

Kinetic and Gravitational Potential Energy

- Kinetic Energy
- Work-Energy Theorem
- Gravitational Potential Energy
- Energy Conservation
- Application
- Mechanical Energy
- Practice



Preview File

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Kinetic Energy (E_k or KE)

- _____
- When we do work on an object, energy is transferred into the system
- When the object gains energy, it begins to move
- A train's engine does work on the train causing it to move



Kinetic Energy

- Kinetic energy (E_k or KE) can be found using:

$$E_K = \frac{1}{2}mv^2$$

- E_k is the kinetic energy of the object in joules, m is the mass of the object in kilograms, and v is the speed of the object in metres per second
- _____

Check Your Understanding

Find the kinetic energy of a 48-g dart travelling at a speed of 3.4 m/s.

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Work-Energy Theorem

- The total work done on an object equals the change in the object's
- We can summarize the relationship involving the total work and the kinetic energy as follows:

$$W_{total} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$W_{total} = E_{Kf} - E_{Ki}$$

$$W_{total} = \Delta E_K$$

Check Your Understanding

What total work, in megajoules (10^6), is required to cause a cargo plane of mass 4.55×10^5 kg to increase its speed in level flight from 105 m/s to 185 m/s?

Check Your Understanding

A fire truck of mass 1.6×10^4 kg, travelling at some initial speed, has -2.9 MJ of work done on it, causing its speed to become 11 m/s. Determine the initial speed of the fire truck.

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Gravitational Potential Energy (ΔE_g)

- Because gravity acts vertically, we will use h rather than Δd for the magnitude of the displacement
- The force applied to the box to raise it is in the same direction as the displacement and has a magnitude equal to mg . Therefore, the work done by the force on the box is $W = mgh$
- _____

Things to keep in mind

- ΔE_g = the change in potential energy from one height to another
- ΔE_g is the change in gravitational potential energy, in joules;

- _____

Check Your Understanding

A diver, of mass 57.8 kg , climbs up a diving board ladder and then walks to the edge of the board. He then steps off the board and falls vertically from rest to the water 3.00 m below. Determine the diver's gravitational potential energy at the edge of the diving board, relative to the water.

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Check Your Understanding

A 485-g book is resting on a desk 62 cm high. Calculate the book's gravitational potential energy relative to

a) the desktop and

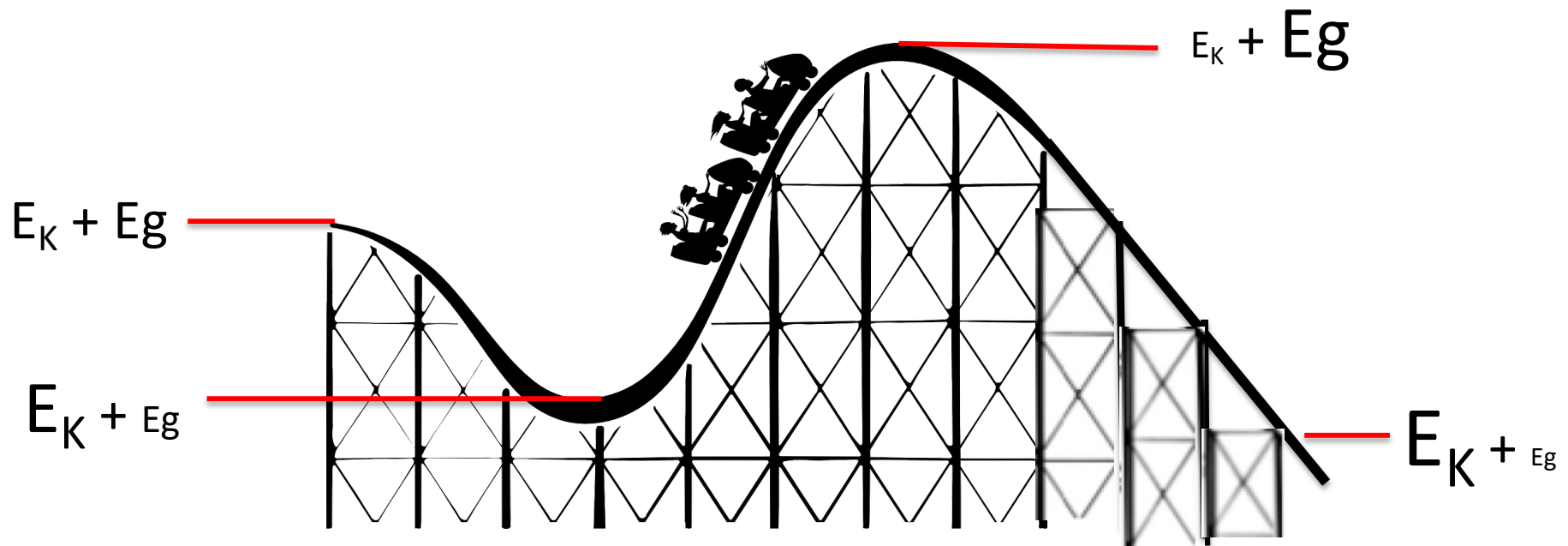
b) the floor.

Check Your Understanding

The elevation at the base of a ski hill is 350 m above sea level. A ski lift raises a skier (total mass = 72 kg, including equipment) to the top of the hill. If the skier's gravitational potential energy relative to the base of the hill is now 9.2×10^5 J, what is the elevation at the top of the hill relative to sea level?

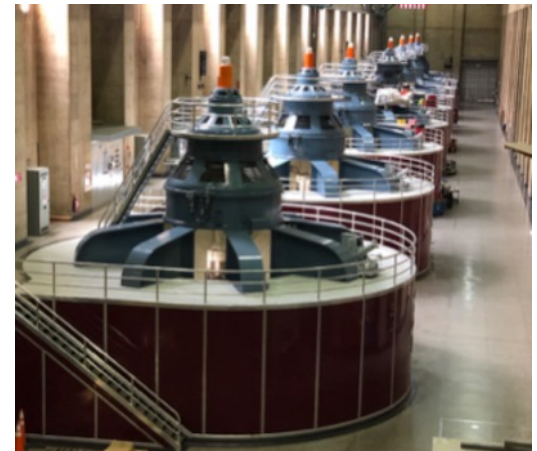
Energy is Conserved

- Energy cannot be created or destroyed, only converted from one form to another
- Assuming no additional work is done on the cart, it loses E_K and gains E_g as it ascends the hill
- At the top, E_g is maximized and E_K is minimized. The majority of the energy from E_K has been converted to E_g at its peak
- _____



Application

Hydroelectric plants convert the E_g of the water at higher elevations into E_k as water rushes down via gravity. _____



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Summary

- Kinetic energy (E_K)
 - The energy of motion
- Gravitational Potential Energy (ΔE_g)
 - The energy stored in an object due to its elevation above a reference point
- Energy can be converted from one form to another (i.e. E_K to E_g)

- _____



Lastly ...

Explain what is wrong (speaking of energy) with this scene.

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