) One fourth

**Solution : (Correct Answer: B )**

(b) Breaking force $\propto$ Area of cross section of wire

i.e. load hold by the wire does not depend upon the length of the wire.

**41.** The ratio of Young's modulus of the material of two wires is $2:3$. If the same stress is applied on both, then the ratio of elastic energy per unit volume will be

A) $3:2$ B) $2:3$ C) $3:4$ D) $4:3$

**Solution : (Correct Answer: A )**

(a) Energy per unit volume $=\frac{(\text{stress})^2}{2Y}$

$\frac{E_1}{E_2}=\frac{Y_2}{Y_1}$ (Stress is constant)

$\frac{E_1}{E_2}=\frac{3}{2}$

**42.** $Assertion$ : Perspiration from human body helps in cooling the body.

$Reason$ : A thin layer of water on the skin enhances its emissivity.

A) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

B) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

C) If the Assertion is correct but Reason is incorrect.

D) If both the Assertion and Reason are incorrect.

**Solution : (Correct Answer: C )**

Perspiration envolves exchange of heat from body to surrounding. Water takes heat from the body and gets converted into vapour. Hence, body cools down. A thin layer of water on the skin will reduce rather than increase its emissivity. So, Assertion is correct but Reason is incorrect.

**43.** For a black body at temperature $727^\circ C$, its radiating power is $60\ watt$ and temperature of surrounding is $227^\circ C$. If temperature of black body is changed to $1227^\circ C$ then its radiating power will be ..... $watt$

A) $304$ B) $320$ C) $240$ D) $120$

**Solution : (Correct Answer: B )**

$E \propto (T^4 - T_0^4)$

$T_2 = 1227 + 273 = 1500, T_1 = 727 + 273 = 1000K,$

$T_0 = 227 + 273 = 500K$

$\frac{E_2}{60}=\frac{(1500)^4-(500)^4}{(1000)^4-(500)^4}=\frac{50625-625}{10000-625}=\frac{50000}{9375}\Rightarrow E_2 = 320\ watt$

**44.** The temperatures of two bodies $A$ and $B$ are respectively $727^oC$ and $327^oC$. The ratio $H_A : H_B$ of the rates of heat radiated by them is

A) $727:327$ B) $5:3$

C) $25:9$ D) $625:81$

**Solution : (Correct Answer: D )**

(d) $Q \propto T^4$==>$\frac{H_A}{H_B}=\left(\frac{273+727}{273+327}\right)^4=\left(\frac{10}{6}\right)^4=\left(\frac{5}{3}\right)^4=\frac{625}{81}$

**45.** The work done in blowing a soap bubble of radius $0.2\ m$ is (the surface tension of soap solution being $0.06\,N/m$)

A) $192\pi \times 10^{-4}\,J$ B) $280\pi \times 10^{-4}\,J$

C) $200\pi \times 10^{-3}\,J$ D) None of these

**Solution : (Correct Answer: A )**

(a) $W = 8\pi r^2 \times T = 8\pi \times (0.2)^2 \times 0.06 = 192\pi \times 10^{-4}\,J$