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| **Worksheet for Lab on Conservation of Energy** | **Name** |  |
|  |  |  |
| **Peg and Pendulum Experiment** | **Date** |  |

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|  | **Partner #1** |  |
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|  | **Partner #2** |  |

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| **First Data Set for Set-up:** |
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| **Length of String** $L\_{0}\left(m\right)$ |  |  | **Radius of Circle** $R\left(m\right)$ |  |
|  |  |  |  |  |
| **Diameter of Bob** $D\left(m\right)$ |  |  | **Mass of Bob** $M\left(kg\right)$ |  |

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| **Predictions Work:** |
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| **1. Draw a free body diagram for the bob as it passes through the top of the smaller circle (Point 2).** |
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| **2.** **For the bob at point 2, derive a general expression for tension on the string** **(FT;2):** in terms of the mass of the bob (M), speed (v2), radius of the smaller loop (R), length of string (Lo) and gravitational acceleration (g). The final expression may not necessarily have all these symbols.Show all of your work. |
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| **3. Derive a prediction for (v2):** |
| Using the expression from the last part, derive a symbolic expression for the speed v2 in the special case where the string is exactly `slack' as the bob passes through the top of the smaller loop (i.e.: FT;2 🡺 0). Once you have the symbolic expression, substitute the numbers from your setup and put your final v2 on the provided space. Show all of your work. |
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| $$v\_{2}\left(^{m}/\_{s}\right)=$$ |  |

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| **4. Derive a prediction for** $\left(h\_{1}\right)$**:** |
| Derive an expression for the height h1 (from the bottom of the swing) the bob should be released, from rest, so that it the tension in the string is exactly zero (exactly `slack') as the bob passes through the top of the smaller loop. Once you have the symbolic expression, substitute the numbers from your setup and put your final result h1 on the provided space. Show all of your work. |
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| $$h\_{1}\left(m\right)=$$ |  |

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| **5. Derive a prediction for (v3):** |
| Derive an expression for the speed v3 of the bob at the bottom photogate if the bob is released fromthe height h1 determined above. Put your final v3 on the provided space Show all of your work. |
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| $$v\_{3}\left(^{m}/\_{s}\right)=$$ |  |

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| **6. Data Collection:** |
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|  | **Trial #1** | **Trial #2** | **Trial #3** | **Trial #4** | **Trial -Average** |
| $$v\_{2}\left(s\right)$$ |  |  |  |  |  |
| $$v\_{3}\left(s\right)$$ |  |  |  |  |  |

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| **7. Calculate Quantities:** |
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| Use the relationship |
| $$\%diff=\frac{v\_{Pred}-v\_{Exp}}{v\_{Pred}} x 100\%$$ |
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| **Complete the table below:** |
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|  | **Prediction**  | **Experimental** | **% diff** |
| $$h\_{1}\left(m\right)$$ |  |  |  |
| $$v\_{2}\left(^{m}/\_{s}\right)$$ |  |  |  |
| $$v\_{3}\left(^{m}/\_{s}\right)$$ |  |  |  |

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