

Student Activity Guide for NAEP Interactive Science Task: Cracking Concrete

http://www.nationsreportcard.gov/science_2009/ict_tasks.asp

Select "Take this task" under Cracking Concrete.



GRADE 4 Cracking Concrete

Predict the effect of the freeze/thaw cycle on a concrete sidewalk.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 4 Here Comes the Sun

Predict path of the sun and number of daylight hours to determine best planting location.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 4 Mystery Plants

Determine optimum amount of light and nutrients for plant growth.

Duration: 40 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 8 Bottling Honey

Investigate flow rates of four liquids to determine best temperature for bottling honey.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 8 Playground Soil

Investigate attributes of two soil samples to determine the best site for building a playground.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 8 Planning a Park

Evaluate the impact of a planned recreation park on specific organisms.

Duration: 40 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 12 Energy Transfer

Investigate energy transfer between substances to determine the best metal for a cooking pot.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 12 Starlight

Investigate relationships between the luminosity and temperature of different stars.

Duration: 20 minutes

[Take this task >](#)

[Scoring information >](#)



GRADE 12 Phytoplankton Factor

Investigate ocean conditions that support phytoplankton growth.

Duration: 40 minutes

[Take this task >](#)

[Scoring information >](#)

In this task, you will investigate what happens to the volume of water when it freezes. Then you will use the results of your investigations to predict and test what will happen when water freezes in the cracks of a concrete sidewalk.

Read the information on each screen. Select "NEXT" when you have finished reading the information on the screen. Screen shots of each screen are on this worksheet.

Welcome!

A city is having a problem with its sidewalks.


In the winter, small cracks in the concrete get bigger. Some students think that this might be caused by rainwater getting into the cracks.

In this task, you will investigate what happens to the volume of water when it freezes.

You will use the results of your investigations to predict and test what will happen when water freezes in the cracks of a concrete sidewalk.

Click "NEXT" to continue.

BACK NEXT



Welcome!

A city is having a problem with its sidewalks.

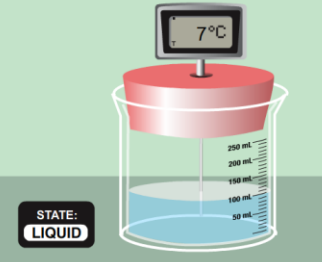
In the winter, small cracks in the concrete get bigger. Some students think that this might be caused by rainwater getting into the cracks.

In this task, you will investigate what happens to the volume of water when it freezes.

You will use the results of your investigations to predict and test what will happen when water freezes in the cracks of a concrete sidewalk.

Click "NEXT" to continue.

BACK NEXT



The beaker on the left contains water.

The thermometer shows the temperature of the water.

Now click on "ZOOM IN" to read the volume of the water in the beaker.

Record the volume of the water in milliliters (mL).

Click "NEXT" to continue.

BACK NEXT

When there is a question, write your answer on this worksheet, not on the computer screen. If you answer directly on the computer, your answer will not be saved. You do not need to answer anything directly on the computer. After answering, select "NEXT" to continue.

Question 1

Record the volume of the water in milliliters.

At 7 degrees Celsius, the water is a liquid.

What do you think will happen to the water if the temperature drops to -1 degree Celsius?

Click "NEXT" to continue. You will not be able to return to this screen once you click on the "NEXT" button.

STATE: LIQUID

ZOOM IN

BACK NEXT

Question 2

At 7 degrees Celsius, the water is a liquid. What do you think will happen to the water if the temperature drops to -1 degree Celsius?

Now click "ZOOM IN" to read the volume of the ice in the beaker.

Record the volume of the ice in milliliters (mL).

Click "NEXT" to continue. You will not be able to return to this screen once you click on the "NEXT" button.

STATE: LIQUID

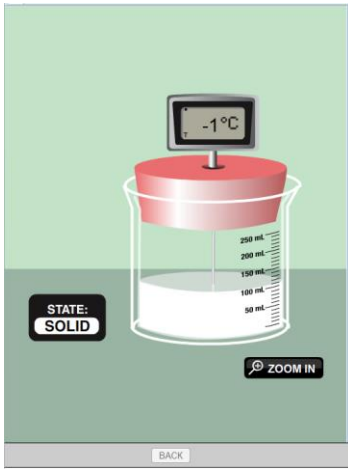
COOL RESET

ZOOM IN

BACK NEXT

Question 3

Record the volume of the ice in milliliters (mL).



A student recorded the following data for the water and ice:

Water
Temperature: 7 degrees Celsius
Volume: 100 mL

Ice
Temperature: -1 degree Celsius
Volume: 110 mL

Describe what happened to the volume when the water changed to ice.

By how much did the volume change?

Click "NEXT" to continue.

BACK NEXT

Question 4

Describe what happened to the volume when the water changed to ice.

By how much did the volume change?

A student recorded the following data for the water and the ice:

Water
Temperature: 7 degrees Celsius
Volume: 100 mL.

Ice
Temperature: -1 degree Celsius
Volume: 110 mL.

If you turn the ice back into water, what do you think will happen to the volume?

A The water will take up less volume than the ice.

B The water will take up the same volume as the ice.

C The water will take up more volume than the ice.

Explain why you think this. Use the data to support your explanation.

Click "NEXT" to continue. You will not be able to return to this screen once you click on the "NEXT" button.

Question 5

A student recorded the following data for the water and the ice:

Water Temperature: 7 degrees Celsius
Volume: 100 mL

Ice Temperature: -1 degree Celsius
Volume: 110 mL

If you turn the ice back into water, what do you think will happen to the volume?

- A. The water will take up less volume than the ice.
- B. The water will take up the same volume as the ice.
- C. The water will take up more volume than the ice.

Explain why you think this. Use the data to support your explanation.

Now click the "HEAT" button to change the ice back to water.
 Click the "ZOOM IN" button to read the volume of the water.
 You can click "RESET" to change the water temperature back to -1 degree Celsius.

What happened to the volume when the ice changed back to water?

A The volume increased.
 B The volume decreased.
 C The volume stayed the same.

Explain how you know. Use your data to support your explanation.

Click "NEXT" to continue.

Question 6

What happened to the volume when the ice changed back to water?

- A. The volume increased.
- B. The volume decreased.
- C. The volume stayed the same.

Explain how you know. Use your data to support your explanation.

Now you will use the results of your investigations to explain how water might affect the cracks in a concrete sidewalk during winter.

Click "NEXT" to continue.

During rainy weather, water fills small sidewalk cracks like the ones shown on the left.

The thermometer shows that the temperature is 7 degrees Celsius.

If the sidewalk temperature drops to -1 degree Celsius, predict what will happen to the cracks in the sidewalk.

A The cracks will become smaller.

B The cracks will remain the same size.

C The cracks will become larger.

Based on your investigations of water and ice, explain why you think this.

Click "NEXT" to continue. You will not be able to return to this screen once you click on the "NEXT" button.

BACK NEXT

Question 7

During rainy weather, water fills small sidewalk cracks like the ones shown on the left. The thermometer shows that the temperature is 7 degrees Celsius.

If the sidewalk temperature drops to -1 degree Celsius, predict what will happen to the cracks in the sidewalk.

- A. The cracks will become smaller.
- B. The cracks will remain the same size.
- C. The cracks will become larger.

Based on your investigations of water and ice, explain why you think this.

PLAY RESET

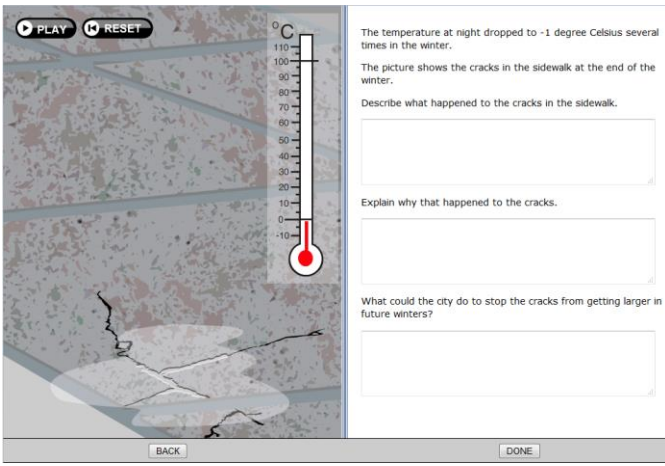
The sidewalk has small cracks in it. On rainy days, water gets into the cracks.

In the winter, the weather gets colder and the temperature drops.

Click "PLAY" to observe what happens. You can click "RESET" to go back to the beginning of the winter.

When you are finished, click "NEXT" to continue.

BACK NEXT



The screenshot shows an interactive simulation interface. On the left, there is a 3D view of a sidewalk with several cracks. A thermometer is overlaid on the sidewalk, showing a temperature of -1 degree Celsius. The thermometer scale ranges from -10 to 110 degrees Celsius. At the top left of the simulation area, there are 'PLAY' and 'RESET' buttons. At the bottom left and right of the simulation area, there are 'BACK' and 'DONE' buttons respectively. On the right side of the simulation, there is a text box containing the following text: 'The temperature at night dropped to -1 degree Celsius several times in the winter. The picture shows the cracks in the sidewalk at the end of the winter. Describe what happened to the cracks in the sidewalk.' Below this text is a large empty rectangular box for the user's answer. Below that box is another text prompt: 'Explain why that happened to the cracks.' followed by another large empty rectangular box. At the bottom of the text area is a third text prompt: 'What could the city do to stop the cracks from getting larger in future winters?' followed by a third large empty rectangular box.

Question 8

The temperature at night dropped to -1 degree Celsius several times in the winter.

The picture shows the cracks in the sidewalk at the end of the winter.

Describe what happened to the cracks in the sidewalk.

Explain why that happened to the cracks.

Question 9

What could the city do to stop the cracks from getting larger in future winters?
