Chapter 1: Movement and Position

1 a Complete the table below with the correct corresponding quantities and units.

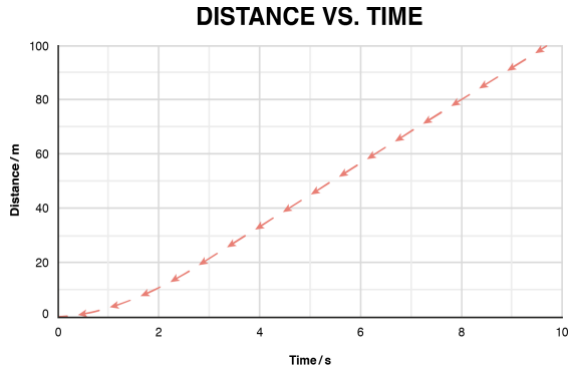
Quantity	**Units**
	m
displacement	
speed	
velocity	
	m/s^2

b List which of the quantities above are vectors.

2 Sarah and Maisie are analysing data from their school sports day. Looking at the 1500 m results for Stephen, Maisie believes that Stephen's displacement from the start line is 1500 m. Sarah says that she is incorrect and that his displacement from the start is actually 0 m. Which of the students is correct? Give reasoning for your answer.

3 Velocity is often described as a vector quantity. Speed is not. Describe the difference between a scalar and a vector quantity.

4 Usain Bolt has been credited as the fastest man in the world over 100 m. Below is a distance–time graph of one of his fastest training runs.



a Describe Usain's motion during the first 2 seconds.

b Using the graph above, calculate Usain Bolt's average speed for the race.

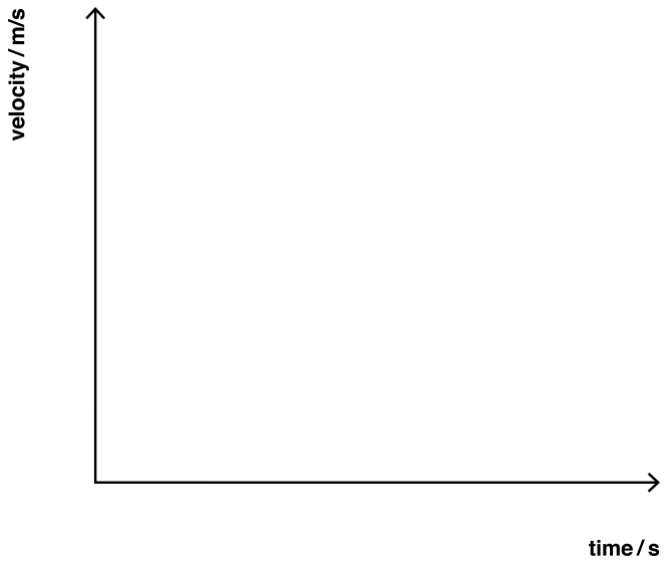
c Now calculate his maximum speed.

d Suggest one reason why these results differ?

5 Paul was asked to investigate the velocity of a ball as it rolled down a tilted ramp. He used a data logger at five equally spaced intervals along the ramp to record its velocity at particular points. The results he recorded are in the table below.

Data logger position	A	B	C	D	E
Velocity/m/s	0.9	2.9	6.0	9.8	14.8
Time/s	0.5	1	1.5	2.0	2.5

a Using the data, plot a velocity–time graph for Paul's results.



b Calculate the acceleration of the trolley down the ramp. Include the units in your answer.

c If data logger E is at the end of the ramp, calculate the length of the ramp Paul used.

6 McLaren racing engineers are testing a variety of new engines in their latest model F1 car. They are testing which engine has the greatest top speed from rest. The engines all accelerate on average at 14.5 m/s^2. The resulting distances are recorded in the table below.

Engine	Distance travelled/m	Final velocity/m/s
A	335	
B	302	
C	290	
D	321	

a Using the data in the table and the equation $v^2 = u^2 + 2as$ calculate the final velocities.

b One of the engineers noted that each engine's results were recorded only once. How could any errors in the recording of results be reduced?