2. **Assignment** **Due October 02nd** (distributed September 28th)

Please note you name clearly on your solutions and number the pages, state clearly which number you are working on. Also, please make sure, the pages stay together. Don't use pencil - it should be something more permanent.

For every exercise, state clearly what you are looking for, make a sketch where useful and write down a few words, so that it is clear what you are doing. Often this will get you points already, even if you make a mistake in the calculation.
Make sure you write the units down in every step of your calculation as well and certainly in your answer.

Find the points for each exercise given.

1.) The left ventricle of the heart accelerates blood from rest to a velocity of +26 cm/s.
a) If the displacement of the blood during the acceleration is +2.0 cm, determine it's acceleration in m/s^2
b) How much time does the blood use to reach its final velocity?
c) After the first 2 cm the blood continues with it's speed of 26 m/s throughout the body. Assume the speed is constant. We approximate the bloods path through the body with a rectangular shape with side length of 2.0 m and 0.4 m. How long is the total path and how long will it take for one drop of blood to make this journey?
(3 points - 1 each part)

2.) A motorcycle daredevil is attempting to jump across as many school buses as possible. The takeoff ramp makes an angle of 18.0° above the horizontal (ground), and the landing ramp is identical to the takeoff ramp. The buses are parked side by side, when each bus is 2.74 m wide. (We assume no space between buses of between bus and ramp.) The cyclist leaves the ramp with a speed of 33.5 m/s.
a) What is the maximum number of buses over which the cyclist can jump?
b) How large is the area under the jumping path from ground to ground? (calculate the circle segment area from beginning of ramp, over busses to end of second ramp)
(4 points - 2 each part)

3.) A supertanker of mass $m = 1.50 \times 10^8$ kg is being towed by two tugboats. The tensions in the towing cables apply the forces T_1 and T_2 at equal angles of 30.0° with respect to the tanker's axis. In addition the tanker's engines produce a forward drive force D, whose magnitude is $D = 75.0 \times 10^3$ N. Moreover, the water applies an opposing force R, whose magnitude is $R = 40.0 \times 10^3$ N. The tanker moves forward with an acceleration that points along that tanker's axis and has a magnitude of 2.00×10^{-3} m/s^2
Find the magnitudes of T_1 and T_2.
(4 points)

4.) A 1.14×10^4 kg lunar landing craft is about to touch down on the surface of the moon, where the acceleration due to gravity is 1.60 m/s^2. At an altitude of 165 m the craft's downward velocity is 18.0 m/s. To slow down the craft, a retrorocket is firing to provide an upward thrust. Assuming the descent is vertical, find the magnitude of the thrust needed to reduce the velocity to zero at the instant when the craft touches the lunar surface.
(3 points)

5.) A centrifuge is a device in which a small container of material is rotated at a high speed on a circular path. Such a device is used in medical laboratories, for instance, to cause the more dense red blood cells to settle through the less dense blood serum and collect at the bottom of the container. Suppose the centripetal acceleration of the sample is 6.25×10^3 times as large as the acceleration due to gravity. How many revolutions per minute is the sample making, if it is located at a radius of 50.0 mm from the axis of rotation?
(3 points)

6.) A speedboat accelerates from rest to 10 m/s in 20 s, then it stays at a constant speed for 30 s, accelerates to 12 m/s in 5 s, stays at the new constant speed for 10s and then decelerates and comes to a complete stop after 40 s.
a) Draw a v-t diagram for the complete motion.
b) How much ground did the speedboat cover overall?
c) Determine the displacement of the boat.
(3 points - 1 each part)