EdExcel Mechanics 1

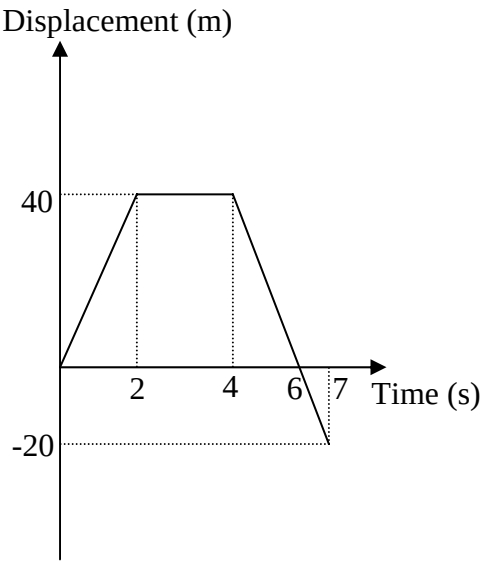
Kinematics of a particle

Section 2: Using graphs

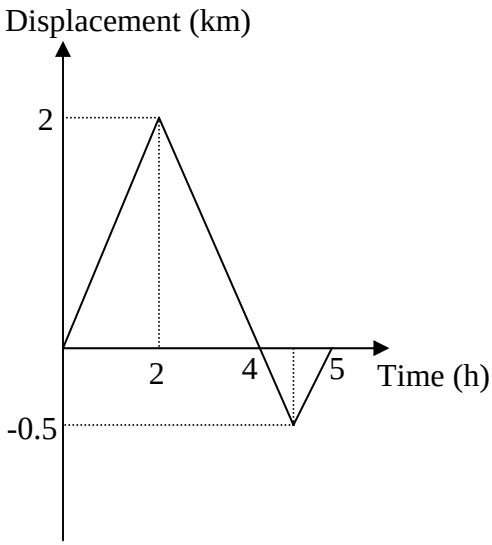
Exercise

1. For the following displacement-time graphs calculate the total overall displacement and the total distance travelled.

(i)

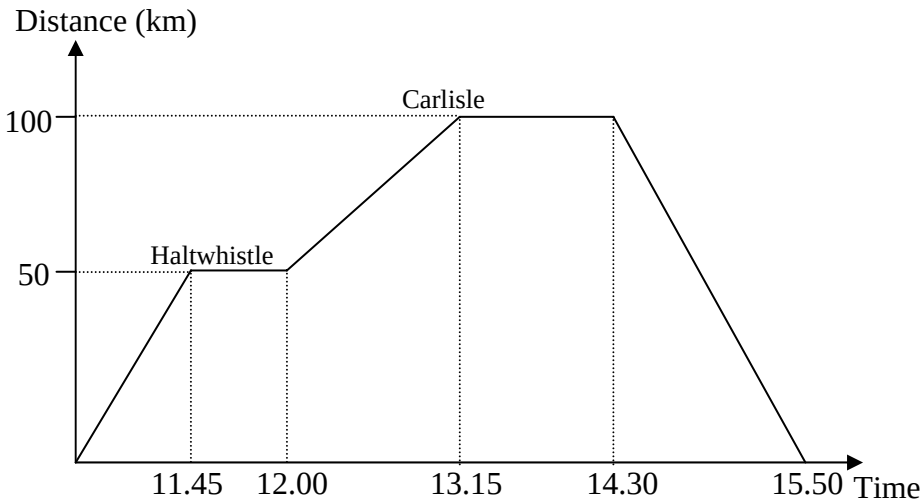


(ii)

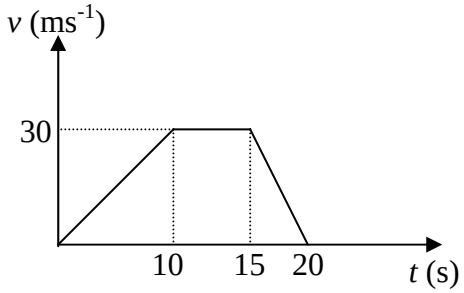


2. The distance time graph below describes a journey from Newcastle to Carlisle and back again. The journey started at 11 a.m.

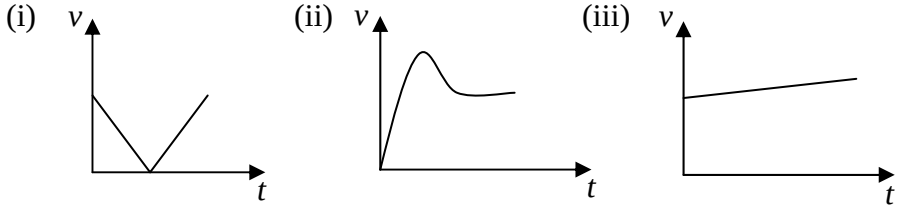
   a) How far is it from Haltwhistle to Carlisle?
   b) Find the average speed from Newcastle to Haltwhistle and from Carlisle to Newcastle.
   c) Find the average speed for the whole journey (including the stops).

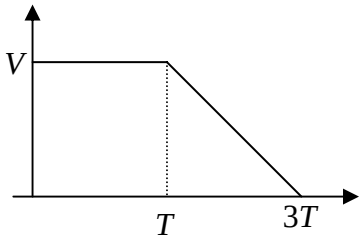


3. From the velocity-time graph below find
   a) The acceleration in the first 10 seconds,
   b) The deceleration in the last 5 seconds,
   c) The total distance travelled.



4. Decide which situation suits each of the 3 graphs below and sketch the speed-time graph for the situation that is not represented.
   a) an apple thrown vertically into the air
   b) a car moving in congested traffic
   c) a ball rolling along the lane in a bowling alley
   d) a parachutist after jumping from a stationary hot air balloon



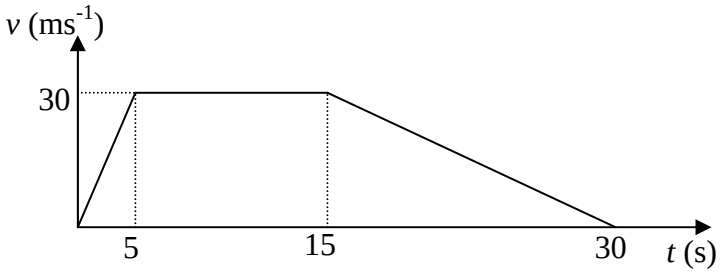
5. 

   For the graph above, the time for the whole journey is 45 seconds. The acceleration between T and $3T$ is -1.5ms^{-2}. Find
   a) the value of T,
   b) the value of V.

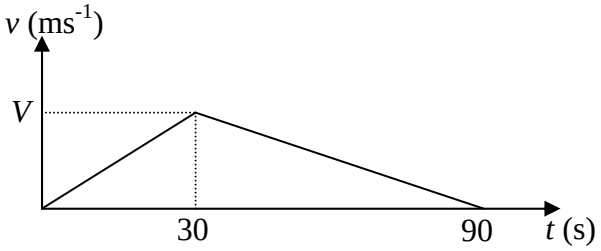
6. A, B, C, and D lie in a straight line. A particle starts from rest at A and moves from A to B with a uniform acceleration for 2 seconds reaching a speed of 12 ms^{-1}. The acceleration then halves and the particle takes 10 seconds to reach C. The particle then retards uniformly for a further 10 seconds before coming to rest at D.
   a) Draw a velocity-time graph for the motion.
   b) Find the acceleration from A to B and from B to C.
   c) Find the speed of the particle at C.
   d) Find the retardation from C to D.

7. A and B are two stations on a line. An express train passes through A at $t = 0$ and, maintains a constant speed of 120 kmh^{-1} for 45 minutes. In this time it covers $\frac{6}{7}$ of the distance from A to B. The train then retards uniformly to rest at B.
   a) Draw a velocity–time graph for the motion from A to B.
   b) Find the distance from A to B.
   c) Find the final retardation in ms^{-1}.

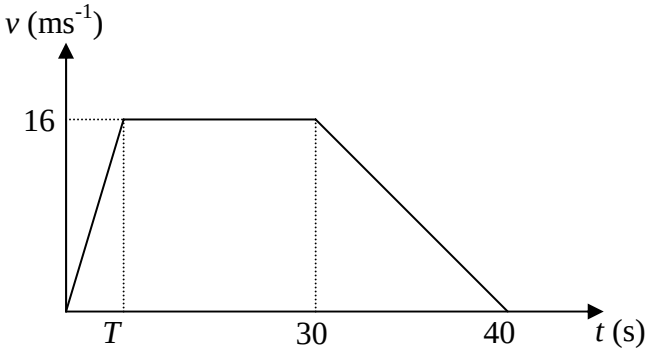
8. From the graph below find
   a) the distance travelled in the first 10 seconds,
   b) the acceleration when $t = 20$,
   c) the total distance travelled.



9. The total distance travelled during the motion shown in the velocity-time graph below is 900 m. Use this information and the graph to find V.



10. In the motion shown in the graph below, the initial acceleration is 2 ms^{-2}.



   a) Find T.
   b) Find the total distance travelled.
   c) Find the average speed for the whole journey.

11. A train takes 12 minutes to travel the 12 km between Parkway and Haymarket. It starts from rest at Parkway and accelerates uniformly to a speed of V kmh^{-1}. It then decelerates uniformly to come to rest at Haymarket. Draw a velocity–time graph to represent this motion and use this to find a value for V.

12. A train stops at both Newcastle and Durham, 30 km apart. Starting from Newcastle it takes 4 minutes to accelerate uniformly to 40 ms^{-1}, maintaining this speed until, with uniform deceleration over 1500 m, it comes to rest in Durham. Find the total time for the journey.