8.4.1 VELOCITY

Vehicles do not typically travel at a constant speed

1.1 Identify that a typical journey involves **speed changes**

- When travelling, you do not travel at a constant speed
  - Acceleration, deceleration, stopping at lights, etc.

1.2 Distinguish between the **instantaneous** and **average speed of vehicles** and other bodies

- Instantaneous speed – speed at a **particular 'instant' of time**
- Average speed – distance travelled **over the total time taken**
- Object moving at **constant speed** will have **same** instantaneous and average speed

1.3 Distinguish between **scalar** and **vector quantities** in equations

- Scalar – has **magnitude** but not direction
- Vector – has **magnitude and direction**
  - When measuring vectors, **direction needs to accounted for** (e.g. 340 N North, 37 ms^{-2} SE)
- See 8.P2

1.4 Compare **instantaneous and average speed** with **instantaneous and average velocity**

- Instantaneous velocity – velocity at a **particular instant of time**
- Differs from speed as there is a **direction** in velocity
- Speed is the same as velocity only at **constant direction** (i.e. cyclist traveling in a straight line)

1.5 Define **average velocity** as: $\boldsymbol{V_{av}} = \frac{\Delta r}{\Delta t}$

- Average velocity V_{av} is equal to **change in displacement over time**

1.P1 Plan, choose equipment or resources for, and perform a first-hand investigation to **measure the average speed of an object or a vehicle**

- See Experiment 1.P1 in 8.4 Experiment Booklet

1.P2 Solve **problems** and analyse information using the **formula** : $\boldsymbol{V_{av}} = \frac{\Delta r}{\Delta t}$ where r = displacement

A swimmer swims 1500 metres N in 15 minutes, then 100 metres S in 5 minutes. Calculate his average velocity and average speed over 20 minutes in ms^{-1}.

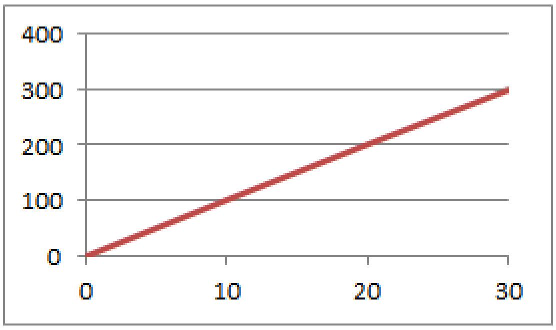
$$v_{av} = \frac{\Delta r}{\Delta t} = \frac{1500 - 100}{20 \times 60} = \frac{1400}{1200} = 1.16\ ms^{-1}$$

$$speed = \frac{distance}{time} = \frac{1600}{20 \times 60} = \frac{1600}{1200} = 1.33\ ms^{-1}$$

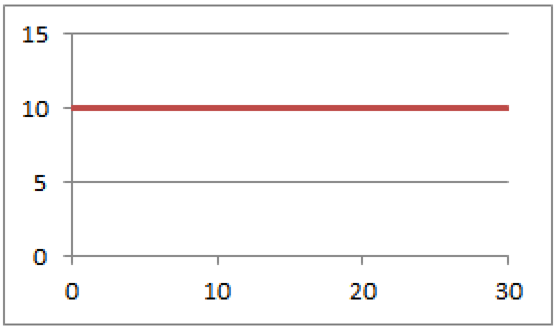
1.P3 Present information **graphically** of **displacement vs time** and **velocity vs time** for objects with **uniform and non-uniform linear velocity**

Case 1			**Case 2**		
Displacement (m)	Time (s)	Velocity (ms^{-1})	Displacement (m)	Time (s)	Velocity (ms^{-1})
0	0	(10)	0	0	(20)
100	10	10	200	10	20
200	20	10	500	20	25
300	30	10	900	30	30

CASE 1



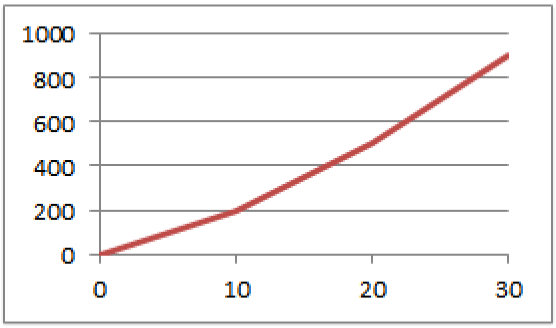
displacement over time



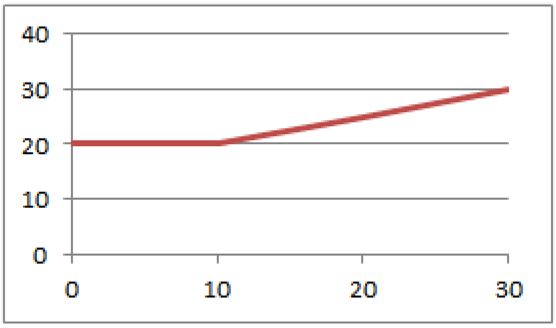
velocity over time

- **Gradient** of displacement over time is equal to **velocity over time**
  - **Since gradient is constant**, velocity remains the same

CASE 2



displacement over time



velocity over time

- Gradient of displacement over time is **increasing** (so cyclist is speeding up)
  - Therefore, velocity over time increases