PHYSICS

BOOKS - NTA MOCK TESTS

NTA JEE MOCK TEST 48

Physics

1. The de-Broglie wavelength of an electron, an α -particle and a proton are λ_e, λ_α, λ_p. Which is wrong from the following:

A. $\lambda_e < \lambda_p$

B. $\lambda_p > \lambda_\alpha$

C. $\lambda_e > \lambda_\alpha$

D. $\lambda_\alpha < \lambda_p < \lambda_e$

Answer: A

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2. The masses of five balls at rest and lying at equal distance in a straight line are in geometrical progression with ratio 2 and their

coefficients of restitution are each 2/3 . If the first ball is started towards the second with velocity u, then the velocity communicated to 5^{th} ball is

A. $\frac{5}{9}u$

B. $\left(\frac{5}{9}\right)^2 u$

C. $\left(\frac{5}{9}\right)^3 u$

D. $\left(\frac{5}{9}\right)^4 u$

Answer: D

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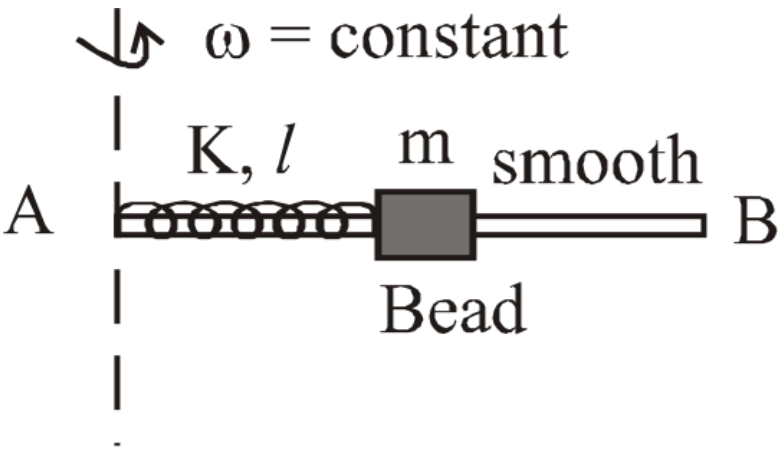
3. AB is a light rigid rod. Which is rotating about a vertical axis passing through A, A spring of force constant K and natural length l is attached at A and its other end is attached to a small bead of mass m. The bead can slide without friction on the rod. At the initial moment the bead is at rest (w.rt. the rod) and the spring is unstreached Select

correct option



A. $V_{\max} = \sqrt{\frac{m\omega^2 l^2}{k - m\omega^2}}$

B. $V_{\max} = \sqrt{\frac{m\omega^4 l^2}{k - m\omega^2}}$

C. $V_{\max} = \sqrt{\frac{m\omega^4 l^2}{m\omega^2 - k}}$

D. $V_{\max} = \sqrt{\frac{m\omega^2 l^2}{m\omega^2 - k}}$

Answer: B

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4. An ammeter has resistance R_0 and range I what resistance should be connected in parallel with it to increase its range by nI ?

A. $R_0/(n-1)$

B. $R_0/(n+1)$

C. R_0/n

D. None of these

Answer: C

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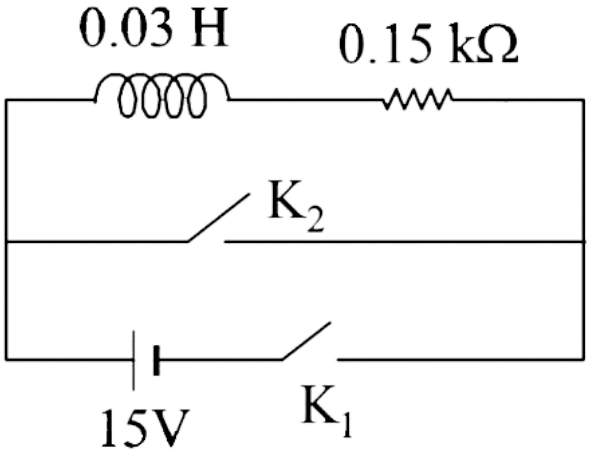
5. An inductor (L =0.03 H) and a resistor $(R = 0.15k(\Omega))$ are connected in series to a battery of 15 V EMF in a circuit shown below. The key K_1 is opened and Key K_2 is closed simultaneously. At t =1 ms, the current in the

circuit will be $\left(e^5 = 150\right)$



A. 0.67 mA

B. 100 mA

C. 67 mA

D. 6.7 mA

Answer: A

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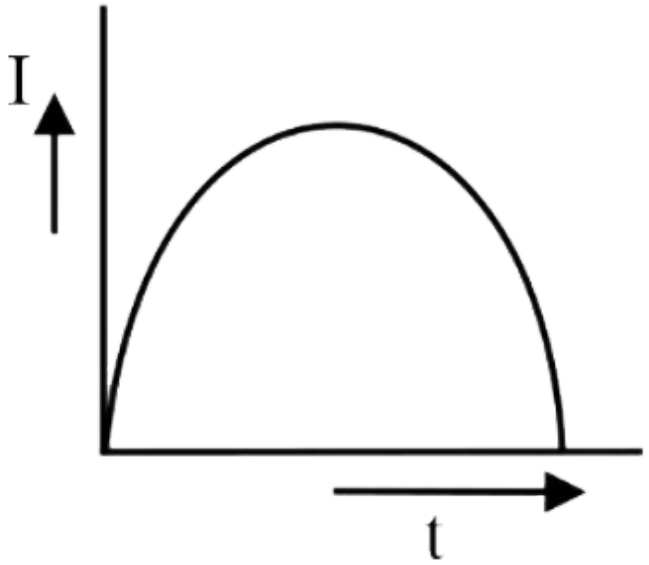
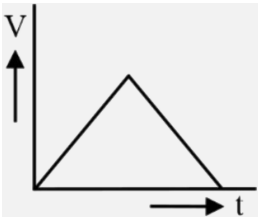
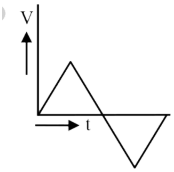
6. The current I in an inductance coil varies with time according to the graph given in the figure.

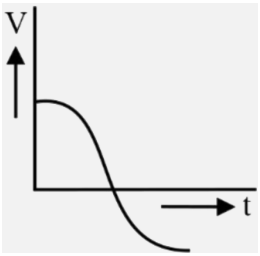


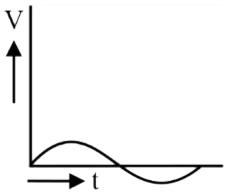
Which one of the following graphs gives the

variation of voltage with time across the inductor?

A. 

B. 

C. 

D. 

Answer: C

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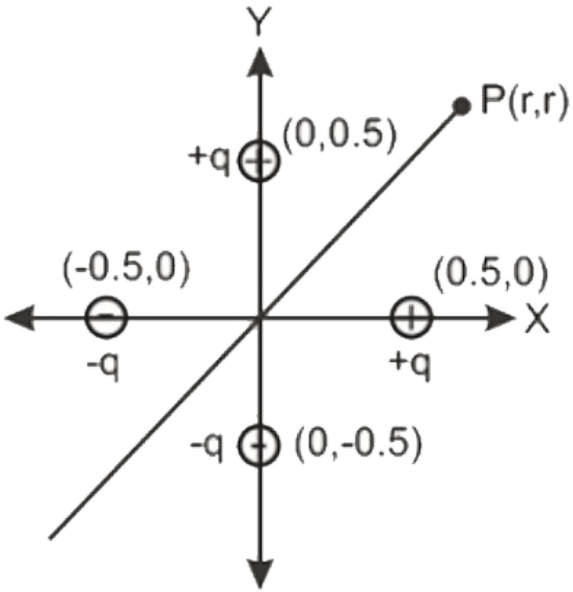
7. Four charges $+q, +q-q,$ and -q are placed on X - Y plane at the points whose coordinates are $(0.5, 0), (0, 0.5), (-0.5, 0)$ and $(0, -0.5)$ respectively.



The electric field due to these charges at a point P(r,r), where $r > > 0.5$, will be

A. $\frac{1}{4\pi\varepsilon_0} \times \frac{q}{2r^3}$

B. $\frac{1}{4\pi\varepsilon_0} \times \frac{q}{r^3}$

C. $\frac{1}{4\pi\varepsilon_0} \times \frac{3q}{r^3}$

D. $\frac{1}{\pi\varepsilon_0} \times \frac{q}{r^3}$

Answer: B

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8. A spherical uniform planet is rotating about its axis. The velocity of a point on its equator is V. Due to the rotation of planet about its axis the acceleration due to gravity g at equator is $1/2$ of g at poles. The escape

velocity of a particle on the planet in terms of V.

A. $V_e = 2V$

B. $V_e = V$

C. $V_e = V/2$

D. $V_e = \sqrt{3}V$

Answer: A

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9. A cylinder of radius R made of a material of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius R and outer radius 2R made of a material of thermal conductivity K_2. The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in steady state. The effective thermal conductivity of the system is

A. $K_1 + K_2$

B. $\frac{K_1 K_2}{K_1 + K_2}$

C. $\frac{K_1 + 3K_2}{4}$

D. $\frac{3K_1 + K_2}{4}$

Answer: C

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10. Two gases occupy two containers A and B then gas in A, of volume $0.10m^3$, exerts a pressure of $1.40Mpa$ and that in B, of volume $0.15m^3$, exerts a pressure $0.7MPa$. The two

containers are joined by a tube of negligible volume and the gases are allowed to intermingle. Then if the temperature remains constant, the final pressure in the container will be (in MPa)

A. 0.9

B. 0.98

C. 1.4

D. 2.1

Answer: B

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11. Two concentric coils of 10 turns each are placed in the same plane. Their radii are 20 cm and 40 cm and carry 0.2 A and 0.3 A current respectively in opposite directions. The magnetic induction (in tesla) at the centre is

A. $\frac{3}{4}\mu_0$

B. $\frac{5}{4}\mu_0$

C. $\frac{7}{4}\mu_0$

D. $\frac{9}{4}\mu_0$

Answer: B

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12. A chain is held on a frictionless table with $1/n$ th of its length hanging over the edge. If the chain has a length L and a mass M, how much work is required to pull the hanging part back on the table?

A. $\frac{MgL}{2n^2}$

B. $\frac{MgL}{n^2}$

C. $\frac{MgL}{4n^3}$

D. $\frac{MgL}{3n^{-1}}$

Answer: A

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13. The radioactive isotope X with a half-life of 10^9 decays to Y which is stable. A sample of rocks was found to contain both the elements X and Y in the years ratio $1:7$. If initially, the

quantity of Y in the rock was zero, then the age of the rocks is

A. $2 \times 10^9 years$

B. $3 \times 10^9 years$

C. $6 \times 10^9 years$

D. $7 \times 10^9 years$

Answer: B

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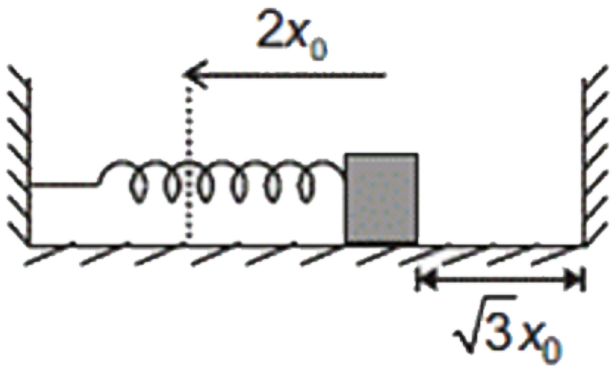
14. One end of a spring of force constant K is fixed to a vertical wall and other to a body of mass m resting on smooth horizontal surface. There is another wall at a distance of $\sqrt{3}x_0$ from the body. If all the collisions are elastic and spring is compressed by $2x_0$and released, then the time period of oscillation is



A. $\frac{5\pi}{3}\sqrt{\frac{m}{K}}$

B. $\frac{5\pi}{4}\sqrt{\frac{m}{K}}$

C. $\frac{3\pi}{2}\sqrt{\frac{m}{K}}$

D. $\frac{4\pi}{3}\sqrt{\frac{m}{K}}$

Answer: A

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15. A given quantity of a ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is

A. $\frac{2}{3}P$

B. P

C. $\frac{3}{2}P$

D. 2P

Answer: B

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16. Two plano-convex lenses of focal lengths 20cm and 30cm are placed together to form a

double convex lens. The final focal length will be

A. 12 cm

B. 60 cm

C. 20 cm

D. 30 cm

Answer: A

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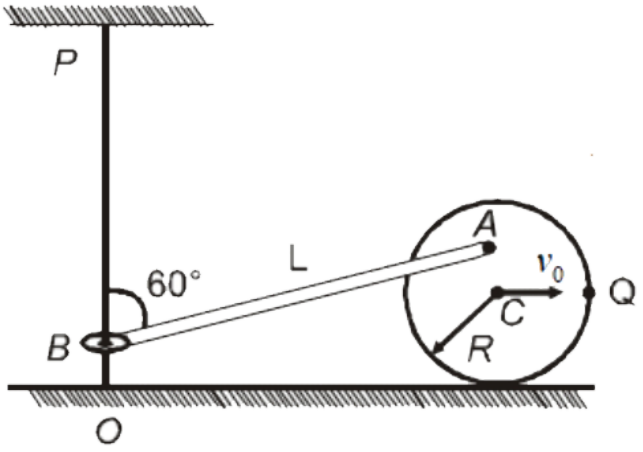
17. A smooth rod OP is fixed vertically. A disc of mass m and radius R is rolling without slipping at the given instant on a rough horizontal surface as shown. Velocity of centre of mass C of disc is v_0. A rod AB of length L is connected with disc at A, $R/2$ distance vertically up from centre of disc with pin joint (about which it can rotate freely), other end of the rod is attached to a small smooth ring B, which can move freely over rod OP. At an instant rod AB makes an angle 60° with the vertical. The velocity of ring on the vertical rod

at this instant is.



A. $\frac{\sqrt{3}}{2}v_0$

B. $\frac{3}{2}v_0$

C. v_0

D. perpendicular to velocity of point Q(Q and C are at same horizontal level)

Answer: A

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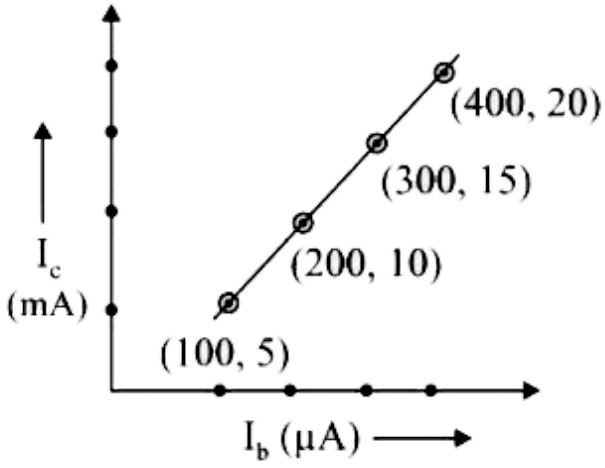
18. The transfer characteristic curve of a transistor, having input and output resistance $100\Omega \text{ and } 100k\Omega$ respectively, is shown in the figure. The Voltage and Power gain, are

respectively:



A. $5 \times 10^4, 2.5 \times 10^6$

B. $2.5 \times 10^4, 2.5 \times 10^6$

C. $5 \times 10^4, 5 \times 10^6$

D. $5 \times 10^4, 5 \times 10^5$

Answer: A

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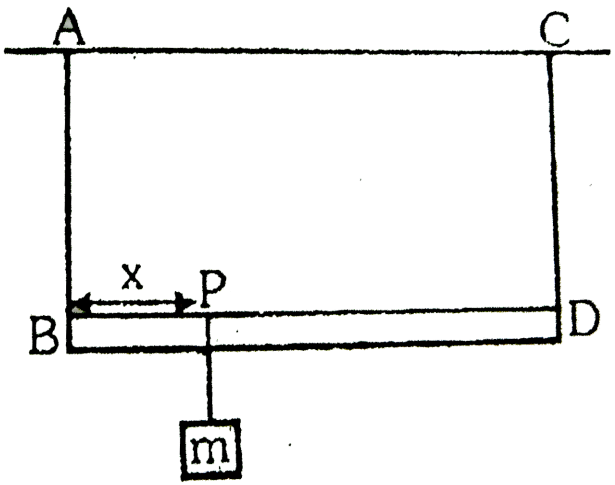
19. A massless rod BD is suspended by two identical massless strings AB and CD of equal lengths. A block of mass m is suspended at point P such that BP is equal to x, If the fundamental frequency of the left wire is twice the fundamental frequency of right wire, then

the value of x is :-



A. $\frac{l}{2}$

B. $\frac{l}{3}$

C. $\frac{l}{4}$

D. $\frac{l}{5}$

Answer: D

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20. Unpolarized light of intensity I is incident on a system of two polarizers, A followed by B. The intensity of emergent light is $\frac{I}{2}$. If a third polarizer C is placed between A and B, the intensity of emergent light is reduced to $\frac{I}{3}$. The angle between the polarizers A and C is θ. Then :

A. $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{4}}$

B. $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{4}}$

C. $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{2}}$

D. $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{2}}$

Answer: A

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21. A particle is projected towards the north with speed $20m/s$ at an angle 45° with horizontal. Ball gets horizontal acceleration of $7.5m/s^2$ towards east due to wind. Range of ball (in meter) minus 42 m will be

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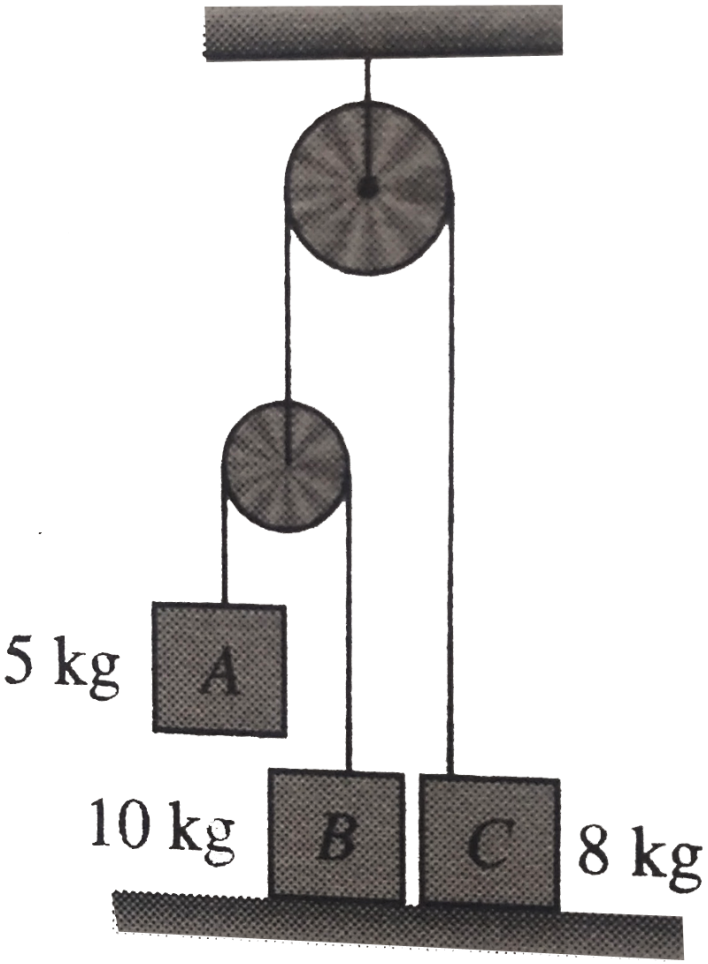
22. In the following arrangement, the system is initially at rest. The 5-kg block is now released. Assuming the pulley and string to be massless

and smooth, the acceleration of block C will be



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23. Light of wavelength $0.6\mu m$from a sodium lamp falls on a photocell and causes the emission of photoelectrons for which the stopping potential is 0.5 V. With wavelength $0.4\mu m$ from a sodium lamp, the stopping potential is 1.5 V. With this data , the value of h/e is

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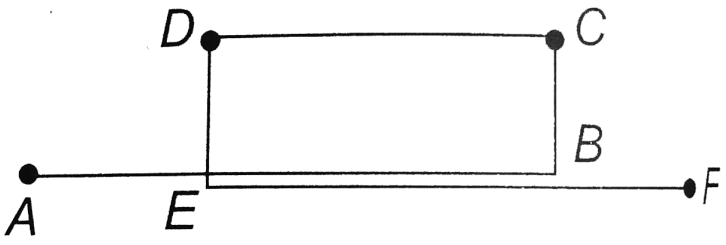
24. In the shown planar frame made of thin uniform rods, the length of section AB and

EF is l_1 and its thermal linear coefficient of expansion is α_1. The length of section CD is l_2 and its thermal linear coefficient of expansion is α_2.CB and DE are of same length having thermal linear coefficient of expansion α_2. point A, B, E and F reside on same line, that is, sections AB and EF overlap. then the ratio of $\frac{l_1}{l_2}$ for which the distance between end A and end F remains the same at all temperatures, is



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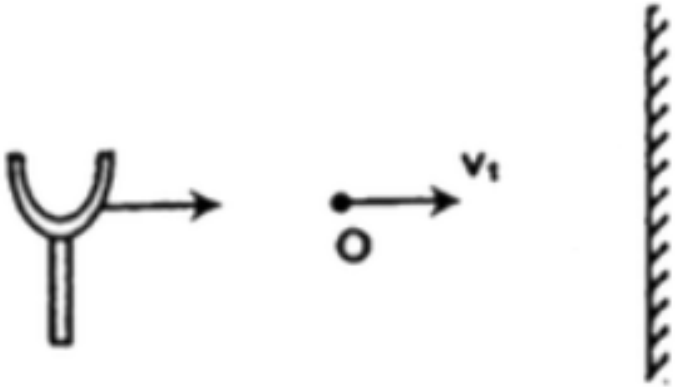
25. There is a source of sound (a tuning fork) moving towards a reflecting wall will a speed of $30ms^{-1}$. The velocity of the sound in air is $330ms^{-1}$and the frequency of the tuning fork is 600 Hz. The observer is between the source and the wall and is moving with some velocity V_1 towards the wall. The beat frequency heard by the observer is 4 Hz. If the tuning fork is waxed, the frequency beats heard by the observer becomes 3 Hz. If the new frequency

of tuning fork is k then $k/50$ is



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