



STUDENTS' WORKSHEET

ARCTIC ISSUES: THE CHANGING ARCTIC



TASK 1.

Match the beginning of the sentence on the left with a proper end on the right:

The most important greenhouse gases are: water vapour, move a system away from its equilibrium state and make it more unstable.
Greenhouse gases transmit radiation emitted by the Sun and absorb radiation emitted from the Earth's surface. This way...	... and less sun radiation reach the Earth's surface.
The greenhouse effect is the phenomenon of increasing the temperature of the planet due to greenhouse gases present in its atmosphere. and it increases the air temperature, which causes further melting of sea ice.
A positive feedback loop enhances or amplifies changes. This tends to reveals the darker ocean surface. It cause the decrease of albedo.
When the sea ice cover melts, heat escapes from the ocean to the atmosphere It changes the Earth's surface temperature by 33°C.
The extent of sea ice is decreasing due to climate change and carbon dioxide and methane.
Due to higher temperature, evaporation increases. There are more clouds an isolation layer and prevent energy radiation from the Earth's surface.
However, during winter clouds act as they retain part of the energy that causes the increase of temperature.



TASK 2.

Complete the terms and definitions

Complete the table by adding missing terms or definitions.

Term	Definition
	a measure of surface reflectivity; in case of the Earth, it says how much sunlight (energy) is reflected back to space
Feedback loop	
	a type of ice formed by the freezing of seawater
Greenhouse effect	



TASK 3.

Calculate sea ice loss

The area covered by sea ice in the Arctic varies over seasons, but also over years due to climate change. Sea Ice Extent index [mln km²] provides a quick look on changes in sea ice in the Arctic. It provides daily, consistently processed ice extent and concentration from images taken by satellites since 1979. You may play a short quiz about the sea ice extent:

<https://polarpedia.eu/en/fill-in-the-gaps-sea-ice-extent-index/>.

Check the latest data on the sea ice extent in the Arctic on the website:

<https://nsidc.org/arcticseaicenews/charctic-interactive-sea-ice-graph/>.

Minimum sea ice extent is observed usually in mid-September, when the average air temperature drops below 0°C. Check the average minimum extent and the minimum extent in the last September. Fill in the table below, calculate the sea ice loss and compare it to the area of your country.

Average minimum sea ice extent (median of 1981-2010)	
Minimum sea ice extent in last September	
Sea ice loss area	
Percentage change (sea ice loss area/median area x 100%)	
Area of your country	
Sea ice loss area/Area of your country	

Conclusion: During last summer the sea ice loss area was time higher than the area of

TASK 4.



Are these phenomena examples of **POSITIVE** or **NEGATIVE** Feedback loop? Underline the correct answer.

With the higher temperature, the sea ice extent in the Arctic decreases. It changes the albedo and causes further rise of the air temperature.

POSITIVE/NEGATIVE Feedback loop

Higher temperature increases evaporation. More clouds are formed, which reflect solar radiation and less energy comes to the ground.

POSITIVE/NEGATIVE Feedback loop

Higher temperature increases evaporation. More clouds are formed, which block the radiation from the Earth and keep warmth below the cloud level.

POSITIVE/NEGATIVE Feedback loop

Less snow cover in boreal forests reduce humidity. Forests are more exposed to fires. Fires cause additional emissions of CO₂ to the atmosphere.

POSITIVE/NEGATIVE Feedback loop

Permafrost contains organic matter. When it thaws, organic matter starts to decay and additional greenhouse gases are released to the atmosphere.

POSITIVE/NEGATIVE Feedback loop

TASK 5.



Melting Greenland ice sheet

Greenland ice sheet has lost 4,7 trillion tons ($4,7 \cdot 10^{12}$ tons) of ice since 2000.

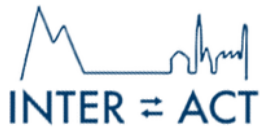
During only one summer in 2019 it lost 600 billion tons of ice.

Let's check how deep would be the layer of water from the Greenlandic ice, if it was poured on the surface of your country.

Use the data below to calculate (theoretically) how much water would cover the area of your country.

NOTE that these calculations are more demonstrative than accurate!

Greenlandic ice melt	600 000 000 000 tons
Volume of melted water (m ³)	
Area of your country (km ²)	
Area of your country (m ²)	



Height of water poured on the surface of your country (m or cm)	
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REMEMBER: volume = area x height, so height = volume/area

UNITS:

Area – km², m²

Height – km, m

Volume – m³

TIPS: First, calculate volume of water. Next change the units of area of your country from km^2 to m^2 , remember that $1 \text{ km}^2 = 1\,000\,000 \text{ m}^2$



TASK 6.

Many scientists say: “What happens in the Arctic, doesn’t stay in the Arctic.” How can you explain this sentence? How do the changes in the Arctic affect the weather patterns in mid latitudes?

[illegible]