DRILL

CHAPTER 6 PRACTICE QUESTIONS

Directions: Complete the following problems as specified by each question, and then check your work using the solutions that follow. For extended, step-by-step solutions, access your Student Tools online.

- **1.** A conservative force $\vec{F} = (3N)\hat{i} + (2N)\hat{j}$ is applied on a mass. If the displacement of the mass is $\Delta \vec{r} = (2m)\hat{i}$, how much work is done if the path taken is an S-shaped curve of distance 5 m ?
- 2. What is the work done by a centripetal force on a mass *m* undergoing uniform circular motion with a tangential speed *v* and a radius *r*?
- 3. What is the power required to move a mass against a constant force F at a constant speed v?
- 4. Imagine a roller coaster that is about to go through a loop-the-loop.



The loop has a radius of *R*. Imagine that it is perfectly circular. If the roller coaster wants to safely pass through the loop, what should its initial speed be? (Hint: The normal force on a passenger in this roller coaster measures how hard they are in contact with their seats. To safely pass through the loop, the passengers should always be in contact with their seats.)

- 5. A rigid rod of mass 5 kg and length 10 cm has a 100 g mass attached to one end of it. If it rotates uniformly with the axis fixed at the rod's other end, what is the rotational kinetic energy of this system given that the tangential speed of the 100 g mass is 20 m/s?
- 6. A nonideal spring has a force constant of 10 N/m when stretching, but a force constant of 20 N/m when compressing. If you stretch it a distance of 10 cm and release it, what is the maximum distance that the spring will compress?
- 7. A compressed spring is used to propel a mass *m* forward along a frictionless surface. After some distance, there is a small ramp of inclination angle θ that will allow the mass to leave the surface. This is a very simple way to produce a projectile. If the spring's force constant was *k*, and you compressed it to an initial displacement of *A*, what would the maximum height of the projectile be?
- 8. Simple harmonic motion has been used for ages to build reliable clocks. A grandfather clock, for example, uses a pendulum to measure time properly. Let's say you wanted to build a clock utilizing a simple harmonic motion with a period of 1 s, and that this clock is intended to go to the Moon. Should you build it out of a massspring system or out of a pendulum?