Instructions for teachers:

The ACT Science practice allows the students and teacher to break down the figures, examine more carefully what the variables are in each graph, what is being studied, and how everything is measured.

The document is 3 pages (one page for each day of ACT week). You can photocopy the first 2 pages of the document front-to-back and have students keep this paper for the entire week.

The last page can be read out loud, projected on an LCD or an overhead projector, or photocopied. However, it should not be handed out to students until the final day, as many students want to rush into the multiple choice questions.

It is more important that some discussion takes place about the experiments rather than rushing through the answers to the questions.

Any feedback on Science ACT practice is appreciated to the science team. Send e-mails to Victor Chen.

PASSAGE VII

DAY 1 – SCIENCE ACT
In the ACT Science Section, you will see three "Experiments" passages. They are easy to spot. They usually contain an introductory paragraph followed by a number of experiments and six questions.

Friction is the resistive force to motion. If an object is moving in one direction, friction is pulling in the opposite direction, allowing an object to stop moving or stay in place. Friction depends mostly on the smoothness of the surfaces that come into contact with an object and the magnitude of force (or weight) of one object on the other. A rough surface, for example, increases friction, making it more difficult for one object to slide over the other.

Some students conducted three experiments to test their hypotheses about the influence of surface material and speed on the force of friction. The students created a ramp and runway from different-sized blocks and two pieces of plywood (Figure 1). They used a toy car to test the effect of friction on the speed and distance that the car was able to travel, once it reached the flat surface. The same car was used in all of the experiments. The students changed the angle (or height) of the ramp in order to change the speed that the car could travel.

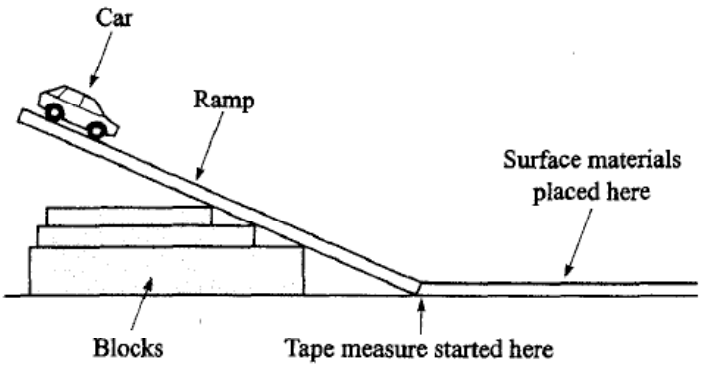

Figure 1

Experiment 1

The ramp in this experiment was placed at a 45° angle. The car was placed at the top of the ramp and released. A tape measure was used to determine the distance that the car traveled once it left the ramp until it stopped on different materials that covered the flat surface at the bottom of the ramp. For each material, the experiment was repeated three times and the results are shown in Table 1.

Table 1

Surface	Distance (in inches)			
	Trial 1	Trial 2	Trial 3	Avg
Waxpaper	42.00	40.50	43.50	42.00
Plywood	11.00	12.50	11.75	11.75
Carpet	4.25	5.00	5.25	4.83
Asphalt	22.00	23.50	21.75	22.42

Experiment 2

The experiment was repeated with the ramp placed at a 30° angle. The results are shown in Table 2.

Table 2

Surface	Distance (in inches)			
	Trial 1	Trial 2	Trial 3	Avg
Waxpaper	32.00	30.00	32.50	31.50
Plywood	7.00	7.50	7.25	7.25
Carpet	3.00	3.25	3.50	3.25
Asphalt	16.00	16.50	17.25	16.58

Experiment 3

The experiment was repeated with the ramp placed at a 15° angle. The results are shown in Table 3.

Table 3

Surface	Distance (in inches)			
	Trial 1	Trial 2	Trial 3	Avg
Waxpaper	18.00	20.75	19.75	19.50
Plywood	4.00	3.75	4.00	3.92
Carpet	1.75	2.25	2.00	2.00
Asphalt	10.25	12.75	11.50	11.50

1. The first thing you need to do in an Experiments passage is to identify the ***objective***. The objective is a statement that tells you the purpose of the study (*what* they are studying). The objective is usually found in the beginning or the end of the introductory paragraph. Once you find it, underline the objective.

2. The second thing you need to do is to follow the procedure of each experiment and identify the variables. Then, jot down a few words along side each of the experiments to make a note of what is changing in each case. Space is given to you here so you can write down your notes.

3. The final thing you need to do in an Experiments section is to study the results. The results are the conclusion of the study. When you study the results, make sure you underline them or write some notes in the margin. Once you've finished this step, look for any patterns, and move on to the questions.

PASSAGE VII

DAY 2 – SCIENCE ACT
Try to answer the following open-ended questions about the passage. Use your notes from the previous page to guide your thinking.

Friction is the resistive force to motion. If an object is moving in one direction, friction is pulling in the opposite direction, allowing an object to stop moving or stay in place. Friction depends mostly on the smoothness of the surfaces that come into contact with an object and the magnitude of force (or weight) of one object on the other. A rough surface, for example, increases friction, making it more difficult for one object to slide over the other.

Some students conducted three experiments to test their hypotheses about the influence of surface material and speed on the force of friction. The students created a ramp and runway from different-sized blocks and two pieces of plywood (Figure 1). They used a toy car to test the effect of friction on the speed and distance that the car was able to travel, once it reached the flat surface. The same car was used in all of the experiments. The students changed the angle (or height) of the ramp in order to change the speed that the car could travel.

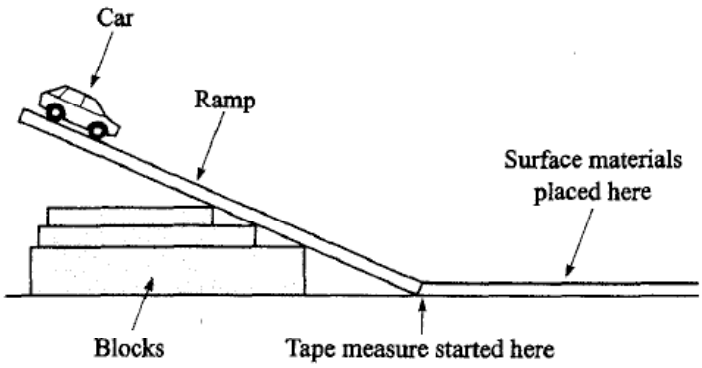

Figure 1

Experiment 1

The ramp in this experiment was placed at a 45° angle. The car was placed at the top of the ramp and released. A tape measure was used to determine the distance that the car traveled once it left the ramp until it stopped on different materials that covered the flat surface at the bottom of the ramp. For each material, the experiment was repeated three times and the results are shown in Table 1.

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1. Based on the experiments and the passage, what can you conclude about the effects that friction has on the toy car?

2. Based on the experiments, what effects do you think a smoother surface would have on the friction and the distance traveled for the car?

3. Based on the passage, why do you think oil is used to decrease the friction between two objects?

4. Which variable was kept constant throughout all the experiments?

5. As the ramp height increased, what effects did this have on the speed of the car and the friction needed to stop the car?

PASSAGE VII

DAY 3 – SCIENCE ACT
Answer the following multiple choice questions using what you have learned about the Experiments passage.

Friction is the resistive force to motion. If an object is moving in one direction, friction is pulling in the opposite direction, allowing an object to stop moving or stay in place. Friction depends mostly on the smoothness of the surfaces that come into contact with an object and the magnitude of force (or weight) of one object on the other. A rough surface, for example, increases friction, making it more difficult for one object to slide over the other.

Some students conducted three experiments to test their hypotheses about the influence of surface material and speed on the force of friction. The students created a ramp and runway from different-sized blocks and two pieces of plywood (Figure 1). They used a toy car to test the effect of friction on the speed and distance that the car was able to travel, once it reached the flat surface. The same car was used in all of the experiments. The students changed the angle (or height) of the ramp in order to change the speed that the car could travel.

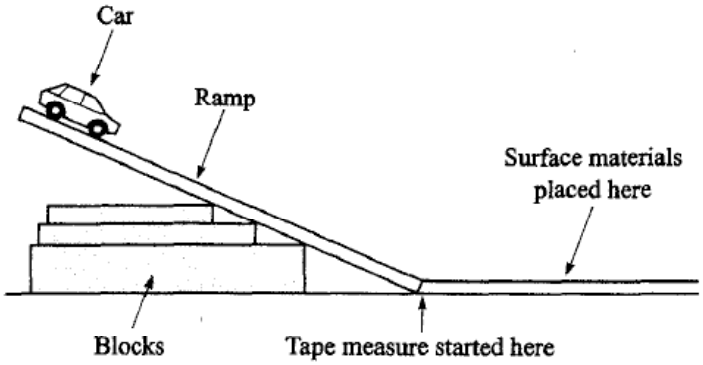

Figure 1

Experiment 1

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Experiment 2

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1 In each experiment, the material used affected the force of friction and, as a result, the distance the car traveled before it came to a stop. Based on the experiments, it is most likely that the stronger the friction, the:
A. heavier the object as compared to the material.
B. lighter the object as compared to the material.
C. longer the distance the car could travel.
D. shorter the distance the car could travel.

2. Using a smoother surface would most likely:
F. both decrease friction and increase the distance traveled before the car came to a stop.
G. both decrease friction and decrease the distance traveled before the car came to a stop.
H. both increase friction and increase the distance traveled before the car came to a stop.
J. both increase friction and decrease the distance traveled before the car came to a stop.

3. If each of the following materials was used, as in the experiments, to cover the flat surface at the bottom of the ramp, the friction exerted will likely be the least with which material?
A. Brick
B. Lace
C. Aluminum foil
D. Window screens

4. Which of the following statements best explains why lubricant or oil is used to decrease the friction between two objects?
F. It increases the magnitude of force on each object, making it harder to slide one object past the other.
G. It smoothes the surfaces of both objects, making it easier for one object to slide past the other.
H. It increases the gravitational pull on the objects, making it harder to slide one object past the other.
J. It decreases the weight of each object, making it easier to slide one object past the other.

5. Which variable was kept constant throughout all the experiments?
A. The mass of the car
B. The speed of the car
C. The surface material
D. The angle of the ramp

6. According to the results of the experiments, increasing the ramp's height increased the distance that the car could travel, regardless of the material used. Increasing the height of the ramp:
F. both decreased the speed of the car and increased friction.
G. both decreased the speed of the car and decreased friction.
H. both increased the speed of the car and increased the distance traveled before friction could stop it.
J. both increased the speed of the car and decreased the distance traveled before friction could stop it.

Multiple Choice Answers

1. The best answer is D. The passage states that friction depends mostly on the smoothness of the surfaces that come into contact with an object. Rough surfaces, like the carpet or driftwood used in the experiments, increase friction because it is harder for the car to travel on these surfaces than on a smoother surface. Therefore, the stronger the friction, the shorter the distance the car can travel, answer choice D.

2. The best answer is F. The passage states that friction depends mostly on the smoothness of the surfaces that come into contact with an object. The smoother the surface, the less friction there will be to stop the car from traveling farther. If the surface is smoother, the friction will be decreased, and the car will be able to travel a longer distance, answer choice F.

3. The best answer is C. According to the passage, friction depends mostly on the smoothness of the surfaces that come into contact with an object. Friction will be the least powerful on a smooth surface, like aluminum foil, answer choice C.

4. The best answer is G. According to the passage, friction depends mostly on the smoothness of the surfaces that come into contact with an object. The smoother the surfaces of the two objects attempting to slide past one another, the less friction there will be to stop or slow the movement. Lubricants or oils cause the surface of an object to become slippery, or smoother, which is why the materials are used to decrease friction, answer choice G.

5. The best answer is A. The passage states that the same car was used in all of the experiments. Therefore, it can be inferred that the mass of the car was kept constant in each experiment, answer choice A.

6. The best answer is H. The passage states that raising the height of the ramp increased the speed that the car could travel, so you can eliminate answer choices F and G. Based on information given in the passage and the results of the experiments, you know that the faster the car traveled, the longer the distance it traveled before the friction stopped it. Therefore, increasing the height of the ramp both increased the speed and increased the distance traveled, answer choice H.