Exercise 14.5 - Enhanced - with Feedback

✔ Complete

A machine part is undergoing SHM with a frequency of 3.60 Hz and amplitude 1.80 cm.

Review | Constants

Part A ✔

How long does it take the part to go from x = 0 to x = -1.80 cm?

Express your answer with the appropriate units.

t = 6.94×10^{-2} s

Exercise 14.15

A block of mass m is undergoing SHM on a horizontal, frictionless surface while attached to a light, horizontal spring. The spring has force constant k, and the amplitude of the SHM is A. The block has $v = 0$, and $x = +A$ at $t = 0$. It first reaches $x = 0$ when $t = T/4$, where T is the period of the motion.

Review | Constants

Part A

In terms of T, what is the time t when the block first reaches $x = A/2$?

Express your answer in terms of the variable T.

$t_1 = \frac{T}{6}$

Submit Previous Answers

Part B

The block has its maximum speed when $t = T/4$. What is the value of t when the speed of the block first reaches the value $v_{\max}/2$?

Express your answer in terms of the variable T.

$t_2 =$

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Part C

Does $v = v_{\max}/2$ when $x = A/2$?

- [x] No, it doesn't.
- [ ] Yes, it does.

Exercise 14.17 - Enhanced - with Solution

This procedure has been used to “weigh” astronauts in space: A 42.5 kg chair is attached to a spring and allowed to oscillate. When it is empty, the chair takes 1.30 s to make one complete vibration. But with an astronaut sitting in it, with her feet off the floor, the chair now takes 2.54 s for one cycle.

For related problemsolving tips and strategies, you may want to view a Video Tutor Solution of Angular frequency, frequency, and period in shm.

Part A

What is the mass of the astronaut?

Express your answer with the appropriate units.

$m_{\text{astronaut}}$ = *Value* *Units*

Exercise 14.28

A harmonic oscillator has angular frequency ω and amplitude A.

Review | Constants

Part A

What is the magnitude of the displacement when the elastic potential energy is equal to the kinetic energy? (Assume that $U = 0$ at equilibrium.)

Express your answer in terms of the variables ω and A.

$x =$

Submit Request Answer

Part B

What is the magnitude of the velocity when the elastic potential energy is equal to the kinetic energy? (Assume that $U = 0$ at equilibrium.)

Express your answer in terms of the variables ω and A.

$v_x =$

Part C

How often does this occur in each cycle?

Express your answer as an integer.

4.00

Submit Previous Answers

✔ Correct

Part D

What is the time between occurrences?

Express your answer in terms of some or all the variables ω and A.

$\Delta t = \frac{\pi}{2\omega}$

Submit Previous Answers

✔ Correct

Review | Constants

Part E

At an instant when the displacement is equal to $A/2$, what fraction of the total energy of the system is kinetic?

Express your answer numerically.

$\frac{K}{E}$ = 0.750

Submit Previous Answers

✔ Correct

Part F

At an instant when the displacement is equal to $A/2$, what fraction of the total energy of the system is potential?

Express your answer numerically.

$\frac{U}{E}$ = 0.250

Submit Previous Answers

Exercise 14.35 - Enhanced - with Solution

A 2.00 kg frictionless block attached to an ideal spring with force constant 365 $\mathrm{N/m}$ is undergoing simple harmonic motion. When the block has displacement +0.200 m, it is moving in the negative x-direction with a speed of 3.50 $\mathrm{m/s}$.

For related problem-solving tips and strategies, you may want to view a Video Tutor Solution of Velocity, acceleration, and energy in shm.

Review | Constants

Part A

Find the amplitude of the motion.

Express your answer with the appropriate units.

$A =$ *Value* *Units*

Submit Request Answer

Part B

Find the block's maximum acceleration.

Express your answer with the appropriate units.

$a_{\mathrm{max}} =$ *Value* *Units*

Part C

Find the maximum force the spring exerts on the block.

Express your answer with the appropriate units.

F_{max} = *Value* *Units*

Exercise 14.38

A uniform, solid metal disk of mass 6.10 kg and diameter 22.0 cm hangs in a horizontal plane, supported at its center by a vertical metal wire. You find that it requires a horizontal force of 4.21 N tangent to the rim of the disk to turn it by 3.37 $^\circ$, thus twisting the wire. You now remove this force and release the disk from rest.

Review | Constants

Part A

What is the torsion constant for the metal wire?

Express your answer in $\mathrm{N \cdot m/rad}$.

$\kappa =$ $\mathrm{N \cdot m/rad}$

Submit Request Answer

Part B

What is the frequency of the torsional oscillations of the disk?

Express your answer with the appropriate units.

$f =$ *Value* *Units*

Part C

What is the period of the torsional oscillations of the disk?

Express your answer with the appropriate units.

T = Value Units

Submit Request Answer

Problem 14.62

An object is undergoing SHM with period 0.260 s and amplitude 6.35 cm. At $t = 0$ the object is instantaneously at rest at x = 6.35 cm.

Review | Constants

Part A

Calculate the time it takes the object to go from $x = 6.35$ cm to $x = -1.50$ cm.

Express your answer with the appropriate units.

t = Value Units

Submit Request Answer