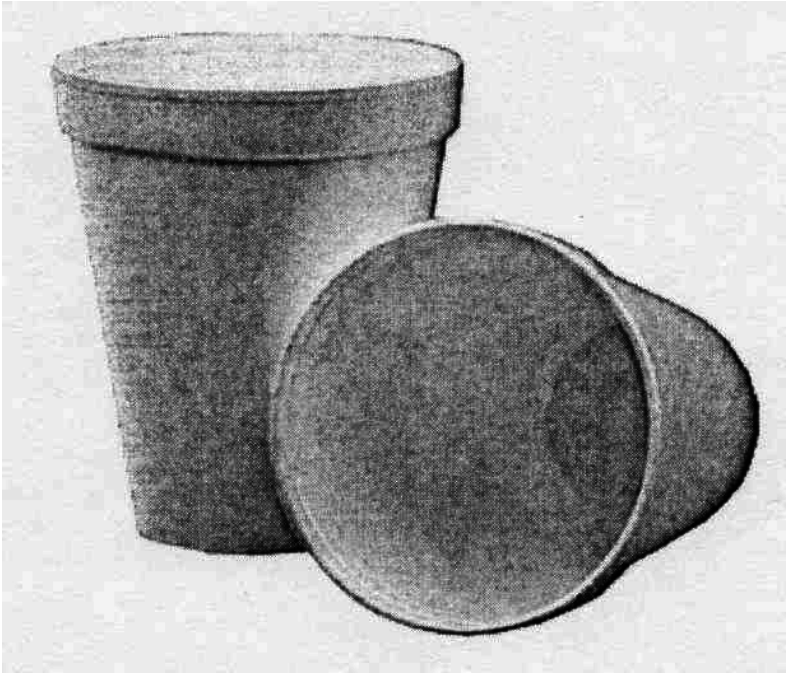
FOSS NOTEBOOK

CHEMICAL INTERACTIONS



Investigation #5: Energy Transfer

*BIG QUESTION: How are energy transfer and particle kinetic energy related?

Salt Crystals

Boris and his friends were looking at tiny crystals of salt with a magnifying glass. They wondered what they would see if they had a magnifying device powerful enough to see the particles. This is what they thought they might see:

Boris: The particles would be packed tightly together. They would look like a solid material without any empty space between the atoms.

Portia: I think I would see vibrating particles arranged in an orderly way with spaces between them. There would be nothing in the spaces, not even air.

Vivi: I think I would see particles not moving and arranged in an orderly way with spaces between them.

Leif: I think I would see vibrating particles arranged in an orderly way. There would be space between the atoms. The space would be filled with air.

Whit: I think I would see particles in the shape of small cubes. Each of these small cubes would join together to form a larger cube of salt.

Julio: I think I would see lots of vibrating particles all connected together by little lines. The lines connecting each particle give them a definite cube shape.

Shanta: I think I would see individual particles moving from place to place. They would be moving all about the inside of the crystal shape.

Which student do you most agree with and why? Draw a picture that best represents how you think you would see the particles in a salt crystal if you had a powerful magnifying device. Explain your picture.

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FOCUS QUESTION:	
Prediction:	
Plan	Data
EXPLANATION:	

Mixing Water

Melinda filled two glasses of equal size half-full with water. The water in one glass was 50 degrees Celsius. The water in the other glass was 10 degrees Celsius. She poured one glass into the other, stirred the liquid, and measured the temperature of the full glass of water.

What do you think the temperature of the full glass of water will be after the water is mixed? Circle your prediction.

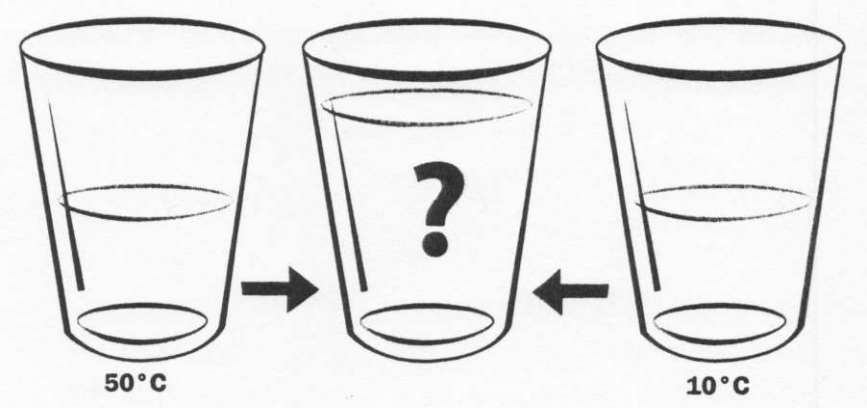
A 20 degrees Celsius

B 30 degrees Celsius

C 40 degrees Celsius

D 50 degrees Celsius

E 60 degrees Celsius



Explain your thinking. Describe the "rule" or reasoning you used for your answer.

ENERGY ON THE MOVE QUESTIONS

SRB pages 32-37

1. Explain how cold milk cools hot cocoa. _____

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2. Why do you think an ice cube feels cold when you hold it in your hand? _____

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3. What will happen to a balloon stretched over the mouth of an "empty" bottle when the bottle is placed in hot water? Explain all the energy transfers. _____

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4. When does energy flow from a cold object to a hot object? _____

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5. What does a thermometer measure, and how does it do it? _____

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RESPONSE SHEET—ENERGY TRANSFER

Julie said,

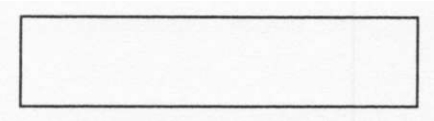
When you put a bottle of juice in a cooler full of ice, the juice gets cold. That's because the cold transfers to the juice and slows down the kinetic energy of the juice particles.

Comment on Julie's ideas and give your explanation for why the juice gets cold.

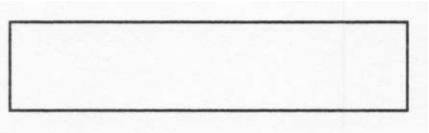
FOCUS QUESTION:	
Plan	Data
EXPLANATION:	
EXTENSION:	

HEAT PRACTICE A

1. What is the equation for calculating final temperature when equal masses of water are mixed?



2. What is the equation for calculating how much heat energy (calories) transferred to or from a mass of water?



3. Mix 30 mL of water at 15°C and 30 mL of water at 55°C

Answer these questions. **Show your work.**

a. What is the final volume of the water?

b. What is the final temperature of the water?

c. How many degrees did the cold water increase?

d. How many degrees did the hot water decrease?

e. How much heat energy transferred to the cold water?

f. How much heat energy transferred from the hot water?

g. What happened to the kinetic energy of the hot-water and cold-water particles?

HEAT PRACTICE B

4. Mix 25 mL of water at 0°C and 25 mL of water at 50°C.

Answer these questions. **Show your work.**

a. What is the final temperature of the water?

b. What is the ΔT for the cold water?

c. How much heat energy transferred to the cold water?

d. What is the ΔT for the hot water?

e. How much heat energy transferred from the hot water?

5. Energy "flow" is the transfer of energy from one place to another. Which direction does energy flow? _____

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6. How does energy transfer happen? _____

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7. What is equilibrium? _____

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FOCUS QUESTION:	
Prediction:	
Plan	Data
EXPLANATION:	

CALCULATING HEAT IN CALORIES A

Temperature is measured in degrees Celsius (°C). Heat is *not* measured in degrees Celsius. Heat is measured in **calories (cal).** The calorie is the unit of heat in the metric system. One calorie is the amount of heat needed to raise the temperature of 1 g of water 1°C. For instance, it takes 1 cal of heat to raise the temperature of 1 g of water from 25°C to 26°C.

1. Calculate the number of calories needed to	Calories (cal)
a. Raise the temperature of 1 g of water 1°C.	
b. Raise the temperature of 2 g of water 1°C.	
c. Raise the temperature of 2 g of water 2°C.	
d. Raise the temperature of 10 g of water 1°C.	
e. Raise the temperature of 1 g of water 70°C.	
f. Raise the temperature of 100 g of water 5°C.	
g. Raise the temperature of 450 g of water 3°C.	
h. Raise the temperature of 16 g of water 62°C.	

2. Billy mixed 40 g of 60°C water with 60 g of 25°C water. The final temperature was 39°C.

a. Calculate the change of temperature (ΔT) for the hot water.

$\Delta T = T_f - T_i$

b. Calculate the amount of heat (calories) transferred *from* the hot water.

calories = mass of hot water X *change of temperature of hot water*

cal = m X ΔT

c. Calculate the amount of heat transferred *to* the cold water.

cal = m $X \Delta T$

d. Compare the amount of heat transferred *from* the hot water and the amount of heat transferred *to* the cold water._____

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CALCULATING HEAT IN CALORIES B

3. Rosella has a 10-liter fish tank. The water needs to be 28°C for her tropical fish. When she filled the tank, the temperature of the water was 12°C. How many calories of heat must transfer to the aquarium before it is ready for the fish?

4. Cindy made tea. She started with 300 g of water at 20°C. She transferred 18,000 cal to the water. What was the final temperature of the water?

5. Lee's 600-mL cup of cocoa got cold. It was only 25°C. He put it in the microwave. How many calories must transfer to the cocoa to bring it up to 70°C?

BIG QUESTION:	
Claim	Evidence
I claim	I know this because
I claim	I know this because
I claim	I know this because