

# Proportions

This set of exercises aims to help you to understand how small the electric charge of a single electron is. It also serves to understand the number of electrons that we need to make a single Coulomb. Talking about math, you need to understand how to solve proportions and how to work with fractions, so if that is not clear, this could be a perfect excuse to get expertise on those two topics.

Solved examples in Youtube:



["Cómo trabajar con proporciones matemáticas"](https://www.youtube.com/watch?v=LhaLQPOZQLQ)

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**Example:**

How many electrons does -1 C have, if the electric charge of one electron is  $-1,6 \times 10^{-19} \text{ C}$ ?

**Solution:**

Known proportion, including units:  $\frac{1 (e)}{-1,6 \times 10^{-19} (C)}$

Unknown proportion, including units:  $\frac{x (e)}{-1 (C)}$

Equating proportions:  $\frac{1}{-1,6 \times 10^{-19}} = \frac{x}{-1}$

Solving for x:  $x = \frac{1 \cdot -1}{-1,6 \times 10^{-19}}$

Answer:  $x = 6,25 \times 10^{18} e$

**1.** How many electrons does -1 C have, if the electric charge of one electron is  $-1,6 \times 10^{-19} \text{ C}$ ?

*Answer:* There are  $6,25 \times 10^{18}$  electrons in -1 C.

**2.** If a metal losses 50 pC, how many electrons were moved?

*Answer:* a total of 312,5 millions of electrons have been removed from the metal.

**3.** How much electric charge is stored in a device if it contains 750 T electrons?

*Answer:* the electric charge in the device is  $-0,12 \text{ mC}$ .

**4.** If a cell is an electron, and a person has  $31,2 \times 10^9$  cells, how many people do we need to make -1 C?

*Answer:* we need to sum up the cells of 200,32 million people to make -1 C.

**5.** If a hard drive has 1 Terabyte of capacity, and 1 byte is equal to 8 bits, and 1 bit is 1 electron, how many hard drives do we need to make -1 C?

*Answer:* we need 0,78125 millions of hard drives to make -1 C.

**6.** If an electron is a character, how many libraries do we need to make -1 C? 1 page equals 1500 characters, 1 book equals to 500 pages, 1 library equals to 10.000 books.

*Answer:* 833,33 millions of libraries make -1 C.

**7.** If a human hair is an electron, how many people do we need to have -1 C? An average human has 150.000 hairs.

*Answer:*  $41,667 \times 10^{12}$  persons makes -1 C. It is 41,667 millions of millions.

**8.** If the population of the earth is 7.000 millions, and a human hair is an electron, how many planets do we need to make -1 C.

*Answer:* 5.952,4 planets, full of people, full of hair, make -1 C.

**9.** If a grain of sand is an electron, how many cubic meters do need to make -1 C? Suppose that a sand is a cube with 0.1 mm in each side.

*Answer:* We need 6,25 million of cubic meters to make -1 C.

**10.** If a drop of water is an electron, how many cubic meters do we need to make -1 C? An average drop of water has 0,05 ml.

*Answer:* 312.500 millions of cubic meters make -1 C.

**11.** If an Olympic swimming pool has 2.500 m<sup>3</sup>, and a drop of water equals an electron, how many swimming pools do we need to make -1 C?

*Answer:* 125 millions of Olympic swimming pools makes -1 C.

**12.** If 1 cm is an electron and the diameter of the solar system is  $9,09 \times 10^9$  km, how many solar systems do we need to make -1 C?

*Answer:* 6.875,7 solar systems make -1 C.

**13.** If a leaf is an electron and an average tree has 63.000 leaves, and there are  $3,04 \times 10^9$  trees in the planet, how many planets do we need to make -1 C?

*Answer:* 32,634 thousand of planets, full of trees, full of leaves, make -1 C.

**14.** if and insect is an electron and there are  $1 \times 10^{19}$  insects in the world, what is the equivalent electric charge of the world?

*Answer:* the equivalent electric charge of a world full of insects is -1.6 C.

**15.** If a drop of water is equivalent to an electron and the Mediterranean Sea is 3.750.000 km<sup>3</sup> of volume, what is the electric charge of the Mediterranean Sea? The volume of a drop is 0,05 ml.

*Answer:* the equivalent electric charge of the Mediterranean Sea is -12 kC.

**16.** If 1 cm<sup>2</sup> is an electron and the surface of the world is 510.1 million km<sup>2</sup>, what is the electric charge of the world?

*Answer:* the equivalent electric charge of the world is  $-8,16 \times 10^{-7} C$ .

**17.** According to WhatsApp Usage Statistics, as of May 2018, WhatsApp users sent 65 billion messages per day, if a single message is an electron, how many centuries do we need to make -1 C?

*Answer:* we need to wait 2.634,4 centuries to have an equivalent -1 C.

**18.** If people upload 657 billion photos to Internet per day, and a photo is an electron, how long will it take to make 1 Coulomb?

*Answer:* we need to wait 260,63 centuries to have an equivalent -1 C.

**19.** According to the Bank for International Settlements the total amount of money in the world is about \$ 5 trillions, if 1 dollar equals 1 electron, what is the charge of the world?

*Answer:* the equivalent electric charge of all the money in the world is  $-8 \times 10^{-7} C$ .

**20.** A chicken lays 250 eggs per year, if we consider 23.7 billion chickens in the world, and that an egg is an electron, what is the total electric charge in 100 years?

*Answer:* the equivalent electric charge is  $-94,8 \times 10^{-3} C$ .