

## Week 2: Plasma and Its Uses

**1 Prepositions:** Fill the gaps in the following text with prepositions

Plasma is a highly ionized gas \_\_\_\_\_ which the number of free electrons is approximately equal \_\_\_\_\_ the number of positive ions. Sometimes described \_\_\_\_\_ the fourth state of matter, plasmas occur in interstellar space, atmospheres of stars (including the sun), discharged tubes and in experimental thermonuclear reactors.

Because the particles \_\_\_\_\_ a plasma are charged, its behaviour differs \_\_\_\_\_ some respects \_\_\_\_\_ that of a gas. Plasmas can be created in the laboratory \_\_\_\_\_ heating a low-pressure gas until the mean kinetic energy of the gas particles is comparable \_\_\_\_\_ the ionization potential of the gas atoms or molecules. \_\_\_\_\_ very high temperatures, \_\_\_\_\_ about 50 000 K upwards, collisions between gas particles cause cascading ionization of the gas. However, \_\_\_\_\_ some cases, such \_\_\_\_\_ a fluorescent lamp, the temperature remains quite low as the plasma particles are continually colliding \_\_\_\_\_ the walls of the container, causing cooling and recombination. \_\_\_\_\_ such conditions, the ionization is only partial and requires a large energy input. In thermonuclear reactors an enormous plasma temperature is maintained \_\_\_\_\_ confining the plasma away \_\_\_\_\_ the container walls using electromagnetic fields.

**2 Reading:** Read the text and fill the gaps with the words suggested below

**predict      storm      current      damage      identified      erupt      state      form      particles  
caused**

Ninety-nine percent of the visible stuff in our universe is in the \_\_\_\_\_ of plasma, ionized gas that is also known as the fourth \_\_\_\_\_ of matter. Flames are plasmas. Lightning is a plasma. Auroras are \_\_\_\_\_ by plasmas, and every fluorescent tube is filled with the stuff. It is also found in the ionosphere, the Earth's upper atmosphere. Stars are balls of super-hot plasma and nebulae are clouds of it.

Since William Crookes first \_\_\_\_\_ plasma in 1879, the phenomenon has captured physicists' imaginations, yet until recently little was known about plasmas. Now in the communications era, understanding plasmas is becoming increasingly important, said Christopher Watts, a physicist at New Mexico Tech. When solar flares \_\_\_\_\_, massive ejections of plasma known as the solar wind can wipe out satellite systems and bring down power grids. In 1989 a huge solar flare left six million people in Quebec without power; in 1998 a flare was blamed for a daylong disturbance to millions of cell phone customers. In 2003, a huge gust of solar wind struck the earth's atmosphere causing a geomagnetic \_\_\_\_\_ rated at G4, the second highest rating on the agency's space weather scales. G4 storms are powerful enough to cause \_\_\_\_\_ to both power lines and satellites. "We can't do anything to stop these events," Mr. Watts said, "but if we could \_\_\_\_\_ them, we could act to protect satellites and grids."

The relationship between plasmas and magnetic fields is crucial to understanding solar flares. Plasmas are a mixture of charged \_\_\_\_\_ (electrons and ions), and hence motions within a plasma can generate circulating streams of electrical \_\_\_\_\_.

**3 Grammar:** In the article above, identify forms of the passive voice

**4 Use the following expressions in sentences**

... also known as ...                      ...is found in ...                      ...was blamed for ...  
... is filled with ...                      ... little was known about ...                      ...is caused by ...

**5 Vocabulary:** In the text in the activity 2 find words that fit the meaning of the following explanations. The words occur in the text in the same order as their explanations in this activity.

Substance

Clouds of gas or dust in interstellar space

Caught

Crucial

A sudden flash of increased brightness on the sun

A constant stream of plasma and particles emanating from the sun

Destroy, devastate

Make sth fall to the ground

Electricity

Failure

A region around a magnetic material within which the force of magnetism can be detected

**6 Grammar:** Rewrite the following sentences in the passive voice

William Crookes discovered plasma in 1879.

Plasmas cause auroras.

The discovery has captured physicists' imaginations.

They blamed a huge solar flare for a daylong disturbance to cell phones in 1998.

Motions within a plasma generate circulating streams of electrical current.

At present, we are dumping 24 billion tonnes of carbon dioxide into the atmosphere every year.

We won't recognize the warming effect until it is too late.

We have used rapidly increasing amounts of fossil fuels.

We may have already done the damage.

The experts expect the temperatures to increase by at least 1.3 °C by 2030.

What changes can such temperature increases bring about in our world?

**7 Word Formation:** Use the word given in capitals to form a word that fits in the space

The research has shown why certain surgical \_\_\_\_\_ for the relief of epilepsy can have disastrous effects on certain types of memory. PROCEED

The teacher clearly indicated to students the \_\_\_\_\_ and weaknesses of the work submitted. STRONG

The \_\_\_\_\_ of the volcano Krakatau was one of the most violent in history. ERUPT

The understanding of plasma is becoming \_\_\_\_\_ important. INCREASE

G4 storms are \_\_\_\_\_ enough to cause damage to both power lines and satellites. POWER

**8 Listening:** Answer the following questions

<https://www.youtube.com/watch?v=yulBSCAEyMM>

1 Why is the definition of a plasma as an ionized gas incomplete?

2 What do you need to form a plasma from all three states of matter?

3 Explain the difference between fully and partially ionized plasma

4 What do  $n$ ,  $v$ ,  $T$ ,  $m$ , and  $k$  [subscript  $b$ ] represent in the expression for the Maxwellian?

Sources:

Wertheim, Margaret. "Machines Explore Odd Behaviours of Ubiquitous Plasmas." *The New York Times* 2013.

Zemanová, Alena. *Angličtina pre fyzikov*. Bratislava: Univerzita Komenského Bratislava, 2007.