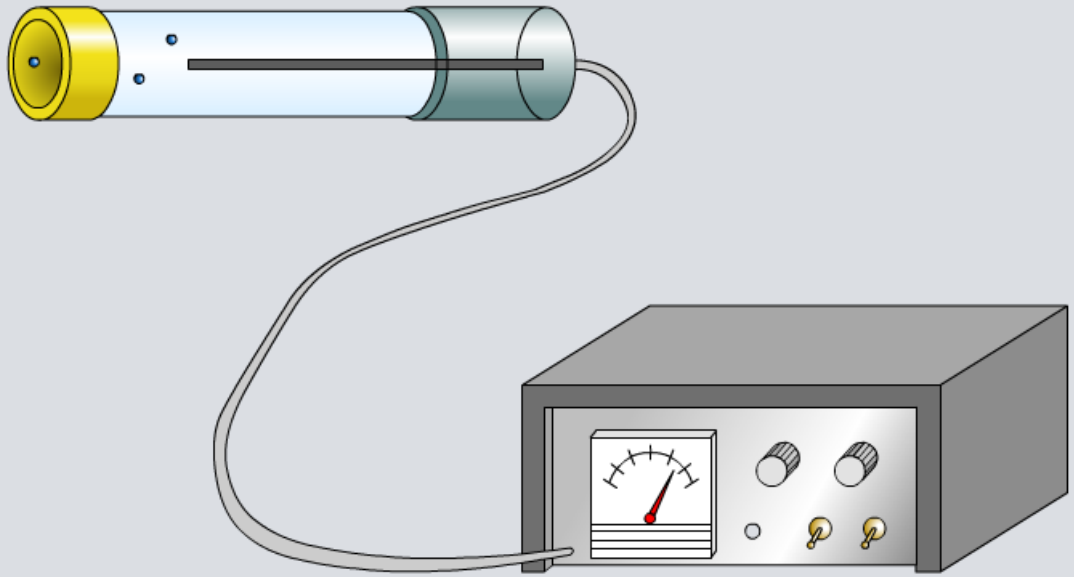
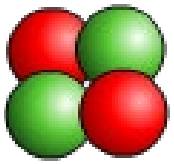
# Types of Radiation



# What happens during alpha decay?

An **alpha particle** consists of two protons and two neutrons. It is the same as a helium nucleus.



When an atom's nucleus decays and releases an alpha particle, it loses two protons and two neutrons.

mass number decreases by 4

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$$

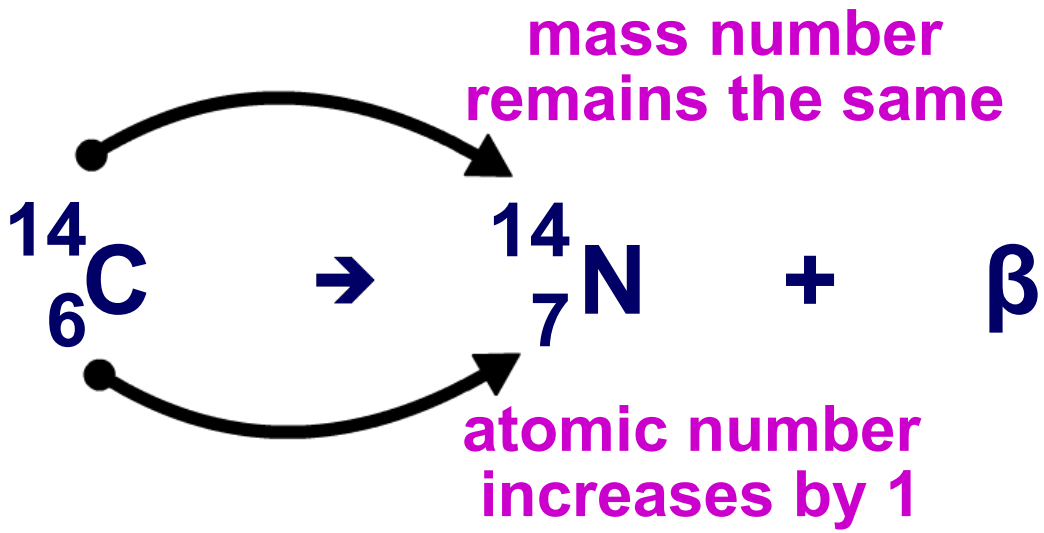
atomic number decreases by 2

The number of protons has changed, so the decayed atom has changed into a **new element**.

# What happens during beta decay?

A **beta particle** consists of a high-energy electron, which is emitted by the nucleus of the decaying atom.

When an atom's nucleus decays and releases a beta particle, a neutron turns into a proton, which stays in the nucleus, and a high-energy electron, which is emitted.




The decayed atom has gained a proton, and so has changed into a **new element**.

# What happens during gamma decay?

**Gamma radiation** is a form of electromagnetic radiation, not a type of particle.

When an atom's nucleus decays and emits gamma radiation, it releases energy in the form of electromagnetic radiation.

There is no change to the make up of the nucleus, and so a new element is **not** formed.

Gamma rays are usually emitted with alpha or beta particles. For example, cobalt-60 decays releasing a beta particle. The nickel formed is still not stable, and so emits gamma radiation.

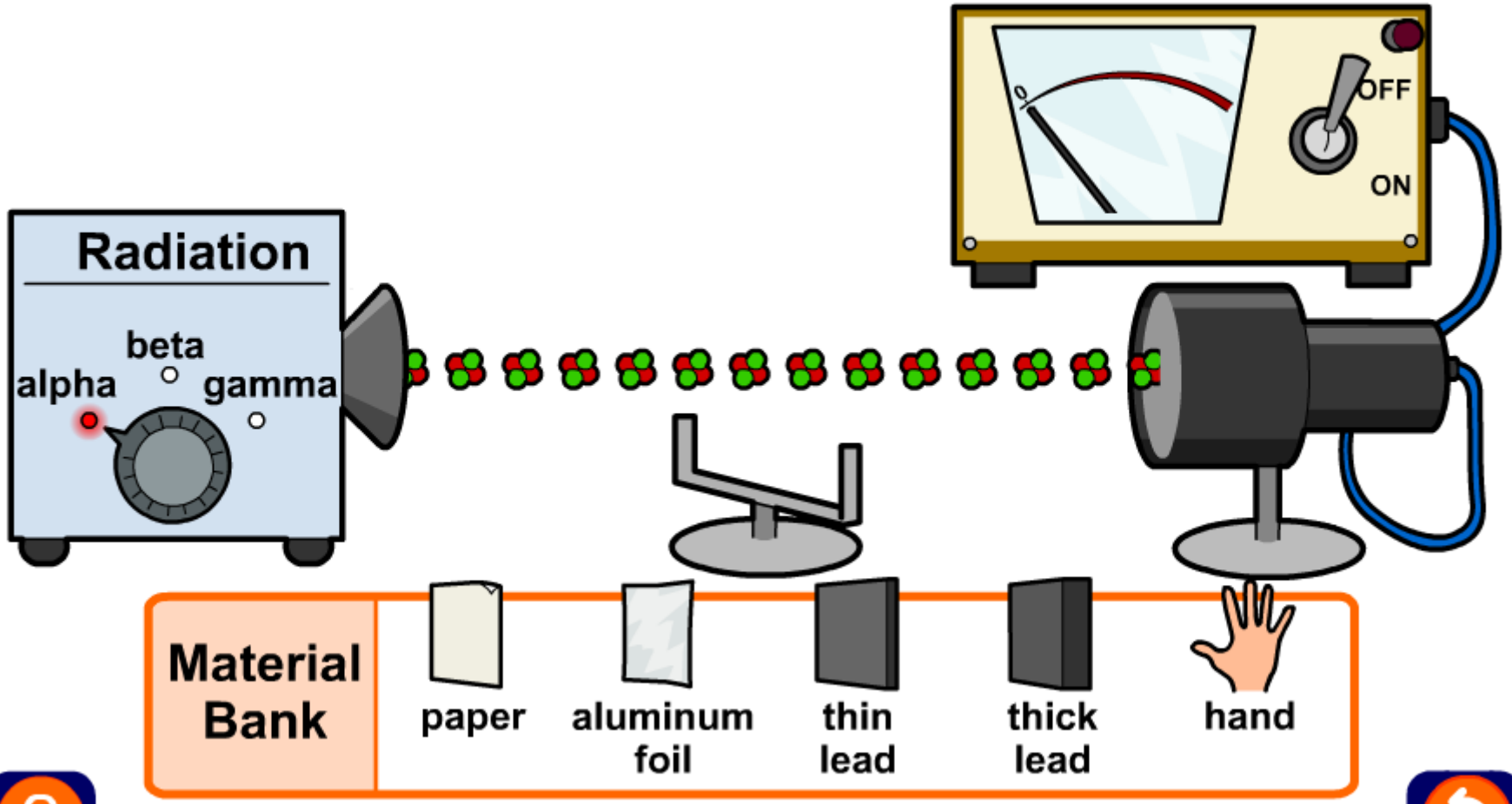
$$^{60}_{27}Co \rightarrow {}^{60}_{28}Ni^{*} + \beta \rightarrow {}^{60}_{28}Ni + \gamma$$

The nickel **does not** change into a new element.

# Radioactive decay – true or false?

# How do materials affect radiation?

## Investigate the penetrating power of radiation



# How do magnetic fields affect radiation?

# What is alpha (α) radiation?

| | |
|---|---|
| **Description** | 2 neutrons, 2 protons<br>  <br>**Note:** An alpha particle is the same as a helium nucleus |
| **Electric charge** | +2 |
| **Relative atomic mass** | 4 |
| **Penetrating power** | Stopped by paper or a few centimeters of air |
| **Ionizing effect** | Strongly ionizing |
| **Effect of magnetic/ electric field** | Weakly deflected |

# What is beta (β) radiation?

| | |
|---|---|
| **Description** | High-energy electron  |
| **Electric charge** | –1 |
| **Relative atomic mass** | 1/1860 |
| **Penetrating power** | Stopped by a few millimeters of aluminum |
| **Ionizing effect** | Weakly ionizing |
| **Effect of magnetic/ electric field** | Strongly deflected |

# Gamma (γ) radiation

| | |
|---|---|
| **Description** | High-energy electromagnetic radiation  |
| **Electric charge** | 0 |
| **Relative atomic mass** | 0 |
| **Penetrating power** | Stopped by several centimeters of lead or several meters of concrete |
| **Ionizing effect** | Very weakly ionizing |
| **Effect of magnetic/ electric field** | Not deflected |

# Types of radiation and penetrating power

What is the penetrating power of each type of radiation?

| | |
|---|---|
| gamma | stopped by a thin layer of aluminum |
| alpha | can only be stopped by thick lead |
| beta | stopped by paper or skin |

?

solve

# Types of radiation and range in air

What is the range in air of each type of radiation?

| | |
|---|---|
| alpha | travels a few centimeters in air |
| gamma | can only be stopped by thick lead |
| beta | travels a few meters in air |

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