PAWS
Reading
Grade 8

Released Items
With Data

2010

Toying Around in Space

1 The scientific study of energy and motion and how they relate to each other is called "physics." One scientist who studied physics during the seventeenth and eighteenth centuries was Sir Isaac Newton. His discoveries made him one of the most recognizable names in the field of physics. More than 300 years after Newton described his three laws of motion, astronauts were applying them while orbiting Earth in a space shuttle.

2 Astronaut Mario Runco believes science can be fun and easy. He served as a mission specialist for the crew of the space shuttle Endeavour in January of 1993. Launched from the Kennedy Space Center in Florida, the five-person crew was given several major assignments. A walk in space and the deployment of a NASA[1] Tracking and Data Relay Satellite were among the assignments. Not all of their six days in space were hard work, however. One important assignment gave them the opportunity to combine work with play. That assignment was called "The Physics of Toys."

3 The project's goal was to introduce students to Newtonian physics by studying the effects of microgravity[2] on toys in space. The demonstrations carried out by the astronauts were designed to stimulate students' curiosity and to show them the importance of following the scientific method. The astronauts would bring Newton's laws of motion to life in space while children watched on televisions on Earth.

4 Unlike the way objects on Earth react to the force of gravity, objects in orbit do not fall toward Earth; they fall around it. This creates a feeling of weightlessness for astronauts. Anything not tied down in space will just float. The various toys on this mission were carefully selected. The astronauts wanted to use toys that would most effectively demonstrate how this microgravity environment influenced the performance of various toys.

5 Five schools were invited to participate in "The Physics of Toys" project. The five elementary schools that were involved were the elementary schools each of the crew members had attended. Sacred Heart School, Mario Runco's elementary school, was one of the schools given an invitation. The students of Sacred Heart would be observers as well as active participants in the project. Televisions and telephones in each classroom would make it possible to view the demonstrations in space as well as to ask the astronauts questions.

6 Ten toys were taken into space on the 1993 Endeavour mission. Each classroom participating in the project had a set of similar toys. Sacred Heart School used a toy racetrack and windup cars for one of its experiments. As part of the project, the students studied the concepts of force, motion, and energy and made predictions about the toys' actions in space. Each student predicted and drew his or her own conclusions based on classroom observations and lessons. How would the toys function away from the force of Earth's gravity?

7 Playing with toys in space was a delight for the astronauts. When astronaut Runco started his experiment with the toy car and circular racetrack, the students in New York watched carefully. They had already experimented with the car and racetrack in class. After winding the car up, they placed it on a looped racetrack. As soon as the car lost friction, it stopped traveling and fell, even though the toy's engine had not completely wound down. Would the windup car go around a looped track in space or would it fall out of the loop?

8 Astronaut Runco was also anxious to discover the answers to the students' questions. He wound up his car and placed it on the looped track. The car moved along the racetrack until it wound down completely. Then the students watched as Runco's toy car left the track and floated in the air. Because it was in a state of free fall in the microgravity environment, the car did not fall to the floor but merely "floated" away.

9 The students also experimented by winding the car and letting it run along a flat surface in the classroom. The wheels moved the car several feet and stopped when the engine stopped. When pushed without being wound up, the car did not move very far. In space, a gentle push moved the car a greater distance. When astronaut Runco wound up the car and released it in the air, it spun around in the opposite direction. The astronauts could hear the children laughing and reacting to the surprise action of the toy. The students were discovering that Newton's laws of motion applied in space too.

10 The astronauts played with additional toys in space and noted the changes. Windup toys that usually moved through the air by themselves did not operate as well in microgravity. Toys that are pushed on Earth usually move in a straight line, but not in space. Each demonstration showed various principles of Newton's laws. Studying the concept of microgravity and the effects on objects away from the force of Earth's gravity was one lesson the students will never forget.

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[1] NASA – the National Aeronautics and Space Administration, an American organization that conducts space travel

[2] microgravity – an environment with very little gravity

3419772

What is the author's purpose for writing Paragraph 1?

A. To introduce the reader to the space shuttle

B. To introduce the reader to the astronauts' mission

C. To introduce the reader to famous scientists

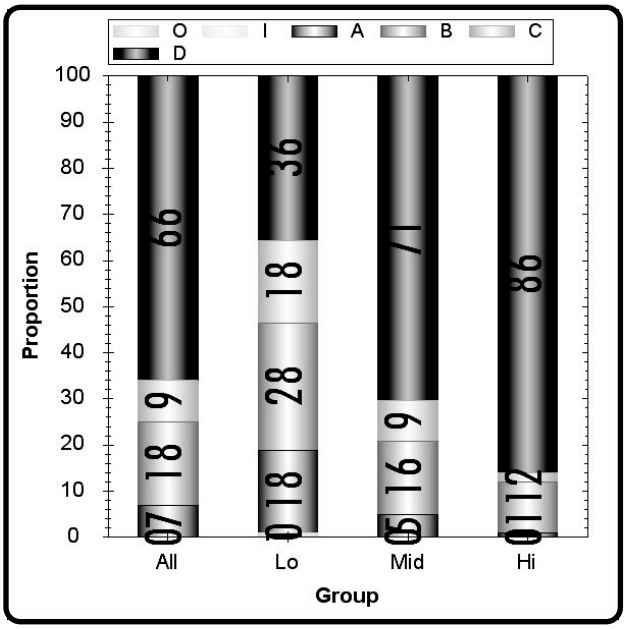
D. To introduce the reader to the idea of physics

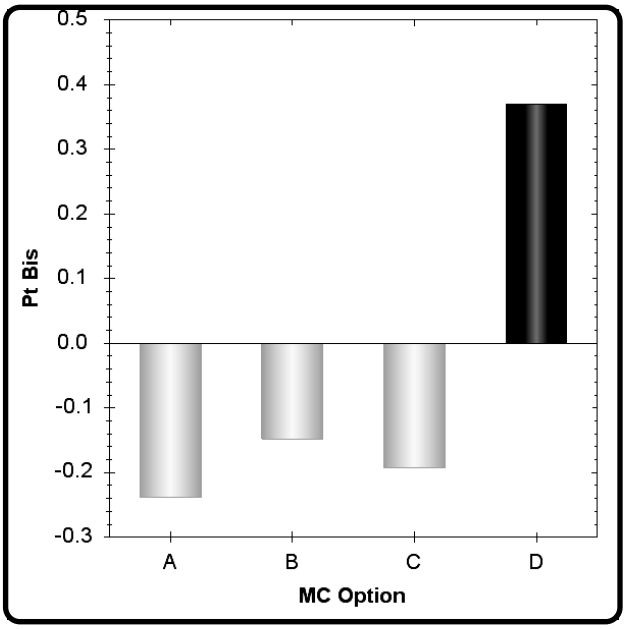
Grade 8	Reading	CID 3419772
Item # 45		R.08.E.2
Psg : Toying Around in Space_TOY		OP09

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	D	6200	0.664	0.370

	A	B	C	D	Omit	Invalid
All	7	18	9	66	0	0
Low Scorers	18	28	18	36	1	0
Middle Scorers	5	16	9	71	0	0
High Scorers	1	11	2	86	0	0

MC Item Option Discriminations			
A	B	C	D
-0.239	-0.148	-0.193	0.370





Notes:

What is the main idea of Paragraph 2?

A. Space shuttle Endeavour had both serious and fun assignments.

B. Mario Runco served as a mission specialist on the space shuttle.

C. The space shuttle was launched from the Kennedy Space Center.

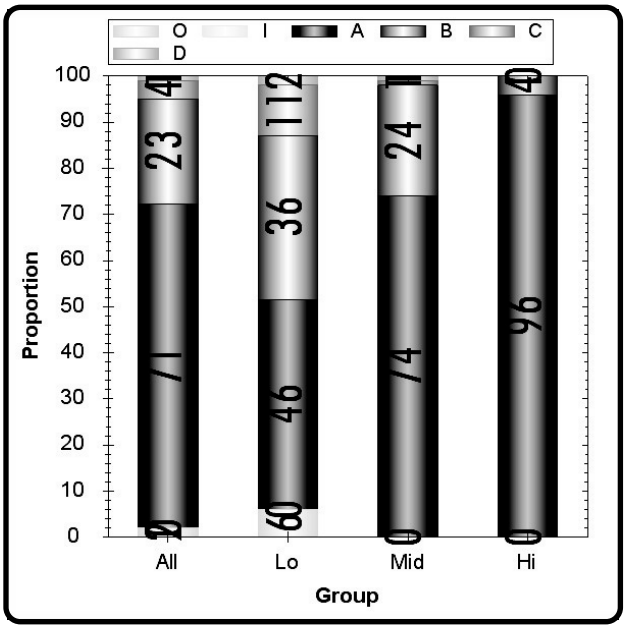
D. Space shuttles often have many crew members.

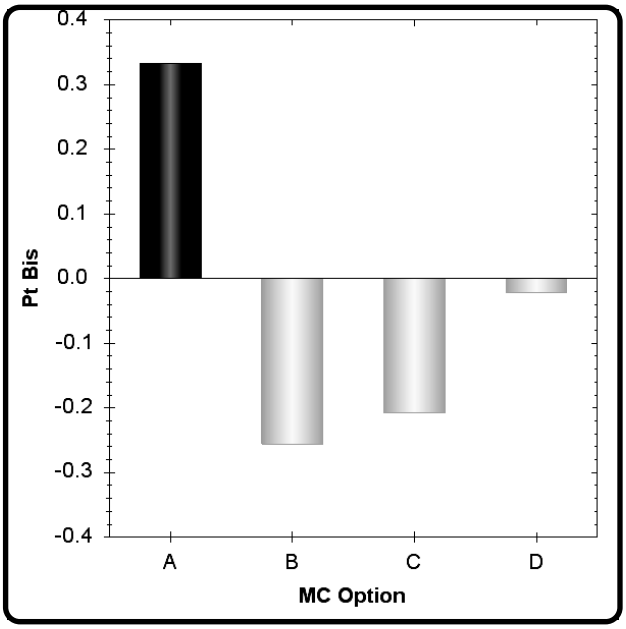
Grade 8	Reading	CID 3419787
Item # 2		R.08.E.1
Psg : Toying Around in Space_TOY		OP07

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	A	489	0.722	0.333

	A	B	C	D	Omit	Invalid
All	71	23	4	1	2	0
Low Scorers	46	36	11	2	6	0
Middle Scorers	74	24	1	1	0	0
High Scorers	96	4	0	0	0	0

MC Item Option Discriminations			
A	B	C	D
0.333	-0.256	-0.207	-0.022





Notes:

3419773

What is the author's purpose for writing Paragraphs 7 and 8?

A. To entertain with interesting information about space

B. To persuade students to consider becoming astronauts

C. To give information about how toy cars should behave on Earth

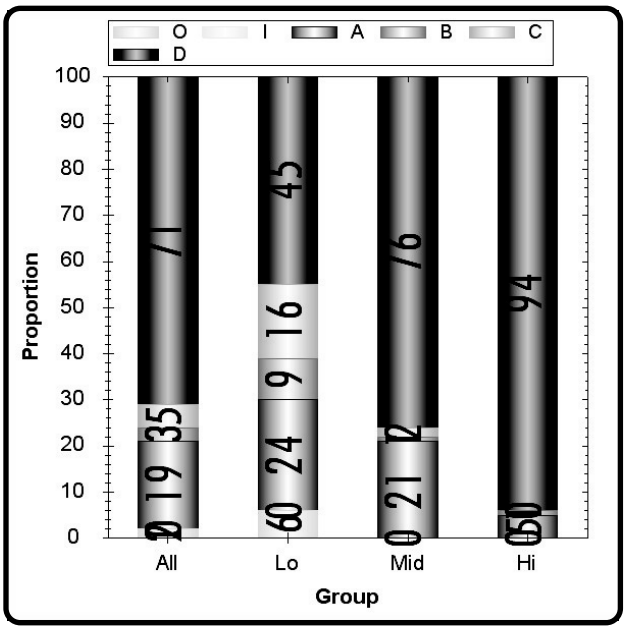
D. To contrast the behavior of toy cars in different situations

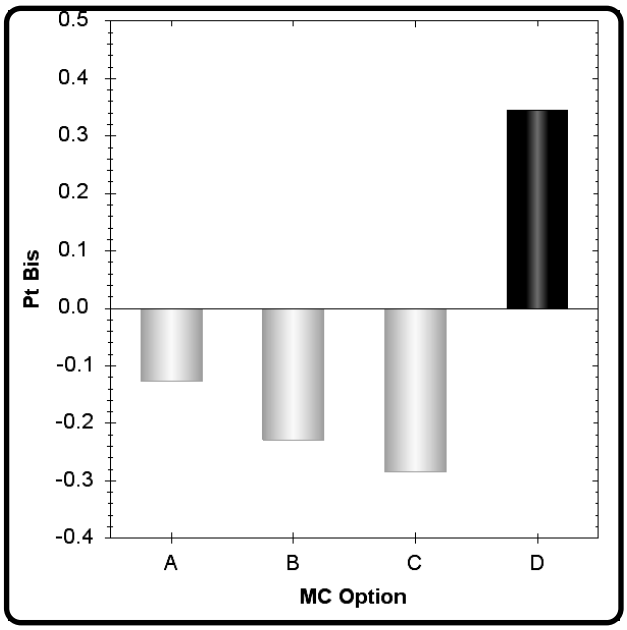
Grade 8	Reading	CID 3419773
Item # 4		R.08.E.2
Psg : Toying Around in Space_TOY		OP07

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	D	489	0.726	0.344

	A	B	C	D	Omit	Invalid
All	19	3	5	71	2	0
Low Scorers	24	9	16	45	6	0
Middle Scorers	21	1	2	76	0	0
High Scorers	5	1	0	94	0	0

MC Item Option Discriminations			
A	B	C	D
-0.127	-0.229	-0.285	0.344





Notes:

3419781

Which of these describes the action of the toy car on the track in the space shuttle after the toy car wound down?

A. It moved rapidly along the track.

B. It lifted off the track and floated.

C. It spun around in circles.

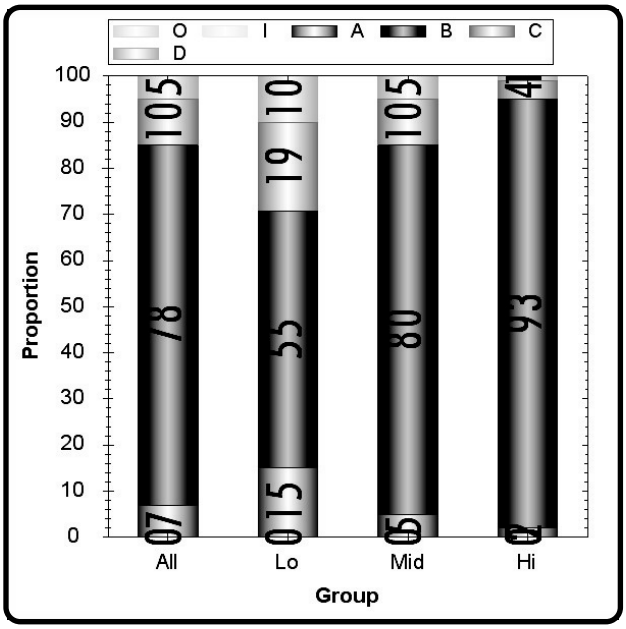
D. It remained where it was.

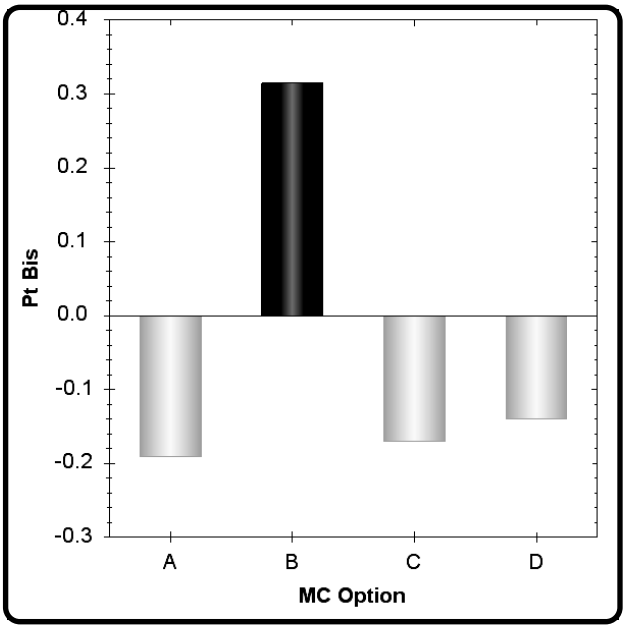
Grade 8	Reading	CID 3419781
Item # 37		R.08.E.1
Psg : Toying Around in Space_TOY		OP08

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	B	6458	0.778	0.315

	A	B	C	D	Omit	Invalid
All	7	78	10	5	0	0
Low Scorers	15	55	19	10	0	0
Middle Scorers	5	80	10	5	0	0
High Scorers	2	93	4	1	0	0

MC Item Option Discriminations			
A	B	C	D
-0.191	0.315	-0.170	-0.140





Notes:

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

Why had the students already observed the behavior of toys similar to those the astronauts used?

A. So the toys could be prepared for the astronauts' use

B. So astronauts could know which toys to use

C. So students could see how space affected the toys' behavior

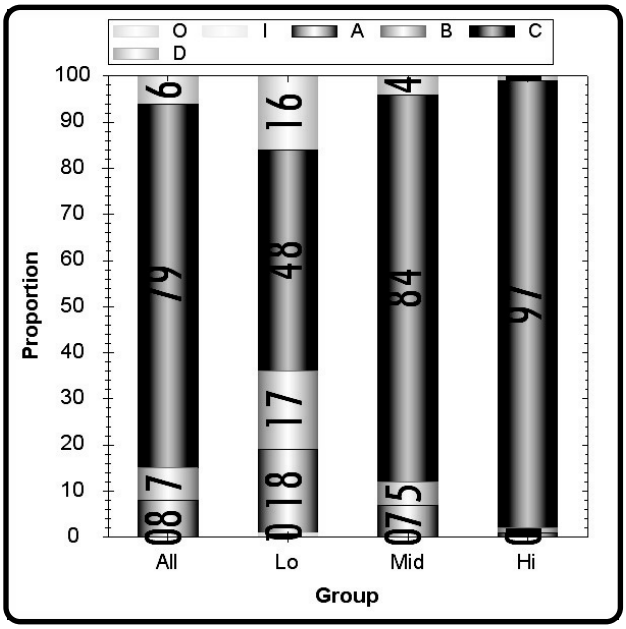
D. So students could see that toys could be taken into space

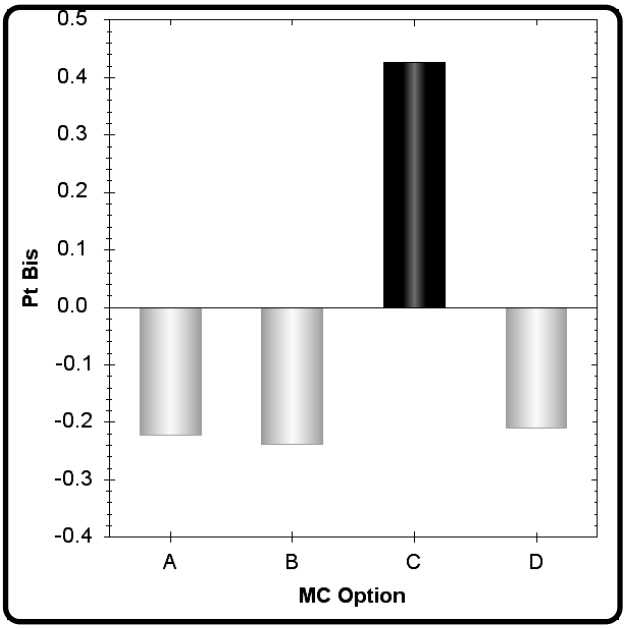
Grade 8	Reading	CID 3419775
Item # 46		R.08.E.3
Psg : Toying Around in Space_TOY		OP09

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	C	6200	0.790	0.427

	A	B	C	D	Omit	Invalid
All	8	7	79	6	0	0
Low Scorers	18	17	48	16	1	0
Middle Scorers	7	5	84	4	0	0
High Scorers	1	1	97	1	0	0

MC Item Option Discriminations			
A	B	C	D
-0.223	-0.239	0.427	-0.210





Notes:

3419786

Which detail from the article <u>best</u> illustrates the idea of weightlessness in space?

A. A car moving on a track

B. A car falling out of the loop

C. A car floating away

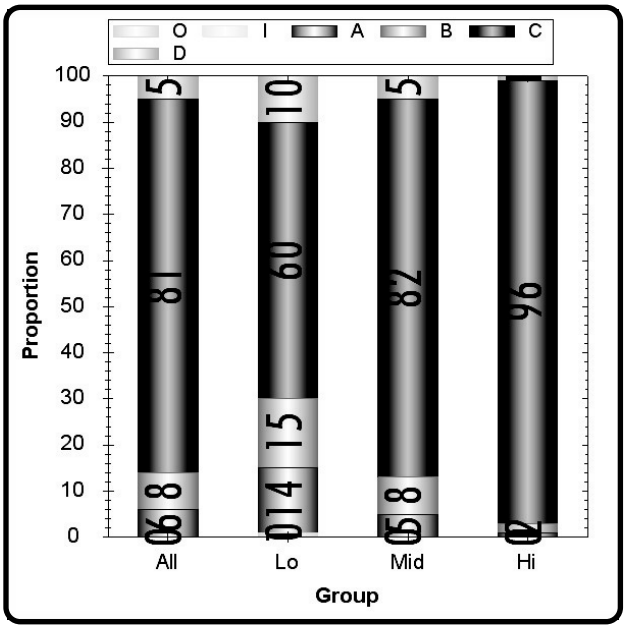
D. A car spinning in circles

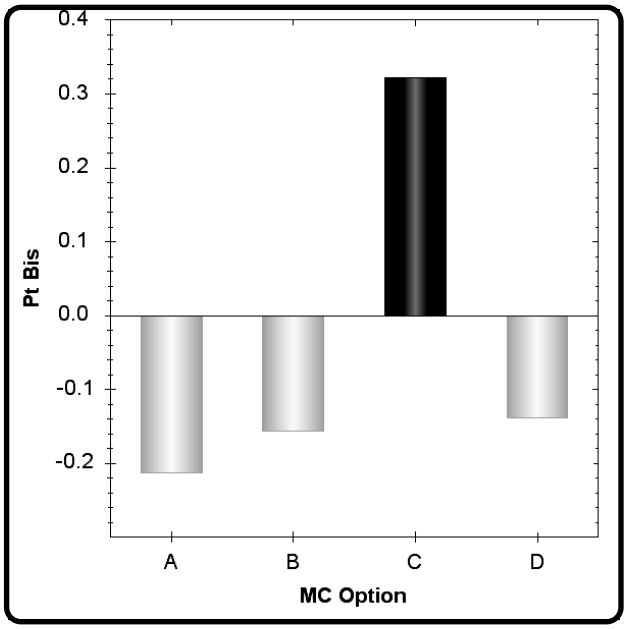
Grade 8	Reading	CID 3419786
Item # 44		R.08.E.1
Psg : Toying Around in Space_TOY		OP09

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	C	6200	0.806	0.322

	A	B	C	D	Omit	Invalid
All	6	8	81	5	0	0
Low Scorers	14	15	60	10	1	0
Middle Scorers	5	8	82	5	0	0
High Scorers	1	2	96	1	0	0

MC Item Option Discriminations			
A	B	C	D
-0.213	-0.157	0.322	-0.139





Notes:

3419774

What is <u>most likely</u> the reason the astronauts used toys in their experiments?

A. The toys were inexpensive.

B. Students could relate to toys.

C. Other objects were unavailable in space.

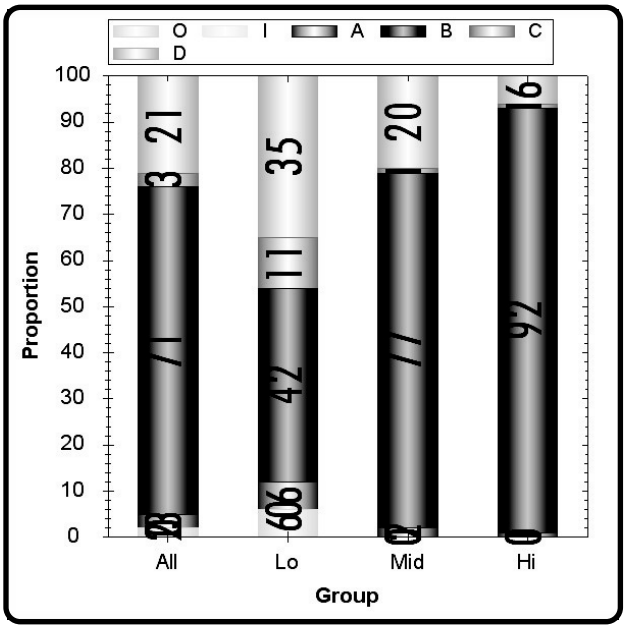
D. Newton used similar objects in his discoveries.

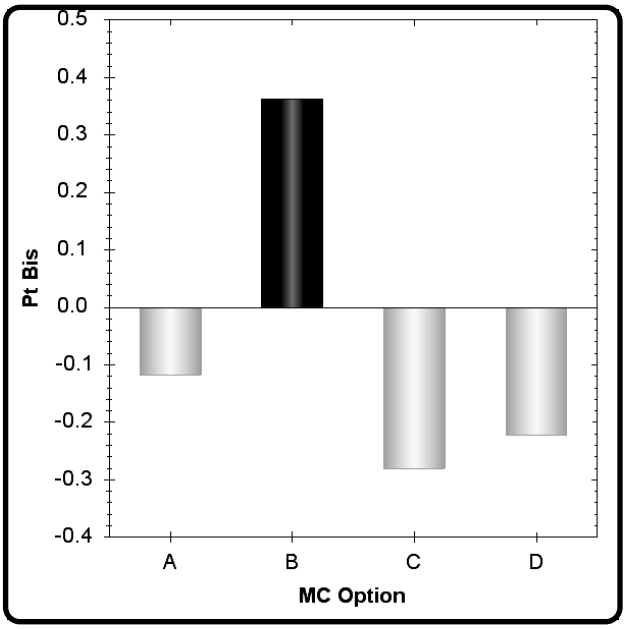
Grade 8	Reading	CID 3419774
Item # 3		R.08.E.1
Psg : Toying Around in Space_TOY		OP07

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	B	489	0.722	0.363

	A	B	C	D	Omit	Invalid
All	3	71	3	21	2	0
Low Scorers	6	42	11	35	6	0
Middle Scorers	2	77	1	20	0	0
High Scorers	1	92	1	6	0	0

MC Item Option Discriminations			
A	B	C	D
-0.117	0.363	-0.280	-0.223





Notes:

3419769

Which activity would <u>best</u> demonstrate the overall purpose of the space experiments?

A. Dressing a doll

B. Bouncing a ball

C. Coloring a picture

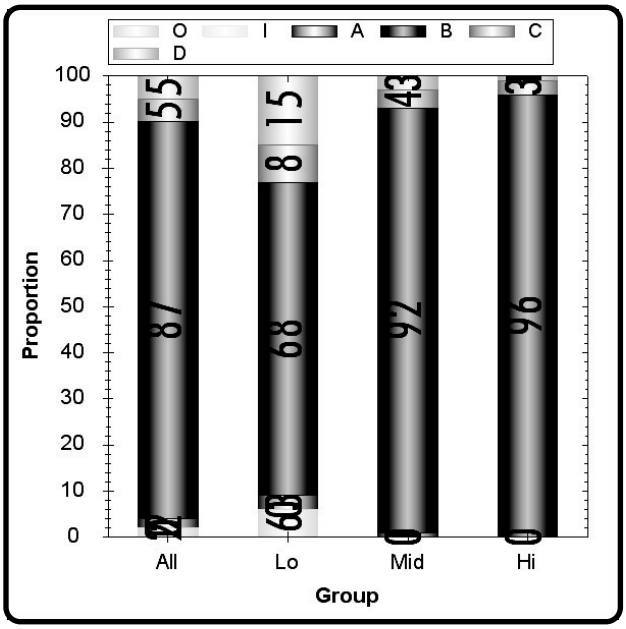
D. Holding some cards

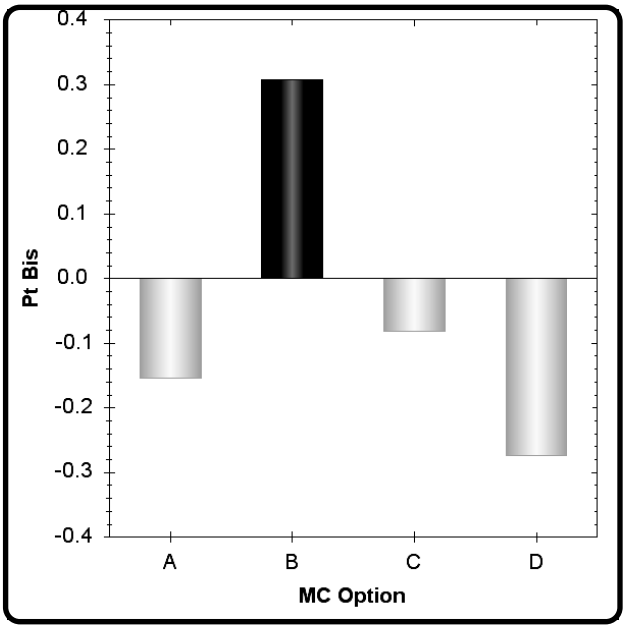
Grade 8	Reading	CID 3419769
Item # 6		R.08.E.3
Psg : Toying Around in Space_TOY		OP07

Type	Max Points	Correct Answer	N Count	Item Mean	Discrimination
Multiple Choice	1	B	489	0.881	0.308

	A	B	C	D	Omit	Invalid
All	2	87	5	5	2	0
Low Scorers	3	68	8	15	6	0
Middle Scorers	1	92	4	3	0	0
High Scorers	0	96	3	1	0	0

MC Item Option Discriminations			
A	B	C	D
-0.154	0.308	-0.082	-0.273





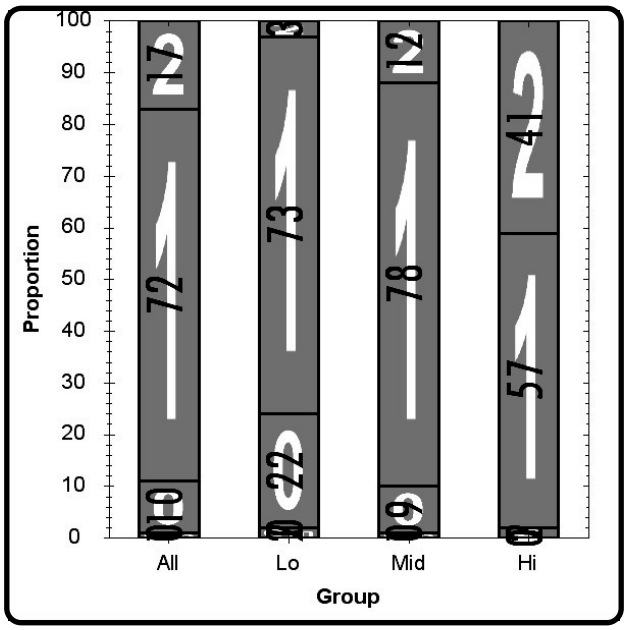
Notes:

Describe what happened to the windup cars in space and compare their actions to the windup cars on Earth.

Grade 8	Reading	CID 3419791
Item # 53		R.08.E.1
Psg : Toying Around in Space_TOY		OP09

Type	Max Points	N Count	Item Mean	Discrimination
SR	2	6200	1.064	0.375

	0	1	2	Omit	Invalid
All	10	72	17	1	0
Low Scorers	22	73	3	2	0
Middle Scorers	9	78	12	1	0
High Scorers	2	57	41	0	0



Notes:

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

7 **Describe what happened to the windup cars in space and compare their actions to the windup cars on Earth.**

The windup cars in space would go around the track and when the engine stopped, the car did not fall, but merely floated away from the track. The windup cars on Earth would go partially around the track, but it would fall off before the motor stopped.

Paper 1
Score Point 2

This response provides an accurate response comparing the car track experiment on earth to the same experiment in space (. . . *in space . . . would go around the track and when the engine stopped, the car did not fall, but merely floated; on Earth . . .go partially around the track, but it would fall off before the motor stopped*). Although only one experiment is referenced, the details of that experiment are specific and sufficient to support the reader's position.

7 **Describe what happened to the windup cars in space and compare their actions to the windup cars on Earth.**

the car in space floated away, and the car on earth fell on the ground.

Paper 2
Score Point 1

The student has responded to the task by comparing how the windup cars in space compared to the wind up cars on earth (*The car in space floated; the car on earth fell*), but the details are insufficient. Although the student mentions part of one experiment, important details are left out such as running on the looped track, motor winding down or not, and/or the car losing friction.

7 **Describe what happened to the windup cars in space and compare their actions to the windup cars on Earth.**

they unwind faster in space.

Paper 3
Score Point 0

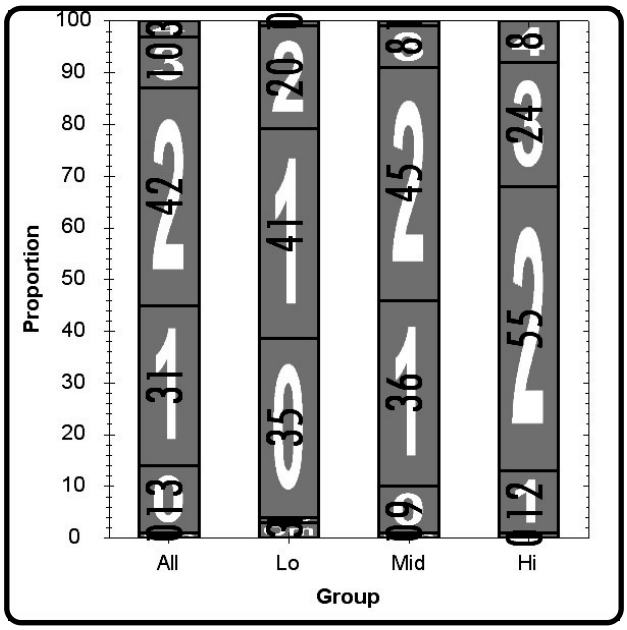
The response does not address the task as the information provided is not found in the text. The text indicates that the motorized cars go further in space when pushed, not unwind faster.

What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.

Grade 8	Reading	CID 3419792
Item # 54		R.08.E.3
Psg : Toying Around in Space_TOY		OP09

Type	Max Points	N Count	Item Mean	Discrimination
ER	4	6200	1.558	0.478

	0	1	2	3	4	Omit	Invalid
All	13	31	42	10	3	1	0
Low Scorers	35	41	20	1	0	3	1
Middle Scorers	9	36	45	8	1	1	0
High Scorers	1	12	55	24	8	0	0



Notes:

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

8 **What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.**

If I were to bring a toy into space, I would bring a yo-yo. On earth, yo-yos are pulled toward the ground by gravity. Because there is no air resistance in space, bringing a yo-yo would be a good experiment. When astronauts brought a toy car and racetrack into space, they expected to car to fall to the ground once it lost friction. With a yo-yo, we would expect it to fall to the ground and quickly snap back up to our hand. However, the yo-yo would only unwind from the circle if a great amount of force was acted upon it. The yo-yo would then float around in the air on the end of the string. Bringing a yo-yo into space would be a good experiment because its reaction displays excellent science terms.

Paper 1
Score Point 4
The student addresses all three required components for a 4: to reference the original toy, compare it to the new chosen toy, and provide sufficient details to support the reader's position. The student chooses an appropriate toy, a yo-yo, and compares its behavior on land and in space (*On earth, yo-yos are pulled to the ground by gravity . . . . no air resistance in space . . . . the yo-yo would only unwind from the circle if a great amount of force was acted upon it . . . . float around in the air on the end of the string*) with that of the toy car and race track that was in the text (. . . *astronauts brought a toy car and race track . . . expected the car to fall to the ground once it lost friction*).

8 **What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.**

Another toy to talk up to space could be a yo-yo. We could find out what it would do it when put in a non-gravity are. Almost any toy that has some sort of motion would work. Like the toy car, one you started to whip the yo-yo down it would probably start floating around in the spacecraft. What would happen if you tried to do tricks. The yo-yo would never come back to your hand. It would just keep going like the itoy car mario Runco experimented with. Talk about a long sleeper

Paper 2
Score Point 3

The student chooses an appropriate toy, a yo-yo, and attempts to describe what the yo-yo might do in microgravity (. . . *start floating* . . . . *The yo-yo would never come back to your hand. It would just keep going*). However, the reference to the experiment with the car is weak (*Like the toy car, one you started to whip the yo-yo down it would probably start floating around in the spacecraft*). Therefore, the details are not sufficient for a score of 4.

8 **What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.**

An appropriate toy to take into space would be a top. This would be appropriate toy because on earth a top will fall from the force of gravity, before it's done spinning. While a top does that onearth, I am sure that a top would quit spinning when it ran out of force to push it. Also kids are more familar with a top. Thats why I would choose a top to go in to space with.

Paper 3
Score Point 2

The student chooses an appropriate toy, a top, and compares how the top would work on earth vs. how it might perform in space (. . . *on earth a top will fall from the force of gravity . . . . I am sure that a top would quit spinning when it ran out of force*). However, the details are not sufficient to support the reader's position because this response does not reference the car experiment.

8 **What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.**

a puzzle, because it would float is space and on earth it would stay on the ground.

Paper 4
Score Point 1

The student chooses a toy (*puzzle*) that in context is appropriate. However, the details are not sufficient to support the reader's position. Saying it (. . . *would float in space and on earth it would stay on the ground*) does not explain why it would float in space nor does it reference microgravity. Also, there is no comparison between the puzzle and the car experiment.

8 **What would be an appropriate toy, other than a car, to take into space? Use details from the article to support your answer.**

Appropriate toy other than a car to take into space is wind up car because it would go on a looped shaped track.

Paper 5
Score Point 0

The student attempts to address the task, but a "*wind up car*" is the toy the students and astronauts used in the passage. Since the question asks students for an appropriate toy other than a car and the student provides no relevant details from the text, the response is considered irrelevant.

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