

Simple Harmonic Motion

Question Paper

Level	A Level
Subject	Physics
Exam Board	Edexcel
Topic	Oscillations
Sub Topic	Simple Harmonic Motion
Booklet	Question Paper
Paper Type	Multiple Choice

Time Allowed: 26 minutes

Score: /21

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Questions 1 and 2 refer to the information below.

In a shop window an illuminated spot on a display oscillates between positions W and Z with simple harmonic motion.

The diagram shows the display with a scale added.



1 The acceleration of the spot at position X is $+1.5 \text{ ms}^{-2}$.

What is the acceleration of the spot at position Y?

- A $+1.5 \text{ ms}^{-2}$
- B $+3.0 \text{ ms}^{-2}$
- C -1.5 ms^{-2}
- D -3.0 ms^{-2}

(Total for Question = 1 mark)

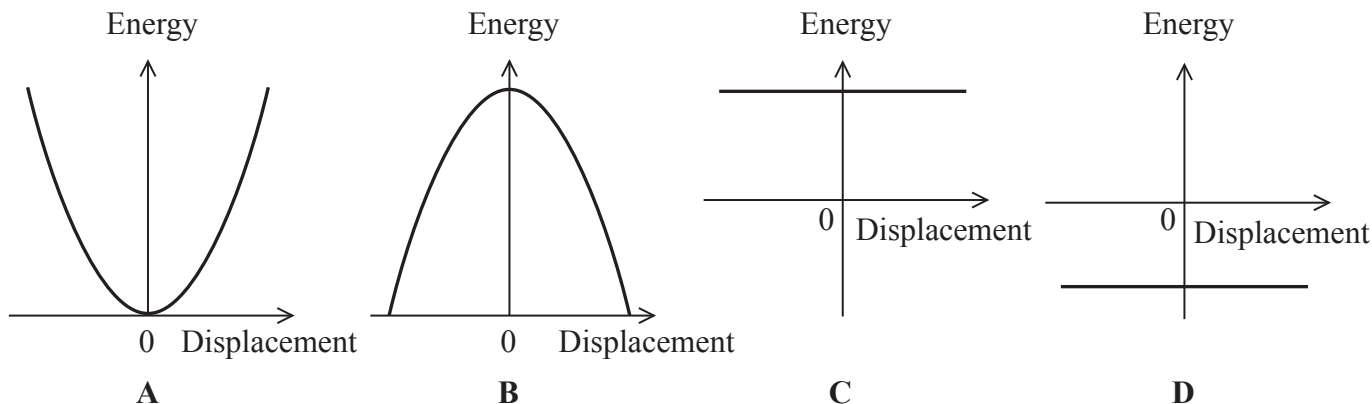
2 The maximum velocity of the spot is 1.2 ms^{-1} .

What is the angular frequency ω of the spot?

- A $\frac{1}{2} \text{ rad s}^{-1}$
- B $\sqrt{2} \text{ rad s}^{-1}$
- C 2 rad s^{-1}
- D 4 rad s^{-1}

(Total for Question = 1 mark)

Questions 3 and 4 refer to the graphs below.



3 Which graph correctly shows the variation of potential energy with displacement for a particle undergoing simple harmonic motion?

- A
- B
- C
- D

(Total for Question = 1 mark)

4 Which graph correctly shows the variation of total energy with displacement for a particle undergoing simple harmonic motion?

- A
- B
- C
- D

(Total for Question = 1 mark)

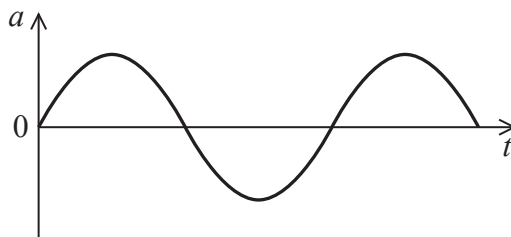
- 5 Whilst a car is being driven over a bridge, it sets the bridge into vibration. Which of the following terms definitely describes the oscillations of the bridge?

The oscillations of the bridge are

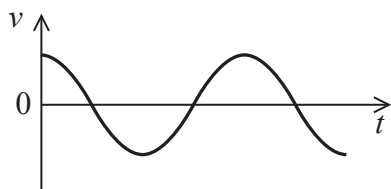
- A free.
- B forced.
- C natural.
- D resonant.

(Total for Question = 1 mark)

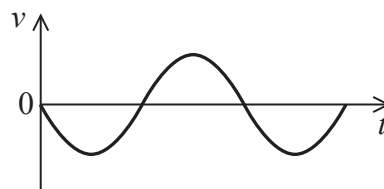
- 6 The graph shows how the acceleration varies with time for an object undergoing simple harmonic motion.



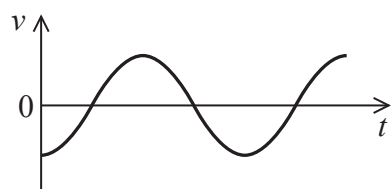
Which of the following graphs, **A**, **B**, **C** or **D**, shows how the velocity of the object varies with time?



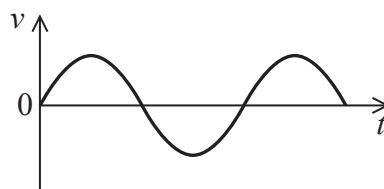
A



B



C



D

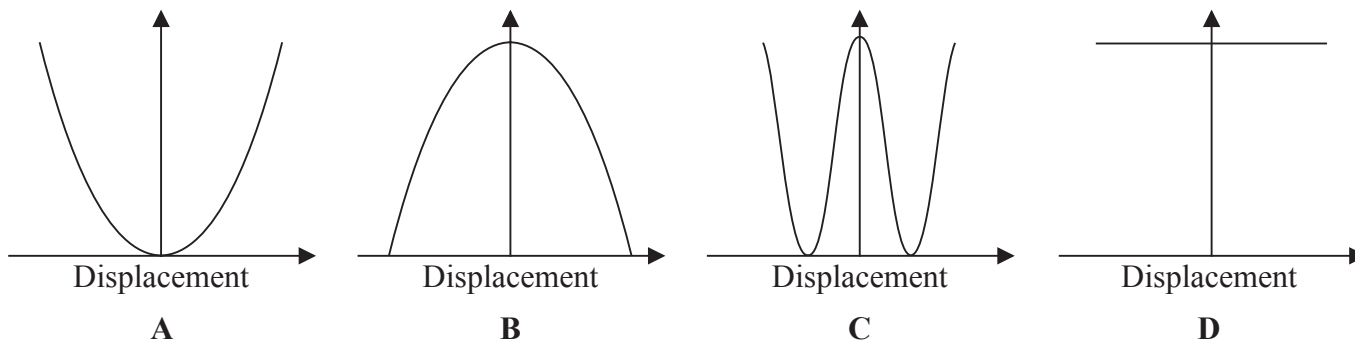
- A**
- B**
- C**
- D**

(Total for Question = 1 mark)

- 7 A mass is bouncing on the end of a vertical spring. Its motion will be simple harmonic if the spring
- A can store energy.
 - B has elasticity.
 - C is hung vertically.
 - D obeys Hooke's law.

(Total for Question = 1 mark)

Questions 8 and 9 refer to the graphs below.



8 For an object undergoing simple harmonic motion select the graph that represents the variation of kinetic energy with displacement.

- A
- B
- C
- D

(Total for Question = 1 mark)

9 For an object undergoing simple harmonic motion select the graph that represents the variation of the total energy with displacement.

- A
- B
- C
- D

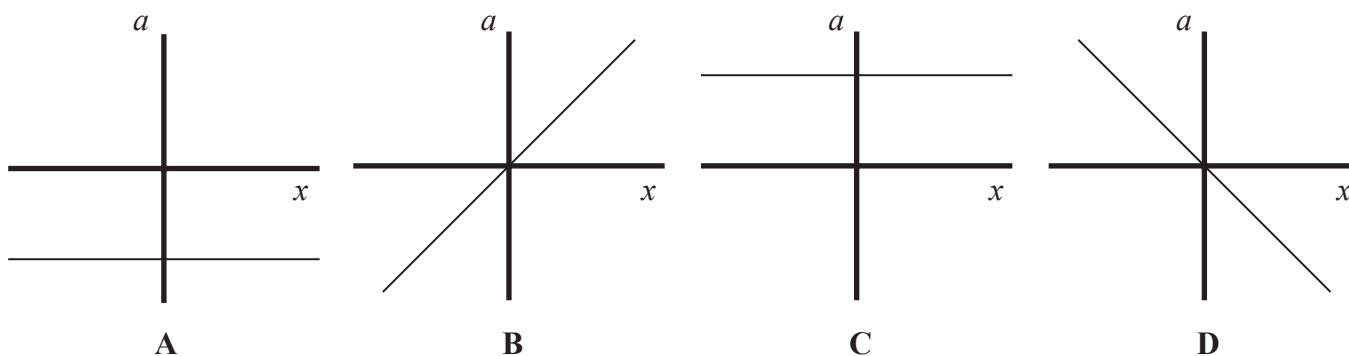
(Total for Question = 1 mark)

10 Which of the following is **not** an example of simple harmonic motion?

- A A car bouncing on its suspension system.
- B A child jumping on a trampoline.
- C A person bouncing on the end of a bungee cord.
- D A swinging pendulum in a grandfather clock.

(Total for Question = 1 mark)

11 A mass-spring system is set into simple harmonic motion. Which graph shows the variation of the acceleration, a , of the mass with its displacement, x ?



- A
- B
- C
- D

(Total for Question = 1 mark)

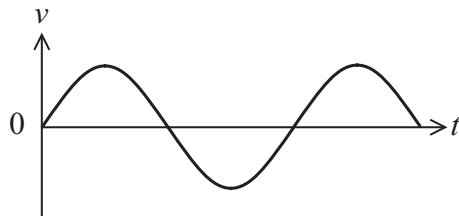
12 A mass is hung from a spring and set into vertical oscillation. Which row in the table correctly shows the kinetic energy E_k of the mass at maximum displacement and the potential energy E_p of the mass at the equilibrium position.

		Maximum displacement position	Equilibrium position
<input type="checkbox"/>	A	E_k is a maximum	E_p is minimum
<input type="checkbox"/>	B	E_k is a maximum	E_p is a maximum
<input type="checkbox"/>	C	E_k is zero	E_p is a maximum
<input type="checkbox"/>	D	E_k is zero	E_p is minimum

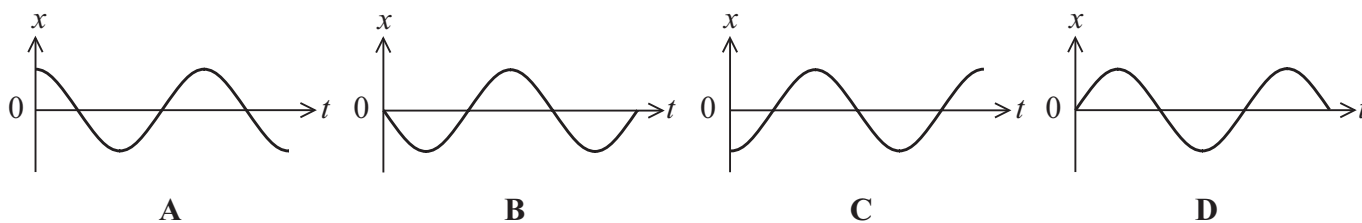
(Total for Question = 1 mark)

Questions 13 and 14 refer to the diagram below.

The graph below shows how the velocity varies with time for an object undergoing simple harmonic motion.



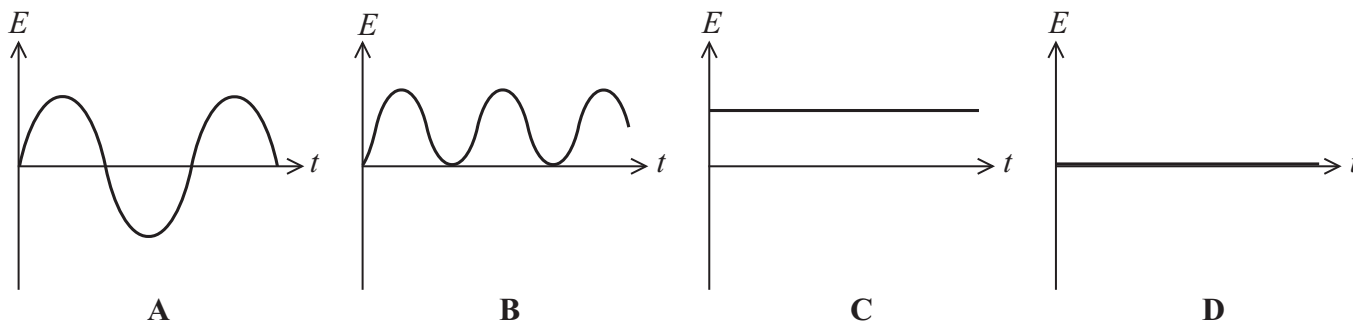
13 Which graph shows the variation of displacement with time?



- A
- B
- C
- D

(Total for Question = 1 mark)

14 Which graph shows the variation of total energy with time?



- A
- B
- C
- D

(Total for Question = 1 mark)

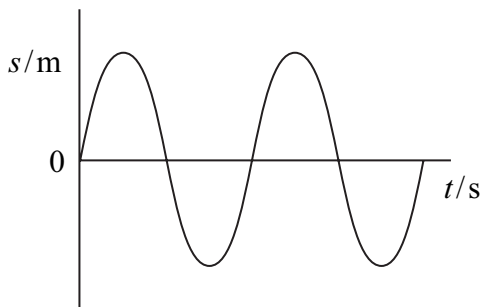
15 A bridge vibrates gently as cars are driven across it. This is an example of

- A forced oscillation.
- B free oscillation.
- C resonance.
- D stationary waves.

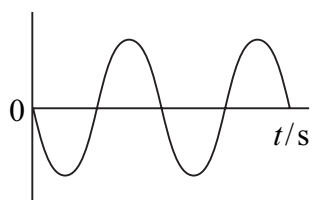
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Use the graphs below for questions 16, 17

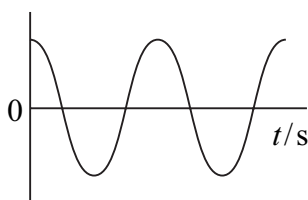
The graph below shows how displacement varies with time for a particle moving with undamped simple harmonic motion during a particular time interval.



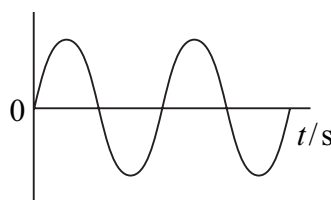
For each of the questions 8 to 10, which of the following graphs best represents the quantities described during the corresponding time interval? Each graph may be used once, more than once or not at all.



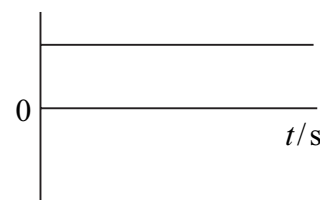
A



B



C



D

16 The velocity of the particle.

- A
- B
- C
- D

(Total for Question = 1 mark)

17 The acceleration of the particle.

- A
- B
- C
- D

(Total for Question = 1 mark)

18 The total energy of the particle.

(1)

- A
- B
- C
- D

(Total for Question = 1 mark)

19 A mass is hanging vertically from a spring. The mass is set into small amplitude vertical oscillations.

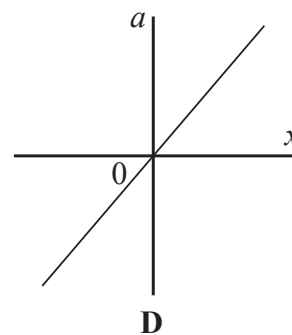
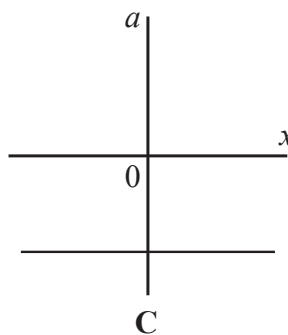
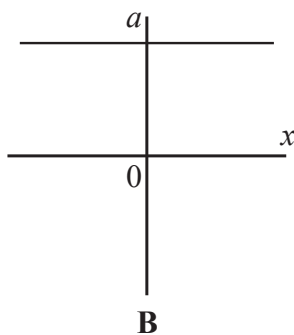
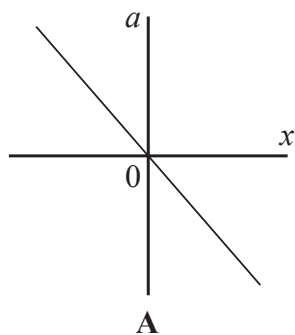
The total energy of the undamped oscillating system is

- A a maximum at an extreme position of the mass.
- B a maximum at the mean position of the mass.
- C a minimum at the mean position of the mass.
- D the same at all positions of the mass.

(Total for Question = 1 mark)

20 An object is undergoing simple harmonic motion.

Which graph shows how the acceleration a varies with displacement x from the equilibrium position?



A

B

C

D

(Total for Question = 1 mark)

21 An object is hung from a vertical spring and undergoes undamped simple harmonic motion.

It is correct to say that there are **no** changes in the

A elastic potential energy of the oscillating system.

B gravitational potential energy of the oscillating system.

C kinetic energy of the oscillating system.

D total energy of the oscillating system.

(Total for Question = 1 mark)