Print your Name:

1	2	3	4	5	Total	Grade
9	8	6	8	9	40	100

Physics 1422 **General Physics I-A**

Exam 3 **April 12, 2006**

All numerical answers require an explanation for credit, which must show symbolically any formulas you used. Numerical results must include correct units for full credit. Non-numerical answers (multiple-choice or matching) do not require an explanation. Answers and explanations must be legible for credit. Verbal explanations after the exam will not add points to your score.

Only work on the front of the page will be graded. You may use the backs of the pages as private scratch space to plan your strategy. This may help you write more readable calculations, which will maximize partial credit. In the event of a wrong answer, more partial credit can usually be assigned to an algebraic solution than a purely numerical one. Try not to do all the work on your calculator.

If you are not sure how to work a problem in terms of formulas, or do not have time to do so, a good verbal analysis may receive partial credit. If you need a result from an earlier part of a problem to work a later part, but do not have it, an algebraic solution will recieve most of the credit.

Useful Relations

Moments of inertia of uniform objects about axis through center:

Ring	mR^2
Disk	$\frac{1}{2}mR^2$
Solid ball	$\frac{2}{5}mR^2$
Hollow ball	$\frac{2}{3}mR^2$

1 liter $= 10^{-3}$ m^3 $= 1000$ cm^3.

Density of water $= 1000$ kg/m^3 $= 1$ kg/L.

Speed of sound in air: $v = 343$ m/s.

Threshold of hearing: $I_0 = 10^{-12} W/m^2$.

1. [9pt] A 50 cm long violin string of mass 1.5 g is tuned to produce an A (440 Hz) in its fundamental mode.

(a) [3pt] If the string is fingered 1/3 of the way down from the neck, so that 2/3 of the length of the string can vibrate, what frequency is produced?

(b) [3pt] What is the tension on the string?

(c) [3pt] A person sitting 5 m away from the violin hears a sound level of 40 dB when a note is played. What sound level would a person sitting 10 m away hear?

2. [8pt] A solid steel disk of mass $m = 57$ kg and radius $r = 35$ cm rolls down a ramp without slipping, reaching a speed of 21 m/s at the bottom.

(a) [3pt] What is the disk's translational kinetic energy at the bottom of the ramp?

(b) [3pt] What is the disk's rotational kinetic energy at the bottom of the ramp?

(c) [2pt] If the following objects are rolled from the same height on the ramp, which would be going **faster** than the given steel disk when reaching the bottom? (Select **all** correct answers.)

a) a steel disk of radius 10 cm.

b) a wooden disk of radius 35 cm.

c) a solid steel ball of radius 35 cm.

d) a steel ring of radius 35 cm.

3. [6pt] An ice cube floats in a glass of water so that 90% of its volume is under water.

(a) [3pt] What is the specific gravity of ice?

(b) [3pt] If the ice melts, the water level in the glass will

a) rise.

b) fall.

c) stay the same.

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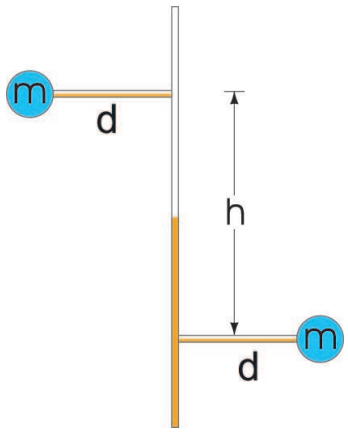
4. [8pt]

Two lightweight rods are mounted perpendicular to an axle as shown, and masses are attached to the ends of the rods. The entire object is rotated at a constant angular speed ω about the vertical axis so that the mass on the right is going into the paper (away from you) and the mass on the left is coming out of the paper (toward you).



(a) [2pt] What is the direction of the angular velocity vector $\vec{\omega}$? Take the z axis pointing upward, the x axis to the right, and the y axis into the paper.

a) $+x$ b) $-x$ c) $+y$

d) $+y$ e) $+z$ f) $-z$

(b) [3pt] What is the direction of the angular momentum vector $\vec{\mathbf{L}}$ at the instant shown?

a) upward to the left b) downward to the left

c) upward to the right d) downward to the right

e) upward into the paper f) downward into the paper

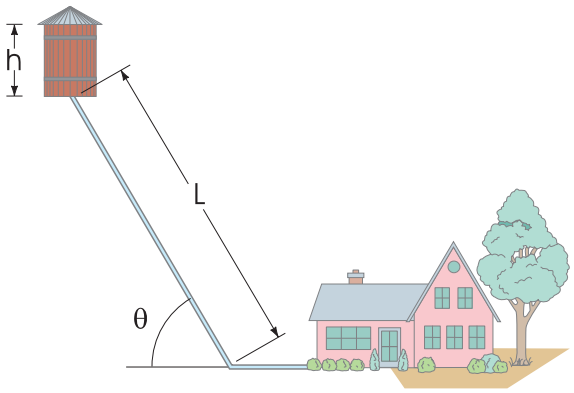
g) upward out of the paper h) downward out of the paper

(c) [3pt] What is direction of the torque vector $\vec{\tau}$ at the instant shown?

a) $+x$ b) $-x$ c) $+y$ d) $-y$

e) $+z$ f) $-z$ g) none: $\tau = 0$

5. [9pt] The water in a house is supplied by a full tank of depth $h = 4.5$ m which is connected to the house by a pipe of length $L = 63$ m at an angle of $\theta = 30°$.



(a) [3pt] What is the gauge pressure in the pipes of the house when the water is not running?

(b) [3pt] How fast will water flow from a faucet in the house when it is turned on? Give the speed, neglecting turbulence and viscosity.

(c) [3pt] Which of the following phenomena are explained by Bernoulli's principle? (Select **all** correct answers.)

a) The water flow to a shower drops when a toilet is flushed.

b) When you blow between two sheets of paper, they are drawn together.

c) A river flows fastest where the channel is narrowest.

d) The pressure in a pipe is greater where the pipe is wider.

e) Smoke is drawn more quickly up a chimney when the wind is blowing outside than when it is still.

f) The pressure difference between the ends of a narrow artery is greater than the pressure difference between the ends of a wide artery of the same length.