SmallParticleMixtures

Small-Particle Mixtures

Mr. Mitchell's class is learning about density by studying samples of small particles. Mr. Mitchell gives the students this list of small particles and their densities and reminds the students that water has a density of 1.0 gram per cubic centimeter (g/cm^3).

Particle Densities

Particle	Density (g/cm^3)
Carbon powder	0.08
Chalk powder	1.1
Moist soil	1.44
Wheat flour	0.6

Mr. Mitchell gives each pair of students a 10-gram sample of each particle and 4 capped plastic bottles containing 100 milliliters of water. He instructs them to do the following:

1. Add about 5 grams of carbon powder to 1 plastic bottle.
2. Cap the bottle and shake the mixture for 1 minute.
3. Observe and record the appearance of the mixture in the bottle.
4. Allow the bottle to sit undisturbed for 10 minutes.
5. Observe and record the mixture in the bottle.
6. Repeat Steps 1 through 5 with chalk powder, moist soil, and wheat flour using the other three bottles.

When the students compare their results, they find that all of their observations are similar. The table below shows the results for the class.

Particles Added to 100 mL of Water

	Carbon Powder	Chalk Powder	Moist Soil	Wheat Flour
Appearance of solution immediately after shaking	The water is dark with some clumps floating on the surface.	The water is cloudy.	The water is dark and cloudy with some foam on the surface.	The water is cloudy with some particles floating on the surface.
Appearance of solution 10 minutes after shaking	The water is clear with clumps of carbon on the surface.	The water is clear with a chalk layer at the bottom.	The water is clear with a soil layer at the bottom.	The water is clear with wheat flour floating on the surface.

3525861

Which additional information should be included in the students' observation table to better show what the particles do in each bottle?

A The final volume of the mixture

B The amount of water that evaporates

C The amount of particles that dissolves

D The starting temperature of the particles

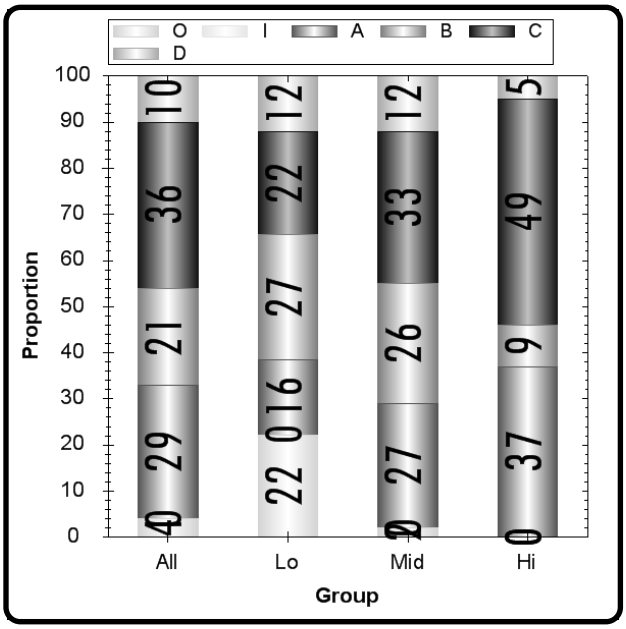
Grade 8	Science	CID 3525861
Item # 22,22,22,22,22,22	Form 1,2,3,4,5,6	2007 FT
Psg : Small Particle Mixtures		S.08.4.d

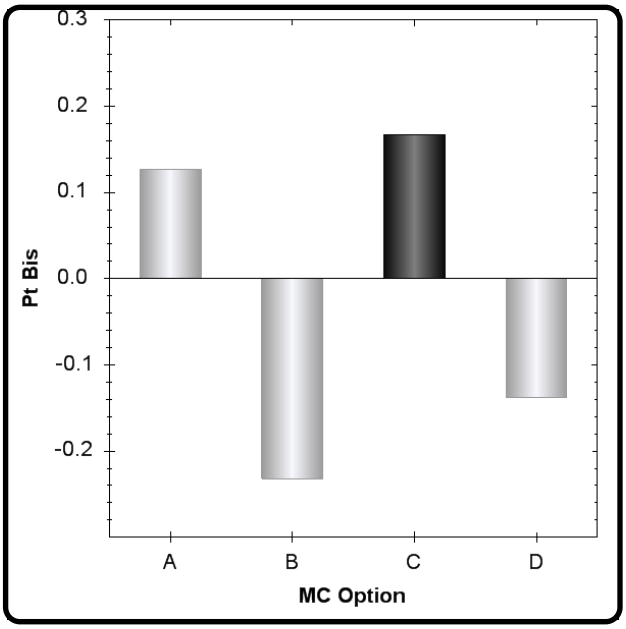
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	C	5889	0.374	0.167

Rasch Diff	Diff SE	Infit	Outfit
0.569	0.029	1.140	1.200

	A	B	C	D	Omit	Invalid
All	29	21	36	10	4	0
Low Scorers	16	27	22	12	22	0
Middle Scorers	27	26	33	12	2	0
High Scorers	37	9	49	5	0	0

MC Item Option Discriminations			
A	B	C	D
0.127	-0.232	0.167	-0.138





Notes:

Option A has positive discrimination. Check option for ambiguity/correctness.

3525862

Which of the following <u>most likely</u> occurs in each bottle during the 10 minutes they are left undisturbed?

A Undissolved particles separate from the solution.

B Dissolved particles expand the volume of the solution.

C Undissolved particles increase the mass of the solution.

D Dissolved particles increase the temperature of the solution.

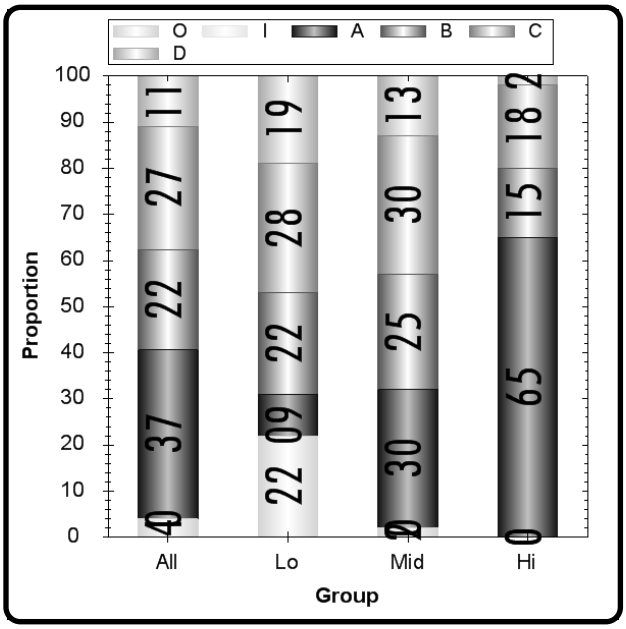
Grade 8	Science	CID 3525862
Item # 23,23,23,23,23,23	Form 1,2,3,4,5,6	2007 FT
Psg : Small Particle Mixtures		S.08.5.d

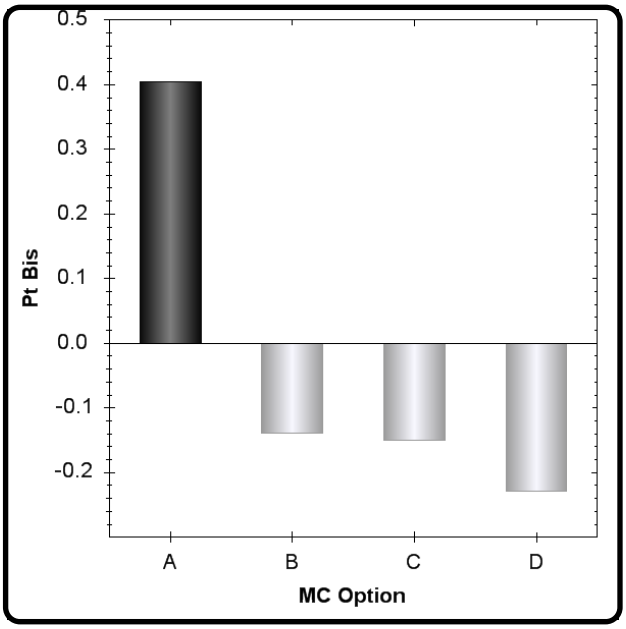
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	A	5888	0.384	0.405

Rasch Diff	Diff SE	Infit	Outfit
0.521	0.029	0.950	0.940

	A	B	C	D	Omit	Invalid
All	37	22	27	11	4	0
Low Scorers	9	22	28	19	22	0
Middle Scorers	30	25	30	13	2	0
High Scorers	65	15	18	2	0	0

MC Item Option Discriminations			
A	B	C	D
0.405	-0.139	-0.150	-0.229





Notes:

3525863

Which <u>best</u> explains why the mixture of chalk powder and water appears cloudy immediately after it is shaken?

A Chalk powder particles are decreasing in mass.

B Chalk powder particles are electrically charged.

C Chalk powder particles are increasing in volume.

D Chalk powder particles are suspended in the mixture.

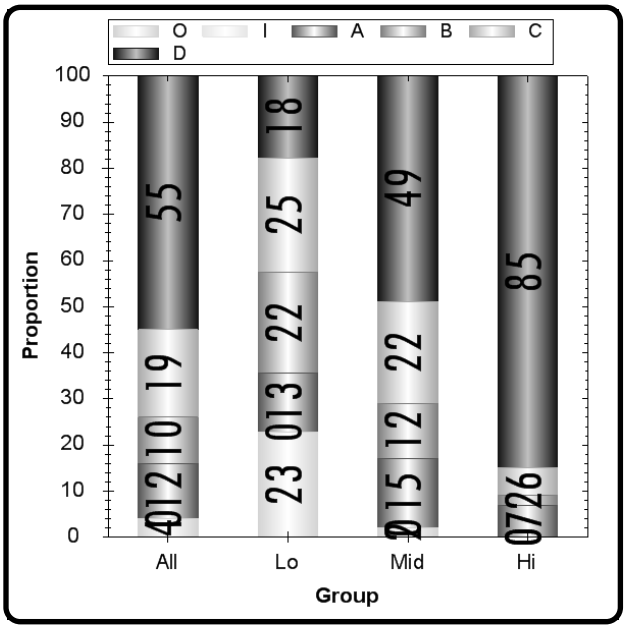
Grade 8	Science	CID 3525863
Item # 24,24,24,24,24,24	Form 1,2,3,4,5,6	2007 FT
Psg : Small Particle Mixtures		S.08.6.d

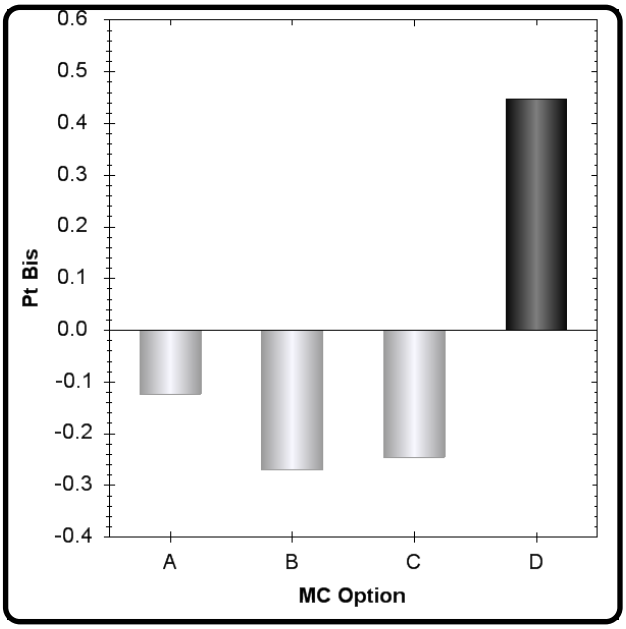
Type	Max Points	Key	N Count	Item Mean	Discrimination
Multiple Choice	1	D	5879	0.570	0.448

Rasch Diff	Diff SE	Infit	Outfit
-0.341	0.028	0.920	0.890

	A	B	C	D	Omit	Invalid
All	12	10	19	55	4	0
Low Scorers	13	22	25	18	23	0
Middle Scorers	15	12	22	49	2	0
High Scorers	7	2	6	85	0	0

MC Item Option Discriminations			
A	B	C	D
-0.123	-0.270	-0.245	0.448





Notes:

3525867

The students carefully follow the procedure Mr. Mitchell gives them to make sure their observations are reliable.

Part A. In the space provided, identify two important measurements that each pair of students makes in this activity. Explain why the measurements are important.

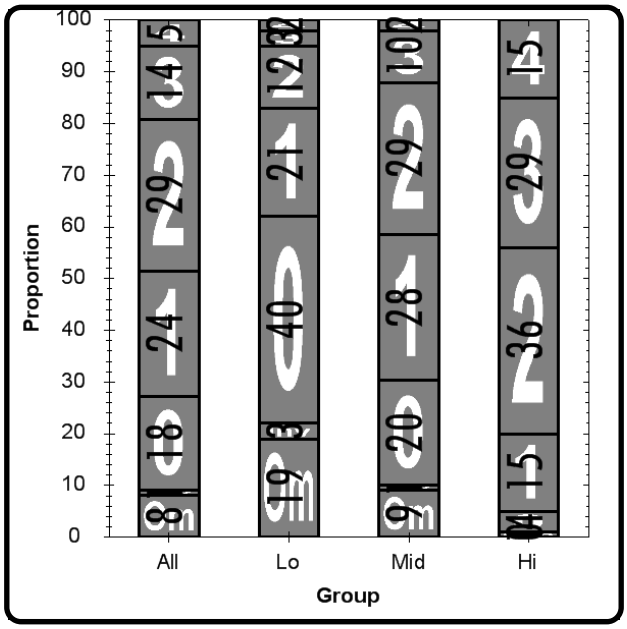
Part B. In the space provided, explain why the observations made by the students should be considered reliable.

Grade 8	Science	CID 3525867
Item # 28,28,28,28,28,28	Form 1,2,3,4,5,6	2007 FT
Psg : Small Particle Mixtures		S.08.4.d

Type	Max Points	N Count	Item Mean	Discrimination
Open Ended	4	5583	1.608	0.513

Rasch Diff	Diff SE	Infit	Outfit
0.478	0.015	1.070	1.070

	0	1	2	3	4	Omit	Invalid
All	18	24	29	14	5	8	1
Low Scorers	40	21	12	3	2	19	3
Middle Scorers	20	28	29	10	2	9	1
High Scorers	4	15	36	29	15	1	0



Notes:

Female students may perform better on this item as compared to Male students. (B)

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

Grade 8 PAWS Science Sample Items
Key for Multiple Choice Items

Passage: Break it Down

Item/Key		
3471451/**A**	3479135/**C**	3479130/**A**
3461107/**C**	3461109/**C**	

Passage: Judith Miles: Student Space Scientist

Item/Key		
3426421/**C**	3459813/**A**	3426423/**D**
3489751/**D**		

Passage: Pea Pod Investigation

Item/Key		
3471386/**C**	3476998/**D**	3477027/**D**

Passage: The Dominant Pea

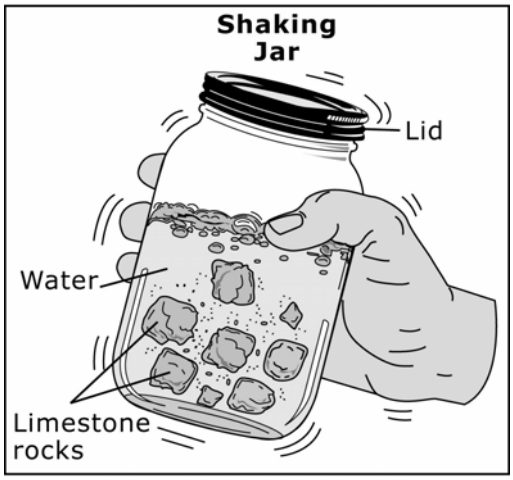
Item/Key		
3476973/**A**	3476977/**C**	3461557/**B**

Break It Down

Students in Ms. Lee's class are studying the processes of weathering. The steps for their investigation and the data they collected are shown below.

Steps:

1. Use a permanent marker to label four limestone rocks 1–4.
2. Measure the mass of each rock and record the data in a table.
3. Place the rocks in a plastic jar that is three-fourths full of water. Screw the lid on tightly.
4. Shake the jar vigorously for 10 minutes.
5. Remove the labeled rocks from the jar with a large spoon. Leave behind any pieces that have broken off.
6. Dab the rocks dry with a towel. Measure the mass of each rock again.
7. Pour the liquid that remains in the jar through a coffee filter and observe the sediment.



Rock Data

Rock	Mass Before Shaking (g)	Mass After Shaking (g)
1	24.0	23.5
2	29.2	27.1
3	25.4	22.8
4	21.0	20.2

PAWS Science		
3471451		
Grade	08	
Passage		Break It Down
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	g	Earth's Processes and Features
Item Type	MC	Multiple Choice

Students test different types of rock using the same procedure. Which question about the properties of rocks does this investigation <u>most likely</u> answer?

A. Which type of rock wears away fastest?
B. Which type of rock is the most colorful?
C. Which type of rock has the greatest mass?
D. Which type of rock has the most minerals?

PAWS Science		
3479135		
Grade	08	
Passage		Break It Down
PAWS Skill	2	Design a scientific investigation to collect data
Context	g	Earth’s Processes and Features
Item Type	MC	Multiple Choice

Which of the following is a dependent variable in the investigation conducted by Ms. Lee's students?

A. The type of rock used
B. The volume of water in the jar
C. The amount of sediment produced
D. The period of time the jar is shaken

PAWS Science		
3479130		
Grade	08	
Passage		Break It Down
PAWS Skill	3	Conduct a Scientific Investigation
Context	g	Earth's Processes and Features
Item Type	MC	Multiple Choice

Students want to measure the amount of sediment produced by this investigation. Which of the following is the <u>best</u> reason to use a triple-beam balance instead of a spring scale?

A. Triple-beam balances are more precise.
B. Spring scales are used for one item at a time.
C. Spring scales are used only to measure small items.
D. Triple-beam balances can only measure the mass of large items.

PAWS Science		
3461107		
Grade	08	
Passage		Break It Down
PAWS Skill	5	Draw conclusions and make connections
Context	g	Earth’s Processes and Features
Item Type	MC	Multiple Choice

Based on the results of this investigation, one student in Ms. Lee's class made the following conclusion:

> **Water is responsible for making most of the changes on Earth's surface.**

Which of these identifies a weakness in the student's conclusion?

A. A limited amount of water was used.
B. The mass of the plastic jar was not recorded.
C. Other causes of weathering were not investigated.
D. The acidity of the water changed during the investigation.

PAWS Science		
3461109		
Grade	08	
Passage		Break It Down
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	g	Earth's Processes and Features
Item Type	MC	Multiple Choice

In the investigation, the limestone was weathered away by the water in the jar. Which of the following is caused by a similar process?

A. Rivers flowing faster
B. Mountains growing taller
C. Canyons becoming deeper
D. Ponds becoming shallower

Judith Miles: Student Space Scientist

In the early 1970s a high school student named Judith Miles wrote to the National Aeronautics and Space Administration (NASA). Judith wondered if spiders would spin the same kinds of webs in space as on Earth.

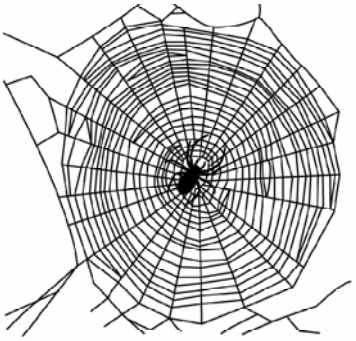
NASA scientists decided to do Judith's experiment and send two spiders into space. They would compare these against a control group of spiders on Earth.

In 1973 two spiders were each fed a housefly and then launched into space aboard Skylab, an experimental space station. The spiders were in a specially made cage. A camera took pictures of the spiders as they built their webs.

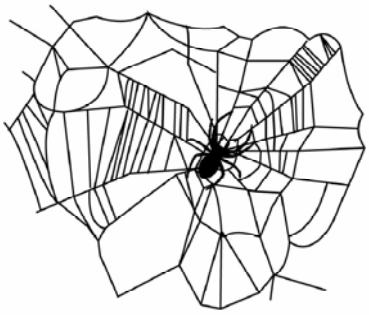
It took two days before one of the spiders began weaving a web. The first webs were poorly constructed. However, both spiders soon made webs almost identical to the webs made by control spiders on Earth.

The diagrams below show a comparison of spider webs.

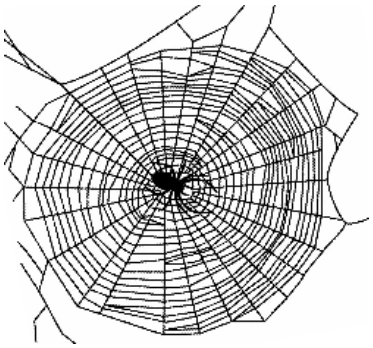
Web Made by a Control Spider on Earth



One of the First Webs Constructed in Space



Web Made in Space After Several Days



PAWS Science		
3426421		
Grade	08	
Passage		Judith Miles: Student Space Scientist
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	f	Force and Motion
Item Type	MC	Multiple Choice

Which question was Judith <u>most likely</u> trying to answer with her experiment?

A. Why do houseflies become tangled in a spider's web?
B. What amount of time does it take a spider to spin a web?
C. Will weightlessness affect a spider's ability to construct a web?
D. What kinds of insects get caught in spider webs constructed in space?

PAWS Science		
3459813		
Grade	08	
Passage		Judith Miles: Student Space Scientist
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	f	Force and Motion
Item Type	MC	Multiple Choice

What data were being collected with the camera on the space station?

A. The shape of the webs constructed in space
B. The strength of the webs constructed in space
C. The differences in the masses of the webs in space
D. The differences in the temperatures of the webs in space

PAWS Science		
3426423		
Grade	08	
Passage		Judith Miles: Student Space Scientist
PAWS Skill	2	Design a scientific investigation to collect data
Context	f	Force and Motion
Item Type	MC	Multiple Choice

Why were control spiders kept on Earth to build webs while scientists observed the webs produced in space?

A. To see if insects would be attracted to the webs
B. To see if spiders on Earth could copy the webs in space
C. To see if spiders could distinguish one web from another
D. To see if the webs on Earth differed from the webs in space

PAWS Science		
3489751		
Grade	08	
Passage		Judith Miles: Student Space Scientist
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	f	Force and Motion
Item Type	MC	Multiple Choice

Which of the following is the <u>most likely</u> reason that the spiders on Skylab had a difficult time spinning webs during the beginning of the experiment?

A. They needed more food and water.
B. There was no place to attach webs.
C. There were no flies for them to catch.
D. They were not used to weightlessness.

Pea Pod Investigation

Students are investigating pea plants. They are testing the hypothesis that green pod color is a dominant trait and yellow pod color is a recessive trait. They begin their experiment using a group of pea plants with green pods. All of the plants are grown in the same potting soil. They are each given equal amounts of water, fertilizer, and sunlight.

Experiment 1

A cross is made between two pea plants that each have green pods. Ten seeds produced from this cross are then planted and allowed to grow and mature. The ten plants that grow from the seeds produce green pods.

First-Generation Cross

Type of Cross	Green pod x Green pod
Number of plants that grow and produce pods	10
Result	All 10 of the plants produce green pods.

Experiment 2

Next, two of the ten pea plants resulting from the cross in Experiment 1 are crossed. Twenty seeds produced from this cross are planted and allowed to grow and mature.

Second-Generation Cross

Type of Cross	Green pod x Green pod
Number of plants that grow and produce pods	20
Result	5 plants produce yellow pods. 15 plants produce green pods.

PAWS Science		
3471386		
Grade	08	
Passage		Pea Pod Investigation
PAWS Skill	4	Collect, organize, and represent data
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

A plant with green pods is crossed with a plant that has yellow pods. The genotype of each parent plant is represented by the Punnett square shown.

	G	**g**
g	Gg	gg
g	Gg	gg

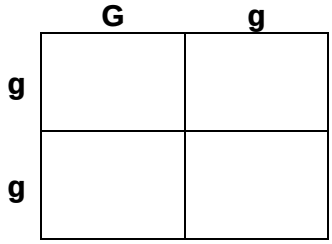
According to the information in the Punnett square, what percent of the offspring is expected to have yellow pods?

A. 0%
B. 25%
C. 50%
D. 100%

PAWS Science		
3461555		
Grade	08	
Passage		Pea Pod Investigation
PAWS Skill	4	Collect, organize, and represent data
Context	b	Heredity and Evolution
Item Type	ER	Extended Response

Two of the twenty pea plants resulting from Experiment 2 are crossed. One pea plant has yellow pods and the other has green pods. The assumption made is that green pod color (G) is dominant over yellow pod color (g).

Part A. Complete the Punnett square provided for this cross to determine the possible offspring.



Part B. What percentage of pea plants that result from this cross are expected to have yellow pods?

PAWS Science		
3476998		
Grade	08	
Passage		Pea Pod Investigation
PAWS Skill	5	Draw conclusions and make connections
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

A student crosses two green plants. She observes that approximately 75% of the plants resulting from this cross have green pods and approximately 25% have yellow pods. What are the <u>most likely</u> genotypes of the parent plants?

A. GG x gg
B. gg x gg
C. GG x GG
D. Gg x Gg

PAWS Science		
3477027		
Grade	08	
Passage		Pea Pod Investigation
PAWS Skill	6	Merge conclusions with concepts and knowledge
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

Mule deer begin eating most of the yellow pods from pea plants in a field and stop eating the green pods. If this trend continues, what will <u>most likely</u> occur?

A. The pea plants will all die out.
B. The pea plants will produce more yellow pods.
C. The allele for yellow pods will become dominant.
D. The allele for green pods will become more common.

The Dominant Pea

Pea plants clearly share some dominant and some recessive traits. "Carriers" express the dominant trait but carry a recessive trait, which is passed on to offspring.

Caleb uses separate groups of pea plants to study each of four traits. He crossbreeds plants within each group and studies the traits of the resulting offspring.

All of the plants are grown in the same location and in the same type of soil. They receive equal amounts of water, fertilizer, and sunlight.

The traits Caleb observes in the pea plants are shown in the table below.

Forms of Traits

Trait	Dominant	Recessive
Seed shape	Round (R)	Wrinkled (r)
Seed color	Yellow (Y)	Green (y)
Pod color	Green (G)	Yellow (g)
Flower color	Purple (P)	White (p)

PAWS Science		
3476973		
Grade	08	
Passage		The Dominant Pea
PAWS Skill	1	Use observation to pose questions that can be addressed through a scientific investigation
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

Caleb crossed his first generation of plants in the pod color group. He saw that about 25% of the plants produced yellow pods. Which of these would be the <u>best</u> cross to make next to determine whether plants with green pods are carriers of the recessive trait?

A. Green-pod plant with green-pod plant
B. Yellow-seed plant with yellow-seed plant
C. Green-pod plant with yellow-pod plant
D. Yellow-seed plant with green-seed plant

PAWS Science		
3476977		
Grade	08	
Passage		The Dominant Pea
PAWS Skill	2	Design a scientific investigation to collect data
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

Which of the following is the independent variable in the investigations?

A. Amount of water
B. Exposure to sunlight
C. Which plants are crossed
D. Where the plants are grown

PAWS Science		
3461557		
Grade	08	
Passage		The Dominant Pea
PAWS Skill	3	Conduct a Scientific Investigation
Context	b	Heredity and Evolution
Item Type	MC	Multiple Choice

Which of these tools is <u>most</u> useful for observing the parts of a white flower on a pea plant?

A. Metric ruler
B. Magnifying glass
C. Electronic balance
D. Graduated cylinder

PAWS Science		
3461554		
Grade	08	
Passage		The Dominant Pea
PAWS Skill	4	Collect, organize, and represent data
Context	b	Heredity and Evolution
Item Type	SR	Short Response

Caleb crossbreeds a pea plant with round seeds and a pea plant with wrinkled seeds. The genotypes of the two plants are given below. All the plants were grown in the same location under identical conditions.

Round seed x Wrinkled seed
Rr x rr

Part A: In the space below construct a Punnett square that shows a cross between a heterozygous plant with round seeds (Rr) and a homozygous plant with wrinkled seeds (rr).

Part B: What is the probability that an offspring will have wrinkled seeds? Show or explain you answer in the space below.