

第7問 (配点 16)

You are preparing a presentation for science class. You found some interesting information in the article below and are now making your outline.

Hard and Soft Water

Every day water flows through the pipes in our homes. It is used for bathing, cooking, and many other things. Although water is a liquid which does not appear to be hard, there are actually different degrees of hardness or softness. In fact, there are distinct differences in the makeup of water, how it becomes hard or soft, and suitable uses for each type.

Natural water in the form of rain or snow is soft. Water becomes hard when it absorbs calcium, magnesium, or small amounts of iron. According to the World Health Organization (WHO), water containing 60 or more milligrams of these minerals per liter (mg/L) is generally considered hard water. This “hard water” can be further subdivided. Water containing 60-120 mg/L is *moderately hard*, and water containing 120-180 mg/L is *hard*. If water contains more than 180 mg/L, it is classified as *very hard*. In contrast, water with low mineral content (below 60 mg/L) is said to be *soft*. Scientists explain that mineral content in water varies by location. Researchers at the University of Tokyo, comparing water in Japan with that of 27 other countries from 2017 to 2020, determined that Japanese water was considered to be on the soft side, whereas water in parts of Europe and Africa tended to be harder. The researchers found that water hardness depended more on the quality of the raw, or unpurified, water than the purification process or the pipes used for its transportation.

There are several variables affecting the mineral content of raw water. These include the kinds of rock in the ground, the amount of rain or snow that falls in a region, and urbanization. Areas where water is taken from underground sources have harder water because it has passed through rocks

containing minerals that dissolve in it. In addition, places where there is a lot of snow have softer water, especially when it melts in spring. The movement of more people and industries into cities, as well as the infrastructure such as roads and buildings to support them, also affects the mineral content of the water.

Since the properties of hard and soft water differ, each type has different uses. The minerals in hard water make it more difficult for soaps and detergents to form lather. These soapy bubbles don't wash away easily and can leave a thin film of soap on the skin or hair. The minerals may also leave white spots on glasses, cutlery, or shower mirrors. Limescale, a hard white substance, might restrict water flow in pipes and discolor or damage appliances as well. Despite these negative aspects, hard water tends to rate higher on taste tests and could be beneficial for our health because it boosts our daily mineral intake.

If the water we use at home is soft, it could save us money. We will use less water and electricity for cleaning because soap rinses out more efficiently. Our clothes will also be cleaner and last longer because minerals in hard water make them wear out more quickly. When tap water is hard, it can be softened at home using special devices attached to a house's water system. These devices remove minerals by filtering water through beads with positively charged potassium ions. These ions attract the minerals, removing them from the water. However, this process could make the treated water saltier than before.

If water filtration systems are too costly to buy and maintain, there are home remedies that can help solve hard water problems. Boiling water removes the minerals, which is useful when smaller amounts of soft water are needed. White vinegar and baking soda both react to and neutralize calcium and other minerals in water. Therefore, these products are good cleaning or washing supplements when you have hard water at your home.

Now that we know the differences between hard and soft water, perhaps an ideal mix of the two is best for our daily lives.

Your presentation outline

Hard and Soft Water: 32

WHO Water Hardness Standards 33

(1)	(2)	(3)	(4)
< 60 mg/L	60-120 mg/L	120-180 mg/L	> 180 mg/L

(mineral content per liter)

Research Results

- 34

Factors Affecting the Hardness of Water 35

- A. Increased human activities
- B. Regional climate
- C. Substances in raindrops
- D. Underground conditions

Effects on Our Daily Lives

- 36

- 37

問 1 You are going to add details to your presentation title. Choose the best option for

32

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- ① Advantages and Disadvantages for Health
- ② Characteristics, Sources, and Daily Uses
- ③ Ingredients, Cleaning Systems, and Consumption
- ④ Locations, River Types, and Possible Problems

問 2 Choose the best option to complete the table in the outline.

33

- | | |
|---------------------------|---------------------------|
| ① (1) Soft Water | (2) Hard Water |
| (3) Moderately Hard Water | (4) Very Hard Water |
| ② (1) Soft Water | (2) Moderately Hard Water |
| (3) Hard Water | (4) Very Hard Water |
| ③ (1) Very Soft Water | (2) Moderately Soft Water |
| (3) Soft Water | (4) Hard Water |
| ④ (1) Very Soft Water | (2) Soft Water |
| (3) Moderately Soft Water | (4) Hard Water |

問 3 Choose the best option for

34

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- ① It was difficult to determine the regional differences of water hardness.
- ② Japanese water was the hardest among all of the countries studied.
- ③ Regional water hardness was affected by the quality of raw water.
- ④ The power of purification plants in Europe was different from Japan.

問 4 Under the heading, “Factors Affecting the Hardness of Water,” you spotted an error in your presentation outline. Which of the following should you remove? 35

- ① A
- ② B
- ③ C
- ④ D

問 5 Choose the best options for 36 and 37. (The order does not matter.)

- ① Hard water can completely get rid of a soapy film.
- ② Home remedies are ineffective for softening water.
- ③ Minerals in hard water can positively affect our health.
- ④ Soft water can help reduce household energy costs.
- ⑤ Water spots are effective for improving appliance use.