Name _____ AP Physics2. <u>Summer Bonus problems</u>.

1) A 915 gram tennis ball is thrown straight up with a speed of 18.6m/sec.
(a) Calculate the ball's maximum height above its release point.
(b) Calculate the amount of time the ball is in the air before it returns its initial release point.
(c) Calculate the amount of gravity force acting on the ball while it is in the air.

2) A movie stunt car drives horizontally off a 55 meter tall cliff at a speed of 55 meters per second.
(a) Draw a diagram of the cliff and the path of the car as it falls to the ground.
(b) After leaving the cliff, how much time is the car in the air before hitting the ground?
(c) How far from the base of the cliff will the car impact the ground?

3) Tarzan (89kg) swings across an alligator infested river on a 21.0meter long vine. His speed at the bottom of the arc is 11.4m/sec.

(a) Draw a free-body diagram of the 2 actual forces acting on Tarzan at the bottom of the circle.

(b) What is Tarzan's weight? (How much downward force does gravity provide?)

(c) How much Centripetal Force is needed to keep Tarzan moving in that circle?

(d) How much total tension force must the vine provide to keep Tarzan moving in that circle? Remember, the vine must counteract the Gravity Force and also provide the Centripetal Force.

4) Tarzan's mass is 89kg.

(a) Assuming Tarzan is a simple pendulum, swinging across an alligator infested river on a 21.0meter long vine, how much time is required to swing across the river and back to his starting place?

(b) Assume Tarzan is dangling on the end of a bungee-cord and oscillating up and down with simple harmonic motion. The cord's spring constant is 57N/m. What is Tarzan's period of oscillation?

5) A speeder, moving at constant speed of 36.3m/sec, passes a parked police car. The police car begins to accelerate at 7.40m/sec^2 as the speeder passes.

(a) Write an equation for the <u>displacement</u> of the speeder with respect to time.
(b) Write an equation for the <u>displacement</u> of the police car with respect to time.
(c) The police car will catch the speeder after they have both traveled the same <u>displacement</u>. Using your equations from parts a and b, calculate how much time it takes the police car to reach the same <u>displacement</u> as the speeder.
(d) Calculate how much distance the police car must travel to catch the speeding car.
(e) Construct a data table, and calculate the <u>displacement</u> of each vehicle at one second intervals from 0 seconds to 10 seconds. [use your previous <u>displacement</u> equations]
(f) On the graph below, draw and label one line for the <u>displacement</u> of the speeder and another line for the <u>displacement</u> of the police car. [Use values from your data table]
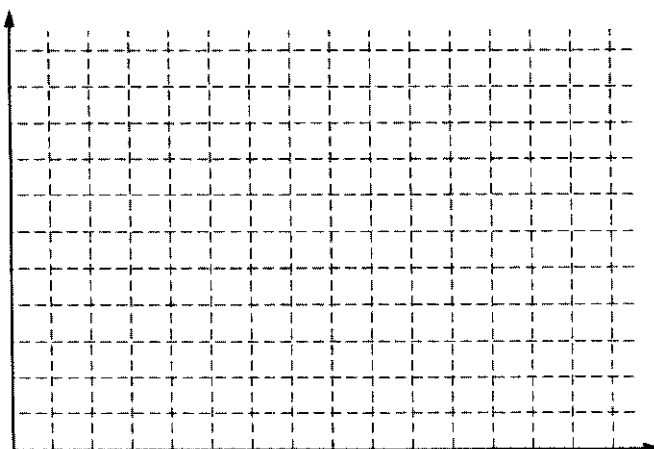
6) A 19.0 gram bullet traveling 257m/sec is fired into a stationary 1.8kg apple and becomes embedded.
(a) Draw a diagram of the objects before and after the collision.
(b) How fast were the bullet and apple moving just after their collision?

7) One resistor has a resistance of 8.0Ω, and another resistor also has a resistance of 8.0Ω.
(a) If these two resistors are connected in series, calculate the equivalent resistance.
(b) If these two resistors are connected in parallel, calculate the equivalent resistance.

8) On an icy road, a 8736kg car traveling at 18.0m/sec panic brakes and skids until kinetic friction causes it to stop. The coefficient of kinetic friction is 0.32 between the road and the vehicle.

(a) Draw a free body diagram of the forces acting on the vehicle as it skids to a stop.
(b) Calculate the gravity force acting on the vehicle.
(c) Calculate the Kinetic Energy that must be removed from the vehicle while it skids to a complete stop.
(d) Calculate the Friction Force acting on the vehicle as it skids.
(e) Calculate the distance the vehicle will skid before stopping. [Remember $ME_i + W = ME_f$]

9) A piano string is vibrating 440 times a second. A longitudinal sound wave from the string travels at a speed of 346m/sec through 25°C air.

(a) Calculate the period of the string's vibration.
(b) Calculate the wavelength of this sound wave in air.
(c) Calculate the amount of time required for this sound wave to travel from the instrument to a listener 46.5 meters away.

10) During a lab experiment, a 119gram meterstick is setup like a seesaw. The pivot point (or fulcrum) is placed at the 31cm 'mark' of the meterstick, and 216grams of mass is hung at the 14cm 'mark' of the meterstick. 136grams of mass must be placed somewhere on the meterstick make it balenced.
a) Draw a picture of this situation.
b) Calculate the lever arm length for the 136grams of mass.
c) Calculate the actual 'mark' on the meter stick where the 136grams of mass must be positioned.