The problems on this practice exam are representative of the types of problems that will be on the actual exam. These problems do not necessarily cover all of the topics that the exam will cover. You should study the ideas and problems associated with all of the chapters that the exam will cover.

Physics 161 - General Physics Practice Exam 2 Block 5

Questions 1-4 are each worth 5 pts, questions 3-9 are each worth 10 points, and questions 10 and 11 are each worth 15 points.

1. Briefly explain what thermal energy is and describe two specific ways to increase the thermal energy of an object.

For each of the following problems, you must write out the equations you are using before plugging in numbers and justify any steps that are not just algebra.

2. I heat water for tea in the microwave. How much energy does it take to heat 0.25 kg of water from 20°C to 80°C?

3. You want to increase the temperature of a 0.75 kg block of aluminum by 3°C by dropping it. Assuming that all of the thermal energy is retained in the block, from how high would you have to drop it? Is this a reasonable thing to do?

4. A coffee shop wants to start serving iced coffee. They need to know how much ice to use to cool down the coffee. How much ice should they use to cool a 2 kg batch of coffee from 95°C to 15°C, assuming that the characteristics of coffee are the same as those of water?

5. A solid ball (sphere) of radius 5 cm, mass 4 kg, rolls without slipping across the floor at a speed of 6 m/s towards you, and passes you at a distance of 0.4 m at its closest point. What is its total kinetic energy? What is its total angular momentum?

6. A 10 kg wheel 60 m in radius is connected to an axle that is 1.5 cm in radius. Someone pulls with a force of 50 N on a thin cord wrapped around the axle. If this force is applied for 3 seconds, by how much does the angular speed change?

7. A 45 kg child sits on the edge of a merry-go-round. The merry-go-round has a diameter of 3 m and is initially at rest. The child is holding a 5 kg rock, and she throws the rock tangentially from the merry-go-round at a speed of 2 m/s. After the rock is thrown, the merry-go-round spins with a period of 92 seconds. Use conservation of angular momentum to find the mass of the merry-go-round (you do not have to justify your use of conservation of momentum, although it may be helpful to you to identify the parts of the systems before you start).

8. In a Rube Goldberg machine, a solid steel ball (m=0.3 kg) rolls without slipping down an incline. If the ball is moving at a speed of 2 m/s at the top and is moving at a speed of 5 m/s when it reaches the bottom of the incline, how high is the top of the incline? (Ignore air resistance.)

9. Campers at Camp Minihaha put together a makeshift diving board for jumping into Lake Minihaha. The diving board consists of a 5.2 kg, 4.5 meter long wooden plank which they prop on top of two overturned metal barrels. (Luckily, the beach is very level where they are constructing the diving board.) The red barrel is placed at the edge of the lake, and the board sticks out over the lake, 1.5 meters past the point where the red barrel touches it. The blue barrel is placed 0.75 meters from the opposite end of the board. The

campers place a third, upright yellow barrel full of sand directly above the blue barrel. What should the mass of the sand in the yellow barrel be, if the diving board should support a person of mass 120 kg standing on the end over the lake without the board tipping? What force does the red barrel exert on the board in this case? To get full credit for this problem, you must identify all of the forces acting on the plank, identify the values of all of the variables with known values, and identify the unknown variables. You must also state (in words) the principles that apply and write down the master equation(s) which reflect those principles.