

Average speed = distance / time $v_{ave} = d/t$

(v_{ave} = average velocity or average speed, **d = distance, t= time**)

speed in metres/second (m/s) or kilometres/hour (km/hr), distance in metres (m) or kilometres (km), time in seconds (s) or hours (hr).

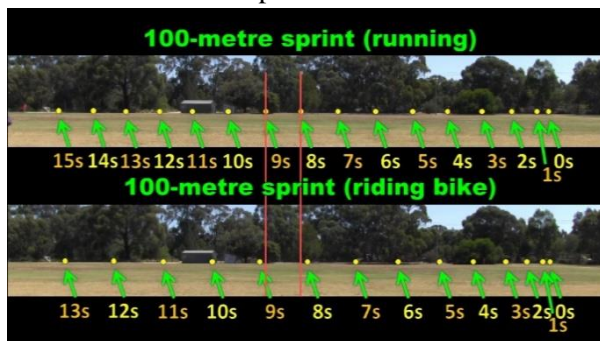
Part A

1. Explain why the study of forces and of motion is so important.

Part B

2. Calculate the average speed of
- (a) a car travelling 300 km in 4 hours:
 - (b) world-record holder Usain Bolt running his 100 m race in 9.58 s:
 - (c) world-record holder Wayde van Niekerk running his 400 m race in 43.03 s:
3. By converting the information below into consistent units, calculate the average speed (in m/s or km/hr) of
- (a) a cyclist travelling 200 km in 3 hrs 30 minutes.
 - (b) a car travelling 40 km in 30 minutes. (HINT: 30 minutes = _____ hours)
 - (c) a marathon runner running 42 km in 2 hours 10 minutes. (HINT: 10 minutes = _____ hours)

4. The dots below show the presenter’s position every second in two 100 m sprints (one running and one on a bike). Describe the way his speed changed in both sprints. Indicate the position of where the highest speed was reached in both sprints.



5. What is the difference between average speed and actual (also called “instantaneous”) speed?

Bike moving at 8 m/s	
Time (seconds)	Distance Travelled (metres)
0	0
1	
2	
3	
10	
20	

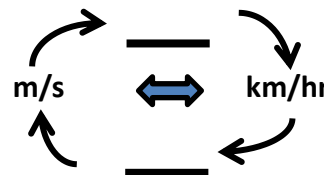
6. A bike is moving at a **speed of 8 m/s**. Fill in the table on the left.

7. A 20 km car trip takes half an hour. What is the car’s average speed in the trip and how might the car’s instantaneous speed have changed over the half hour?

8. Rearrange the $v_{ave} = d/t$ equation to make d the subject: distance, $d =$ _____
9. Rearrange the equation again to make t the subject. time, $t =$ _____
10. Calculate the **distance** you would travel if you moved at:
- 100 km/hr for 8 hours
 - 6 m/s for 2 seconds
 - 6 m/s for 2 minutes
 - 6 m/s for 2 hours
11. Calculate the **time** it would take:
- a car to travel 900 km at 100 km/hr.
 - a boat to travel 200 m at a speed of 20 m/s.
12. Calculate...
- The speed of a Melbourne Cup horse which runs the 3200 m horse race in 3 minutes and 16 seconds. (write down the appropriate equation and then perform the calculations)
Equation: _____
 - The time that it will take a truck to travel 60 km at 40 km/hr.
Equation: _____
 - The distance a helicopter will travel if it moves at a speed of 30 m/s for 20 seconds.
Equation: _____

Part C

13. Fill in the graphic on the right and then convert the following speeds from km/hr to m/s or vice versa:



- | | |
|---|--|
| <ol style="list-style-type: none"> 100 km/hr 20 m/s 60 km/hr | <ol style="list-style-type: none"> 10 m/s 330 m/s (the speed of sound in 0°C air) 263 km/hr (the fastest ever tennis serve) |
|---|--|

14. What are some of the things you should and shouldn't do while driving to maximise your chance of avoiding accidents.

Part D

15. Describe how you can use a digital camera to measure the duration of an event.

How does a bike speedometer work?

16. A BMX bike wheel with a diameter of 50 cm takes exactly 0.4 seconds to make one complete rotation as it rolls along.

- What is the circumference of the wheel in metres? ($C = 2\pi r = \pi d$)
- Your answer above is the distance that the wheel will roll during one rotation. How fast is the bike going?