Oscillations

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. A body in SHM has angular frequency $2\pi/3$ rad/s. Its period is:

(a) 1.5 s **(b)** 0.33 s **(c)** 6 s **(d)** 3 s

2. A particle moves in SHM with amplitude 19 cm and angular frequency 9 rad/s. Its greatest speed is:

(a) 171 cm/s **(b)** 1539 cm/s **(c)** 2.11 cm/s **(d)** 28 cm/s

3. A mass of 1 kg oscillates on a spring of spring constant 4 N/m. The period is:

(a) 0.5π s **(b)** 2π s **(c)** 4π s **(d)** π s

4. The period of a simple pendulum of length 0.25 m is (take $g = \pi^2$ m/s^2):

(a) 2 s **(b)** 0.5 s **(c)** 1 s **(d)** 0 s

5. In simple harmonic motion, the restoring force is proportional to:

(a) the time
(b) the velocity
(c) the displacement, and directed towards the mean position
(d) the square of the displacement

6. In SHM with amplitude 13 cm and $\omega = 6$ rad/s, the speed when the displacement is 5 cm is:

(a) 48 cm/s **(b)** 72 cm/s **(c)** 78 cm/s **(d)** 30 cm/s

7. Springs of spring constants 110 N/m and 30 N/m are joined side by side (in parallel). The effective spring constant is:

(a) 140 N/m **(b)** 3,300 N/m **(c)** 23.57 N/m **(d)** 80 N/m

8. Assertion (A): If the length of a simple pendulum with period 1.5 s is made 16 times, its period becomes 6 s.
Reason (R): The period of a simple pendulum is proportional to its length.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. The displacement of a particle is $x = 1 \sin(2\pi t + \pi/3)$ cm. Find the amplitude, angular frequency, period, frequency and initial phase.

10. A particle performs SHM with amplitude 14 cm and period 2 s. Find its greatest speed and greatest acceleration (leave π in the answer).

11. A 9 kg mass hangs on a spring of spring constant 36 N/m. Find the period and frequency of its oscillations.

12. What length of simple pendulum has a period of 2 s? (Take $g = \pi^2$ m/s^2.)

13. A block on a spring (k = 700 N/m) oscillates with amplitude 17 cm. Find its total energy, and its kinetic energy when it is 12.75 cm from the mean position.

14. A 4 kg block is attached to two springs (160 N/m and 140 N/m) side by side (in parallel). Find the effective spring constant and the period of oscillation (2 decimal places; π = 3.14).

15. A pendulum has a period of 3.5 s on the earth. What is its period on a planet where g is 9 times the earth's?

16. For x = 34 sin ωt cm, find the displacement when ωt = 5π/6.

Section C — Word problems — 4 × 4 = 16 marks

17. A particle moves according to x = 18 cos(πt) cm. Find (a) the amplitude, period and frequency, (b) the greatest speed, (c) the greatest acceleration, (d) its position at t = 0 (leave π in the answers).

18. A 4 kg block on a spring (k = 100 N/m) oscillates with amplitude 5 cm. Find (a) the total energy, (b) the kinetic and potential energy when the displacement is 4 cm, (c) its speed then (2 decimal places).

19. A 4 kg block is attached to two springs of 180 N/m and 40 N/m. Find the effective spring constant and the period when the springs are joined (a) in parallel, (b) in series. Which arrangement oscillates faster? (π = 3.14; 2 decimal places)

20. A seconds pendulum has a period of 2 s. (a) Find its length (take $g = \pi^2$ m/s^2). (b) If its length is increased by 44%, what is the new period? (c) Will a clock using it run fast or slow?

Want another sheet on this chapter? In the Ambiful Worksheets app every sheet is new, with its answer key, and your child never gets the same question twice.
Scan the code to get the free app, or open **worksheets.ambiful.com/get**

Answer key

Oscillations · AW-11P-OSC-2026-V1 · For parents — fold back or tear off before handing the sheet to your child.

Q	Answer	Working
1	**(d) 3 s**	$T = 2\pi/\omega$
2	**(a) 171 cm/s**	$v_{max} = A\omega$
3	**(d) π s**	$T = 2\pi\sqrt{(m/k)}$
4	**(c) 1 s**	$T = 2\pi\sqrt{(l/g)} = 2\sqrt{l}$
5	**(c) the displacement, and directed towards the mean position**	—
6	**(b) 72 cm/s**	$v = \omega\sqrt{(A^2 - x^2)}$
7	**(a) 140 N/m**	$k = k_1 + k_2$
8	**(c) A is true, but R is false.**	A is true: $T \propto \sqrt{l}$, so the period becomes 4 times: 6 s. R is false.
9	**A = 1 cm; ω = 2π rad/s; T = 1 s; f = 1 Hz; phase π/3**	compare with $x = A\sin(\omega t + \varphi)$; $T = 2\pi/\omega$
10	**14π cm/s; $14\pi^2$ cm/s^2**	$\omega = 2\pi/T = \pi$; $v_{max} = A\omega$; $a_{max} = A\omega^2$
11	**T = π s; f = 1/π Hz**	$T = 2\pi\sqrt{(m/k)}$; $f = 1/T$
12	**1 m**	$T = 2\sqrt{l}$, so $l = T^2/4$
13	**E = 10.12 J; KE = 4.43 J**	$E = \frac{1}{2}kA^2$; $KE = \frac{1}{2}k(A^2 - x^2)$
14	**300 N/m; 0.73 s**	$k = k_1 + k_2$; $T = 2\pi\sqrt{(m/k)}$
15	**1.17 s**	$T \propto 1/\sqrt{g}$
16	**17 cm**	$x = 34\sin(5\pi/6)$
17	**(a) 18 cm, 2 s, 0.5 Hz; (b) 18π cm/s; (c) $18\pi^2$ cm/s^2; (d) x = 18 cm, at an extreme position**	$\omega = 2\pi/T$; $v_{max} = A\omega$; $a_{max} = A\omega^2$
18	**(a) 0.125 J; (b) KE 0.045 J, PE 0.08 J; (c) 0.15 m/s**	$E = \frac{1}{2}kA^2$; $PE = \frac{1}{2}kx^2$; $KE = E - PE$
19	**(a) 220 N/m, T = 0.85 s; (b) 32.73 N/m, T = 2.2 s; the parallel arrangement (stiffer spring, shorter period)**	parallel $k_1 + k_2$; series $k_1k_2/(k_1 + k_2)$
20	**(a) 1 m; (b) 2.4 s; (c) slow, because each swing takes longer**	$T = 2\sqrt{l}$; $T \propto \sqrt{l}$

Ambiful Worksheets · worksheets.ambiful.com · Not affiliated with CBSE / NCERT