John's Shadow Investigation

John plans to investigate shadows caused by sunlight. He writes these steps for his investigation.

1. Get a tape measure and a 40-inch-long stick.
2. Find a spot that is sunny all day.
3. Put one end of the stick into the ground.
4. Measure the length of the stick's shadow every hour for 8 hours.

When John finishes with his investigation, he looks over the data. The table shows the data he collects.

Shadow Data

Time	Shadow Length (inches)
9:00 a.m.	92
10:00 a.m.	45
11:00 a.m.	30
12:00 noon	20
1:00 p.m.	12
2:00 p.m.	4
3:00 p.m.	13
4:00 p.m.	20
5:00 p.m.	31

3517069

According to John's results, when is the Sun <u>most</u> directly overhead?

A About 12:00 noon

B About 1:00 p.m.

C About 2:00 p.m.

D About 3:00 p.m.

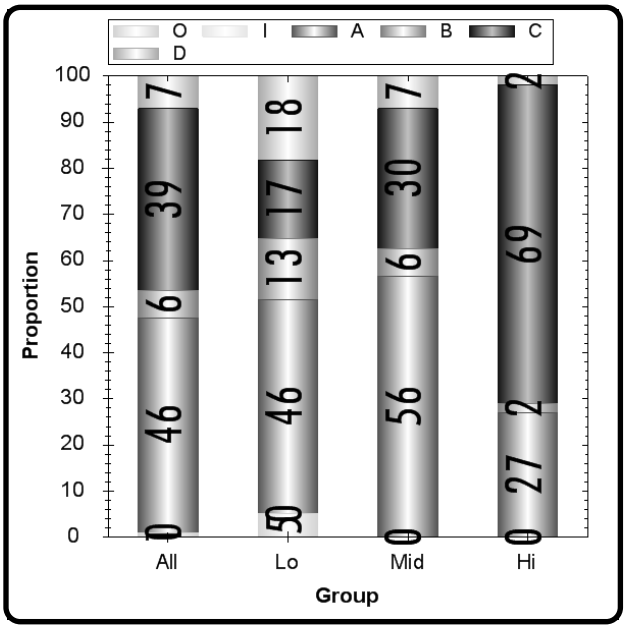
Grade 4	Science	CID 3517069
Item # 16,16	Form 3,8	2007 FT
Psg : John's Shadow Invs		S.04.4.h

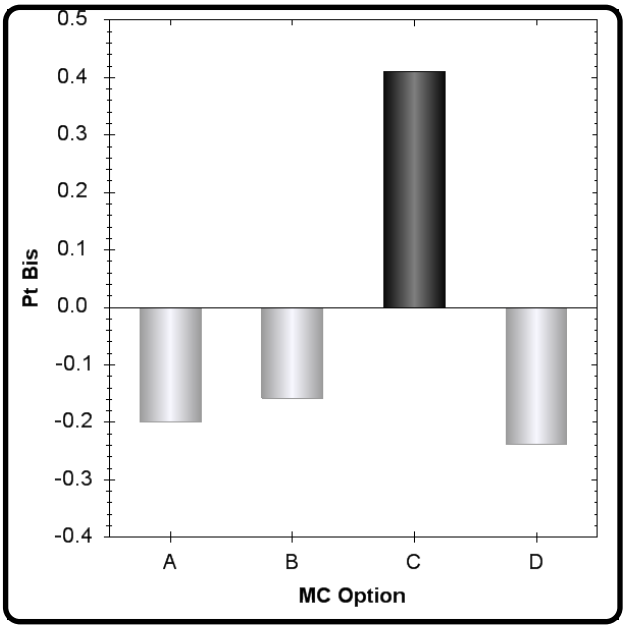
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	C	1564	0.396	0.410

Rasch Diff	Diff SE	Infit	Outfit
0.918	0.055	0.930	0.950

	A	B	C	D	Omit	Invalid
All	46	6	39	7	1	0
Low Scorers	46	13	17	18	5	0
Middle Scorers	56	6	30	7	0	0
High Scorers	27	2	69	2	0	0

MC Item Option Discriminations			
A	B	C	D
-0.200	-0.158	0.410	-0.238





Notes:

Option A is more popular than key C. Check option discrimination.

3517070

Which measurement schedule would improve John's data?

A Every 30 minutes

B Every 2 hours

C Every 12 hours

D Every 3 days

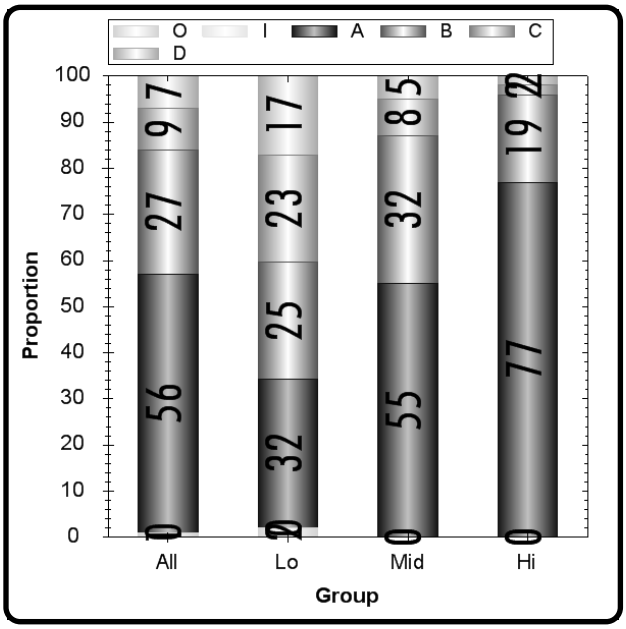
Grade 4	Science	CID 3517070
Item # 17	Form 4	2007 FT
Psg : John's Shadow Invs		S.04.5.h

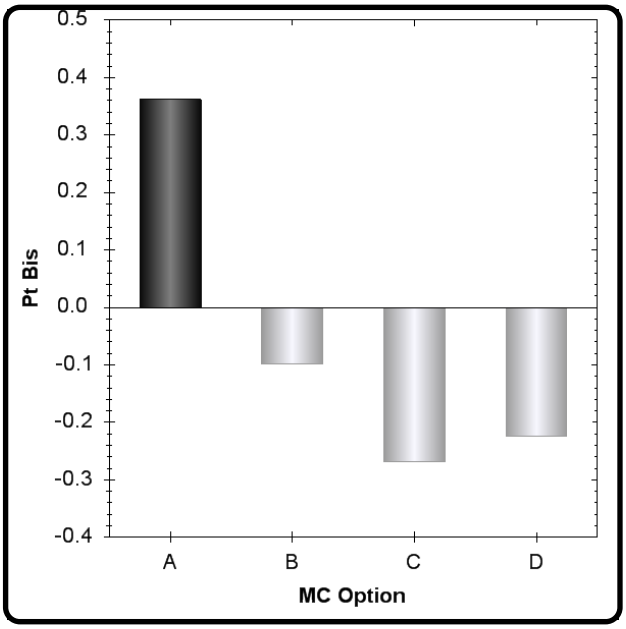
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	A	783	0.567	0.362

Rasch Diff	Diff SE	Infit	Outfit
0.076	0.079	1.030	1.020

	A	B	C	D	Omit	Invalid
All	56	27	9	7	1	0
Low Scorers	32	25	23	17	2	0
Middle Scorers	55	32	8	5	0	0
High Scorers	77	19	2	2	0	0

MC Item Option Discriminations			
A	B	C	D
0.362	-0.099	-0.268	-0.225





Notes:

Non SPED students may perform better on this item as compared to SPED students. (B)

3517073

John's class conducts his activity. Which of the following questions could <u>best</u> be answered by the class activity?

A When is the Sun farthest away from Earth?

B When are clouds most likely to appear over the school?

C At what time is the temperature going to be the hottest?

D At what time is the Sun shining most directly down on the school?

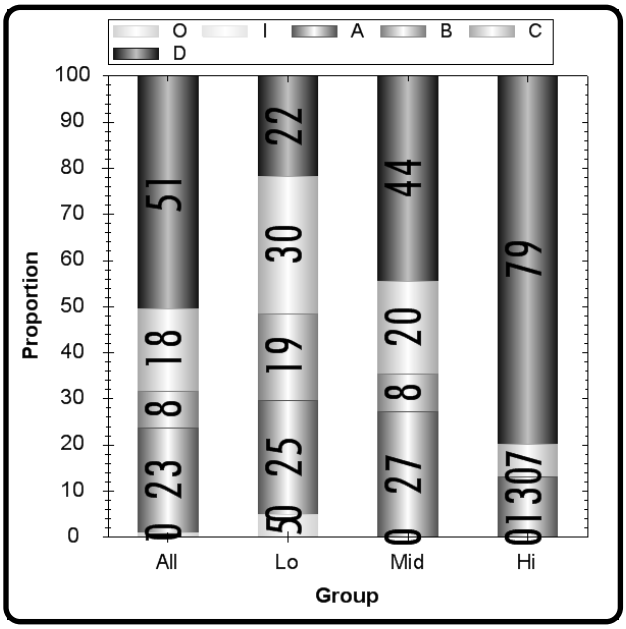
Grade 4	Science	CID 3517073
Item # 18,18	Form 3,8	2007 FT
Psg : John's Shadow Invs		S.04.6.h

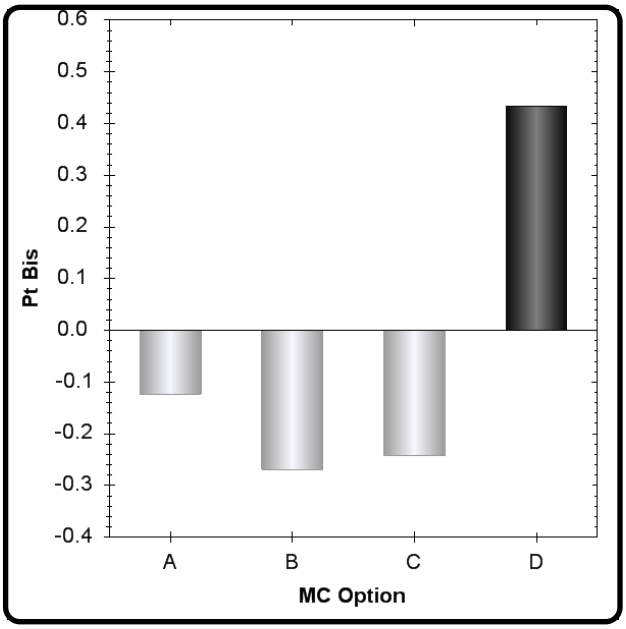
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	D	1564	0.511	0.434

Rasch Diff	Diff SE	Infit	Outfit
0.385	0.054	0.930	0.920

	A	B	C	D	Omit	Invalid
All	23	8	18	51	1	0
Low Scorers	25	19	30	22	5	0
Middle Scorers	27	8	20	44	0	0
High Scorers	13	0	7	79	0	0

MC Item Option Discriminations			
A	B	C	D
-0.123	-0.269	-0.243	0.434





Notes:

White students may perform better on this item as compared to Hispanic students. (B)

SPED students may perform better on this item as compared to non SPED students. (B)

Grade 4 PAWS Science Sample Items
Key for Multiple Choice Items

Passage: Blubber Study

Item/Key		
3471611/**D**	3456132/**D**	3456133/**A**
3476890/**A**	3476891/**C**	3479179/**B**

Passage: Feather Activity

Item/Key		
3485049/**A**	3485062/**C**	3485104/**D**
3485096/**D**	3485095/**C**	

Passage: Sugar Cube Activity

Item/Key		
3477046/**A**	3456865/**D**	3477037/**D**
3485048/**A**	3477029/**A**	3477040/**C**

Blubber Study

Polar bears and walruses live in cold, icy climates. These animals have a thick layer of fat, or blubber, under the skin. They can swim in very cold water because of blubber.

A zoo invites visitors to do an activity to find out how blubber helps animals live. In this activity, lard takes the place of blubber. Lard is made from animal fat.

The steps to the activity are:

1. Find the plastic bag with lard in it.
2. Place an empty plastic bag inside the bag of lard.
3. Put your left hand inside the empty bag.
4. Have a friend help you put your right hand inside another empty plastic bag.
5. Dip both hands into the tub of ice water.
6. Have your friend write down which hand feels colder.
7. Put your answer into the box on the table. The results will be counted at the end of the day.

The table below shows the results from one day.

Which Hand Felt Colder?		
Left Hand – Lard	**Right Hand – No Lard**	**Could Not Tell**
𝍸 𝍸 ||	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |||	𝍸 𝍸 ||||
Total Number of People Doing the activity: 74		

PAWS Science		
3471611		
Grade	04	
Passage		Blubber Study
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

After doing the activity, Paul wrote the statements shown in the box below.

1. **The color of lard is white.**
2. **The bag is made of plastic.**
3. **The tub is filled with ice water.**
4. **The right hand felt colder.**

Which one of Paul's statements tells the <u>most</u> about how polar bears are able to live in icy conditions?

A. Statement 1
B. Statement 2
C. Statement 3
D. Statement 4

PAWS Science		
3456132		
Grade	04	
Passage		Blubber Study
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Which of the reasons below <u>best</u> explains why ice water was used for the experiment?

A. To keep the lard in the plastic bag fresh
B. To protect polar bears and walruses from sickness
C. To keep people cool while they perform the experiment
D. To model the temperature of the water where the animals swim

PAWS Science		
3456133		
Grade	04	
Passage		Blubber Study
PAWS Skill	5	Draw conclusions and make connections
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Which of these changes to the activity would cause more people to say they could not tell which hand was colder?

A. Using room-temperature water
B. Asking fewer people to do the activity
C. Adding more ice to the tub of ice water
D. Placing a second plastic bag over the lard

PAWS Science		
3476890		
Grade	04	
Passage		Blubber Study
PAWS Skill	5	Draw conclusions and make connections
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Paul and Bill want to repeat the zoo's activity for a project. They each test a different group of people. Their results are shown below.

Paul's Blubber Activity
Which Hand Felt Colder?

Left Hand-Lard	Right Hand-Plastic	Could Not Tell
||	|||	|

Total Number of People: 6

Bill's Blubber Activity
Which Hand Felt Colder?

Left Hand-Lard	Right Hand-Plastic	Could Not Tell
𝍸	𝍸 𝍸 𝍸 𝍸 |||	||

Total Number of People: 30

Their results show that most people chose the same hand. Why would a judge in a science fair think that Paul's project was <u>less</u> dependable than Bill's?

A. Bill tested more people.
B. Bill had more room at his table.
C. Paul used a different group of people.
D. Paul conducted his experiment on a different day.

PAWS Science		
3476891		
Grade	04	
Passage		Blubber Study
PAWS Skill	5	Draw conclusions and make connections
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

What is represented by the plastic bags in this activity?

A. They act like animal blubber.
B. They keep visitors' hands dry.
C. They act like the skin of an animal.
D. They keep the body temperature constant.

PAWS Science		
3479179		
Grade	04	
Passage		Blubber Study
PAWS Skill	5	Draw conclusions and make connections
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Why did people put <u>both</u> hands into the water instead of one hand?

A. To let a friend help with the activity
B. To feel the difference the lard makes
C. To make their hands look like bear paws
D. To make sure the bags would stay warm

PAWS Science		
3470675		
Grade	04	
Passage		Blubber Study
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	a	Cells and Cellular Processes
Item Type	SR	Short Response

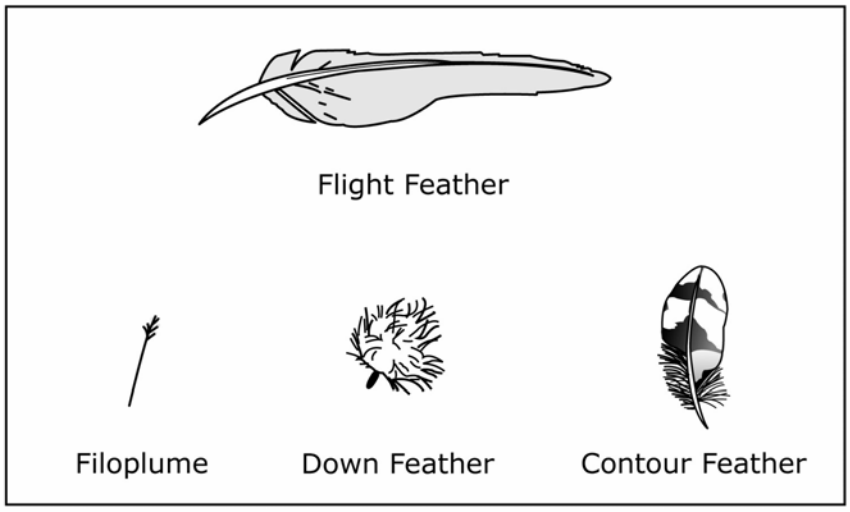
After the activity a boy wrote this conclusion:

The fat in polar bears helps to keep them warm.

In the space provided, tell one way the data in the table supports what the boy wrote.

Feather Activity

Birds are animals with feathers. Feathers grow in neat, tight rows so no skin shows. Birds have four main types of feathers, which are shown in the picture below.



Michelle wants to find out which type of feather keeps a bird warmest. She sets up an activity by using these steps.

1. Find four shoeboxes of the same size.
2. Put the name of a feather type from the picture on each shoebox.
3. Measure 100 grams of each type of feather.
4. Place the feathers in the correct shoebox.
5. Put a hot-water bottle filled with the same amount of water heated to 97°F in each shoebox.
6. Lay a thermometer inside each shoebox.
7. Put a lid on each shoebox.
8. Place each of the shoeboxes under the same type of lamp and light bulb.
9. Observe the temperature of each thermometer every 10 minutes for one hour.
10. Record the temperatures in a data table.

The results of the activity are shown in the data table below.

Feather Activity

Type of Feather	Temperature (°F) in Shoebox Measured Every 10 Minutes						
	Start	**10 min.**	**20 min.**	**30 min.**	**40 min.**	**50 min.**	**60 min.**
Flight	97	91	89	87	84	80	79
Filoplume	97	93	90	88	88	86	84
Down	97	95	95	95	95	93	93
Contour	97	94	92	90	88	88	85

PAWS Science		
3485049		
Grade	04	
Passage		Feather Activity
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Which of the following questions could <u>best</u> be answered with this activity?

A. Which type of feather holds heat longest?
B. Which type of feather floats on water longest?
C. Which type of feather absorbs the most water?
D. Which type of feather will fall to the ground fastest?

PAWS Science		
3485062		
Grade	04	
Passage		Feather Activity
PAWS Skill	2	Design a scientific investigation to collect data
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Why was it important for every shoebox to be covered during Michelle's activity?

A. To keeps the feathers cool
B. To make all the boxes look the same
C. To get a proper temperature reading
D. To prevent water from getting into the box

PAWS Science		
3485104		
Grade	04	
Passage		Feather Activity
PAWS Skill	2	Design a scientific investigation to collect data
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Which of these would <u>prevent</u> Michelle from collecting fair data in her activity?

A. Recording the temperatures in a data table
B. Placing each shoebox the same distance from the lamps
C. Conducting the activity at night instead of during the day
D. Measuring the temperature in each shoebox at different times

PAWS Science		
3485096		
Grade	04	
Passage		Feather Activity
PAWS Skill	3	Conduct a Scientific Investigation
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Which tool is <u>best</u> to find the mass of each box of feathers?

A. Stopwatch
B. Centimeter ruler
C. Thermometer
D. Pan balance

PAWS Science		
3485095		
Grade	04	
Passage		Feather Activity
PAWS Skill	5	Draw conclusions and make connections
Context	a	Cells and Cellular Processes
Item Type	MC	Multiple Choice

Ben works outside in a very cold climate and needs a warm coat. Based on the results of Michelle's activity, which type of feather would be <u>best</u> to fill the inside of Ben's coat?

A. Flight
B. Filoplume
C. Down
D. Contour

PAWS Science		
3485097		
Grade	04	
Passage		Feather Activity
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	a	Cells and Cellular Processes
Item Type	SR	Short Response

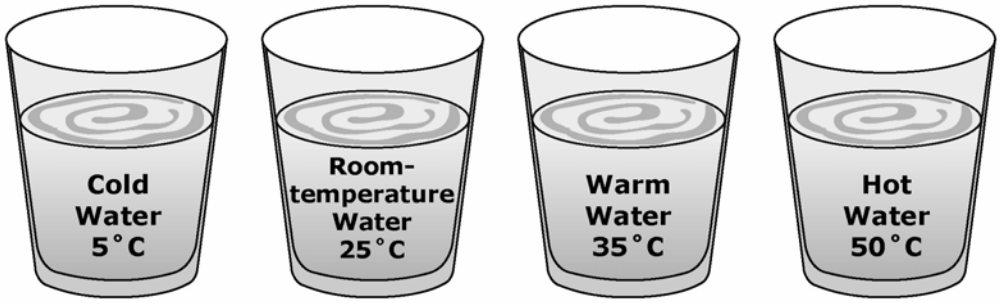
According to Michelle's activity, which type of feather would least likely keep a bird warm in cold winter temperatures? In the space provided, show or explain your answer.

Sugar Cube Activity

Sometimes it is hard to separate things that are mixed. If sugar is stirred well into water, the sugar cannot be seen because it dissolves.

Sam wanted to find out which water temperature would dissolve sugar fastest. He followed the steps below.

1. Label four clear glasses as shown in the picture.



2. Pour 200 mL of 5°C water into a glass.
3. Place one sugar cube into the first glass.
4. Begin timing as soon as the sugar cube is in the water.
5. Stir the water until the sugar cube dissolves.
6. Record the time it takes the sugar cube to dissolve.
7. Repeat steps 2–6 using 25°C, 35°C, and 50°C water.

The results are shown in the table below.

Sugar Cube Activity

Water	Temperature (°C)	Time to Dissolve (seconds)
Cold	5	200
Room-temperature	25	125
Warm	35	90
Hot	50	45

PAWS Science		
3477046		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	e	Energy Types
Item Type	MC	Multiple Choice

Which question can be answered using Sam's activity?

A. At which temperature will sugar dissolve slowest?
B. In which type of liquid will sugar dissolve fastest?
C. How much stirring does it take to dissolve sugar?
D. How many sugar cubes can dissolve in warm water?

PAWS Science		
3456865		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	3	Conduct a Scientific Investigation
Context	e	Energy Types
Item Type	MC	Multiple Choice

Which of these tools was <u>most likely</u> used to measure the temperature of the water in this activity?

A. Metric ruler
B. Microscope
C. Pan balance
D. Thermometer

PAWS Science		
3477037		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	4	Collect, organize, and represent data
Context	e	Energy Types
Item Type	MC	Multiple Choice

Ben tried to repeat Sam's activity. Ben's results are shown in the table.

Sugar Cube Activity

Water	Temperature (°C)	Time to Dissolve (seconds)
Cold	25	125
Room-temperature	5	200
Warm	35	90
Hot	50	45

Which of the following is the <u>most likely</u> reason that Ben's results are different from Sam's results?

A. Ben measured the time incorrectly.
B. Ben used more sugar than Sam did.
C. Ben spilled some water during the activity.
D. Ben wrote two temperatures in the wrong place.

PAWS Science		
3485048		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	5	Draw conclusions and make connections
Context	e	Energy Types
Item Type	MC	Multiple Choice

How could Sam make sure the results are dependable?

A. Repeat the activity several times
B. Repeat the activity with larger glasses
C. Repeat the activity at a different time of day
D. Repeat the activity with different water temperatures

PAWS Science		
3477029		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	e	Energy Types
Item Type	MC	Multiple Choice

Sam's mother pours two cups of sugar into a pan containing one cup of cold milk. She is having a hard time getting the sugar to dissolve in the milk. Which of these should Sam's mother do to make the sugar dissolve more quickly in the milk?

A. Heat the mixture on the stove
B. Add more sugar to the mixture
C. Leave the mixture on the counter
D. Put the mixture in the refrigerator

PAWS Science		
3477040		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	e	Energy Types
Item Type	MC	Multiple Choice

Which of these statements is supported by Sam's data?

A. Sugar is a solid, and water is a liquid.
B. Sugar tastes sweet, and water does not.
C. Sugar dissolves faster in hot tea than in iced tea.
D. Sugar settles to the bottom quicker in water than in tea.

PAWS Science		
3456873		
Grade	04	
Passage		Sugar Cube Activity
PAWS Skill	5	Draw conclusions and make connections
Context	e	Energy Types
Item Type	SR	Short Response

Before the activity Sam made the following prediction.

Sugar will dissolve fastest in cold water.

Was Sam's prediction correct or incorrect? Write your answer in the space provided. Use information from the table to support your answer.