### Scientific notation

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**ARITMÉTICA**

15

***Back to the Big Bang*: the timeline of the Universe (II)**

Let us make a journey in time to the past from the present moment and see some of the most relevant physical events during the evolution of the Universe:

• News (13.7 billion years since the Big Bang). At CERN, physicists have started a journey in time to determine the origin of the matter that makes up our Universe. The cosmic background temperature has dropped to almost -270 oC. Does our thermal death begin?

• Life on Earth (10 billion years since the Big Bang). A soup of organic molecules appears on Earth, a small blue planet located at the edge of the Milky Way, a medium-sized spiral galaxy lost in the vastness of the Universe.

• Solar System (9.2 billion years since the Big Bang). The force of gravity has grouped the star residues around the Sun to form a planetary system.

• Stars and galaxies (200 million years after the Big Bang). The force of gravity attracts the material cosmic dust and the light atoms merge in the heart of the stars, which are gradually grouped in clusters and galaxies. Heavy atoms begin to be produced as a result of nuclear fusion reactions. The cosmic temperature drops to 4,000 oC.

• Light atoms (380,000 years since the Big Bang). The first hydrogen and helium atoms are formed. The photons escape the interaction with the electrons and the Universe is illuminated for the first time.

• Light cores (3 minutes from the Big Bang). Protons and neutrons come together to form the nuclei of light atoms. Photons are continuously emitted and absorbed by matter. Everything is dark, the Universe is opaque.

• Protons and neutrons (0.01 milliseconds after the Big Bang). Protons and neutrons are formed from quarks and gluons. The entire existing Universe is the size of the current Solar System. The cosmic background temperature exceeds one trillion degrees Celsius.

• Plasma of quarks and gluons (one trillionth of a second since the Big Bang). The weak nuclear force and the electromagnetic force come into action. The radius of the Universe does not reach 300 million kilometers. The cosmic background temperature is 10 billion trillion degrees Celsius.

• Zoo of particles (10-35 s after the Big Bang). One trillionth of a trillionth of a trillionth of a second after the great explosion, hardly a cosmic sigh. Mesons, electrons, quarks, neutrinos and photons interact continuously. The strong nuclear force and the electroweak force dominate a universe that fits in an apple. The cosmic background temperature is 1 trillion trillion trillion degrees Celsius.

• t = 10-43 s, T = 1032 oC. Dawn of the Big Bang: origin of our horizon of temporary exploration. The entire Universe, concentrated in one point, has just exploded.

 Express the temporal quantities of the text in scientific notation and with the indicated unit of measure.

**1**

 Express the previous amounts in seconds.

**2**

 Express in decimal logarithmic scale the temporal values corresponding to each of the previous milestones.

**3**

Find the proportion corresponding to the temporal distance between the consecutive milestones.

**4**

What can be deduced from the results obtained?

Imagine that the entire history of the Universe could be concentrated in the period of time corresponding to a single solar year. At what time point of that year would we find ourselves today??

**5**

Discuss and reflect with your colleagues about the results obtained in the previous activities.

**6**

What conclusions can be drawn?

What new questions would you ask from the model of temporal evolution of the Universe that has been worked on?

**7**

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