Review for Final – First Installment

1. How much time will it take me (70 kg) to run up 50 steps if I generate the equivalent power of a 100 watt light bulb. Each step is 23 cm tall.

2. If a car generates 20 hp when it travels at a constant 90 km/hr, what must be the average force exerted on the car due to friction and air resistance?

   20 hp = 14914 W; P = F*v so F=P/v=14914/25 = 5676.56 N
   v= 90 km/h = 25 m/s;
   F=?;

3. A motor is used to pull a 60 kg skier along a horizontal surface at a constant speed of 2 m/s to enable him to learn to keep his balance. The coefficient of kinetic friction (μ_k) is 0.10. What power motor is required?

4. A 1000 kg car moving at 30 m/s crashes into a tree and comes to a stop in 0.2 seconds. How much force is exerted on the car?

5. A 100 gram bouncy ball is dropped from the second floor. The ball hits the first floor moving downward at 10 m /s. If the floor imparts a force of 1800 N over a time of .001 seconds, how fast will the bouncy ball bounce up off of the floor?

   m = 0.1 kg F= 1800 N F=ma so a=F/m=1800/.1=18000m/s2; vf = vi + at = 10 - (18000)(0.001) = 8m/s
   vi = 10 m/s t= 0.001s
   vf = ? m/s

6. A 1500 kg car moving east at 20 m/s collides with a stationary 1000 kg car. If the first car after the collision is moving at 5 m/s what is the speed of the second car?

   m1 = 1500 kg m2 = 1000 kg
   v1 = 20 m/s v2 = ?

7. What is the force of gravity between Jupiter and Io (one of its 63 moons) if the mass of Io is 8.94 E 22 kg, the mass of Jupiter is 1.9 E 27 kg, and the distance between them is 1.77 E 3 **km**?

   m(Io) = 8.94 E 22 kg G = ?
   m(J) = 1.9 E 27 kg
   R = 1.77 E 3 km = 1.77 E 5 km

8. A 0.5 kg ball swinging in a horizontal circle at the end of a 64 cm long string, causes the string to break when it is swung at 150 RPM. What was the maximum tension the string could withstand?

9. A 40 **gram** ball attached to a string is swung in a vertical circle. If the tension in the string at the top of the circle is 15 N and the ball is traveling at 12 m / s, what was the length of the string?

10. It is found (through trial and error) that you will "feel" weightless when you travel at 42 mi / hr over a smoothly rounded hill. What is the radius of the hill?

11. A force of 140 N is felt by a 60 kg passenger when they are upside down at the top of a loop on a roller coaster traveling at 15 m/s. What is the radius of the loop? How much force will the passenger feel at the bottom of the loop assuming that they continue to travel at 15 m / s?

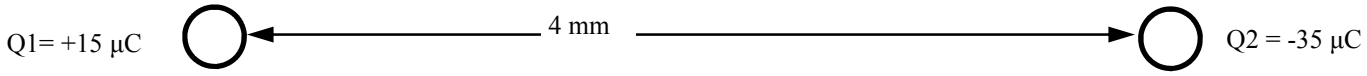
12. As a car goes around a curve of radius 200 m, the coefficient of static friction between the tires and the pavement is 0.6. What is the maximum speed that the car go around the curve without sliding off the road?

Know the relationship between force of gravity and the distance between the objects.

Know the relationship between force of gravity and the masses of the objects.

Know what feeling "weightless" means as it relates to circular motion.

Know what centripetal acceleration is and the direction it points.



Use the diagram above for questions 13 and 14:

13. What is the electrical force between the two charges q1 and q2?

14. How much work was done to move Q2 from Johnson City to its position on the 4 mm line?

15. What is the intensity of the E-field where an electric force of 8 E-4 N is exerted on a charge of 2 E-12 C?

16. How far away from a 12 μC point charge would the potential be 5.8 E4 V?

The following list is meant to help focus your studies from your NOTES.

Centripetal Force	Universal Law of Gravitation		Centripetal Acceleration
Electrostatics	E – field	Electric Force	Charge
Voltage	Electric Potential	Coulomb's Law	

Some Formulas and constants that you MAY want to review:

Power, Impulse, and Momentum,

$$P = \frac{W}{t} \qquad P = \frac{Fd}{t} \qquad P = Fv \qquad P = \frac{\Delta KE}{t} \qquad P = \frac{(1/2mv_f^2 - 1/2mv_i^2)}{t}$$

$$P = \frac{mgh}{t} \qquad P = mgv \qquad P = \frac{mg\mu d}{t} \qquad P = mg\mu v \qquad P = \frac{mg\mu d\cos\theta}{t} \qquad P = mg\mu v\cos\theta$$

$$\rho = mv \qquad F = \frac{\Delta\rho}{t} \qquad \Delta\rho = J \qquad J = (mv_f - mv_i) \qquad J = m(v_f - v_i) \qquad J = Ft$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f} \qquad m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f \qquad (m_1 + m_2)v_i = m_1v_{1f} + m_2v_{2f}$$

Gravity & Circular Motion

G = 6.67 E -11 Nm^2/kg^2 $\qquad F_g = G\frac{M_1M_2}{R^2} \qquad g = \frac{GM}{R^2} \qquad F_g = mg$

$$a_c = \frac{v^2}{r} \qquad a_c = \frac{4\pi^2 r}{T^2} \qquad v_c = \frac{2\pi r}{T} \qquad F_f = F_N\mu \qquad \Sigma F = ma$$

Electrostatics:

Point Charge Formulas:

$F_e = (K\ Q_1\ q_2) / r^2 = q\ E$

$E = (K\ Q) / r^2$

$V = (K\ Q) / r$

$W = U_e = q\ V$

Other important information:

milli = m = E –3
micro = μ = E –6
nano = n = E –9
pico = p = E –12

Proton:
mass = 1.67 E –27 kg
charge = 1.6 e –19 C

Electron:
mass = 9.11 E –31 kg
charge = - 1.6 E –19 C

G = 6.67 E –11 Nm^2 / kg^2
K = 9 E 9 Nm^2 / C^2

KEEP IN MIND THAT MANY QUESTIONS WILL BE CONCEPTUAL!!!
YOU'LL NEED TO STUDY YOUR NOTES!!!!!!!!!!!!!!!!!!