Factors influencing sea level changes

An attempt for a teaching unit

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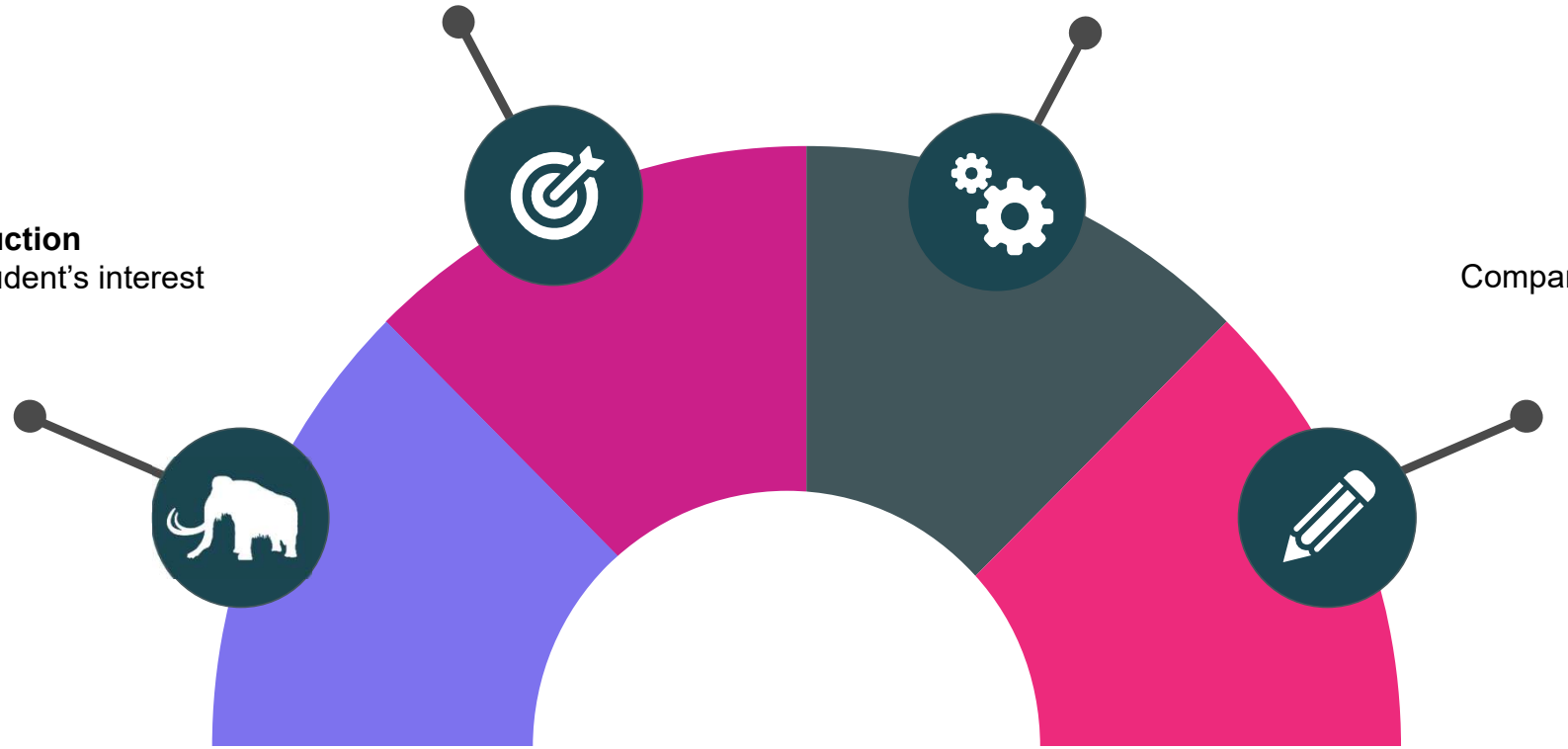
Procedure of the lesson

Problem
Setting the goal of the lesson

Elaboration
Working through the problem
with the help of AI

Introduction
Catching the student's interest

Cutout
Comparing and discussing
the results

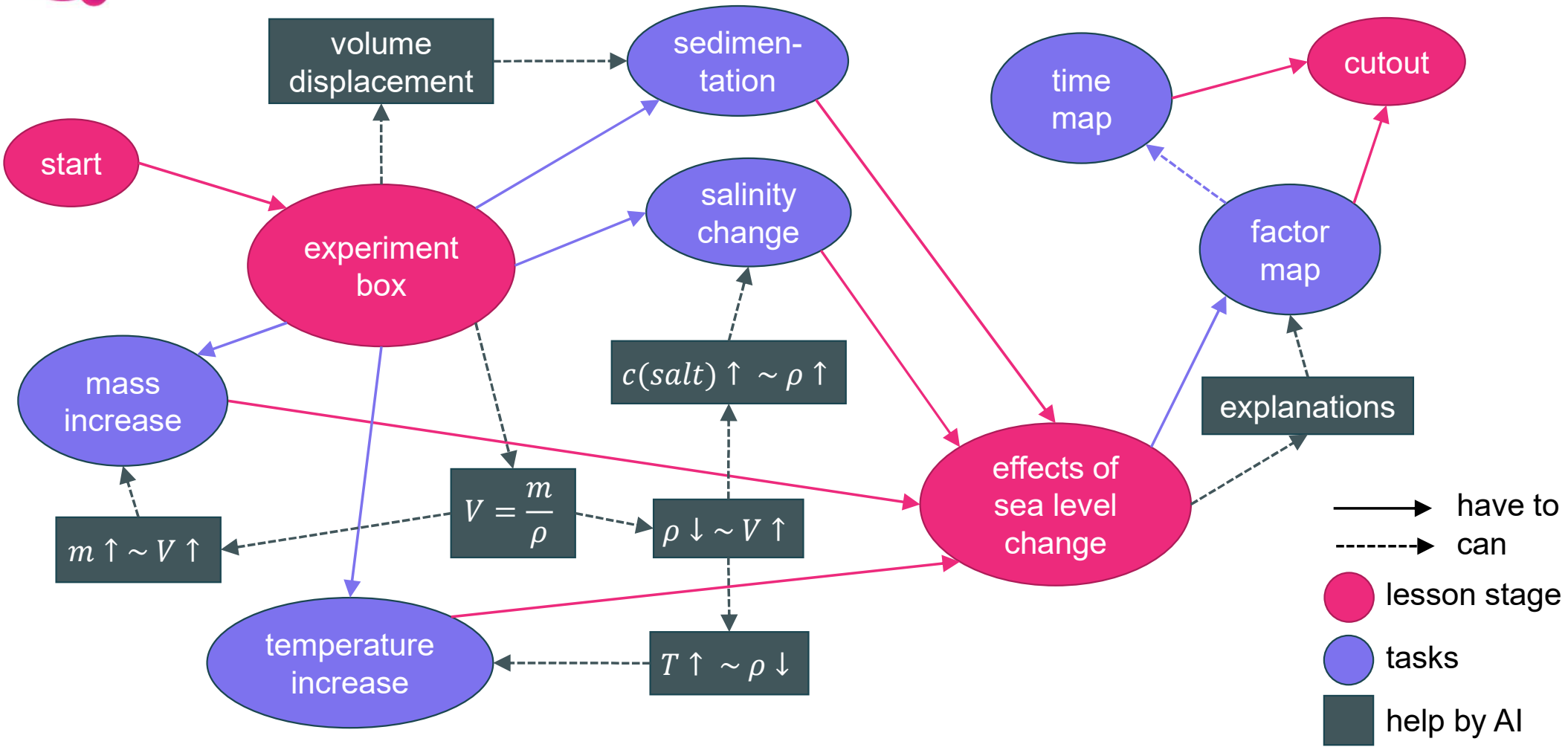


Teaching objectives of the lesson

- The students understand sea level as a dynamic principle.
  - The students can name six factors that influence the sea level.
  - The students are able to describe the mechanisms of sedimentation, mass increase, temperature increase and salinity decrease as factors to rise the sea level.
  - The students know the impact of changing sea levels on the European coastline.

- time: about 90 min
- grade: 8

Flow chart of the AI processes



Introduction to the lesson

Catching the students' interest

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The Telegraph

Fossil hunters find skeleton of 40,000-year-old woolly mammoth in North Sea

The bones were found at a depth of 100 feet off the east coast of England

How is this possible?

A. The woolly mammoth must have been an amphibious species that inhabited both land and sea.

B. 40,000 years ago, the North Sea could not yet have been a sea.

C. Early humans must have sacrificed the mammoth bones to their fertility gods on the high seas.

Pleistocene Europe

The Pleistocene (2.6 million - 10,000 B.C.) is the so called “Ice Age”. At the maximum of the last glacial, the sea level was about 130 m lower than today. This made the European coastline very different from today's.

The Problem

Setting the goal of the lesson

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What could be reasons for that?

Sedimentation
The principle of volume displacement: sediments displace seawater.

Volcanism
There are short-term changes in coastal courses and sea depths due to earthquakes and volcanism.

Temperature change
Changing temperatures influence the density and thus the volume of the water.

Mass change
Water comes in or disappears and thus changes the total volume.

Plate tectonics
There are long-term tectonic changes in the shape and depth of ocean basins.

Change in salinity
The salt content also influences the density and thus also the volume of the water.

Elaboration

Working through the problem
with the help of AI

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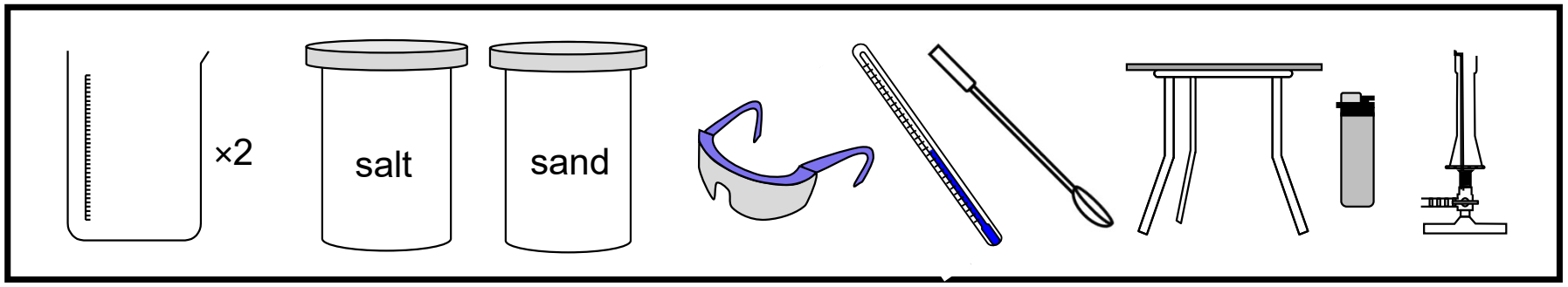
Part I – Students are given the same learning box with different material

low performer

moderate performer

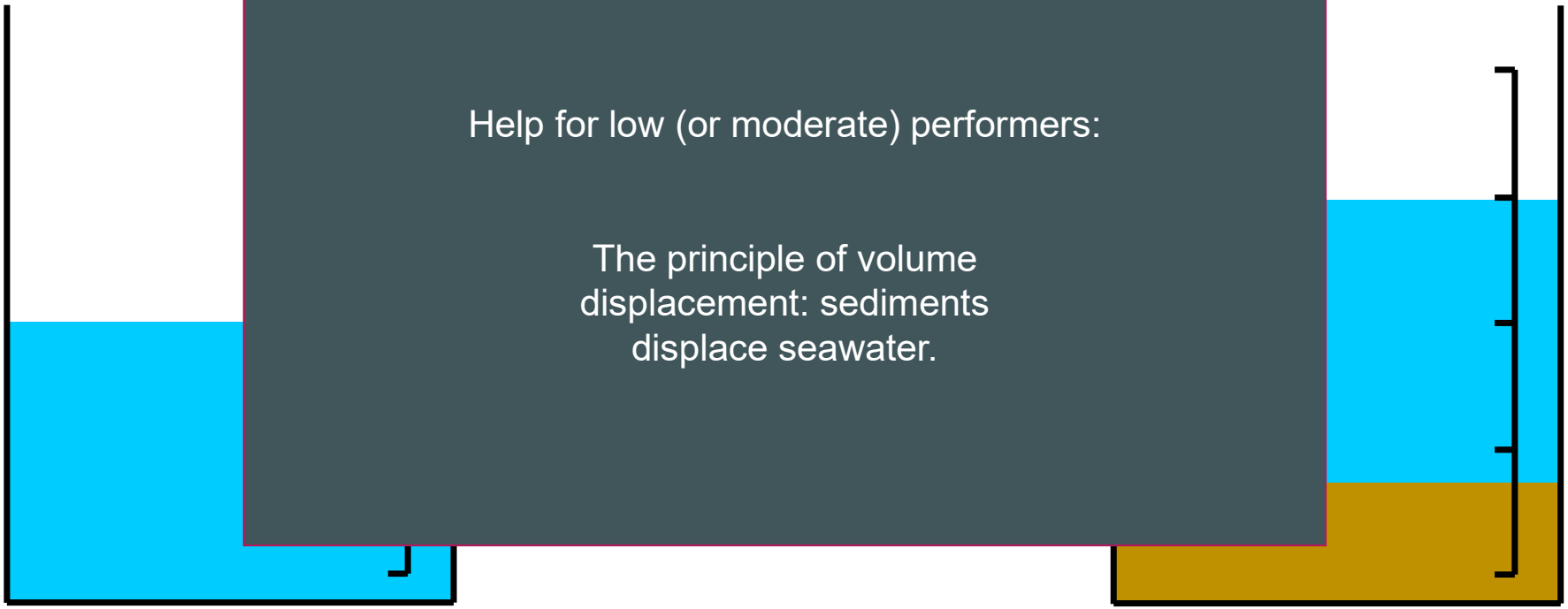
high performer



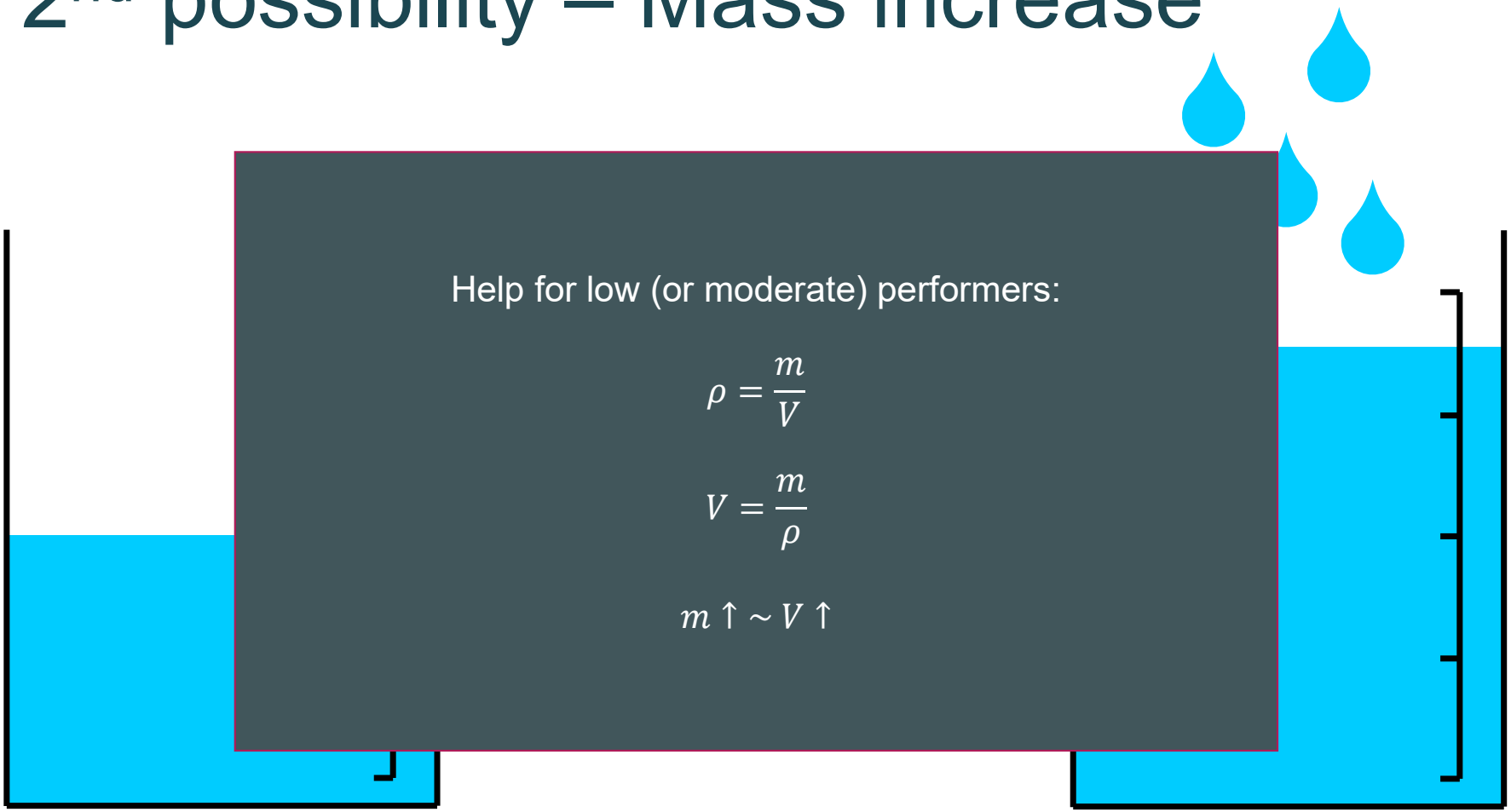
1st possibility – Sedimentation

Help for low (or moderate) performers:

The principle of volume displacement: sediments displace seawater.



2nd possibility – Mass increase



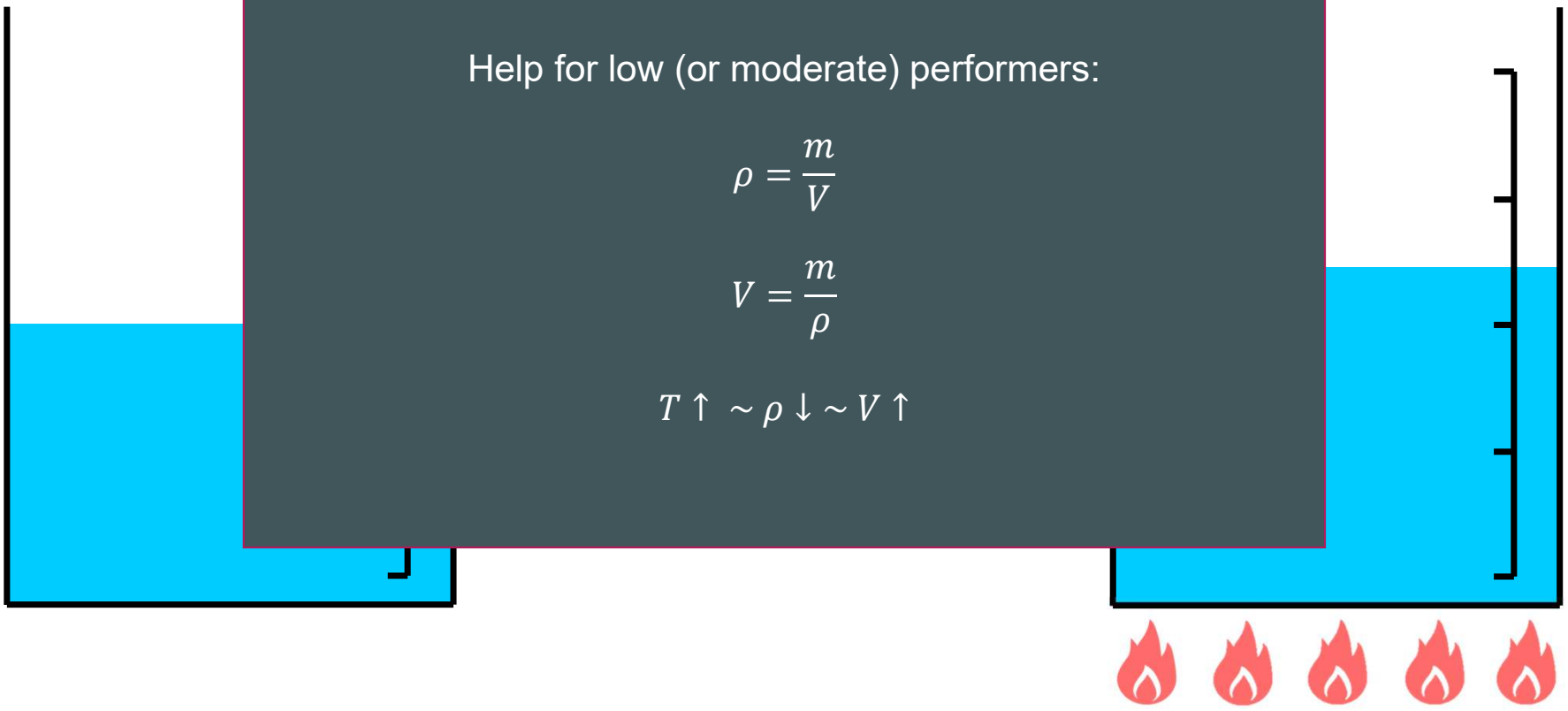
3rd possibility – Temperature increase

Help for low (or moderate) performers:

$$\rho = \frac{m}{V}$$

$$V = \frac{m}{\rho}$$

$$T \uparrow \sim \rho \downarrow \sim V \uparrow$$



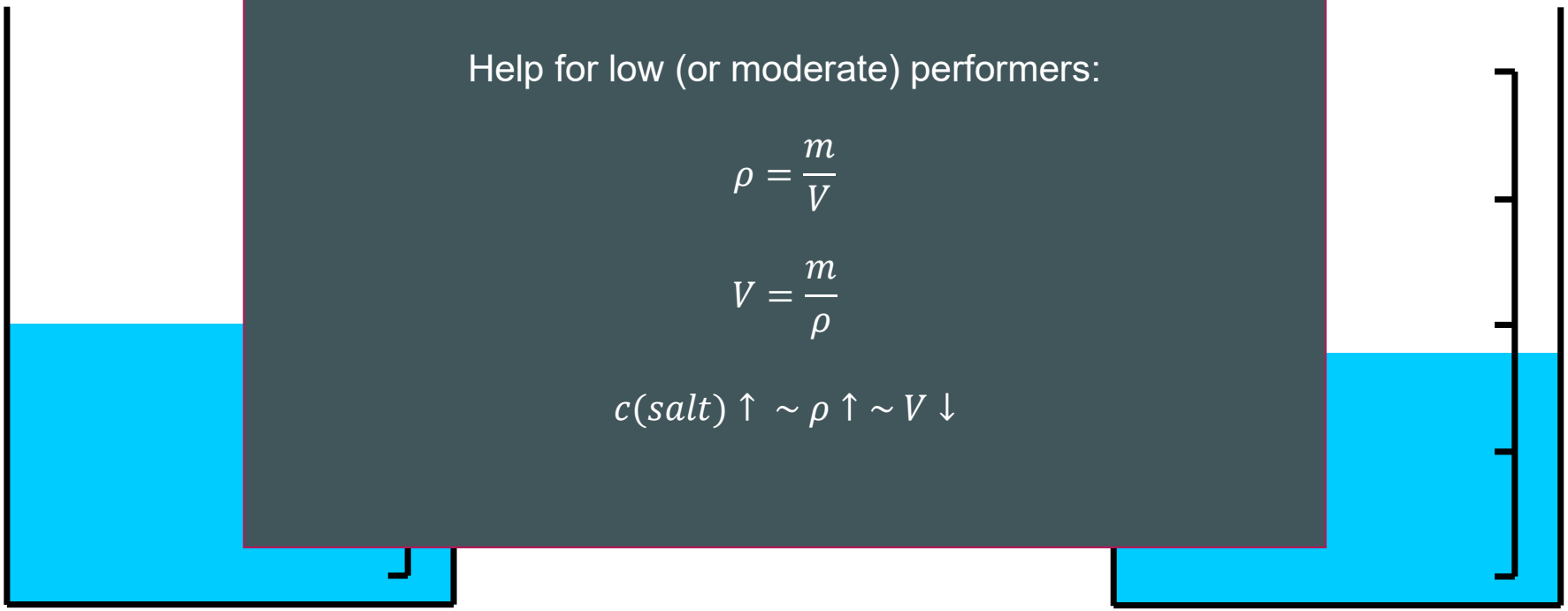
4th possibility – Salinity change

Help for low (or moderate) performers:

$$\rho = \frac{m}{V}$$

$$V = \frac{m}{\rho}$$

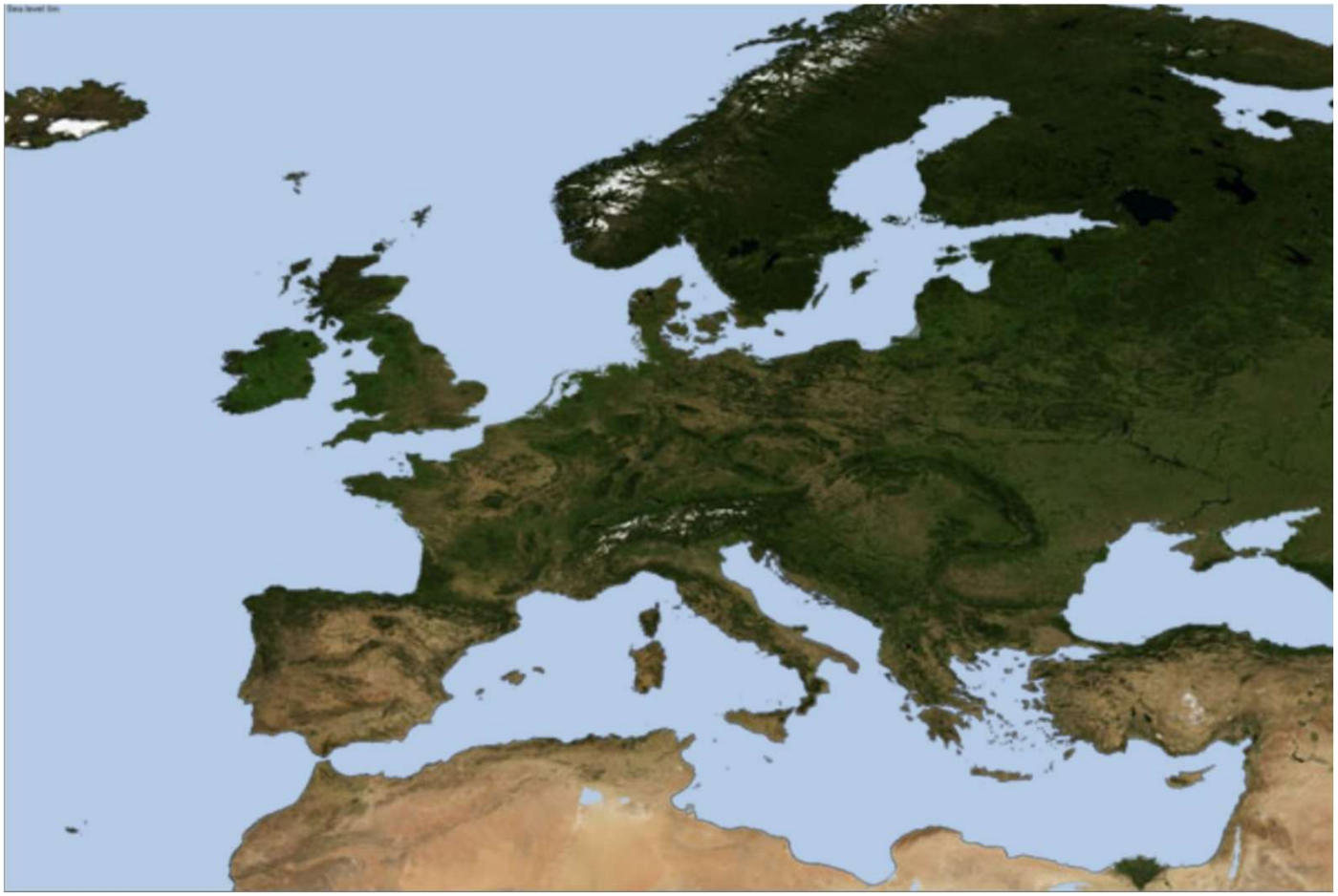
$$c(salt) \uparrow \sim \rho \uparrow \sim V \downarrow$$



Part II – Simulation of sea level changes

- There will be an AI-guided simulation environment.

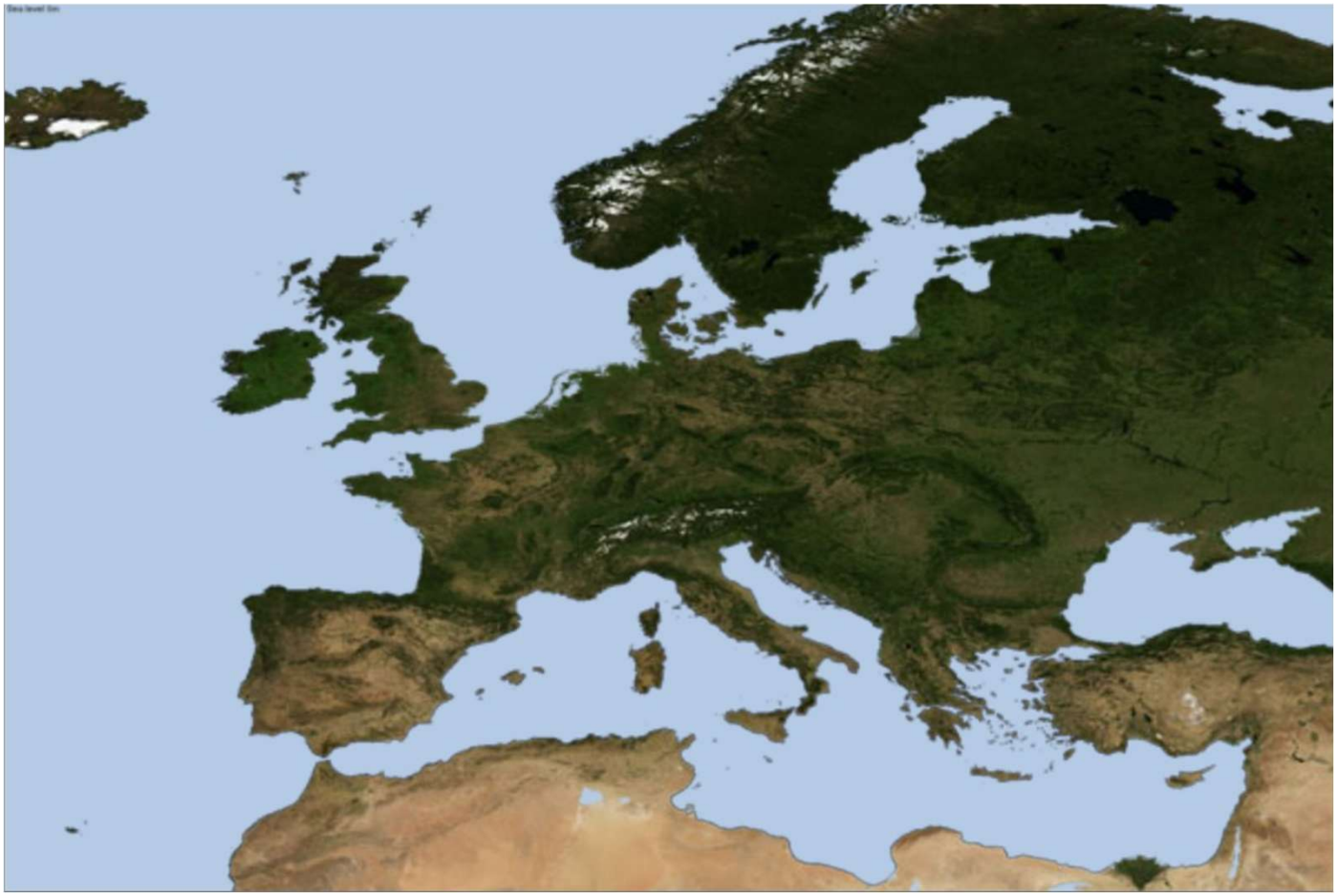
- Moderate and low performers get a simulation environment in which the European map is displayed depending on the factors already examined.
- High performers also get a simulation environment in which the European map is displayed depending on the course of time in addition.



Please set parameters!

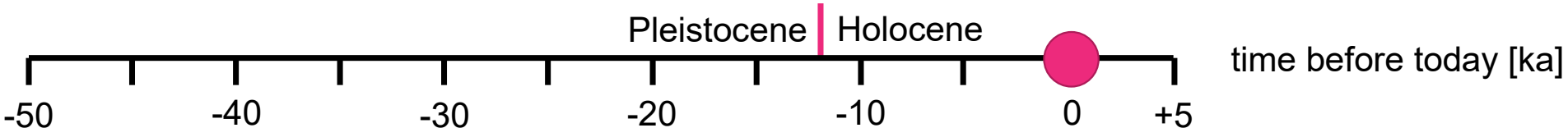
water temp.:	3.5	°C
total ice mass:	9.57*10^(19)	kg
sea floor rise:	0	m
salinity of water:	3.5	%

sea level change:	0 m
percentage land:	51.01%
percentage water:	48.99%



sea level change:	0	m
percentage land:	51.01	%
percentage water:	48.99	%
time before today:	0	ka

show glaciers



Possible questions to test the student

- Give the mass of ice that must melt for your school to stand right next to the beach.
- Give the water temperature that has the same effect on the sea level as a salinity of 1.2%.
- Give the mass of water that would have to freeze for the mammoth bones at a depth of 100 feet to be above sea level again. (100 feet = 30.48 m)

- State how many years ago the British Isles were connected to mainland Europe.

Cutout

Comparing and discussing the results

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The End