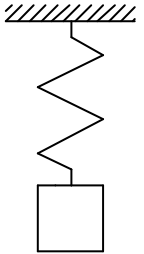# Springs 2

1. A 6-kg block is attached to a spring of $k = 40$ N/m and **held vertically** at the unstretched position and then released from rest.
   a. What is the frequency of the ensuing oscillation?
   b. How far does the mass drop before stopping and turning around?
   c. What is the maximum speed of the mass?
   d. What is the largest acceleration of the mass?
   e. What is the total mechanical energy (GPE, EPE, KE) of the oscillator?
   f. If there were friction, the mass would eventually come to rest. How far below the unstretched point will it be?

2. An oscillator has a period of 5 seconds and an amplitude of 20 m. What is the position of the mass, relative to the equilibrium position, when its EPE equals its KE? What are the maximum velocity and acceleration?

3. A spring with $k = 50$ N/m is compressed 20 cm when a 2-kg block is pushed against it. The block is released from rest and slides across a frictionless table. The table is 1.5 m high.
   a. How fast is it going when it leaves the table?
   b. How far from the edge of the table does the mass hit the floor?
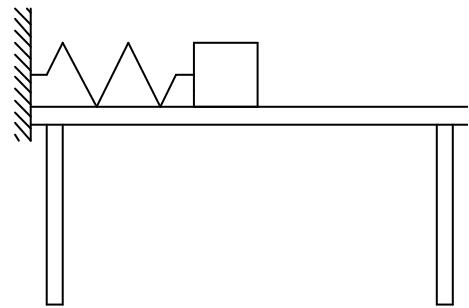
4. A simple harmonic oscillator has a period of 12 seconds. What is the new period if:
   a. the spring constant is quadrupled?
   b. the mass is doubled?
   c. the total energy is doubled by increasing the amplitude?

ANSWERS:
1. .
   a. $f = 0.411$ Hz (T = 2.43 s)
   b. 3 m
   c. 3.87 m/s
   d. 10 m/s^2
   e. 180 J
   f. 1.5 m (Note that this is also the amplitude)

2. $x = 14.14$ m; $v_{max} = 25.13$ m/s; $a_{max} = 31.6$ m/s^2

3. .
   a. 1.00 m/s
   b. 0.55 m

4. .
   a. 6 s
   b. 17.0 s
   c. 12 s