Discussion 2: Graphical Representations of 1-D motion

In this tutorial, we will study the motion of an object in one dimension and the graphs that represent that motion. You will also be answering the reflection questions for Reflection 2. Remember that you only get one try per question on a reflection assignment, so be sure discuss with your group and ask your TA or LA's for help if you are not sure!
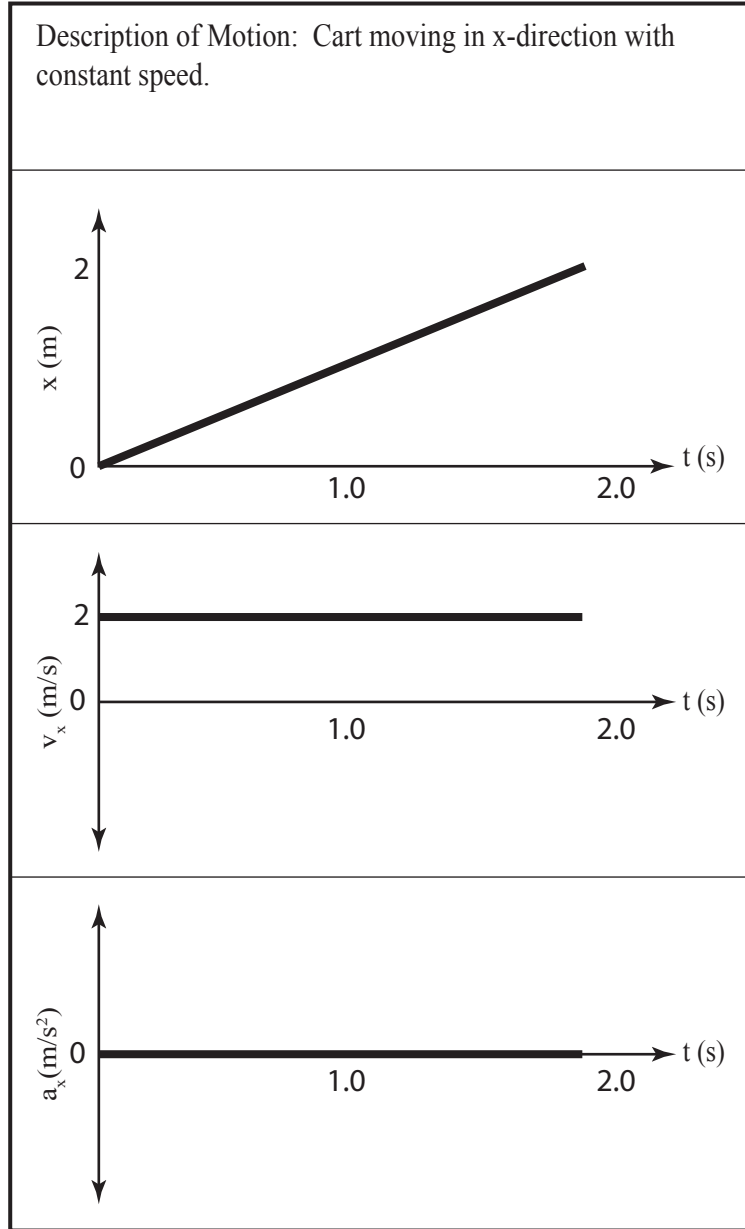
- **First open the program Tutorial_2.py**
- **Press F5 to run the program**
- **The Python Shell asks you first to specify the initial position x_0, initial velocity v_0 and acceleration for the object**
- **Enter a test value such as 0 for the initial position, 1 for the velocity and 0 for the acceleration**
- **The program not only opens the 3-D Scene, but also three windows showing the position, velocity and acceleration in the x-direction**
- **Using this program you can now work through the plotting exercises below**

Instructions for the graphs: We begin by considering one-dimensional, x-direction motion. In a future tutorial session we will consider to two-dimensional motion.
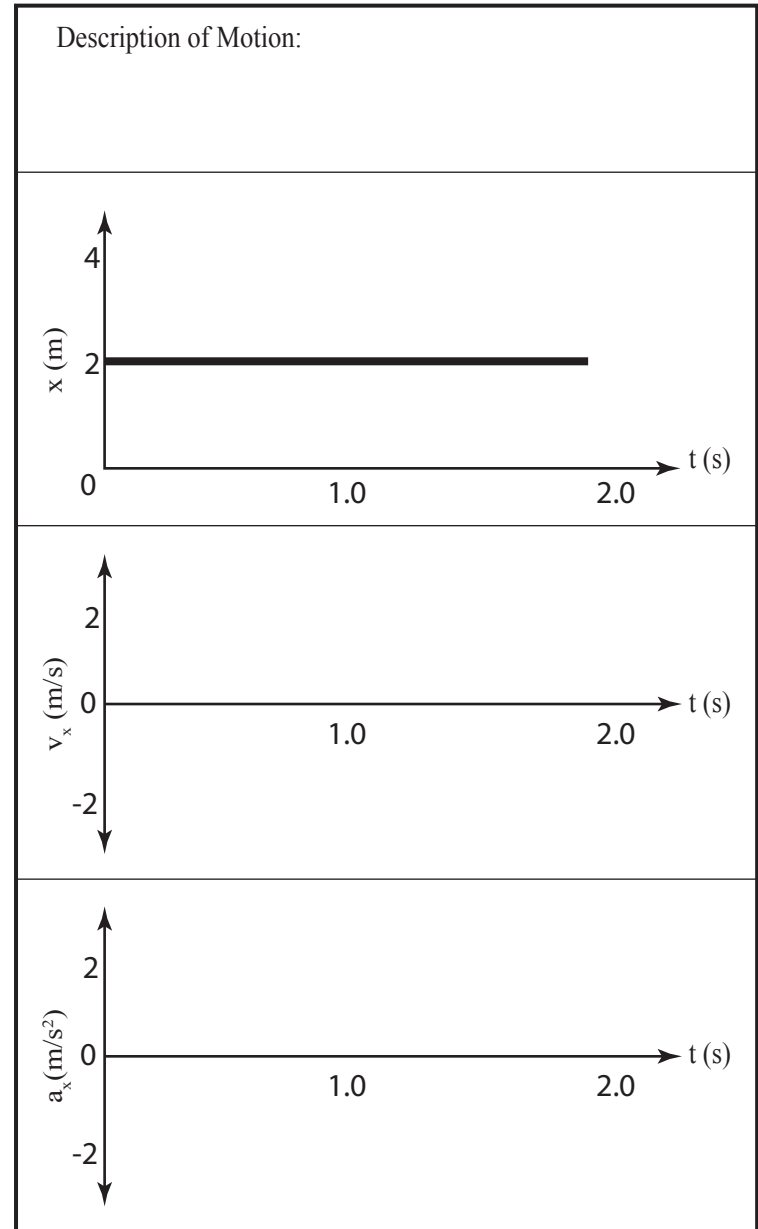
Exercises:
1. In each of the following problems, you will be given one of the following representations of an object moving:

      a. written description
      b. plot of - x vs. t
      c. plot of - v vs. t
      d. plot of - a vs. t

2. Discuss what you expect as a GROUP and agree on a prediction for the other three descriptions of the motion. Draw prediction graphs on a separate sheet of paper or on the PDF if you have that capability.

3. AFTER MAKING PREDICTIONS - use the VPython program to check your answers. Run the program by pressing F5 and enter the simulation data when prompted.

4. Write down the parameters from your simulations and correct your graph predictions if they were wrong. Discuss what was wrong with your predictions so that you improve your ability to predict the motion.

5. Check your predictions one-by-one and write notes about what you expected and how it differed from what you found.

6. Answer the corresponding Reflection Questions in the Quest system, remembering that you only get one chance so make sure the GROUP agrees before answering.

7. Ask for help from the TA and the LA's if you are not sure.

The problem below has been worked to as an example.
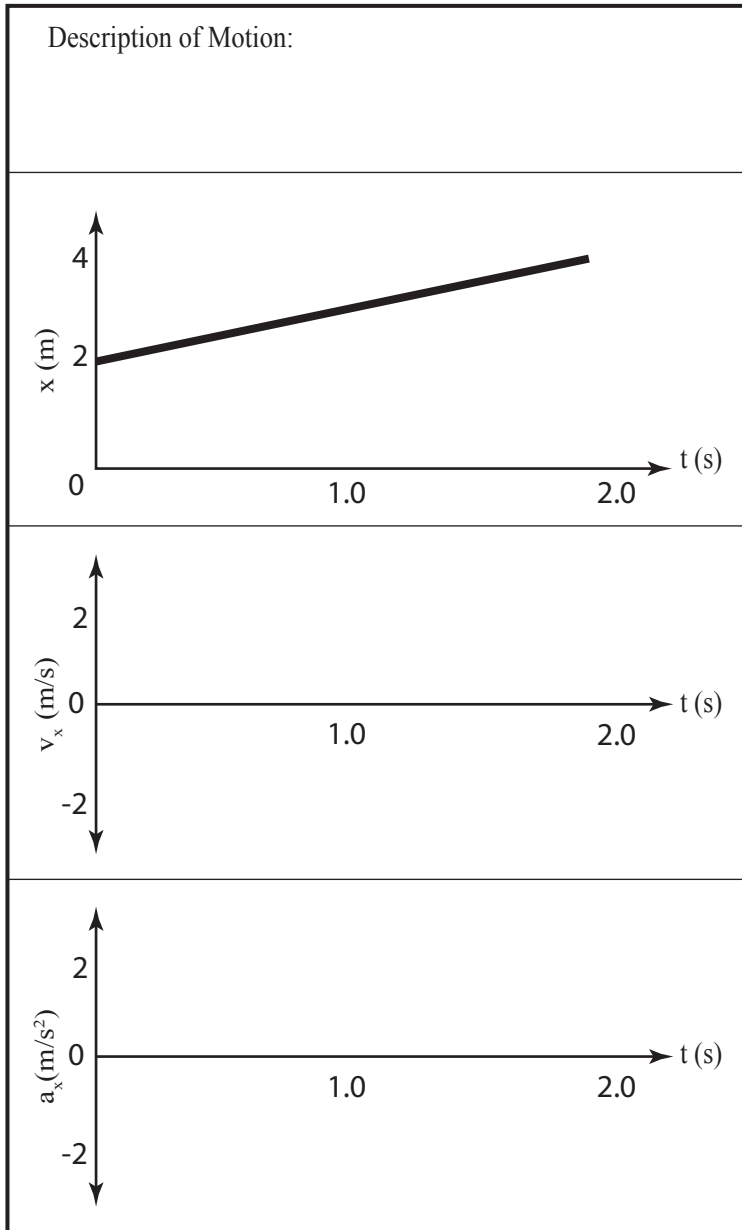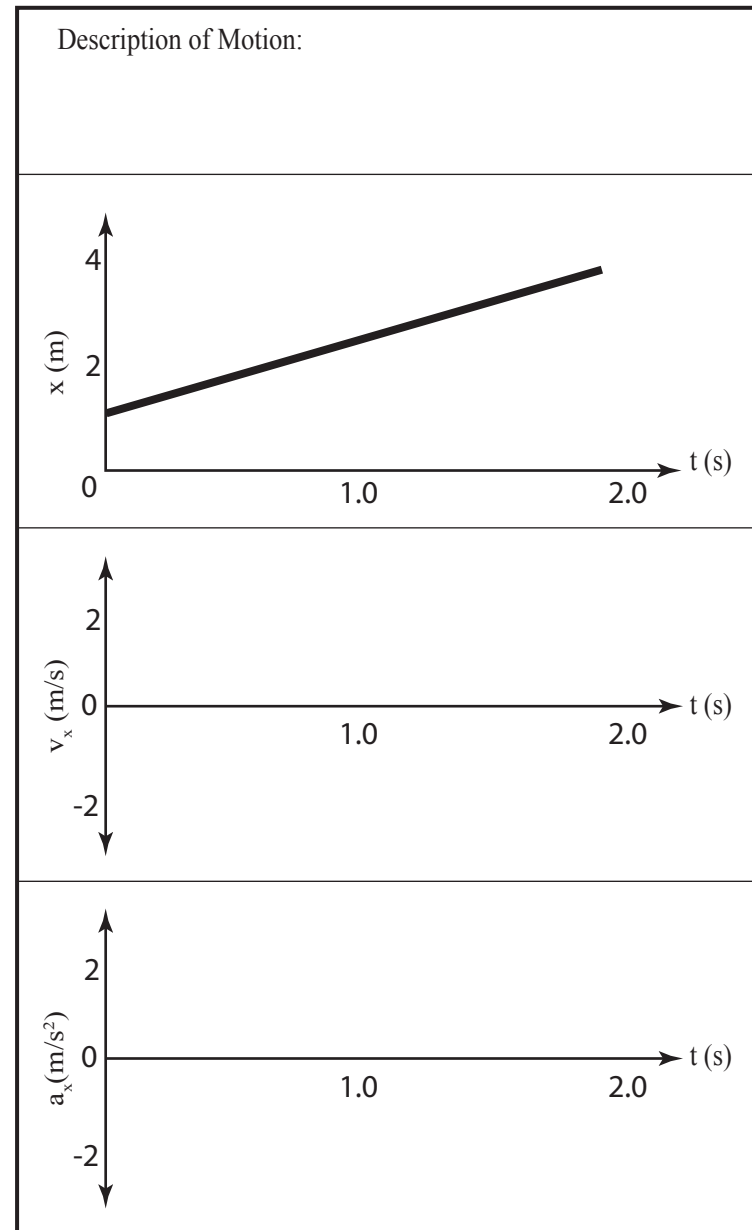Use the VPython program to verify the answers.

B.

Description of Motion: Cart moving in x-direction with constant speed.

Description of Motion:

A. Answer Reflection Problem 1

C.

Description of Motion:

x (m)

4

2

0   1.0   2.0   t (s)

v_x (m/s)

2

0   1.0   2.0   t (s)

-2

a_x (m/s²)

2

0   1.0   2.0   t (s)

-2

D.

Description of Motion:

x (m)

4

2

0   1.0   2.0   t (s)
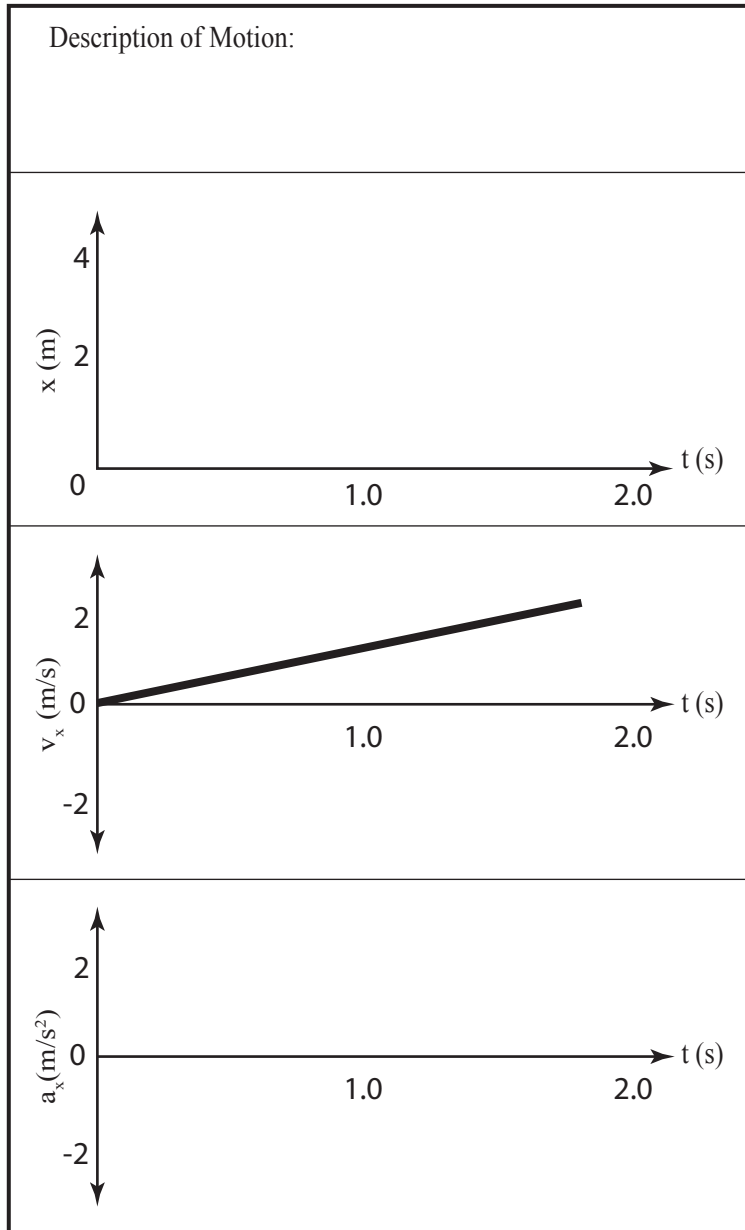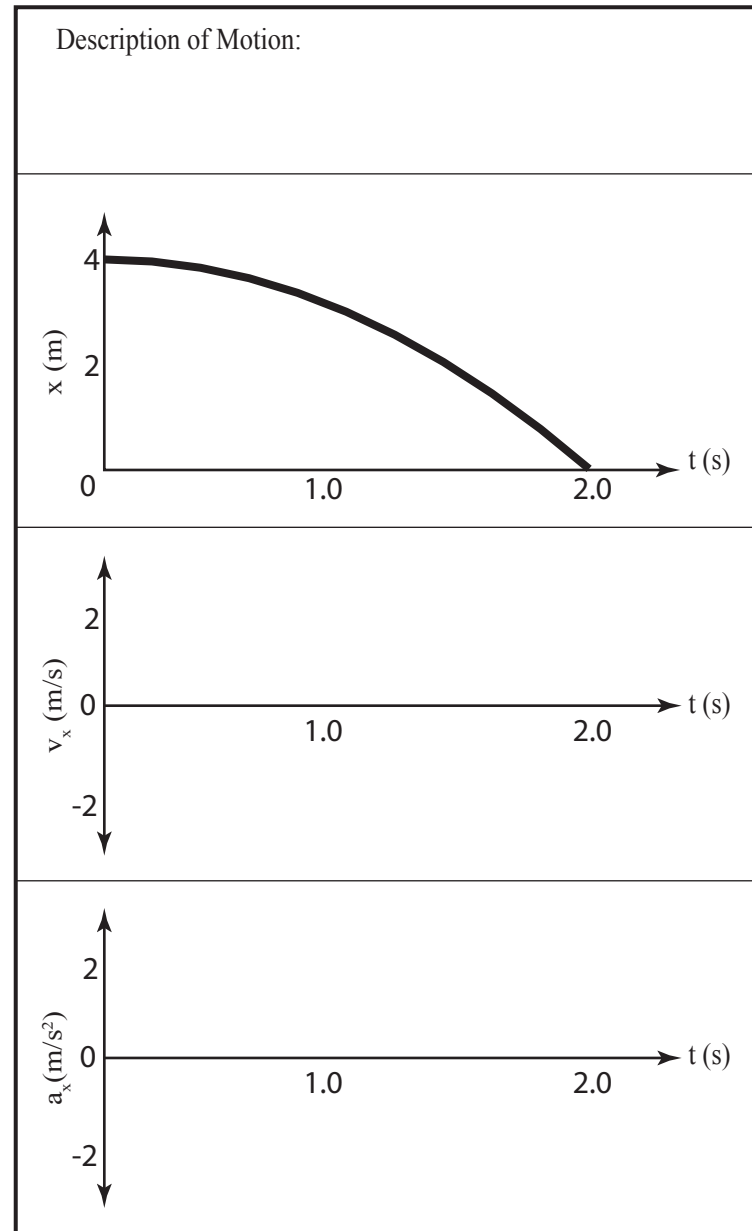
v_x (m/s)

2

0   1.0   2.0   t (s)

-2

a_x (m/s²)
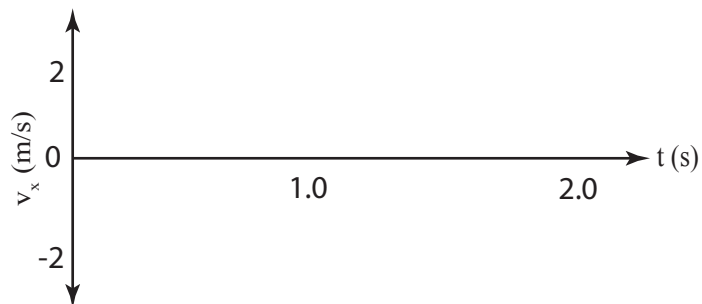
2

0   1.0   2.0   t (s)

-2

E. Answer Reflection Problems 2-4
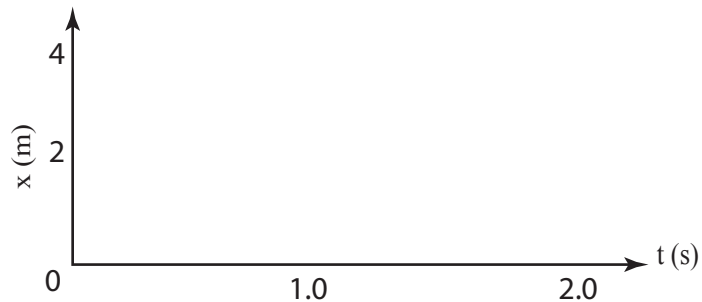
F.

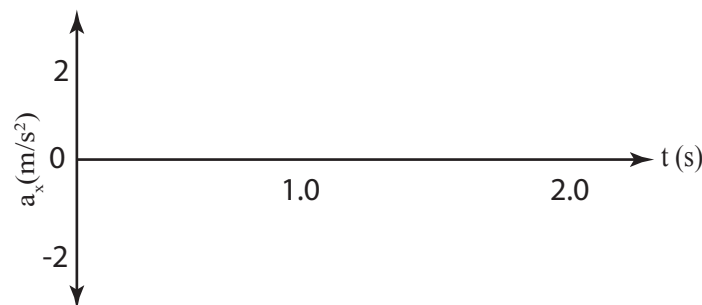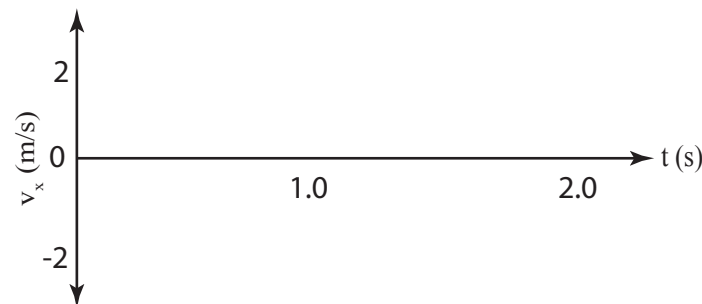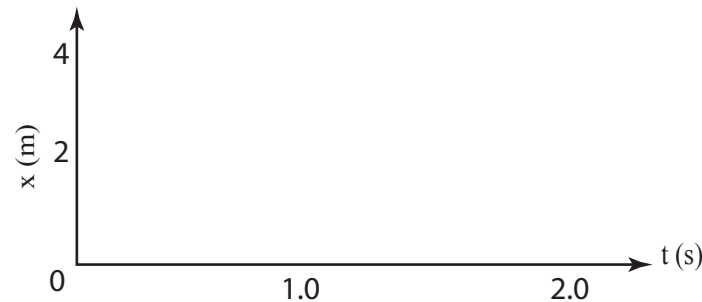Description of Motion:

G.

Description of Motion:

H.

Description of Motion: The cart moves toward the left end of the track with decreasing speed, then just as the cart comes torest, it moves away from the left end of the track with increasing speed.

x (m)

4

2

0   1.0   2.0   t (s)

v_x (m/s)

2

0   1.0   2.0   t (s)

-2

a_x (m/s²)

2

0   1.0   2.0   t (s)

-2
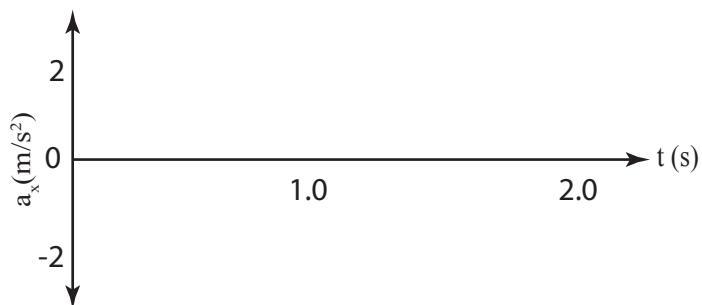
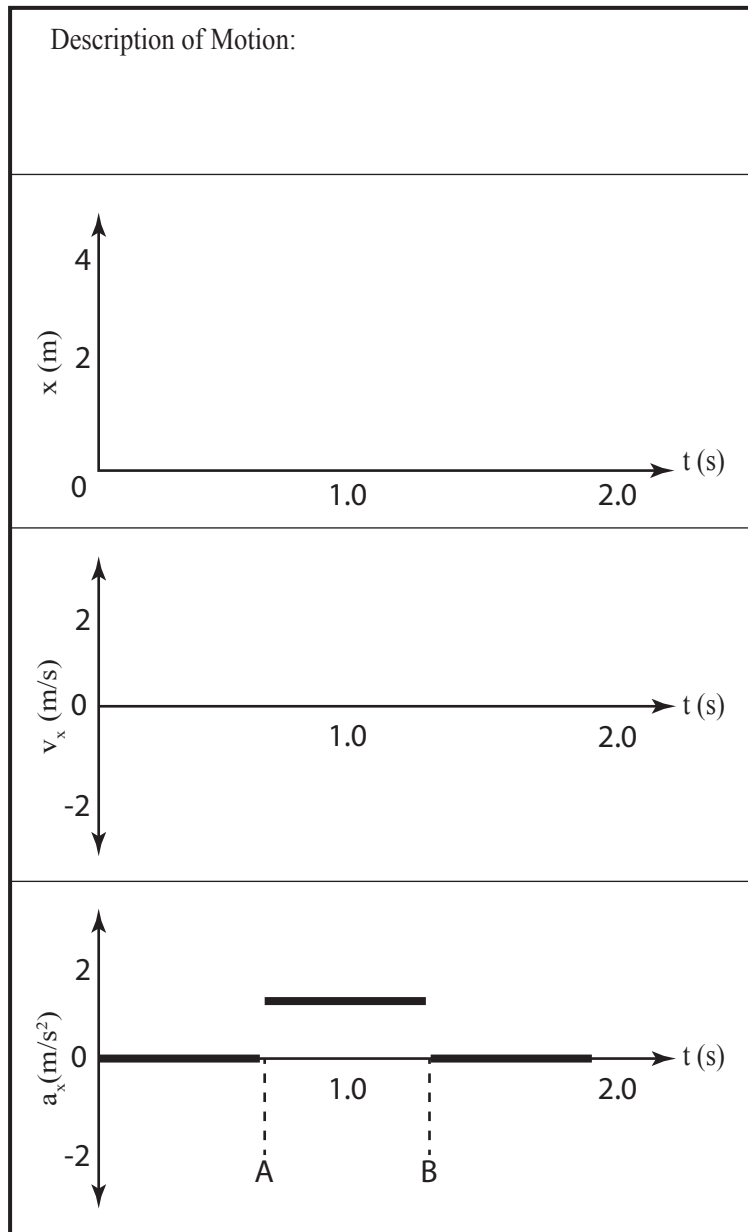**J.**

Description of Motion: Initially move away from the left edge of the track; maintain a constant negative acceleration.

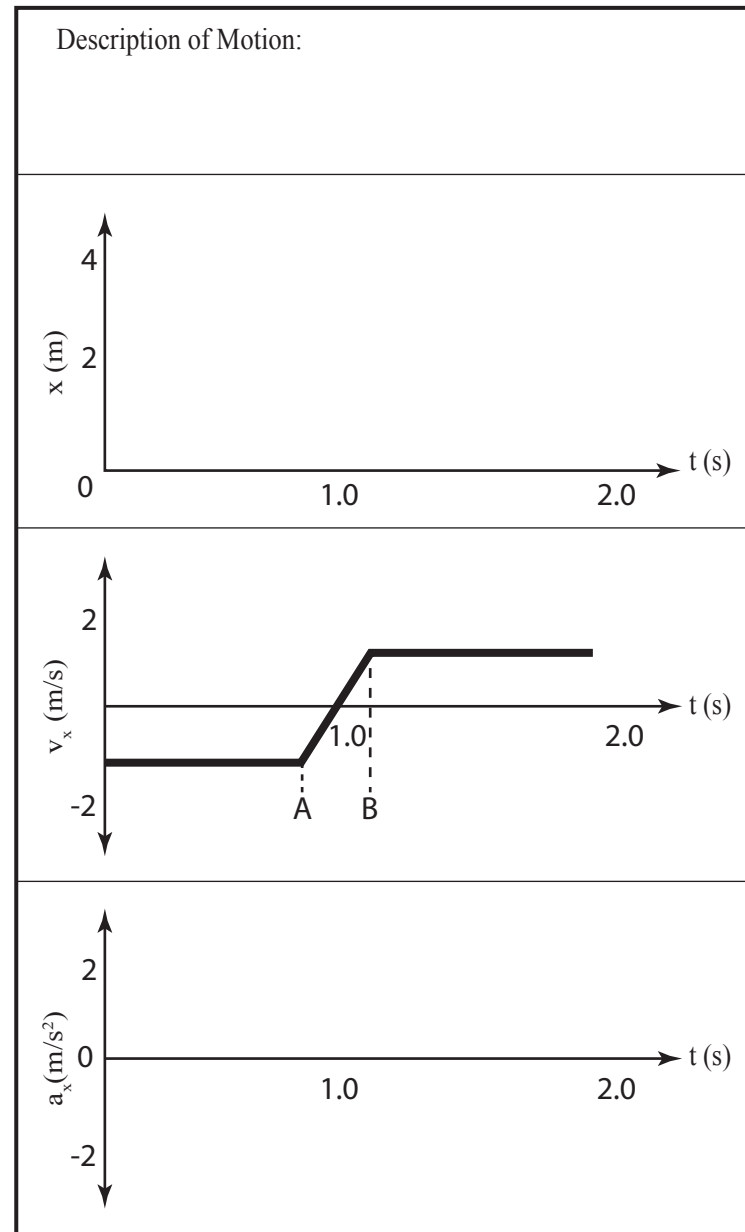x (m)

4

2

0   1.0   2.0   t (s)

v_x (m/s)

2

0   1.0   2.0   t (s)

-2

a_x (m/s²)

2

0   1.0   2.0   t (s)

-2

I. Answer Reflection Problems 5-6

K.

Description of Motion:

x (m)

4

2

0   1.0   2.0   t (s)

v_x (m/s)

2

0   1.0   2.0   t (s)

-2

a_x (m/s²)

2

0   1.0   2.0   t (s)

-2

A   B

L.

Description of Motion:

x (m)

4

2

0   1.0   2.0   t (s)

v_x (m/s)

2

0   1.0   2.0   t (s)

-2

A   B

a_x (m/s²)

2

0   1.0   2.0   t (s)

-2

M. Answer Reflection Problems 7-10