PHY 1601 FALL 2011

Optional Problem; Week of Oct 17

In class we saw a catapult in action. This machine converted gravitational energy into elastic energy, and then elastic energy into kinetic energy of a projectile.

In class we obtained the following data, which suggest the following questions:

1. When a weight of 56kG was attached to the elastic, the weight dropped a distance \( \Delta z = 0.48 \text{m} \) and the elastic stretched the same amount, while a weight of 36kG dropped a distance \( \Delta z = 0.36 \text{m} \) and stretched the elastic by the same amount.

   **Question:** How harmonic is the elastic? Is its energy described by \( E_{\text{elastic}} = 0.5kx^2 \) and if so what is \( k \)?

2. When the weight was instantaneously detached from the elastic, the release of elastic energy was partially converted into kinetic energy. We obtained the following results, presented as (distance travelled, change in vertical height) for given projectile mass and mass of counterweight that stretched the spring.

<table>
<thead>
<tr>
<th>( M_{\text{counterweight}} ) (kG)</th>
<th>( M_{\text{projectile}} ) (kG)</th>
<th>Distance travelled (m)</th>
<th>Change in height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>0.065</td>
<td>(7.8, 0.2)</td>
<td>(10, 0.8)</td>
</tr>
<tr>
<td>56</td>
<td>0.15</td>
<td>(6.0, -1.2)</td>
<td>(10, -1.2)</td>
</tr>
</tbody>
</table>

Please figure out from this information how much of the elastic energy of the catapult was converted to kinetic energy of the projectile?

Does air resistance present a significant complication?