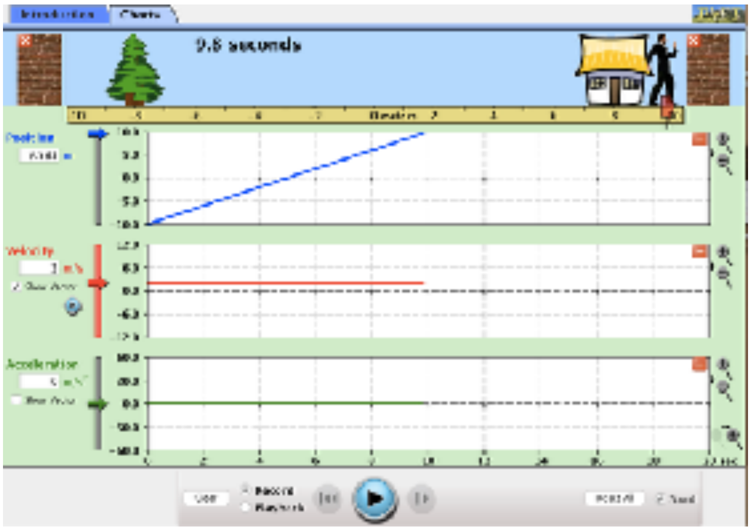
Motion Graphs

In this activity students will be exploring motion graphs with the “Moving Man” PhET simulation.

Open the simulation by clicking on the link:

https://phet.colorado.edu/en/simulation/legacy/moving-man

Take a look at the explanatory video via YouTube:
https://youtu.be/Hlua6ybbpVM



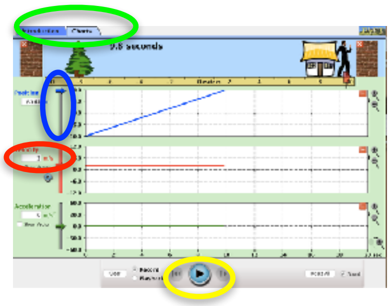
Learning Objectives

By the end of these activities it is hoped that students will have an acquired the following skills:

- Following explicit instructions to gain acquired knowledge
- Explore how changing various variables affect the graphs of distance; displacement; velocity and acceleration.
- Using gradient calculations to determine velocity and acceleration.
- Using area to calculate distance from a a velocity v time graph.

Author: Simon Lees 2017

1. Comparing displacement and constant velocity.



- Click on the **CHARTS** tab at the top of the screen, green circle.
- Move the man by dragging him to the far **LEFT**. You will notice that the blue arrow, blue circle, moves down.
- In the velocity box, red circle, type **2**.
- Press **PLAY**, yellow circle, and allow the programme to run until the man gets to the end of the track and then **STOP** the animation.
- Take a screenshot of the graphs and place it in the space below.

Screenshot of the graph

- What is the total distance travelled?

- If 0m is home what is the man’s displacement?

- What can be said about the man’s velocity and how do you know?

- How does this compare to the blue distance vs time line?

- If the velocity is constant what do you notice about the acceleration line, green line?

- Use the blue distance v time line and calculate the gradient by dividing the RISE ÷ RUN. (*Note: the time of the journey is shown in the top blue area)*

- What does this number relate to?

- Produce a generic equation from the graph that combine velocity distance and time.

- **CLEAR** and **RESET ALL**
- Now do exactly the same thing but move the man to the other end, the **RIGHT** side.
- Place **-2** in the velocity box.
- Press **PLAY**.
- Screen shot the screen

Screenshot of the graphs

- What do you notice about these graphs compared to the first set?

- Use the blue distance v time line and calculate the gradient by dividing the RISE ÷ RUN. (*Note: the time of the journey is shown in the top blue area as the line is going down the distance must be negative)*

- What then do you think the negative on -2 tells us?

2. What is the relationship when acceleration is not 0?

- Move the man to the **LEFT** by pulling the blue arrow to the bottom, blue circle.
- In the box of acceleration, green circle, type in 1 for 1m/s/s.
- Press **PLAY** and **STOP** before the mane hits the wall.
- Take a screenshot and place in the area below.

Screenshot of the graph

- What is the total distance travelled?

- Compare and contrast the three curves.

- Use the red velocity v time line and calculate the gradient by dividing the RISE ÷ RUN. (*Note: the time of the journey is shown in the top blue area as the line is going down the distance must be negative)*

This is virtually the same as the acceleration.

- Calculate the area under the velocity v time graph

- What does the area under the velocity v time graph represent?

- **CLEAR** and **RESET ALL**
- Now do exactly the same thing but move the man to the other end, the **RIGHT** side.
- Place **-2** in the acceleration box.
- Press **PLAY**.
- Screen shot the screen and place in the space provided.

Screenshot of the graphs

• What do you notice about these graphs compared to the first set?

• Pull the red arrow to the base of the velocity line to determine the maximum velocity reached. Use the time then to determine the distance by calculating the area.

SUMMARY

- Complete the table below to summarise what you have found.

SUMMARY	GRAPH		
	Dist v Time	Vel v Time	Acc v Time
Constant Velocity			
Constant Acceleration			
Area under the curve			

- If the value of either the displacement, velocity or acceleration is negative what does this mean?