PHYSICS 4A - LAB FINAL REVIEW

Here is a summary of the material that will be covered on the lab final. The format for the final will include: practical component, short-answer conceptual questions/explanations, and theory. You should also be familiar with the components of the format for a comprehensive scientific lab report that you've been using for the quarter.

Error Analysis

1. Understand and define random and systematic errors.
2. Make measurements and calculations to the correct number of significant figures.
3. Calculate the uncertainties in measurements using analog and digital measuring devices.
4. Understand error propagation.
5. Know how to apply the error propagation equations to calculate uncertainties.
6. Know how to use every measuring device used in any lab and how to calculate its uncertainty.
7. Know how to calculate % error.

LAB 1- Measurements and Error Analysis

1. What was the objective of this lab?
2. What was the theory associated with this lab?
3. Know how to use the measuring devices; digital balance, triple-beam balance, metric ruler, Vernier calipers.
4. What are the uncertainties of the measuring devices?
5. Know how to calculate area, volume and density.
6. Calculate the uncertainty of area, volume and density using the error propagation equations.
7. Identify the systematic and random errors involved and how they affected the results.

LAB 2 – Behr Free-Fall

1. What were the objectives of the lab?
2. What was the theory associated with this lab?
3. What methods were used to analyze the velocity of the "bob"?
4. What were the proofs involved? Can you do the proofs?
5. How did you calculate the acceleration of gravity?
6. What does the slope of x vs. t , v vs. t, V_{ave} vs t, a vs. t represent.
7. Know how to use EXCEL to construct a graph and obtain equation of best curve-fit.
8. Identify the systematic and random errors involved and how they affected the results.
9. Was air resistance a significant error in this lab? Why or why not? What type of error is it?

LAB 3 – Newton's 2nd Law

1. What were the objectives of the lab?
2. What was the theory associated with this lab?
3. Know how to apply N2L to a system.
4. What assumptions were made in deriving the expected acceleration for the system?

5. Know how to use the kinematic equations.
6. Was air resistance a significant error in this lab? Why or why not? What type of error is it?
7. Identify other systematic and random errors involved and how they affected the results.
8. What mode was used in the photogate timers for each part of the lab?
9. How did you measure the distance between the photogates?
10. Why did you measure the diameter of the flag?
11. Which method gave the most accurate result? Why?
12. If the string was vibrating before the mass was released from rest, how did it affect the outcome of experiment? Was this a random or systematic error?
13. Identify other systematic and random errors involved and how they affected the results.

LAB 5 – Centripetal Acceleration

1. What was the objective of this lab?
2. What was the theory associated with this lab?
3. How did you calculate the expected and experimental value of the acceleration?
4. What is UCM?
5. What are the two equations for radial acceleration?
6. For how many different radii did you calculate the net force?
7. Was friction in the pulley, in the equilibrium part, a random or systematic error? Why? How did it affect the outcome of the experiment?
8. Was friction in the rotating axle a random or systematic error?
9. Not rotating the mass at a constant speed a random or systematic error?
10. What role did the spring force play in this experiment?
11. Identify other systematic and random errors involved and how they affected the results.

LAB 6 – Spring Constant and Simple Harmonic Motion

1. What was the objective of this lab?
2. What was the theory associated with this lab?
3. How did you calculate the expected and experimental value of the spring constant?
4. What is simple harmonic motion?
5. What is the period of oscillation?
6. What is amplitude of oscillation?
7. What does angular frequency measure?
8. What does the spring constant measure?
9. Know how to use EXCEL to calculate “k”.
10. Did we neglect the mass of the spring? If so, what type of error did this introduce?
11. How did we physically justify the solution to the simple harmonic motion equation?
12. What assumptions did we make in deriving the simple harmonic motion equation?
13. Describe the procedure for collecting data for the period of oscillation.
14. If the spring “wobbled” along its motion, what type of error did it introduce? How would it affect the experimental result?
15. Identify other systematic and random errors involved and how they affected the results.

LAB 7 – Static Equilibrium

1. What at the conditions for static equilibrium?
2. What was the objective of this lab?
3. What was the theory associated with this lab?
4. What is torque conceptually?
5. What line of action of a force?
6. What is lever arm?
7. What are the 3 methods of computing torque?
8. What was the system for this experiment?
9. Identify systematic and random errors involved and how they affected the results.

LAB 8 – Conservation of Linear Momentum

1. What are two reasons momentum important?
2. What was the objective of this lab?
3. What was the theory associated with this lab?
4. When is momentum conserved?
5. What is an isolated system?
6. Why is V_{cm} constant for an isolated system?
7. What is an elastic and inelastic collision?
8. Is kinetic energy a vector?
9. Can you sketch the collision the you observed?
10. Why was the spark generator used? What was the frequency used?
11. What was the system for this experiment?
12. How were you able to conclude if momentum and kinetic energy was conserved?
13. Identify systematic and random errors involved and how they affected the results.

LAB 9 – Moment of Inertia and Conservation of Energy

1. What was the objective of this lab?
2. What was the theory associated with this lab?
3. What are the steps in determining if the mechanical energy of a system is conserved?
4. What are conservative forces?
5. What is potential energy?
6. What is an isolated system?
7. What does moment of inertia measure conceptually/practically?
8. What were the Vernier calipers used for?
9. What was the metric ruler used for?
10. What was the digital balance used for?
11. Through what height did the falling mass fall through?
12. Was the mass of the pulleys taken into account in deriving the theory?
13. Identify systematic and random errors involved and how they affected the results.