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## **4.1 Oscillations**

Medium



# **PHYSICS**

## **IB HL**

# 4.1 Oscillations

## Question Paper

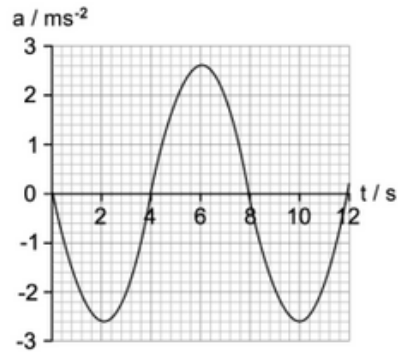
Course	DP IB Physics
Section	4. Waves
Topic	4.1 Oscillations
Difficulty	Medium

EXAM PAPERS PRACTICE

Time allowed: 20  
Score: /10  
Percentage: /100

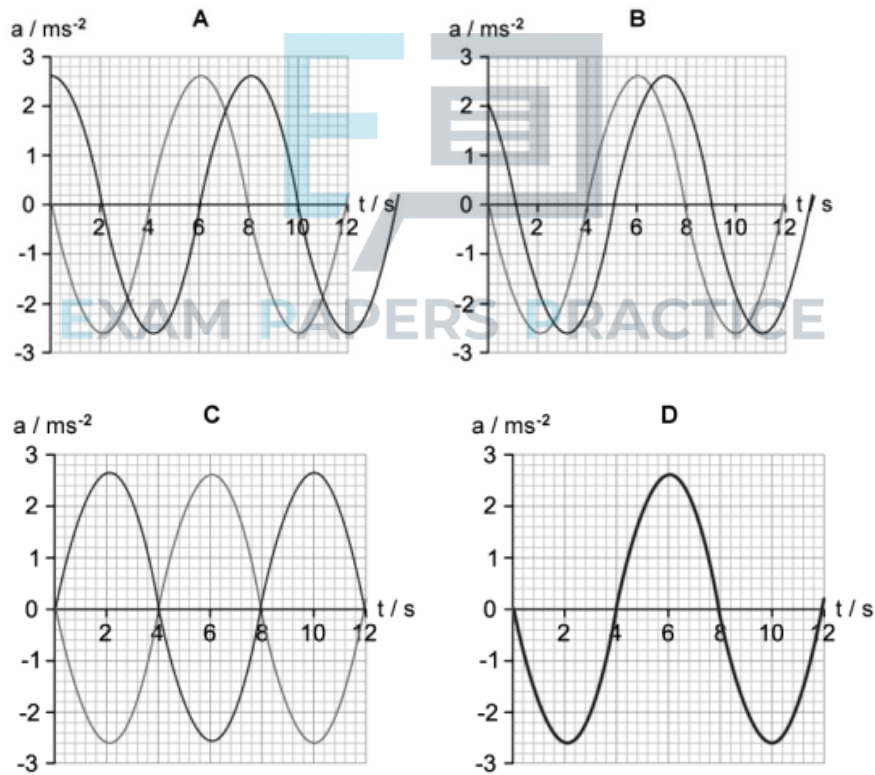
### Question 1

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  $\frac{\pi}{4}$ .

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



[1 mark]

### Question 2

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 3

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

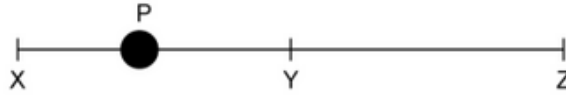
[1 mark]



#### Question 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?



- 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  $\omega$ .

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.  $6\omega$
- B.  $3\omega$
- C.  $\frac{\omega}{3}$
- D.  $\frac{\omega}{6}$

[1 mark]

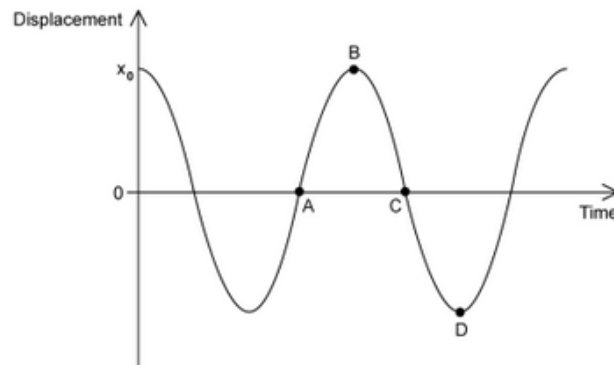


### Question 6

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.

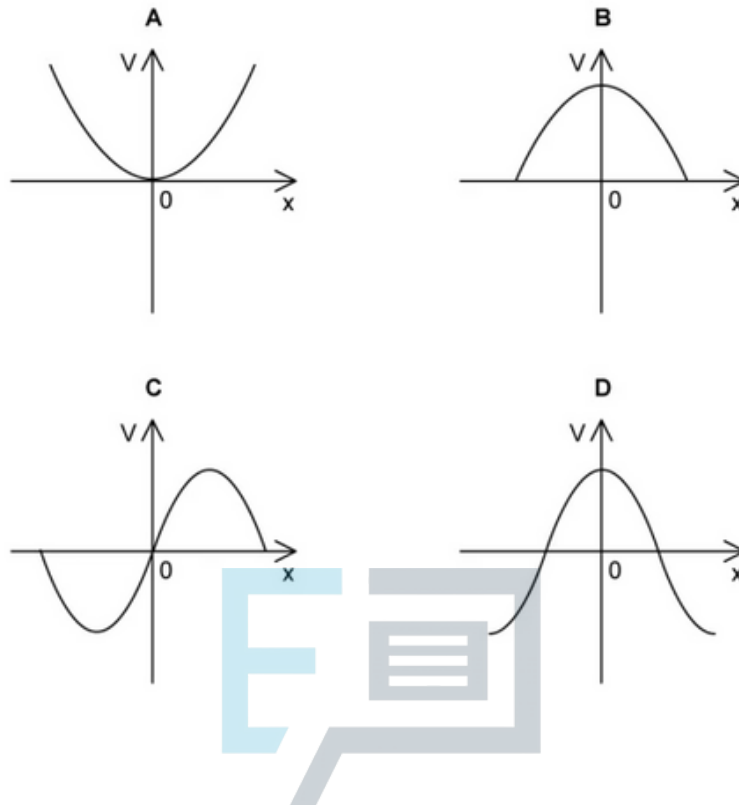
Which line correctly identifies the total energy and time period of the second oscillations?

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

[1 mark]

### Question 8

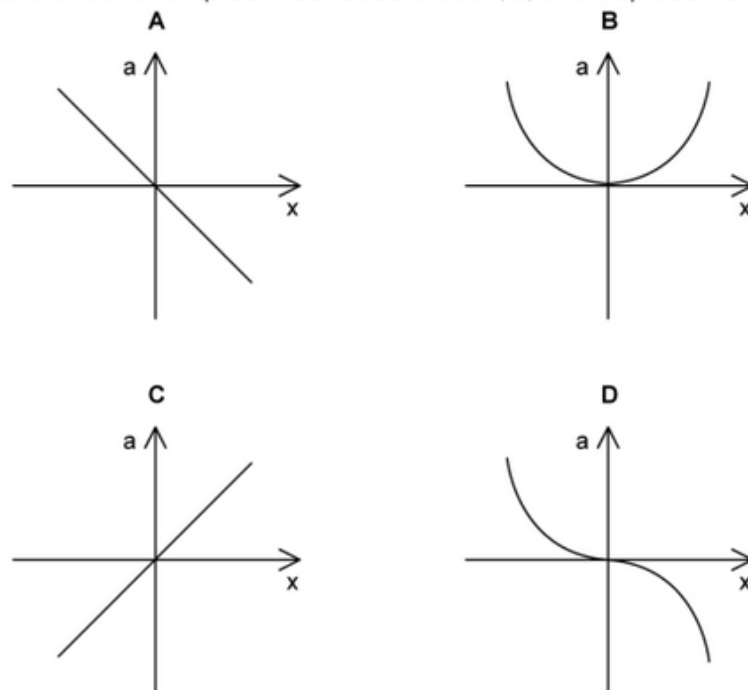
Which of the following graphs shows the variation with displacement  $x$  of the speed  $v$  of a particle performing simple harmonic motion?



[1 mark]

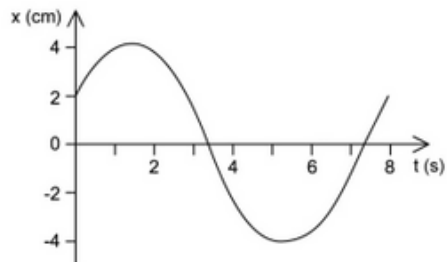
### Question 9

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



### Question 10

The graph shows the motion of an oscillating body.



What is the frequency of the oscillation?

- A.  $\frac{1}{3.5}$  Hz
- B. 7.5 Hz
- C.  $\frac{1}{7.5}$  Hz
- D. 3.5 Hz