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.

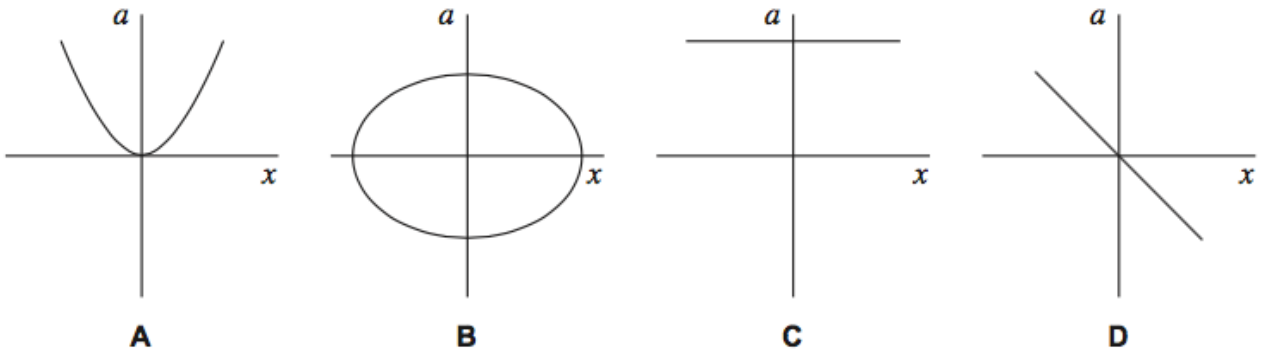
B The time for one oscillation is directly proportional to the frequency.

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 0.32π mm s^{-1}

C 160π mm s^{-1}

D 320π 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

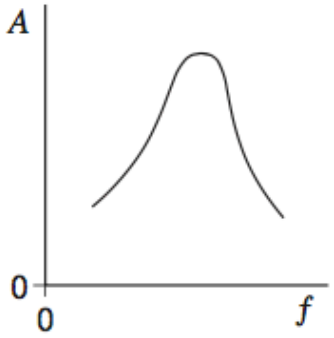
B $2E$

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?

Figure 1

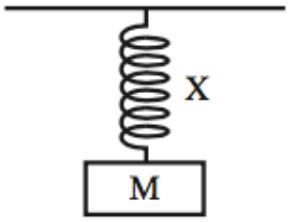
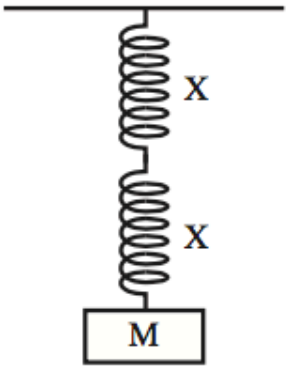


Figure 2



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)

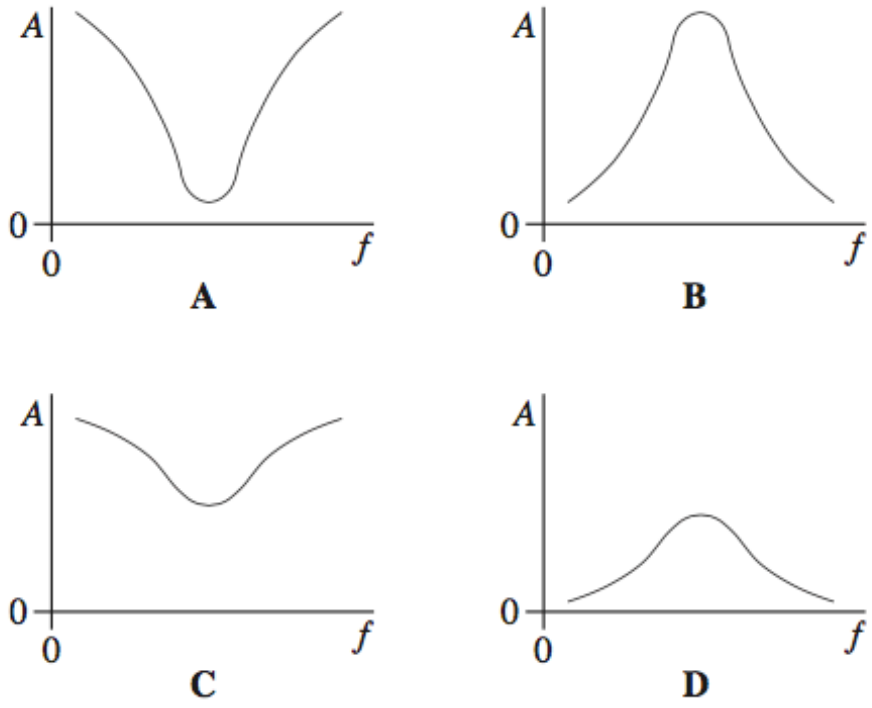
A simple pendulum and a mass-spring system both have the same time period T at the surface of the Earth. If taken to another planet where the acceleration due to gravity is twice that on Earth, which line, **A** to **D**, in the table gives the correct new time periods?

	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.

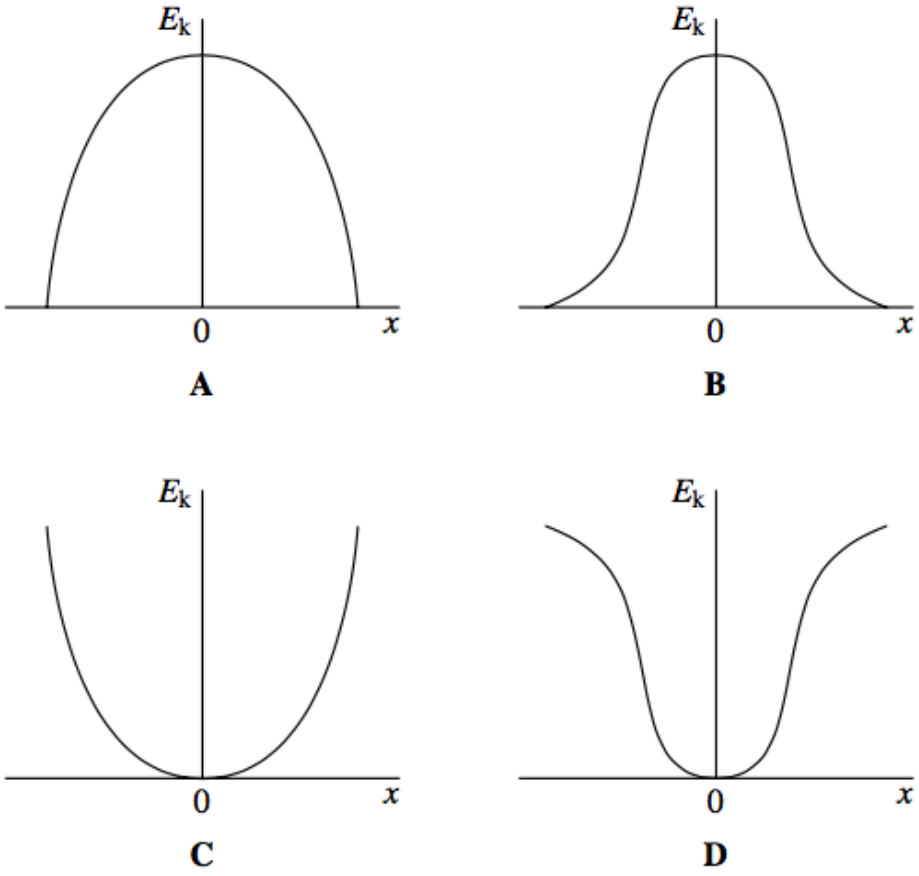
18)

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 $0.11\ \text{m s}^{-1}$
B $0.22\ \text{m s}^{-1}$
C $0.40\ \text{m s}^{-1}$
D $0.80\ \text{m s}^{-1}$

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	$\frac{l}{2}$	$\frac{M}{2}$