Phys1010 Homework 1 (26 points)

Due Tuesday 9/4 at start of class

1) (1 pt) In physics and many other fields, we often find ourselves working with either very large numbers or very small numbers. Expressing these very large or small numbers using scientific notation makes them much easier to work with. For example, the number 1,256,000,000 can be expressed using scientific notation as 1.256×10^9 (handwritten) or 1.256E9 (typed) where $\times 10^9$ and E9 means to multiply by (1,000,000,000) or 10^9, or move the decimal point 9 places to the right. We can express the number 0.00956 as 9.56×10^{-3} or 9.56E-3, where $\times 10^{-3}$ and E-3 indicates to multiply the number by 0.001, or equivalently to divide the number by 1000 or 10^3, or move the decimal place to the left by 3 digits.

Which of the following are alternative ways to express the number 18,000 ? **(Check all that are correct)**
a) 18×10^{-5} b) 1.8E4 c)18.0 E3 d) 1800E-7 e) 0.18×10^{-4} f) 0.18E-3

2) (1pt) What are the alternative ways of writing 9.65E4? **(Check all that are correct)**

a) 9650 b) 96500 c) 0.000965 d) 0.0965×10^{-2} e) 965E-2 f) 9650 E-4

3) (1 pt) your average walking speed is probably about 4 km/hr. What is this, expressed in m/s?

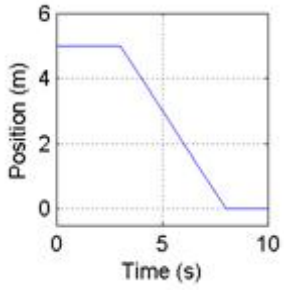
4) (1pt) Express the answer to 4km/hr in miles/day

5) (1 pt) For the next few questions, you will need to use the Moving Man Exploration available from the course website at http://www.colorado.edu/physics/phys1010. As you work through these problems **focus on making sense of the motion graphs and discuss your reasoning with your peers!** What is the graph really telling you about the motion? Graphs are used in science and many other areas (!) to record and convey a whole lot of information, just like a photo of the foothills conveys a whole lot of information about the area we live in. They provide a compact way to tell the whole **history** of an object's motion.

First, orient yourself to the Moving Man tool by going to the charts page. With the moving man starting at a position of -5 m, set him to "accelerate" at +1 m/s^2 from an initial velocity of 0. Observe the motion. Also notice that the tool comes equipped with a **playback** feature and a double-bar **cursor that you may move with the mouse** to probe position, velocity, and acceleration along the graph.
What is his velocity when he crosses the origin (the position of 0 meters)?

6) (1 pt) Below is a graph of motion. Use the Moving Man Applet to reproduce the shape of this graph.

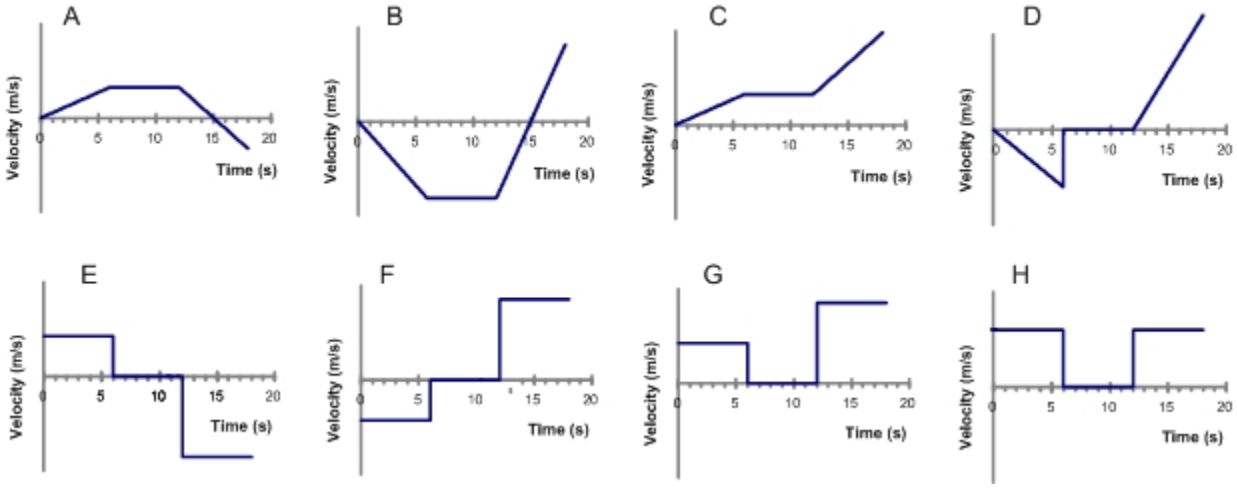
Provide a scenario that describes what motion this might be like, if this were plotting you in your car over time.



7) (1 pt) In class, we looked at how human motions could be represented on *position versus time* and *velocity versus time* graphs by using a motion detector to collect data. Use Moving Man to simulate the following scenario:

A man starts at the origin, walks towards the house (to the right) slowly and steadily for 6 seconds, then stands still for 6 seconds, and then turns around and walks towards the tree steadily about twice as fast for 6 seconds.

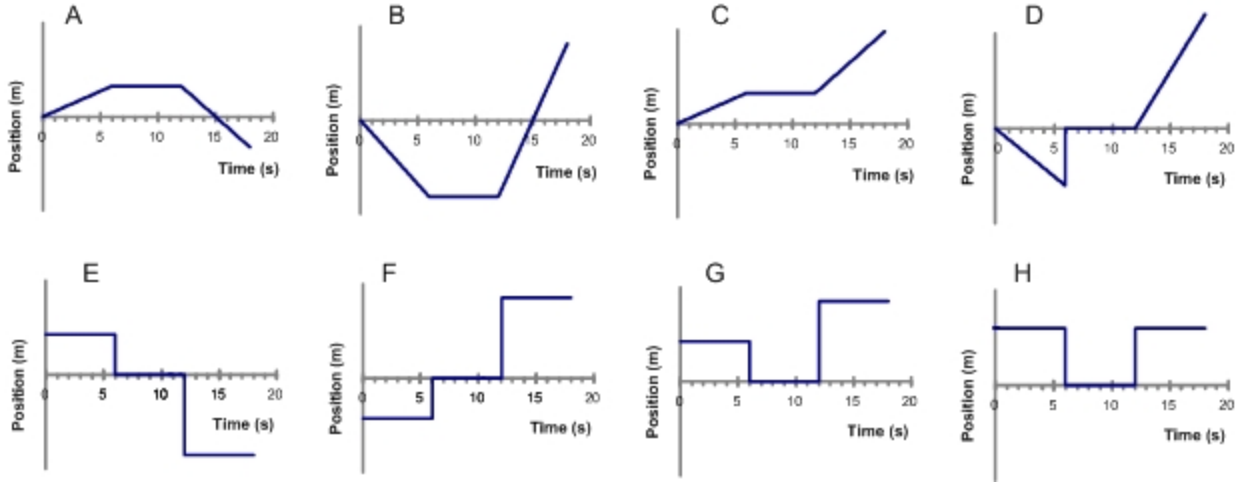
Which of the following *velocity versus time* graphs conveys this type of motion:



8 (1 pt) Use Moving Man to simulate the following scenario:

A man starts at the origin, walks towards the house slowly and steadily for 6 seconds, then stands still for 6 seconds, and then turns around and walks towards the tree steadily about twice as fast for 6 seconds.

Which of the following *position versus time* graphs also conveys this motion?



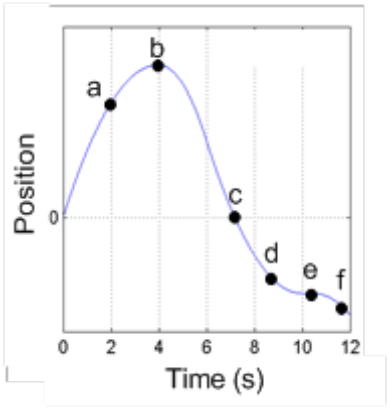
9) (1 pt) Play with the velocity and position settings for the moving man on the charts page (either change the numbers in the box or move the slider) and then answer the following question:

True or false: If the velocity is negative, the man is walking towards the tree under all conditions.

10) (1pt) True or false: If the velocity is positive, the man's position is always greater than zero.

11) (1 pt) The motion of a walking man is recorded on the *position vs time* graph below. Use the Moving Man Applet in the "Walk" mode to reproduce this *position vs time* graph by adjusting the velocity slider as the man is walking.

What does point b represent in terms of velocity and motion?

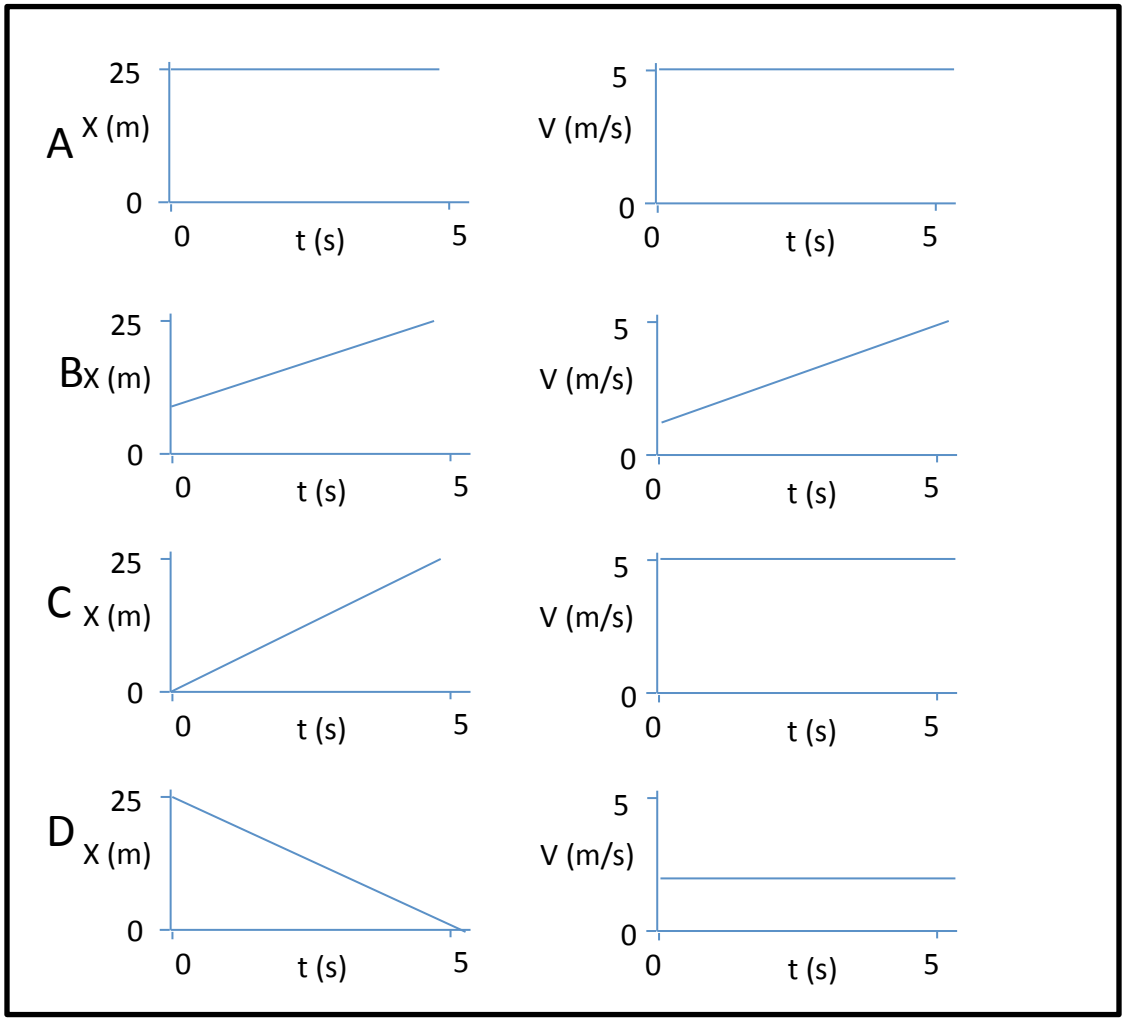


12) (1 pt) At which point(s) is the velocity greater (note speed and sign!) than at point (b)?

13) (1 pt) At which point has the person shown the greatest displacement from the origin?

14) (1 pt) At which point has the person traveled the longest distance overall?

15) (1 pt) Which of the following appropriately show position vs. time graphs that match the velocity vs. time graphs?

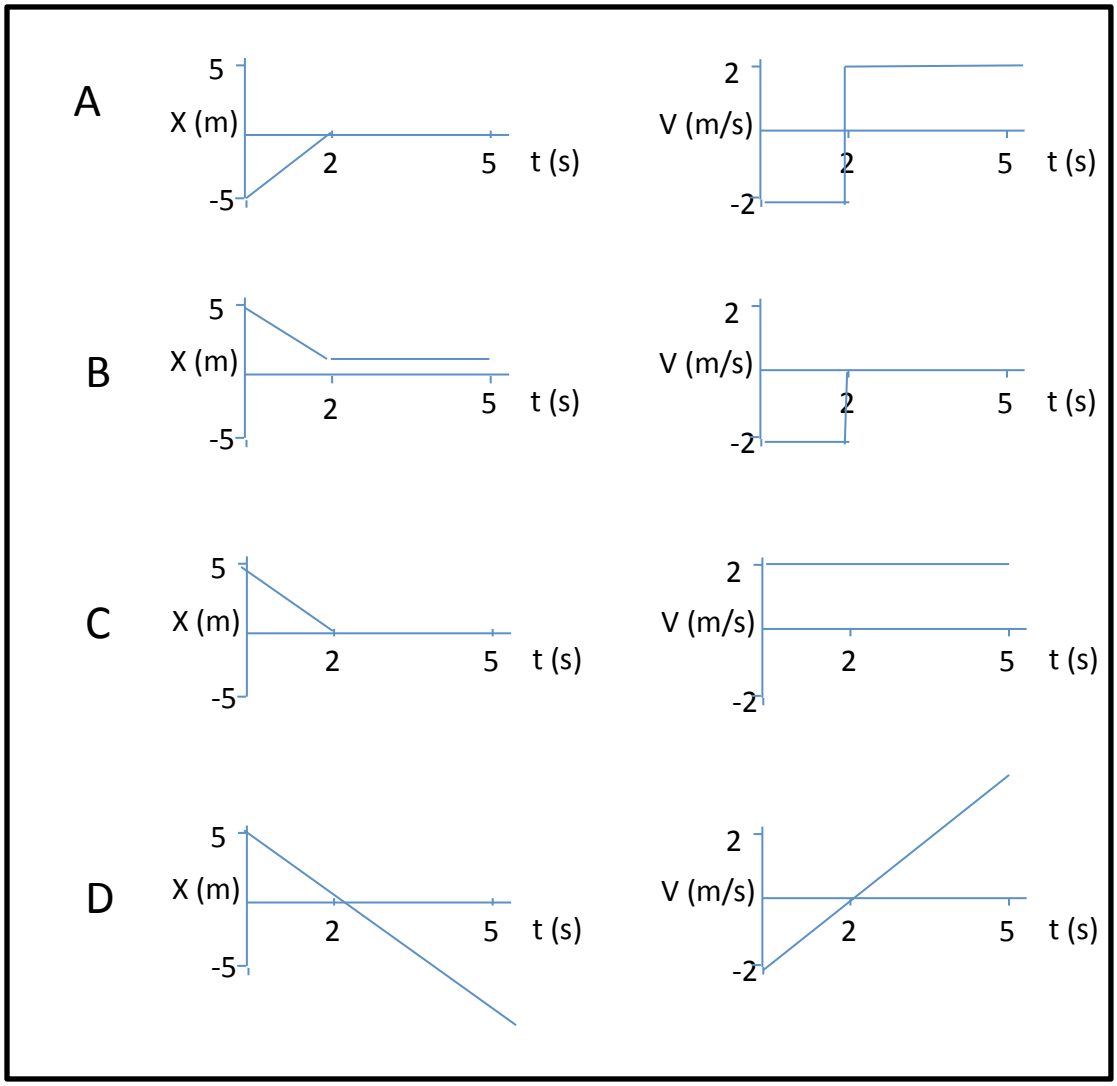


16) (1 pt) What is a real world scenario that describes this?

17) (1 pt) Pick one of the incorrect answers: why can this clearly not work?

18) (1pt) Which pair of position and velocity graphs best matches the following situation:

A person starts from position of +5m and walks at a steady speed of 2m/s in the negative direction. At t = 2s he stops, and he stands still from then on.



19) (1pt) Calculate the position of the man (relative to origin) at t = 4s in Question **15**. (remember to show working and units)

20) (1pt) Calculate the position of the man relative to origin at t= 5s in Question **18**. (remember to show working and units)

21) (1pt) A person starts from +12m at t = 0s and runs at 4m/s in the negative direction.

At what time will she pass the origin?

22) (1 pt) At what time will she pass -15m?

23) (2 pts) What experiences in your life do you have where understanding position and velocity are essential?

24) (1 pt) What are you most looking forward to learning in this class?

25) (1 pt) What part of the class counts the most for your grade:

a) inclass participation

b) homework

c) midterms

d) final