Phy 111 EXAM practice exam 1 Solutions

R.E. Tremblay Specific heat capacity of liquid water = 1cal/g°C

1) Find the sum of the following two vectors: 25 m/s at 30 deg and 20 m/s at 220 degrees. _____



2) A man stands on his toes by exerting an upward force through the Achilles tendon. Calculate the force 'F' in the Achilles tendon if he stands on one foot and has a mass of 83 kg.



Note that the man weighs $83kg(9.8m/s^2) = 813$ Newtons

clockwise torque = counterclockwise torque $F_A(4cm) = 813N(11 cm)$ $F_A = \frac{813N(11cm)}{4cm} = 2,240$ Newtons 3) If a ball is thrown straight up from a balcony at a speed of 24 m/s calculate its:

- (a) position after 1.9 seconds ______
 (b) its velocity after 1.9 seconds ______

a)

$$\Delta X = V_o t + \frac{1}{2} a t^2$$

$$\Delta X = 24 \frac{m}{s} 1.9 s + \frac{1}{2} \left(-9.8 \frac{m}{s^2}\right) (1.9 s)^2$$

 $\Delta X = 27.9$ meters above the balcony

b)

$$V = V_o + at$$

$$V = 24 \frac{m}{s} + -9.8 \frac{m}{s^2} (1.9s)$$

$$V = 5.38 \frac{m}{s} \text{ upward}$$

4) How much kinetic friction will there be in a knee joint if the weight supported by the joint is 650 N? (coefficient of kinetic friction= .016)

$f = \mu F_N = .016 \cdot 650 \text{N} = 10.4 \text{ Newtons}$

5) Two movers push horizontally on a desk, which is on a flat surface. One pushes due north with a force of 300 N and the other pushes due west with a force of 640 N. The desk has a mass of 60 kg and the coefficient of friction between the desk and the floor is .14. Find the direction and magnitude of the resultant force on the desk.



Total force from movers is 707 Newtons @ 295°

friction = $\mu F_N = \mu mg = .14 \cdot 60 kg \cdot 9.8 \frac{m}{s^2} = 82.3N$ Ans. The net force is: 707 N- 82.3N= 625 N @ 295° 6) How much heat is required to raise the temperature of 20 grams of water from 30°C to 80°C in 10 seconds?_____

$$Q = mc\Delta T = 20g \left(1\frac{cal}{g \cdot c}\right)50^{\circ}C = 1000 \text{ calories}$$

7) What centripetal force is necessary to hold a 1200 kg car from slipping as it rounds a corner of radius 240 m at a speed of 36 m/sec?

$$F = ma = m\frac{v^2}{R} = 1200kg\frac{\left(36\frac{m}{s}\right)^2}{240m} = 6,480$$
 Newtons

8 Calculate the work done by a 75 kg person in climbing a flight of stairs 4.2m high in 4.2 seconds._____

$$W = F\Delta X = Wt \cdot \Delta X = 75kg \cdot 9.8 \frac{m}{s^2} \cdot 4.2m = 3090 \text{ joules}$$

(b) How much power was needed?_____

$$Power = \frac{Energy}{time} = \frac{3090}{4.2s} = 736 \text{ watts}$$