Mechanics
Pre Lab Questions

The pre lab questions can be answered by reading the theory and procedure for the related lab. You are strongly encouraged to answers these questions on your own. Each question is worth 1 point towards the lab grade for the unit. The questions are designed to give you some insight into the lab and to address known areas of difficulty. The questions will be turned in prior to the start of the lab.

Some of the subject matter address in these questions can be on the lab final.

Pre-Lab questions are due at the start of the lab period.

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UNIT 1 Appendices II-IV – Uncertainties

1) Appendix II. Given the data 13.2, 13.4, 13.3 and 13.1 cm. Determine the average and its standard deviation. **Note: Most calculators have the ability to perform a standard deviation see Note 1.**

2) Appendix II. If you have two uncertainties, δ_1 and δ_2, and they are from two different sources and contribute to the uncertainty of a measurement, what formula should be used to combine these and find the total uncertainty for the measurement?

3) Appendix II. The area for a rectangle is determined by A = W*L. The width and length are given as $W \pm \delta W$ and $L \pm \delta L$. Determine an equation to for the uncertainty in the area, δA? (**Propagation of uncertainties**)

4) Through experimentation you have determine that a block of wood has a density of 0.674 gm/cm^3. The instructors value for the same block of wood is 0.682 gm/cm^3. What is the Percent Discrepancy between your value and the instructors value. See page 4.

5) What value must the x-axis contain in order to find the y-intercept?

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Note 1: There is a help file available for this unit @ www.uta.edu/physics/labs/

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UNIT 2 – Newton's 2nd Law:

1) In unit 2, equation [4] is a linear function of the type (y = kx + b)? Record what each variable in equation 4 represents (i.e. mass, weight etc) and match it to the appropriate variable in the linear function y = kx + b.

2) From figure 2-1, which masses contribute to the <u>total mass of the system</u>?

3) In this experiment, the weight of the hanging mass W_2 is to be increased for each data run but also the total mass of the system needs to be kept constant. How can this be accomplished? (Hint: See procedure)

4) What would be the weight, W_2, for a hanging mass of 0.15 kg? g = 9.8

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Unit 3 – Composition and resolution of Forces

1) For a set of vectors what is the relationship between the equilibrant and the resultant? Answer in terms of magnitude and direction.

2) You have two vectors 50@0° and 100 at 90°. Use graphical analysis to show the **equilibrant**.

3) You have a vector **B** @ θ° from the horizontal. Break this vector down into its x and y rectangular components (B_x,B_y).

4) You have two vectors 100@ 25° and 200 @ 125°. Determine its magnitude and direction of the resultant using mathematical analysis.

Note: This lab has a help file located at our web site. www.uta.edu/physics/labs/
You may want to attempt the problems and questions prior to the lab.

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UNIT 4 – Uniform Circular Motion

Download Appendix V file prior to attending the lab @ www.uta.edu/physics/labs.

1) What equation will this lab ultimately verify?

2) In this lab exercise, four variables will be dealt with. In part A, which variables will be kept constant, which one will be varied and which one will be measured.

3) Combine equation [3] with equation [4] and solve for time, T.
You may want to write this equation down in your lab manual for reference during the lab.

4) Using the equation in question 3 what would be the expected trend for time when the radius is increased with each subsequent data run and the force F_c and the mass, m are kept constant?

5) For each part A, B, and C, the best fit line for the data will pass through what point on the graph.

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UNIT 5 – Projectile motion and the Ballistic Pendulum

1) Method 1 uses equation [6], conservation of energy, to determine the initial velocity of the pendulum-ball, v, where m is the mass of the pendulum ball and h is the determined height it rose to from rest. Using equation [6], solve for v.

2) Equation [3], conservation of momentum, is used to find the initial velocity of the ball, v_b. The velocity of the pendulum-ball, v_f, is taken from the velocity v found in question 1. The pendulum, m_2, is initially at rest, and m_1 is the mass of the ball. Using equation [3], determine an equation to solve for the velocity of the ball, v_b, in terms of m_1, m_2 and v_f .

3) In method 2, what equation is used to find the total time the ball is in flight? What does each variable represents?

4) In method 2, how is the velocity of the ball determined?

5) A projectile is fired at an angle, θ, above the horizontal at a velocity **v**. Determine the rectangular components for the velocity v_{ox} and v_{oy} in terms of **v** and θ?

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UNIT 6 – Rotational Equilibrium and Center of Gravity

1) How is the magnitude of torque determined?

2) How is rotational equilibrium achieved?

3).What is the definition for center of gravity?

4) A mass is placed along the x-axis. This mass will produce a torque **about** which axis, x or y?

5) What is the magnitude for the torque produced by a 50 gram mass placed 6 inches directly on the y-axis? Answer in gram-inches.

For this lab the weight of a mass is the force which produces the torque. Since weight is the product of acceleration of gravity and mass and since gravity is constant within the confines of the experiment it can be factored out. Our units for torque while not conventional will be in gram-inches. Therefore torque will be the product of mass and displacement from the origin.

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UNIT 7 Rotational Dynamics

1) In determining the theoretical value of the angular acceleration of a rotating disc several measurements are made. The diameter of the spool is to be measured about which part of the spool? (Hint look at Figure 7-4 and procedure I step 9)

2) Within the equation $\omega_f = \left(\frac{mgr}{mr^2 + I}\right)t + \omega_i$. Which part represents the angular acceleration?

3) Express angular momentum, **L**, for a single disc in terms of angular velocity and moment of inertia?

4) What is the equation for conservation of angular momentum?

5) From equation [8] if you have two discs each moving with an angular velocities in the same direction would you add or subtract the momentum to find the total momentum? What if the angular velocities were in opposite directions?

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UNIT 8 – Hooke's Law and Simple Harmonic Motion

1) The area under a plotted line for F vs. distance (length the spring is stretched) represents what quantity?

2) The slope of the linear line for F vs. distance (length the spring is stretched) represent what quantity?

3) A mass, m, is connected to a spring and then stretched a distance x, beyond its resting position (equilibrium). It is then released. At what positions during the motion of the mass is the energy in the spring considered purely potential energy? Purely kinetic energy?

4) The mass, m, in question 3 is connected to a spring undergoing simple harmonic motion. the period, T , is measured, determine an equation to find the spring constant in terms of T and m.

5) In the Hooke's law portion of the lab, you are taking measurements using a motion sensor. What precautions should be observed so that no erroneous data point is taken?

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Unit 9 Speed of Sound

1) What relationship does the speed of sound, v, have to the wavelength and frequency of the sound?

2) When standing waves form, the region of minimum amplitude is called a _____.
The region of maximum amplitude is called an _____.

3) What is the theoretical value for the speed of sound in a room at 24° C?

4) In a resonance tube the 1^{st} maximum is found at 0.060 m and the 2^{nd} at 0.166 m what is the wavelength? See procedure.

5) A metal bar is measured to have a length of 0.68 m. When clamped in it's centered and then struck on its end (see figure 9-2) what is the expected wavelength produced by the vibrating bar?