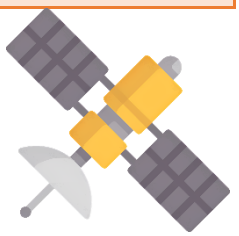
Physics 05-03 Satellite Crash Lab ***Name:*** _____



The USA and Russia both decide to launch new weather satellites. Unfortunately, the two countries do not communicate, and the satellites are destined for a collision. USA-1 and RUS-2 are traveling towards each other on the same orbit, but opposite directions. USA-1 has a mass of 500 kg and RUS-1 has a mass of 800 kg. Both are in a stable circular orbit 500 km above the earth's surface.

1. What is the speed of each satellite?
2. What is the relative speed of one satellite compared to the other?
3. In real life, what will happen to the satellites when they hit each other?
4. In a miraculous event, the two satellites stick together after the collision. What is the speed of the combined mass after the collision?
5. What will happen to the combined mass after the collision? Explain.
    a. It will fall straight down to the earth.
    b. It will travel in a decaying orbit, eventually hitting the earth.
    c. It will travel in an ascending orbit, eventually moving to a higher orbit.

Later, the USA wants to remove one of its old weather satellites, USA-3, from orbit, so they plan to hit it with space probe which is essentially just a satellite that has a small thruster on it. The probe comes up behind USA-3 and fires its thruster so that it hits at 100 m/s relative velocity. USA-3 was 600 kg and in a stable circular orbit of 450 km above the earth's surface. The probe is 200 kg and at the same altitude.

6. What is the speed of USA-3 and the probe?
7. In another miraculous event, the two satellites bounce off each other without breaking in an elastic collision. What are the final speeds of satellite and the probe?
8. What will happen to USA-3 after the collision? Explain.
    a. It will fall straight down to the earth.
    b. It will travel in a decaying orbit, eventually hitting the earth.
    c. It will travel in an ascending orbit, eventually moving to a higher orbit.
9. What will happen to the probe after the collision? Explain.
    a. It will fall straight down to the earth.
    b. It will travel in a decaying orbit, eventually hitting the earth.
    c. It will travel in an ascending orbit, eventually moving to a higher orbit.