Energy – GCSE Physics

CONTENTS:

1. Introduction

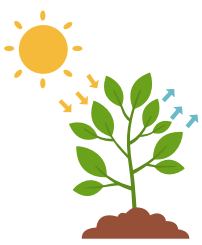
- It is a fundamental concept in physics, and we learn the concept of energy because it helps us understand and explain how the physical world works.
- Energy is transferred whenever things happen and the transferred of energy by a force is called **work done.**
- When energy is transferred by doing work, it causes things to happen — like moving an object, heating something etc.

Real-life example:

Switching on a Light Bulb

Solar Panels on a Roof

Riding a Bicycle



Photosynthesis

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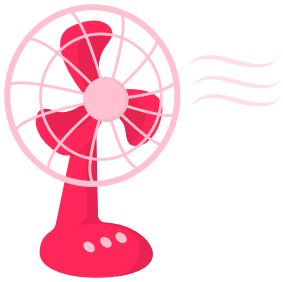
2. What is Energy?

- **Energy** is the ability to do work or cause change.
- It exists in various forms like- kinetic, potential, thermal, etc.
- It is measured in **joules (J)**.

Real-life examples of energy in different forms:

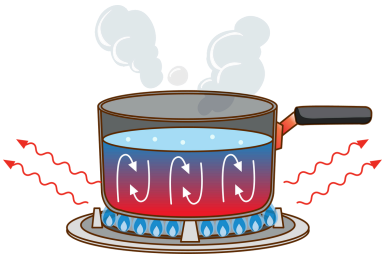
1. Electrical Energy

A fan runs using electricity and electric current powers the motor to rotate the blades.



2. Thermal Energy

Boiling water on a stove and heat energy from the flame increases the temperature of water.



3. Kinetic Energy

A moving car or a running person and objects in motion have kinetic energy

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3. How Power is related to Energy?

- **Energy** is the total amount of work done.
- Where, **Power** is the rate at which that work is done per unit of time.
- The SI unit of **Energy** is the Joule(**J**).
- The SI unit of **power** is the watt (**W**).

Key Relationship:

$$P = \frac{E}{t} \quad \text{or} \quad E = P \times t$$

Where,

- **P** = Power
- **E** = Energy Transferred
- **t** = Time

Example: A machine uses 100 watts of power and runs for 5 seconds. How much energy does it use?

Solution:

Given:

- **P** = 100 watts
- **t** = 5 second

Using the formula,

$$E = P \times t$$

$$E = 100 \times 5$$

$$E = 500$$

It used **500 joules** of energy in 5 seconds.

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4. How to Calculate Energy?

- **Steps to Calculate Energy**

Steps#1: Identify the Term

Steps#2: Apply the formula

Steps#3: Calculate the Energy

Example: A 60-watt bulb is turned on for 10 seconds. How much energy does it use?

Solution:

Steps#1: Identify the Term

Given:

- **F** = 60 watt
- **t** = 10 seconds

Steps#2: Apply the formula

Putting the values in formula,

$$E = P \times t$$

Steps#3: Calculate the Energy

$$E = 60 \times 10$$

$$E = 600$$

It used **600 joules** of energy in 10 seconds.

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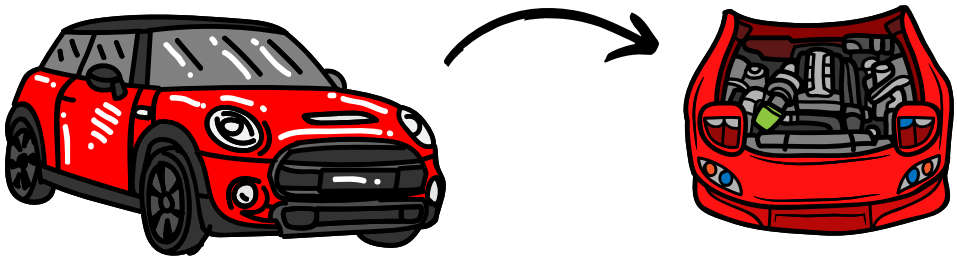
5. Solved Examples.

Problem1: A car engine uses **10,000 joules** of energy in **20 seconds**. What is its power?



Solution:

Steps#1: Identify the Term

Given:

- E = 10,000 joules
- t = 20 seconds

Steps#2: Apply the formula

$$P = \frac{E}{t}$$

Steps#3: Calculate the Energy

Putting the values in formula,

$$P = \frac{10{,}000}{20}$$

$$P = 500$$

The Power of car engine is **500 watts**

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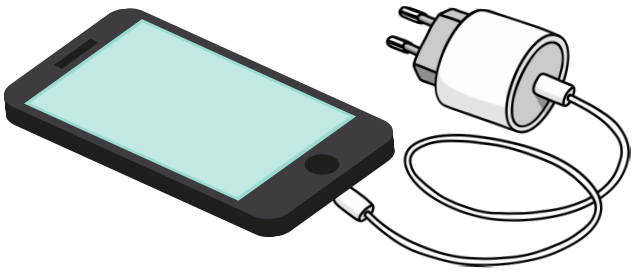
Problem2: A mobile charger uses **15 watts** of power. How much energy will it use in **2 minutes**?



Solution:

Steps#1: Identify the Term

Given:

- **P** = 15 Watts
- **t** = 2 minute - **2 x 60 seconds** = **120 seconds**

Steps#2: Apply the formula

$$E = P \times t$$

Steps#3: Calculate the Energy

Putting the values in formula,

$$E = 15 \times 120$$

$$E = 1800$$

It uses **1800 joules** of energy in 2 minutes.

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6. FAQs

1. What is energy?
Energy is the ability to do work or cause change. It powers movement, heat, light, and machines.

2. What are the units of energy?
The SI unit of Energy is the Joule (**J**).

3. What are the main types of energy?

- Kinetic Energy – motion
- Potential Energy – position or stored
- Thermal Energy – heat

4. What is the difference between energy and power?

- **Energy** = Total work done.
- **Power** = How fast energy is used.

5. Can energy be destroyed?
No. According to the **Law of Conservation of Energy**,
Energy can neither be created nor destroyed, only changed from one form to another.

6. What is renewable vs non-renewable energy?

- **Renewable:** Comes from natural sources that won't run out (sunlight, wind, water).
- **Non-renewable:** Comes from sources that will eventually run out (coal, oil, gas).