

APOLLO

Simple harmonic motion

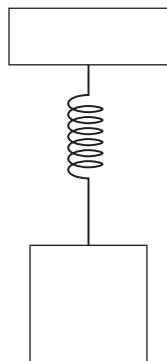
HL

Physics

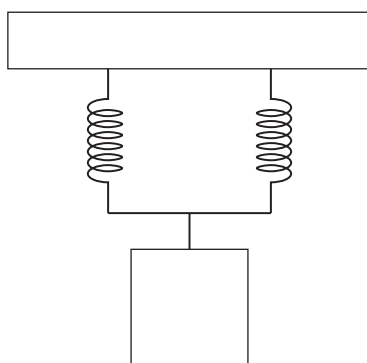
First assessment 2025

12 questions | questions

17. A mass–spring system oscillates with time period T_1 .



Another identical spring is connected in parallel with the first spring as shown. The mass is unchanged.



The time period of the oscillation for the two-spring system is T_2 .

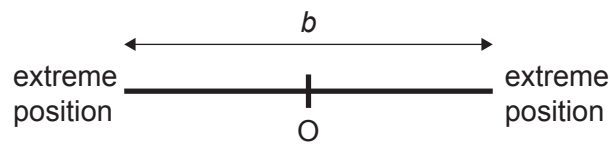
What is $\frac{T_2}{T_1}$?

- A. $\frac{1}{2}$
- B. $\frac{1}{\sqrt{2}}$
- C. $\sqrt{2}$
- D. 2

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4425-0101

19. An object performs simple harmonic motion with frequency f . The distance between the extreme positions at which the object is at rest is b .

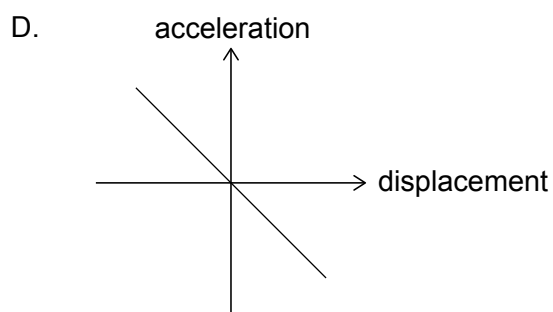
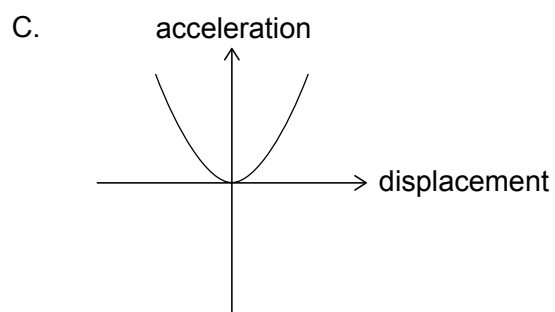
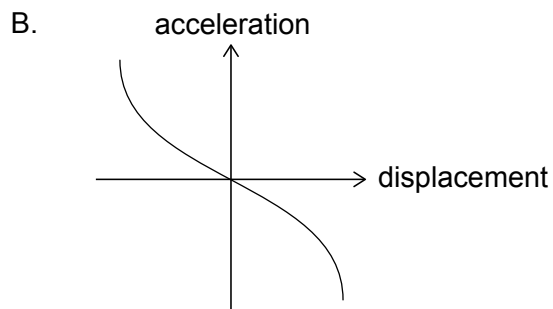
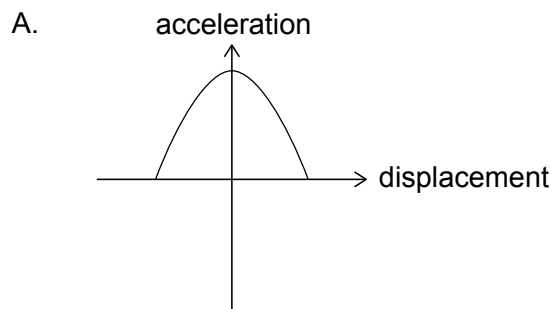


What is the speed of the object when it is halfway between its equilibrium position O and its extreme position?

- A. $\frac{1}{4}\pi fb$
- B. $\frac{1}{2}\pi fb$
- C. $\frac{\sqrt{3}}{4}\pi fb$
- D. $\frac{\sqrt{3}}{2}\pi fb$

15. A mass–spring system is oscillating with simple harmonic motion.

Which graph represents the variation of acceleration with displacement?



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2225-0713

- 16.** A mass–spring system oscillates in simple harmonic motion with maximum elastic potential energy E . The mass is tripled and the amplitude is doubled.

What is the new maximum elastic potential energy of the system?

- A. $\frac{4}{3}E$
- B. $4E$
- C. $6E$
- D. $12E$

20. For a lightly damped oscillation...

- A. the amplitude goes to zero within one period of oscillation.
- B. the oscillation frequency does not change with time.
- C. energy is transferred from the oscillation as quickly as possible.
- D. the oscillation frequency equals the undamped oscillation frequency.

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2225-0713

- 19.** A simple pendulum oscillates with period T on Earth. The mass of the pendulum is doubled and oscillates on the Moon where the acceleration due to gravity is $\frac{1}{6}$ that of Earth. The length of the pendulum stays the same.

What is the period of the pendulum on the Moon?

- A. $\sqrt{12} T$
- B. $\sqrt{6} T$
- C. $\sqrt{3} T$
- D. $\sqrt{2} T$

- 20.** A body of mass 2.0 kg undergoes simple harmonic motion with a maximum displacement of 0.5 m.
The period of oscillation of the body is $\frac{\pi}{4}$ s.

What is the total energy of the body?

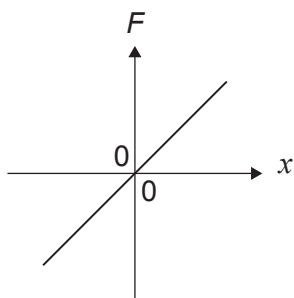
- A. 2 J
- B. 8 J
- C. 16 J
- D. 32 J

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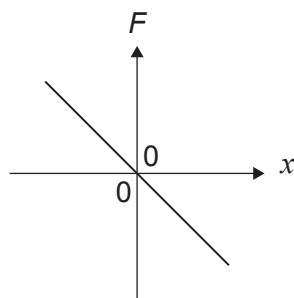
Turn over
4445-0713

17. A force F acts on a particle. The displacement of the particle is x . Which variation of F with x results in simple harmonic motion?

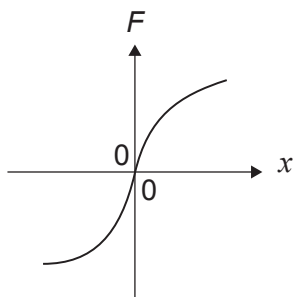
A.



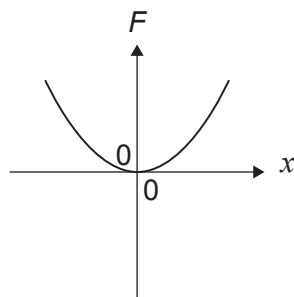
B.



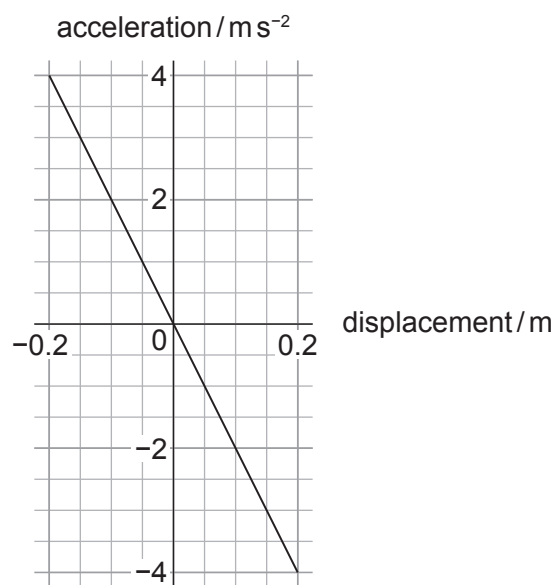
C.



D.



18. An object undergoes simple harmonic motion with frequency f . The graph shows the variation of its acceleration with displacement.



What is the value of f^2 in s^{-2} ?

- A. $\frac{5}{\pi^2}$
- B. $\frac{5}{\pi}$
- C. $\frac{100}{\pi^2}$
- D. $\frac{100}{\pi}$

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0020-0719

19. A mass oscillating vertically on a spring undergoes simple harmonic motion with amplitude X , total energy E and maximum speed v_{max} .

What is correct about the elastic potential energy E_H and speed v when the displacement is $\frac{X}{2}$?

A.	$E_H < \frac{E}{2}$	$v > \frac{v_{max}}{2}$
B.	$E_H < \frac{E}{2}$	$v < \frac{v_{max}}{2}$
C.	$E_H > \frac{E}{2}$	$v > \frac{v_{max}}{2}$
D.	$E_H > \frac{E}{2}$	$v < \frac{v_{max}}{2}$

19. A particle undergoes simple harmonic motion of period T . At time $t = 0$ the particle is at its equilibrium position.

What is t when the particle is at its greatest distance from the equilibrium position?

- A. $\frac{T}{8}$
- B. $\frac{T}{2}$
- C. $\frac{3T}{4}$
- D. T

21. A mass of 0.25 kg hangs from a spring of spring constant 4.0 N m^{-1} .

What is the natural frequency of oscillation for this system?

- A. 0.50 Hz
- B. 0.64 Hz
- C. 1.6 Hz
- D. 2.0 Hz

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