Names:

School:

2000 UTAH SCIENCE OLYMPIAD - PHYSICS LAB

AREA 1: MOTION IN TWO DIMENSIONS - PART 1

There are <u>three</u> parts to the **MOTION IN TWO DIMENSIONS** competition. All three parts must be completed within a time of **20 minutes**. **Don't forget to include units in your answers!**

Equations and values: $T = 2B\ L/g$ $g = 9.8\ m\ s^{-2}$

- -

You do not have to complete PART 1 in order to do PART 2.

PART 1: Measure the length of the string the diameter of the ball. **Record these values below**, including units:

String length: _________ Ball radius: _________

Calculate the period T of the pendulum, and **record your answer at the bottom of the page**. Show your work below. **Do not swing the pendulum or time its motion in PART 1!**

Predicted period T: __________

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AREA 1: MOTION IN TWO DIMENSIONS - PART 2

There are three parts to the **MOTION IN TWO DIMENSIONS** competition. All three parts must be completed within a time of **20 minutes**. **Don’t forget to include units in your answers!**

Equations and values: $T = 2B L/g$ $g = 9.8\ m\ s^{-2}$

- -

You do not have to complete PART 2 in order to do PART 3.

Copy your data and calculated period from PART 1 here:

String length: _________ Ball radius: _________

Predicted period T: __________

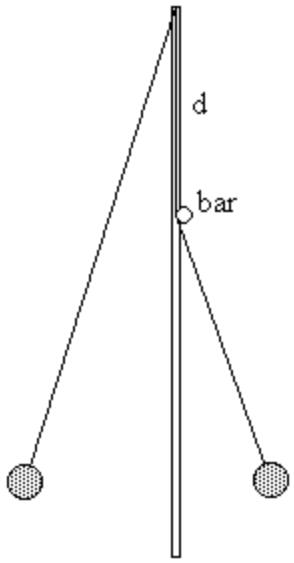
PART 2: Measure the time it takes for 20 back-and-forth swings of the pendulum, and **record this time below**. Then determine the actual period of your pendulum, and **record this below**. Show your calculations here:

Time for 20 swings: __________ Actual period: __________

PART 2 CONTINUES ON THE NEXT PAGE

PHYSICS LAB - AREA 1: MOTION IN TWO DIMENSIONS - PART 2 - PAGE 2

In PART 3, you will insert a horizontal bar through the holder so the pendulum's length is shortened for half its swing (see figure at right). The string will hit the center of the bar. **DO NOT INSERT THE BAR FOR PART 2!**



Calculate the distance d, **from the top of the string to the center of the bar** so the pendulum's new period is 3/4 of its former period. Show your work below, and **record your answer at the bottom of the page**. Correctly explained reasoning will count more than a lucky guess!

Distance d: _____

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AREA 1: MOTION IN TWO DIMENSIONS - PART 3

There are <u>three</u> parts to the **MOTION IN TWO DIMENSIONS** competition. All three parts must be completed within a time of **20 minutes**. **Don't forget to include units in your answers!**

Equations and values: $T = 2BL/g$ $g = 9.8\ m\ s^{-2}$

- -

Copy your actual period and distance d from PART 2 here:

Actual period (without bar): _____

Distance d: _____

PART 2: Insert the bar into the bar holder. Adjust the bar so the distance from the top of the string to the center of the bar is equal to your distance d. (The string should just touch the center of the bar when it is hanging at rest.) Measure the time it takes for 20 back-and-forth swings of the pendulum, and **record this time below**. Then determine the actual period of your pendulum, and **record this below**. Show your calculations here:

Time for 20 swings: _____ Actual period: _____

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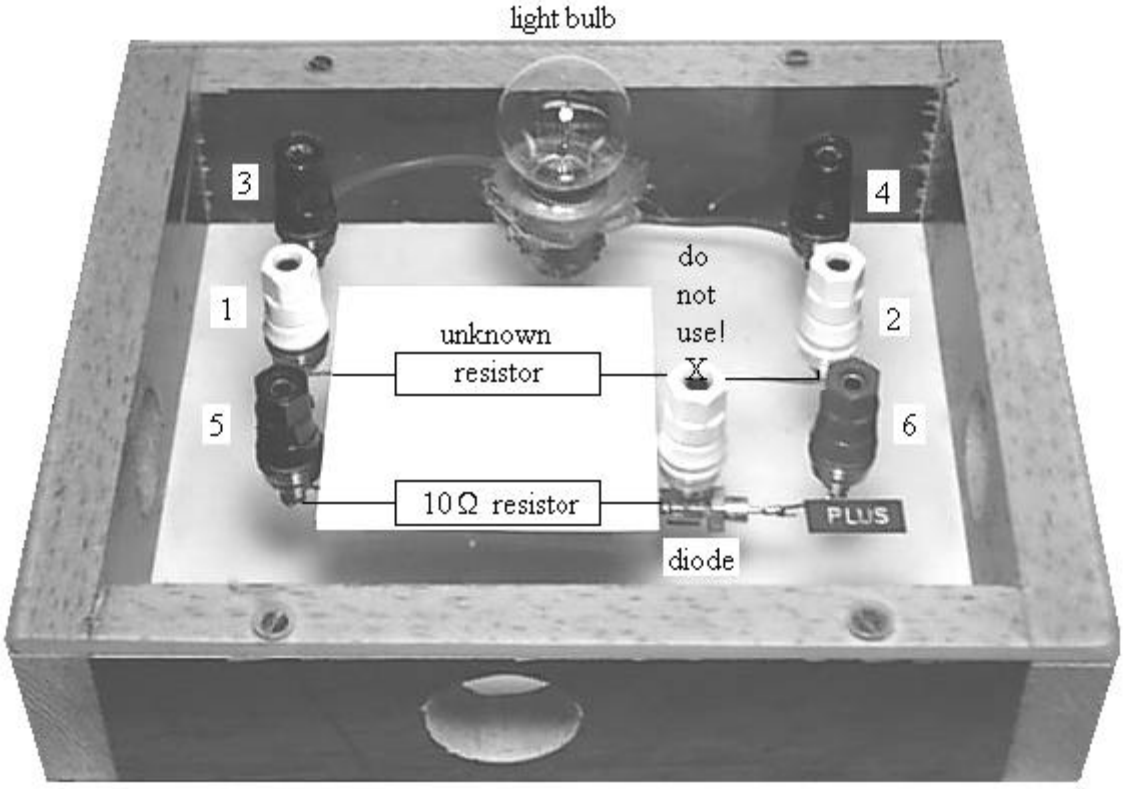
AREA 2: CIRCUITS

There is one part to the **CIRCUITS** competition. This must be completed within a time of 20 minutes. **Don't forget to include units in your answers!**

Resistance R = V / I if R is constant. If R is not constant, than the resistance R is the slope of the tangent line to a voltage-current graph ()V /)I).

- -



NEVER EXCEED 12 VOLTS ON THE POWER SUPPLY!

DO NOT CONNECT THE POWER SUPPLY TO THE WHITE TERMINAL BETWEEN TERMINALS 5 AND 6!

DO NOT REMOVE THE YELLOW PAPER HIDING THE RESISTORS OR LIFT THE BOX!

Your instructions are on the next page.

PHYSICS LAB - AREA 2: Circuits - PAGE 2

Your circuit is connected to a DC power supply. You will take readings of the voltage and current using the meters on the power.

A magnifying glass may be used to help read the meters. If either meter reads below zero, the actual value is zero.

1. With the power supply turned off and the voltage knob turned completely counterclockwise, attach the black lead to Post 1 and the red lead to Post 2. Make a table of voltages and currents for voltages between 0 and 12 volts, then make a voltage-current graph for your data. **NEVER EXCEED 12 VOLTS ON THE POWER SUPPLY!** Use the graph to determine the value of the unknown resistor. Show all work below, and record your value of the unknown resistor here:

Unknown R: _____

continued on next page

2. With the power supply turned off and the voltage knob turned completely counterclockwise, attach the black lead to Post 3 and the red lead to Post 4. Make a table of voltages and currents for voltages between 0 and 12 volts, then make a voltage-current graph for your data. **NEVER EXCEED 12 VOLTS ON THE POWER SUPPLY!** Use the graph to determine the value of the bulb's resistance when the voltage is 5 V. Show all work below, and record your value of the bulb's resistance here:

Bulb R: _____

continued on next page

3. With the power supply turned off and the voltage knob turned completely counterclockwise, attach the black lead to Post 5 and the red lead to Post 6. Make a table of voltages and currents for voltages between 0 and 12 volts, the make a voltage-current graph for your data. **NEVER EXCEED 12 VOLTS ON THE POWER SUPPLY!** Use the graph to determine the value of the total resistance of the combination of the diode and 10 S resistor when the voltage is 5 V. Show all work below, and record your value of the resistance here:

Diode and resistor R: _____

continued on next page

4. With the power supply turned off and the voltage knob turned completely counterclockwise, attach the red lead to Post 5 and the black lead to Post 6. **NEVER EXCEED 12 VOLTS ON THE POWER SUPPLY!** What is the total resistance of the combination of the diode and 10 S resistor when the leads are connected in this manner?

Diode and resistor R: _____

REMEMBER TO PUT YOUR NAMES AND SCHOOL ON THE GRAPHS!