Grade 6

Science

2015 Japanese Achievement Test

Original can be found at

http://www.nier.go.jp/15chousa/pdf/15mondai_shou_rika.pdf

Translated by Tad Watanabe

[1] At a clock shop, Katsuya and his friends saw an old-fashioned clock that makes use of the properties of pendulums. At the store, a store clerk was adjusting the pendulum clock.

Because the clock is going slow, I'm making the time for a 1 full swing of the pendulum shorter.

Store Clerk

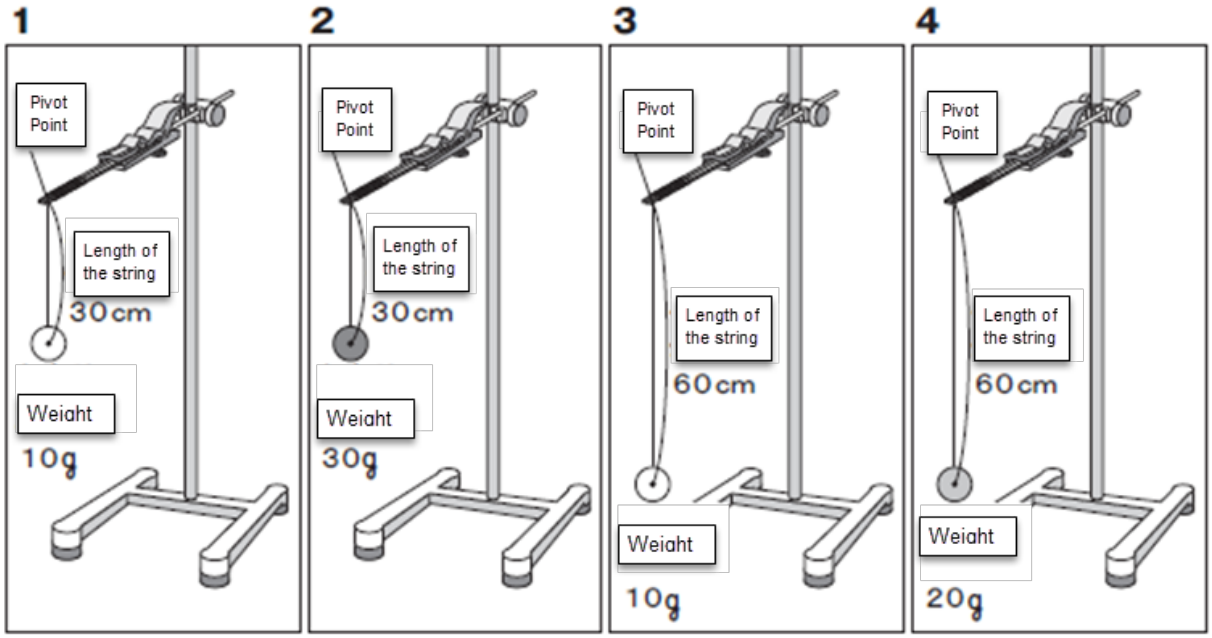
How is he making the time for a 1 full swing shorter? It looks like he is touching the weight.

Harumi

I think if we move the weight up and down, we can change the time for 1 full swing.

Katsuya

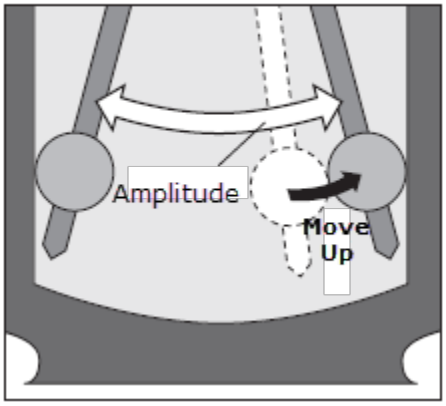
(1) Which of the pendulums shown in the figure below can be used in an experiment to test **Katsuya's prediction**? Select 2 from **1** through **4** below and write the numbers.



(2) After the experiment, they learned that by moving the position of the weight up and down, the time for 1 full swing can be changed.

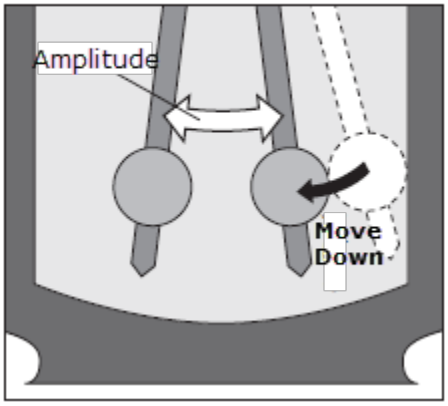
In order to make the pendulum clock go faster, how should we adjust the position of the weight? Select 1 from **1** through **4** below and write the number.

1



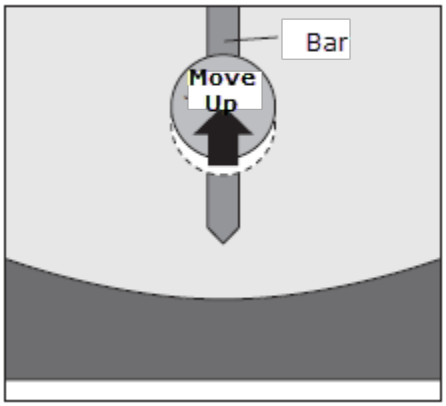
By moving up the starting position of the weight, we make the amplitude greater.

2



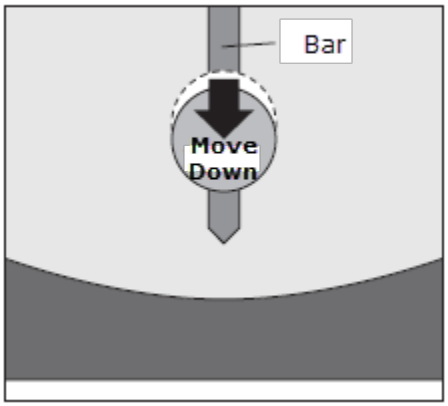
By moving down the starting position of the weight, we make the amplitude smaller.

3



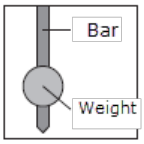
Move the weight up along the bar.

4



Move the weight down along the bar.

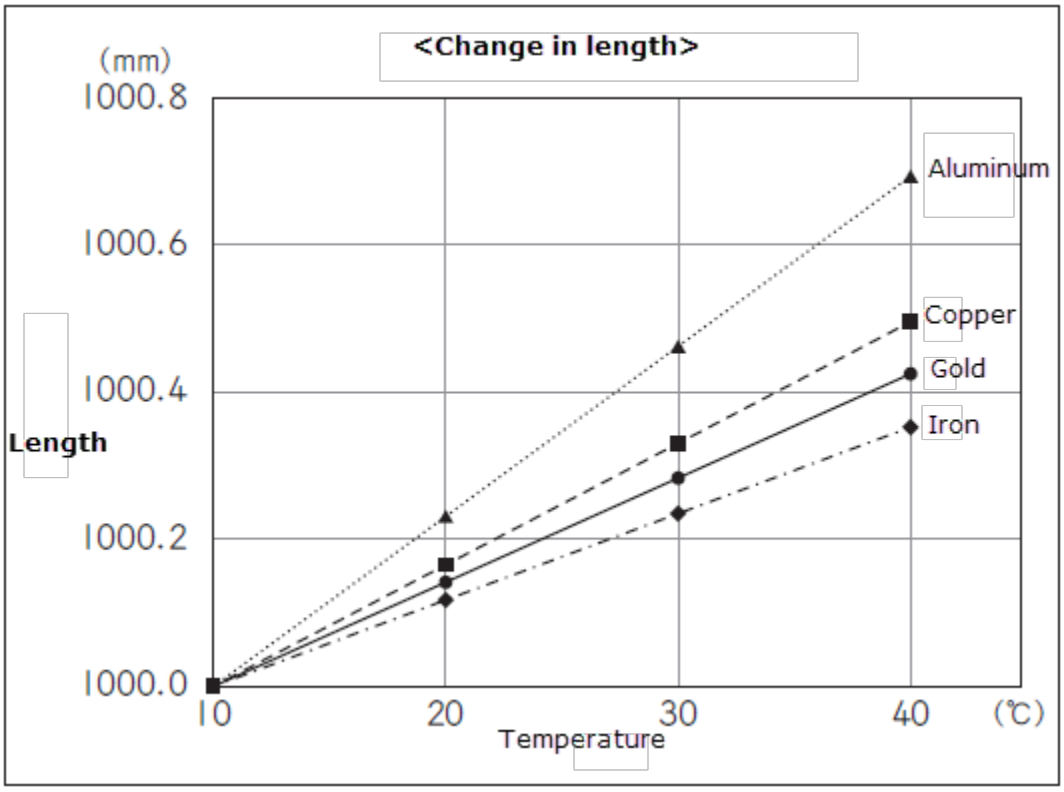
(3) Katsuya asked the store clerk why the clock starts going slower. The store clerk gave the following explanation.



When it gets warm, the pendulum bar which is made of metal gets longer, and the time for 1 full swing changes.

Store Clerk

So, Katsuya checked how much different metals get longer as the temperature goes up.



From the graph, we can tell that a copper bar that was 1000.0 mm long at 10°C will be about 1000.5mm at 40°C. The ways the length changes varies are different for different metals.

Katsuya

Based on the graph above, which of the 4 types of metal will have the least amount of change in the time for 1 full swing even when temperature rises? Select one from **1** through **4** below and write the number. Also, explain why you chose that number.

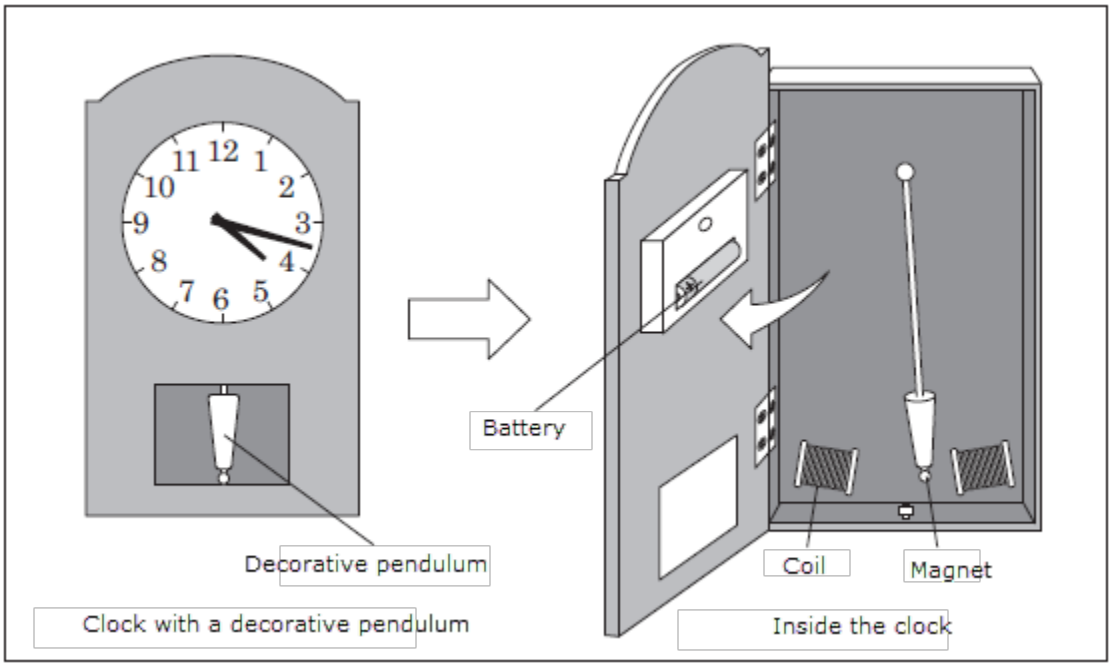
1 Aluminum

2 Copper

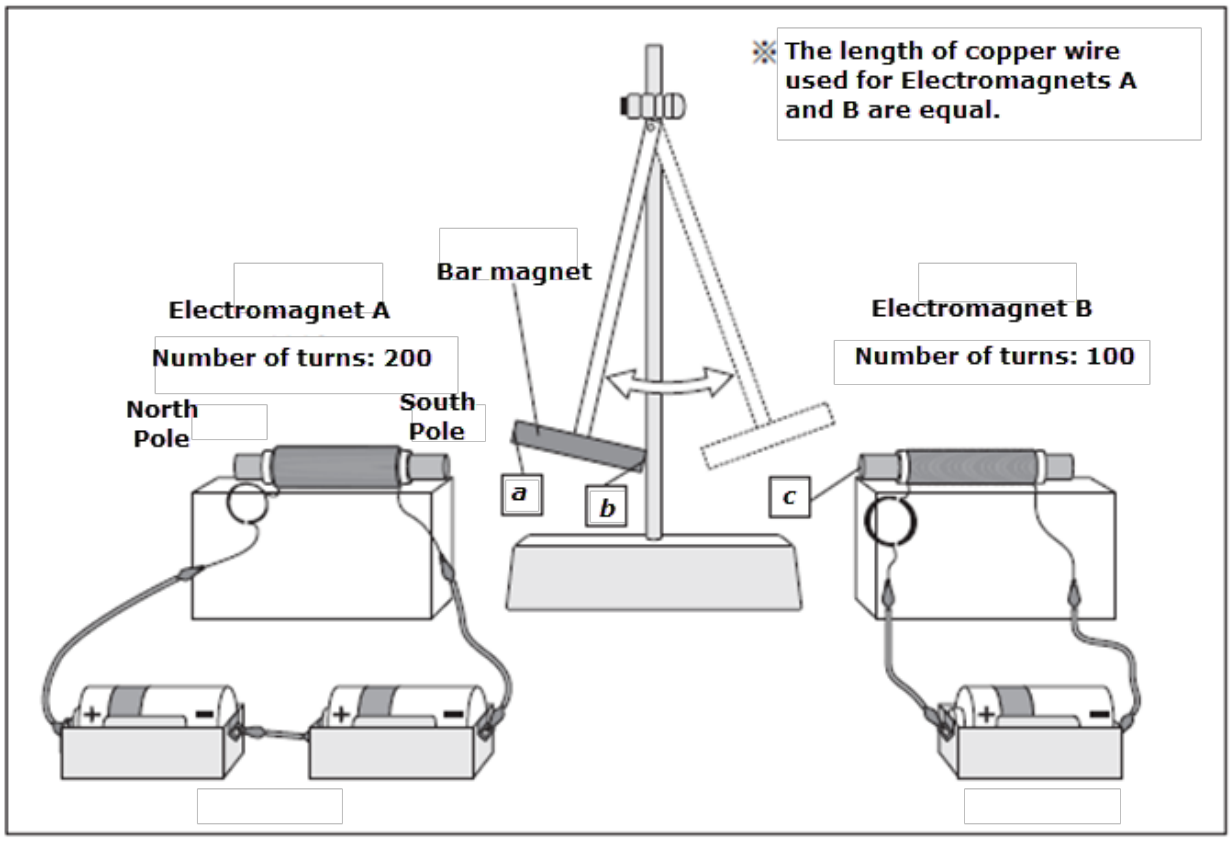
3 Gold

4 Iron

(4) Katsuya found another pendulum clock at the clock store. When he looked inside the clock, he saw that the clock was powered by a battery independently from the pendulum. The pendulum was just decorative. On the pendulum, there was a magnet, and it moved back and forth between 2 coils.



Based on the design of this pendulum, Katsuya built a pendulum that moves using the property that an electromagnet and a bar magnet repel each other.



As shown in the figure above, Katsuya decided that the right side of the Electromagnet A is its South Pole. In order to make a pendulum that will move using the property that electromagnets and the bar magnet will repel each other, how should he setup the poles for [a], [b] and [c]? From **1** through **4** below, select one and write the number.

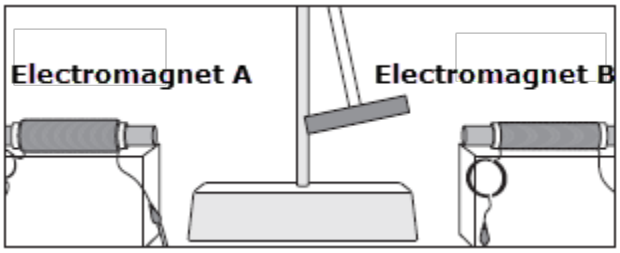
1 [a] South Pole [b] South Pole [c] South Pole

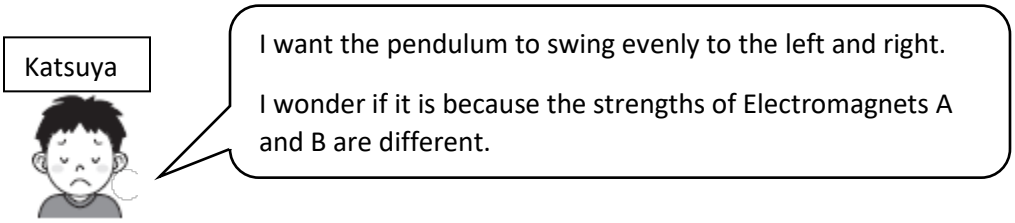
2 [a] South Pole [b] North Pole [c] North Pole

3 [a] North Pole [b] South Pole [c] North Pole

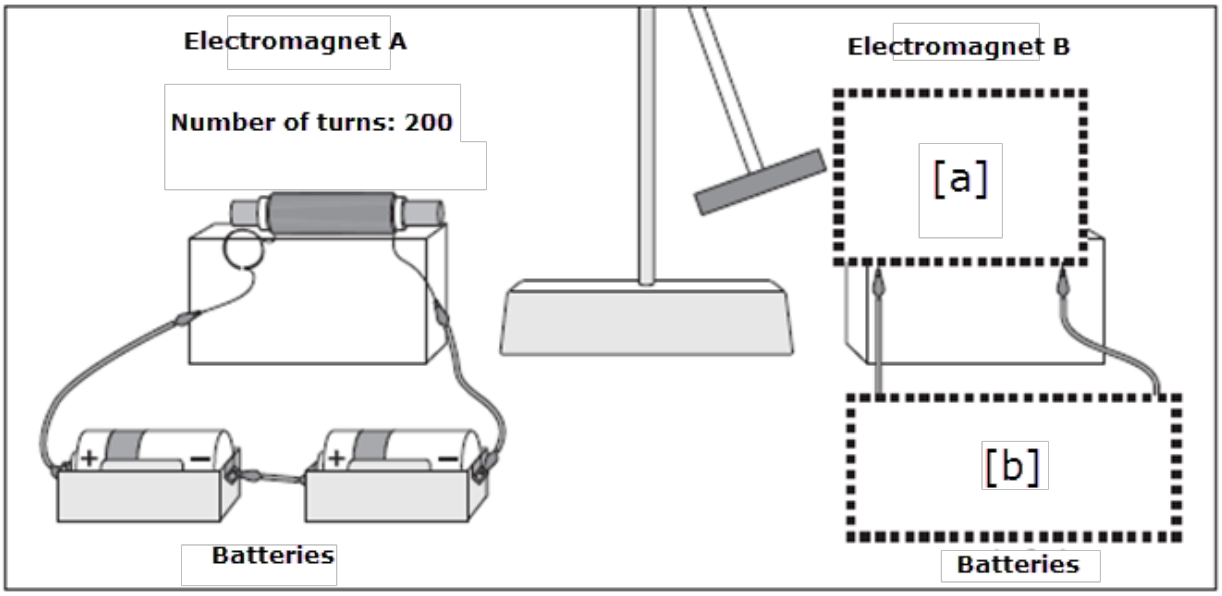
4 [a] North Pole [b] North Pole [c] South Pole

(5) When Katsuya let the pendulum he made move, it kept swinging more to the right and it did not swing evenly to the left and right.





So, Katsuya decided to re-make the pendulum so that the strength of Electromagnets A and B will be the same.



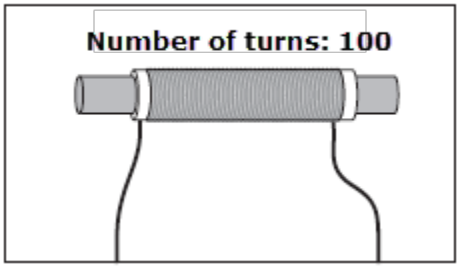
In order to make the strength of the 2 electromagnets the same, how should he wind the wired on Electromagnet B? How should he arrange the batteries?

From the [Way to wind the wire] **1** through **4** below, select 1 that should go into [a] in the figure above and write the number.

Also, from the [Way to arrange batteries] **1** through **4** below, select 1 that should go into [b] in the figure above and write the number.

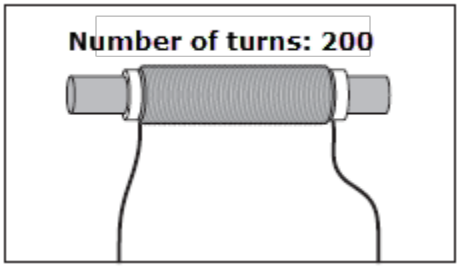
[Way to wind the wire] (the direction for winding will be the same as Electromagnet A)

1



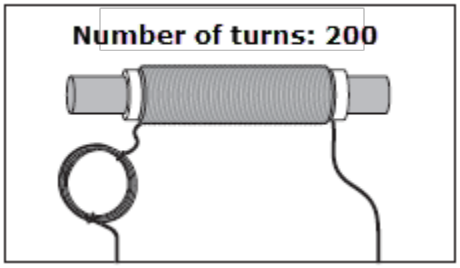
Cut the extra wire off.

2



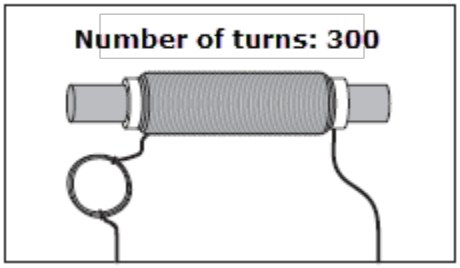
Cut the extra wire off.

3



The length of wire will be the same as the length used in Electromagnet

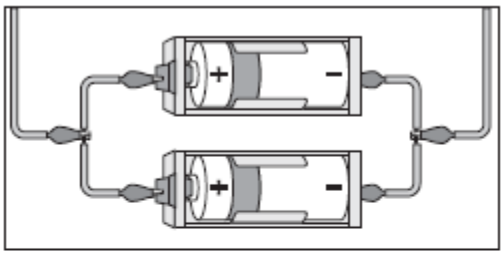
4



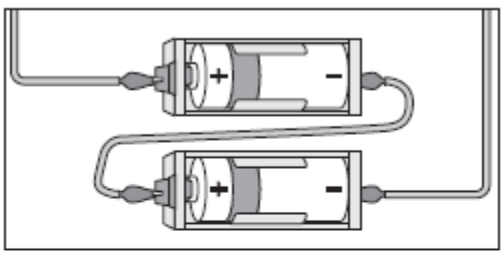
The length of wire will be the same as the length used in Electromagnet

[Way to arrange batteries] (View from directly above)

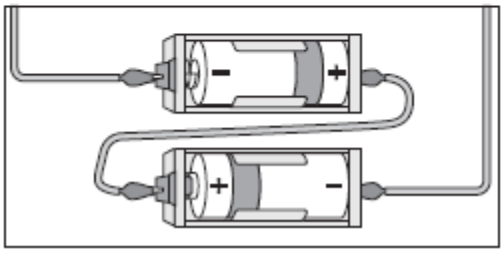
1



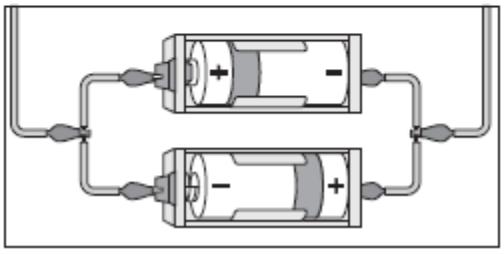
2



3



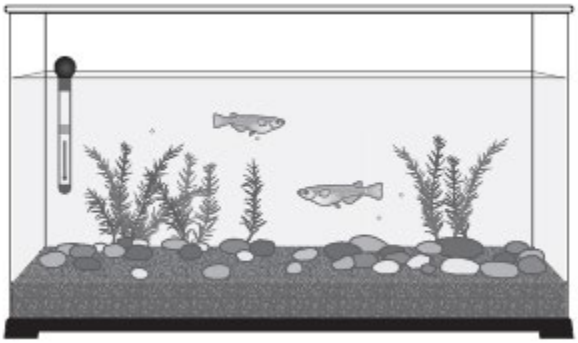
4



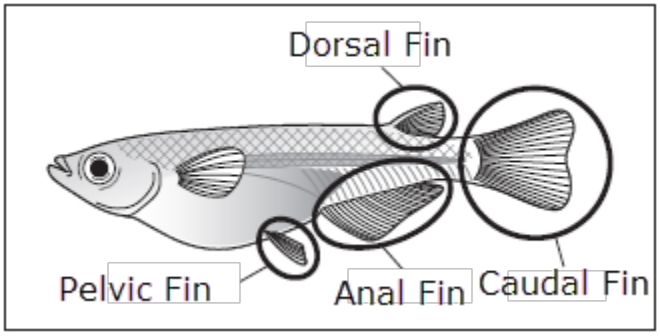
[2] Yoshiko and her friends decided to investigate how creatures such as killifish, person or kidney beans grow.

Let's keep male and female killifish so that we can get their eggs.

Yoshiko



(1) Yoshiko decided to check if there are indeed male and female killifish in the aquarium. Which part of the fish should she check to see if it is male or female? Select two from **1** through **4** below and write the numbers.



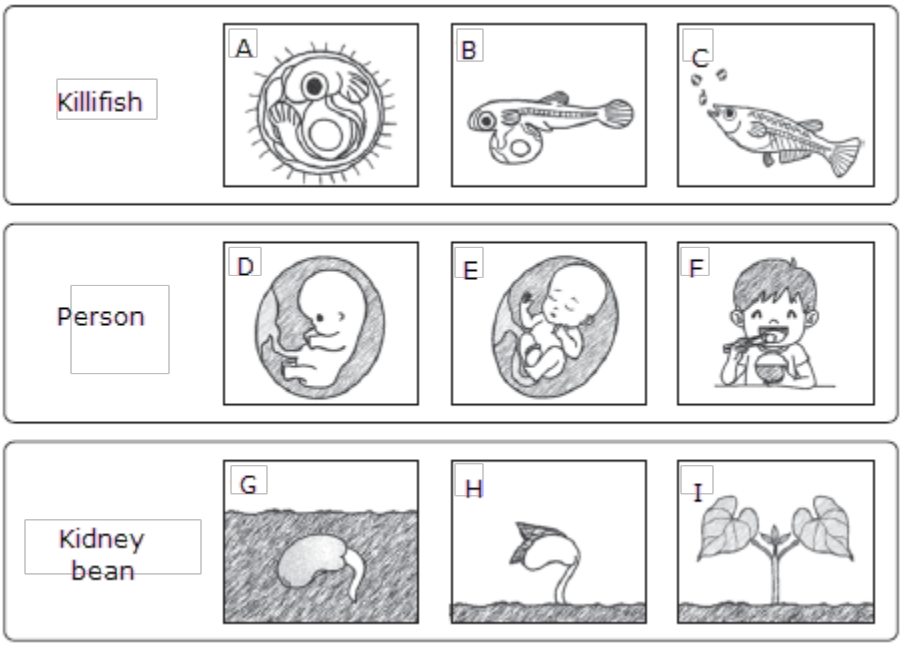
1 Dorsal fin

2 Pelvic fin

3 Anal fin

4 Caudal fin

(2) After examining cards showing how killifish, person and kidney beans grow, they decided to sort them based on how the necessary nutrition is being acquired.



I think A, B, G and H acquire the nutrition in similar ways.

Yoshiko

I think C and F are similar.

Hiroshi

What did Yoshiko and Hiroshi base their sorting on? From **1** through **4** below, select one for each and write the number.

1 Acquiring the necessary nutrition by consuming other living things.

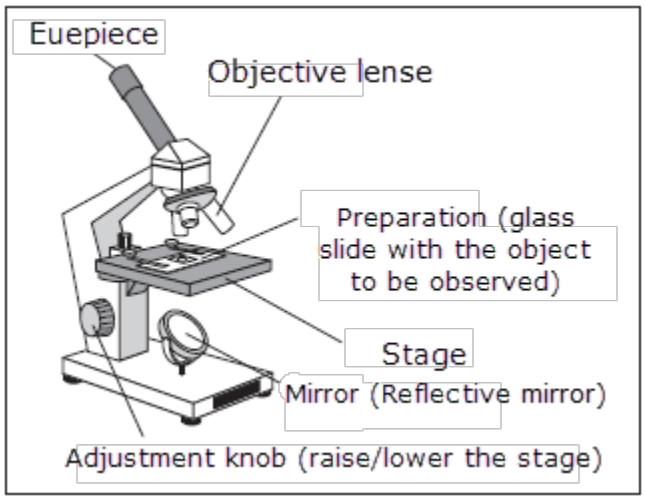
2 Using the nutrition it possesses from the beginning.

3 Obtaining the necessary nutrition from its mother.

4 Generating the necessary nutrition by itself.

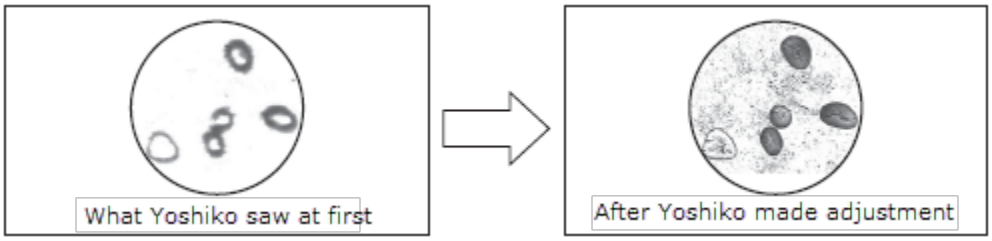
(3) Yoshiko decided to investigate the nutrition stored in the cotyledon of kidney beans using the instrument shown below.

Write the name of the instrument Yoshiko used.



Instrument used by Yoshiko

(4) When Yoshiko used the instrument shown in (3), what she saw at first was fuzzy as shown on the left in the figure below even though there was plenty of light. But after she moved a part of the instrument, the image became clearer as shown on the right in the figure below. What did she do to make the image clear? Select from **1** through **4** below and write the number.



1 She changed the orientation of the mirror.

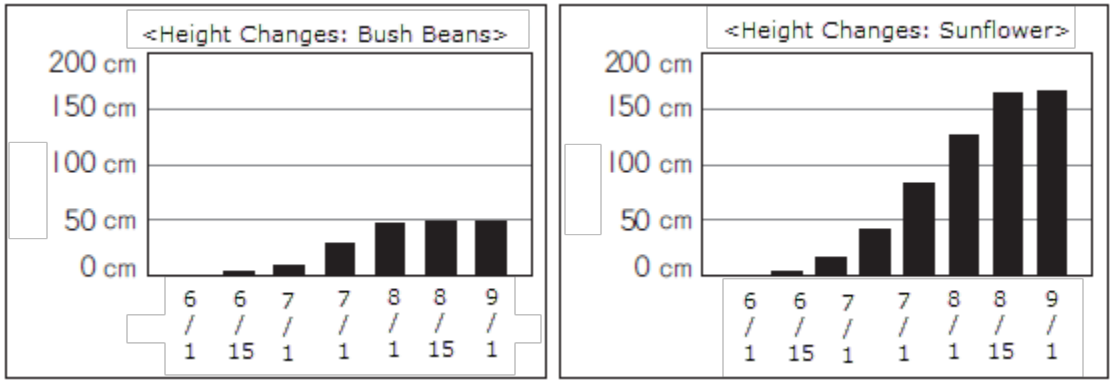
2 She turned the adjustment knob.

3 She moved the preparation.

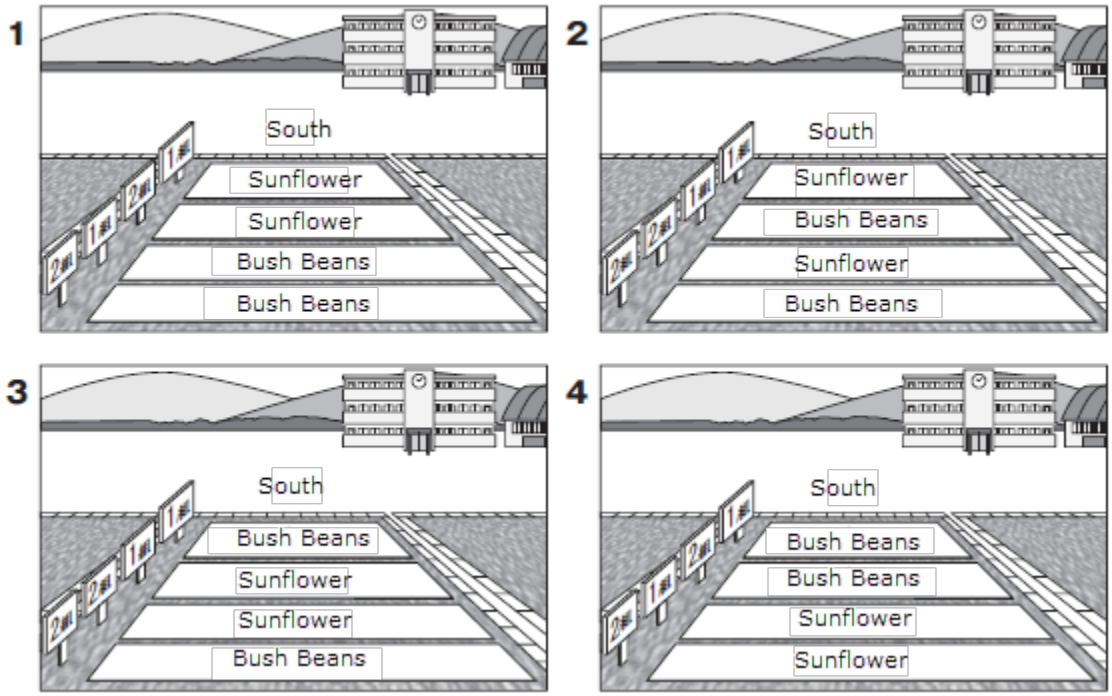
4 She changed the objective lense.

(5) The two classrooms (Room 1 and Room 2) in Yoshiko's grade decided to plant bush beans and sunflower seeds in the school garden.

The charts below show the changes in the height of plants when Yoshiko grew bush beans and sunflower previously.

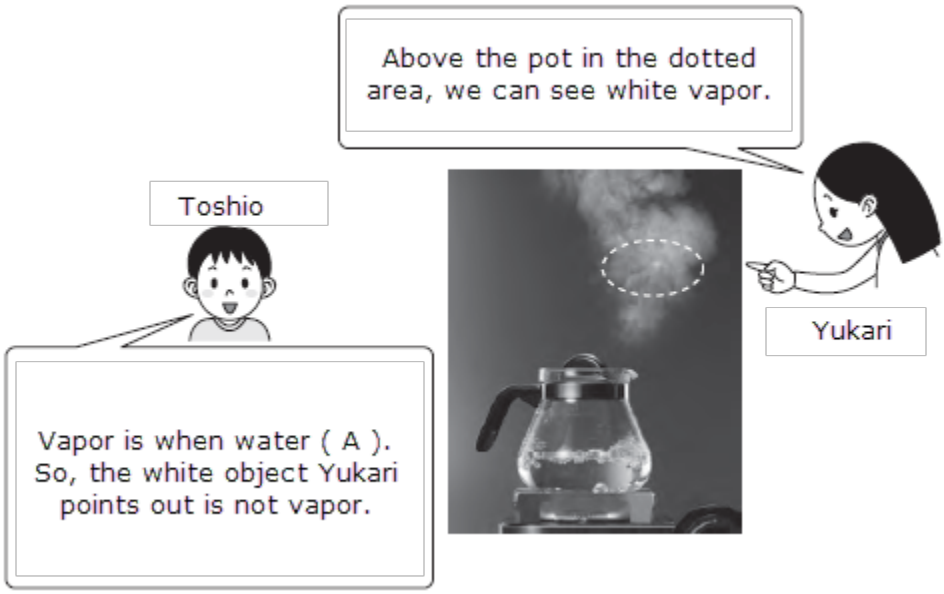


Based on these data, where should the seeds of bush beans and sunflowers be planted in the school garden so that both bush beans and sunflowers will be in the sun. Select one from 1 through 4 below and write that number. Also, write the reason for selecting that number.



[3] Yukari and her friends are making iced milk tea and sugar syrup .

(1) To make iced milk tea, Yukari and her friends boiled water in a pot.



Insert what goes into (A) in Toshio's statement from 1 through 4 below and write that number.

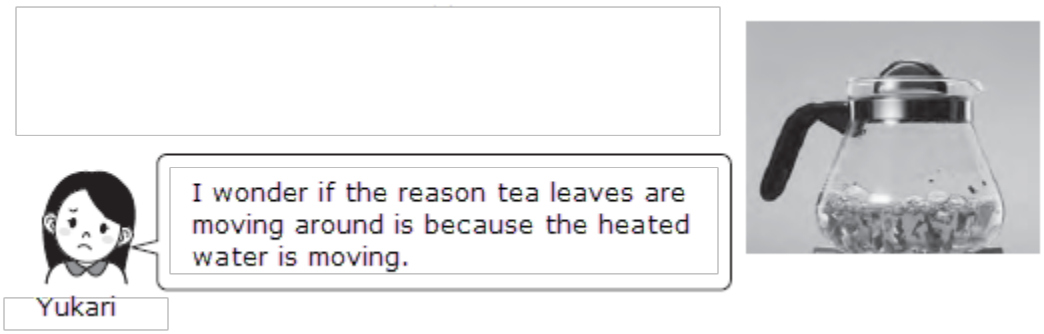
1 becomes gas and invisible

2 becomes liquid and invisible

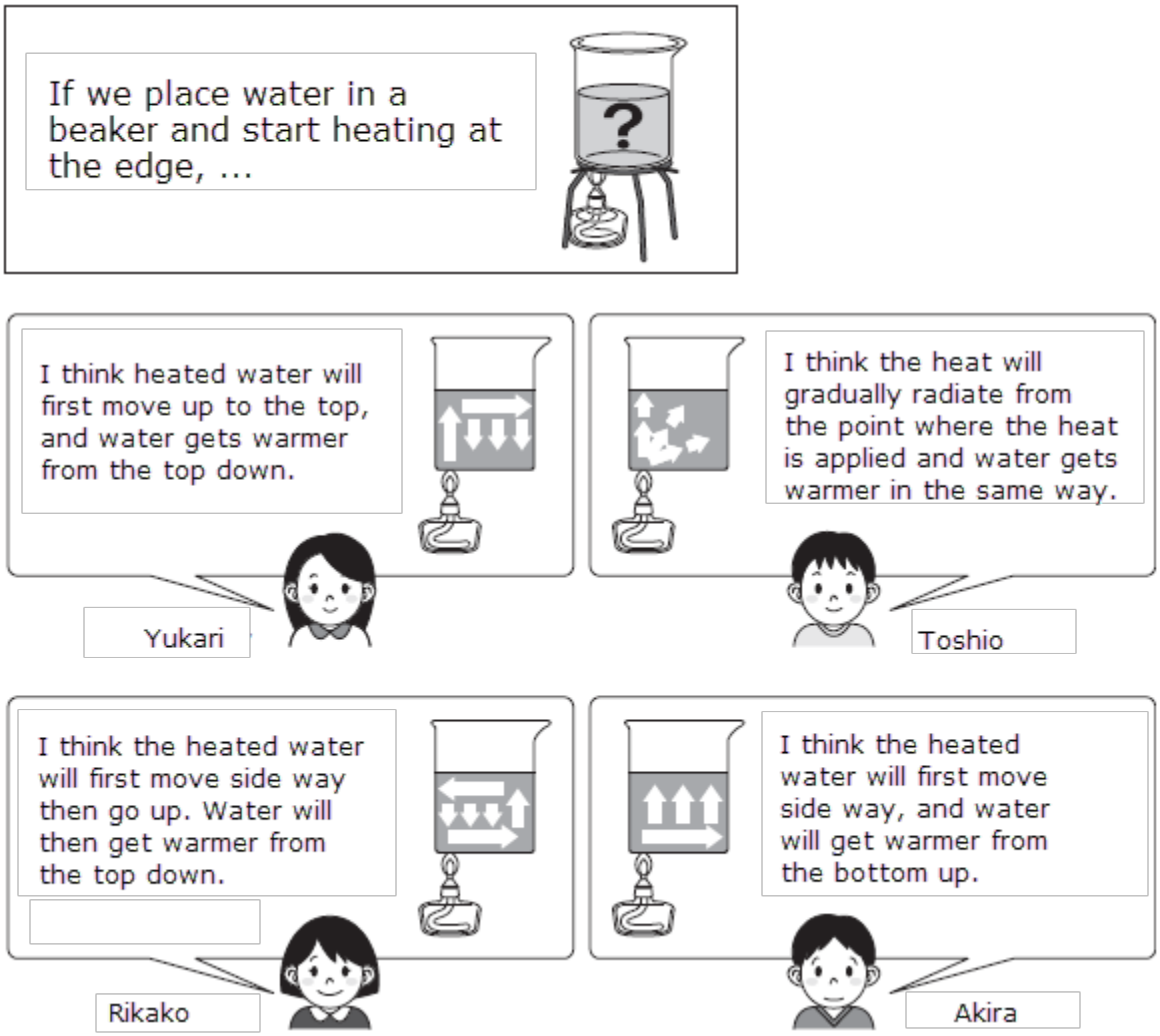
3 becomes solid and invisible

4 disappears and becomes invisible

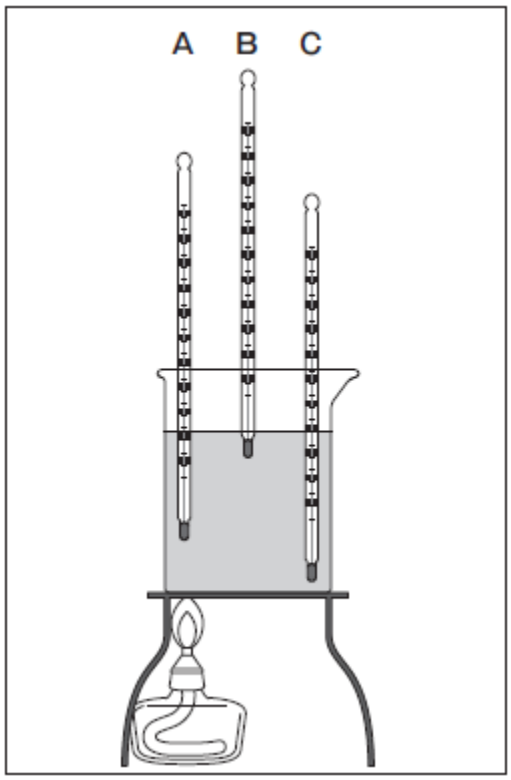
(2) When tea leaves were put in the boiling water, they can see tea leaves moving around in the pot.



So, Yukari and her friends decided to investigate the question, “How does water get heated?” and they represented their predictions in a diagram.



Yukari and her friends decided to conduct an experiment to test their predictions. They placed 3 thermometers, A, B, and C as shown in the figure below to conduct their experiment.



If Rikako's prediction is correct, in which order will the temperature on the thermometers will rise? Select on from 1 through 4 and write that number.

1 B → A → C

2 B → C → A

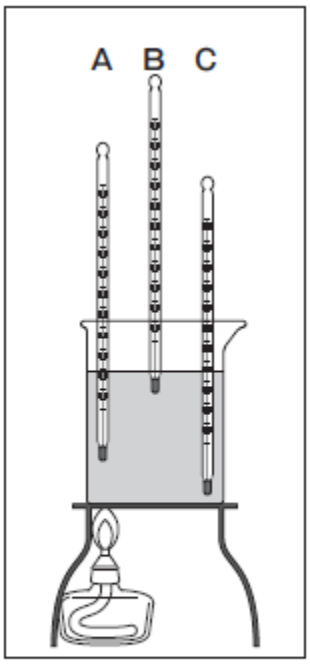
3 C → A → B

4 C → B → A

(3) The results of the experiment were as shown in the table below.

<Change in Water Temperature>

Elapsed Time	0 min.	2 min.	4 min.	6 min.	8 min.
Therm. A	25 ℃	37 ℃	45 ℃	52 ℃	58 ℃
Therm. B	25 ℃	34 ℃	41 ℃	48 ℃	54 ℃
Therm. C	25 ℃	30 ℃	38 ℃	45 ℃	53 ℃



Akira

The results of the experiment show that my prediction was not correct.

Based on these data, the correct way is (B).

Select what goes into (B) in Akira's statement from 1 through 4 below and write that number.

1 the same as Yukari's prediction

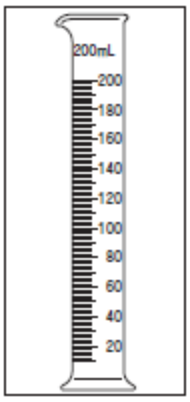
2 the same as Toshio's prediction

3 the same as Rikako's prediction

4 not any or the 3 predictions.

(4) Toshio decided to measure 100 mL of water using the measuring instrument shown on the right.

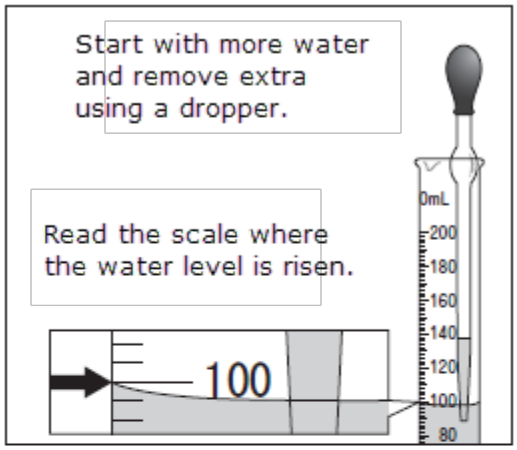
What is the name of the instrument Toshio used?



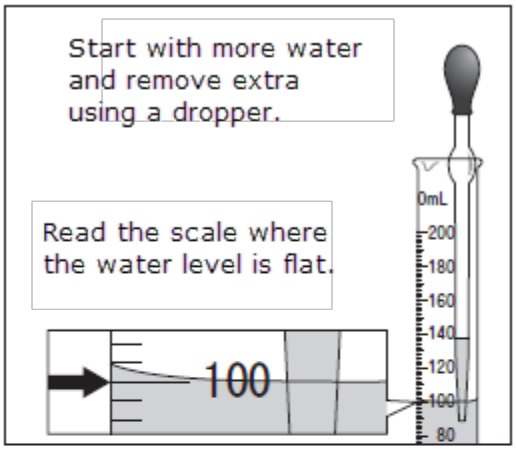
Instrument Toshio used

(5) Which of 1 through 4 below shows the correct way to measure the amount of water? Select one and write the number.

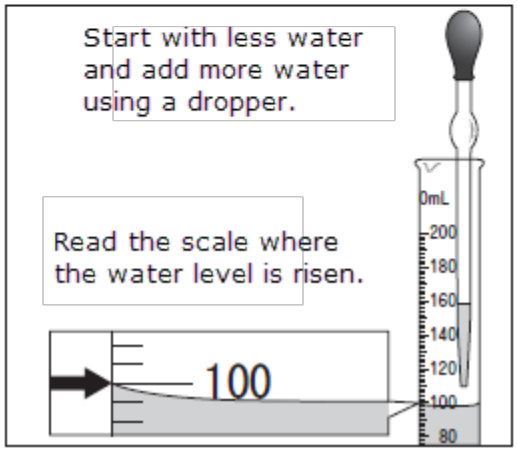
1



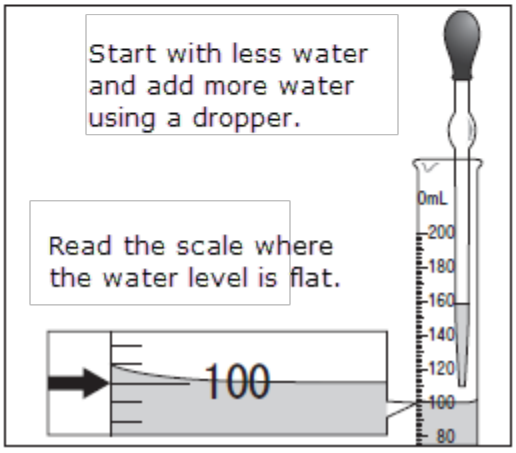
2



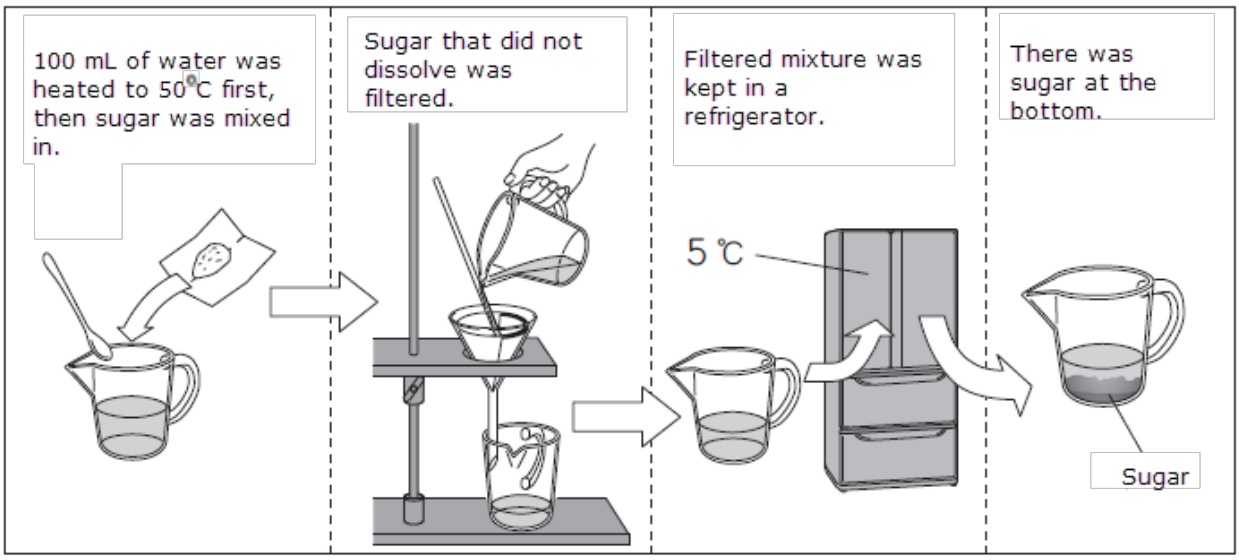
3



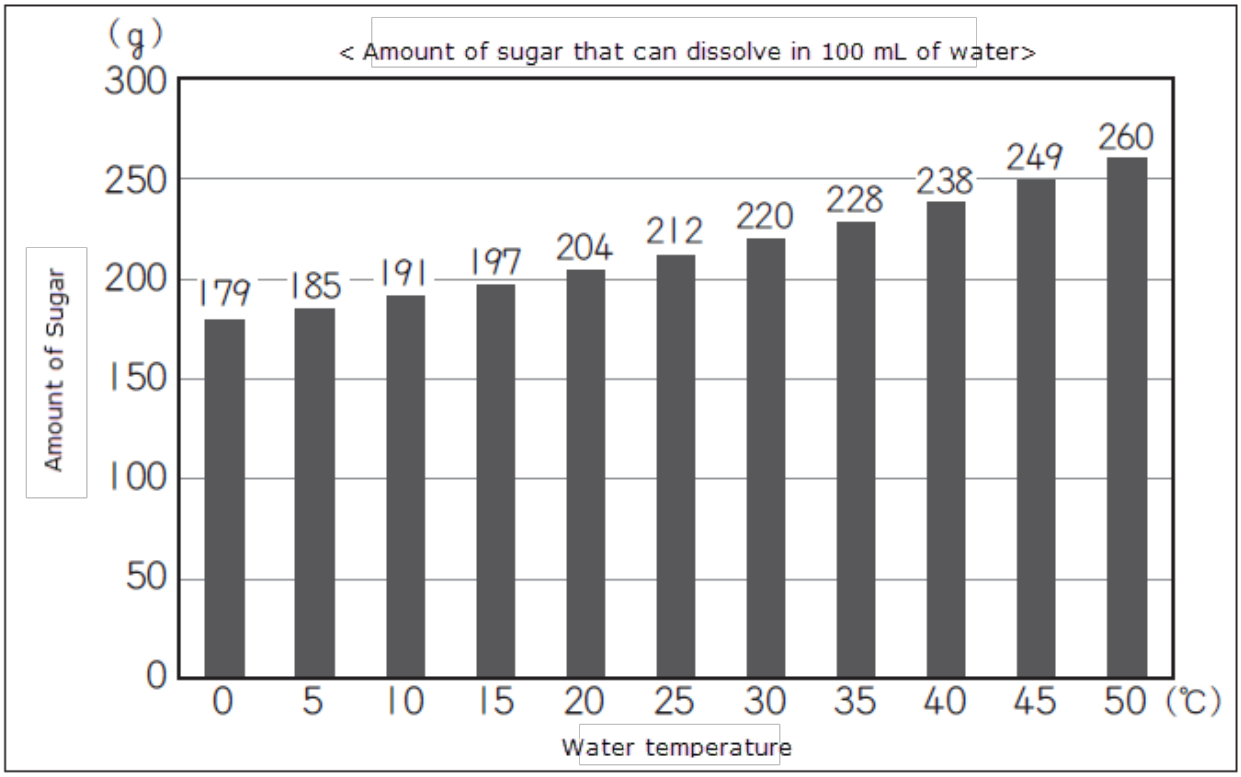
4

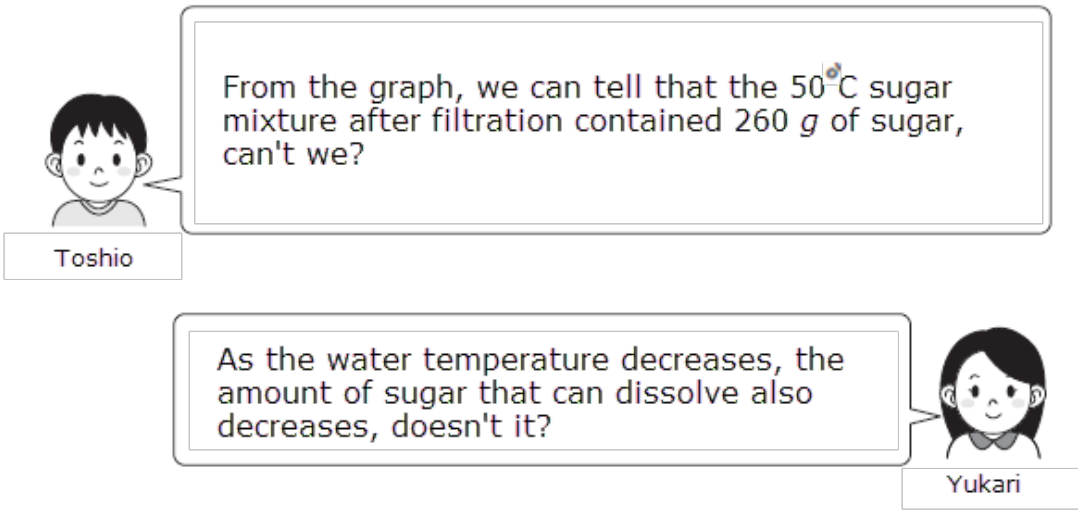


(6) Toshio heated 100 mL of 20 °C water to 50 ° then mixed in sugar. Because some sugar did not dissolve, he filtered the mixture before putting it in a refrigerator. Next day, when he pulled the water out of the refrigerator, there was sugar at the bottom.



Toshio then investigated the relationship between water temperature and the amount of sugar that can dissolve in the water.





Based on the graph above, how many *g* of sugar was at the bottom of the container when the sugar mixture was pulled out of the 5 °C refrigerator? Select one from 1 through 4 below and write that number. Also, write the reason you chose that number.

1 About 19 *g*

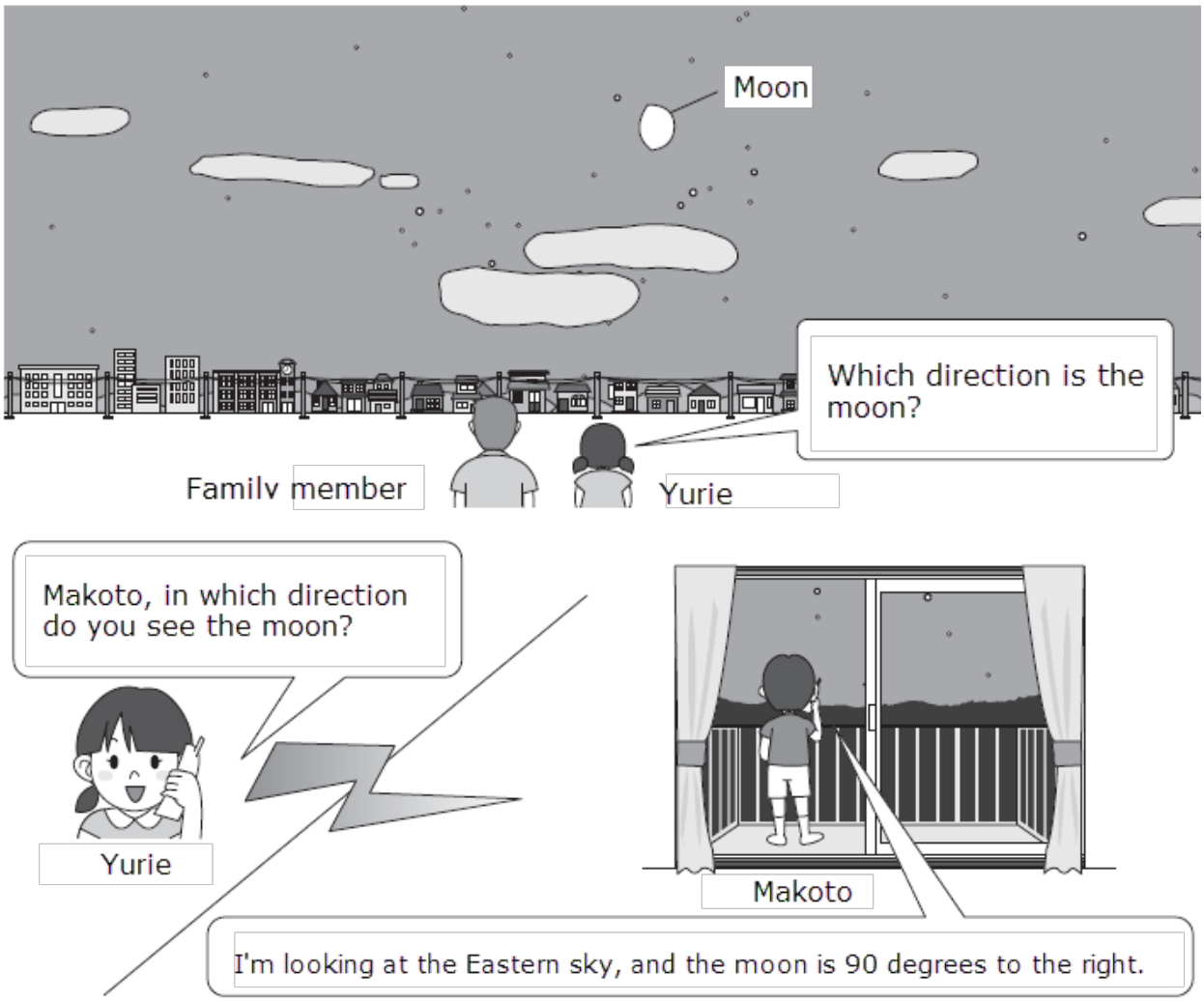
2 About 75 *g*

3 About 185 *g*

4 About 260 *g*

[4] Yurie and her family were observing the moon and various constellations. She decided to exchange her observations with Makoto who lives nearby.

(1) Yurie observed the moon at 8 pm.



What can we say about the direction in which Yurie is making her observation? Select one from 1 through 4 below and write the number.

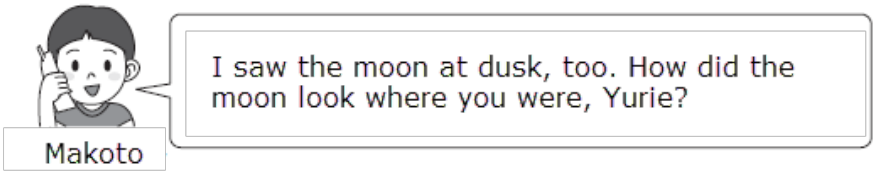
1 She is looking to the north.

2 She is looking to the south.

3 She is looking to the west.

4 We cannot tell because she and Makoto are at different locations.

(2) Makoto made the following statement about the moon he observed that day.



Which of the following pictures show the way the moon looked at 4 pm, looking in the same direction as Yurie found the moon at 8 pm. Select one from 1 through 4 below and write that number.

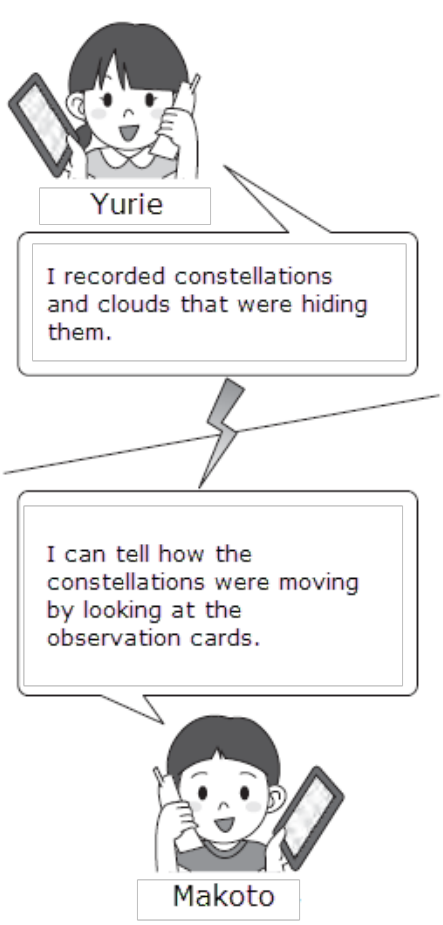
1

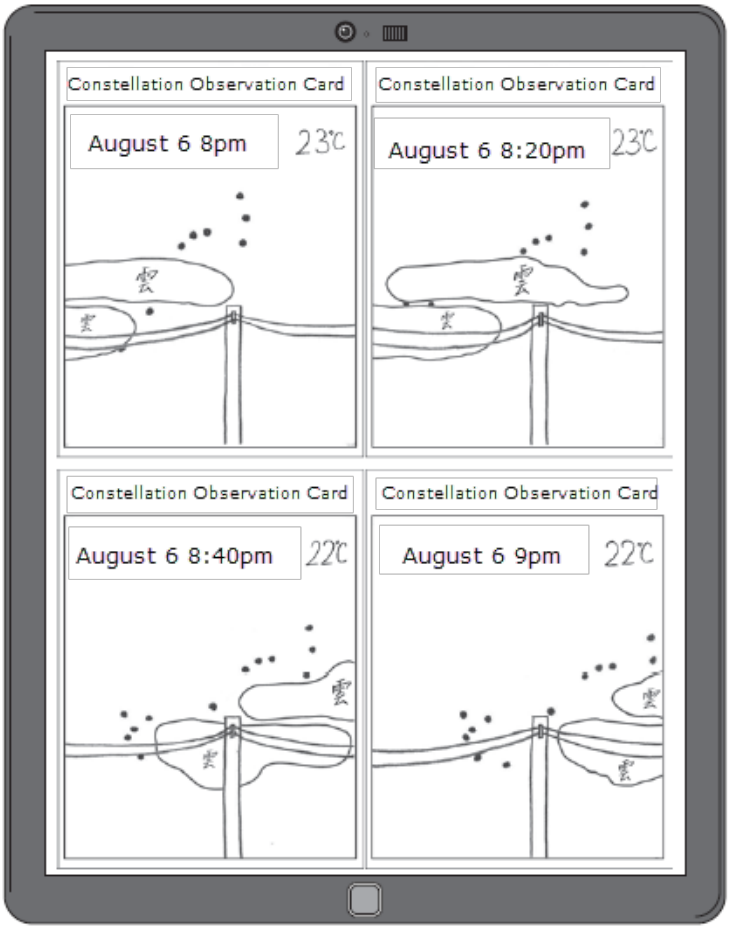
2

3

4

(3) Yurie continued to observe constellations at the same location and recorded their movements in the observation cards. She then emailed her observation cards to Makoto.





Aside from the position of the constellations, what additional information recorded on Yurie's observation cards can help us understand the way the constellations were moving? Select two from 1 through 4 below and write their numbers.

1 Time

2 Position of clouds

3 Temperature

4 Electric pole as a reference point

(4) Based on the 4 observation cards Yurie emailed to Makoto, how did the constellations and clouds moved from Yurie's view point? Select one from 1 through 4 below and write the number.

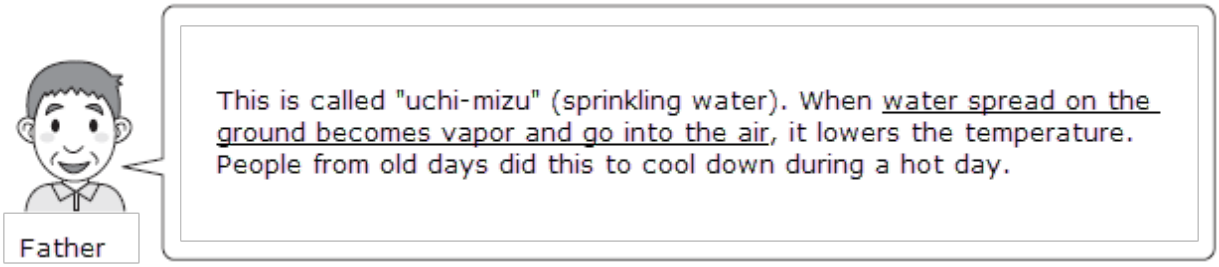
1 The constellations moved to her left while the clouds moved to her right.

2 The constellations moved to her left and the clouds also moved to her left but far more.

3 The constellations moved to her right while the clouds moved to her left.

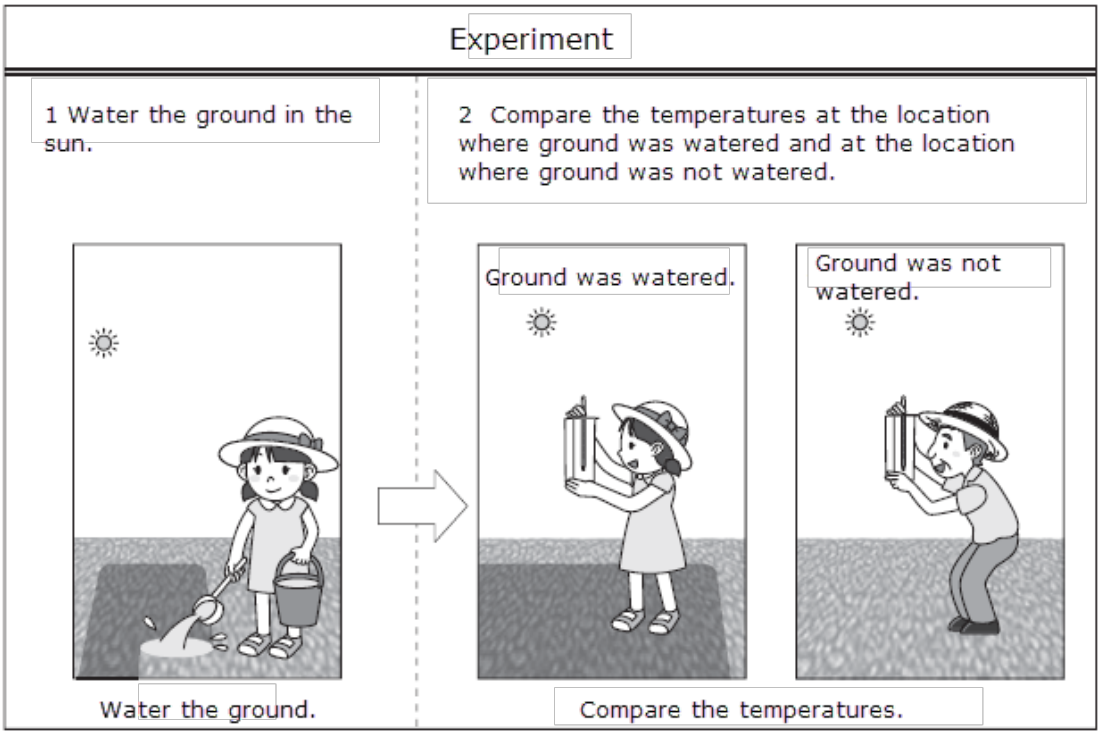
4 The constellation moved to her right and the clouds also moved to her right but far more.

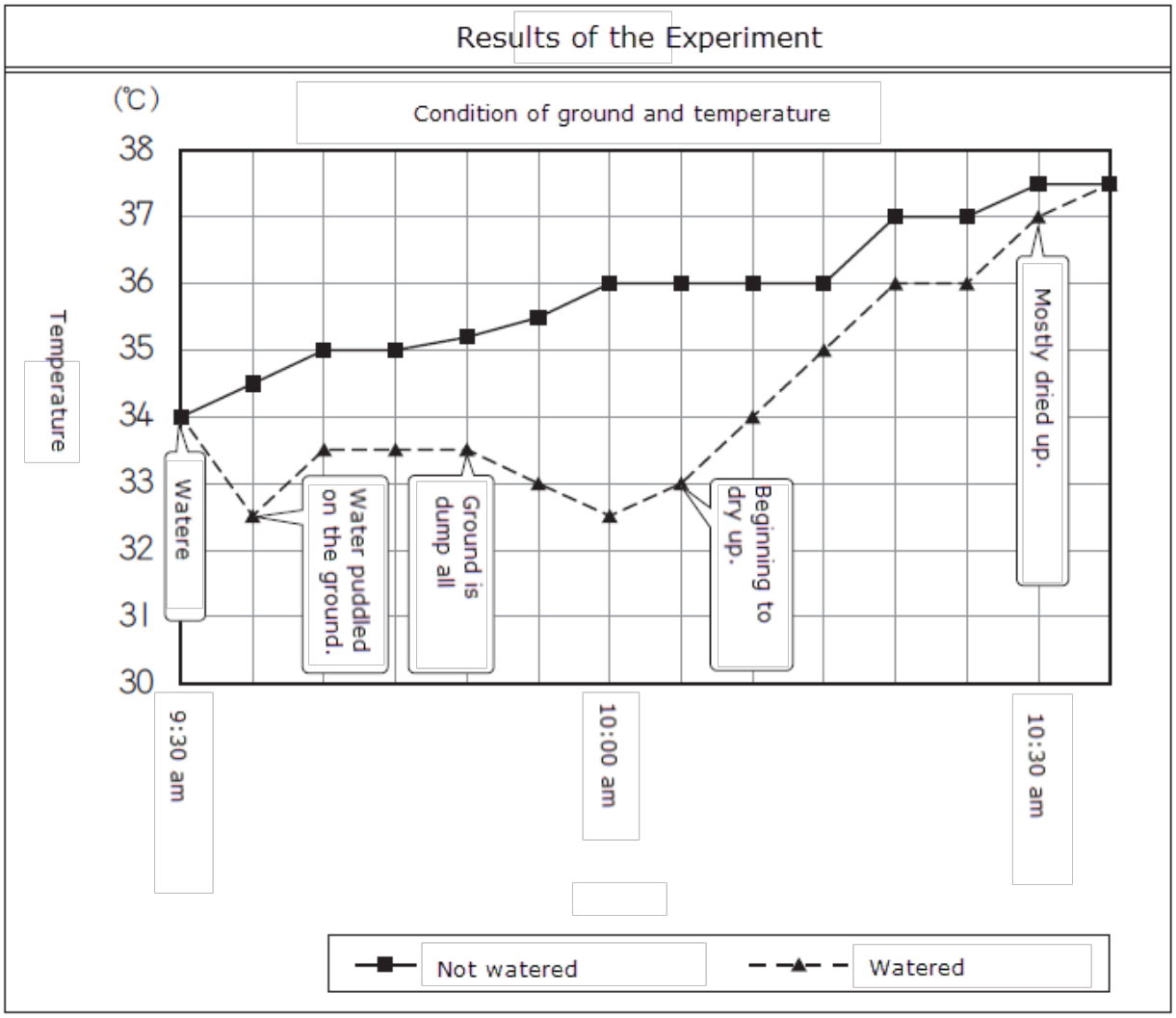
(5) Next day, Yurie saw her father spreading water in front of their house.



What is the process of "water spread on the ground becomes vapor and go into the air" called? Write the word that describes the process.

(6) Yurie conducted the following experiment to see “whether or not temperature will go down if we water the ground.”





What can we conclude from Yurie's experiment. Select one from 1 through 4 below and write the number.

1 If you water the ground, the temperature will keep going down.

2 If you water the ground, the temperature will be higher than if you do not water the ground.

3 If you water the ground, the temperature will be lower than if you do not water the ground until the ground dries.

4 Even if you water the ground, the temperature will be the same.