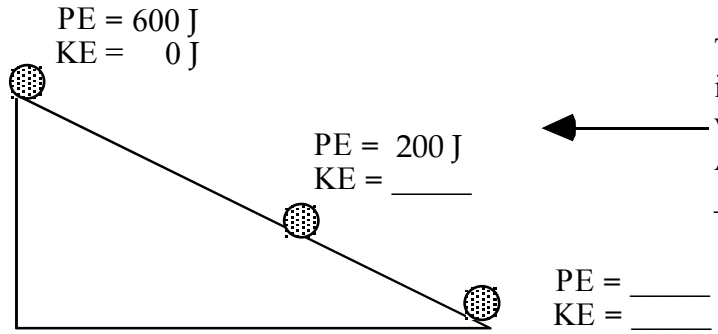
Name: _____

Integrated Physics and Math

Final Exam 2006/07

1. (5 pt) Fill in the missing energies on the diagram below. Then answer the questions. Ignore friction.



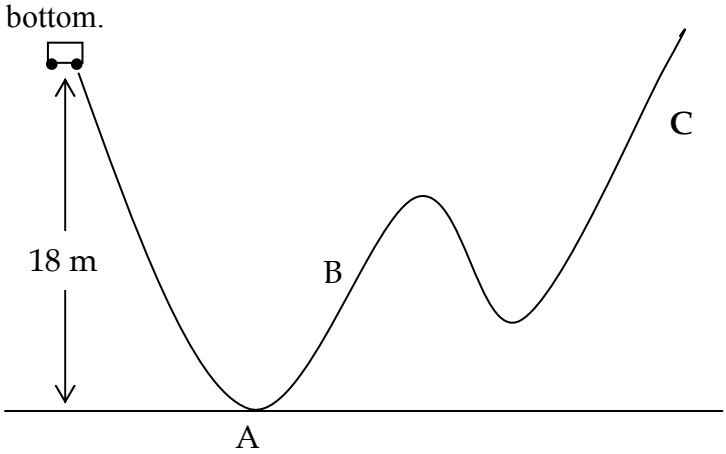
The ball has a mass of 4.0 kg. Find its velocity at this point
v = _____
And its height above the ground h = _____

2. (4 pt) Sean makes a shot from the top of the key, and as the 0.65 kg basketball reaches the hoop, it is traveling at 2.5 m/s and is 10.2 ft (3.1 m) off the ground.
   (a) Find the ball's potential energy relative to the ground at this moment.

   (b) Find the ball's kinetic energy.

3. (2 pt) A small bomb sits on Mr. Doucette's desk. It explodes into 2 pieces, one of them 10 times the mass of the other. The smaller piece flies off at 50 m/s. How fast does the other piece go?
   a) 500 m/s
   b) 50 m/s
   c) 5.0 m/s
   d) 0.5 m/s
   e) It can't be determined without more information

4. (4 pt) Rivey is in a cart at the top of the first hill of the **frictionless** PHYSICS DEATHTRAP™ Rollercoaster shown below. He starts at rest at the top of the hill and will <u>not</u> lose his lunch by the bottom.



(a) Find his speed at the bottom of the first hill (point A).

(b) At point B, he is moving at 12 m/s. How high above the ground is he?

(c) Put an "X" on the drawing to show how high up hill C his roller coaster cart will go before rolling back the other way. Enter the height at that point.

5. (4 pt) David is standing still on the glassy ice of the Old Res. He throws his shoe off to the left so that he'll slide to the right.
a) Draw a before and after sketch of the situation.

(a) Which has more momentum: David, his shoe or are they the same? Defend your answer.

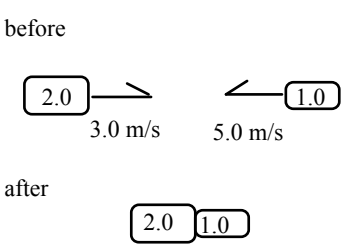
(b) Which has a larger velocity: David, his shoe or are they the same? Defend your answer.

6. (5 pt) Rashad and Paul are driving the bumper cars at Canobie Lake Park. Rashad is sitting in his car (total mass 250 kg) at rest. Paul (320 kg with his car) is traveling at 6.0 m/s when he collides into Rashad. After the collision, Paul has slowed down to 3.5 m/s.
   a) Draw a before and after sketch of the situation.

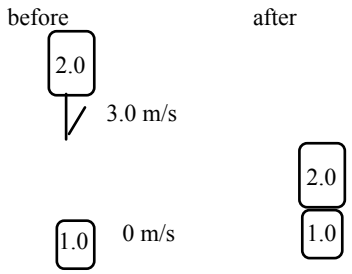
   b) What is Rashad's velocity after the collision?

7. (4 pt) Draw in the <u>direction</u> these (frictionless) objects will travel after they have collisions and **stick together**. Then find the <u>speed</u> of the combined object. (All masses are in kg.)

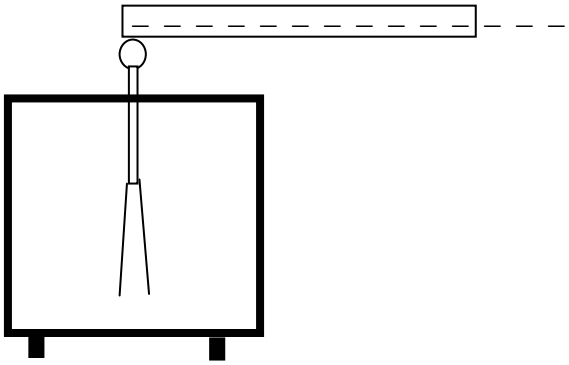
a)



b)



8. (4 pt) A negatively charged conducting rod is brought close to this electroscope and touches to the ball on the top.
   a) Draw the movement of charges as the rod touches the electroscope.
   b) Describe what happens to the aluminum foil leaves of the escope and explain why.



9. (4 pt) Draw a schematic diagram in the space below of a circuit that shows two 8ohm resistors wired in parallel across a 9 V battery.
   a. What is the equivalent resistance of the circuit?
   b. What is the total current through the circuit?

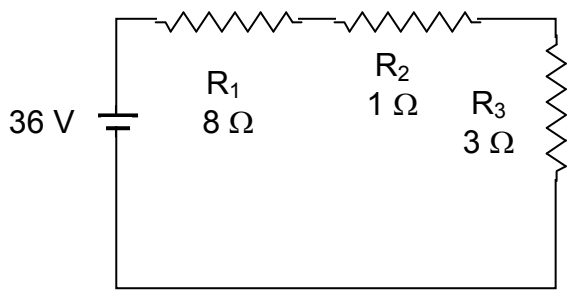
   R_{eq}:

   I_{total}:

10. (5 pt) For the circuit shown below:
   a. What is the equivalent resistance of the circuit?
   b. What is the total current through the circuit?
   c. Fill in the voltage for each resistor.
   d. Draw where in the circuit you would connect a voltmeter to measure the voltage across R_1.

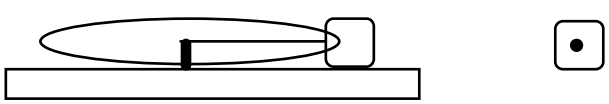
R_{eq}=
I_{eq}=

V_1 =
V_2 =
V_3 =

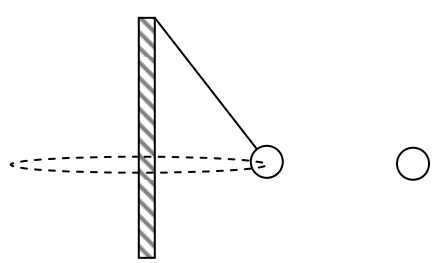


11. (4pts)Draw the free body diagram for each situation below. Label all the forces, and write an expression for F_c in terms of the forces (and r, t or p components if needed.)

a) Block attached to a string rotating on a horizontal, frictionless table.



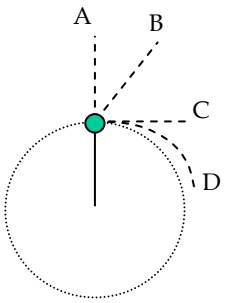
b) Tether ball on a string swinging in a horizontal circle.



Fc = Fc =

12. (2pts)This yo-yo is going around clockwise in a horizontal circle (seen from above). When the string breaks at the point indicated, which path will it follow?

a) A b) B c) C
d) D e) none of these



13. (4pts)Liz (m = 53 kg) rides on a merry-go-round that has a diameter of 2.20 m. She makes it around once every 3.5 seconds.

a) Find her velocity.

b) Find a_c on her

c) Find the force she needs to exert to hang on to the pipe on the merry-go-round.