

Document Based Exam

I'm a big believer in visualizing science. I'm a late bloomer, but Mom always encouraged me to picture myself as the largest land mass in North America. Now who's the smallest? Is it a pickup truck? This buff

Free Response: Step 1 of 6

Experimental Design



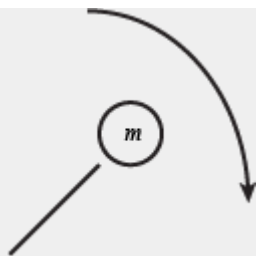
1. If a plumb bob of mass, M , is attached to any length of string, the result is a pendulum that oscillates in simple harmonic motion. Using a stopwatch and other common physics laboratory equipment, determine the acceleration due to gravity.

- Articulate the experimental procedure, explaining what measurements will be recorded and how.
- Explain how the measurements recorded will be used to calculate the acceleration due to gravity.
- Another student overestimated the acceleration of gravity to be 14 m/s^2 . Identify and explain one way in which this may have occurred.

Qualitative/Quantitative Translation

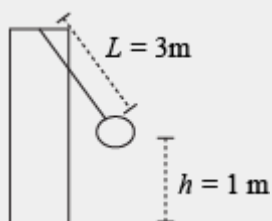
2. A student spins a ball attached to a string above her head. The ball has a mass of M and the string is length, R . She spins it around her head slowly at first (v_0) and more quickly later (v).

- On the diagram below, draw and label all the ways in which the ball is accelerating.



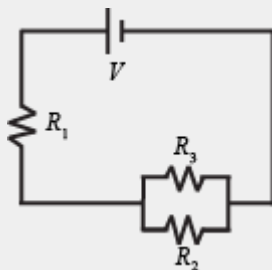
- b) The student acquires a new string that is one-third the length of the original string and a new ball that is double the mass of the original ball. She goes through the same motion. What will happen to angular momentum of the ball? Include a pertinent equation in your answer.
- c) Relate the qualitative answer above with the quantitative equation. In complete sentences, express how the equation explains the change in linear momentum.

Short Answers



3. A 13 kg pendulum hangs from a beam with a 3 m rope so that it is 1 m off the ground at equilibrium. A student holds the pendulum so that it is 1.5 m off the ground as shown above. At this point the pendulum has an angle of 35° . Assume it behaves as a simple pendulum. SEP1SEP1

- a) What is the restoring force? On the diagram above, draw and label the measurements needed to calculate the restoring force.
- b) Calculate the velocity of the pendulum when it is 62.5 percent through one oscillation.
- c) Instead of normally swinging the pendulum back and forth, the student sends the pendulum into uniform circular motion vertically around the tree limb. Assuming the rope is taut, calculate the pendulum's minimum speed at the top of a circle. Justify your answer.



4. A teacher sets up this circuit.

- a) Expressed in terms of the variables, what is the equivalent resistance of the circuit?
- b) Calculate the current that goes through R_1 .
- c) What is the total voltage drop throughout the entire circuit? Justify your answer.

5. A block of mass, M , sits on top of a blanket. The blanket is pulled out very quickly from underneath the block. The block doesn't move. In a clear, coherent, paragraph-length answer, explain why the block doesn't

move. You may include diagrams and/or equations as part of your explanation.