**General Physics eJournal 2**

**Forces in Equilibrium**

**Instructions:**

Follow the Writeup and fill out the eJournal as you complete the lab activities. Submit your eJournal report by uploading the completed WORD or PDF document to our class Learninghub site. If the Learninghub site is down, email the completed report file directly to a lab TA.

**Preliminaries:**

* Title:
* Name(s):
* Date:
* Time In & Out:

**Plan:**

**Hypothesis**

Form hypotheses regarding the sum of two (non-equal) forces separated by 90 degrees and also two (equal) forces separated by 135 degrees. Sketch vectors on paper and add graphically. Capture images of your sketches to include in this eJournal.

*Insert images of your sketches*

**Experiment Outline**

Briefly describe your plan for testing your hypotheses.

**Equipment List**

* List
* Equipment
* Here

**Action:**

Describe the techniques used to collect data by responding to the bullet point questions:

* How did you generate forces F1 and F2?
* How did you measure the equilibrant?

*Insert labeled image of your apparatus*

**Results:**

Record the magnitudes and directions of the three forces in Table I for the 90° forces.

**Table I: Two right-angled forces in equilibrium with a third equilibrant force exerted by a spring balance.** **F1 = m1g, F2 = m2g, and FSB is the measured force of the spring balance.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Mass (kg)** | **F (N)** | **θ (degrees)** |
| **F1** |  |  |  |
| **F2** |  |  |  |
| **FSB** | -------------- |  |  |

Record the magnitudes and directions of the three forces in Table II for the 135° forces.

**Table II: (Write appropriate title)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Mass (kg)** | **F (N)** | **θ (degrees)** |
| **F1** |  |  |  |
| **F2** |  |  |  |
| **FSB** | -------------- |  |  |

**Analysis:**

Compute predicted resultants, R, and equilibrant angles, θeq, and compare with measured values, FSB and θSB.

**Table III: Resultant of two right-angled forces compared with equilibrant.**

|  |  |
| --- | --- |
| $R=\sqrt{F\_{1}^{2}+F\_{2}^{2}}$ **(N)** |  |
| $θ\_{R}=tan^{-1}\left(\frac{F\_{2}}{F\_{1}}\right)$ **(deg)** |  |
| $θ\_{eq}=θ\_{R}+180^{o}$ **(deg)** |  |
| **FSB (N)** |  |
| **θSB (deg)** |  |
| $$\%Δ\_{mag}=\frac{\left|R-F\_{SB}\right|}{R}×100\%$$ |  |
| $$\%Δ\_{θ}=\frac{\left|θ\_{eq}-θ\_{SB}\right|}{θ\_{eq}}×100\%$$ |  |

**Table IV: Components of resultant of two forces angled at 135o**

|  |  |
| --- | --- |
| $$R\_{x}=F\_{1}cosθ\_{1}+F\_{2}cosθ\_{2}$$ | $$R\_{y}=F\_{1}sinθ\_{1}+F\_{2}sinθ\_{2}$$ |
|  |  |

**Table V: (Write appropriate title)**

|  |  |
| --- | --- |
| $R=\sqrt{R\_{x}^{2}+R\_{y}^{2}}$ **(N)** |  |
| $θ\_{R}=tan^{-1}\left(\frac{R\_{y}}{R\_{x}}\right)$ **(deg)** |  |
| $θ\_{eq}=θ\_{R}+180^{o}$ **(deg)** |  |
| **FSB (N)** |  |
| **θSB (deg)** |  |
| $$\%Δ\_{mag}=\frac{\left|R-F\_{SB}\right|}{R}×100\%$$ |  |
| $$\%Δ\_{θ}=\frac{\left|θ\_{eq}-θ\_{SB}\right|}{θ\_{eq}}×100\%$$ |  |

**Conclusion:**

Write a conclusion summarizing your results whether or not they support your hypotheses. Address what you consider to be the largest source of error in this experiment. How might you improve this experiment or explore it further?