Q1. A mass M hangs in equilibrium on a spring. M is made to oscillate about the equilibrium position by pulling it down 10 cm and releasing it. The time for M to travel back to the equilibrium position for the first time is 0.50 s. Which line, **A** to **D**, is correct for these oscillations?

	amplitude/cm	period/s
A	10	1.0
B	10	2.0
C	20	2.0
D	20	1.0

(Total 1 mark)

Q2. Which one of the following statements is true when an object performs simple harmonic motion about a central point O?

A The acceleration is always away from O.

B The acceleration and velocity are always in opposite directions.

C The acceleration and the displacement from O are always in the same direction.

D The graph of acceleration against displacement is a straight line.

(Total 1 mark)

Q3. A girl of mass 40 kg stands on a roundabout 2.0 m from the vertical axis as the roundabout rotates uniformly with a period of 3.0 s. The horizontal force acting on the girl is approximately

A zero.

B 3.5×10^2 N.

C 7.2×10^2 N.

D 2.8×10^4 N.

(Total 1 mark)

Q4. For a particle moving in a circle with uniform speed, which one of the following statements is **incorrect**?

A The velocity of the particle is constant.

B The force on the particle is always perpendicular to the velocity of the particle.

C There is no displacement of the particle in the direction of the force.

D The kinetic energy of the particle is constant.

(Total 1 mark)

Q5. A simple pendulum and a mass-spring system are taken to the Moon, where the gravitational field strength is less than on Earth. Which line, **A** to **D**, correctly describes the change, if any, in the period when compared with its value on Earth?

	period of pendulum	period of mass–spring system
A	decrease	decrease
B	increase	increase
C	no change	decrease
D	increase	no change

(Total 1 mark)

Q6. 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

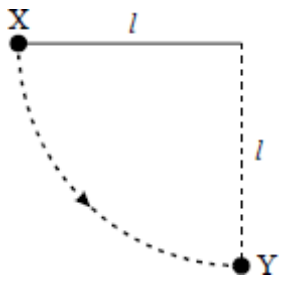
B $4\pi^2 Ab^2$

C Ab^2

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

(Total 1 mark)

Q7.



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)

Q8. 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)

Q9. 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.

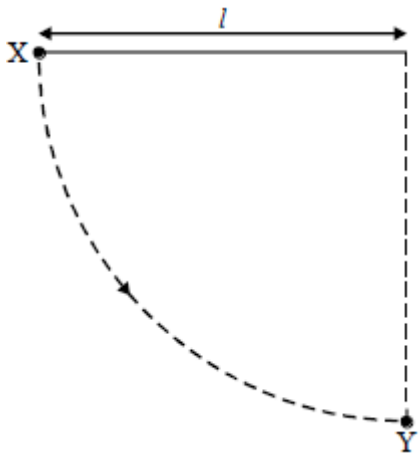
B It is in the same direction as the displacement.

C It is in the opposite direction to the velocity.

D It is proportional to the displacement.

(Total 1 mark)

Q10.



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)

Q11. 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)

Q12. 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)

Q13. 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)

Q14. 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.

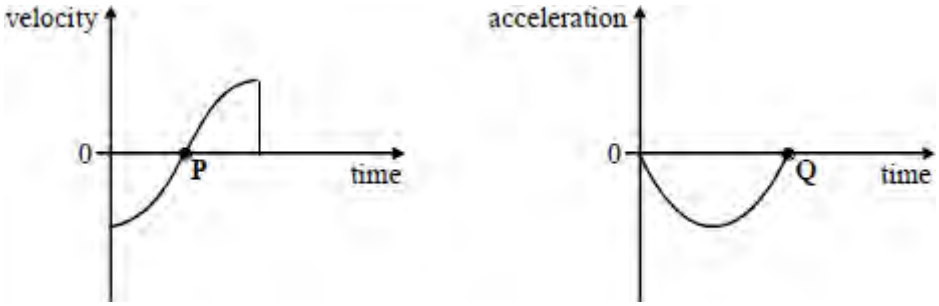
(Total 1 mark)

Q15. 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)

Q16. 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)

Q17. 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

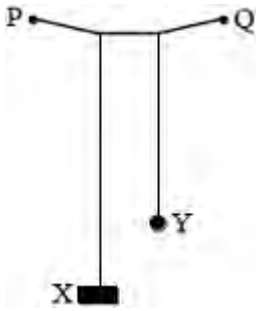
B $\frac{1}{20}$ s

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

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

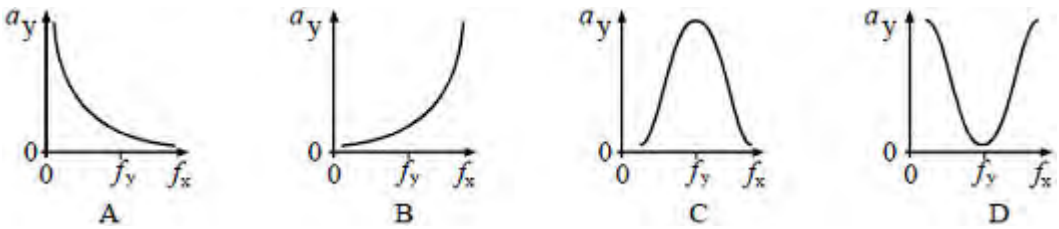
(Total 1 mark)

Q18. 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)