

Review on Mass and Energy

Mass:

is a scalar quantity measuring the amount of matter in a body. It is measured in kg. (Alternative definition: Mass measures the inertia of a body → meaning the resistance of a body to any change in its state of motion. More massive objects exhibit greater inertia).

Remember: Mass shouldn't be confused with Weight!



My **WEIGHT** on Earth is around 560N



My **WEIGHT** on the moon is around 90N



My **MASS** is always 56kg!!

Energy:

Even though both physicists and non-physicists may use this term in an almost daily basis, there is no working definition for the term.

However, we know that energy can be transferred from a body to another, can transform from one type to another and that energy is neither created nor destroyed: It is conserved.

During every physical process the total energy before and after the process is constant.

There are many forms of energy: Energy of motion (Kinetic Energy), Potential Energy, Solar energy, chemical energy, heat and others. All these though finally break up in two fundamental forms of energy: Potential and Kinetic energy. Energy is measured in Joules (J). Another unit to measure energy in the microcosm is the eV ($1 \text{ eV} = 1,6 \cdot 10^{-19} \text{ J}$).

Check the following video about energy conversions and definitions:

<https://www.youtube.com/watch?v=GqtUWyDRifg>

Check the following videos about the conservation of energy theorem:

<https://www.youtube.com/watch?v=87EoDKs5bok>

https://www.youtube.com/watch?v=PplaBASQ_3M

Do you see anything in common between mass and energy??

Short quiz

1. Mass

An object weighs 200N on the surface of the Earth. Assuming that the gravitational acceleration of the Earth is $g=10 \text{ m/s}^2$ and that the gravitational acceleration at the moon is $g_{\text{moon}}= g/6$, choose the correct answer:

- a) The weight at the Moon is $200/6 \text{ kg}$
- b) The mass is everywhere equal to 20 kg
- c) The weight is everywhere equal to 200 N

2. Energy

A. A 1 tone car is travelling at a speed of 36km/hr . Find its kinetic energy.

- a) $K = 36 \text{ J}$
- b) $K = 500 \text{ J}$
- c) $K = 50,000 \text{ J}$

B. The same car starts decelerating at a rate of -2m/s^2 . Find its kinetic energy 3 seconds after it began decelerating

- a) $K = 8000 \text{ J}$
- b) It's the same
- c) $K = 18 \text{ J}$

3. Energy conservation

A billiard ball is shot with a kinetic energy of 2J . It traverses the pool table and strikes another ball initially at rest. The other ball starts moving while the initial ball recoils to another direction.

Find the correct answer.

- a) After the collision, the forms of energy produced are heat, sound energy and kinetic energy for both balls with a total sum less than 2J .
- b) The speed of the ball in the beginning is equal to the sum of speeds after the collision.
- c) The total kinetic energy of the balls after the collision is equal to 2J due to the conservation of energy.