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9.1 Simple Harmonic Motion

Easy

PHYSICS

IB HL

EXAM PAPERS PRACTICE

9.1 Simple Harmonic Motion

Question Paper

Course	DP IB Physics
Section	9. Wave Phenomena (HL only)
Topic	9.1 Simple Harmonic Motion
Difficulty	Easy

Time allowed: 20

Score: /10

Percentage: /100

Question 1

Which equation correctly shows the kinetic energy-displacement relation for simple harmonic motion?

A. $K_E = \frac{1}{2}mv^2$

B. $E_T = \frac{1}{2}m\omega^2 x_0^2$

C. $E_P = \frac{1}{2}k\Delta x^2$

D. $E_K = \frac{1}{2}m\omega^2(x_0^2 - x^2)$

[1 mark]

Question 2

The defining equation of SHM describes the relationship between acceleration, a, angular frequency, ω, and displacement, x, from the equilibrium position:

$$a = -\omega^2 x$$

Which value correctly shows the resulting acceleration if the angular frequency was doubled?

A. $-4a$

B. $\frac{1}{4}a$

C. $2a$

D. $4a$

[1 mark]

Question 3

Which equation is used for calculating the displacement as a function of time for an oscillator that begins its oscillation from the equilibrium position?

A. $x = x_0 \sin \omega t$

B. $v = \omega x_0 \cos \omega t$

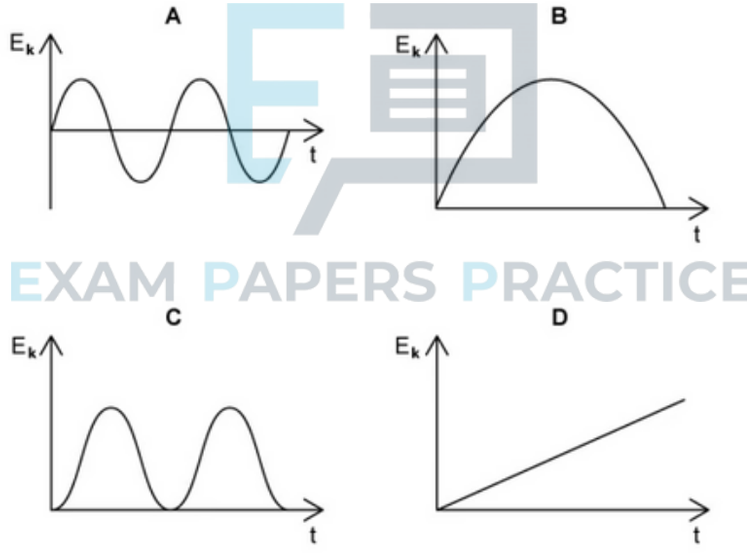
C. $a = -\omega^2 x_0 \sin \omega t$

D. $a = -\omega x$

[1 mark]

Question 4

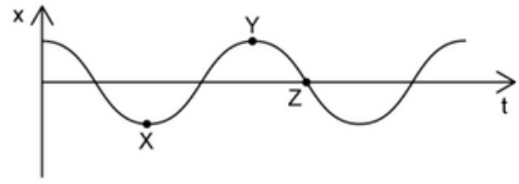
Which graph correctly shows how the kinetic energy of an oscillator varies as a function of time through one complete oscillation?



[1 mark]

Question 5

The graph shows the displacement over time of a simple pendulum oscillating in simple harmonic motion.



What is the potential energy of the pendulum at points X, Y and Z?

	X	Y	Z
A.	Max	Zero	Max
B.	Zero	Max	Zero
C.	Max	Max	Zero
D.	Zero	Zero	Max

[1 mark]

Question 6

A spring loaded with mass *m* oscillates with simple harmonic motion. The amplitude of the motion is *A* and the spring has total energy *E*.

What is the total energy of the spring when both the mass and the amplitude are doubled?

A. E_T

B. $2E_T$

C. $4E_T$

D. $8E_T$

[1 mark]

Question 7

A simple pendulum undergoes simple harmonic motion. The kinetic energy of the pendulum is at a maximum at the equilibrium position.

How many times during one oscillation is the kinetic energy of the pendulum equal to its gravitational potential energy?

A. 1

B. 2

C. 3

D. 4

[1 mark]

Question 8

A mass with mass, m, is attached to a spring with a spring constant, k, and oscillates in simple harmonic motion with a period, T.

A new spring is introduced with a spring constant of $4k$. How does this affect the period of the oscillation?

A. $\frac{1}{4}T$

B. $\frac{1}{2}T$

C. $2T$

D. $4T$

[1 mark]

Question 9

A small ball is attached to a thread of length l, and set to oscillate isochronously.

If the length of the thread is reduced by 10%, what effect will this have on the period, T, of the oscillation?

A. $0.1\ T$

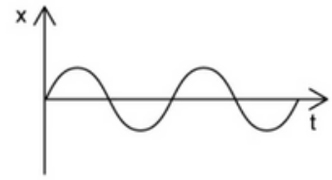
B. $0.3T$

C. $0.6T$

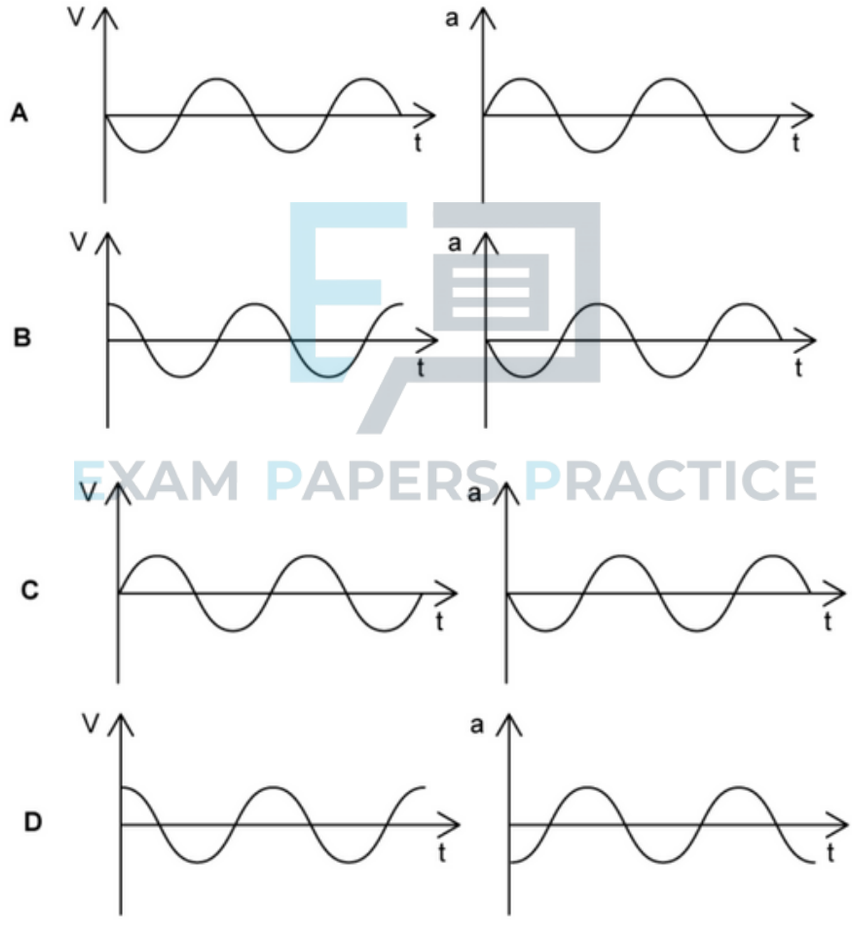
D. $0.9T$

Question 10

A particle oscillates in simple harmonic motion. The particle's displacement over time is shown in the following graph.



Which graphs are the correct velocity-time and acceleration-time graphs for this particle?



[1 mark]