**Experimental verification of Newton’s Second Law, ΣF = Ma.**

**Equipment:**

A wooden Planck with scale and frictionless surface, trolley of known weight. Cotton threads, stop watch, and slotted weights

**Theory**:

Newton's 2nd law simply states that

"A nonzero net force ΣF acting on mass M generates an acceleration a in that mass such that ΣF = Ma."

In Fig. 1, assuming no friction, the hanging mass m can cause motion for both m and M**.**   The force of gravity on m is F = mg**.**   This force has to move a total mass of m + M**.**  In the absence of friction, F = mg is the **only force** causing motion**.**   In this case mg is the ΣF.

|  |  |
| --- | --- |
| Using Newton's 2nd Law:   ΣF = (Mass)(Accel.) , we may write**:**  mg  = (m + M) a   or,  a = mg / (m + M). | http://www.pstcc.edu/departments/natural_behavioral_sciences/Web%20Physics/E2010D0701web.gif  Fig. 1 |

|  |  |
| --- | --- |
| Using Newton's 2nd Law:   ΣF = (Mass)(Accel.), we may write**:**  mg - μ Mg  = (m + M) a   or,  a = (mg - μ Mg ) / (m + M). | http://www.pstcc.edu/departments/natural_behavioral_sciences/Web%20Physics/E2010D0702web.gif  Fig. 2 |

In Fig. 2, assume friction is present for M only because it has to slide on the top of the horizontal table**.**  Since N = w in magnitude for M, we may write or N = Mg**.**

The force of kinetic friction is  Fk = μ N , or      Fk = μ Mg.

**Procedure:**

1. Fix the trolley on one side of wooden Planck and note its position by scale provided on it.
2. Tied the hook of Planck with thread and pass over pulley and tied the slotted weight.
3. When the Planck moves due to weight start stop watch and when it moves other end of Planck stop the stop watch.
4. Note the time taken by wooden trolley to move.

**OBSERVATION TABLE**

**Given and Measured**          g = 9**.**81 m/s2**.**  S = length of the wooden bench

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S. No | m  **( )** | M  **( )** | μ**k** | Time | | ΣF=mg – μMg  **( )** | Total mass  M + m  **( )** | Actual a =  ΣF**/**(M+m)  **(  )** | Experimetal a **=**   2S**/**t2  **(  )** | % Error |
| Individual time  ( ) | Average Time (t)  ( ) |
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|  |  |  |  |  |  |  |  |
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| 3 |  |  |  |  |  |  |  |  |  |  |
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| 4 |  |  |  |  |  |  |  |  |  |  |
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| 5 |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |

**Error calculation.**

**Conclusion:**

**Precaution.**