YEAR 13 PHYSICS

WORKSHEET 02

STRAND 2: OSCILLATORY MOTION

1. Force of simple harmonic motion at center position is always ________.

A. zero B. negative C. minimum D. maximum

2. When an object is oscillating with simple harmonic motion, its motion through the equilibrium position can best be described by

A. zero velocity and maximum force. B. zero acceleration and minimum speed.

C. zero acceleration and maximum speed. D. zero amplitude and maximum acceleration.

3. There is maximum amplitude during resonance of any system because the

A. natural frequency is above the driving frequency.

B. driving frequency is almost same as the natural frequency.

C. energy absorbed in each oscillation depends on the damping of the system.

D. energy absorbed in each oscillation equals the energy lost in each oscillation.

4. In order for an object to move in a simple harmonic motion (SHM) when it is released from its equilibrium position, the object must

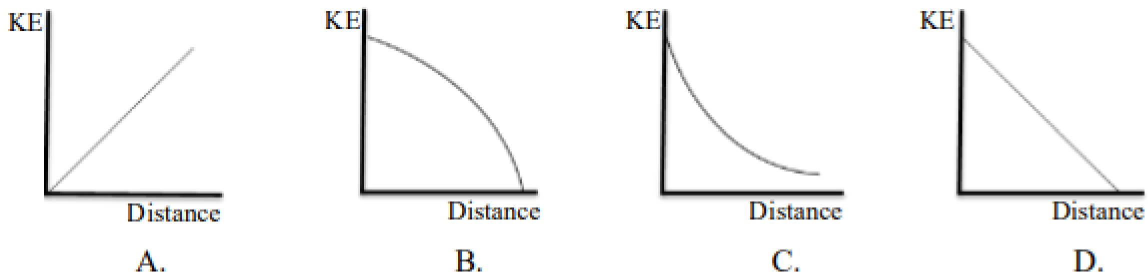
A. be suspended like a pendulum.

B. experience a gravitational force.

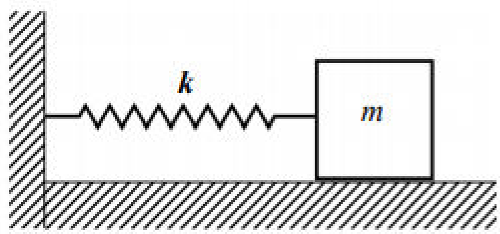
C. move in a circular path at a constant speed.

D. experience a restoring force proportional to its displacement.

5. A body executes simple harmonic motion. Which one of the graphs, A to D, best shows the relationship between the kinetic energy (KE) of the body and its distance from the center of oscillation?



6. A 5 kg mass is oscillating at the end of a spring with an amplitude of 12 cm. The spring constant, k, is 700 N/m.



Calculate the

(i) angular frequency. (1 mark)
(ii) maximum velocity of the oscillating mass. (1 mark)
(iii) maximum acceleration. (1 mark)
(iv) kinetic energy of the mass at the centre/equilibrium. (1 mark)

7. The forward component of a standing wave is represented by

$$Y = 0.04 \sin 3\pi\left(\frac{-x}{0.5} + 50t\right)$$

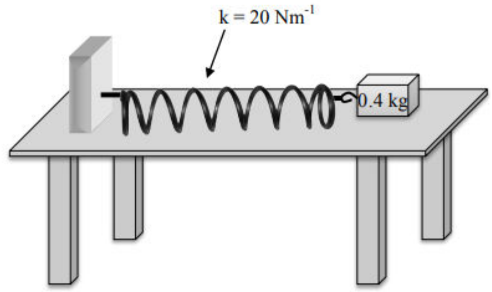
where all measurements are in S.I units.

(i) Find its frequency. (1 mark)

(ii) Calculate the velocity of the wave. (1 mark)

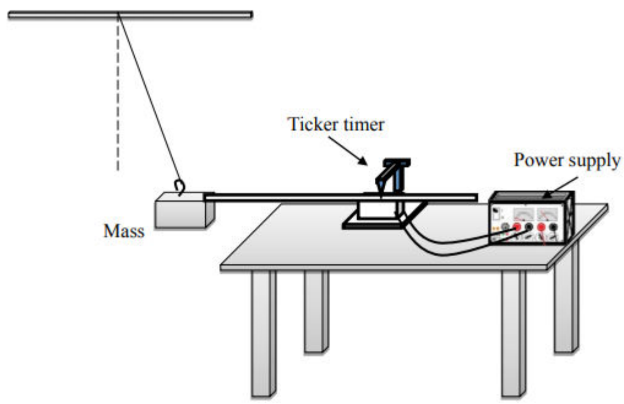
(iii) Write the equation for the reflected component of the standing wave. (1 mark)

8. A 0.4 kg mass is connected to a spring with a spring constant of 20 Nm^{-1} and oscillates on a frictionless horizontal surface with amplitude of 5.0 cm.



Calculate the velocity when the mass is at a displacement of 4.0 cm. (2 marks)

9. The diagram given below shows the experimental set-up to test the suitability of simple harmonic motion as a model to describe the behaviour of a simple pendulum



(i) Why is it important to choose a heavy mass for this pendulum? (1 mark)

(ii) State one way of locating the point from which the displacement is measured. (1 mark)

(iii) Sketch a graph of “acceleration, a (ms^{-2}) versus displacement, x (m)” (1 mark)

(iv) State what is represented by the slope of the graph. (1 mark)

(v) State what does the graph show about the motion of the simple pendulum. (1 mark

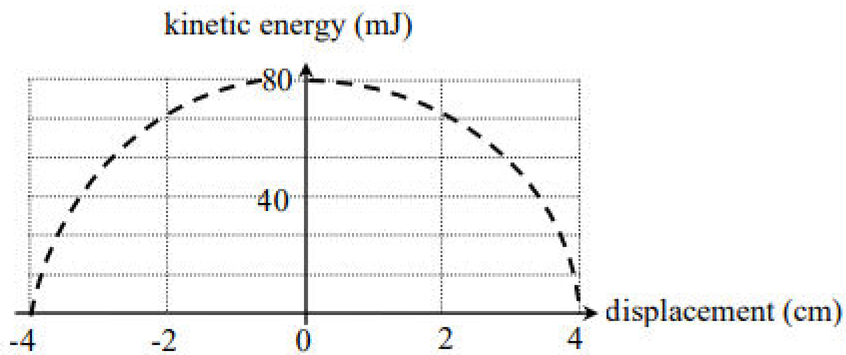
10. An object undergoing simple harmonic motion (SHM) has its displacement y, at time t seconds given by the equation:

$$y = 5\text{Sin}\,(4t + \frac{\pi}{4})$$

(i) What is the initial phase angle ϕ? (1 mark)

(ii) Calculate the velocity at time t = 0 sec. (2 marks)

11. The graph given below shows the variation of kinetic energy with displacement of a particle of mass 0.40 kg performing Simple Harmonic Motion (SHM).



Use the graph to determine the:

(i) amplitude of the motion. (1 mark)

(ii) total energy of the particle. (1 mark)

(iii) period of the motion. (2 marks)

THE END.