Physics 151
Homework Assignment #5
Due Monday, July 7 at 5:00PM

#1 A plane flies along the earth's equator such that the sun appears to stand still.

(a.) Is the plane flying east to west or west to east? Explain.

(b.) How fast is the plane flying? Give your answer in both km/h and mph. Use $6400\,km$ as the earth's radius at the equator.

#2 A man weighs himself at the north pole and at the equator. Are the results different? If so, explain which reading is larger. If not, explain why there would be no difference.

#3 A 5.0-g coin is placed on a turntable that is spinning at $60\,RPM$.

(a.) If the coefficient of static friction between the coin and the turntable is 0.75, what is the farthest distance that the coin can be placed from the turntable's center without it sliding off?

(b.) Does the mass of the coin matter in determining this distance?

#4 A car drives over a hill that has a radius of $60\,m$.

(a.) As the car's speed increases, what happens to the magnitude of the normal force acting on the car at the top of the hill? (Imagine the car going over the hill many times, each time with a larger speed.)

(b.) What is the maximum speed the car can have without flying off the road at the top of the hill?

#5 While a person is walking, his arms (each with length $70\,cm$ as measured from the shoulder joint) swing through a 40° angle in $0.8\,s$. As a reasonable approximation, we can assume his arms are swinging with a constant speed.

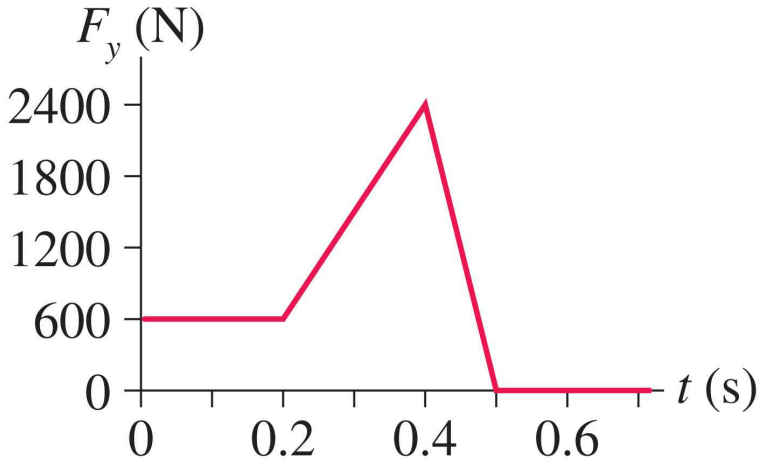
(a.) What is the acceleration of a 2.0-g drop of blood in the fingertips as the person swings his arms?

(b.) At the bottom of his swing (when his arm is vertical), draw the free-body diagram for the droplet of blood of part (a.). **Hint:** The blood vessels in the fingers will exert a force, $\vec{\mathbf{F}}_{BV}$, on the droplet of blood. This force can be in any direction.

(c.) Find the magnitude of the blood-vessel force when the arm is at the bottom of its swing.

(d.) What would the blood-vessel force be if the arm were not swinging?

#6 This figure shows the force exerted by the floor on a woman making a vertical jump. At what speed does she leave the ground? **Hint:** You must include all forces acting on the woman to apply the impulse-momentum theorem.



#7 A tennis player swings her 0.7-kg racket with a speed of $10\,m/s$. She hits a 40.0-g tennis ball that was approaching her at $20\,m/s$. The ball rebounds at $30\,m/s$. For simplicity assume both the racket and the ball are moving horizontally before and after their collision.

(a.) How fast is her racket moving immediately after impact? You can ignore the interaction of the racket with her hand for the brief period of the collision.

(b.) If the tennis ball and racket are in contact for $15\,ms$, what is the average force exerted on the ball by the racket?

#8 At the center of a 50-m diameter circular ice rink, a 75-kg skater traveling west at $2.5\,m/s$ collides and hold onto a 60-kg skater who had been heading north at $3\,m/s$.

(a.) How long will it take them to glide to the edge of the rink?

(b.) Where will the reach the edge of the rink. Give your answer as an angle.