



Einstein, the crazy scientist

On the track of the lost water

14-15



Einstein, the crazy scientist

On the track of the lost water

Topic: Science - Biology, Chemistry, Physics

Level: Secondary school (14-15 years old)

Concepts: The importance of water in living organisms, the water cycle in nature

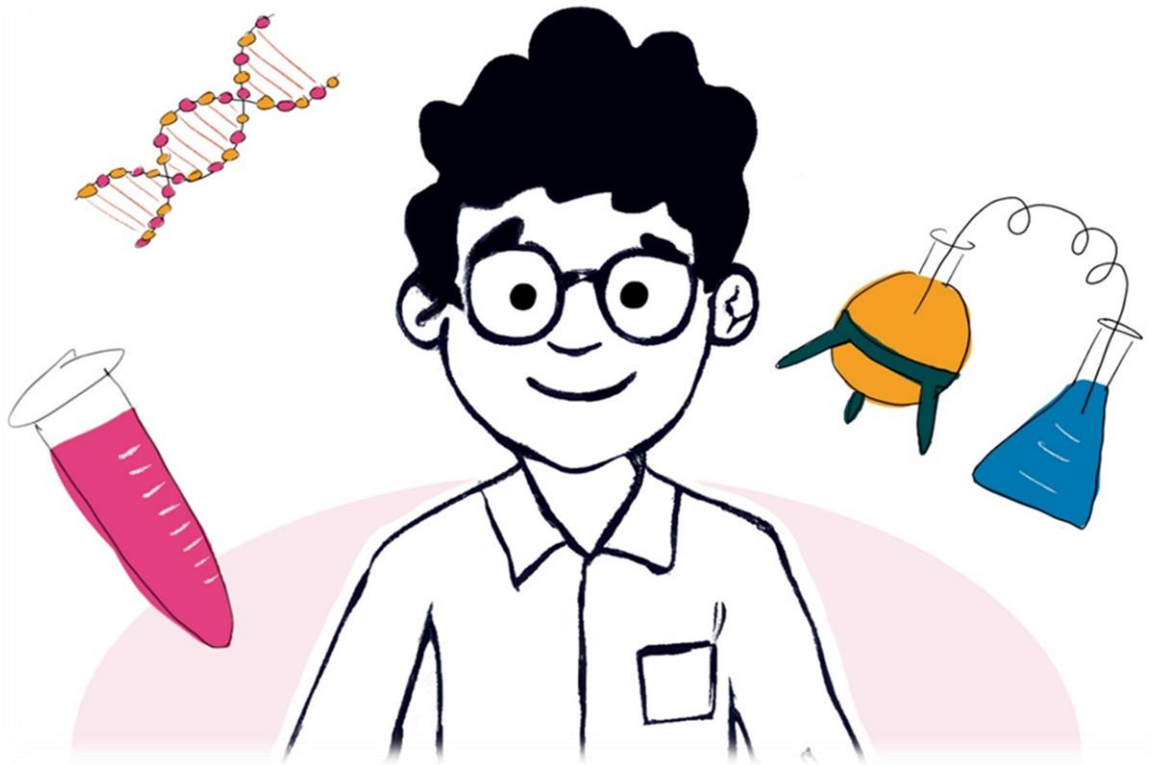
Time needed: +/- 30 minutes

Summary of the activity: A little scientist needs your help to find the cause of the water shortage that threatens the lives of the inhabitants of a small town.

Materials needed: Paper, pen, a periodic table of the elements, and... motivation!

Itinerary/Process Summary: This is a classic itinerary with multiple choices. The correct choice will lead to the progress of the story. Usually, the wrong choice leads to an explanation and a return to the previous paragraph to try again.

1



This is Einstein, the little scientist to whom we owe many of the innovations that make our everyday lives easier.

He invented the automatic vacuum cleaner, and he also created the device that prepares and serves breakfast in bed, making Sunday mornings perfect!

Nothing surprises this little genius and he always has an answer for everything!

 → **Go to paragraph 20.**

2

It looks like this and even the habitat matches. This is the rainbow trout.

 → **Go to paragraph 48.**

3

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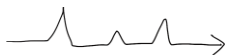
As you look inside the mill, you notice an interesting sound. One of the bags is covered with a striped tablecloth and when you lift it, a tablet screen lights up in your eyes. It displays the following text: "Wanderer, who passes by, remember this! There is a solution to every mystery if you use your mind! You never know when you might need something you may find unnecessary for the moment!"



Go to paragraph 13.

4

That's not what it looks like. This is a description of the carp.





Go to paragraph 46.

5

You must continue your journey on the river, the water mill is not the cause of the water shortage. In the water and along the water's edge, more and more plants are appearing, you are no longer walking among stones. Your capsule gets quite close to the roots of a waterfront plant hanging in the water. But suddenly it gets dark!

Einstein exclaims: "This plant has sucked us in! We're in some kind of very narrow capillary tube! The tunnel wall has an interesting thickening of twisted horns, with a ringed, pitted pattern and no partition anywhere, we are moving forward fast." Where are we now?

- In the xylem  **Go to paragraph 7.**
- In the phloem  **Go to paragraph 9.**

6

That's not what it looks like. This is a description of the pike.

 **Go to paragraph 46.**

7

You are actually in the xylem, one of the transport tissues of the plant, which was formed by the cells fusing together and the dividing partition between them disappeared.

 **Go to paragraph 16.**

8

Oops, that doesn't seem right. The drinking water is colourless, odourless, transparent but not exactly tasteless, and 7°C would be too cold.

 **Go to paragraph 23.**

9

You can't be in a phloem, because in the phloem there are sieve plates, which would slow down your progress.

 **Go to paragraph 5.**

10

Indeed, potable(fresh) water is colourless, odourless, transparent, doesn't have much taste and a temperature of between 7-15 °C.

 **Go to paragraph 32.**

11

Einstein is fascinated by water molecules. He is interested in what holds hydrogen and oxygen atoms together. Could you explain to him the kind of bonds between the atoms in a water molecule?

➤ Ionic bond  **Go to paragraph 36.**

➤ Covalent bond  **Go to paragraph 38.**

12

Photo from
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Suddenly, a water mill lifts you up a boost and you find yourself inside a small wooden hut.

"What is the time you measured?" asks Einstein. "Your clock says 300 seconds. I measured 600 metres," Einstein quickly looks at his watch.

Calculate the speed of water since you already know the formula in previous physics lessons!

Let's see the solution!

➤ The speed of the water is 0,5 m/s.

→ **Go to paragraph 40.**

➤ The speed of the water is 2 m/s.




→ **Go to paragraph 42.**

13

A little brain teaser!

In its golden age, this mill ground 10 hundredweight of grain a day. The mill worked 2880 J per 60 s. What was its output?

Let's see the answer!

- The mill had a power output of 2880 W.  **Go to paragraph 41.**
- The mill had a power output of 48 kJ.  **Go to paragraph 43.**
- The mill had a power output of 48 W.  **Go to paragraph 53.**

14

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And then another fall! It starts to rain, and you plunge into the waters of the Olt, right at the spring. There are no problems with water shortages here.

"I'm getting fed up with this up and down; my stomach is all upset, I feel dizzy!" says Einstein. "I could do with some peace and quiet now! But the rush goes on!"

 **Go to paragraph 27.**

15

Suddenly you notice that your little vehicle is not moving forward, as if you are standing still. "What happens if you don't move forward? You will never be able to find out the cause of the problem!", says Einstein. With the help of the shrinking machine, you change back to normal size, and then you notice that the waterway is blocked by a big dam.

Hey, a micro-hydroelectric power station!

 **Go to paragraph 17.**

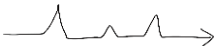

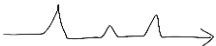
16

Then, suddenly, you experience the same floating sensation again that you once felt when you were in the cloud with the water evaporating from the glass. "I didn't even know that water evaporates from plants, just as it evaporates from a glass or from lakes and oceans," Einstein marvels. "What interesting connections between processes in nature!" You won't be surprised when you land back in the Olt as water droplets!

As you are swept along by the water, you notice that the water becomes more and more turbid.

You quickly explain: water is a very good solvent, dissolving solids and gases in the soil. However, there are some substances that are not soluble in water (e.g. sand, gravel, etc.). This can make river water muddy.

Which of the following is insoluble in water?

- Sodium chloride  **Go to paragraph 30.**
- Potassium permanganate  **Go to paragraph 37.**
- Oil  **Go to paragraph 39.**

17

"So, this is the cause of the water shortage!", exclaims Einstein. "We must act now! We must open the floodgates!"

You rush to the engine room, but the door is locked - it has a code lock.

"We're so close to saving the people of the city! No way we're giving up!"

Suddenly, you notice a sign above the door: "Anyone who can calculate the amount of energy produced by the power station correctly will already know the numbers of this lock code." Below are the details of the power station: the height of the dam is 5 m, the mass of water flowing through it is 1400 kg, per second.

Einstein exclaims: "Well, that's not difficult, if you remember what you've learned about positional energy! Here, water falls down and its energy is converted into electrical energy as it drives the turbine blades. Go on, get on with it."

Let's see the solution!

- The energy produced by the power plant is 70,000 J, or 70 kJ.

 **Go to paragraph 22.**

- The energy produced by the power plant is 7000 J, or 7 kJ.

 **Go to paragraph 54.**

18

That's it, we've solved that one too, let's quickly put the numbers in sequence! 24870.
This code can open the lock! You find yourselves in the engine room.

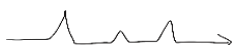
 **Go to paragraph 55.**

19

You console him quickly: it's a chemistry problem, we can solve it!

A healthy adult needs 2.5-3 litres of water a day to prevent dehydration. Thales needs to drink exactly 2.7 litres of water, as recommended by his doctor, to recover. How many moles of water will Thales consume? (The density of water is $\rho=1 \text{ g/cm}^3$)

➤ 0,15 mol  **Go to paragraph 57.**

➤ 150 mol  **Go to paragraph 44.**

20

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Bailetusnad.ro



Einstein and his brother Thales have spent their summers for years in the picturesque setting of Tusnad, a small Transylvanian resort town on the banks of the river Olt.

This year, however, their holiday is disrupted by an unexpected event: despite abundant rainfall, the river Olt has dried up and there is a water shortage throughout the town. The authorities have issued an order to save water so that everyone can have some! More and more people are falling ill due to the water shortage. Thales is not feeling well and is already showing symptoms of water deficiency.

Which of the following symptoms are typical of a water-deficient body?

- Tiredness, dry mouth and eyes, dizziness ➤➤➤➤➤ ➤ **Go to paragraph 56.**
- Diarrhoea, fever, vomiting ➤➤➤➤➤ ➤ **Go to paragraph 58.**

21

Image by Alex Antropov on Pixabay

You are close! Think about it! I'm sure you will remember! We talked about it in chemistry class.

→ **Go to paragraph 34.**



22

Einstein's face brightens! The energy produced is 70 kJ. Let's see that code!

→ **Go to paragraph 18.**

23

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An urgent solution is needed!
Thales and the people need
drinkable water!

What should be the right quality
of potable (fresh) water?



➤ Colourless, odourless, transparent, tasteless, temperature between 0-7 °C

→ **Go to paragraph 8.**

➤ Colourless, odourless, transparent, almost tasteless, temperature between 7-15 °C

→ **Go to paragraph 10.**

24

That's a bit much for fresh water.

97% of the Earth's total water supply is salt water.

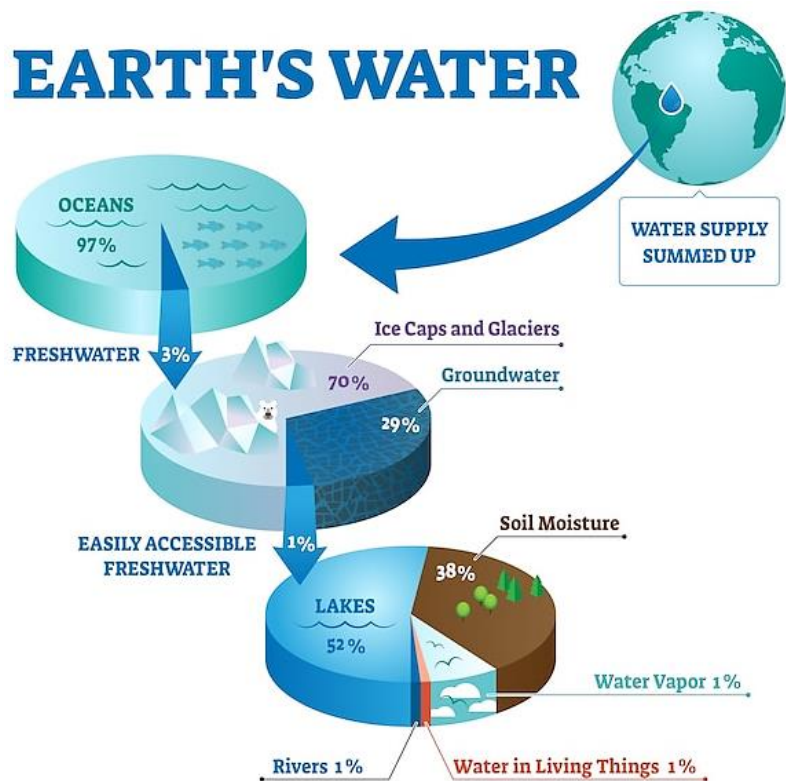
→ Go to paragraph 25.

25

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Exactly! 3% of the Earth's total water supply is freshwater.

→ Go to paragraph 50.



26

Indeed! Clouds are formed when water vapour condenses around particles of dust, smoke or salt. Condensation is a physical phenomenon.

→ Go to paragraph 34.

27

Suddenly, curious eyes peep into your travelling capsule. Fish with glistening bodies appear, wondering what this unusual object is doing in the water. "It would be nice to know what kind of fish they are", says Einstein. taking a photo of them with his mobile phone.



Go to paragraph 46.

28

Oops, that's incorrect! This is not a chemical phenomenon, because a cloud is formed when water vapour condenses around particles of dust, smoke or salt. Condensation is a physical phenomenon.



Go to paragraph 26.

29

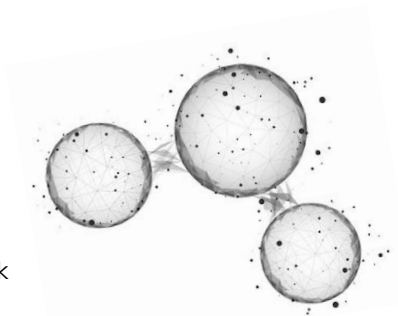





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Wow, that was really sudden! You look carefully around the liquid... The travelling capsule is stuck to a water molecule. Upon closer inspection of the water molecule, you notice that there is a larger sphere and two smaller spheres stuck together. You immediately realise that they are oxygen and hydrogen atoms.

What is the correct chemical formula for water? Remember the rules you have learned about when writing chemical formulae and use the Periodic table!

- H_2O  **Go to paragraph 47.**
- HO_2  **Go to paragraph 49.**
- H_3O  **Go to paragraph 51.**

30

Sodium chloride is table salt. Are you sure it won't dissolve in water? Try again!

 **Go to paragraph 16.**

31

During evaporation, water changes from a liquid to a gas. So, you may have been returned to the ground by the opposite process of evaporation.

 **Go to paragraph 50.**

32

Einstein wants to find out why the waters of the Olt disappeared! He thinks he should follow the water's path from the source of the Olt, but it is up in the Giurgiu Mountains. How can you get up there as quickly as possible? Einstein is stumped and asks for your help to solve the mystery. Are you ready?

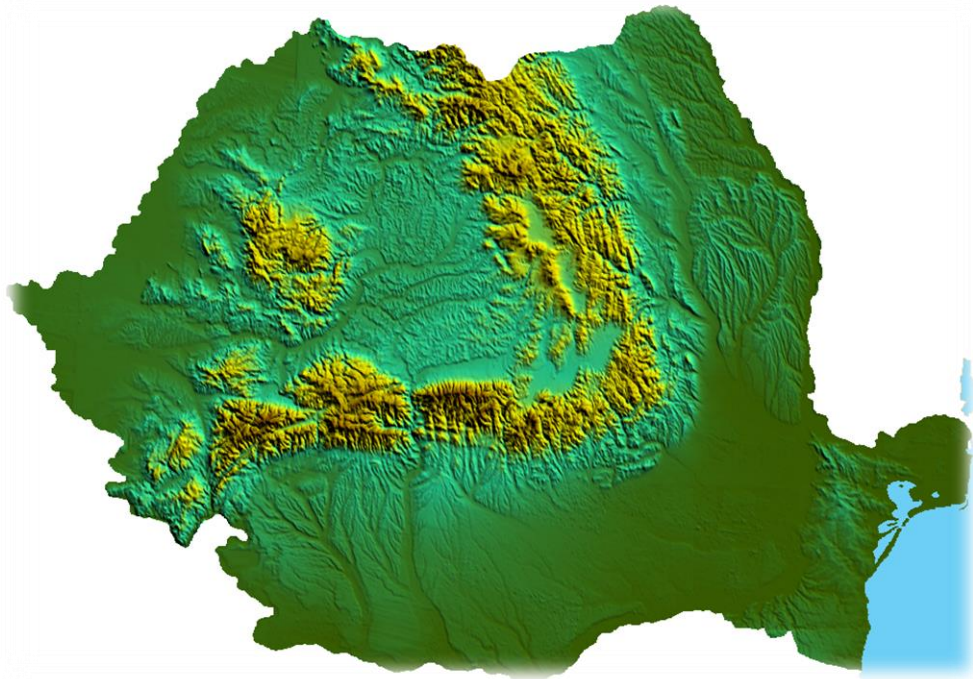
 **Go to paragraph 45.**

33

Indeed, precipitation (rain) is the process by which you can get back on the ground.

 **Go to paragraph 14.**

34



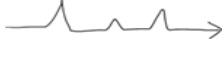


"The world is wonderful!" Einstein shouts! Directly below you, there are Gheorgheni and Bălan, pine forests everywhere, a tiny wooden house surrounded by grazing sheep.

You can see quite far away, watercourses, lakes and even the sea. Einstein wonders: "It's incredible that they still complain about a lack of water!"

You remember what you learned in chemistry class about the Earth's water supply. Indeed, 71% of the Earth's surface is covered by water.

How much of the Earth's total water is fresh water?

- 5%  **Go to paragraph 21.**
- 97%  **Go to paragraph 24.**
- 3%  **Go to paragraph 25.**

35

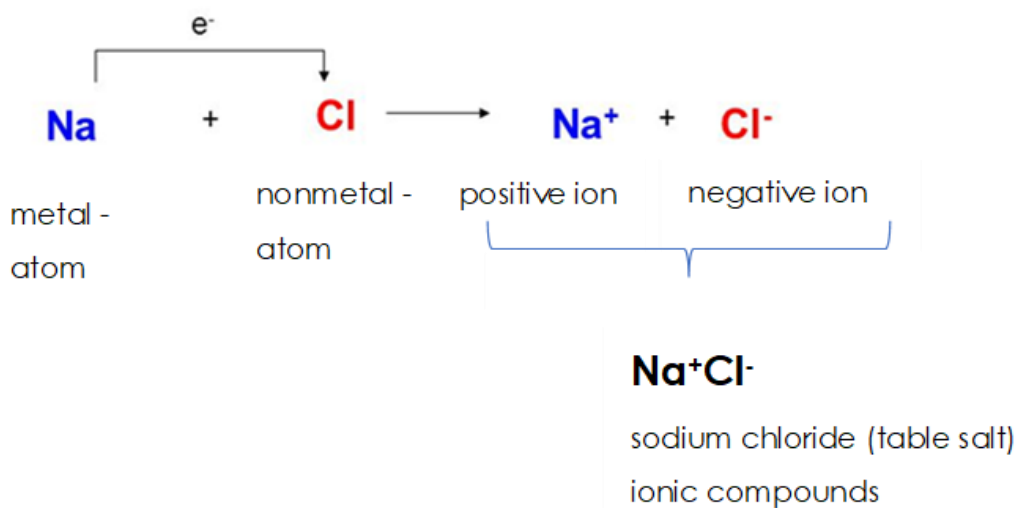
Exactly! Condensation and precipitation are similar phenomena that convert water molecules from vapour to liquid droplets and can produce rain.

➔➔➔ ➔ **Go to paragraph 14.**

36

An ionic bond is formed between a metal atom and a non-metal atom by electron transfer. The H and O atoms are both non-metallic, so the bond between them cannot be ionic.

An ionic bond is found, for example, in sodium chloride (table salt).



➔ ➔ ➔ ➔ **Go to paragraph 38.**

37

Photo by David Mülheims, Wikipedia Commons

Remember! In the chemistry lab, your teacher showed you how the purple potassium permanganate dissolves in water. Try again!

 **Go to paragraph 16.**



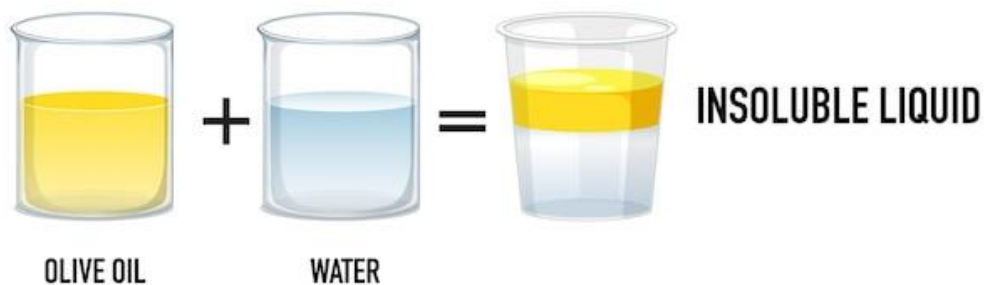
38

Indeed! The O and H atoms form a covalent bond by making non-metals and electrons common. So, there are two covalent bonds in the water molecule.

 **Go to paragraph 52.**

39

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It's true that oil is not soluble in water.

 **Go to paragraph 15.**

40

Are you sure about this result? Have you applied the formula correctly?



Go to paragraph 12.

41

Einstein is shaking his head. Go back and try again!



Go to paragraph 13.

42

That's it! Your result is perfect!



Go to paragraph 3.

43

Einstein is shaking his head: "There is a problem with this result because power is not measured in kJ!"



Go to paragraph 53.

44

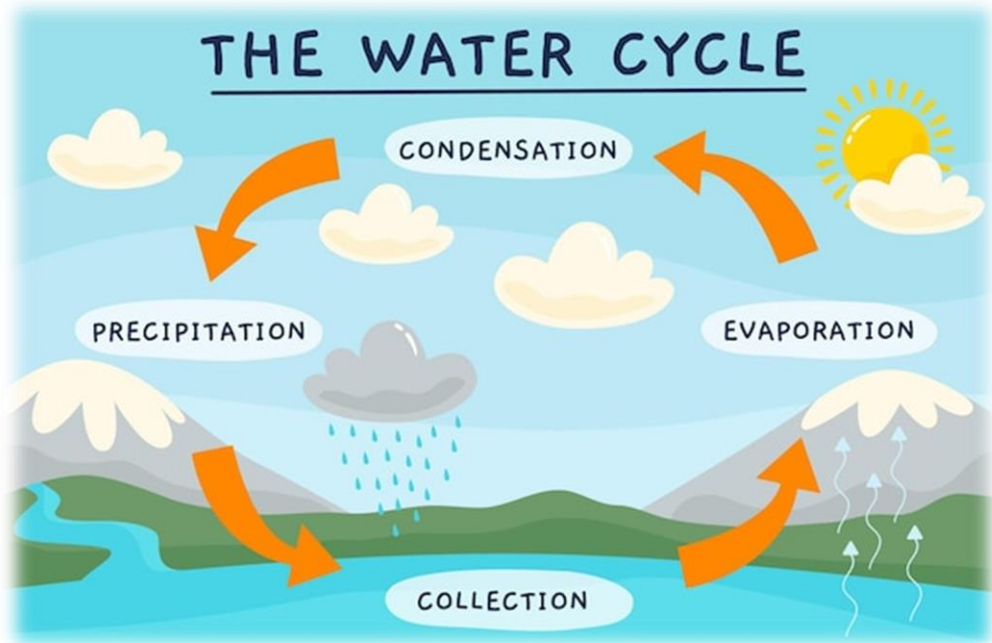
Well done! The result is 150 mol.



Go to paragraph 59.

45

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You consider that the fastest way to get to the top of the mountain would be in the form of a tiny particle, like a drop of water. You remember what you have learned about the water cycle in chemistry class: water rises as vapour when it is hot, forms clouds when it cools and falls back to earth as rain. Einstein likes your idea. He pulls out his brand-new invention, a shrinking device that can turn objects and people into small ones. Then get ready to travel! Put on your protective gear! Einstein presses the shrink button and you and your travel capsule land in the glass left on the table, with a few drops of drinking water still floating at the bottom.

 **Go to paragraph 29.**

46

Not only can you take photos with your mobile phone, but you can also access a lot of information via the internet. Just look up in a descriptor who those lovely fish you have just met might be!



Image from Pixabay

- Its body is greenish or brownish. It has dark red spots on its sides and a white stripe along the lateral line and underneath. Inhabitant of cold, oxygen-rich rivers and lakes with gravel or boulders.

→ **Go to paragraph 2.**

- Back greenish or brown, lightening towards the belly, yellow on the sides, the belly is white. It prefers warm, muddy, still and slow-flowing waters.

→ **Go to paragraph 4.**

- The base colour is silvery brown to olive green, arranged in bands, possibly marbled, with yellowish patches of varying brightness. It occurs in lakes and estuaries with dense vegetation but also open water.

→ **Go to paragraph 6.**

47

Well done! Two hydrogen atoms bond to an oxygen atom to form a water molecule.

 **Go to paragraph 11.**

48

You start down the stream. "It'd be fun to know what speed we're going!", Einstein thinks. "How about a simple experiment?"

"We both have smartwatches. I'll measure the distance, you measure the time until we end up somewhere!"

The two adventurers start measuring, and suddenly they see a water mill!

"Here's the first landing!", exclaims Einstein.

 **Go to paragraph 12.**

49

Almost! In this case, you did not apply the rule you learned when you were finding chemical formulae. Hydrogen has a chemical value of 1 and oxygen has a chemical value of 2. Using the rule for cross-tabulating chemical values used in chemical formulae, this gives H_2O .




 **Go to paragraph 47.**

50

"But there's still snow on the top of the mountain! I didn't bring gloves and a scarf." Einstein remarks, shivering. You know the explanation for that, too. Water exists on our planet in all three states: solid, liquid and gas.

To get back to earth, you need to convert the water that makes up your cloud from a gas to a liquid.

This process is called:

- Evaporation  **Go to paragraph 31.**
- Precipitation  **Go to paragraph 33.**
- Condensation  **Go to paragraph 35.**

51

Almost! In this case you didn't look at the chemical value of the atoms in the Periodic Table. The chemical value of hydrogen is 1 and that of oxygen is 2. Using the rule of cross-tabulation of chemical values used in chemical formulae, we arrive at the formula H_2O .

 **Go to paragraph 47.**

52


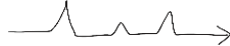
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There is no time for daydreaming, you feel a strange floating and suddenly you are surrounded by a great brightness. You are inside a cloud!

"What ..." wonders Einstein, "How did we get here?" "Of course! It's the process of evaporation!" you explain. Evaporation is part of the natural cycle of water.

What is the phenomenon of cloud formation?

- Physics phenomenon  **Go to paragraph 26.**
- Chemical phenomenon  **Go to paragraph 28.**

53

Einstein shakes his head with satisfaction: that's it! 48 W is the correct result! That's the way to do it! Let's remember this number, it might be good for something!

 **Go to paragraph 5.**

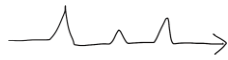
54

Einstein shakes his head: "Did you take into account the gravitational constant of 10 N/kg? Let's look again!"

 **Go to paragraph 17.**

55

But behind the door, you run into another problem: the floodgates are controlled by a computer program, but the computer is encrypted. "They must have hidden the code somewhere", Einstein mutters. Every minute counts, so you have a good look around for any clue to the code. "Got it!", exclaims Einstein when he finds a piece of paper hidden in an Erlenmeyer flask. He's a little disappointed to read that the code to open the computer is the solution to another problem.



Go to paragraph 19.

56

Tiredness, dry mouth, dry eyes, dizziness - Yes, that is exactly how Thales is feeling.



Go to paragraph 23.

57

Unfortunately, that is not the right answer. The problem must be the conversion.

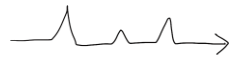
$$2,7 \text{ l} = 2,7 \text{ dm}^3 = 2700 \text{ cm}^3$$



Go to paragraph 19.

58

Diarrhoea, fever, vomiting - No, these are symptoms of an infection!



Go to paragraph 56.

59

You have cracked the code! Einstein quickly enters this number into the computer and uses the corresponding command to open the floodgates. In minutes, the water rushes down into the valley and the small town on the banks of the river Olt comes back to life. You have overcome all obstacles and saved the lives of the people!

The end



Designed by 6 European organisations, the project intends to create efficient, engaging pedagogical materials and tools for teachers in order to implement an innovative gamified Homework methodology with pupils. In doing so, we wish to contribute to boosting their efficiency and engagement rate in remote work and, more specifically, in Homework.

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