Phys 8A Midterm I Review  
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1. For time of you who arrive a little early, we'll do an order-of-magnitude estimation question. This type of problem is good to get your brain working. For instance: How many Ping-Pong balls would it take to fill 1 liter? Make sure to justify your assumptions!

2. a) Many of the kinematic quantities used by physicists are contrived, though useful (for instance, average velocity). In fact, geophysicists use a quantity called the "slowness" defined as $\frac{1}{v}$. What does this quantity mean physically?

b) A particle starts from rest and accelerates as shown below. Draw the associated position-time and velocity-time graphs. Be quantitative!

![Graph showing position and velocity over time](image)

3. Projectile Motion: A superball (bouncy ball) is thrown from the window of an apartment building. The ball is given an initial velocity of 8.00 m/s at an angle of 20.0° below the horizontal. It strikes the ground 3.00 s later.

a) How far (horizontally) from the base of the building does the ball strike the ground?

b) From what height is it thrown?

c) If the ball bounces perfectly, how high does it go?

4. Uniform Circular Motion: A penny of mass 2.10g rests on a small block of mass 20.0g. The two are supported by a spinning disk of radius 0.12 m, and are loaded towards the rim. I6 the coefficients of friction between the block and the disk are 0.350 (static) and 0.140 (kinetic), what is the maximum rate of rotation (in RPM) that the disk can have before either the block or the penny slips?
9 A small block is placed on the top of a large, hemispherical, wet rock. This situation is unstable, and the block begins to slide down the side. At what angle, \( \theta \), described below, does the block lose contact with the rock? Because the rock is wet, we ignore friction. This is a hard problem.

![Diagram of a block on a hemispherical rock](image)

10 A pendulum is made by tying a ball of mass, \( m \), to a light string of length, \( l \). If the pendulum is held at an initial angle, \( \theta \), in the vertical, what is the maximum speed of the pendulum ball? What is the tension in the rope when the ball is at angle \( \theta \), at \( 0^\circ \)?

![Diagram of a pendulum](image)

11 A science student is riding in the caboose of a train moving in a straight line with speed 100 km/h. The student throws a ball into the air along a path she judges to be 60° above the horizontal initially and in line with the track. Her professor is standing outside on the ground nearby and sees the ball rise vertically. How high does the ball rise?

A note: I may not get to all of these problems, as my review is only 2 hours long. I still may substitute a problem or two for one or two Feel free more approximate or relevant. You should try all of these problems before you come in the exam. This way, you will get much more out of these two hours.

I look forward to seeing you all.