Conservation of Energy

Work is defined as

Calculated by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Note**: Units!

Work done on an object:

**Example 1:**

A 2.0kg textbook is lifted off of the ground to a height of 1.5m. What is the work done on this book?

Is somebody inputting energy to do this?

What are we working against?

**Example 2:**

How much work is being done on a 4.0kg ball that is being held at a height of 1.6m?

Is energy being used to hold the ball?

Is the *ball* changing its energy?

Work is only done by forces…

**Positives and Negatives**

We have seen work be positive or negative. What’s the deal?

Positive work means

Negative work means

**Law of Conservation of Energy**

**Conservative and Non-conservative Forces**

When work is done by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force, the all energy changes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. For example, lifting a book may take 12J of work from an electric motor, but putting the book back down will release 12J of potential gravitational energy that can be generated back into electrical energy (under ideal conditions).

For conservative forces, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ taken between two points is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

When work is done by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force, the energy is \_\_\_\_\_\_\_\_\_\_\_\_ to the rest of the system. Due to the degrees of freedom within the particle an object, there is work that is dispersed into the system as latent heat energy (see, not ACTUALLY lost, just not “recoverable”).

For non-conservative forces the work done is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ upon the path taken by the object.

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| --- | --- |
| **Conservative Forces** | **Non-conservative Forces** |
|  |  |

Still being argued:

**Important, Interesting, but not Mandatory (yet) Side Note: (somewhat simplified for the sake of sanity)**

**Entropy**: a quantity that represents the unavailability of a system’s energy for conversion into mechanical work (the quantity of “randomness/chaos” in a system)

The use of conservative forces do not increase the entropy of a system, meaning as they are used, there is still the same amount of energy that can be used to produce work.

Non-conservative forces change low entropy energy into higher entropy energy. The work they do reduces the overall effectiveness of a system to do more work later.

The **Second Law of Thermodynamics** talks about the irreversibility of entropic changes. A *rough* summary says “If you want to reduce the entropy (make a system more able to do work) you need to INPUT outside energy.” Thus, to reduce the entropy of one system, you need to increase the entropy of another!

Energy always gets less useful. Thus ***everything*** dies, deal with it. -Physics