Kentucky Academic Standards

Grade 7 Science
Released Items
2020

Science

DIRECTIONS **Read all the information and the questions carefully. Choose the best answer(s).**

A teacher asks students to touch their plastic tabletop and then touch the metal leg of their chair. When asked which one is colder, the students respond that the leg is colder. The teacher then uses an infrared thermometer to determine the temperatures. Much to the students' surprise, the metal chair leg and the plastic tabletop are the same temperature.

The teacher asks, "Why is it that metal objects generally feel cool or cold while plastic objects feel warm when they're the same temperature?"

The class decides to investigate this phenomenon.

1

Which relationship(s) could be investigated with the experiment the students completed to investigate heat characteristics of objects?

Select the TWO **best** answers.

A Object mass and substance

B Substance and temperature change

C Object mass and temperature change

D Object color and temperature change

E Object color and substance

As an introduction to understanding this phenomenon, students investigate the heat characteristics of three samples from three different substances.

- The samples of the substances were placed in a freezer overnight.
- The next day, they were taken out of the freezer and placed on the same surface.
- The temperature of each sample was taken immediately and again after 20 minutes.
- The students calculated the change in temperature over the 20 minutes for each sample.

The results are shown in the tables.

Substance 1

	Sample 1	Sample 2	Sample 3
Mass (g)	50	100	150
Temperature Change (°C) after 20 minutes	37	23	18

Substance 2

	Sample 1	Sample 2	Sample 3
Mass (g)	75	150	225
Temperature Change (°C) after 20 minutes	41	32	18

Substance 3

	Sample 1	Sample 2	Sample 3
Mass (g)	50	100	150
Temperature Change (°C) after 20 minutes	49	36	24

2

Which one of the following claims is **best** supported by the data for Substances 1, 2, and 3?

A All the samples' temperatures changed at the same rate.

B The mass of the sample had no effect on the temperature change.

C Larger masses resulted in less temperature change in the samples.

D A decrease in temperature change results in the sample having more mass.

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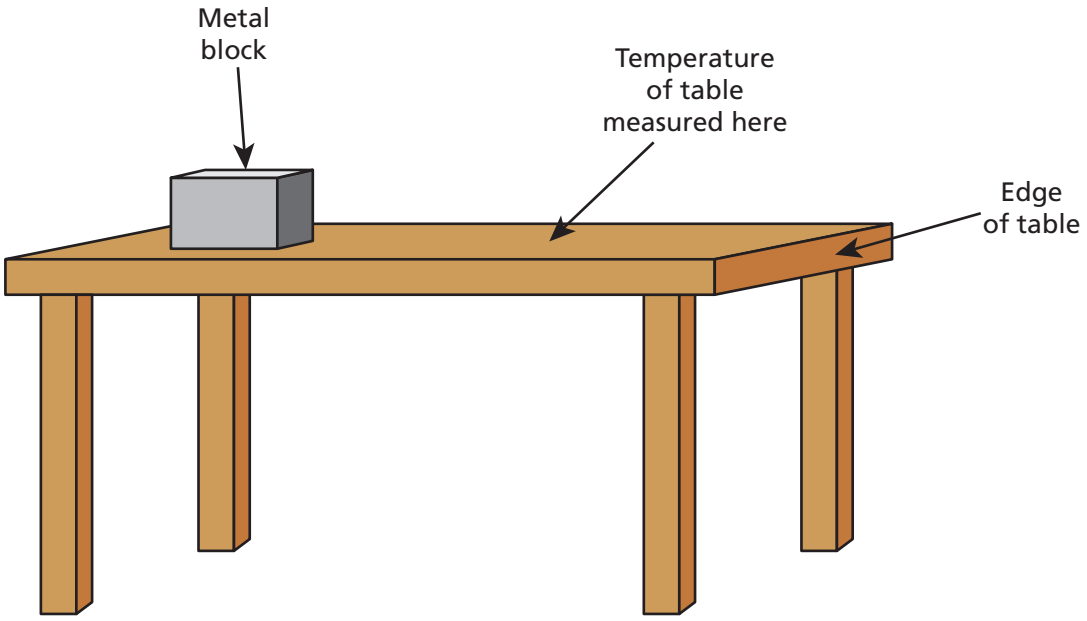
The teacher explained that heat moving into objects that touch is called conduction. The class wanted to investigate conduction to help them understand what they observed about the different substances. They decided to investigate how temperatures change when different substances touch.

They began by investigating how a heated metal block changed the temperature of a table it was placed upon. They repeated this investigation with a cooled metal block.



Heated Metal Block

Time (min)	Metal Block Temperature (°C)	Table Temperature (°C)
0 (start)	200	20
5	120	70
10	107	79
15	98	85
20	87	87

Cooled Metal Block

Time (min)	Metal Block Temperature (°C)	Table Temperature (°C)
0 (start)	0	20
5	5	19.5
10	11	19
15	16	18.5
20	18	18

3

Which one piece of data from the students' investigation **best** supports the following claim?

When the average kinetic energy of an object's particles increase, energy must be transferred to those particles.

A The table's temperature changed much faster in the heated metal block experiment.

B The table's temperature increased 67° over the course of 20 minutes in the heated metal block experiment.

C The table's temperature changed 2° in the cooled metal block experiment and 67° in the heated metal block experiment.

D In the heated metal block experiment, the table's temperature increased 50° in 5 minutes and the metal block's temperature decreased 80° in 5 minutes.

Suzanne made a claim that much less energy was transferred during the cooled metal block investigation than when the block was heated.

4

The teacher asked Suzanne what evidence caused her to make this claim.

Select the TWO **best** answers.

A The table's temperature changed more slowly during the cooled metal block experiment.

B The table's temperature changed more quickly during the heated metal block experiment.

C The table's temperature changed a lesser amount during the cooled metal block experiment.

D The table's temperature was higher during the cooled metal block experiment.

E The table's temperature changed a greater amount during the heated metal block experiment.

Suzanne noticed that the edge of the table was warmer after the heated block had been on the table for a few minutes.

The teacher asked, "Are you saying the temperature is greater now than when the block was first added?"

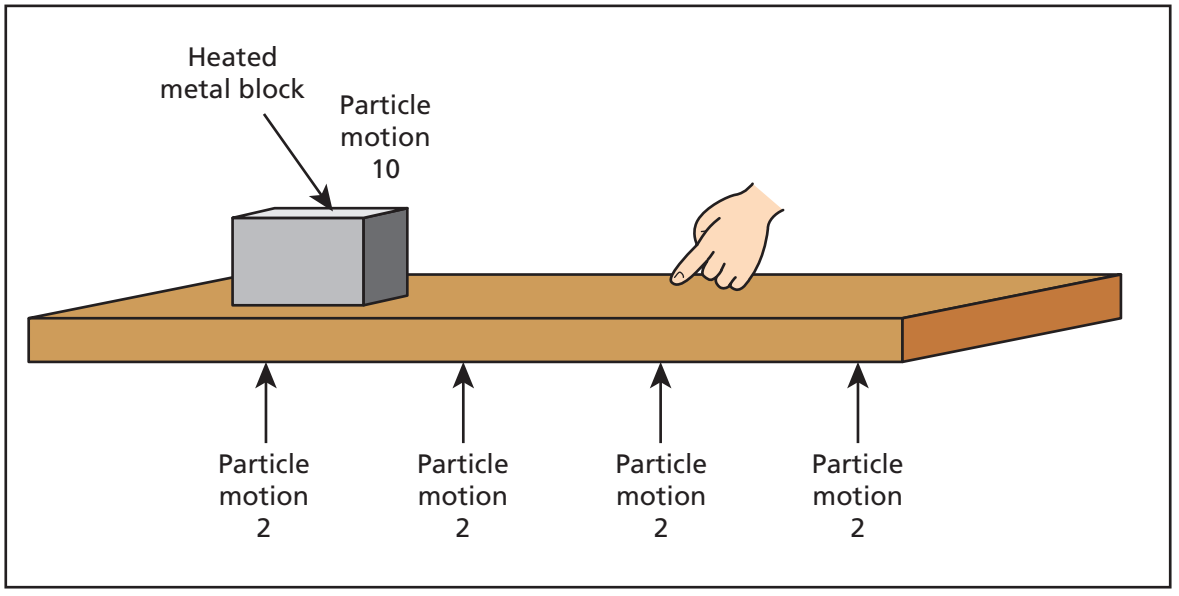
"Yes," Suzanne replied.

"What does that tell you about the speed of the particles in the table?" the teacher asked.

"The particles at the table edge are moving faster than they were before the heated metal block was placed on the table," said Suzanne.

The teacher then makes the claim that "kinetic energy transfer through the particles is responsible for transmitting the energy from the heated block to Suzanne's hand."

The model shows the particle motion of the table and the heated block immediately after the block was placed (0 minutes). Particle motion is represented on a scale of 1–10, with 10 being highest.



GO ON

5

Draw three separate models in the provided space to show how the particle motion changed at 5, 10, and 20 minutes after the block was placed on the table. Explain how the models support the teacher's claim about particle motion and energy transfer.

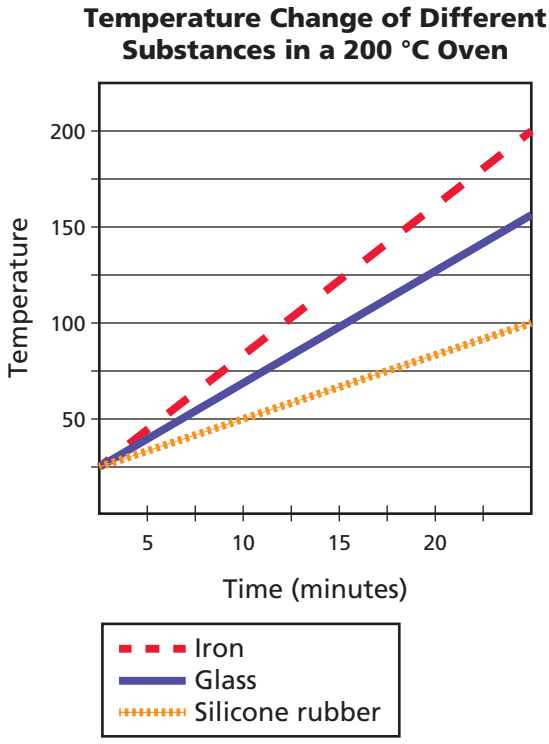
Write your answer on the next page.

5

GO ON▶

The class wanted to investigate how the temperature of different kinds of materials change when heated.

They placed equal masses of three different substances in a 200 °C oven and measured their temperature rise over a 20-minute period. Their results are shown in the graph.



This graph shows the rate of temperature change of different substances when heated at a constant rate.

All of the objects absorbed energy at the same rate while in the oven, but their temperatures did not change equally.

GO ON

6

Which one statement is **best** supported by this data?

A Iron absorbs more energy than the other two substances.

B Silicone rubber absorbs less energy than the other two substances.

C Iron changes temperature at a slower rate than the other two substances.

D Silicone rubber changes temperature at a slower rate than the other two substances.

Some in the class were still uncertain how the results of this investigation were helpful in understanding why the tabletop and the chair leg felt different. The teacher asked them how they could use those same materials to conduct their own investigation.

7

The students decided to perform another investigation where they placed a sample of metal and plastic under a heat lamp to determine which absorbed the most energy.

Which one of the following sets of variables must be controlled to produce the **best** results for the investigation?

A The mass of both samples, the distance from the heat source, the final temperature of each sample, and the time of exposure to the heat source

B The mass of both samples, the distance from the heat source, the beginning temperatures of each sample, and the time of exposure to the heat source

C The mass of both samples, the temperature of the heat source, the beginning temperatures of each sample, and the time of exposure to the heat source

D The mass of both samples, the temperature of the heat source, the final temperatures of each sample, and the time of exposure to the heat source

The teacher offers students one more piece of information: "When you touch an object and it transfers kinetic energy away from your hand, the object feels cool or cold. When kinetic energy moves from the object to your hand you feel warm or hot."

This last piece of information results in the students being able to explain why the chair leg felt cold and the table felt warm.

8

Which one of the following **best** explains why your hand feels cold when you touch the chair and warm when you touch the table, even though the table and chair are each the same temperature?

A Your hand feels cold because its particles lose energy slowly. When you touch the substances, energy quickly leaves your hand making it feel cold.

B Plastics change temperature quickly. When you touch the table, your hand feels warm because the table quickly absorbs energy from your hand.

C Metals change temperature quickly. When you touch the chair with your hand, you feel cold because the metal quickly absorbs energy from your hand.

D Your hand feels cold because its particles lose energy slowly. Energy leaves your hand slowly, causing your hand to feel cold.

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ACKNOWLEDGMENTS

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