Aim: To determine coefficient of friction between given pair of surfaces

Apparatus: The apparatus consists of wooden plane having adjustment for setting the required angle precisely with graduated and vertical scale is provided. A frictionless pulley is attached to the end by means of a clamp adjustable to any necessary position. It is supplied with a wheeled trolley and a set of eight slide draws having bottom of different materials, string and pan.

Theory: It has been established since long that the surface of the bodies are never perfectly smooth. Wherever one or the blocks moves or tends to move tangentially with respect of the surface, on which it rests, the interlocking property of the projecting particles opposes the motion. This opposing force, which acts in the opposite direction of the movement of the block is called force of friction or simple friction.

Consider a body of weight W on a plane having an angle of inclination α i.e resting on an inclined plane. Suppose it just tends to move upwards, the frictional force F will be acting downwards. The force on the body can be resolved into two components perpendicular and parallel to the plane.

\[ F = \mu R + W \sin \alpha \]

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The component \( W \cos \alpha \) perpendicular to the plane balances the normal reaction \( R \) and the component \( W \sin \alpha \) parallel to the plane provides the necessary force for the body to move down the plane.

we get, \( P = W \cos \alpha + W \sin \alpha \)

\[ \mu = \frac{P - W \cos \alpha}{W \cos \alpha} \]

Procedure

Note down the angle of inclination \( \alpha \) after setting the inclined plane. The top surface of inclined plane is of wood.

Place the wooden block of known weight \( W \), on the inclined plane.

Tie the slider to the pan with the help of the thread passing over the frictionless pulley.

Put some weights in the pan till the slider just begins to slide upwards. Note down this weight in the pan.

Repeat above procedure with other slides and with other angle of inclinations.

Result

Mean value of coefficient of friction \( (\mu) \) for given pair of surfaces = ?

Precaution

Pulley should be frictionless

There should not be any knot in the string.

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(iii) Weight should be placed in effort pan slowly.
(iv) String should be parallel to the plane.
(v) The surface of the inclined plane should be smooth and clean.
(vi) Proper lubrication of the pulley should be done to decrease friction.

Vi Va
\[ P = \mu R \sin \alpha \]

Body moving up on a rough inclined plane.
### Observation

<table>
<thead>
<tr>
<th>Surface of slider</th>
<th>Weight of slider</th>
<th>Weight of pan + weight in pan</th>
<th>Inclination</th>
<th>( \mu )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium + wood</td>
<td>150</td>
<td>130</td>
<td>24</td>
<td>0.503</td>
</tr>
<tr>
<td>Aluminium + wood</td>
<td>150</td>
<td>152</td>
<td>30</td>
<td>0.532</td>
</tr>
<tr>
<td>Aluminium + wood</td>
<td>150</td>
<td>125</td>
<td>20</td>
<td>0.522</td>
</tr>
</tbody>
</table>

### Calculations

1) \( \mu = \frac{P - \omega \sin \theta}{\omega \cos \theta} = \frac{130 - 61}{137} = 0.503 \)

2) \( \mu = \frac{152 - 75}{90.93} = 0.532 \)

3) \( \mu = \frac{150 - 51}{190.95} = 0.522 \)

Mean \( \mu \) = \( \frac{0.503 + 0.532 + 0.522}{3} \) = 0.539