Training Header Sheet with Change Log Form

Kentucky Academic Standards

Science

Operational 2018

SC071602_05

Particle Motion

Anchor Set

Date	Comments	Version
3/2018	Initial Operational Training Set	Set A

Stimulus

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.

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

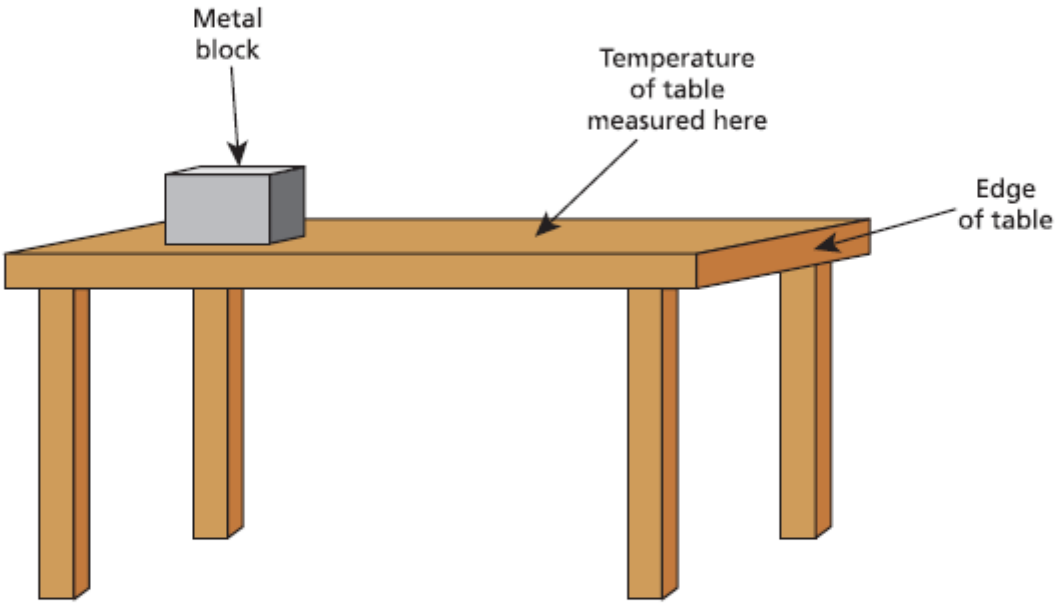
Substance 3

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

Stimulus

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

Stimulus

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

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

Stimulus

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?"

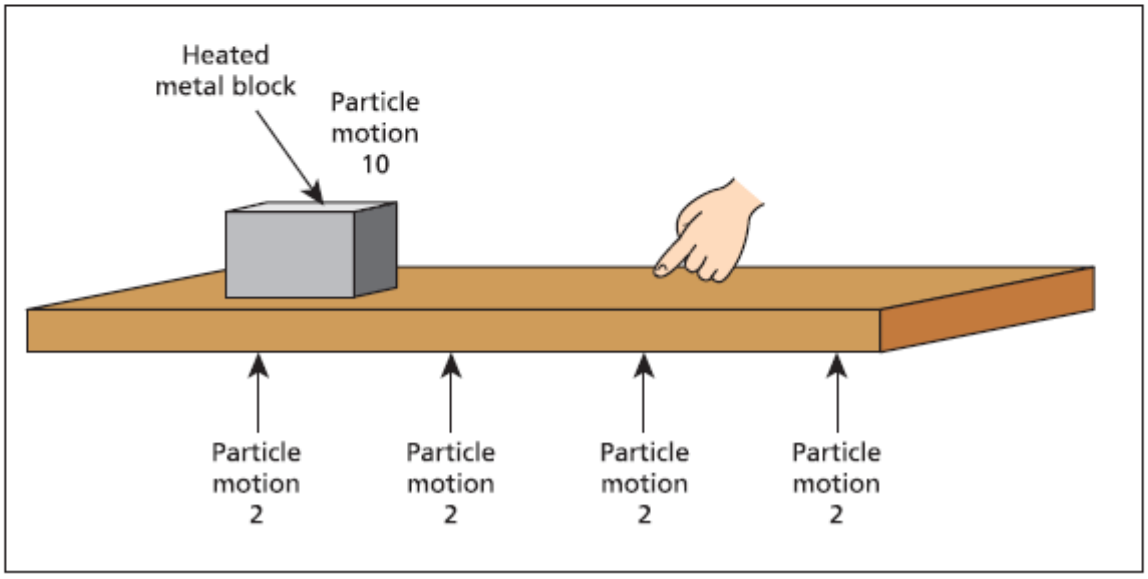
"Yes," Suzanne replied.

"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.



Prompt
SC071602_05

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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.

A101
Score: 0

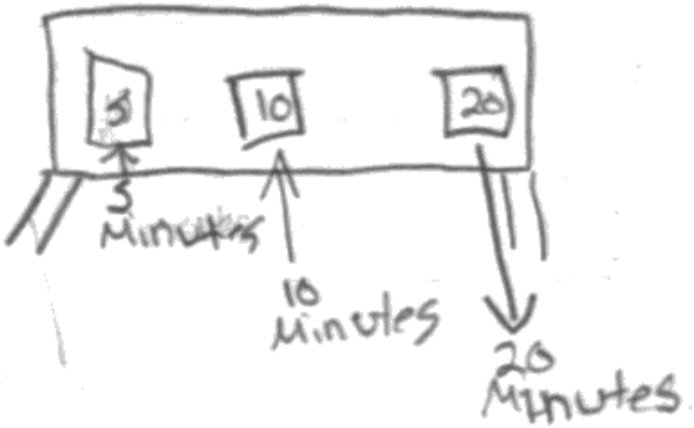
The particle motion changed during the time it was on the table.

5 minutes

10 minute

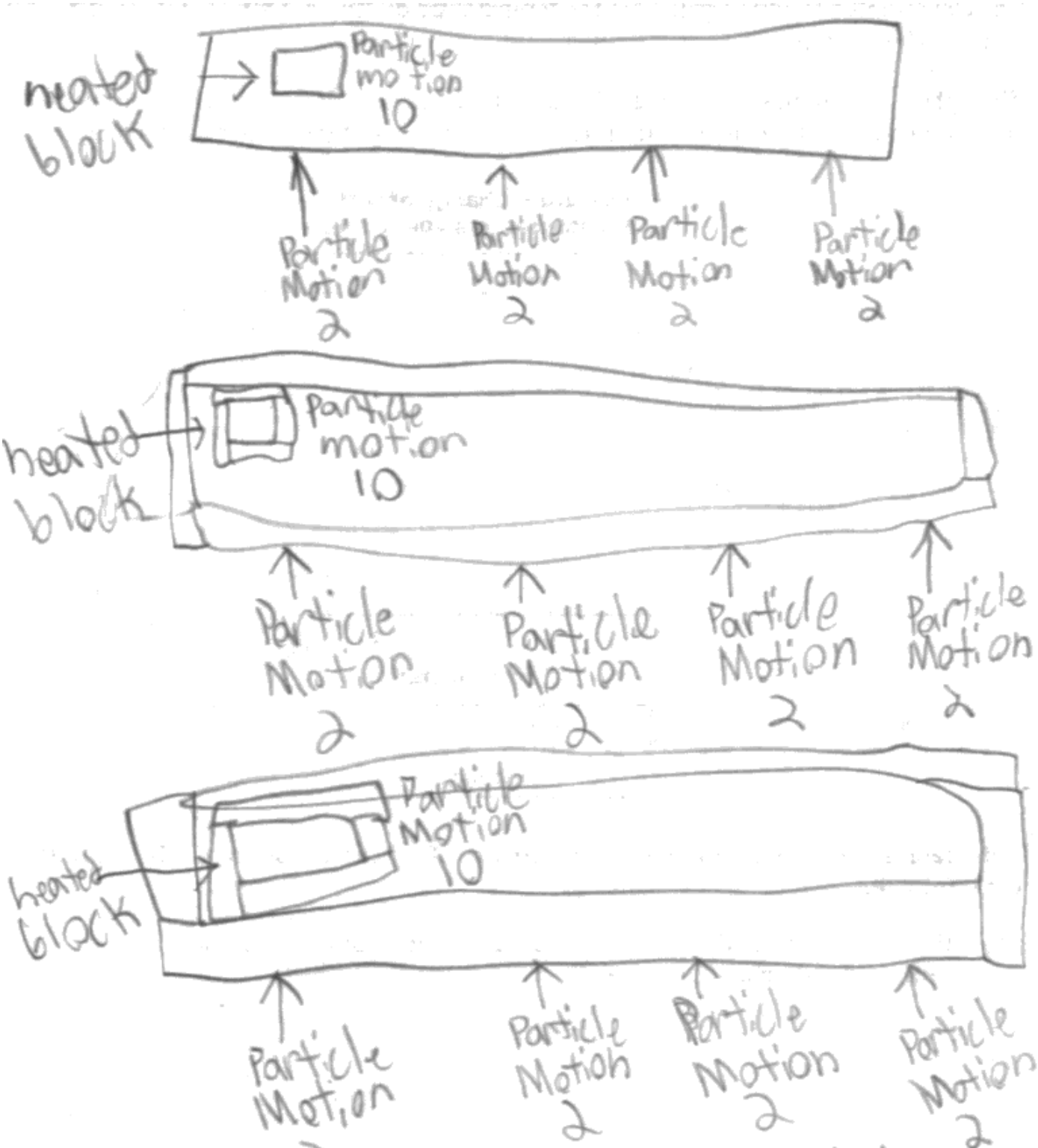
A102
Score: 0

It Explained How they would put it on the table and move it the way it is going to go and the way it wants to go not the way you want it to go the way your teacher wants it to it Moves from 5, 10, and to 20 in minutes.



A103

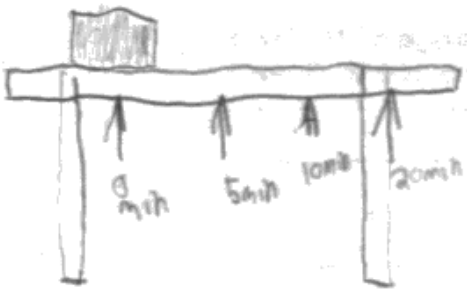
Score: 0



It support the teachers claim that the temperature stays the same.

A104

Score: 1

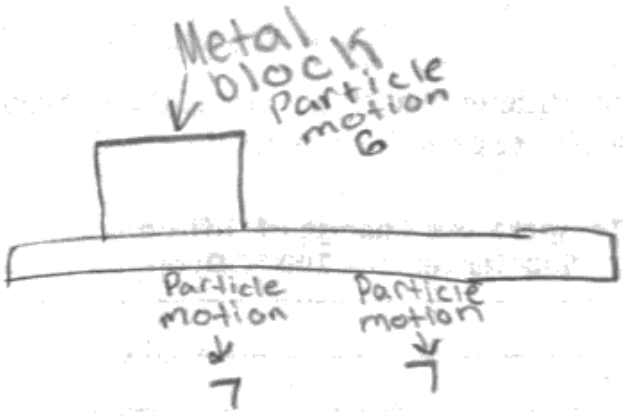


each 5 min that the black sits there it (table) gets warmer.

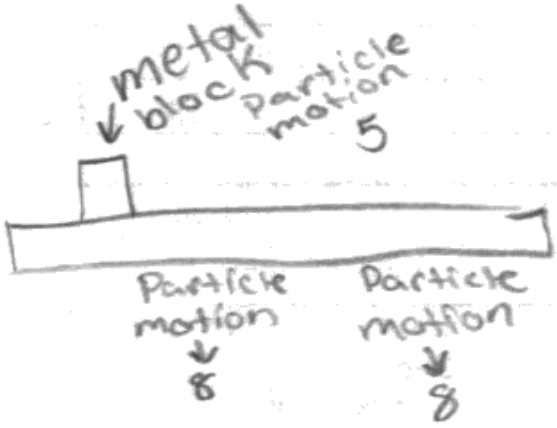
A105

Score: 1

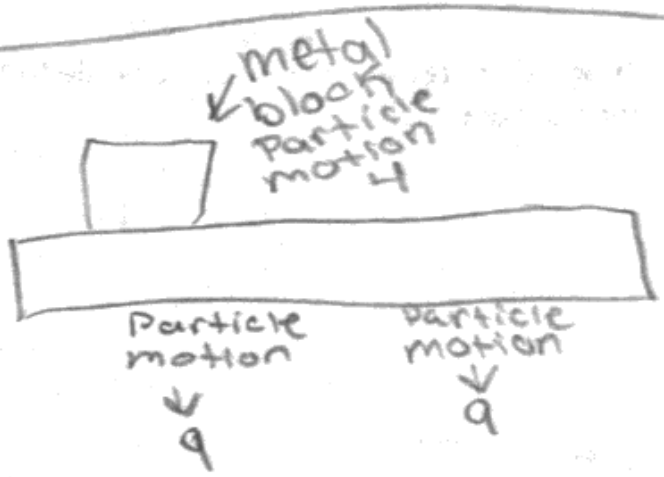
5 min



10 min



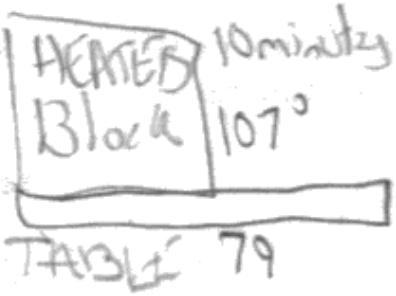
20 min



00097349328215201706

A106

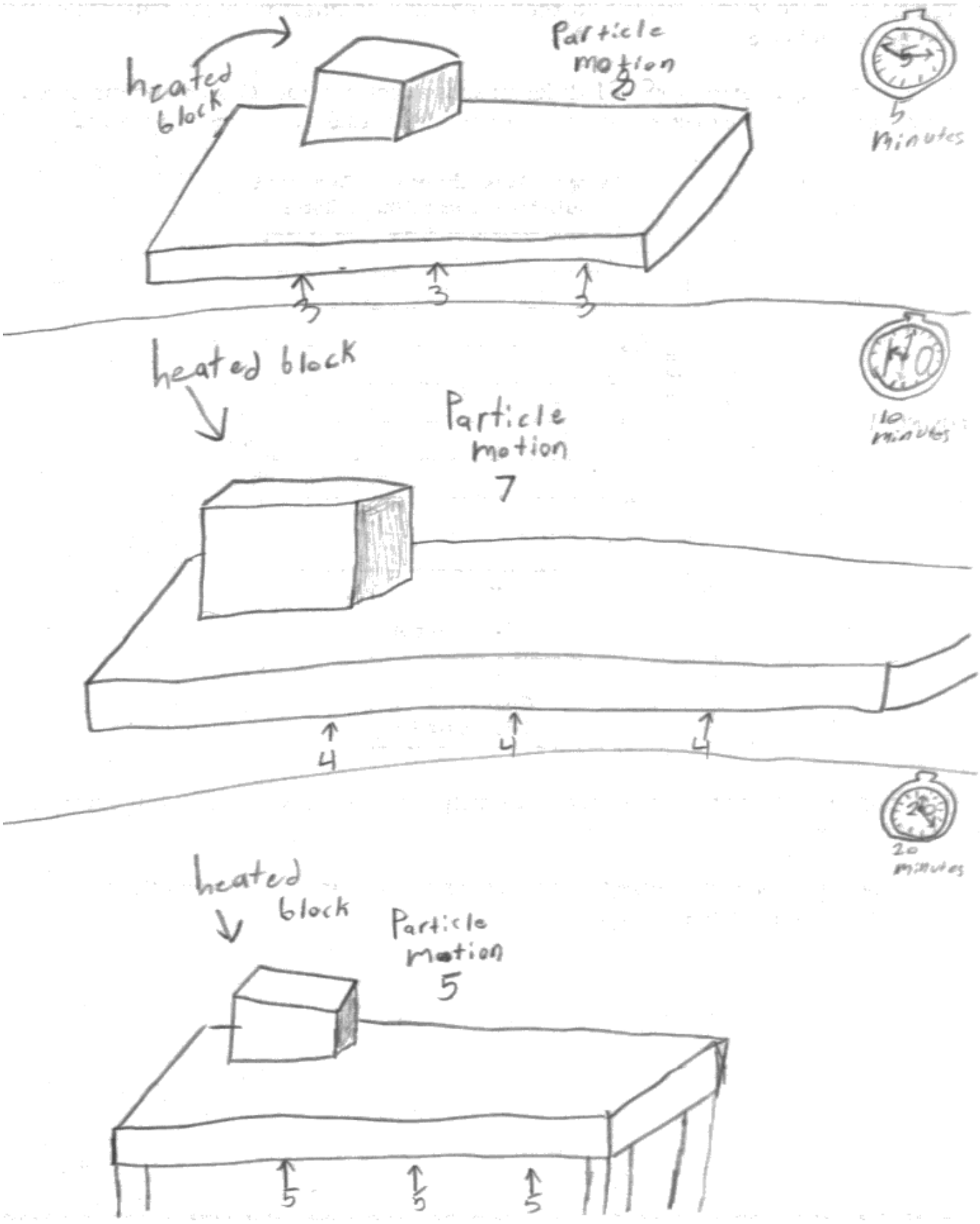
Score: 1



If supports her claim because at five minutes The block is at 120° which starts warming the table at 70°. At 10 min. The Block is 107° and the table is 79. After 20 minutes both the block and the Table are at 87°.

A107

Score: 2



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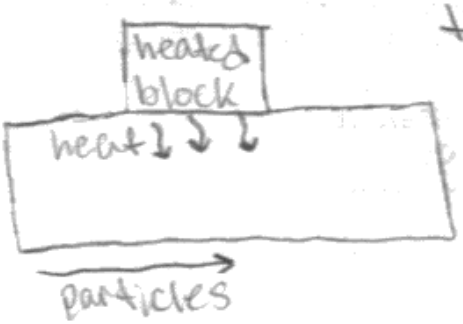
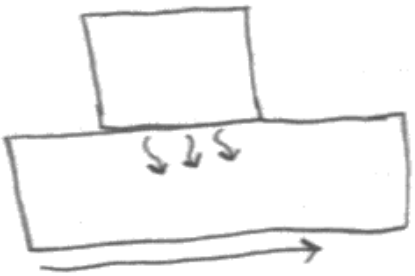
A108
Score: 2

5 minutes



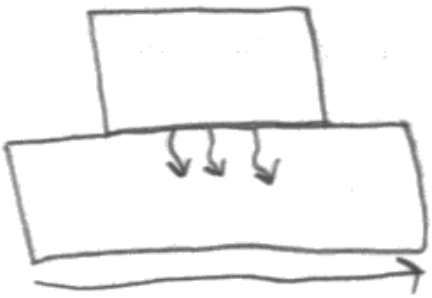
The particles are starting to move faster throughout the table as the heat travels.

10 minutes



The longer the block stays there the more the energy will spread and particles will keep moving faster.

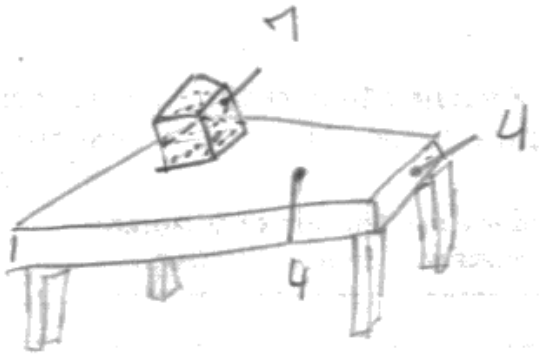
20 minutes



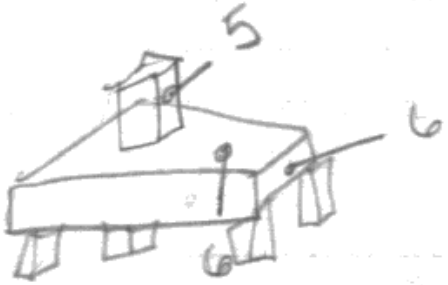
After the heated block has been there for so long, the temperatures will become the same and the particle speed will be the same all in the table.

A109
Score: 2

5 min



10 min

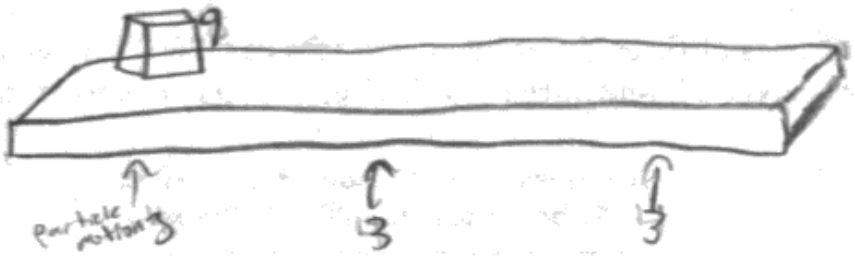


20 min

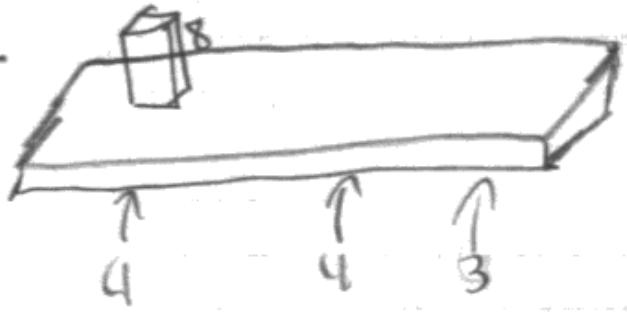
As time passes, the particles in the heated metal block cools down, while the heat transfers to the table, the tables particles, move faster.

A110
Score: 3

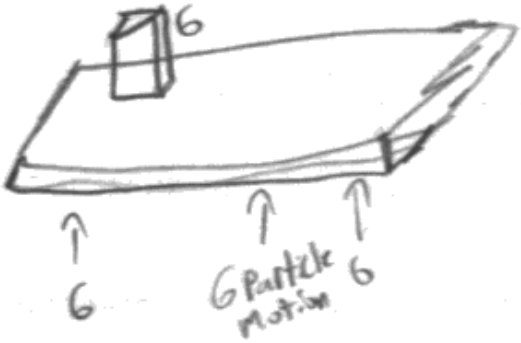
5-



10-



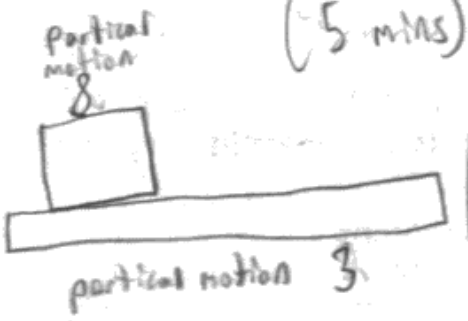
20-



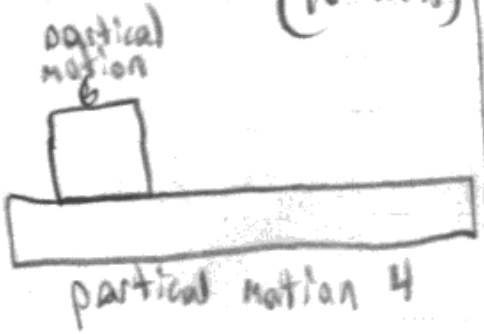
The tempature slowly evens out, as the KE or speed of the particles evens out. Which is why the table got warmer.

A111

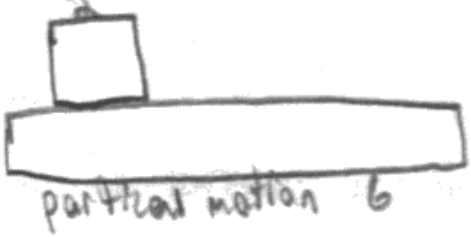
Score: 3



(5 mins)



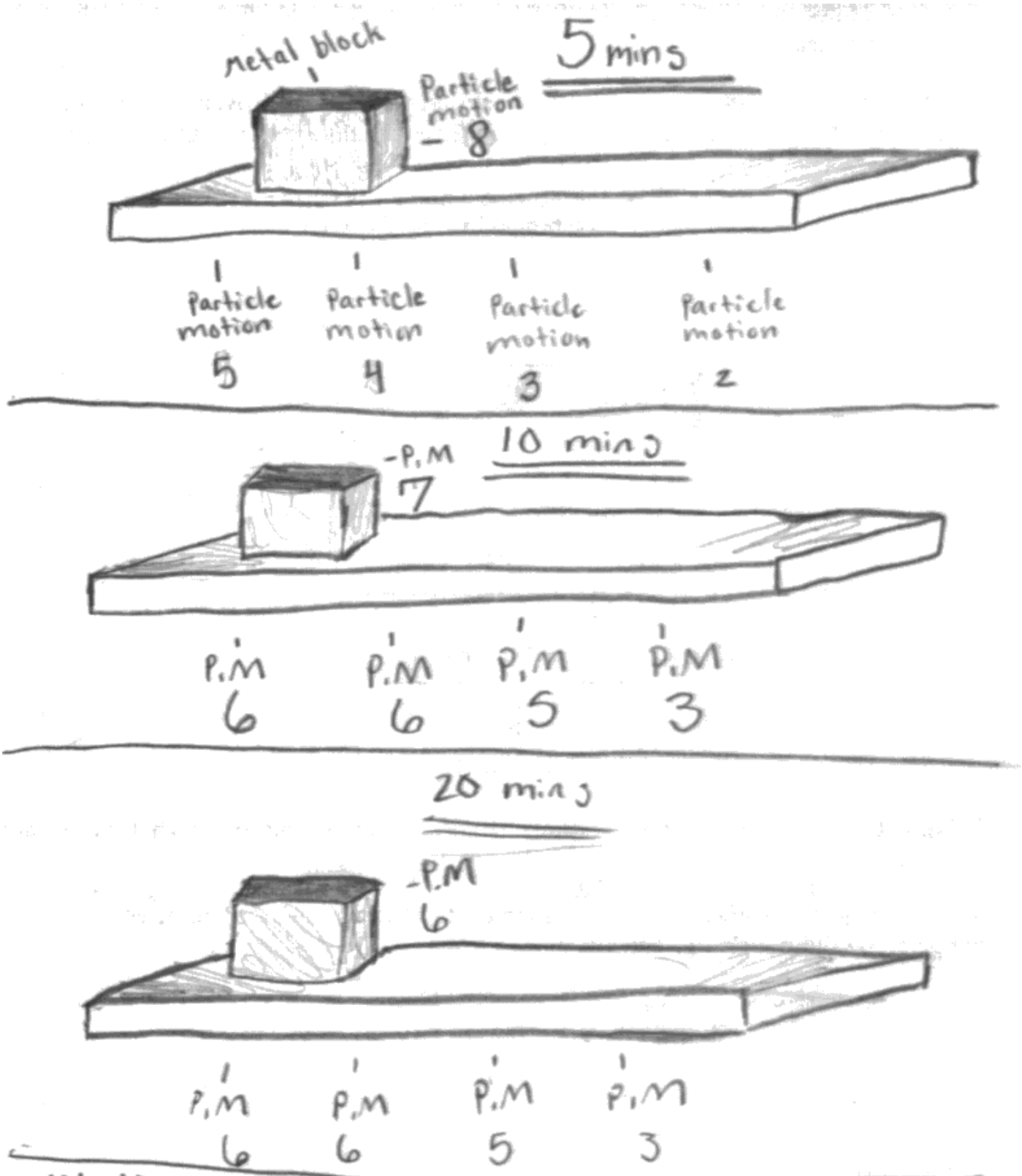
(10 mins)



(20 mins)

the partical motion in the metal block has slowed down to 8 from ten but the partical motion raised on the table from 2 to 3 because the energy transfered from the block throughout the whole table. Since the table has more mass than the block then the partical motion slows down on the block faster than the tables partical motion speeds up. The model supports the teacher's claim because the energy transfers from the block to the table making the tables particals move faster because the energy is transfering into the table particals from the block. There for the block is loosing energy. But the energy is also just filing out of the two into the air so after words the table wont be getting as much energy because the block is loosing energy and the tables energy is filing out.

A112
Score: 3



with time, the block and table start to become the same temperature because the block is causing the particles to speed up.

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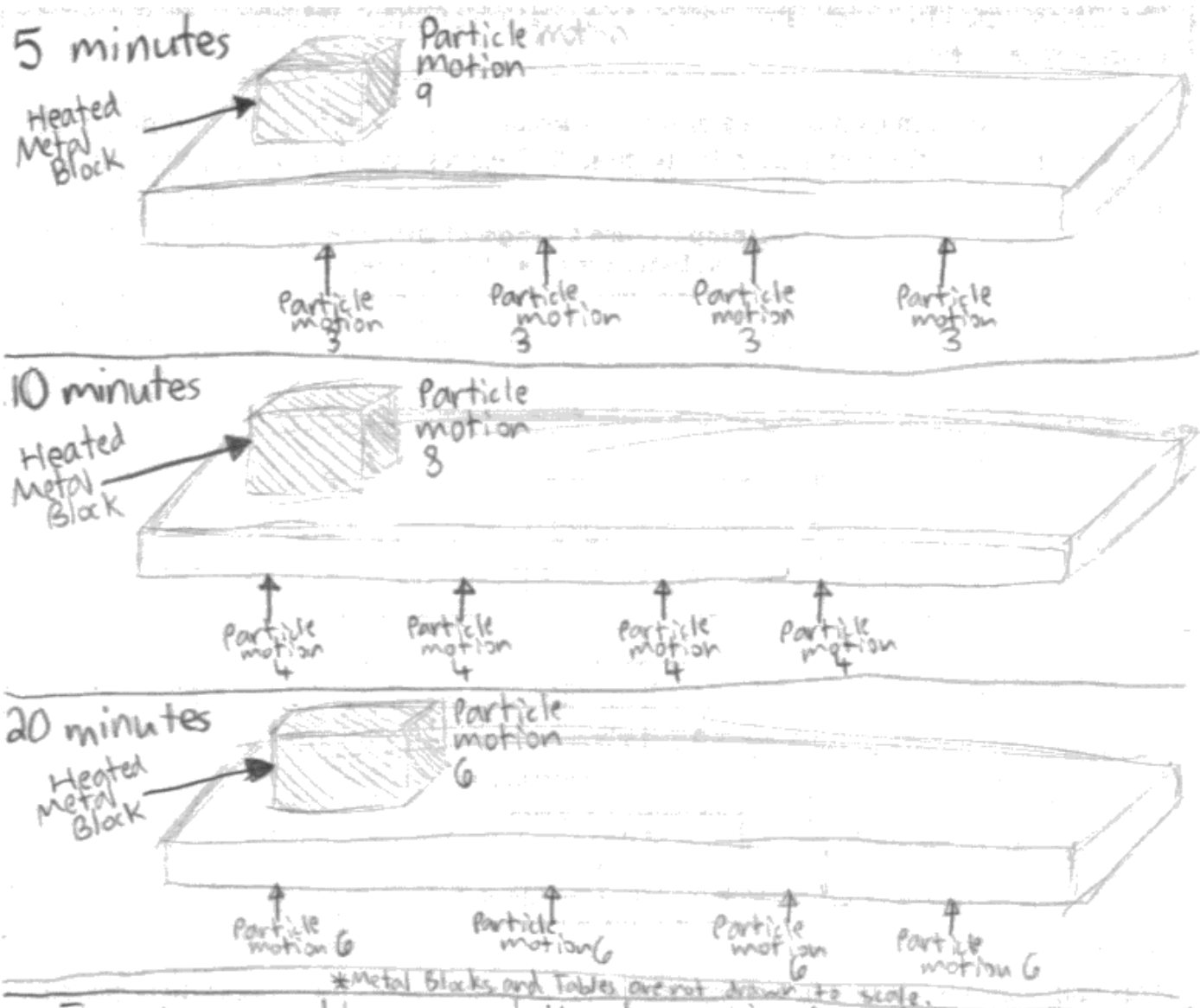
A113

Score: 4

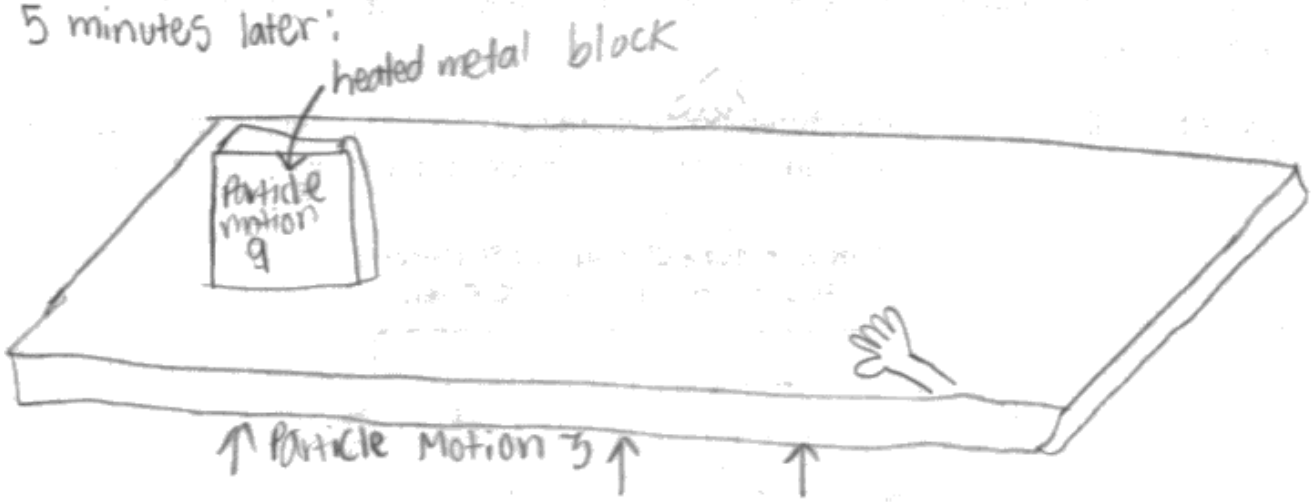


The above models support the teacher's claim that, "Kinetic energy transfer through the particles is responsible for transmitting the energy from the heated block to Suzanne's hand," because they show how as the block's particle motion decreases, the tables particle motion increases. This demonstrates how Kinetic energy transfers through particles. Therefore, the model shows how the energy was passed from the heated block, to the table, to Suzanne's hand, through the particles.

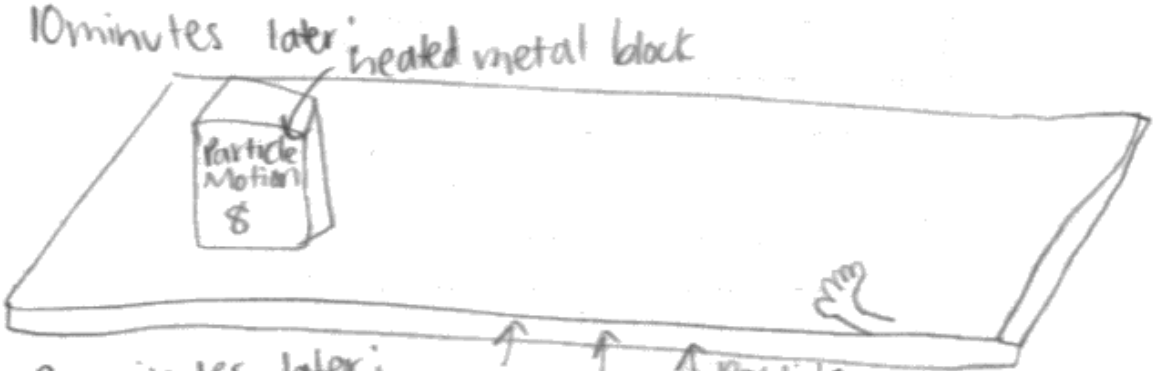
A114

Score: 4

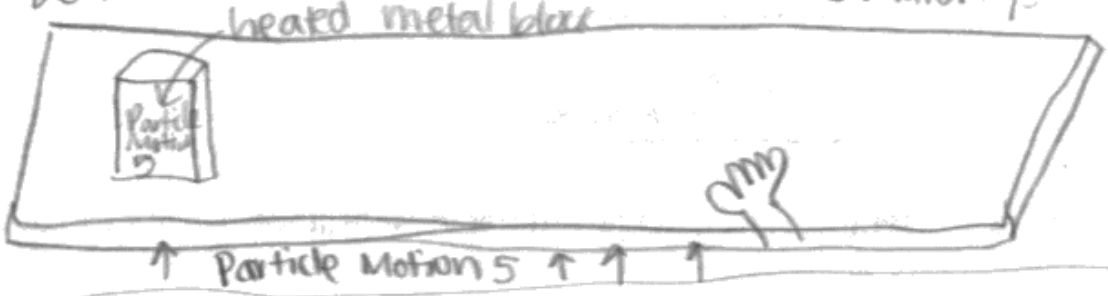
5 minutes later:



10minutes later:



20 minutes later:



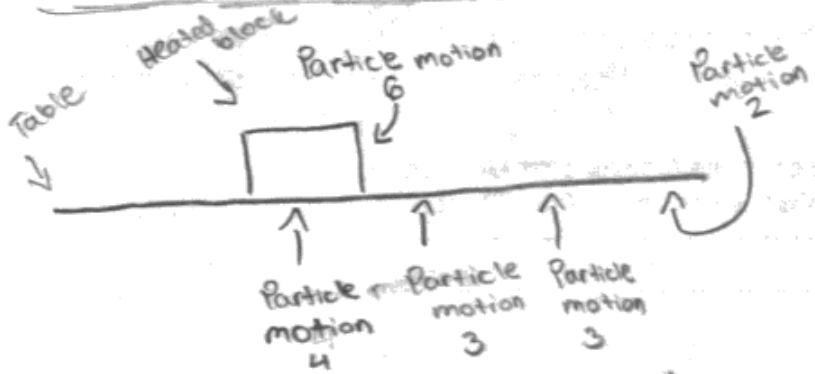
Through conduction the energy trailed from the particles in the heated metal block to Suzanne's hand when she touched the edge of the table. The kinetic energy moved to area of (over kinetic energy which was the table. when kinetic energy moved from the block to the table to the hand, the temp. of the block moved to the table and then to the hand. Temperature is the average kinetic energy in the particles. The kinetic energy moved which resulted in the change of temperature.

00098500008105201706

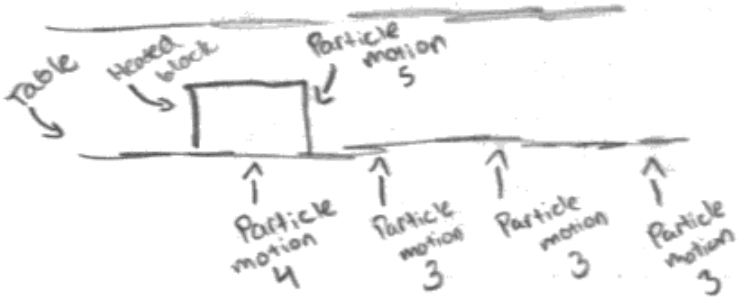
A115

Score: 4

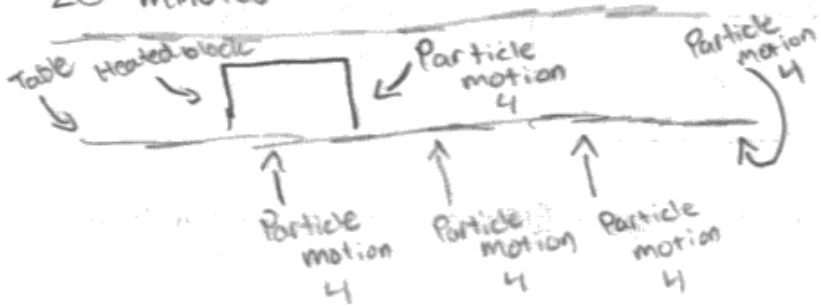
5 minutes after block was placed



10 minutes after block was placed



20 minutes after block was placed



These models support the teacher's claim of kinetic energy transfer through particles is responsible for transmitting energy from the heated block to Suzanne's hand, because they both show the same principle. The teacher is saying that the energy was transfered from the heated block to the table and evantually to her hand. The model also shows this transfer as it shows how the energy filled block transfers energy throughout the table. with the collision of their particles.

through the collision of their particles