EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

Time allowed
21 Minutes

Score /43

Percentage %

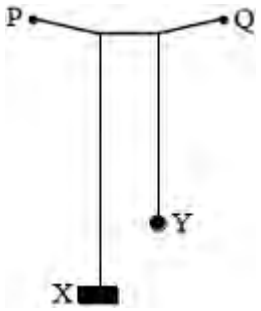
Physics

Topic Questions

AQA
AS & A LEVEL

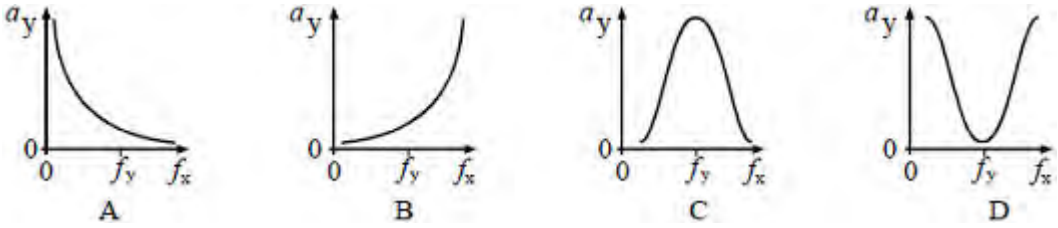
3.6 Further mechanics and thermal physics (A-level only)

1. 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)

2 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

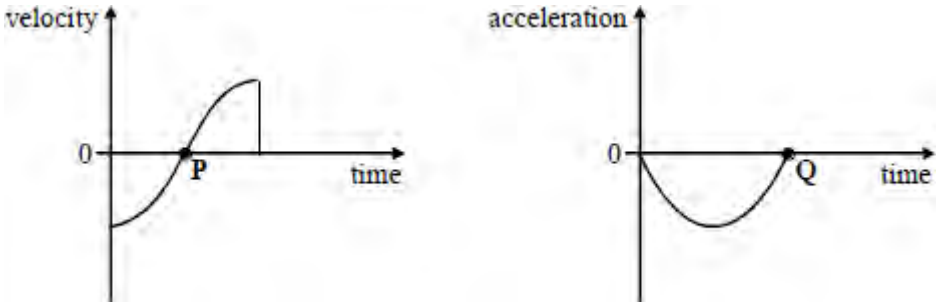
B $\frac{1}{20}$ s

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

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

(Total 1 mark)

3 . 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)

4 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)

5 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)

6 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)

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 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 $2\pi^2 mfA^2$

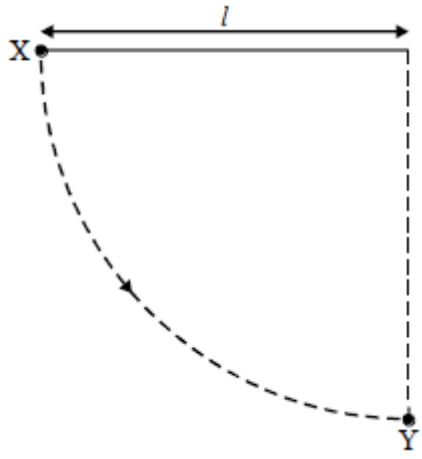
B $2\pi^2 mf^2A^2$

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

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

(Total 1 mark)

9



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)

10 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)

11 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 $0.10 ms^{-1}$

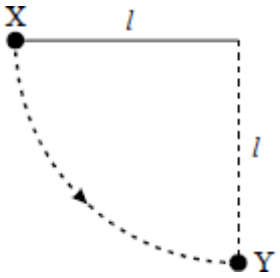
B $0.15 ms^{-1}$

C $0.20 m s^{-1}$

D $0.40 m s^{-1}$

(Total 1 mark)

12



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)

13 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)

14 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)

15 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)

16 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)

17 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)

18 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)