

(Part 1)

Passage IV

In 2 experiments, a student pulled each of 3 blocks in a straight line across a flat, horizontal surface.

In Experiment 1, the student measured the *pulling force* (the force required to move each block at a constant speed) and plotted the pulling force, in newtons (N), versus block mass, in kilograms (kg). The results are shown in Figure 1.

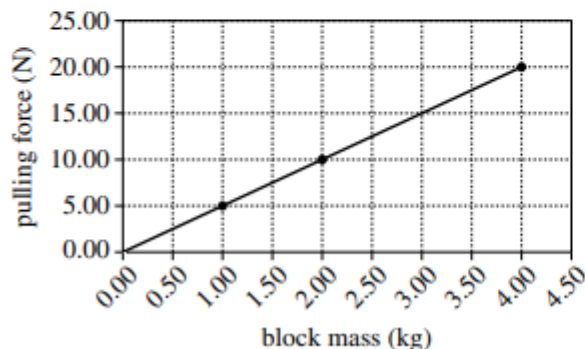


Figure 1

In Experiment 2, the student measured the speed versus time of a 2.00 kg block, a 2.50 kg block, and a 3.00 kg block as each block was pulled across the surface with a constant 30 N force. The results are shown in Figure 2.

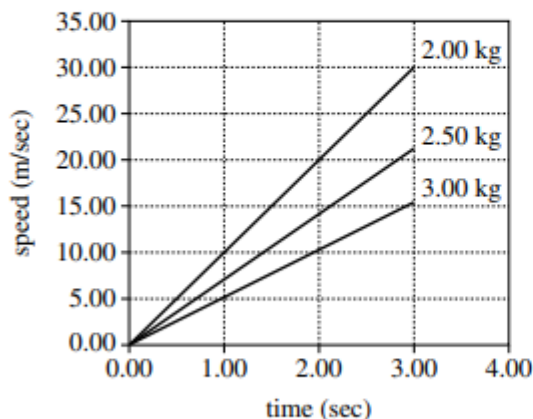


Figure 2

25. At each of the times plotted in Figure 2 (except 0.00 sec), as block mass increased, block speed:

- A. increased only.
- B. decreased only.
- C. varied, but with no general trend.
- D. remained the same.

21. If a block was pulled toward the east, the frictional force exerted on the block by the surface was directed toward the:

- A. north.
- B. south.
- C. east.
- D. west.

22. Based on Figure 2, what is the order of the 3 blocks, from the block that required the shortest time to reach 15 m/sec to the block that required the longest time to reach 15 m/sec ?

- F. 2.00 kg block, 2.50 kg block, 3.00 kg block
- G. 2.00 kg block, 3.00 kg block, 2.50 kg block
- H. 3.00 kg block, 2.00 kg block, 2.50 kg block
- J. 3.00 kg block, 2.50 kg block, 2.00 kg block

23. Based on Figure 2, what was the approximate value of the acceleration of the 3.00 kg block?

- A. 0.0 m/sec²
- B. 5.0 m/sec²
- C. 15.0 m/sec²
- D. 20.0 m/sec²

24. Based on Figure 1, the results of Experiment 1 are best modeled by which of the following equations?

- F. Block speed (m/sec) = 0.2 × time (sec)
- G. Block speed (m/sec) = 5.0 × time (sec)
- H. Pulling force (N) = 0.2 × block mass (kg)
- J. Pulling force (N) = 5.0 × block mass (kg)

26. Based on Figure 1, an applied force of 30.00 N would most likely have been required to maintain the constant speed of a block having a mass of:

- F. 4.00 kg.
- G. 5.00 kg.
- H. 6.00 kg.
- J. 7.00 kg.

Passage IV

Some students conducted experiments using different brands of adhesive tape, one kind each of paper and plastic, a board, and a spring scale.

Experiment 1

A student stuck one end of a piece of tape onto the edge of a board that was wrapped with paper. The other end of the tape was clamped to a spring scale, as shown in Figure 1.

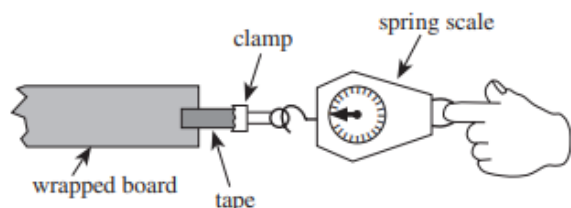


Figure 1

While one student held the board, a second student pulled the spring scale until the tape came off the paper wrapping; a third student recorded the force in newtons, N, indicated on the spring scale at the moment the tape came off the paper wrapping.

The procedure was repeated for 3 different brands of tape; each brand of tape came in many different widths, of which 2 or 3 were tested. The results are shown in Table 1.

Tape brand	Tape width (cm)	Force (N) to remove tape:			
		Trial 1	Trial 2	Trial 3	Average
X	1.0	1.6	1.9	2.2	1.9
	2.0	3.9	3.7	4.1	3.9
	3.0	6.0	5.6	5.8	5.8
Y	2.0	4.0	4.5	4.3	4.3
	2.5	5.4	5.1	5.7	5.4
Z	1.0	2.2	1.6	1.8	1.9
	2.0	4.1	3.9	3.6	3.9

22. Which brand(s) of tape was/were used at only 2 different widths in both experiments?

F. Brand X only
 G. Brand Y only
 H. Brand Z only
 J. Brands Y and Z only

23. For the students to determine the force required to remove tape from a wrapping, which of the following attractive forces had to exceed the adhesive force between the tape and the wrapping?

A. The force between the clamp and the tape
 B. The force between the clamp and the paper or plastic wrapping
 C. The force between the Earth and the wrapping
 D. The force between the Earth and the tape

Experiment 2

The students performed an experiment similar to Experiment 1, except that the paper wrapping was replaced by a plastic wrapping. The results are shown in Table 2.

Tape brand	Tape width (cm)	Force (N) to remove tape:			
		Trial 1	Trial 2	Trial 3	Average
X	1.0	1.7	1.5	1.6	1.6
	2.0	3.2	3.2	3.3	3.2
	3.0	5.0	5.0	5.1	5.0
Y	2.0	4.3	4.3	4.3	4.3
	2.5	5.5	5.4	5.4	5.4
Z	1.5	2.8	2.8	2.9	2.8

19. The results of the 2 experiments support the conclusion that, for a given brand of tape, as the tape's width increases, the force required to remove the tape from a given wrapping:

A. increases only.
 B. decreases only.
 C. remains constant.
 D. varies, but with no particular trend.

20. In Experiment 2, had Brand X tape in a 4.0 cm width been tested, the force required to remove the tape from the plastic wrapping would have been closest to:

F. 5.0 N.
 G. 7.0 N.
 H. 9.0 N.
 J. 11.0 N.

21. Based on the average results of Experiments 1 and 2, which of the following brands of tape adhered better to the paper than to the plastic?

A. Brand X
 B. Brand Y
 C. Brands X and Y
 D. Brands Y and Z

24. The students' instructor gave them a strip of tape that was 2.5 cm wide and asked them to identify the brand. The students repeated the procedures from Experiments 1 and 2 using the tape and obtained average forces of 4.9 N for paper and 4.1 N for plastic. Which of the following brands would most likely have produced these results?

F. Brand X only
 G. Brand Y only
 H. Brands X and Y only
 J. Brands Y and Z only