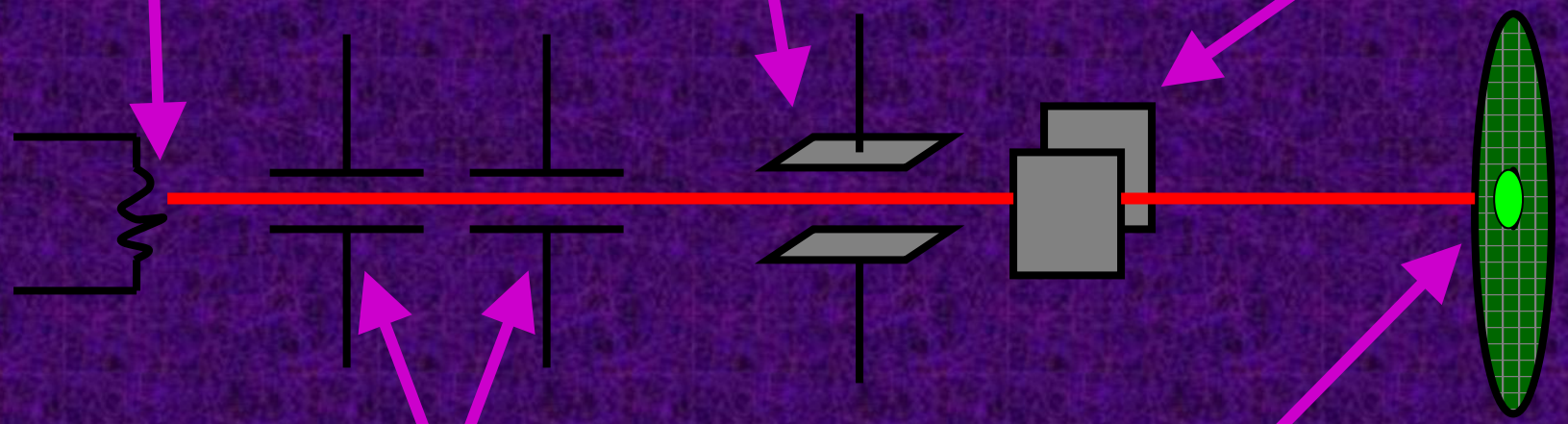
Download more resources like this on ECOLEBOOKS.COM

Parts of a cathode ray tube

The **filament** is a heated wire from which electrons are emitted.

Y plates deflect the electron beam vertically.

X plates deflect the electron beam horizontally.



Anodes attract the electrons produced at the filament and accelerate them.

A **fluorescent screen** allows the position of the electron beam to be seen.

Download more resources like this on ECOLEBOOKS.COM

How does a cathode ray tube work?

The hot metal filament emits electrons.

↓

The electrons are attracted to the anodes and accelerated.

↓

Electron beam passes through the X and Y plates.

↓

Electrons strike the fluorescent screen and the beam is seen as a spot of light.

Download more resources like this on ECOLEBOOKS.COM

What are electron beams used for?

oscilloscopes

TV tubes

electroplating

X-ray production

monitors

combustion engines

Download more resources like this on ECOLEBOOKS.COM

Kinetic energy of an electron beam

An electron beam can be treated as a flow of electrons and so the kinetic energy of the electrons can be calculated using:

kinetic energy = electronic charge x accelerating voltage

$$KE = eV$$

What are the units of kinetic energy, charge and voltage?

- Kinetic energy is measured in **joules (J).**
- Charge is measured in **coulombs (C).**
- Voltage is measured in **volts (V).**

Download more resources like this on ECOLEBOOKS.COM

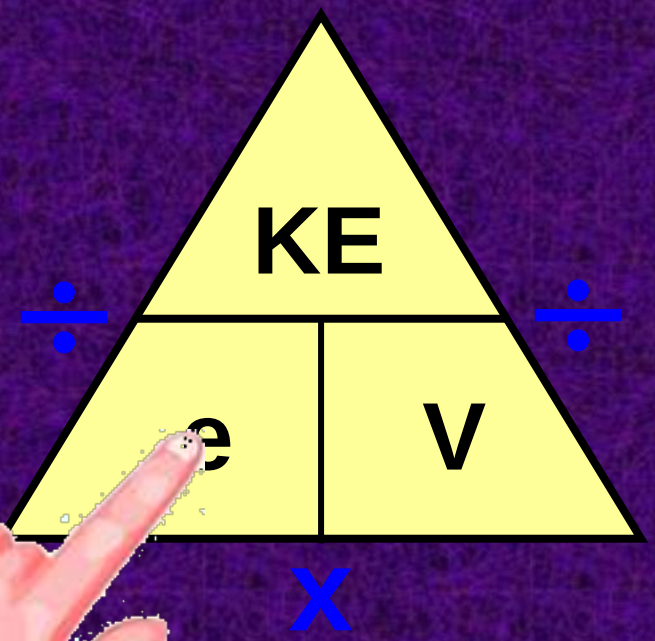
Electron beam formula triangle

A formula triangle helps you to rearrange a formula. The formula triangle for the kinetic enegy of an electron beam (**KE = eV**) is shown below.

Cover up the quantity that you want to work out and this will leave the formula required for the calculation.

So if you are trying to work out charge (**e**)...

…cover up **e**…



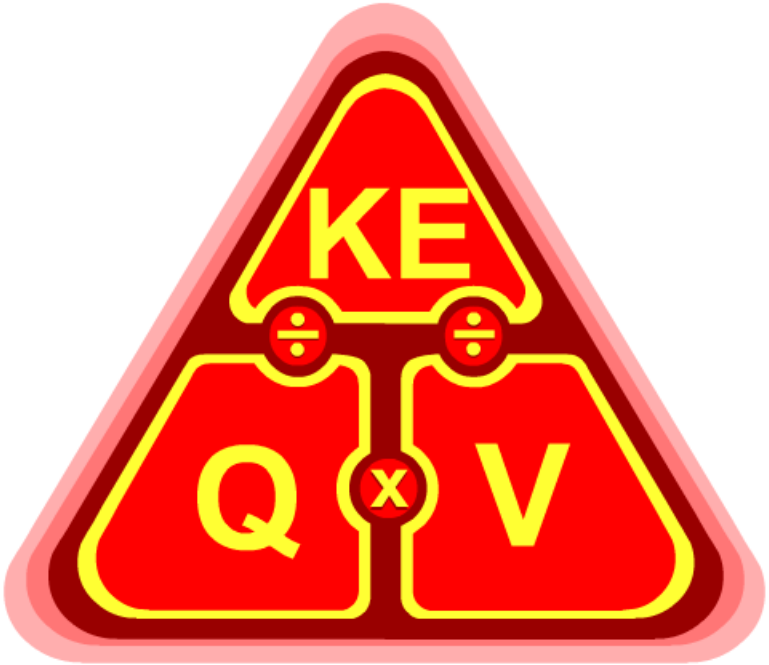
…which gives the formula…

$$e = \frac{KE}{V}$$

Download more resources like this on ECOLEBOOKS.COM

Using the kinetic energy formula triangle

Formula triangle



Download more resources like this on ECOLEBOOKS.COM

Calculating the kinetic energy of an electron

What is the kinetic energy of an electron accelerated by a 45 000 V accelerating voltage?

Take the charge on an electron to be 1.6×10^{-19} C.

Download more resources like this on ECOLEBOOKS.COM

Calculating the kinetic energy of an electron

What is the kinetic energy of an electron accelerated by a 45 000 V accelerating voltage?

Take the charge on an electron to be 1.6×10^{-19} C.

$$KE = eV$$

$$KE = 1.6 \times 10\text{-}19 \times 45\ 000$$

$$KE = 7.2 \times 10\text{-}15\ J$$

Download more resources like this on ECOLEBOOKS.COM

Glossary

- **absolute zero –** The lowest possible temperature which is equal to -273°C. At this temperature particles cannot move any slower and have the minimum kinetic energy.
- **cathode ray tube –** A device with a heated filament which emits an electron beam that can be seen when it hits a fluorescent screen.
- **Einstein –** The scientist who worked out how to calculate the energy released when mass changes into energy.
- **electron beam –** A stream of electrons that have been emitted from a hot cathode and accelerated by anodes.
- **Kelvin –** The temperature scale which uses absolute zero as its zero (0 K).
- **pressure –** This property of a gas is caused its particles bouncing off the walls of the container. It is directly proportional to the temperature of the gas.