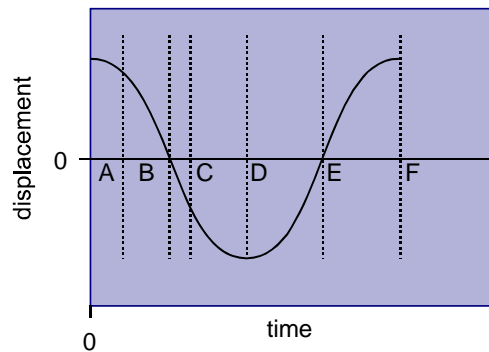


TAP 305- 2: Oscillators

Questions

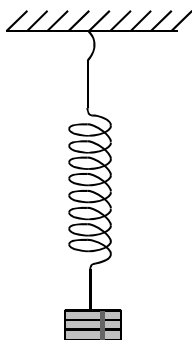
Here is the displacement–time graph of an oscillator.



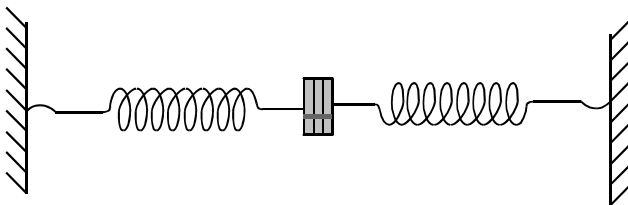
1. Consider the speed of the oscillator at the four times labelled A , B , C , and D . Arrange the times A , B , C , D in order of decreasing speed.
2. How does the velocity at time B compare with that at time E ?
3. How does the velocity at time D compare with that at time F ?
4. At which of the times 0 to F is the acceleration at its largest value?
5. At which of the times 0 to F is the displacement equal in size to the amplitude of the motion?
6. Consider the time intervals $0-B$, $0-D$, $0-F$, $B-E$, $D-F$. If the periodic time of the oscillator is T , write down each interval in terms of T . ($0-F = 3T$ is the sort of answer expected, though this particular answer would be wrong.)

Here are three things which would oscillate in a laboratory on Earth.

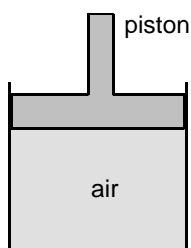
(a)



(b)



(c)



7. Which, if any, would oscillate in a spacecraft going at steady speed a long way from the Earth and from any planet or star?

Explain your answer.

Sketch a large displacement–time graph for two periods of a simple harmonic motion.

8. Mark with M any instant where the speed is a maximum
9. Mark with Z any instant when the speed is zero.
10. Mark places where the acceleration is high H and where it is low L.

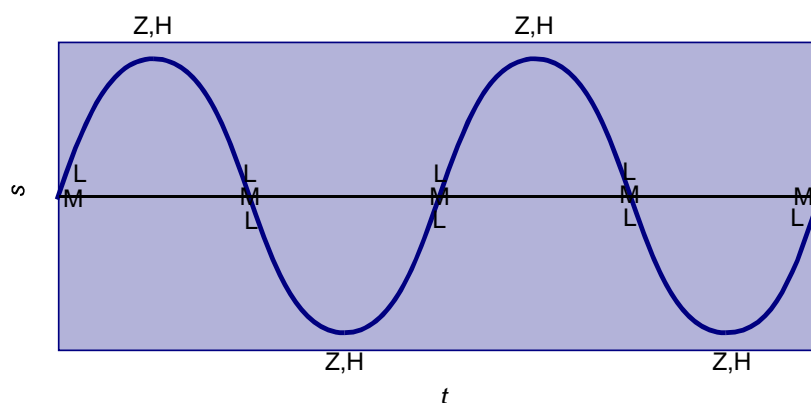
Practical advice

These questions are concerned with basic ideas about simple harmonic motion. They may therefore prove useful for class discussion. Others provide practice identifying and using relevant equations.

Answers

1. B C A D
2. Same magnitude, opposite direction.
3. Both zero. 4. 0, D and F
5. 0, D and F
6. $0-B = T/4$, $0-D = T/2$, $0-F = T$, $B-E = T/2$, $D-F = T/2$
7. (b) will oscillate. Only the horizontal mass-spring system does not depend on gravity.
8., 9. and 10.

Note again that a is proportional to displacement, but in the opposite direction.



11. Yes. For small displacements, this is an instance of Hooke's law, with the force proportional to the displacement.
12. No. The force (and acceleration) is constant when removed from the surface, being the weight of the ball.
13. Loses time.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

and g decreases with height (distance from Earth's centre), so T will increase.

External reference

This activity is taken from Advancing Physics chapter 10, 160S