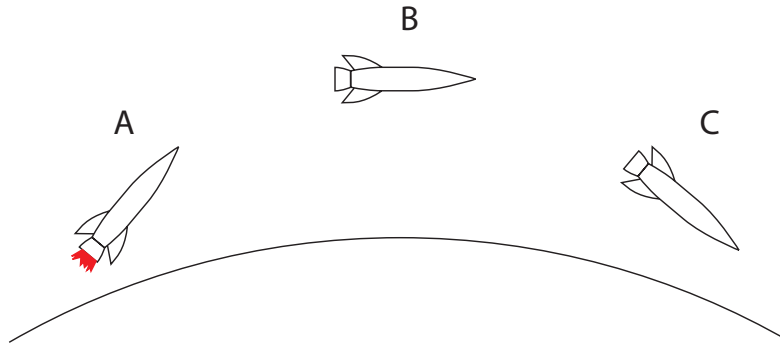


Physics 106 - How Things Work II - Spring 2008

Problem Set #1

At point "A", a rocket is taking off from the surface of the earth by firing its engine. At point "B" the rocket is at its maximum altitude, its engine is off, and it is coasting above the atmosphere. At point "C" the rocket still has its engine off, is still above the atmosphere, and is beginning to move back toward the earth's surface.



1. Consider the rocket trip illustrated in the figure above.
 - a. At point "A", you may assume that the rocket's direction of travel with respect to the earth's surface is roughly in keeping with what is shown in the figure. Is the rocket accelerating? If so, what can you say about the direction of acceleration? Explain your answer.
 - b. At point "B", is the rocket accelerating? If so, describe in words the direction of its acceleration. Either way, give your reasoning.
 - c. At point "C", is the rocket accelerating? If so, describe in words the direction of its acceleration. Either way, give your reasoning.
2. On the moon, the acceleration due to gravity is 1.6 m/s^2 .
 - a. What would a rock's velocity be 3 seconds after you dropped it on the moon ?
 - b. How far would the rock have fallen after 3 seconds?
3. Why does tapping your toothbrush on the sink dry it off?
4. A speedboat is pulling a water-skier with a rope, exerting a large forward force on her. The skier is traveling forward in a straight line at constant speed. What is the net force she experiences? Explain your answer.
5. When you kick a soccer ball, which pushes on the other harder: your foot or the soccer ball?
6. You are cutting wood with a handsaw. You have to push the saw away from you as it moves away from you and pull the saw toward you as it moves toward you. When are you doing work on the saw?
7. You are towing your friend's car up a long steep hill at a constant speed. The height of the hill is 50 meters. The road leading to the top of the hill is straight, at a constant incline, and 250 meters in length. The weight of your friend's car is 10,000 Newtons.
 - a. How much work would it take to lift the car straight up by 50 meters (imagine you are lifting it using a crane).
 - b. How much work would it take to tow your friend's car up as described above? You may ignore friction.
 - c. What is the size of the force that you must exert on your friend's car when towing it?