Lecture 19

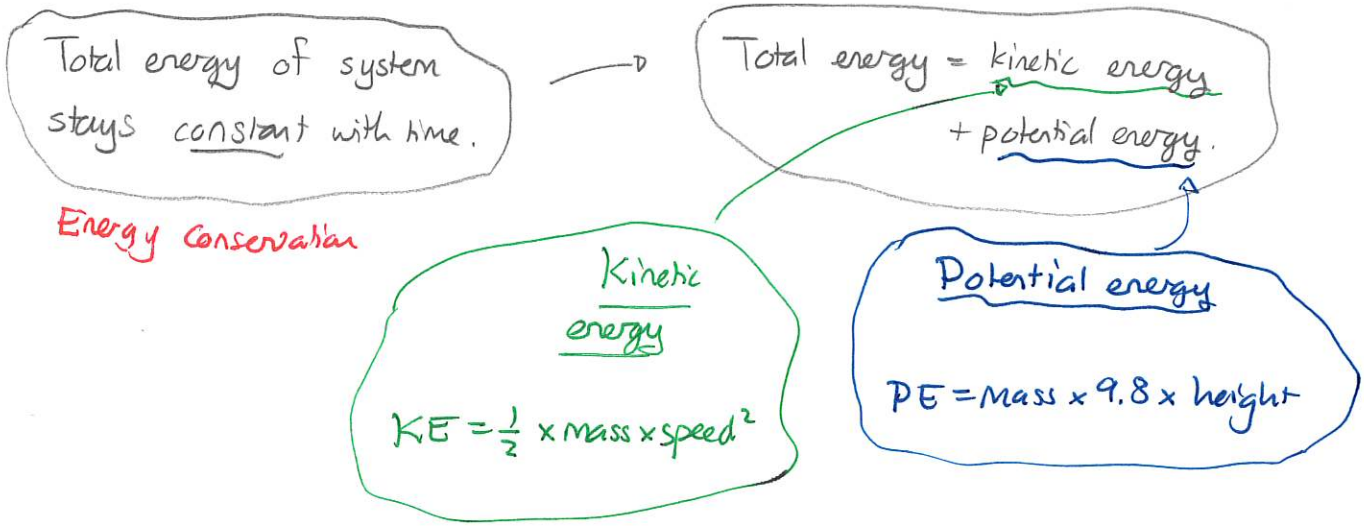
Fri: Read
HW by 5pm

Thurs: Seminar 12:30pm
Wubben 203

Mon:

Energy Conservation

For systems that move primarily under Earth's gravity (a precise definition of "primarily" exists in higher level physics), the Law of the Conservation of Energy gives



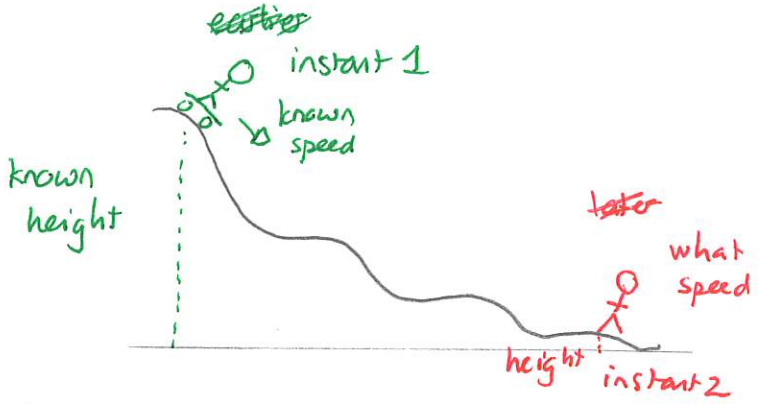
DEMO: PhET Energy Skate Park.
- Measure Tab → use human and measuring device → observe total energy constant.

Quiz 1 30% - 90%

Quiz 2 80% -

Energy conservation is important because it allows us to predict aspects of motion. For example when objects slide along tracks and ramps, we can predict speeds and heights easily using energy

Consider a skater sliding down a track. The process is:



① Use information at one instant (instant 1) to get:

* KE $= \frac{1}{2} \times$ mass $\times$ speed^2 → ~~critical~~ instant 1
* PE = mass $\times$ g $\times$ height
* Total energy = KE + PE → constant

② If we have partial information later

* Total energy = same as TE from ①
* Determine PE using information from instant 2
* Determine KE = Total Energy − PE

Then

If we can determine KE at any moment.

$$\text{speed}^2 = \frac{2 \times KE}{\text{mass}} \quad \Rightarrow \quad \text{speed} = \sqrt{\frac{2 \times KE}{\text{mass}}}$$

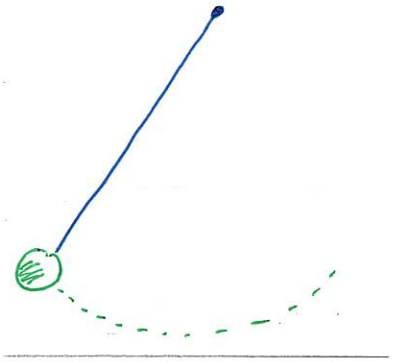
and

If we can determine PE at any moment

$$\text{height} = \frac{PE}{(\text{mass} \times 9{,}8)}$$

Pendulum and energy

The Law of the Conservation of Energy applies to an object that swings on a string or rope. This is often called a pendulum.



Quiz 3

DEMO : Stopped Pendulum

} After exercise

1 Swinging pendulum

A pendulum with mass 0.20 kg is released from rest. At the lowest point of its swing the pendulum is moves with speed 3.0 m/s. The aim of this exercise will be to find the maximum height reached by the pendulum.

You can use the table beneath to record the information about the energies.

a) Determine the potential, kinetic and total energies of the pendulum at the lowest point of its swing.

b) Determine the potential, kinetic and total energies of the pendulum at the instant at which it reaches its highest point.

c) Determine the maximum height that the pendulum reaches.

Instant	KE	PE	Energy
At lowest point	0.90J	0,0J	0.90J
At max height	0J	0.90J.	0,90J

a) $KE = \frac{1}{2} \times \text{mass} \times \text{speed}^2 = \frac{1}{2} \times 0.20\text{kg} \times (3.0\text{m/s})^2 = 0,90\text{J}$

$PE = \text{mass} \times 9.8 \times \text{height} = 0.20\text{kg} \times 9.8\,\text{m/s}^2 \times 0\text{m} = 0\text{J}$

b) At max height speed = 0 $\Rightarrow$ KE = 0J

Then PE = Total − KE = 0,90J

c) $\text{height} = \frac{PE}{\text{mass} \times 9.8} = \frac{0,90\text{J}}{0.20\text{kg} \times 9,8} = 0.46\text{m}$