CBSE Class 9 Science Notes Chapter 11: With the comprehensive CBSE Class 9 Science Notes Chapter 11 PDF, students can now study science more easily in class 9. Each topic and subtopic are carefully explained to ensure that students grasp the material. The PDF versions of these explanations are now available on the website. These notes are your one-stop shop for convenient exam preparation.

Now consult them to gain a comprehensive understanding of the fundamental subjects of Work and Energy so that you may easily pass your tests. Students can access free notes and other study resources on our website.

CBSE Class 9 Science Notes Chapter 11 Overview

The concepts of effort, energy, and power are thoroughly covered in Class 9 Chapter 11, "Work and Energy." In daily life, we refer to any productive physical or mental activity as work, but scientists have a distinct definition of the term. The amount of work a force does on an object is determined by multiplying its magnitude by the distance it moves in the force's direction. There is no direction and only magnitude to work.

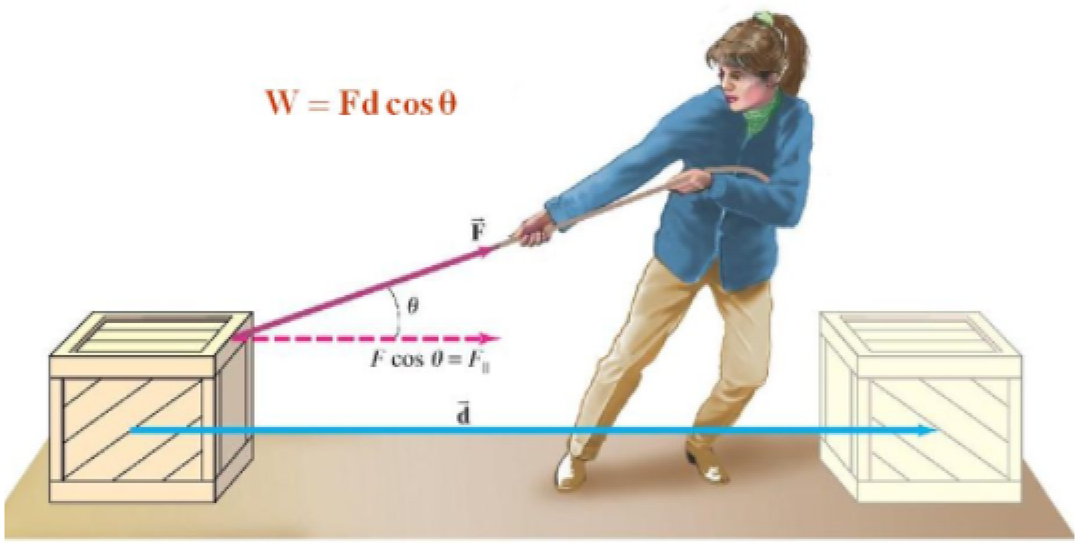
Similarly, we use the term "energy" a lot in our daily lives, yet science defines it differently. According to physics, energy is the quantifiable quality that is transferred to a physical system or body and is evident in the production of heat and light as well as in the performance of work.

CBSE Class 9 Science Notes Chapter 11

Work

The product of the force acting on the body and the displacement in the force's direction is the definition of work done on an object. W is equal to F.s. The Newton is the SI unit of force.

The work done is zero when a force applied on a body result in no displacement. Say, pushing against a wall.



The force component along the direction of the body's displacement is given by the formula F cos θ. The angle formed by the force vector and displacement vector is denoted by Cos θ.

Why sometimes not much work is done despite working hard?

Energy is used in reading, writing, drawing, thinking, and analyzing. However, in the foregoing circumstances, no work is done scientifically.

Example: A man is pushing a rock (a wall) until he is utterly tired, but there is no progress made because the wall is immobile.

A man carrying a big bag and standing motionless may get fatigued soon, but since he is immobile, he cannot perform any labor.

Work is said to be done when

(i) A moving object comes to rest.
(ii) an object at rest starts moving.
(iii) velocity of an object changes.
(iv) the shape of an object changes.

Energy

Energy is defined as the ability to do work. Its unit is the same as that of work. Energy is a scalar quantity.

By now, we should all be aware that energy is essential to life itself. Energy seems to be needed at an accelerating rate. But the real query is: Where does energy originate?

The sun, after all, is the main natural energy source for all living things. The sun is the main source of several energy sources. In addition, the earth's interior, tides, and atoms' nuclei can all provide us with energy.

SI unit of energy or work = Joule (Nm) or Kgm^2s^{-2}.

Forms of Energy

Our world offers a myriad of forms of energy. These include- potential energy + kinetic energy (mechanical energy), light energy, chemical energy, electrical energy, and heat energy.

Energy has different forms: Light, heat, chemical, electrical or mechanical.
Mechanical energy is the sum of
(i) Kinetic energy (K.E)
(ii) Potential energy (P.E)

Kinetic Energy

Objects in motion possess energy and can-do work. This energy is called Kinetic Energy.

$F = ma$

Also,

$W = Fs$

From the second equation of motion, we know that

$v^2 - u^2 = 2as$

Rearranging the equation, we get

$s = \frac{v^2-u^2}{2as}$

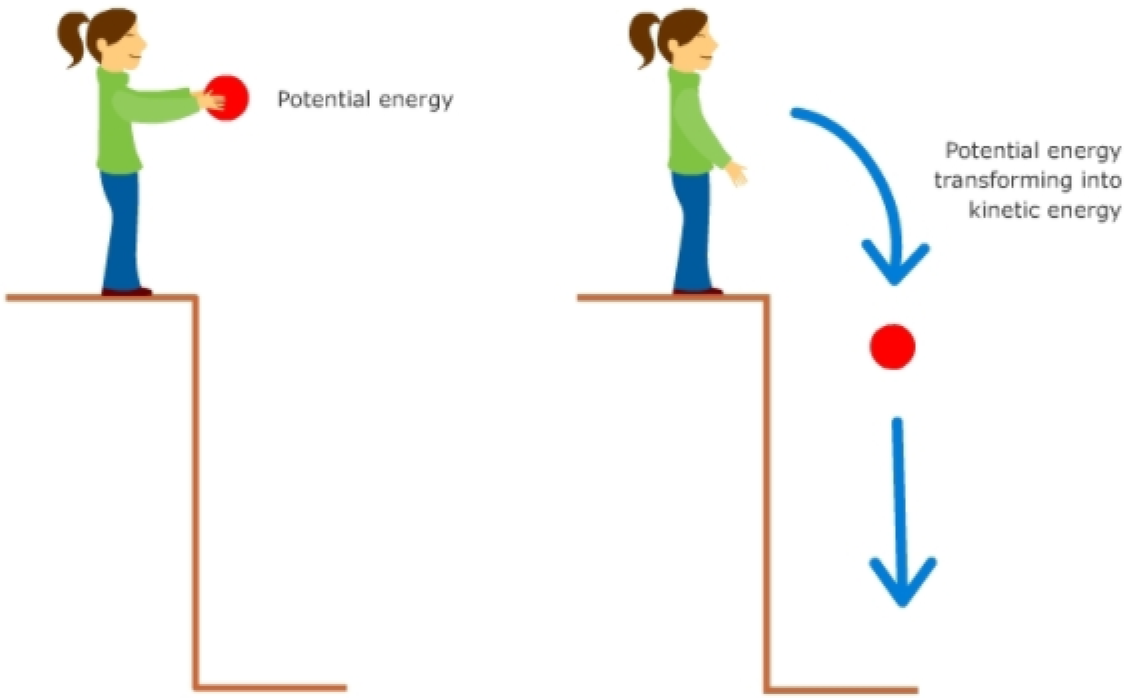
Substituting equation for work done by a moving body,

$W = (m \times a)(\frac{v^2-u^2}{2a})$

Taking initial velocity as zero, we get

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

When two identical bodies are in motion, the body with a higher velocity has more KE.



Examples of kinetic energy

- A moving cricket ball
- Running water
- A moving bullet
- Flowing wind
- A moving car
- A running athlete
- A rolling stone

Work-Energy Theorem

The work-energy theorem states that the net work done by a moving body can be calculated by finding the change in KE.

$$\Rightarrow W_{net} = KE_{final} - KE_{initial}$$

$$\Rightarrow W_{net} = \frac{1}{2} m[v^2 - u^2]$$

Factors Affecting Kinetic Energy

- Mass
- Velocity
- Momentum

Potential Energy

When work is done on an object, energy can be stored in it.

As an illustration, extend a rubber thread. Potential energy is the energy that a body possesses as a result of its configuration or change in position.

The potential energy of an object at a height

When an object is raised to a certain height, work is done against gravity to change its position. This energy is stored as Potential Energy.

$$\Rightarrow W = F.s$$

$$\Rightarrow F = ma$$

In the case of increasing the height, $F = mg$

Therefore, $W (P.E) = mgh$

$$\Rightarrow \Delta PE = mg(h_{final} - h_{initial})$$

Law of Conservation of Energy

Energy can be transformed from one form to another, but it cannot be created or destroyed, according to the law of conservation of energy. Both before and after the transition, the total energy is the same.

Total energy = KE + PE

where, $1/2\ mv^2 + mgh$ = constant

For example: consider a ball falling freely from a height. At height h, it has only PE = mgh.

By the time it is about to hit the ground, it has a velocity and therefore has KE=

$\frac{1}{2}$

mv^2. Therefore, energy gets transferred from PE to KE, while the total energy remains the same.

Power

The rate of doing work or the rate of transfer of energy is called power. It is denoted by P.

$\Rightarrow$ P =

$\frac{W}{t}$

SI unit is Watt (Js^{-1}).

Average power = Total energy consumed/Total time taken

Commercial Unit of Power

Since the joule is a very small unit, it cannot be used to accurately define large and specific amounts of energy. For this reason, the kilowatt hour (kW h), a larger unit, is utilized. 1 kW h is the amount of energy that can be obtained at a rate of 1 kW in roughly one hour.

The commercial unit of power is kWh, i.e. energy used in 1 hour at 1000 Joules/second.

Benefits of CBSE Class 9 Science Notes Chapter 11

Students can access free notes and other study resources on the website. Math students looking for better answers can download the class 9 notes, which will help them review the entire syllabus and get higher grades in their exams.

- thorough explanations for every task and question, encouraging a better comprehension of the material.
- Presentation that is well-organized and easy to understand.
- Precise responses that correspond with the syllabus enhance student's self-assurance in their comprehension.
- visual tools to help explain difficult ideas, such as pictures and diagrams.
- Extra pointers and advice to improve student performance.
- Synopses of chapters for rapid editing.
- Resources that can be downloaded and used online for flexible study and revision.