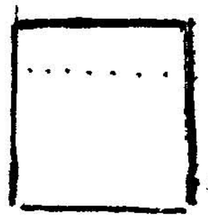
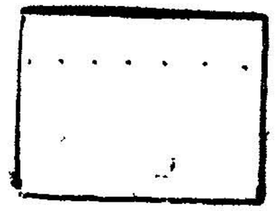
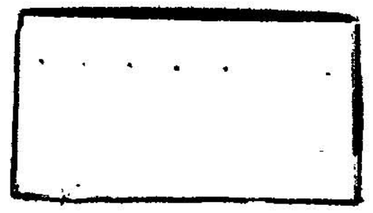
9.8 cm/s



15.2 cm/s

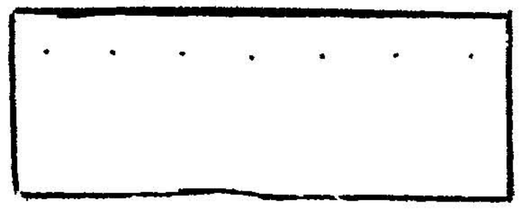


20.2 cm/s

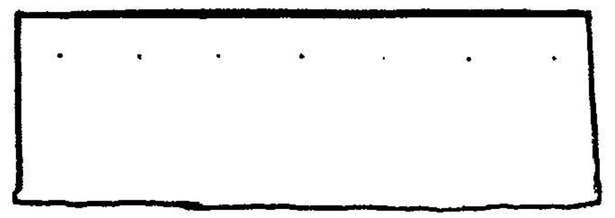


25.2 cm/s

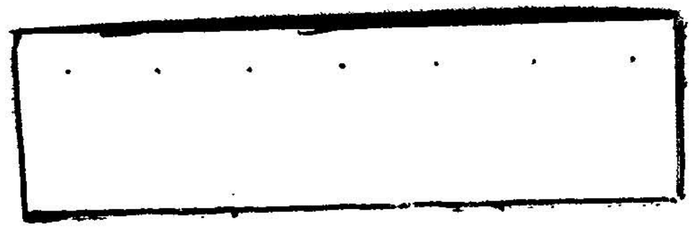
30.1 cm/s



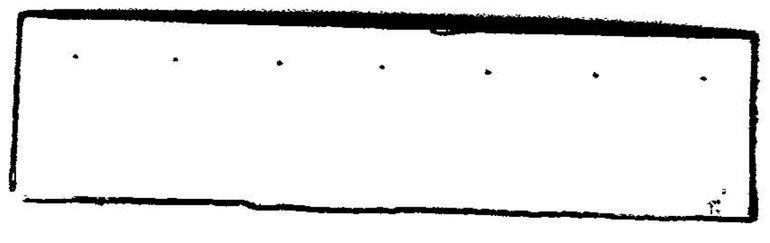
34.7 cm/s



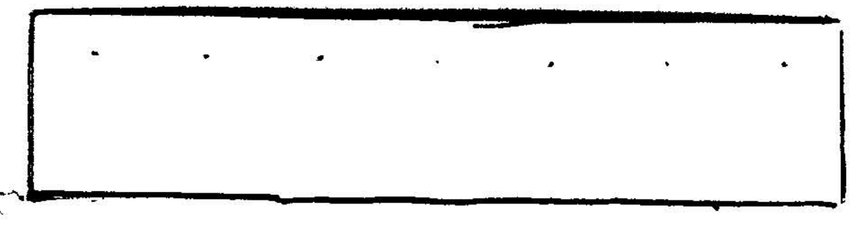
39.6 cm/s



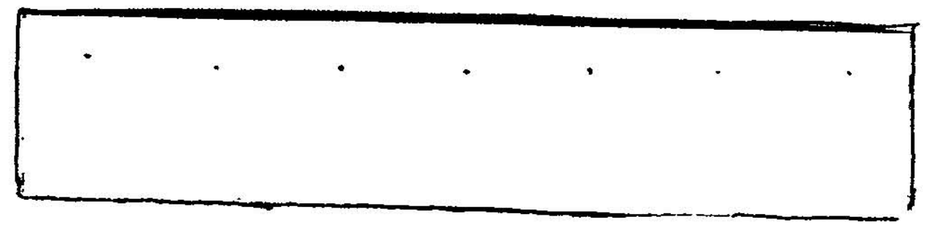
44.2 cm/s



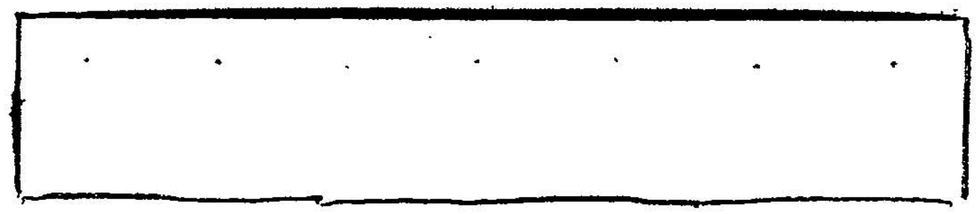
48.7 cm/s



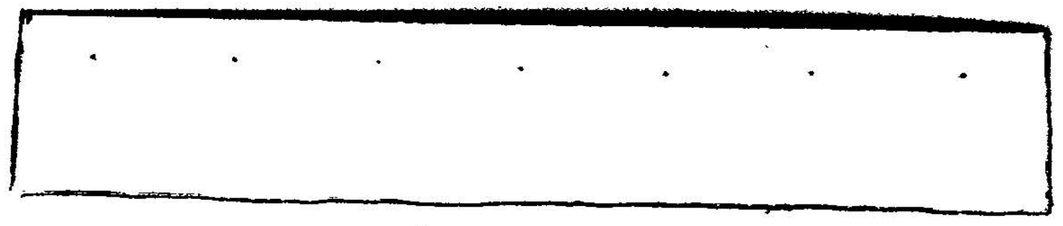
53.5 cm/s



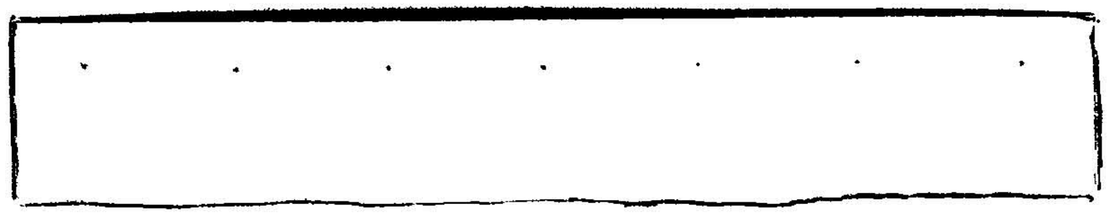
56.6 cm/s



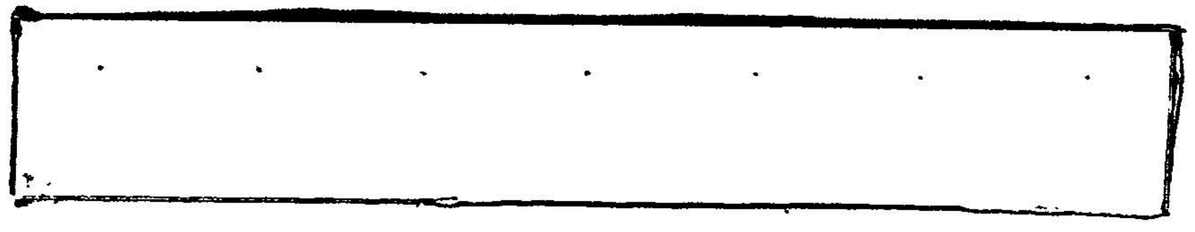
61.0 cm/s



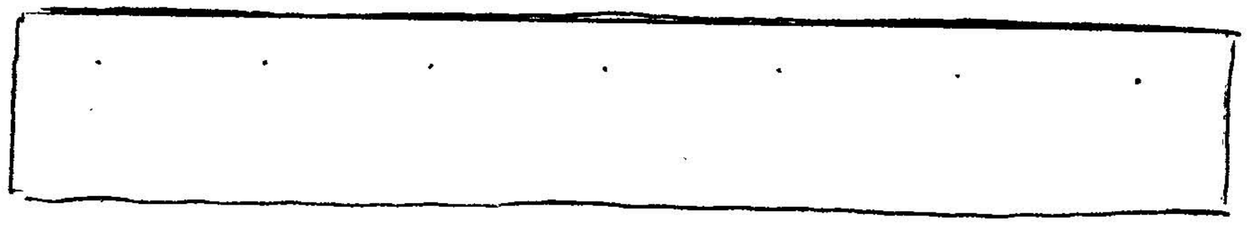
65.9 cm/s



69.1 cm/s



73.1 cm/s



I. Motion with constant speed

Each person in your group should obtain a ruler and at least one ticker tape segment from the staff. All the tape segments were generated using the same ticker timer. Do not write on or fold the tapes. If a ticker timer is available, examine it so that you are familiar with how it works.

A. Describe the motion represented by your segment of tape. Explain your reasoning.

B. Compare your tape segment with those of your partners.

How does the time taken to generate one of the short tape segments compare to the time taken to generate one of the long tape segments? Explain your answer.

Describe how you could use your answer above to arrange the segments in order by speed.

C. Suppose the ticker timer that made the dots strikes the tape every $1/60^{th}$ of a second.

How far did the object that generated your tape segment move in: $1/60^{th}$ of a second? $2/60^{th}$ of a second? $3/60^{th}$ of a second? Explain your answer.

Predict how far the object would move in: 1 second, $1/120^{th}$ of a second. Explain the assumption(s) you used to make your predictions.

D. In your own words, describe a procedure you could use to calculate the speed of an object.

E. Determine the speed of the object that generated each of your tapes. Record your answers below.

Give an interpretation of the speed of the object. (*i.e.*, Explain the meaning of the number you just calculated.) Do not use the word "speed" in your answer. (*Hint:* Which of the distances that you calculated in part C is numerically equal to the speed?)

Write the speed of the object that generated each tape on a small piece of paper and attach the paper to the tape. Express your answer in terms of centimeters and seconds.

II. Motion with varying speed

A. In the space below, sketch a possible ticker tape resulting from motion with varying speed and write a description of the motion.

How can you tell from your diagram that the motion has varying speed?

B. Together with your classmates, take your ticker tape segments and arrange yourselves in a line, ranked according to the speed of the segments. Discuss the following questions as a class.

Compare your segment of ticker tape to neighboring tape segments. What do you observe?

Compare the smallest and largest speeds. What do you observe?

C. Based on your observations of your tape segment and the tape segments of other members of your class, answer the following questions.

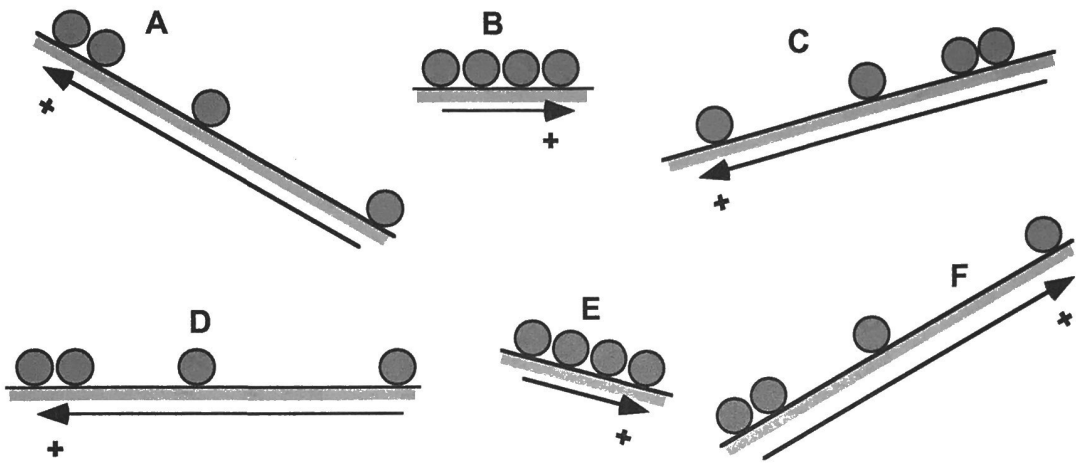
Is each small tape segment a part of a motion with constant or varying speed?

Did your examination of a single, small tape segment reveal whether the entire motion that generated the tape had constant or varying speed?

Ball Motion Diagrams—Acceleration II[4]

The following drawings indicate the motion of a ball subject to one or more forces on various surfaces from left to right. Each circle represents the position of the ball at succeeding instants of time. Each time-interval between successive positions is equal.

Rank each case from the highest to the lowest acceleration, based on the drawings. Assume all accelerations are constant and use the coordinate system specified in the drawing. Note: Zero is greater than negative acceleration, and ties are possible.



Highest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Lowest

Or, all have the same acceleration. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed					Sure			Very Sure	
1	2	3	4	5	6	7	8	9	10

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[4] D. Schramme, C. Fang, B. Speers, C. Hieggelke D. Maloney, T. O Kuma