PHY 201 Quiz #7 **Name** _____

Score _____

Instructions:
1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place you **answers in a box**. Do not forget **units**!
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

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1. **Multiple Guess (4 pts)** Find the answer which best fits the question and write it in the space provided.

a. When one stretches liquorice, the stress is given by
a) the change in length per original length; b) the applied force per unit area; c) the restoring force; d) none of these. _____

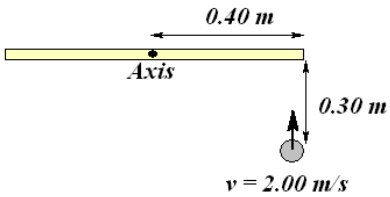
b. When the distance between two masses is doubled and one of the masses is doubled, the gravitational force between them is _____ the original force.
a) half b) the same as c) twice d) four times e) eight times f) None of these. _____

c. If $\mathbf{a}\times\mathbf{b} = \mathbf{0}$ for two nonzero vectors, then
a) the vectors are perpendicular. b) the vectors are parallel. c) Neither of these. _____

d. Under what condition(s) is the angular momentum of a rotating body, such as a spinning ice skater, conserved?
a) Each external force acting on the body must be zero.
b) Each external force and each external torque acting on the body must be zero.
c) Each external force may be non-zero, but the sum of the forces must be zero.
d) Each external torque may be non-zero, but the sum of the torques must be zero. _____

2. **Definition/Principle (3 pts)**

a. A 50.0 g piece of putty is thrown at a rod as shown. Determine the angular momentum of the putty with respect to the axis.



b. What is Newton's Shell Theorem?

Bonus: What is the escape speed of an object from the surface of Jupiter? [Use the data from 3e.]

Constants: $G = 6.67\times10^{-11}$ Nm^2/kg^{2,}

3. **Problems (13 pts)**

a. Compute $(3\mathbf{i}-\mathbf{k})\times(\mathbf{i}+2\mathbf{j}+\mathbf{k})$

b. After a fall, a 95 kg rock climber dangles from the end of a rope that had been 15 m long with a cross section of 3.2×10^{-4} m^2, but which has stretched by 2.8 cm. Find the Young's modulus.

c. Three masses lie on the *x*-axis: 5.00 kg at x = 0.0 m; 15.0 kg at x = 3.0 m and, 10.0 kg at x = 5.0 m. Find the gravitational force on the 15.0 kg mass.

d. A merry-go-round with radius 2.00 m and moment of inertia of 150 kg m^2 has an angular speed of 1.00 rad/s. A 50.0 kg child jumps on the merry-go-round 1.0 m from the center. Treat the child as a point mass. Find the system's new angular speed.

e. What is the gravitational acceleration near Jupiter's surface? [Jupiter's Mass = 1.9×10^{27} kg, Radius = 6.99×10^{4} km.]

f. (3 pts) A uniform beam of weight 250 N and length 1.50 m is suspended by a cable and rests against a wall. If $\theta = 30^{\circ}$, then what are the tension in the cable, the normal and friction forces where the beam contacts the wall?