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**Lab 7: Rotational Motion**

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1. **Analysis**

**(Q 5.1)**

**Sum of Forces on Hanger**

**New equation for Torque**

**Values from Table 1 row 1**

The torque calculated from measured values with respect to tension is exactly the same as in our table. Tension depends on two measured values, the mass of the hanger and the acceleration of the hanger.

**(Q 5.2)**

Sample Calculations from Table 3 in Data Section

**(Q 5.3)**

Our percent differences were all above 100%, this means that the final kinetic energy was higher than our starting potential energy. Therefore, the total mechanical energy of a rotating object is NOT conserved because. The work done in the radial direction opposite to the centripetal force accounts for the difference between the final kinetic energy and starting potential energy.

**(Q 5.4)**

There are four potential sources of error:

1.Friction of the rope, on the rope, as the spindle turned.

2. Dropping the hanger as opposed to letting it go.

3. Friction between spindle and the rope .

4. Rope being imperfectly placed .

**(Q 5.5)**

As the radius increases, the acceleration, alpha, velocity, tension, final kinetic energy and translational energy increase while inertia decreases with a larger radius.

**2.) Calculations**

**3.) Data**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial |  |  |  |  |  |  |  |
| 1 | .0280 | .0709 | .9930 | .0280 | 9.716 | .2720 | .4489 |
| 2 | .0959 | 1.427 | .0400 | 11.72 | .3282 | .6071 |
| 3 | .1209 | 1.824 | .0500 | 13.67 | .3827 | .7654 |
| 4 | .0380 | .0709 | 1.431 | .0540 | 10.15 | .3855 | .4489 |
| 5 | .0959 | 2.132 | .0810 | 12.34 | .4689 | .6071 |
| 6 | .1209 | 2.701 | .1030 | 14.15 | .5375 | .7654 |
| 7 | .0495 | .0709 | 1.899 | .0940 | 10.55 | .5222 | .4489 |
| 8 | .0959 | 2.690 | .1332 | 12.65 | .6262 | .6071 |
| 9 | .1209 | 3.574 | .1770 | 14.48 | .7166 | .7654 |

Table 1: Data table for angular acceleration and final angular speed of disk and hanger system

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial |  |  |  |  |  |  |  |
| 1 | .0194 | .0195 | .9204 | .0026 | .9230 | 206.0 | 0.018 |
| 2 | .0262 | .0184 | 1.264 | .0052 | 1.269 | 209.0 |  |
| 3 | .0330 | .0179 | 1.672 | .0089 | 1.681 | 222.0 |  |
| 4 | .0263 | .0184 | .9469 | .0053 | .9522 | 212.0 | 0.017 |
| 5 | .0354 | .0166 | 1.264 | .0105 | 1.275 | 210.0 |  |
| 6 | .0445 | .0165 | 1.651 | .0175 | 1.669 | 218.0 |  |
| 7 | .0341 | .0180 | 1.002 | .0100 | 1.012 | 225.0 | 0.017 |
| 8 | .0459 | .0171 | 1.368 | .0188 | 1.387 | 228.0 |  |
| 9 | .0576 | .0161 | 1.687 | .0310 | 1.718 | 224.9 |  |

Table 2: Data table for energy conservation analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | From table 1 | | For Q 5.2 | |
| Trial |  |  |  |  |
| 1 | 0.0277 | 0.272048 | 0.2078 | 23.62 |
| 2 | 0.0120 | 0.328216 | 0.1364 | 58.44 |
| 3 | 0.0505 | 0.382704 | 0.2802 | 26.79 |
| 4 | 0.0532 | 0.38551 | 0.2876 | 25.39 |
| 5 | 0.0810 | 0.468882 | 0.3551 | 24.28 |
| 6 | 0.1026 | 0.537548 | 0.3996 | 25.66 |
| 7 | 0.0940 | 0.5221755 | 0.3824 | 26.76 |
| 8 | 0.1332 | 0.6262245 | 0.4552 | 27.31 |
| 9 | 0.1767 | 0.716562 | 0.5244 | 26.82 |

Table 3: Data table for calculated velocity and percent difference with respect to angular speed