

1. In an electric shaver, the blade moves back and forth over a distance of 2.0 [mm]. The motion is simple harmonic, with frequency 94 [Hz].
  - a. Find the amplitude.
  - b. Find the maximum blade speed.
  - c. Find the magnitude of the maximum blade acceleration.
  
2. A 0.15 kg body undergoes simple harmonic motion of amplitude 8.7 [cm] and period 0.20 [s].
  - a. What is the magnitude of the maximum force acting on it?
  - b. If the oscillations are produced by a spring, what is the spring constant?
  
3. An automobile is mounted on four identical vertical springs. The springs of a certain car are adjusted so that the oscillations have a frequency of 4 [Hz].
  - a. What is the spring constant of each spring if the mass of the car is 1450 [kg] and the weight is evenly distributed over the springs?
  - b. What will be the vibration frequency if five passengers, averaging 68 [kg] each, ride in the car with an even distribution of mass?
  
4. A block is on a horizontal surface (a shake table) that is moving back and forth horizontally with simple harmonic motion of frequency 2.4 [Hz]. The coefficient of static friction between block and surface is 0.36 [1]. How great can the amplitude of the SHM be if the block is not to slip along the surface?
  
5. A performer, seated on a trapeze, is swinging back and forth with a period of 8.55 [s]. If she stands up, thus raising the center of mass of the trapeze + performer system by 25.0 [cm], what will be the new period of the system? Treat trapeze + performer as a simple pendulum.

6. The velocity of a rocket is  $v(t) = 4t^3$  [m/s]. How far does the rocket travel from time 2 [s] to 8 [s]?

7. When a certain spring is stretched by an amount  $x$ , it produces a restoring force  $F(x) = -ax + bx^2$  [N], where  $a$  and  $b$  are constants. How much work is done by an external force in stretching the spring by an amount  $D$  from its equilibrium length?

## HW Set 1 Answers

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- 1a. 1 [mm]  
1a. 0.591 [m/s]  
1a. 349 [m/s<sup>2</sup>]
- 2a. 12.9 [m/s<sup>2</sup>]  
2b. 148 [m/s<sup>2</sup>]
- 3a.  $2.29 \times 10^5$  [N/m]  
3b. 3.6 [Hz]
4. 0.0155 [m]
5. 8.49 [s]
6. 4080 [m]
7.  $aD^2/2 - bD^3/3$  [J]