1

A body moves with simple harmonic motion of amplitude A and frequency $\frac{b}{2\pi}$.

What is the magnitude of the acceleration when the body is at maximum displacement?

A zero

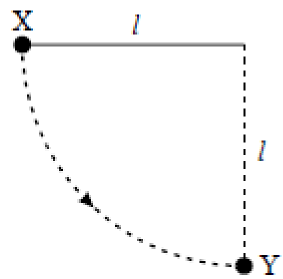
B $4\pi^2 A b^2$

C Ab^2

D $\frac{4\pi^2 A}{b^2}$

(Total 1 mark)

2



A ball of mass m, which is fixed to the end of a light string of length l, is released from rest at X. It swings in a circular path, passing through the lowest point Y at speed v. If the tension in the string at Y is T, which one of the following equations represents a correct application of Newton's laws of motion to the ball at Y?

A $T = \frac{mv^2}{l} - mg$

B $T - mg = \frac{mv^2}{l}$

C $mg - T = \frac{mv^2}{l}$

D $T + \frac{mv^2}{l} = mg$

(Total 1 mark)

3 A body is in simple harmonic motion of amplitude 0.50 m and period 4π seconds. What is the speed of the body when the displacement of the body is 0.30 m?

A $0.10 ms^{-1}$

B $0.15 ms^{-1}$

C $0.20 m s^{-1}$

D $0.40 m s^{-1}$

(Total 1 mark)

4 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.

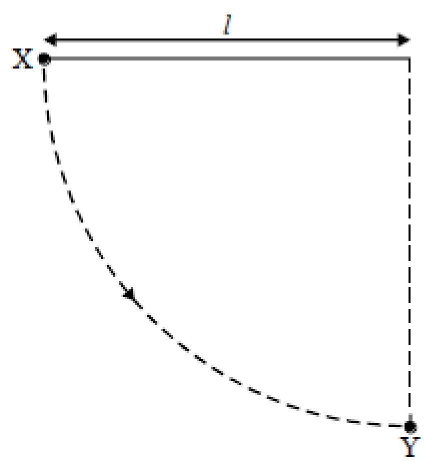
B It is in the same direction as the displacement.

C It is in the opposite direction to the velocity.

D It is proportional to the displacement.

(Total 1 mark)

5



A simple pendulum consists of a bob of mass m on the end of a light string of length l.
The bob is released from rest at X when the string is horizontal. When the bob passes through Y its velocity is v and the tension in the string is T. Which one of the following equations gives the correct value of T?

A $T = mg$

B $T = \frac{mv^2}{l}$

C $T + mg = \frac{mv^2}{l}$

D $T - mg = \frac{mv^2}{l}$

(Total 1 mark)

6 A particle of mass m executes simple harmonic motion in a straight line with amplitude A and frequency f. Which one of the following expressions represents the total energy of the particle?

A $2\pi^2 mfA^2$

B $2\pi^2 mf^2A^2$

C $4\pi^2 m^2f^2A$

D $4\pi^2 mf^2A^2$

(Total 1 mark)

7 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 was half that on Earth, which line, **A-D**, in the table gives correctly the new periods?

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

(Total 1 mark)

8 A body undergoes forced oscillation. Which one of the following will **not** be increasedby increasing the amplitude of the oscillatory driving force?

A the amplitude of the driven oscillation

B the energy of the driven oscillation

C the frequency of the driven oscillation

D the power required to maintain the driven oscillation

(Total 1 mark)

9 Which one of the following statements is **not** true for a body vibrating in simple harmonic motion when damping is present?

A The damping force is always in the opposite direction to the velocity.

B The damping force is always in the opposite direction to the acceleration.

C The presence of damping gradually reduces the maximum potential energy of the system.

D The presence of damping gradually reduces the maximum kinetic energy of the system.

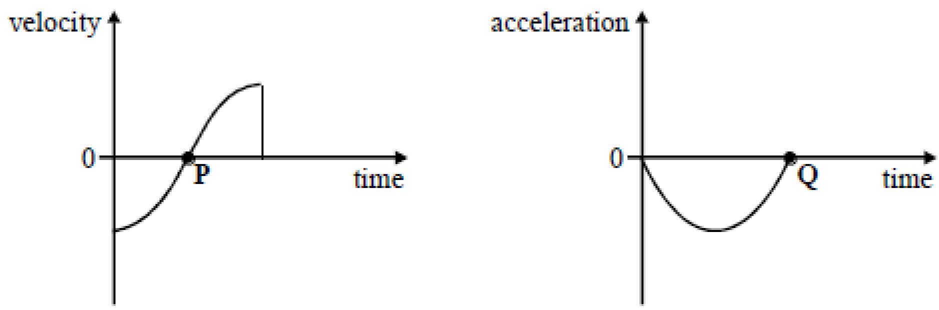
(Total 1 mark)

10 For which of the following relationships is the quantity y related to the quantity x by the relationship $x \propto \frac{1}{y}$?

	x	y
A	energy stored in a spring	extension of the spring
B	gravitational field strength	distance from a point mass
C	de Broglie wavelength of an electron	momentum of the electron
D	period of a mass-spring system	spring constant (stiffness) of the spring

(Total 1 mark)

11 The diagrams show the variation of velocity and acceleration with time for a body undergoing simple harmonic motion.



Which one of the following is proportional to the change in momentum of the body during the time covered by the graphs?

A The area enclosed by the velocity-time graph and the time axis

B The gradient of the velocity-time graph at the point **P**

C The area enclosed by the acceleration-time graph and the time axis

D The gradient of the acceleration-time graph at the point **Q**

(Total 1 mark)

12 A particle is oscillating with simple harmonic motion described by the equation:

$$s = 5 \sin (20\pi t)$$

How long does it take the particle to travel from its position of maximum displacement to its mean position?

A $\frac{1}{40}$ s

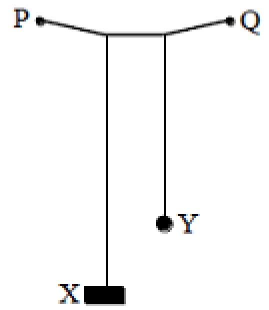
B $\frac{1}{20}$ s

C $\frac{1}{10}$ s

D $\frac{1}{5}$ s

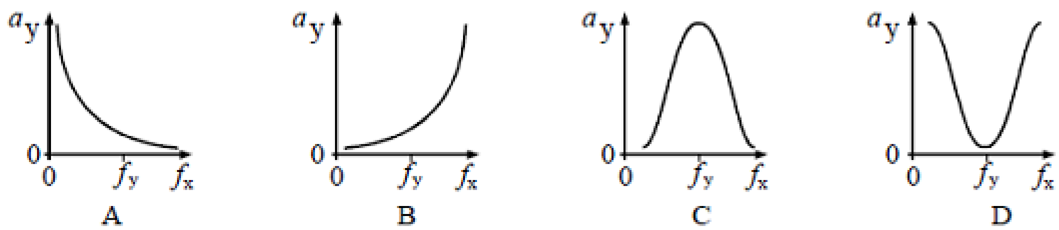
(Total 1 mark)

13 The diagram shows two pendulums suspended from fire same thread, **PQ**.



X is a heavy pendulum, the frequency f_x of which can be varied. **Y** is a lighter pendulum of fixed frequency f_y. As the frequency of oscillation of **X** is increased by shortening the thread, the amplitude of the oscillation of **Y** changes.

Which one of the following graphs best represents the relationship between the amplitude a_y of the oscillation of **Y** and the frequency f_x of **X**?



(Total 1 mark)

Mark schemes

1 C **[1]**

2 B **[1]**

3 C **[1]**

4 C **[1]**

5 D **[1]**

6 B **[1]**

7 A **[1]**

8 C **[1]**

9 B **[1]**

10 C **[1]**

11 C **[1]**

12 A **[1]**

13 C **[1]**