4.1 Oscillations

Question Paper
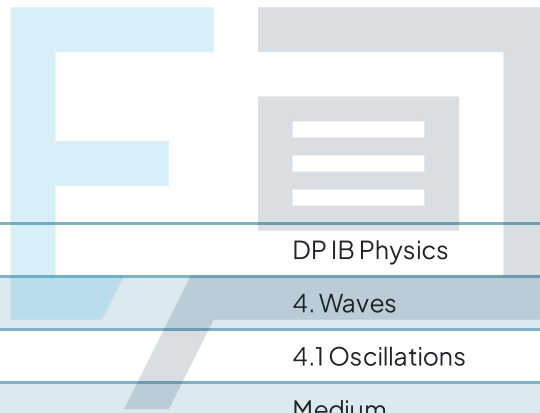
Course	DP IB Physics
Section	4. Waves
Topic	4.1 Oscillations
Difficulty	Medium

To be used by all students preparing for DP IB Physics SL
Students of other boards may also find this useful

Question 1

A mass-spring system is oscillating with simple harmonic motion.

What is the total energy of the object proportional to?

    A. The square of both the mass and the amplitude

    B. Mass and displacement of the object

    C. Angular frequency

    D. Mass and the square of the amplitude

[1 mark]

Question 2

Which line identifies quantities which always have opposite directions during simple harmonic motion?

    A. Acceleration and displacement

    B. Acceleration and velocity

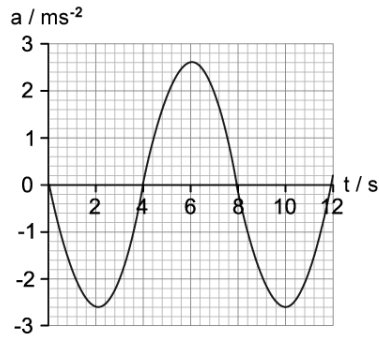   C. Velocity and restoring force

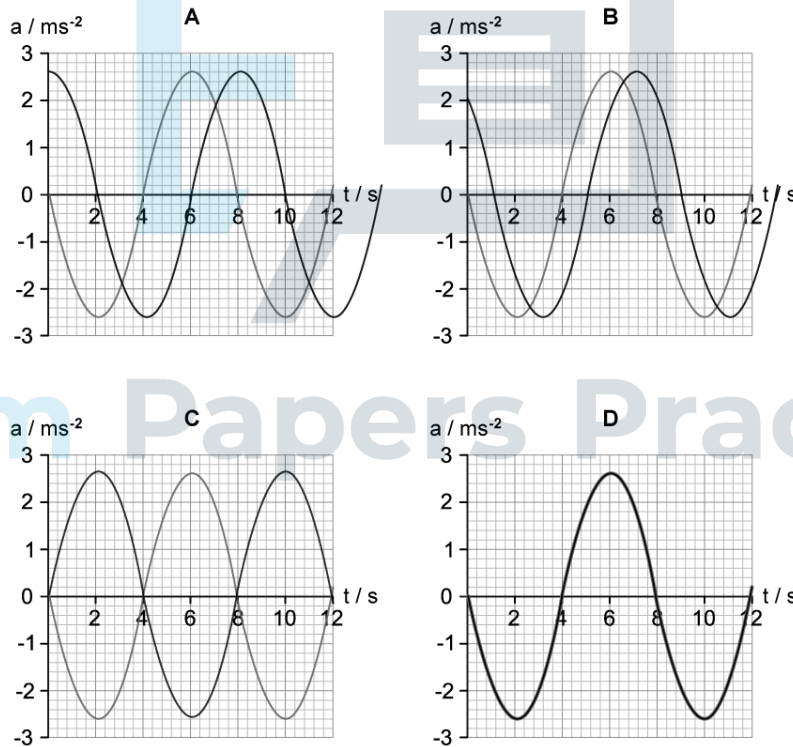   D. Acceleration and restoring force

[1 mark]

Question 3

The graph shows the variation with time t of the acceleration a of an object X undergoing simple harmonic motion (SHM).

A second object Y oscillates with the same frequency as X but with a phase difference of $\dfrac{\pi}{4}$.

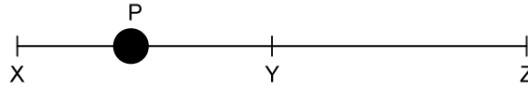Which graph shows how the acceleration of object Y varies with t?

[1 mark]

Question 4

A particle, **P**, oscillates on the line **XZ** about its equilibrium point **Y**, in simple harmonic motion.

At the point shown, which statement could be correct about the motion of the particle?

P
X   Y   Z

  A. It has maximum kinetic energy and minimum potential energy

  B. The total energy is equal to the kinetic energy at **X**

  C. The restoring force is towards **Z** and the particle is accelerating

  D. The restoring force is towards **X** and the particle is accelerating

[1 mark]

Question 5

A pendulum is undergoing simple harmonic motion with a time period T and angular frequency ω.

A student makes a change to the set up so that the pendulum has a new time period $3T$.

What is the new angular frequency?

  A. 6ω

  B. 3ω

  C. $\dfrac{\omega}{3}$

  D. $\dfrac{\omega}{6}$

[1 mark]

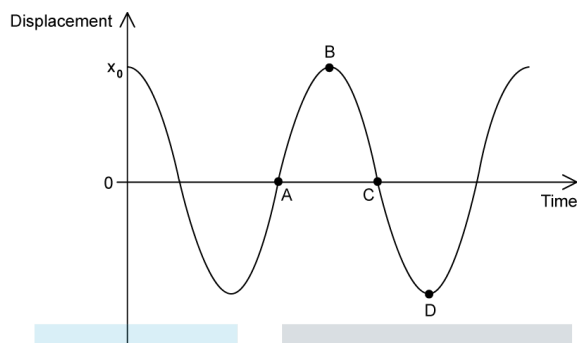## Question 6

A pendulum is made to swing by a student pulling the bob to the left and releasing it. The student is careful to displace the bob by only a small amount.

After two full oscillations, the motion of the pendulum is plotted on a graph.

At which point is the velocity of the bob towards the right?

[1 mark]

Question 7

A mass is attached to a vertical spring and allowed to reach equilibrium. It is then displaced by a distance d and released. The total energy and time period are E_T and T respectively.

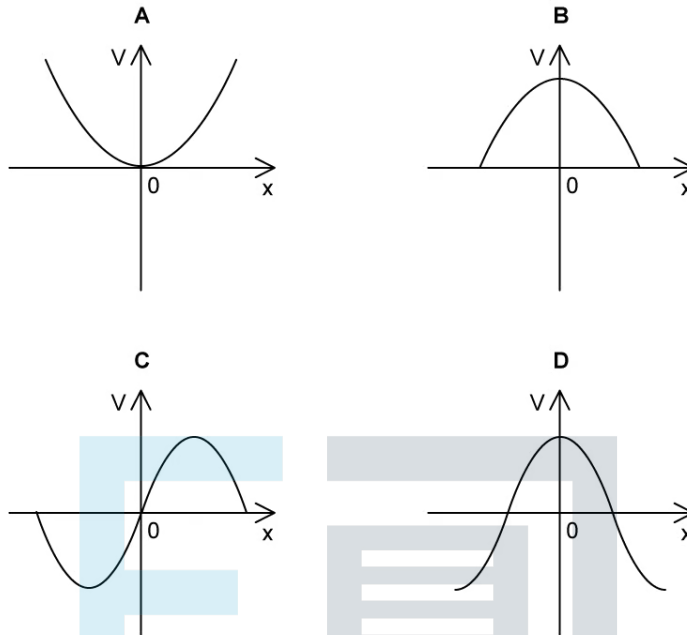In a second investigation the same mass–spring system travels twice as fast.

Which line correctly identifies the total energy and time period of the second oscillations?

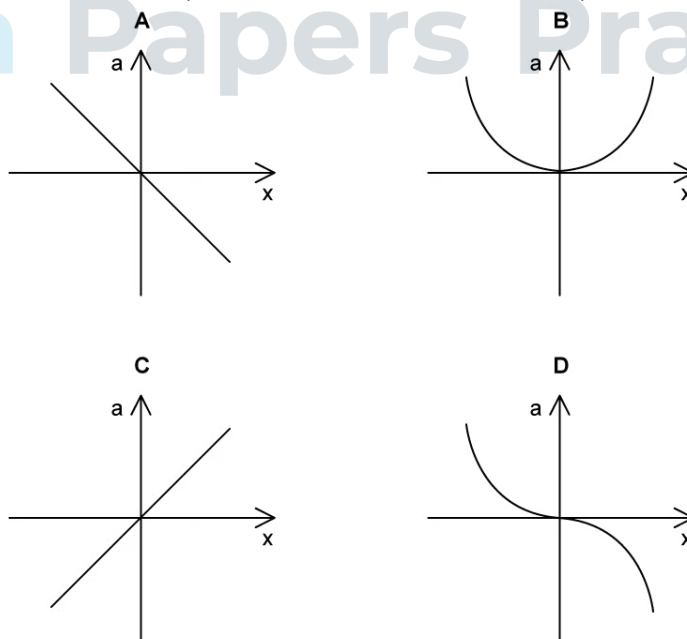|	E_T	T
A.	2E	$\dfrac{T}{2}$
B.	4E	$\dfrac{T}{2}$
C.	2E	2T
D.	4E	T

[1 mark]

Question 8

Which of the following graphs shows the variation with displacement x of the speed v of a particle performing simple harmonic motion?

A

B

C

D

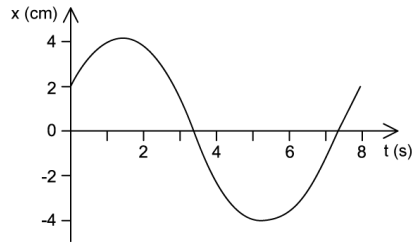[1 mark]

Question 9

Which graph correctly represents the relationship between acceleration, a, and displacement, x, in simple harmonic motion?

A

B

C

D

[1 mark]

Question 10

The graph shows the motion of an oscillating body.

What is the frequency of the oscillation?

A. $\dfrac{1}{3.5}$ Hz

B. 7.5 Hz

C. $\dfrac{1}{7.5}$ Hz

D. 3.5 Hz

[1 mark]