## Ranking Task Sample I

For a ranking task, each item will have a number of situations as illustrated. Your task will be to rank the items in a specific order. After ranking them you will be asked to identify the basis you used for the ranking and the reasoning behind your choice. It is extremely important that you are careful to write out the proper ranking once you have determined what basis you are going to use, i.e., make sure all of the situations are ranked in the proper order according to your basis. The sample below shows how to rank items and what your explanation should be like. **NOTE: Although the procedure for working the item is correct, the particular answer, which was chosen at random from actual student responses, may not be correct.**

Example:

Shown below are eight cars that are moving along horizontal roads at specified speeds. Also given are the masses of the cars. All of the cars are the same size and shape, but they are carrying loads with different masses. All of these cars are going to be stopped by plowing into barrel barriers. All of the cars are going to be stopped in the same distance.

Rank these situations from greatest to least on the basis of the strength of the forces that will be needed to stop the cars in the same distance. That is, put first the car on which the strongest force will have to be applied to stop it in x meters, and put last the car on which the weakest force will be applied to stop the car in the same distance.
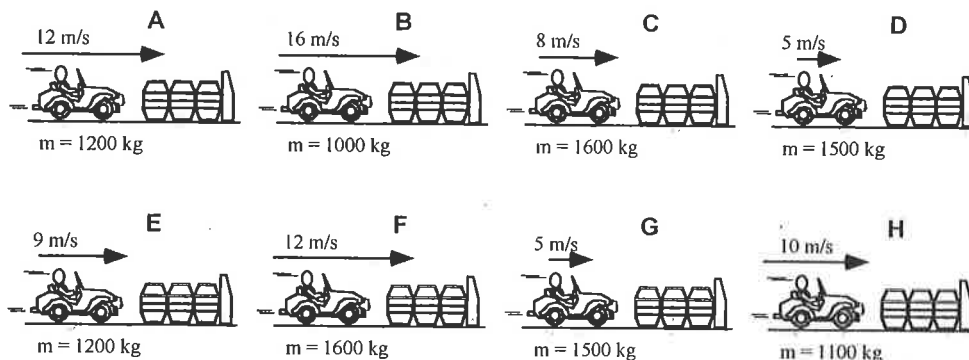
Greatest   1 __B__   2 __A F__   3 _____   4 __H__   5 __E__   6 __C__   7 __D G__   8 _____   Least

Or, all cars require the same force. _____

Please carefully explain your reasoning.

Since acceleration is the change in velocity divided by the change in time and all the changes in times are the same, then I used the change in velocity.

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

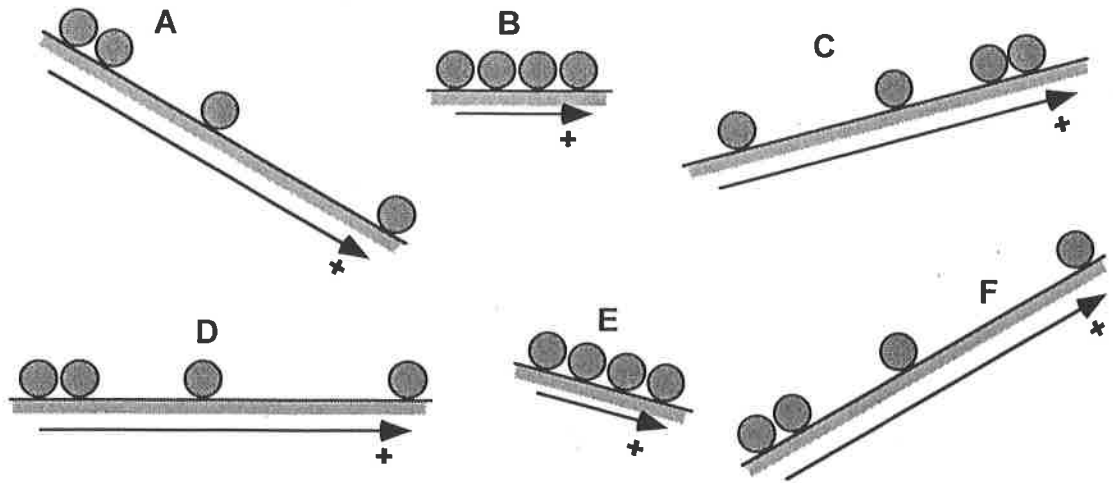| Basically Guessed					Sure			Very Sure	
1	2	3	4	5	6	7	(8)	9	10

Notice in this example that two situations produced the same result for the ranking and that these were listed in the same answer blank. Such a possibility exists for all items. In the same way, it is possible that all of the situations will give the same result. If that occurs, and only if that occurs, the option of all equal, or all the same, should be chosen.
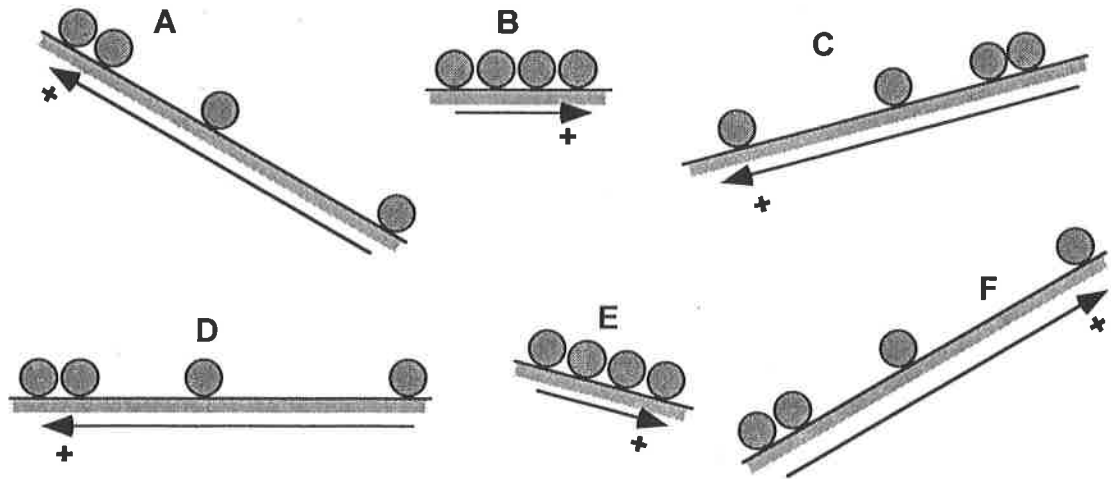
Ball Motion Diagrams—Velocity I[1]

The following drawings indicate the motion of a ball subject to one or more forces on various surfaces from <u>left to right</u>. 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 velocity based on the ball's last velocity using the coordinate system specified in the figures. Note: Zero is greater than negative, and ties are possible.

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

Or, all have the same velocity. _____

Please carefully explain your reasoning.

Ball Motion Diagrams—Velocity II[3]

The following drawings indicate the motion of a ball subject to one or more forces on various surfaces from <u>left to right</u>. 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 velocity based on the ball's last velocity using the coordinate system specified in the drawing. Note: Zero is greater than negative, and ties are possible.

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

Or, all have the same velocity. _____

Please carefully explain your reasoning.

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

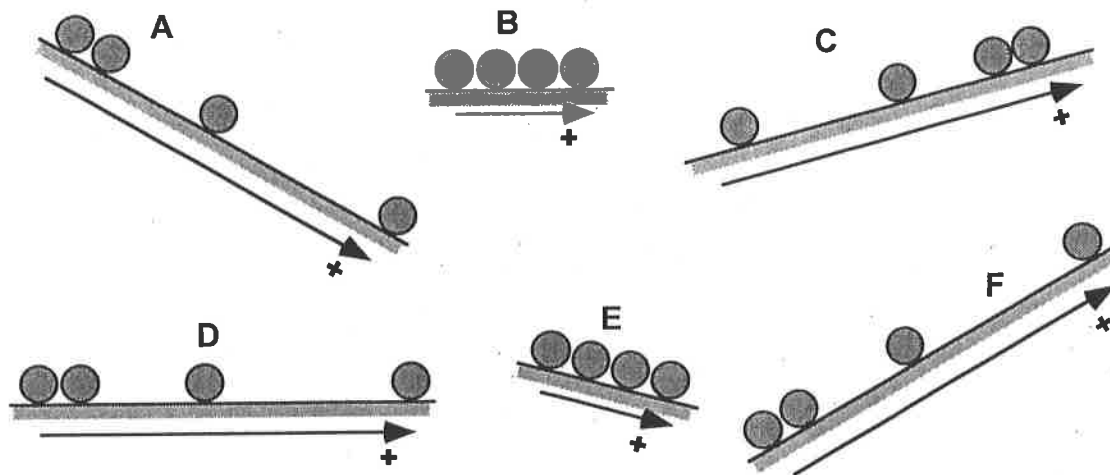Basically Guessed   Sure   Very Sure

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Ball Motion Diagrams—Acceleration I[2]

The following drawings indicate the motion of a ball subject to one or more forces on various surfaces from <u>left to right</u>. 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)

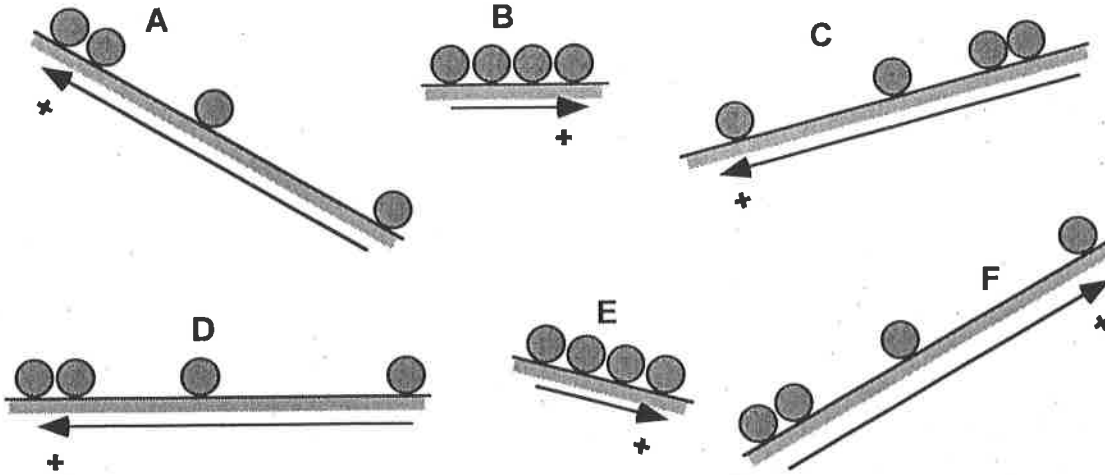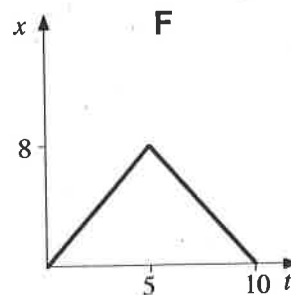Basically Guessed   Sure   Very Sure

1   2   3   4   5   6   7   8   9   10

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 <u>left to right</u>. 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.

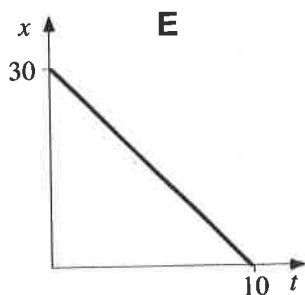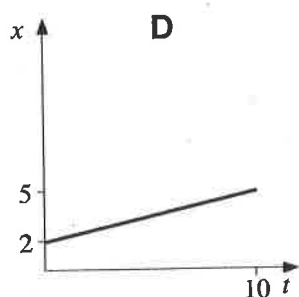How sure were you of your ranking? (circle one)

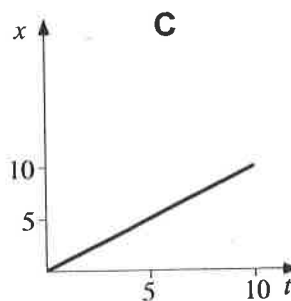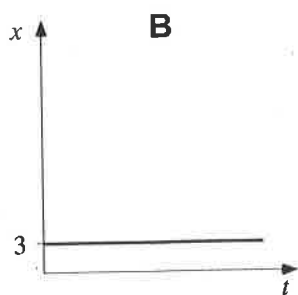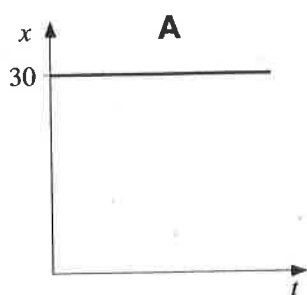| Basically Guessed				Sure				Very Sure	
1	2	3	4	5	6	7	8	9	10

Position Time Graphs—Displacement[8]

In the position vs. time graphs below, all the times are in seconds (s), and all the positions are in meters (m).

Rank these graphs on the basis of which graph indicates the greatest displacement from beginning to end of motion. Give the highest rank to the one(s) with the greatest displacement, and give the lowest rank to the one(s) indicating the least displacement. Note: Zero is greater than negative, and ties are possible.

Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, none of these graphs indicate any displacement at all. _____

Or, all of the displacements are the same. _____

Please carefully explain your reasoning.

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

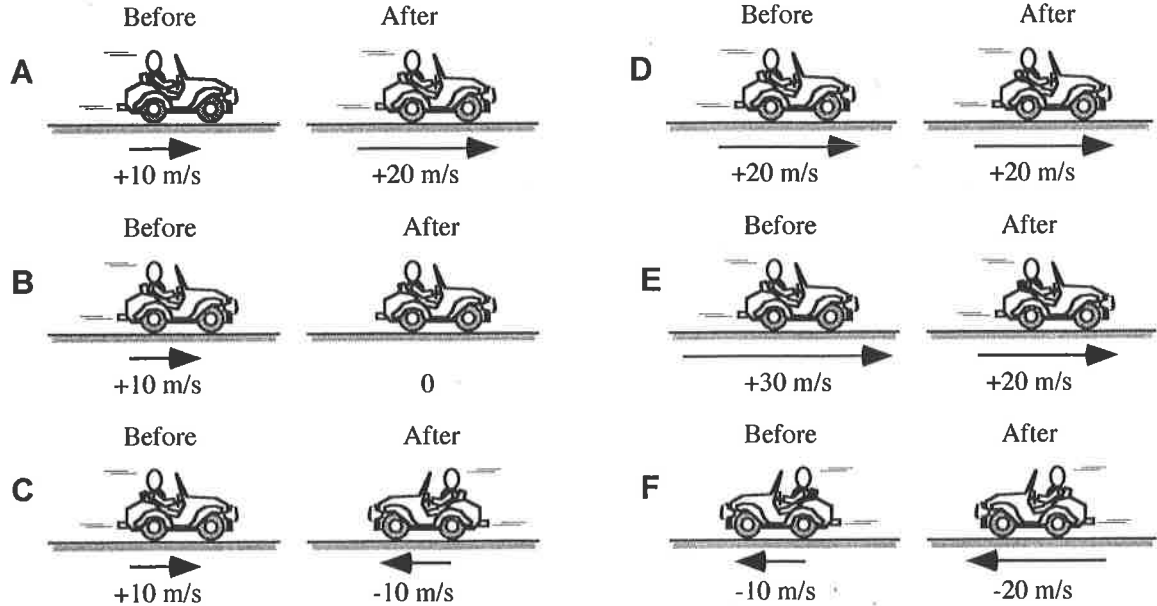| Basically Guessed					Sure				Very Sure	
1	2	3	4	5	6	7	8	9	10

Cars—Change of Velocity[9]

The six situations below show *before* and *after* "snapshots" of a car's velocity. All cars have the same mass and they traveled the same distance.

Rank these situations, in terms of the change in velocity, from most positive to most negative. Negative numbers, if any, rank lower than positive ones (-20 m/s < -10 m/s $< 0 < 5$ m/s).

	Before	After			Before	After
A			D			
	+10 m/s	+20 m/s			+20 m/s	+20 m/s
B			E			
	+10 m/s	0			+30 m/s	+20 m/s
C			F			
	+10 m/s	-10 m/s			-10 m/s	-20 m/s

Most
Positive 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Most Negative

Or, the change in velocity is the same (but not zero) for all of these. _____

Or, the change in velocity is zero for all of these. _____

Or, it is not possible to determine the change in velocity for all of these. _____

Please carefully explain your reasoning.

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

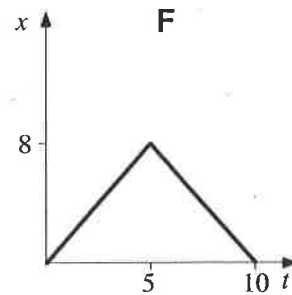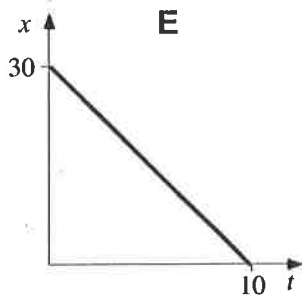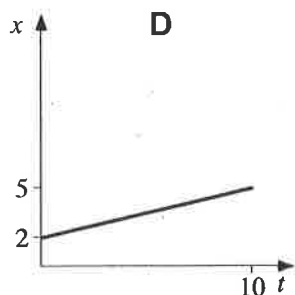| Basically Guessed					Sure			Very Sure	
1	2	3	4	5	6	7	8	9	10

Position Time Graphs—Average Speed[10]

In the position vs. time graphs below, all the times are in seconds (s), and all the positions are in meters (m).

Rank these graphs on the basis of which graph indicates the greatest average speed, where the average speed is calculated from the beginning to the end of motion. Give the highest rank to the one(s) with the greatest average speed, and give the lowest rank to the one(s) indicating the least average speed.
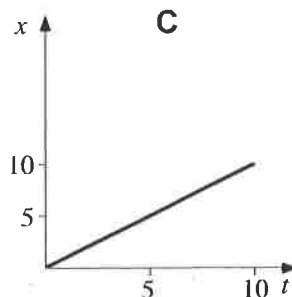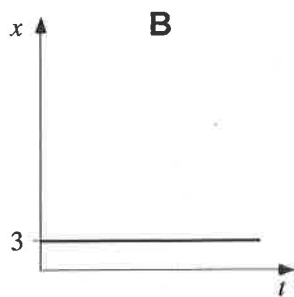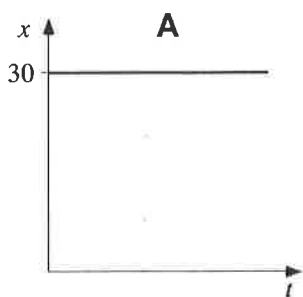
Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, none of these are moving at all. _____

Or, the average speed is the same for all of these. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)
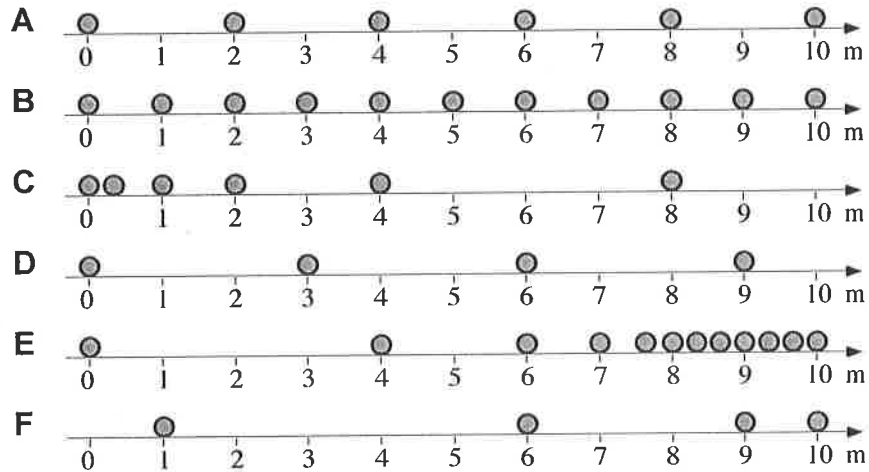
Basically Guessed				Sure				Very Sure	
1	2	3	4	5	6	7	8	9	10

Motion Diagrams—Displacement[11]

Flash strobe photographs were taken every second of a set of spheres moving from left to right. The diagram below shows the location of each sphere when each photograph was taken. The total time intervals shown vary among the spheres. All the displacements are in meters.

Rank these spheres on the basis of the greatest displacement over the first 3 seconds. Give the highest rank to the one(s) with the greatest displacement, and give the lowest rank to the one(s) indicating the least displacement.

Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, none of these motion diagrams indicate any displacement at all. _____

Or, the displacement is the same for all of these. _____

Please carefully explain your reasoning.

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

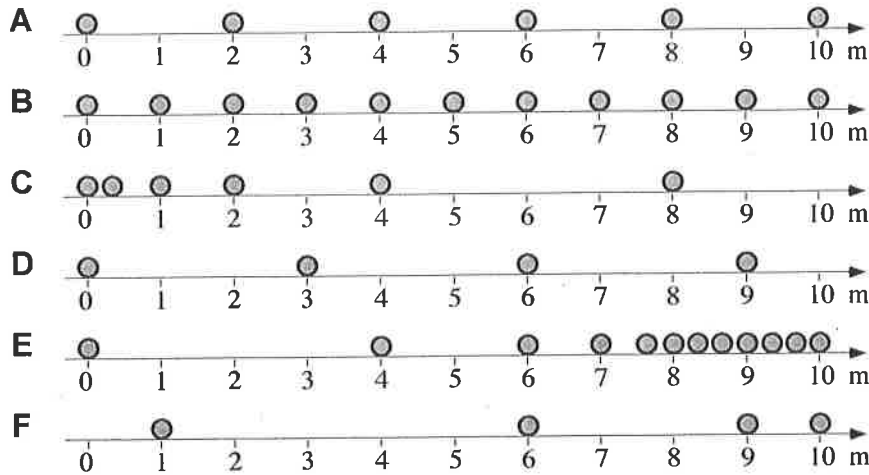| Basically Guessed					Sure			Very Sure	
1	2	3	4	5	6	7	8	9	10

[11] K. W. Nicholson, C. Hieggelke, D. Maloney
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Motion Diagrams—Average Velocity[12]

Flash strobe photographs were taken every second of a set of spheres moving from left to right. The diagram below shows the location of each sphere when each photograph was taken. The total time intervals shown vary among the spheres. All the displacements are in meters.

Rank these spheres on the basis of the greatest average velocity over the first 3 seconds. Give the highest rank to the one(s) with the greatest average velocity, and give the lowest rank to the one(s) indicating the least average velocity.

Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, none of these are moving at all. _____

Or, the average velocity is the same for all of these. _____
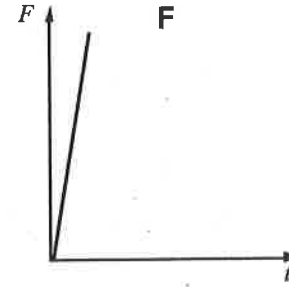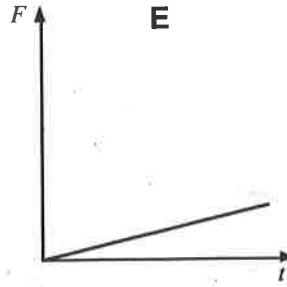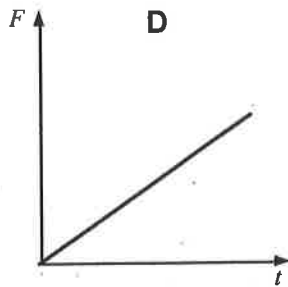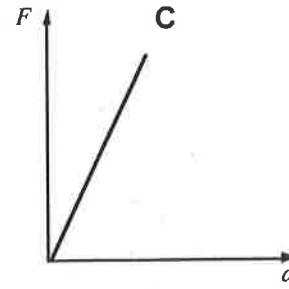
Please carefully explain your reasoning.

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

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

[12] K. W. Nicholson, C. Hieggelke, D. Maloney

Force Acceleration Graphs—Mass[26]

The following graphs plot force vs. acceleration for several objects. All graphs have the same scale for each respective axis.

Rank each situation according to mass. That is, order the situations from the largest to the smallest mass that the force is acting upon.
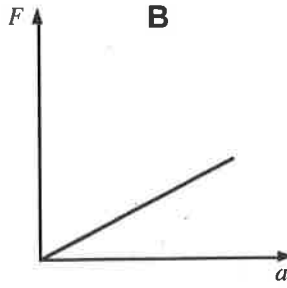
Largest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Smallest

Or, all the masses are the same. _____
Please carefully explain your reasoning.

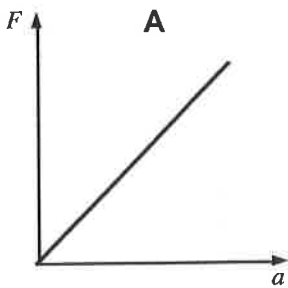How sure were you of your ranking? (circle one)
Basically Guessed   Sure   Very Sure
1   2   3   4   5   6   7   8   9   10

[26] D. Schramme, C. Fang, B. Speers