Oscillations

Q.No.1: Time period of a simple pendulum is T inside a lift when the lift is stationary. If the lift moves upwards with an acceleration g/2, the time period of pendulum will be : **JEE 2021**

A. $\sqrt{\frac{2}{3}}\mathrm{T}$

B. $\sqrt{3}\mathrm{T}$

C. $\sqrt{\frac{3}{2}}\mathrm{T}$

D. $\frac{\mathrm{T}}{\sqrt{3}}$

Q.No.2:
A uniform cylinder of length L and mass M having cross - sectional area A is suspended, with its length vertical, form a fixed point by a massless spring, such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equilibrium is:

JEE 2013

A. $\frac{\mathrm{Mg}}{\mathrm{k}}$

B. $\frac{\mathrm{Mg}}{\mathrm{k}}\left(1-\frac{\mathrm{LA}\sigma}{\mathrm{M}}\right)$

C. $\frac{\mathrm{Mg}}{\mathrm{k}}\left(1-\frac{\mathrm{LA}\sigma}{2\mathrm{M}}\right)$

D. $\frac{\mathrm{Mg}}{\mathrm{k}}\left(1+\frac{\mathrm{LA}\sigma}{\mathrm{M}}\right)$

(Here k is spring constant)

Q.No.3:
The amplitude of a damped oscillator decreases to 0.9 times its original magnitude in 5s. In another 10s it will decrease to α times its original magnitude, where α equals:

A. 0.7 **JEE 2013**
B. 0.81
C. 0.729
D. 0.6

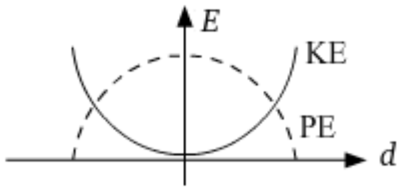
Q.No.4:
An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross sectional area A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure if P_0. The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency:
JEE 2013

A. $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$
B. $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$
C. $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$
D. $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A^2\gamma P_0}}$

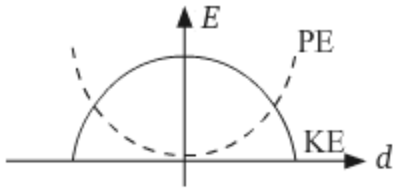
Q.No.5: A particle moves with simple harmonic motion in a straight line. In the first τ s, after starting from rest, it travels a distance a, and in the next τ s, it travels $2a$ in the same direction, then :
A. amplitude of motion is $4a$
B. time period of oscillations is 6τ
C. amplitude of motion is $3a$
D. time period of oscillations is 8τ

Q.No.6: For a simple pendulum, a graph is plotted between its kinetic energy (KE) and potential energy (PE) against its displacement d. Which one of the following represents these correctly?
(graph are schematic and not drawn to scale). **JEE 2015**

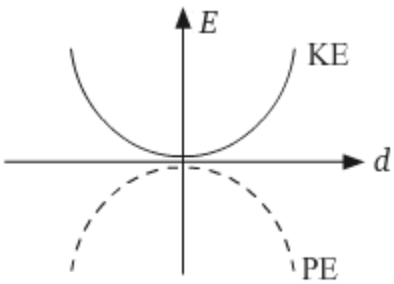
A.



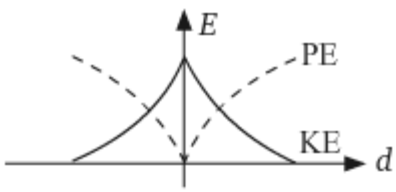
B.



C.



D.



Q.No.7: A pipe open at both ends has a fundamental frequency *f* in air. The pipe is dipped vertically in water so that half of it is in water. The fundamental frequency of the air column is now : **JEE 2016**

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

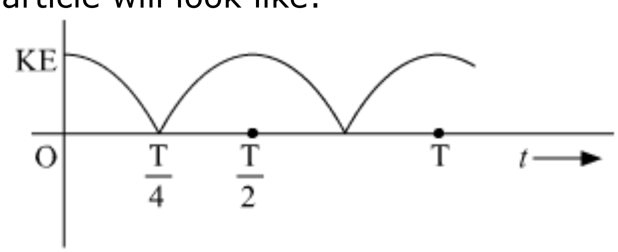
B. $2f$

C. f

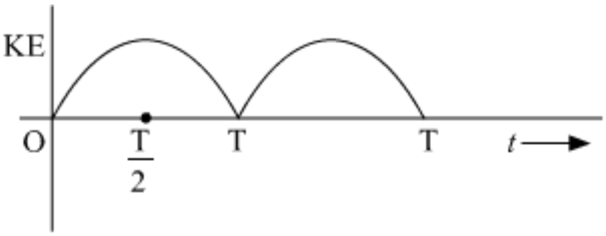
D. $\frac{f}{2}$

Q.No.8: A particle is executing simple harmonic motion with a time period T. At time = 0, it is at its position of equilibrium. The kinetic energy-time graph of the particle will look like: **JEE 2017**

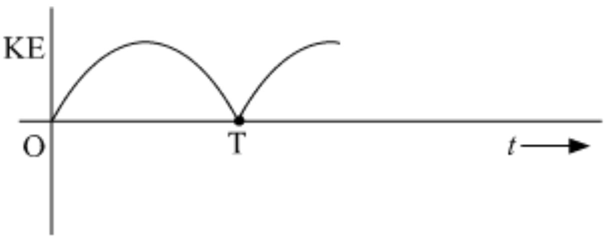
A.



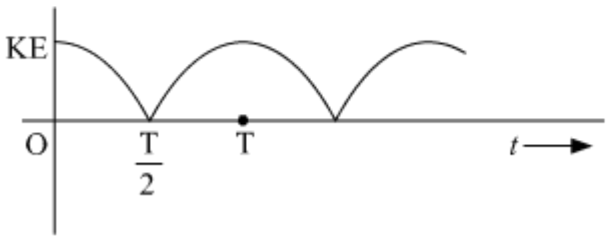
B.



C.



D.



Q.No.9: A granite rod of 60 cm length is clamped at its middle point and is set into longitudinal vibrations. The density of granite is 2.7×10^3 kg / m^3 and its Young's modulus is 9.27×10^{10} Pa. What will be the fundamental frequency of the longitudinal vibrations? **JEE 2018**

A. 10 kHz
B. 7.5 kHz
C. 5 kHz
D. 2.5 kHz

Q.No.10: A silver atom in a solid oscillates in simple harmonic motion in some direction with a frequency of 10^{12}/sec. What is the force constant of the bonds connecting one atom with the other? (Mole wt. of silver = 108 and Avagadro number = 6.02×10^{23} gm $mole^{-1}$) **JEE 2018**

A. 2.2 N/m
B. 5.5 N/m
C. 6.4 N/m
D. 7.1 N/m