Physics 20

Chapter 5 Circular Motion Worksheet

1. Draw a **sketch** that shows an object moving in a circle (nothing fancy!). For any one position on the circle, **sketch** vectors that show the direction of the object's instantaneous velocity, centripetal acceleration, and centripetal force.

2. Many people approach problems thinking that centripetal force is just another force like applied force. **Explain** what centripetal force actually is.

3. The rotor on a Schweizer 300 helicopter runs at 460 rpm.
   a) **Explain** what this number measures.
   b) **Determine** what 460 rpm would be equal to in regular metric units.
   c) **Determine** how much time it takes a rotor to spin once around.
   d) Each rotor on the helicopter experiences 3.9e4 N of centripetal force at its tip due to the spinning of the rotor. If the blade has a 4.2 m radius, **determine** the mass of the blade.

4. You are spinning a 10kg pail of water around in a vertical circle, trying not to dump the water on your head! Your arm is 60 cm long. Your swings have a frequency of 1.33 Hz.
   a) **Determine** the velocity of the pail.
   b) **Determine** the centripetal acceleration of the pail in gees.
   c) When the pail is at the bottom of the swing **determine** the tension acting on your arm.
   d) **Determine** the lowest frequency you could spin the pail at without dumping water on your head.

5. You are running around the corner of the sidewalk by your house at 20 km/h. If your turn has a radius of 1.8 m, **determine** the smallest coefficient of static friction that will allow you to do this without slipping.

6. **Explain** why Brahe and Kepler were actually a good pairing of scientists (even f they had arguments).

7. If we examine the orbit of the moon around the Earth, draw a **sketch** showing the position of the Earth and the path of the moon. **Identify** the mathematical name for the position of the Earth.

8. **Comparing** the orbit of Mercury (planet closest to the Sun) to the orbit of Mars (fourth planet from the Sun), make a general statement about their orbital speeds.

9. The moon orbits the Earth once every 27 days at a distance of 384 400 km. The International Space Station orbits the Earth at an altitude of 400 km. **Determine** the period of orbit of the Space Station.

10. Use the concepts of "Newton's Cannon" to **explain** how an object can stay in orbit.

11. A couple of years ago an astronaut accidentally released a 1.2 kg wrench while making a repair during a space walk. **Determine** its orbital velocity if it is still going around the Earth at an altitude of 350 km.

12. NASA is studying a new solar system, Kepler-186, which is 500 light-years from our solar system. It is known to have a planet, Kepler-186f, which sits in the "Goldilock's Zone" where water, heat, and other conditions could support life. (https://youtu.be/RlidbLyDnPs) Kepler-186 has a mass of 1.08e30 kg.
   a) **Determine** the Kepler constant for planets in that solar system.
   b) Kepler-186f orbits its star once every 130 days. **Determine** its orbital radius.