# PHYSICS

## NEET and JEE Main 2020 : 45 Days Crash Course

# Problem Solving Class
# (SHM and Waves)

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## P-Q1001

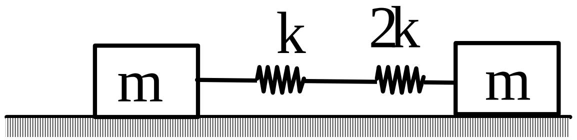
The time period for small oscillations of the two blocks will be

A) $2\pi\sqrt{\frac{3m}{k}}$

B) $2\pi\sqrt{\frac{3m}{2k}}$

C) $2\pi\sqrt{\frac{3m}{4k}}$ ✓

D) $2\pi\sqrt{\frac{3m}{8k}}$

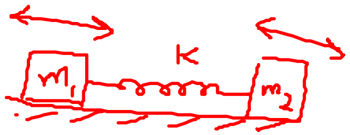



$\mu = \frac{m \times m}{m+m} = \frac{m}{2}$

$K_{eq.} = \frac{K_1 K_2}{K_1 + K_2} = \frac{K \times 2K}{3K}$

$= \frac{2K}{3}$

$T = 2\pi\sqrt{\frac{\mu}{K_{eq}}} = 2\pi\sqrt{\frac{m}{2}\frac{3}{2K}}$




$T = 2\pi\sqrt{\frac{\mu}{K}}$

where

$\mu = \frac{m_1 m_2}{m_1 + m_2}$

↑ reduced mass of system

# P-Q1001-Solution

**Ans [C]**

Springs are connected in series

$$K_{eq} = \frac{k(2k)}{k+2k} = \frac{2k}{3}$$

$$\text{Time period } T = 2\pi\sqrt{\frac{\mu}{K_{eq}}}$$

$$\text{Where } \mu = \frac{m_1.m_2}{m_1+m_2}$$

$$\text{Here } \mu = \frac{m}{2}$$

$$\therefore T = 2\pi\sqrt{\frac{m}{2}.\frac{3}{2k}} = 2\pi\sqrt{\frac{3m}{4k}}$$

## P-Q1002

A simple pendulum has a period T. It is taken inside a lift moving up with uniform acceleration of g/3. Now its time period will be

A) $\frac{\sqrt{2}}{3}T$ B) $\frac{1}{3}T$ C) $\frac{\sqrt{3}}{2}T$ D) $\frac{2}{\sqrt{3}}T$

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$T' = 2\pi\sqrt{\frac{l}{g_{eff}}} \quad ; \quad g_{eff} = g + a = g + \frac{g}{3} = \frac{4g}{3}$$

$$= 2\pi\sqrt{\frac{l\,3}{4g}} = \sqrt{\frac{3}{4}}\,T = \frac{\sqrt{3}}{2}\,T$$

# P-Q1002-Solution

## Ans [C]

Initial Time Period is *T*

When pendulum present in accelerated system them

When object move with acceleration $\vec{a}$ then $\overrightarrow{g_{eff}} = \vec{g} - \vec{a}$

$$T = 2\pi\sqrt{\frac{l}{g_{eff}}}$$

Lift moving up so $g_{eff}$ = g + g/3 = 4g/3

When moving up **a** is opposite sign so **g + a**

Putting the value of $g_{eff}$ we get $T' = \frac{\sqrt{3}}{2}T$

## P-Q1031



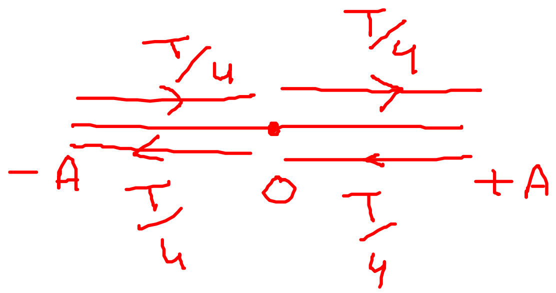
A particle executing S.H.M. of amplitude 4 *cm* and $T = 4$ *sec*. The time taken by it to move from positive extreme position to half the amplitude is

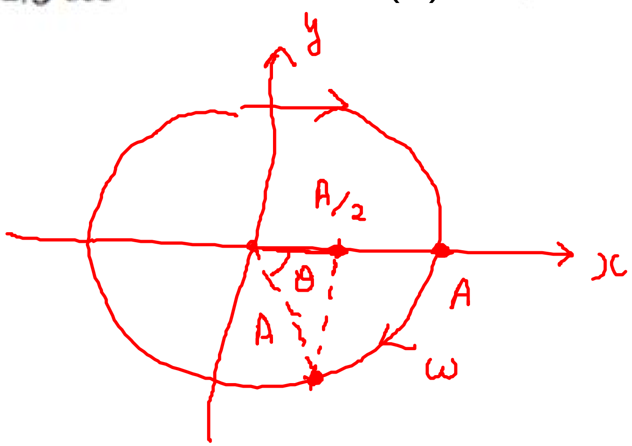
(A) 1 *sec*

(B) 1/3 *sec*

(C) 2/3 *sec* ✓

(D) $\sqrt{3/2}$ *sec*




$$\theta = \omega t$$

$$\cos\theta = \frac{A/2}{A} = \frac{1}{2}$$

$$\theta = \frac{\pi}{3}$$

$$\frac{\pi}{3} = \frac{2\pi}{T}\cdot t \Rightarrow t = \frac{T}{6} = \frac{2}{3}\ s$$

## P-Q1031-Solution

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## Ans [C]

Equation of motion $y = a.cos\omega t$

$$\Rightarrow \frac{a}{2} = a\cos\omega t \Rightarrow \cos\omega t = \frac{1}{2} \Rightarrow \omega t = \frac{\pi}{3}$$

$$\Rightarrow \frac{2\pi t}{T} = \frac{\pi}{3} \Rightarrow t = \frac{\frac{\pi}{3}\times T}{2\pi} = \frac{4}{3\times 2} = \frac{2}{3}\sec$$

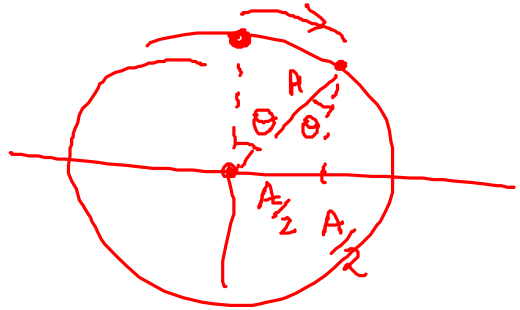
The periodic time of a body executing simple harmonic motion is 3 *sec*. After how much interval from time $t = 0$, its displacement will be half of its amplitude

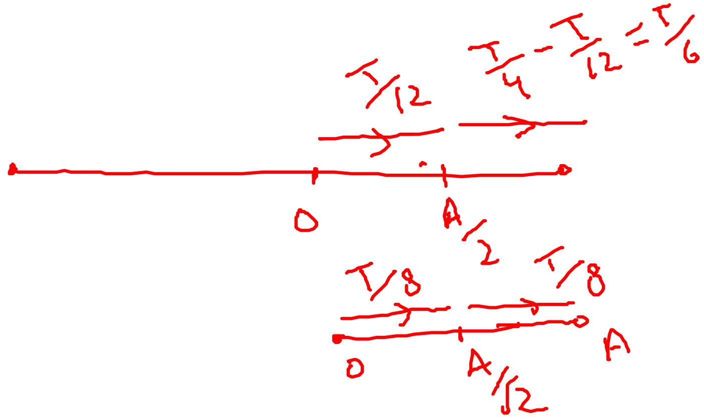
(A) $\frac{1}{8}$ *sec*

(B) $\frac{1}{6}$ *sec*

(C) $\frac{1}{4}$ *sec*

(D) $\frac{1}{3}$ *sec*





$\sin\theta = \frac{1}{2}$

$\theta = \frac{\pi}{6}$

$\theta = \omega t$

$\frac{\pi}{6} = \frac{2\pi}{T} \cdot t \Rightarrow t = \frac{T}{12}$

$= \frac{1}{4}\ s$

# P-Q1033-Solution

## Ans [C]

Equation of motion y=a sin ωt

$$y = a\sin\frac{2\pi}{T}t \Rightarrow \frac{a}{2} = a\sin\frac{2\pi t}{3} \Rightarrow \frac{1}{2} = \sin\frac{2\pi t}{3}$$

$$\Rightarrow \sin\frac{2\pi t}{3} = \sin\frac{\pi}{6} \Rightarrow \frac{2\pi t}{3} = \frac{\pi}{6} \Rightarrow t = \frac{1}{4}\sec$$

# P-Q1034



A simple pendulum performs simple harmonic motion about X = 0 with an amplitude A and time period T. The speed of the pendulum at $X = A/2$ will be

(A) $\frac{\pi A\sqrt{3}}{T}$ ✓

(B) $\frac{\pi A}{T}$

(C) $\frac{\pi A\sqrt{3}}{2T}$

(D) $\frac{3\pi^2 A}{T}$

$v = \omega\sqrt{A^2 - x^2}$

$= \frac{2\pi}{T}\sqrt{A^2 - \frac{A^2}{4}}$

$= \frac{2\pi}{T} \cdot \frac{\sqrt{3}A}{2}$

# P-Q1034-Solution

## Ans [A]

Velocity of a particle executing S.H.M. is given by

$$v = \omega\sqrt{a^2 - x^2} = \frac{2\pi}{T}\sqrt{A^2 - \frac{A^2}{4}} = \frac{2\pi}{T}\sqrt{\frac{3A^2}{4}} = \frac{\pi A\sqrt{3}}{T}.$$

At any point x(distance from centre) the velocity will be this

## P-Q1035

A body of mass 5 *gm* is executing S.H.M. about a point with amplitude 10 *cm*. Its maximum velocity is 100 *cm/sec*. Its velocity will be 50 *cm/sec* at a distance

(A) 5 (B) $5\sqrt{2}$

(C) $5\sqrt{3}$ (D) $10\sqrt{2}$

$v = \omega\sqrt{A^2 - x^2}$ ; $v_{max} = \omega A$

$v = \omega A\sqrt{1 - \left(\frac{x}{A}\right)^2}$

$50 = 100\sqrt{1 - \left(\frac{x}{A}\right)^2}$

$\left(\frac{1}{2}\right)^2 = 1 - \left(\frac{x}{A}\right)^2$

$\frac{1}{4} = 1 - \frac{x^2}{A^2}$

$\frac{x^2}{A^2} = \frac{3}{4} \Rightarrow \frac{x}{A} = \frac{\sqrt{3}}{2}$

$x = \frac{\sqrt{3}}{2} \times 10 = 5\sqrt{3}$

# P-Q1035-Solution

## Ans [C]

It is given $v_{max} = 100\ cm/sec$ , $a = 10\ cm.$

$$\Rightarrow v_{max} = a\omega \Rightarrow \omega = \frac{100}{10} = 10\ rad/sec$$

For max velocity y will be zero

Hence $v = \omega\sqrt{a^2 - y^2} \Rightarrow 50 = 10\sqrt{(10)^2 - y^2}$

$$\Rightarrow y = 5\sqrt{3}\ cm$$

**P-Q1038**

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A body is executing S.H.M. When its displacement from the mean position is 4 *cm* and 5 *cm*, the corresponding velocity of the body is 10 *cm*/*sec* and 8 *cm*/*sec*. Then the time period of the body is

(A) $2\pi\ sec$

(B) $\pi/2\ sec$

(C) $\pi\ sec$

(D) $3\pi/2\ sec$

$v = \omega\sqrt{A^2 - x^2}$

$v^2 = \omega^2(A^2 - x^2)$

$100 = \omega^2(A^2 - 4^2) \Rightarrow 100/\omega^2 = A^2 - 4^2$ — (1)

$64 = \omega^2(A^2 - 5^2) \Rightarrow 64/\omega^2 = A^2 - 5^2$ — (2)

(1) − (2)

$\frac{100}{\omega^2} - \frac{64}{\omega^2} = 5^2 - 4^2$

$\frac{36}{\omega^2} = 9 \Rightarrow \frac{6}{\omega} = 3$

$\omega = 2$

$\frac{2\pi}{T} = 2 \Rightarrow T = \pi\ s$

## Ans [C]

Using the eq. of velocity we can calculate ω

$$v = \omega\sqrt{a^2 - y^2} \Rightarrow 10 = \omega\sqrt{a^2 - (4)^2} \text{ and } 8 = \omega\sqrt{a^2 - (5)^2}$$

$$\text{On solving } \omega = 2 \Rightarrow \omega = \frac{2\pi}{T} = 2 \Rightarrow T = \pi\ sec$$

## P-Q1040



If the displacement of a particle executing SHM is given by $y = 0.30\sin(220t + 0.64)$ in *metre*, then the frequency and maximum velocity of the particle is .

(A) 35 *Hz*, 66 *m / s* (B) 45 *Hz*, 66 *m / s*

(C) 58 *Hz*, 113 *m / s* (D) 35 *Hz*, 132 *m / s*

$\omega = 220$

$2\pi f = 220$

$2 \times \frac{22}{7} \times f = 220$

$f = 35\ Hz$

$v_{max} = \omega A$

$= 220 \times 0.3$

$= 66\ m/s$

# P-Q1040-Solution

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## Ans [A]

$$n = \frac{\omega}{2\pi} = \frac{220}{2\pi} = 35\ Hz$$

$$v_{max} = \omega a = 220 \times 0.30\ m/s = 66\ m/s$$

Maximum velocity will be at centre where y=0

**P-Q1072**



A particle in SHM is described by the displacement equation $x(t) = A\cos(\omega t + \theta)$. If the initial $(t = 0)$ position of the particle is 1 $cm$ and its initial velocity is $\pi$ $cm/s$, what is its amplitude? The angular frequency of the particle is $\pi s^{-1}$

(A) 1 $cm$

(B) $\sqrt{2}$ $cm$

(C) 2 $cm$

(D) 2.5 $cm$

$v = \omega\sqrt{A^2 - x^2}$

$\pi = \pi\sqrt{A^2 - 1^2}$

$1 = A^2 - 1$

$A^2 = 2 \Rightarrow$ $A = \sqrt{2}$ cm

# P-Q1072-Solution

## Ans [B]

Given, $v = \pi\, cm/\sec$, $x = 1\, cm$ and $\omega = \pi s^{-1}$

using $v = \omega\sqrt{a^2 - x^2} \Rightarrow \pi = \pi\sqrt{a^2 - 1}$

$\Rightarrow 1 = a^2 - 1 \Rightarrow a = \sqrt{2}\, cm.$

Given that $\pi$ is the velocity and angular frequency

## P-Q1074



The period of a simple pendulum is doubled, when

(A) Its length is doubled

(B) The mass of the bob is doubled ✗

✓ (C) Its length is made four times

(D) The mass of the bob and the length of the pendulum are doubled

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad T \propto \sqrt{l}$$

$$2T \qquad 4l$$

## P-Q1074-Solution

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## Ans [C]

$$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T \propto \sqrt{l}$$

For double time period its length is has to be made four times

Remember time period doesn’t depend on the mass suspended.

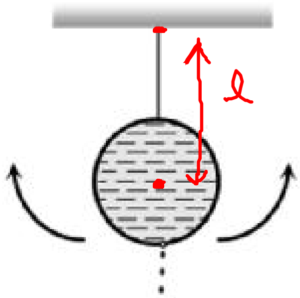
A simple pendulum is made of a body which is a hollow sphere containing mercury suspended by means of a wire. If a little mercury is drained off, the period of pendulum will

(A) Remains unchanged

(B) Increase

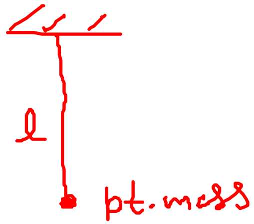
(C) Decrease

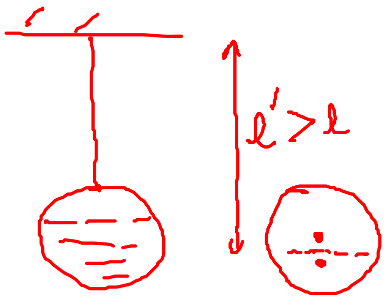
(D) Become erratic




$T = 2\pi\sqrt{\frac{l}{g}}$

l = distance b/w pt. of suspension and C.O.M of bob




$T' = 2\pi\sqrt{\frac{l'}{g}}$

$T' \propto \sqrt{l'}$

$l' \uparrow \quad T' \uparrow \quad f \downarrow$

## P-Q1076-Solution

### Ans [B]

When a little mercury is drained off, the position of center of gravity of ball falls (wrt fixed) so that effective length so pendulum increases hence T increases.

## P-Q1078



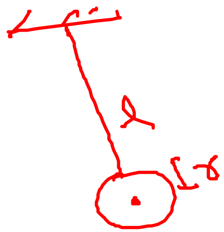
The time period of a second's pendulum is 2 *sec*. The spherical bob which is empty from inside has a mass of 50 *gm*. This is now replaced by another solid bob of same radius but having different mass of 100 *gm*. The new time period will be

(A) 4 *sec*

(B) 1 *sec*

(C) 2 *sec*

(D) 8 *sec*



$T = 2\pi\sqrt{\frac{l}{g}}$, $l = l + r$

## P-Q1078-Solution

**Ans [C]**

$$T = 2\pi\sqrt{\frac{l}{g}}$$

It is independent of mass

## P-Q1099

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A simple pendulum is executing simple harmonic motion with a time period *T*. If the length of the pendulum is increased by 21%, the percentage increase in the time period of the pendulum of increased length is

(A) 10%  (B) 21%

(C) 30%  (D) 50%

$\frac{\Delta T}{T} = \frac{T_f - T_i}{T_i} \times 100$

Small change: $\frac{\Delta T}{T} = \frac{1}{2}\frac{\Delta l}{l}$

$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T \propto \sqrt{l}$

$l' = 1.21\,l$

$T' \propto \sqrt{1.21\,l} = 1.1\,T$

100 + 21 = 1.21

$\sqrt{1.44}$, 1.2T, 44%

1 → 100, 0.2 → 20

1 → 100, 0.1 → 10

# P-Q1099-Solution

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## Ans [A]

If initial length $l_1 = 100$ then $l_2 = 121$

By using $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{l_1}{l_2}}$

For a simple pendulum
$T \propto \sqrt{l}$

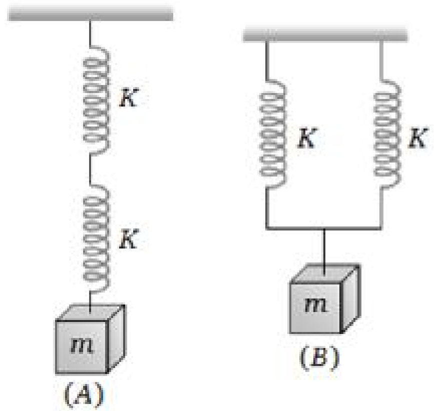
Hence, $\frac{T_1}{T_2} = \sqrt{\frac{100}{121}} \Rightarrow T_2 = 1.1\,T_1$

% increase $= \frac{T_2 - T_1}{T_1} \times 100 = 10\,\%$

## P-Q10101



Two identical spring of constant k are connected in series and parallel as shown in figure. A mass m is suspended from them. The ratio of their frequencies of vertical oscillations will be




(A) 2: 1 (B) 1: 1

(C) 1: 2 ✓ (D) 4: 1

$T = 2\pi\sqrt{\frac{m}{K}} \Rightarrow f \propto \sqrt{K}$

$\frac{f_{series}}{f_{parallel}} = \frac{\sqrt{K_s}}{\sqrt{K_p}} = \frac{\sqrt{K/2}}{\sqrt{2K}} = \frac{1}{2}$

## P-Q10101-Solution

**Ans [C]**

$$n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

$$\Rightarrow \frac{n_S}{n_P} = \sqrt{\frac{k_S}{k_P}}$$

$$\Rightarrow \frac{n_s}{n_p} = \sqrt{\frac{\left(\frac{k}{2}\right)}{2k}} = \frac{1}{2}$$

When in series $\frac{1}{k_{eq}} = \frac{1}{k_1} + \frac{1}{k_2}$

When parallel $k_{eq} = k_1 + k_2$

## P-Q10102



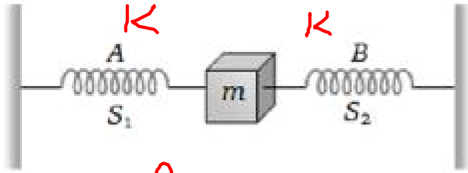
In the figure, $S_1$ and $S_2$ are identical springs. The oscillation frequency of the mass m is $f$. If one spring is removed, the frequency will become

(A) $f$

(B) $f \times 2$

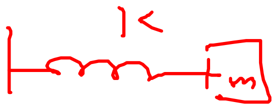
(C) $f \times \sqrt{2}$

(D) $f/\sqrt{2}$ ✓




Parallel

$K_{eq} = 2K$




$f = \frac{1}{2\pi}\sqrt{\frac{2K}{m}}$

$f' = \frac{1}{2\pi}\sqrt{\frac{K}{m}} = \frac{f}{\sqrt{2}}$

$f \propto \sqrt{K}$

# P-Q10102-Solution

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## Ans [D]

For the given figure $f = \frac{1}{2\pi}\sqrt{\frac{k_{eq}}{m}} = \frac{1}{2\pi}\sqrt{\frac{2k}{m}}$ .....(i)

If one spring is removed, then $k_{eq} = k$ and

$f' = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ .... (ii)

From equation (i) and (ii), $\frac{f}{f'} = \sqrt{2} \Rightarrow f' = \frac{f}{\sqrt{2}}$

Think like if the particle is moved by a distance $x$, then both springs have force $kx$ on spring towards central position.
So $Total\ force = 2kx$. Thus $k_{eq} = 2k$.

## P-Q2234

The superposition takes place between two waves of frequency ***f*** and amplitude ***a***.

The total intensity is directly proportional to

(A) $a$ (B) $2a$

(C) $2a^2$ (D) $4a^2$

$I \propto A^2$

$I \propto (2a)^2$

$\propto 4a^2$

# P-Q2234-Solution

## Ans [D]

Resultant amplitude

$$A=\sqrt{a^2+a^2+2aa\cos\phi}=\sqrt{4a^2\cos^2\left(\frac{\phi}{2}\right)}$$

$$\because\ I\propto A^2 \Rightarrow I\propto 4a^2$$

$$A=\sqrt{{A_1}^2+{A_2}^2+2A_1A_2\cos\phi}:where\ \phi\ is\ phase\ difference.$$

$$And\ \ intensity \propto amplitude^2$$

## P-Q2237

Two waves of same frequency and intensity superimpose with each other in opposite phases, then after superposition the

(A) Intensity increases by 4 times

(B) Intensity increases by two times

(C) Frequency increases by 4 times

(D) None of these

destructive interf.

$I_{res} = 0$

$A_{res} = 0$

$f_{res} = f$

## P-Q2237-Solution

**Ans [D]**

This is a case of destructive interference.

# P-Q2241



Two sound waves (expressed in CGS units) given by

$y_1 = 0.3 \sin \frac{2p}{l}(vt - x)$ and $y_2 = 0.4 \sin \frac{2p}{l}(vt - x + q)$ interfere.

The resultant amplitude at a place where phase difference is $p / 2$ will be

(A) 0.7 *cm* (B) 0.1 *cm*

(C) 0.5 *cm* (D) $\frac{1}{10}\sqrt{7}$ *cm*

$A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\Delta\phi}$ → 0

$= \sqrt{(0.3)^2 + (0.4)^2} = \sqrt{0.25}$

$A = 0.5$

# P-Q2241-Solution

## Ans [C]

Resultant amplitude $= \sqrt{a_1^2 + a_2^2 + 2a_1a_2 \cos\phi}$

$$= \sqrt{0.3^2 + 0.4^2 + 2\times0.3\times0.4\times\cos\frac{\pi}{2}} = 0.5\ cm$$

$A = \sqrt{A_1{}^2 + A_2{}^2 + 2A_1A_2\cos\phi}$ : *where* $\phi$ *is phase difference.*

## P-Q2249



The amplitude of a wave represented by displacement equation

$$y = \frac{1}{\sqrt{a}} \sin \omega t \pm \frac{1}{\sqrt{b}} \cos \omega t$$ will be

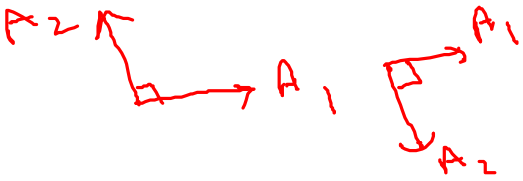
($y_1$, $y_2$)

(A) $\frac{a+b}{ab}$

(B) $\frac{\sqrt{a}+\sqrt{b}}{ab}$

(C) $\frac{\sqrt{a}\pm\sqrt{b}}{ab}$

(D) $\sqrt{\frac{a+b}{ab}}$ ✓




$$A = \sqrt{A_1^2 + A_2^2}$$

$$= \sqrt{\frac{1}{a} + \frac{1}{b}} = \sqrt{\frac{b+a}{ab}}$$

$$y_1 = \frac{1}{\sqrt{a}} \sin \omega t$$

$$y_2 = \frac{1}{\sqrt{b}} \sin\left(\omega t + \frac{\pi}{2}\right)$$

$$\Delta\phi = \pi/2$$

# P-Q2249-Solution

## Ans [D]

$$y = \frac{1}{\sqrt{a}} \sin \omega t \pm \frac{1}{\sqrt{b}} \sin\left(\omega t + \frac{\pi}{2}\right)$$

Here phase difference is $\frac{\pi}{2}$

The resultant amplitude =

$$\sqrt{\left(\frac{1}{\sqrt{a}}\right)^2 + \left(\frac{1}{\sqrt{b}}\right)^2} = \sqrt{\frac{1}{a} + \frac{1}{b}} = \sqrt{\frac{a+b}{ab}}$$

$A = \sqrt{A_1{}^2 + A_2{}^2 + 2A_1A_2\cos\phi}$ : *where* $\phi$ *is phase difference.*

## P-Q2251

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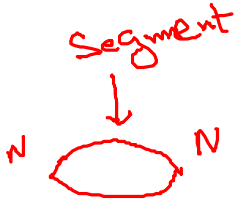
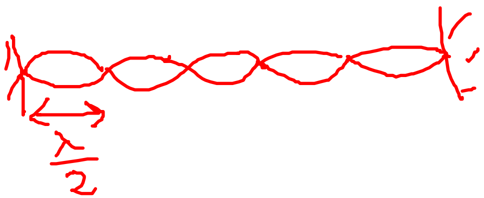
Standing waves are produced in a 10 *m* long stretched string. If the string vibrates in 5 segments and the wave velocity is 20 *m*/*s*, the frequency is

(A) 2 *Hz* (B) 4 *Hz*

(C) 5 *Hz* (D) 10 *Hz*




$5\frac{\lambda}{2} = 10$

$\lambda = 4$

$v = f\lambda$

$f = \frac{v}{\lambda} = \frac{20}{4}$

$= 5\ Hz$

## P-Q2251-Solution

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### Ans [C]

String vibrates in five segment so $\frac{5}{2}\lambda = l \Rightarrow \lambda = \frac{2l}{5}$

Hence $n = \frac{v}{\lambda} = 5 \times \frac{v}{2l} = 5 \times \frac{20}{2 \times 10} = 5 \ Hz$

$v = f\lambda$ *and* *Length of one segment = Node to Node length* $= \lambda/2$

## P-Q2253

A string is producing transverse vibration whose equation is $y = 0.021 \sin(x + 30t)$, Where *x* and *y* are in meters and is in seconds. If the linear density of the string is $1.3 \times 10^{-4}$ *kg/m*, then the tension in the string in will be

(A) 10

(B) 0.5

(C) 1

(D) 0.117

$K = 1$

$\omega = 30$

$v = \frac{\omega}{K} = 30$

$\sqrt{\frac{T}{\mu}} = 30$

$T = (30)^2 \mu$

$= 900 \times 1.3 \times 10^{-4}$

$= 11.7 \times 10^{-2}$

$= 0.117$ N

# P-Q2253-Solution



## Ans [D]

$$y = 0.021\sin(x + 30t)$$

$$v = \frac{\omega}{k} = \frac{30}{1} = 30\ m/s$$

$$v = \sqrt{\frac{T}{m}} \Rightarrow 30 = \sqrt{\frac{T}{1.3 \times 10^{-4}}} \Rightarrow T = 0.117$$

$$v = f\lambda = (2\pi f)\left(\frac{\lambda}{2\pi}\right) = \frac{\omega}{k} = \sqrt{\frac{T}{\mu}}$$

An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be higher by 100 *Hz*, then the fundamental frequency of open pipe is:

(A) 480 *Hz*

(B) 300 *Hz*

(C) 240 *Hz*

(D) 200 *Hz*

## P-Q2269-Solution

### Ans [D]

Fundamental frequency of open organ pipe $= \dfrac{v}{2l}$

Frequency of third harmonic of closed pipe $= \dfrac{3v}{4l}$

$$\therefore \frac{3v}{4l} = 100 + \frac{v}{2l}$$

$$\Rightarrow \frac{3v}{4l} - \frac{2v}{4l} = \frac{v}{4l} = 100$$

$$\Rightarrow \frac{v}{2l} = 200\ Hz.$$

*fundamental frequency or First harmonic (Open pipe)* $= \dfrac{v}{2l}$

*First overtone or third harmonic (Closed pipe)* $= \dfrac{3v}{4l}$

## P-Q2270



The stationary wave $y = 2a \sin kx \cos \omega t$ in a closed organ pipe is the result of the superposition of $y = a \sin(\omega t - kx)$ and

(A) $y = -a \cos(\omega t + kx)$

(B) $y = -a \sin(\omega t + kx)$

(C) $y = a \sin(\omega t + kx)$

(D) $y = a \cos(\omega t + kx)$

$y_1 + y_2 = y$

$x = 0$ ; $A_{sw} = 0 \Rightarrow$ Node

At $x = 0$ ; $y_1 + y_2 = 0$

$y_1 = a \sin \omega t$

$y_2 =$

## P-Q2270-Solution

### Ans [B]

In closed organ pipe. If $y_{incident} = a\sin(\omega t - kx)$

then $y_{reflected} = a\sin(\omega t + kx + \pi) = -a\sin(\omega t + kx)$

Superimposition of these two waves give the required stationary wave.

Direction will be reversed, so $x$ becomes $-x$ and an additional phase difference of $\pi$ will also be there.