(ENG) Designing the movement

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction

#Online activity #In-class activity #Inquiry-based learning #Experiential learning #Simulation

Modern mathematical notation is a highly compact way to encode ideas. Equations can easily contain information equivalent to several sentences.

Describing an object moving with constant speed requires one definition, four axioms, and six theorems. All of these relationships can now be written in a single equation. Equations are great for describing idealized situations, but they don't always cut it. Sometimes you need a picture to show what's going on- a

mathematical picture called a graph. Graphs are often the best way to convey descriptions of real world events in a compact form. Graphs of motion come in several types depending on which of the kinematic quantities (time, position, velocity, acceleration) are assigned to which axis. Drowning the basic graphs of steady accelerated movement (velocity-time, position time) using

Free online software

Graph paper and colored pencils

Learning Objectives

- [ ] drive and recall the kinematic equations
- [ ] use the kinematic equations to calculate the acceleration of an object, analytically, and graphically
- [ ] address real-world problems using the kinematic equations

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Graph design
Role playing

Link to local, national School Curriculum

Accelerated motion and Newton's second law/Steady accelerated movement

Equipment required

- Graph paper
- colouring pencils
- PC

Duration of activity

45 minutes

Sources

- https://phet.colorado.edu/sims/cheerpj/moving-man/latest/moving-man.html?simulation=moving-man
- http://drainmag.com/diagrams-art-as-information/

Step 1 - Motivational Stage

Ask one of your pupils to step up. Place an object (e.g. a chair) to represent the starting point (zero) of the position axis. Ask him/her to walk in any direction, and change his/her velocity during the movement.

Then ask your class to describe the movement of the pupil. One possible solution is using the equations of movement.

Another is by depicting the movement using graphs. Although graphs are simple depictions, advise your pupils on what elements they should pay special attention to make their graphs user friendly and attractive, so that the reader will take all the necessary information.

Step 2 - Investigational Stage

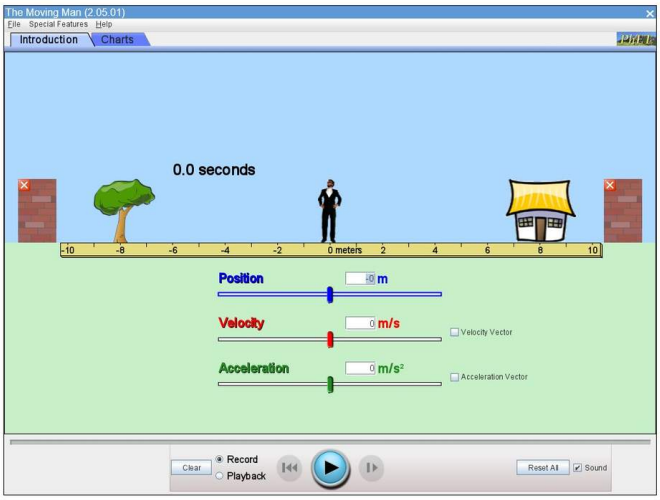
STUDENTS' TASKS

1

Task 1

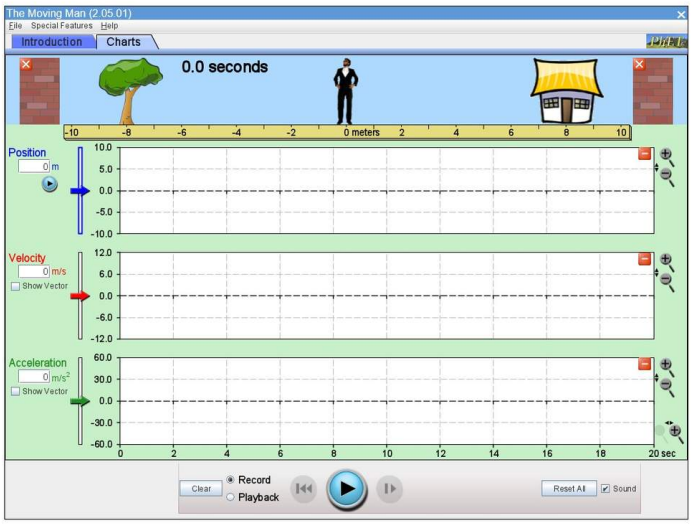
Ask your pupils to navigate to PhET Simulation: The Moving Man

Step 1



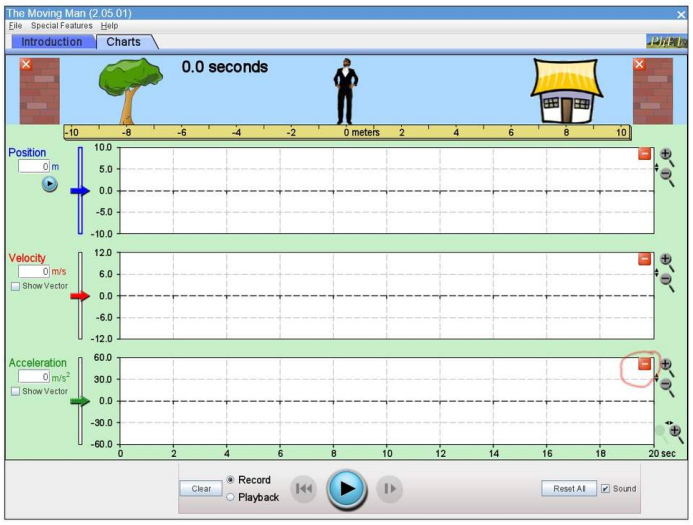
Ask your pupils to navigate to PhET Simulation: The Moving Man (https://phet.colorado.edu/sims/cheerpj/moving-man/latest/moving-man.html?simulation=moving-man)

Step 2



And click the tab Charts

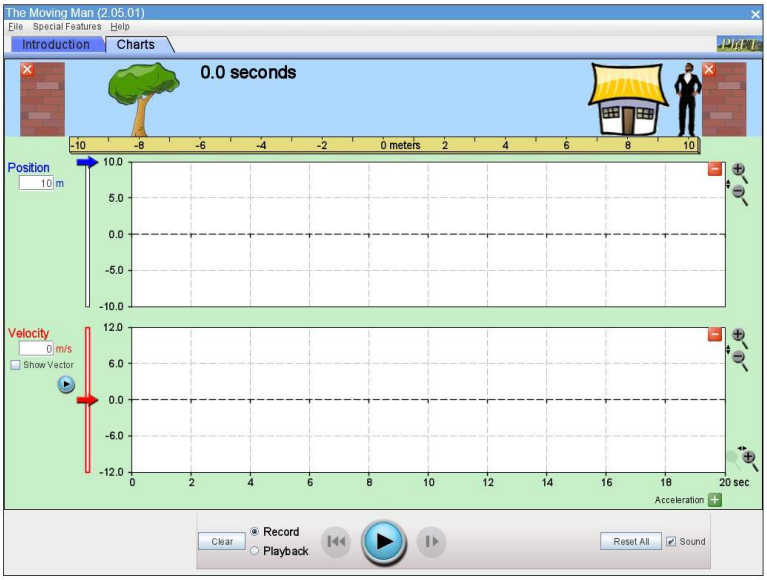
Step 3



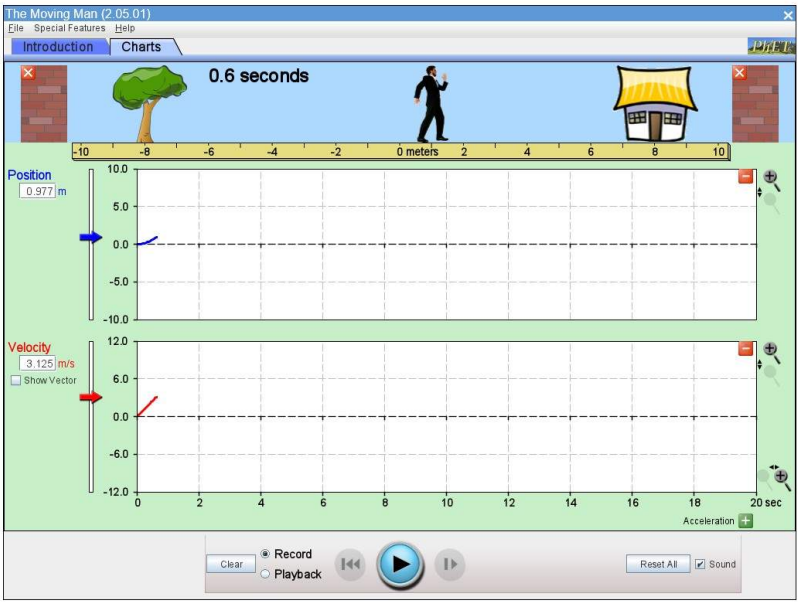
At this point you can also discuss the importance of setting a starting point for your metrics.

Every pupil should choose an acceleration value. Then press the button on the right upper corner of the acceleration graph to hide it and provide more space to the other two graphs.

Step 4

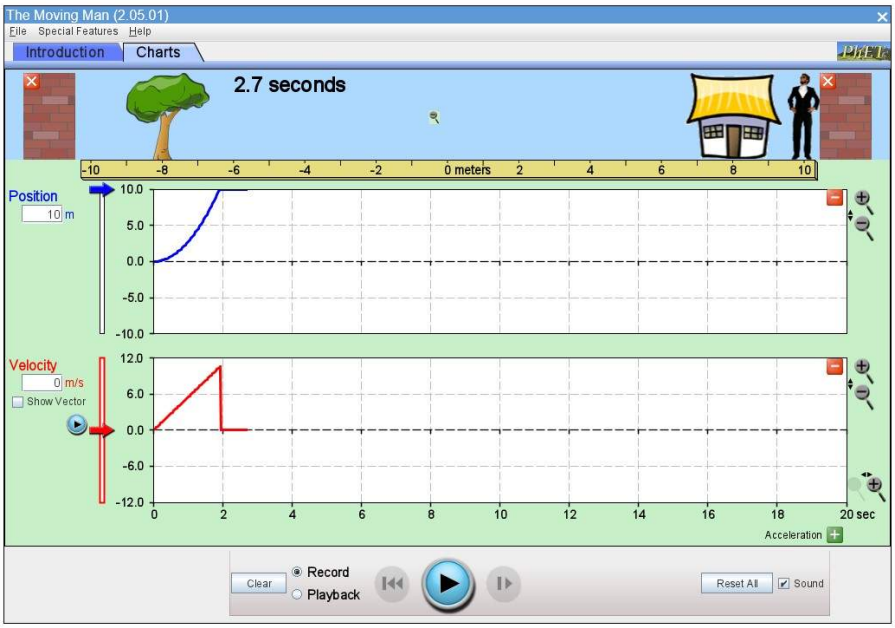

The Moving Man (2.05.01)
File Special Features Help
Introduction
Charts
0.0 seconds
-10 -8 -6 -4 -2 0 meters 2 4 6 8 10
Position
10 m
10.0 5.0 0.0 -5.0 -10.0
Velocity
0 m/s
Show Vector
12.0 6.0 0.0 -6.0 -12.0
0 2 4 6 8 10 12 14 16 18 20 sec
Acceleration
Clear
Record
Playback
Reset All
Sound

Step 5



Then your pupils can push the play button to start producing their graphs

Step 6



2

Task 2

Ask your pupils to peer view the graphs their schoolmates have produced. Allow them to describe the graphs in their own words, addressing the direction of the movement, the value of acceleration and any other feature they see relevant.

3

Task 3

Finally, provide two values of acceleration -it might be a good idea, one to be positive and one negative- and ask your pupil to draw the graphs on the graph paper with different colors and justify their choices.

Step 3 - Consolidation Stage

You can consider the argumentation of pupils on the graphs they have drawn by hand. Even if they do not use the motion equations, but qualitative arguments, the shape of graphs is the most important factor to consider.

Students output can mix contemporary art with graph, as it is mentioned on this source (http://drainmag.com/diagrams-art-as-information/)

Students can appreciate the artistic aspect of their diagram, compare the one produced by the application, changing the default values and try to produce as interesting graphs as they can, to the ones they draw by

themselves.

End of the activity

EXIT