

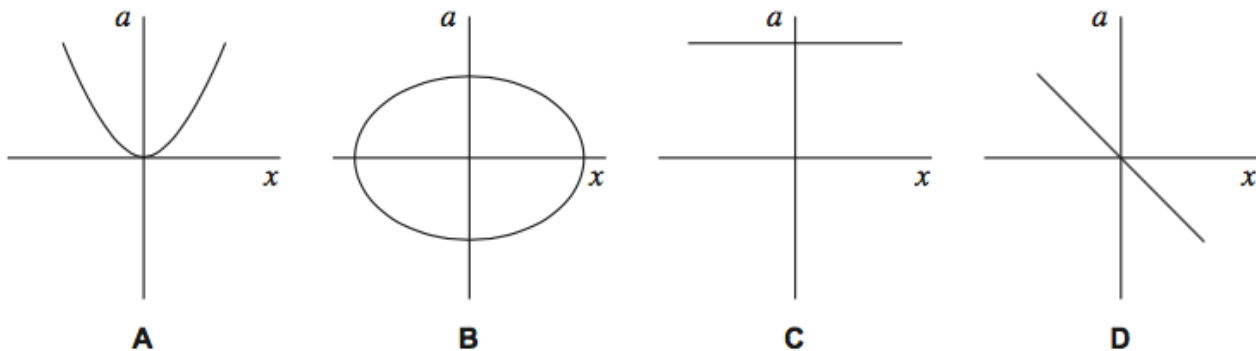
1)

For a body performing simple harmonic motion, which one of the following statements is correct?

- A** The maximum kinetic energy is directly proportional to the frequency.
- B** The time for one oscillation is directly proportional to the frequency.
- C** The speed at any instant is directly proportional to the displacement.
- D** The maximum acceleration is directly proportional to the amplitude.

2)

Which one of the following graphs shows how the acceleration, a , of a body moving with simple harmonic motion varies with its displacement, x ?



3)

A particle of mass 5.0×10^{-3} kg, moving with simple harmonic motion of amplitude 0.15 m, takes 47 s to make 50 oscillations.

What is the maximum kinetic energy of the particle?

- A** 2.0×10^{-3} J
- B** 2.5×10^{-3} J
- C** 3.9×10^{-3} J
- D** 5.0×10^{-3} J

4)

A simple pendulum has a time period of 1.42 s on Earth. The gravitational field strength at the surface of Mars is 0.37 times that at the surface of the Earth.

What is the time period of the pendulum on Mars?

- A** 0.53 s
- B** 0.86 s
- C** 2.33 s
- D** 3.84 s

5)

Which line, **A** to **D**, in the table gives the amplitude and frequency of a body performing simple harmonic motion whose displacement x at time t is given by the equation $x = P \cos Qt$?

	Amplitude	Frequency
A	$\frac{P}{2}$	$\frac{Q}{2\pi}$
B	P	$2\pi Q$
C	P	$\frac{Q}{2\pi}$
D	$2P$	$\frac{Q}{2\pi}$

6)

The tip of each prong of a tuning fork emitting a note of 320 Hz vibrates in simple harmonic motion with an amplitude of 0.50 mm.

What is the speed of each tip when its displacement is zero?

- A** zero
- B** $0.32\pi \text{ mm s}^{-1}$
- C** $160\pi \text{ mm s}^{-1}$
- D** $320\pi \text{ mm s}^{-1}$

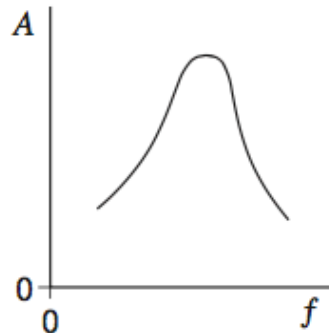
7)

A particle of mass m oscillates in a straight line with simple harmonic motion of constant amplitude. The total energy of the particle is E . What is the total energy of another particle of mass $2m$, oscillating with simple harmonic motion of the same amplitude but double the frequency?

- A** E
- B** $2E$
- C** $4E$
- D** $8E$

8)

A periodic force is applied to a lightly-damped object causing the object to oscillate. The graph shows how the amplitude A of the oscillations varies with the frequency f of the periodic force.



Which one of the following statements best describes how the shape of the curve would differ if the damping had been greater?

- A The curve would be lower at all frequencies.
- B The curve would be higher at all frequencies.
- C The curve would be unchanged except at frequencies above the resonant frequency where it would be lower.
- D The curve would be unchanged except at frequencies above the resonant frequency where it would be higher.

9)

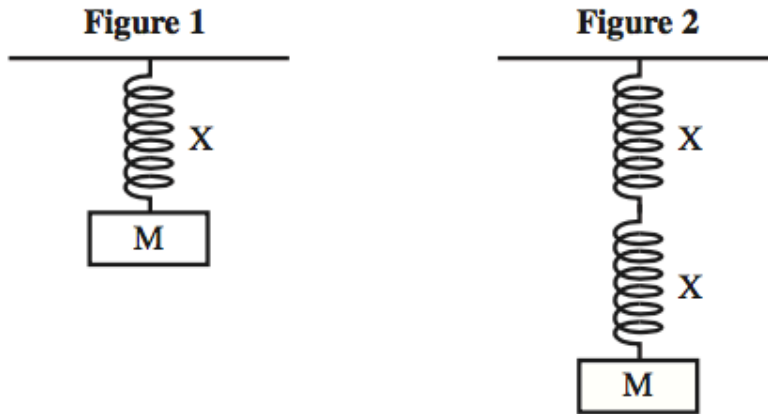
When a mass suspended on a spring is displaced, the system oscillates with simple harmonic motion. Which one of the following statements regarding the energy of the system is **incorrect**?

- A The potential energy has a minimum value when the spring is fully compressed or fully extended.
- B The kinetic energy has a maximum value at the equilibrium position.
- C The sum of the kinetic and potential energies at any time is constant.
- D The potential energy has a maximum value when the mass is at rest.

10)

When a mass M attached to a spring X , as shown in **Figure 1**, is displaced downwards and released it oscillates with time period T . An identical spring is connected in series and the same mass M is attached, as shown in **Figure 2**.

What is the new time period?



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

11)

A mass on the end of a spring undergoes vertical simple harmonic motion. At which point(s) is the magnitude of the resultant force on the mass a minimum?

- A at the centre of the oscillation
- B only at the top of the oscillation
- C only at the bottom of the oscillation
- D at both the top and bottom of the oscillation

12)

A baby bouncer consisting of a harness and elastic ropes is suspended from a doorway. When a baby of mass 10 kg is placed in the harness, the ropes stretch by 0.25 m . When the baby bounces, she starts to move with vertical simple harmonic motion. What is the time period of her motion?

- A 1.0 s
- B 2.1 s
- C 2.3 s
- D 3.1 s

13)

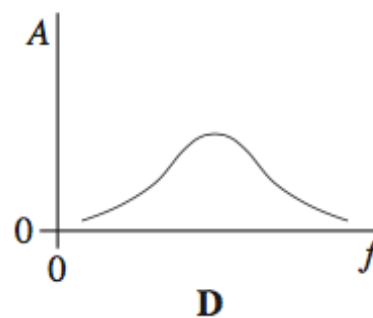
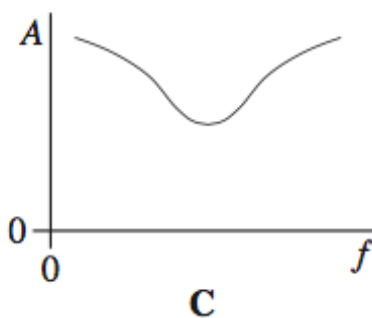
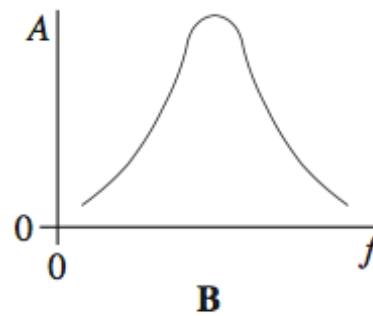
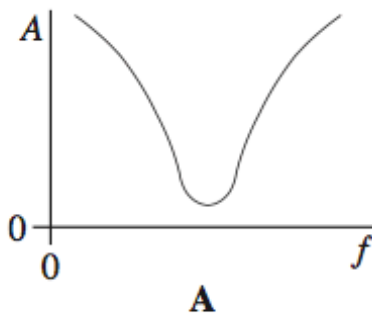
A simple pendulum and a mass-spring system both have the same time period T at the surface of the Earth. If taken to another planet where the acceleration due to gravity is twice that on Earth, which line, **A** to **D**, in the table gives the correct new time periods?

	simple pendulum	mass-spring
A	$T\sqrt{2}$	$\frac{T}{\sqrt{2}}$
B	$T\sqrt{2}$	T
C	$\frac{T}{\sqrt{2}}$	T
D	$\frac{T}{\sqrt{2}}$	$T\sqrt{2}$

14)

An oscillatory system, subject to damping, is set into vibration by a periodic driving force of frequency f . The graphs, **A** to **D**, which are to the same scale, show how the amplitude of vibration A of the system might vary with f , for various degrees of damping.

Which graph best shows the lightest damping?



15)

The frequency of a body moving with simple harmonic motion is doubled. If the amplitude remains the same, which one of the following is also doubled?

- A** the time period
- B** the total energy
- C** the maximum velocity
- D** the maximum acceleration

16)

The time period of a pendulum on Earth is 1.0 s. What would be the period of a pendulum of the same length on a planet with half the density but twice the radius of Earth?

- A** 0.5 s
- B** 1.0 s
- C** 1.4 s
- D** 2.0 s

17)

Which one of the following statements always applies to a damping force acting on a vibrating system?

- A** It is in the same direction as the acceleration.
- B** It is in the same direction as the displacement.
- C** It is in the opposite direction to the velocity.
- D** It is proportional to the displacement.

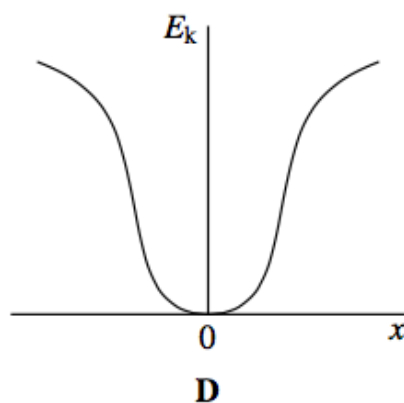
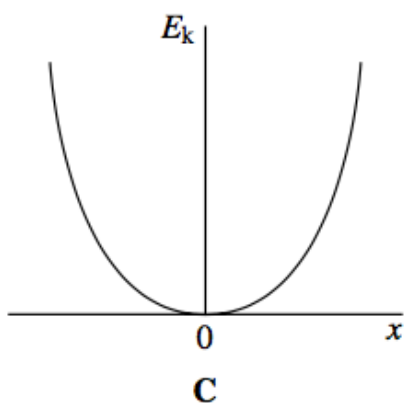
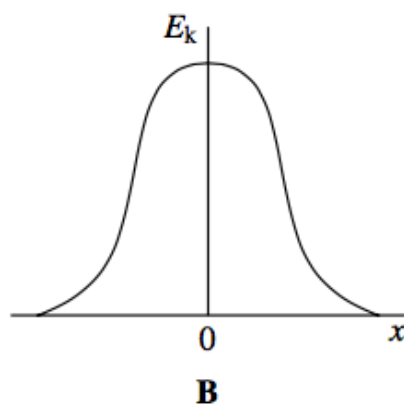
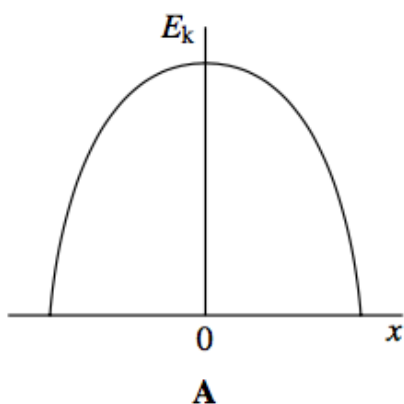
18)

A body moves with simple harmonic motion of amplitude 0.90 m and period 8.9 s. What is the speed of the body when its displacement is 0.70 m?

- A** 0.11 m s^{-1}
- B** 0.22 m s^{-1}
- C** 0.40 m s^{-1}
- D** 0.80 m s^{-1}

19)

Which graph, **A** to **D**, shows the variation of the kinetic energy, E_k , with displacement x for a particle performing simple harmonic motion?



20)

The time period of oscillation of a simple pendulum of length l is the same as the time period of oscillation of a mass M attached to a vertical spring. The length and mass are then changed. Which row, **A** to **D**, in the table would give a simple pendulum with a time period twice that of the spring oscillations?

	new pendulum length	new mass on spring
A	$2l$	$2M$
B	$2l$	$\frac{M}{2}$
C	$\frac{l}{2}$	$2M$
D	$\frac{l}{2}$	$\frac{M}{2}$

