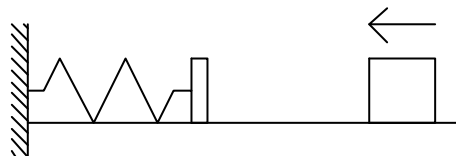


W8.03

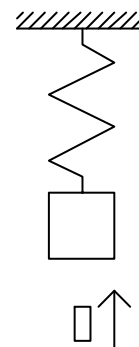
Springs 3

1. A 0.5-kg block, initially moving at 2 m/s, is fired into (and sticks to) a horizontal spring with a spring constant of 32 N/m. No speed is lost during the impact with the spring and the horizontal surface is frictionless. Determine:
 - a. the maximum compression of the spring.
 - b. the period of the resulting oscillation.
 - c. the maximum KE of the block.
 - d. the amplitude of the oscillation.
 - e. the maximum acceleration of the block during the oscillation.
 - f. the speed and acceleration of the block when the spring is stretched 0.1 m.



2. A horizontal spring-mass simple harmonic oscillator has a maximum speed of 6.28 m/s and an amplitude of 40 cm. Calculate the maximum acceleration of the oscillator and the period of the oscillator.
3. A 2-kg block is hung from a vertical spring with $k = 80$ N/m.
 - a. Determine how much the spring stretched when the mass is hung on it. (What is the equilibrium position?)

A 0.05-kg bullet is fired vertically at the block. The speed of the bullet just before impact is 200 m/s. The bullet “bounced off” the block with a speed of 0 m/s.



- b. By conservation of momentum, find the speed of the block after impact.
- c. Determine the kinetic energy of the block just after impact.
- d. Using energy methods, find the speed of the block when it reaches the unstretched position.
- e. Calculate the period of the oscillator.
- f. Find the maximum speed of the oscillator.
- g. By energy methods, determine how far below the equilibrium position the block will drop. (Hint: Set $GPE = 0$ at equilibrium. What is the total energy of the system? What is the GPE below this point? Remember that $x_{max} = x_{eq} + X$.)
- h. Calculate the maximum stretch of the spring, x_{max} , and the maximum EPE.
- i. Determine the amplitude of the oscillation. (Remember the mass oscillates symmetrically about the equilibrium position.)
- j. Calculate the maximum acceleration of the oscillator.

ANSWERS:

1. .

a. 0.25 m	a. 0.25 m
b. 0.785 s	b. 5 m/s
c. 1J	c. 25 J
d. 0.25 m	d. 4.74 m/s
e. 16 m/s ²	e. 0.993 sec
f. 1.83 m/s, 6.4 m/s ²	f. 5 m/s
	g. 0.791 m
	h. 1.041 m; 43.3 J
	i. 0.791 m
	j. 31.6 m/s ²
2. 98.6 m/s², 0.4 s
3. .