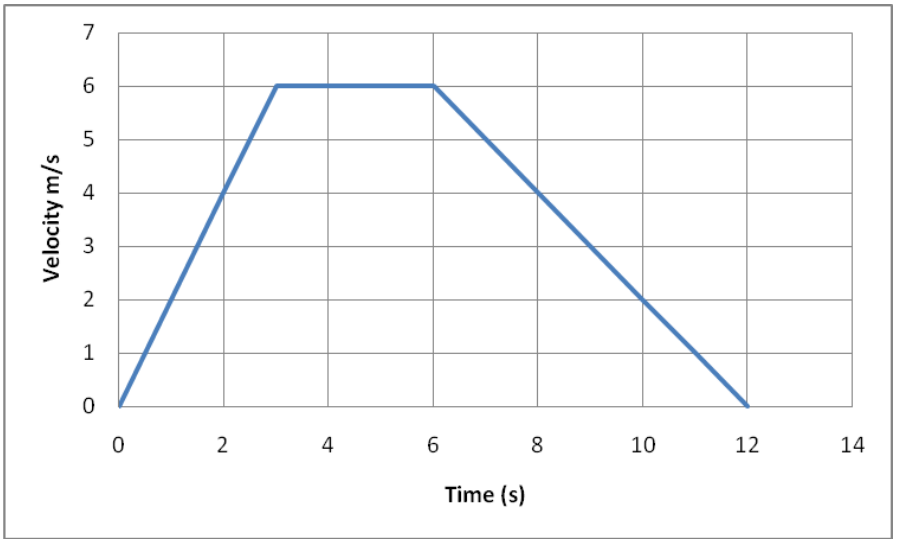
Our Dynamic Universe

Motion Graphs: Velocity time graphs

1) The graph below shows the motion data captured from a robotic rover on the surface of Mars.



a) Calculate the value of accelerations over the 12 second journey.

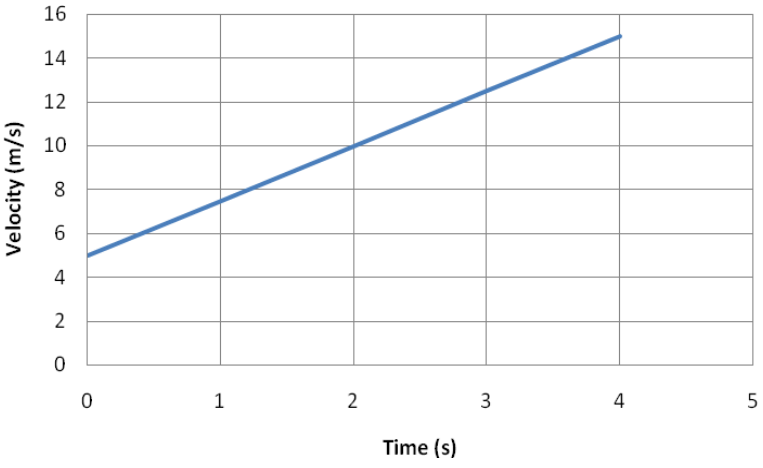
b) Sketch an acceleration time graph of the journey

c) Determine the total displacement of the robot's journey.

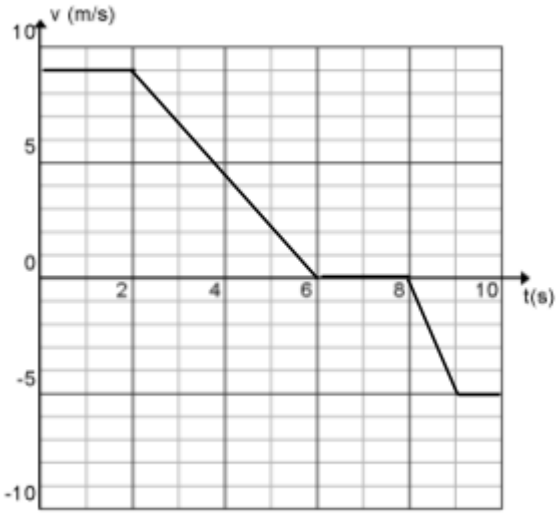
2) An engineer collects data on the velocity of a rocket which is fired from rest. The velocity time graph is shown below.

a) Calculate the acceleration of the test rocket during the first 4 seconds.

b) Determine how far the rocket travelled during the first 4 seconds.



3) A test vehicle`s velocity time graph is shown below.



a) Determine the accelerations during the 10 second data capture and sketch a graph of acceleration against time.

b) State what happens to the vehicle between 6 and 8 seconds.

c) Calculate the displacement of the vehicle from the moment the data capture started.

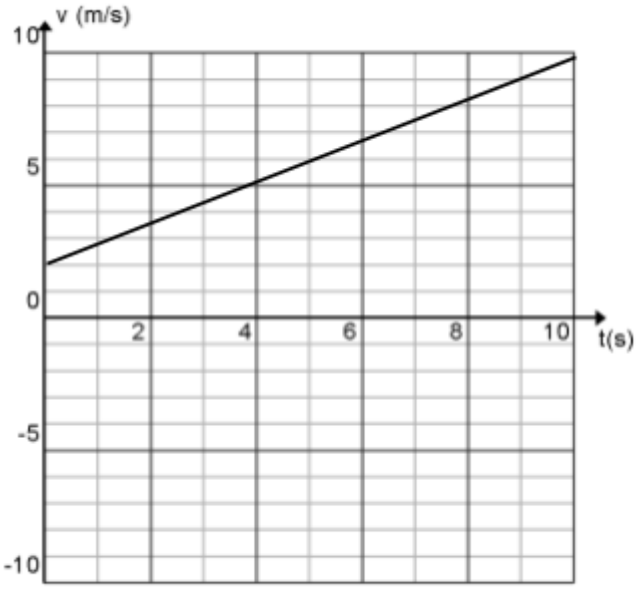
4) A test car has its velocity collected as it passes a reference point on a road. The graph of its velocity with time is shown below.

a) State the speed of the test car's velocity at the start of the data capture.

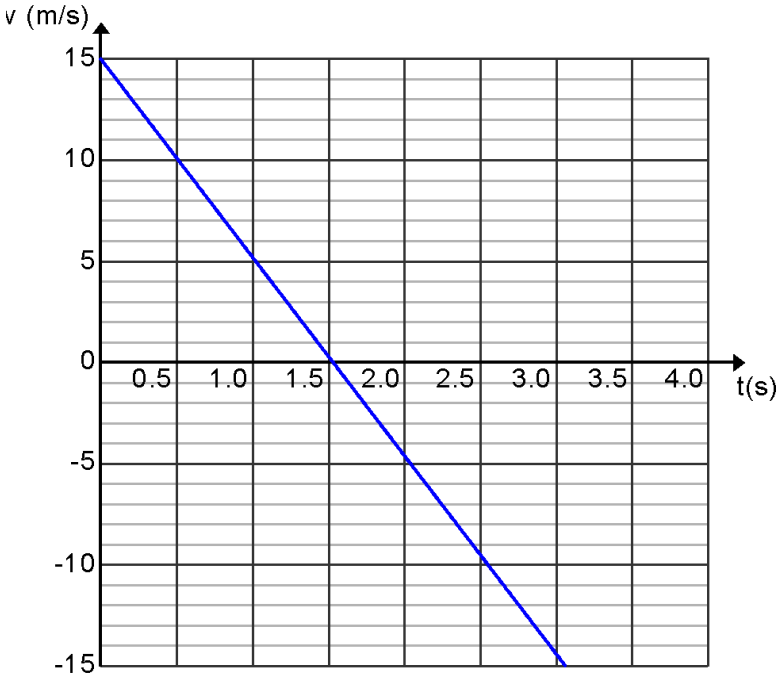
b) Determine the acceleration of the test car.

c) Find the displacement of the car 10 s after it passes the reference point.

d) Calculate the average speed of the test car.



5) The graph below shows the velocity of a ball which was thrown vertically into the air.



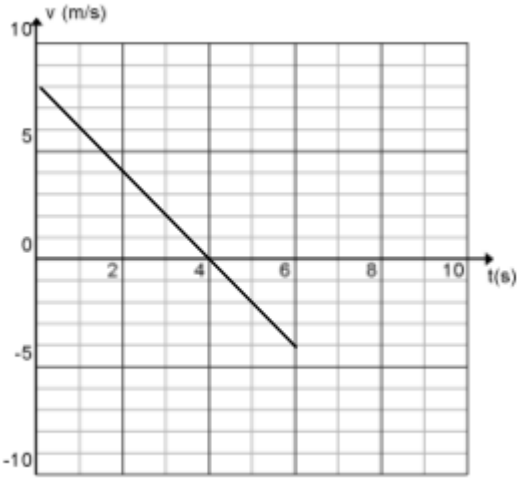
a) State the magnitude of the velocity of the ball as it leaves the thrower's hand.

b) State the time it took for the ball to reach its maximum height.

c) Determine the maximum height the ball reached.

d) Calculate the acceleration of the ball and sketch an acceleration time graph of its flight from the moment it was thrown into the air.

6) A small rocket is launched up an incline. On its way down it is stopped by the experimenter. The graph of its velocity against time is shown below.

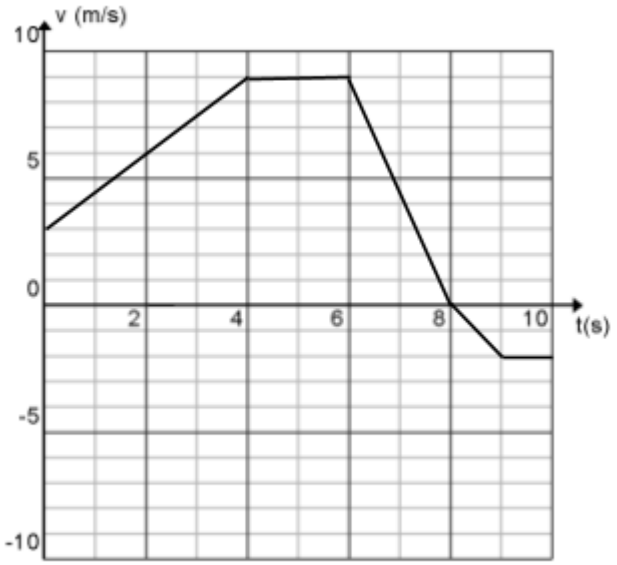


a) Determine how far up the slope the rocket travelled.

b) How far up the slope did the experimenter stop the rocket?

c) Sketch the acceleration time graph for the motion.

7) A test vehicle has its velocity data transmitted to a control room. The velocity time graph is shown below.



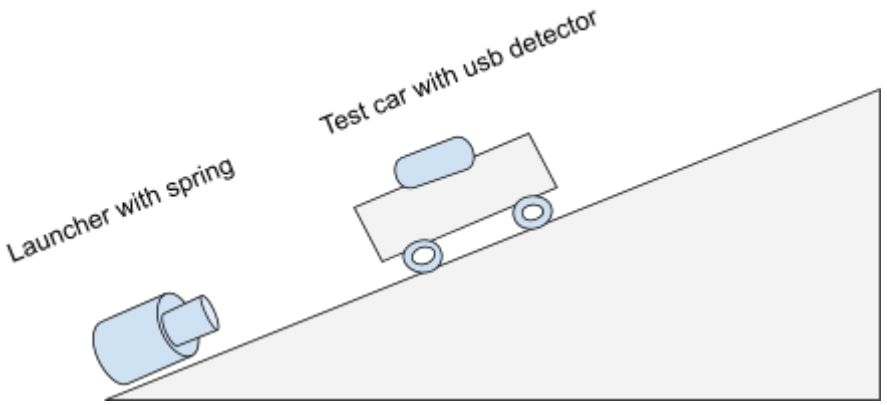
a) State the vehicle's velocity at the beginning of the data transmission.

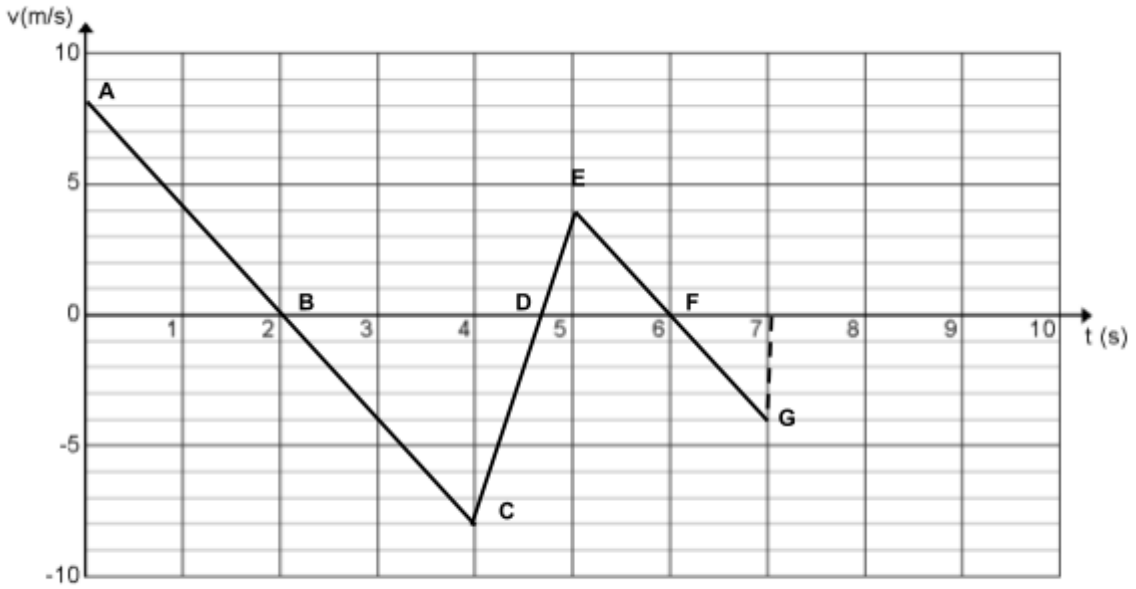
b) Determine the displacement of the vehicle from the start of the transmission til the sixth second.

c) State the time when the vehicle reversed direction.

d) Sketch an acceleration time graph for the complete journey.

8) A velocity time graph is obtained from a test car that is launched up a slope with velocity 8 ms^{-1} from a plunger. The velocity data is downloaded from an onboard usb stick.





The velocity time graph produced from the motion is shown below.

a) Match the letters on the graph to these statements.

   i) After the launch the test car reaches its maximum displacement up the slope.
   ii) The beginning of the bounce.
   iii) The test car reaches the maximum distance up the slope after the bounce.

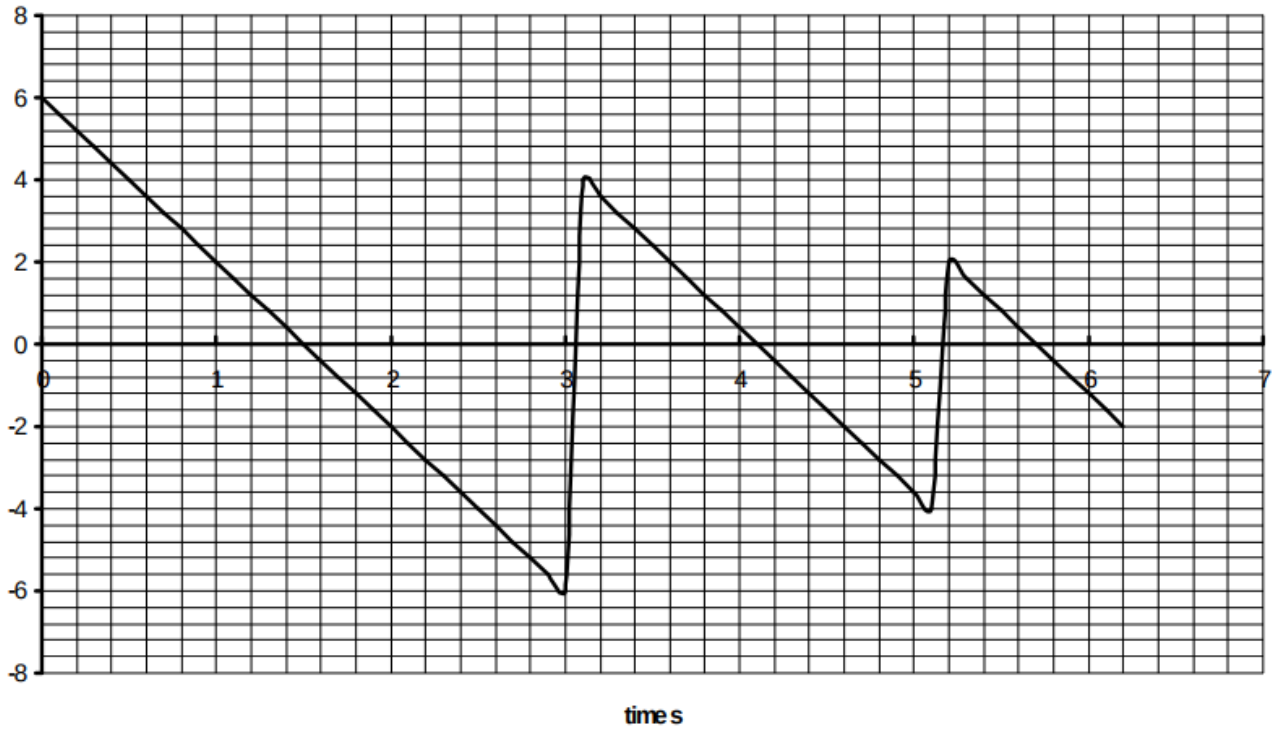
b) Determine the maximum displacement the test car travelled up the slope.

c) Calculate the acceleration of test car during the times:
   i) 0 to 2 seconds
   ii) 2 to 4 seconds
   iii) During the bounce.
   iv) 5 to 7 seconds

d) Sketch an acceleration time graph for the whole of the rest of the car`s journey.

e) The test car moves up the slope between parts A and B of the graph. What is the car doing during these parts of the graph:
   i) BC
   ii) CE
   iii) EF
   iv) FG

9) A motion sensor captures the velocity data from a vehicle which is launched up a slope and allowed to roll down then bounce back up.
The graph of the vehicle's velocity is shown below.



a) Determine the time when the vehicle reaches its maximum displacement up the slope.

b) Find the maximum distance the vehicle reaches up the slope.

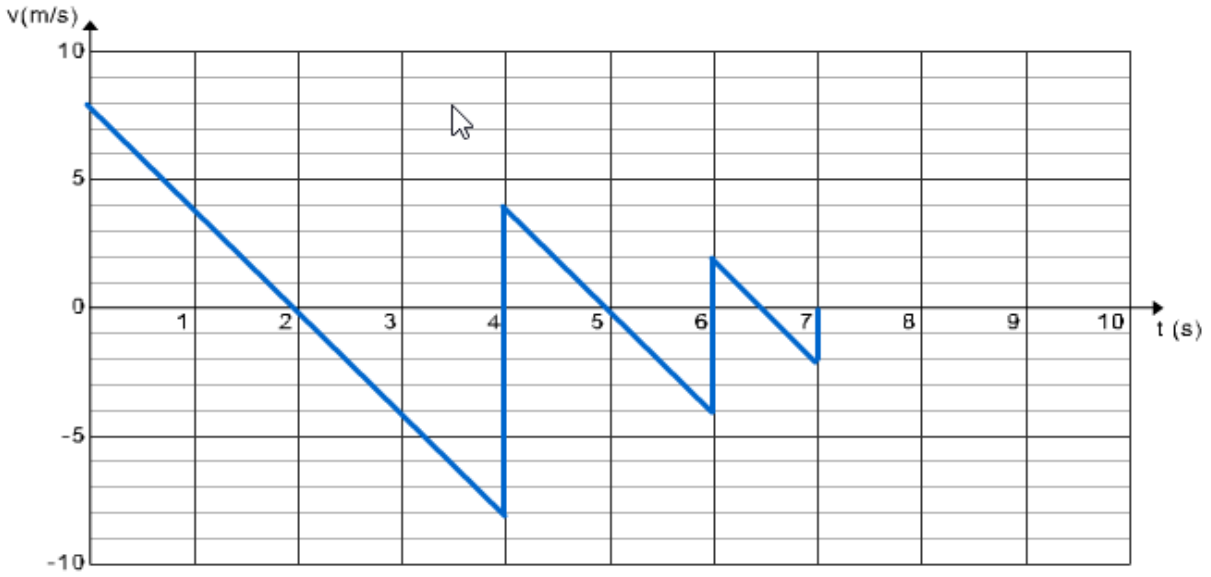
c) State the time when the first bounce occurred.

d) How many bounces occurred during the vehicle's journey?

e) Calculate the acceleration before the first bounce.

f) After each bounce the vehicle's velocity is reduced. Explain why this happens?

10) Here is a graph obtained from the motion of a small car that is pushed up a slope and allowed to run back.



a) What was the magnitude of the velocity that the car was launched up the slope?

b) Determine the maximum displacement of the toy car up the slope.

c) Determine the maximum displacement of the toy car up the slope after the first bounce.

d) Give a reason why this graph is unrealistic in representing the car`s bounce.

e) Find the acceleration of the car caused by the slope.