Technical Problem Solving Lab Exam

Do not open this test until told to do so. Since the topics for this exam change from year to year and because of lack of equipment, we decided to give you four (4) possible experiments to do. There is no way you will be able to completely and thoroughly complete all four labs. Just do the best you can and answer as many questions as possible. **Do not forget your units! Additionally, you may use LOGGER PRO, EXCEL, or any GRAPHING SOFTWARE that you choose.**

Format: The beginning of each lab will explain the purpose and problem. It is your job to then design an experiment that fulfills the problem. Notice that you must thoroughly explain your thinking and your calculations when you do this section of the lab. Finally, you must complete the required questions and an error analysis.

Materials Check:

_____Approved Calculator

_____ ONE standard 8.5x11 Notes Sheet

Name: _____

Exam Number : _____

_____Do not write in this section_____

Free Response: _____+

Extra Credit: _____=

Total Score: _____

Placement: _____/_____

EXPERIMENT 1

EXPERIMENT FOCUS: PHYSICS (KINEMATICS AND NEWTON'S LAWS)

Purpose: To solve for the mass of a lab cart with some weight *w* on it when it is on a ramp and *in motion.*

Materials:

- Vernier LabQuest Motion Sensor
- Vernier LoggerPro
- Frictionless Track (we assume it to be frictionless)
- Lab Cart
- Mystery Mass
- Stopwatch
- Calculator (May not be a TI-84 or higher)

NOTE: YOU MUST PUT THE TRACK ON AN ANGLE! WITHOUT THIS ASPECT, YOU WILL NOT FULFILL THE OBJECTIVE OF THE LAB.

1. Show a detailed drawing of your lab setup. Label everything in your picture.

Write the Letter of your mystery mass here: _____

2. Describe *in words* how you plan on solving for the mass of the mystery mass. Be as specific as possible.

3. What equations are you planning on using to solve this problem? Describe any variables.

4. Qualitative and quantitative work (mathematical or knowledge based work) to solve the problem.

5. Error Analysis: What were the specific causes of error in this lab? BE SPECIFIC!

6. Data Table, graph, and other objects that can PROVE YOUR RESULTS! You ***must*** include these here!

7. Mass of Mystery Mass: _____ | ACTUAL Mass: _____

EXPERIMENT 2

EXPERIMENT FOCUS: PHYSICS (NEWTON'S LAWS AND FRICTION)

Purpose: Solve for the **MAXIMUM** coefficient of friction on a ramp.

Materials:

- Quarter
- Meter Stick
- Scale
- Protractor
- Meter Stick
- Ramp (provided by us)
- You may ask if you need any other materials.

NOTE: YOU MAY CHANGE THE ANGLE, HEIGHT, OR LENGTH OF THE RAMP IF YOU WOULD LIKE.

1. Show a detailed drawing of your lab setup. Label everything in your picture.

2. Describe in words how you plan on solving for the coefficient of friction. Be as specific as possible.

3. What equations are you planning on using to solve this problem? Describe any variables.

4. Qualitative and quantitative work (mathematical or knowledge based work) to solve the problem.

5. Error Analysis: What were the specific causes of error in this lab? BE SPECIFIC!

6. Data Table, graph, and other objects that can PROVE YOUR RESULTS! You ***must*** include these here!

7. MAXIMUM Coefficient of Static Friction: _____

EXPERIMENT 3

EXPERIMENT FOCUS: PHYSICS (DYNAMICS)

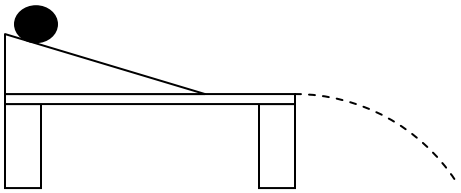
Purpose: To find the distance (X Direction) an object will travel off of a table from rest(see lab set up) and to solve for the speed with which it leaves the table.

Materials:

- Scale
- Meter Stick
- Protractor

NOTE: YOU MAY NOT JUST ROLL THE BALL OFF OF THE RAMP. IF YOU ROLL THE BALL OFF OF THE RAMP, YOUR SCORE ON THIS SECTION OF THE LAB WILL BE VOID. YOU MAY NOT CHANGE THE LAB SET UP IN ANY WAY.

1. Detailed Drawing: Done for you:



2. Describe in words how you plan on solving for the DISTANCE AND SPEED. Be as specific as possible.

3. What equations are you planning on using to solve this problem? Describe any variables.

4. Qualitative and quantitative work (mathematical or knowledge based work) to solve the problem.

5. Error Analysis: What were the specific causes of error in this lab? BE SPECIFIC!

6. Data Table, graph, and other objects that can PROVE YOUR RESULTS! You ***must*** include these here!

7. Distance: _____

What speed will the object be going when it rolls of the table? _____m/s

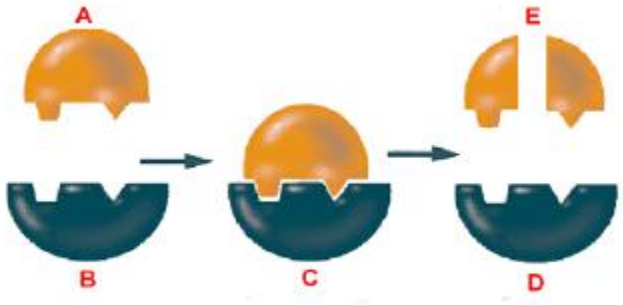
_____Do not write in this section_____

ACTUAL DISTANCE: _____

Actual Speed: _____

EXPERIMENT 4—ENYMATIC REACTIONS

Experiment Focus: Answer the following questions about enzymatic reactions.



1. Which letter(s) represent the enzyme in the diagram above?

2. Is this reaction a catabolic or anabolic reaction?

3. What kind of molecule is the catalase made up of?
   A. Carbohydrate
   B. Lipid
   C. Cholesterol
   D. Protein
   E. Vitamin

4. What cell organelle contains catalase?

5. Where does hydrogen peroxide come from in animal cells?
   a. the denaturation of proteins
   b. the phosphorylation of ATP
   c. the reduction of sugars
   d. the oxidation of fatty acids
   e. the detoxification of amino acids

6. In a laboratory setting, what type of probe would one use to measure yeast catalase enzyme activity? (choose all that apply)
   a. hydrogen peroxide probe
   b. carbon dioxide probe
   c. oxygen probe
   d. temperature probe
   e. pH probe

22. In another catalase experiment, the initial 106.0 mL solution should contain 3.0 g of H_2O_2. Calculate the molarity of this solution. (1 mol of H_2O_2 is 34.02 g)

How does the concentration of catalase change the decomposition of H_2O_2? (Choose all that apply)

a. As you increase the dihydrogen dioxide, the reaction rate increases.
b. As you increase the catalase, the reaction rate increases
c. As you decrease the dihydrogen dioxide, the reaction rate increases
d. As you decrease the catalase, the reaction rate increases.

Here is some sample data from a yeast catalase lab. Use for 19-20

Test tube label	Slope, or Rate (%/s)
5 Drops	0.0045
10 Drops	0.0122
20 Drops	0.0265
0 – 5 °C range: 4°C	0.0097
20 – 25 °C range: 21 °C	0.0137
30 – 35 °C range: 34°C	0.0238
50 – 55 °C range: 51°C	0.0060
pH 4	0.0060
pH 7	0.0148
pH 10	0.0162

8. At what temperature is the catalase at the highest activity?

9. What pH *environment* does yeast catalase function optimally?

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10. Which of the following is a competitive inhibitor of catalase?

a. Cyanide
b. Dopamine
c. Water
d. Copper sulfate
e. Alcohol

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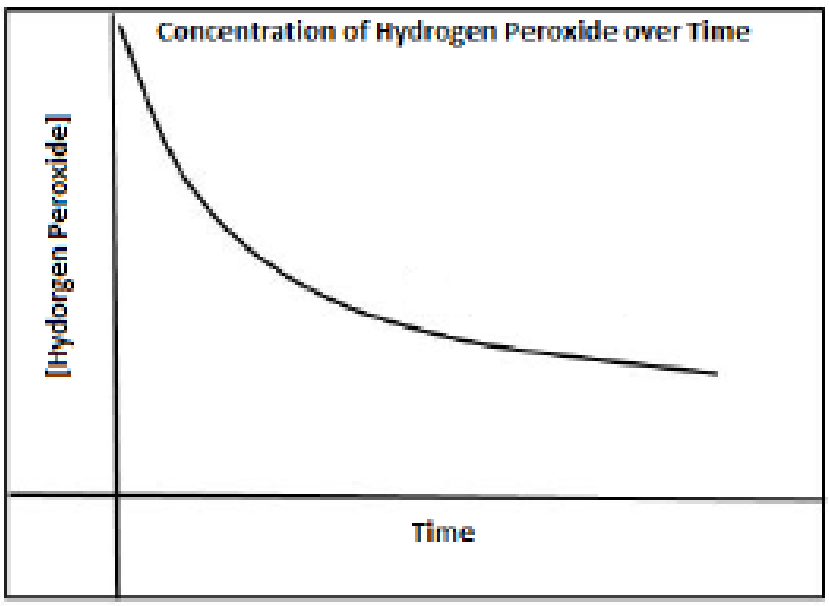

Figure 1

Use with questions 23-24

23. The Figure above depicts the composition of uncatalyzed hydrogen peroxide over a period of time. Sketch a line on the graph that would depict a catalyzed reaction of hydrogen peroxide de-composition. ***Label this "catalyzed."***

24. Refer to this figure above for the following questions:

a. What are the products of decomposition of hydrogen peroxide?

b. Write a balanced equation for the decomposition of hydrogen peroxide

c. 85.05 g of H_2O_2 reacts completely without excess. What is the mass of O_2 produced? (O_2 = 32 g/mol)

25. In terms of energy, why does the catalyzed reaction occur at a different rate than the uncatalyzed reaction? How does the rate differ?