

This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Simple Harmonic Oscillation

001 10.0 points

A body oscillates with simple harmonic motion along the x -axis. Its displacement varies with time according to the equation

$$x(t) = A \sin(\omega t + \phi).$$

If $A = 5$ m, $\omega = 2.169$ rad/s, and $\phi = 1.0472$ rad, what is the acceleration of the body at $t = 1$ s? Note: The argument of the sine function is in radians rather than degrees.

Correct answer: 1.75329 m/s².

Energy in Harmonic Motion 02

002 10.0 points

A 0.106 kg mass is attached to a spring and undergoes simple harmonic motion with a period of 0.5 s. The total energy of the system is 4.3 J.

Find the amplitude of the motion.

Correct answer: 0.716781 m.

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003 (part 1 of 4) 10.0 points

A 0.3 kg block attached to a spring of force constant 18.6 N/m oscillates with an amplitude of 7 cm.

Find the maximum speed of the block.

Correct answer: 0.551181 m/s.

004 (part 2 of 4) 10.0 points

Find the speed of the block when it is 3.5 cm from the equilibrium position.

Correct answer: 0.477336 m/s.

005 (part 3 of 4) 10.0 points

Find its acceleration at 3.5 cm from the equilibrium position.

Correct answer: 2.17 m/s².

006 (part 4 of 4) 10.0 points

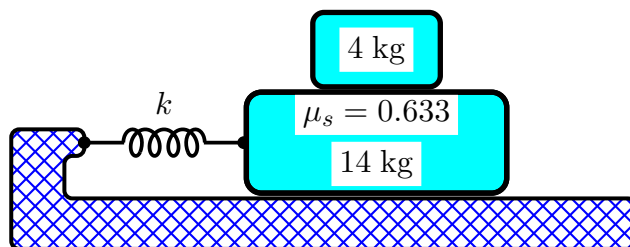
Find the time it takes the block to move from $x = 0$ to $x = 3.5$ cm.

Correct answer: 0.0664971 s.

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007 10.0 points

A large block with mass 14 kg executes horizontal simple harmonic motion as it slides across a frictionless surface with a frequency 1.85 Hz. A smaller block with mass 4 kg rests on it, as shown in the figure, and the coefficient of static friction between the two is $\mu_s = 0.633$.



What maximum amplitude of oscillation can the system have if the top block is not to slip? The acceleration of gravity is 9.8 m/s².

Correct answer: 4.5912 cm.

Gravity on a New Planet

008 10.0 points

Having landed on a newly discovered planet, an astronaut sets up a simple pendulum of length 1.58 m and finds that it makes 507 complete oscillations in 1340 s. The amplitude of the oscillations is very small compared to the pendulum's length.

What is the gravitational acceleration on the surface of this planet?

Correct answer: 8.92942 m/s².