These notes are posted on my site for the following reasons:

- for students to copy in their own hand-writing
  - in order to complete their class notes
  - if student did not have enough time in class
  - if student was away and missed this section
- for assistants and tutors to follow progress of the concepts taught

Photocopied/printed notes can not be used during the Unit Notebook Check in class.

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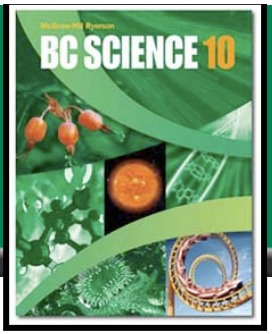
9.1 Describing Acceleration

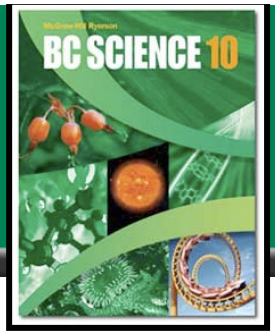


- We have already examined uniform motion.
  - An object travelling with uniform motion has equal displacements in equal time intervals.
- Not all objects exhibit uniform motion.
- It is important to be able to analyze situations where the motion is not uniform.
- An object travelling with non-uniform motion will:
  - have different displacements during equal time intervals.
  - take different amounts of time to travel equal displacements.
  - have a continuously changing velocity.

As she slides, the velocity of the baseball player is continually changing, therefore her motion is non-uniform.

See pages 44 - 45

Positive and Negative Changes in Velocity



- A change in velocity ($\Delta\vec{v}$) occurs when the speed of an object changes, or its direction of motion changes, or both.
- A change in velocity can be calculated by:

$$\Delta\vec{v} = \vec{v}_f - \vec{v}_i$$

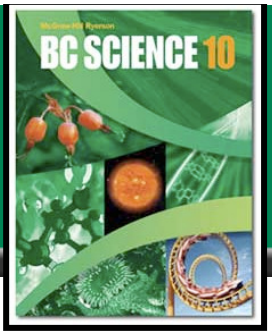
- If the change in velocity is the same sign (+, -) as the initial velocity, the speed of the object is increasing.
- If the change in velocity is the opposite sign (+, -) of the initial velocity, the speed of the object is decreasing.
- If the change in velocity is zero, the object is travelling with uniform motion.

See page 46

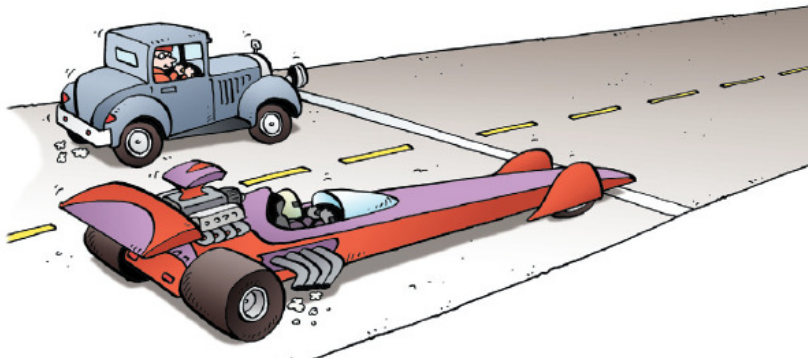
If forward is designated positive, this dragster's change in velocity is positive.

If forward is designated positive, this landing shuttle has a negative change in velocity.

Acceleration



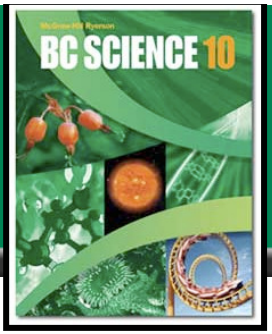
- **Acceleration is the rate of change in velocity.**
  - **This change in velocity can be due to a change in speed, a change in direction, or both.**
- **Two objects with the same change in velocity can have different accelerations.**
  - **This is because acceleration describes the rate at which the change in velocity occurs.**



Suppose both of these vehicles, starting from rest, speed up to 60 km/h. They will have the same change in velocity but since the dragster can get to 60 km/h faster than the old car, the dragster will have a greater acceleration.

See pages 47 - 48

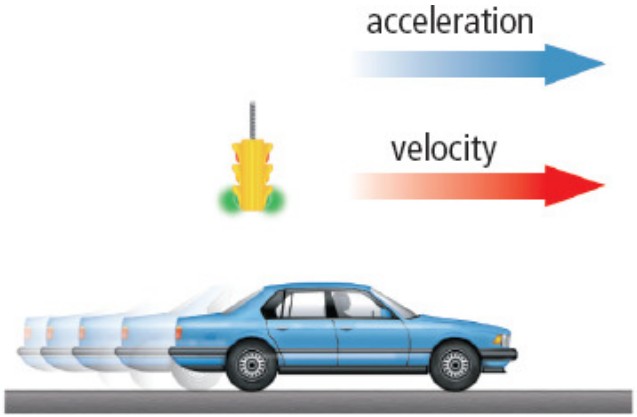
Positive and Negative Acceleration



- **The direction of the acceleration is the same as the direction of the change in velocity.**
- **Acceleration that is opposite the direction of motion is sometimes called deceleration.**

Examples of accelerations:

- **1. A car speeding up in the forward direction.**
  - **If we designate the forward direction as positive (+) then the change in velocity is positive (+), therefore the acceleration is positive (+).**



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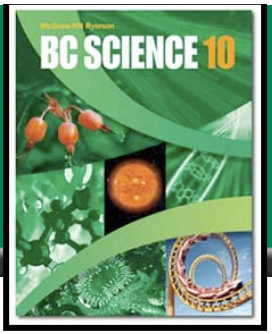
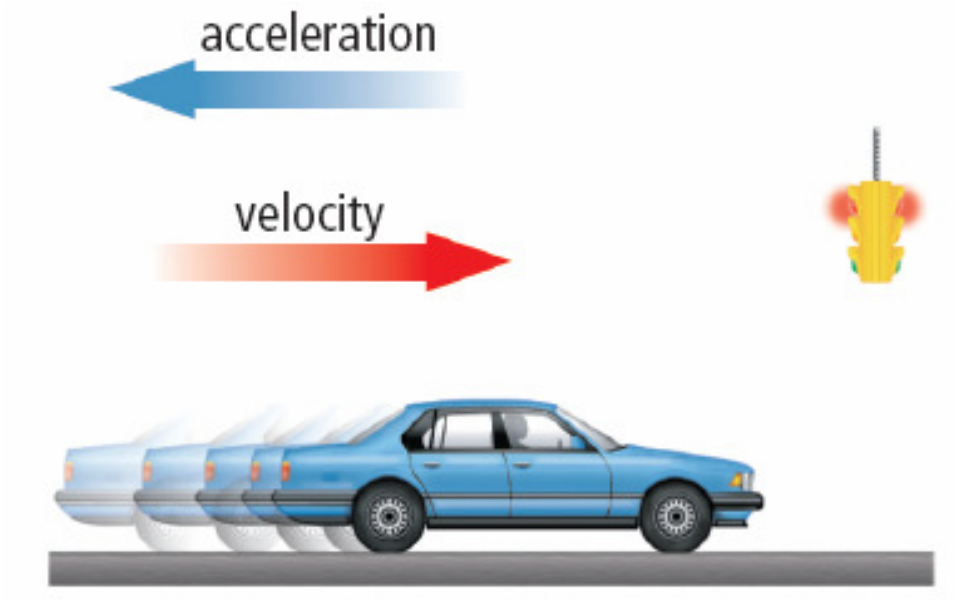
Positive and Negative Acceleration



Examples of accelerations:

- **2. A car slowing down in the forward direction.**
  - **If we designate the forward direction as positive (+) then the change in velocity is negative (-), therefore the acceleration is negative (-).**



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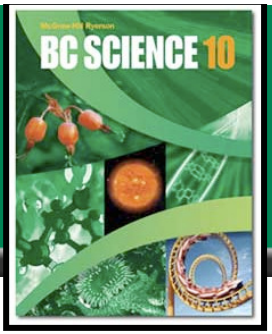
Positive and Negative Acceleration

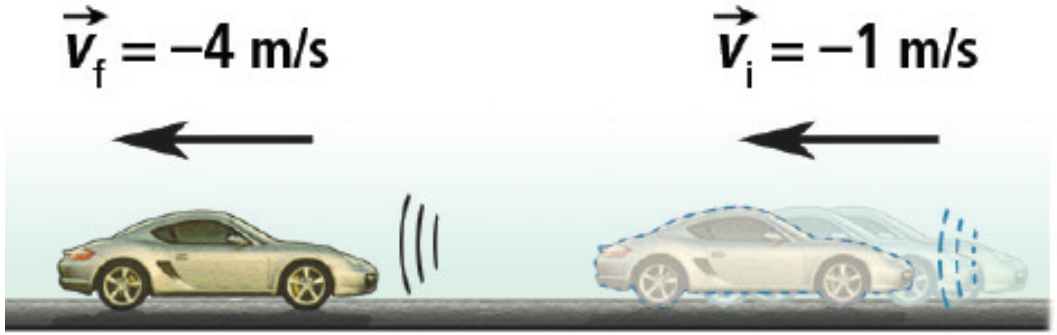


Examples of accelerations:

- **3. A car speeding up in the backward direction.**
  - **If we designate the backward direction as negative (-) then the change in velocity is negative (-).**

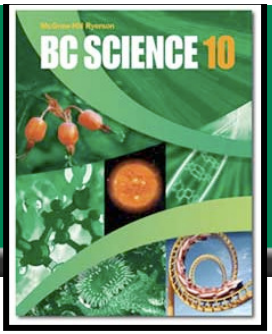
$$\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-4\,m/s) - (-1\,m/s) = -3\,m/s = 3\,m/s \;\; backwards$$

  - **This means that the acceleration is negative (-) even though the car is increasing its speed. Remember positive (+) and negative (-) refer to directions.**



See pages 49 - 50

Positive and Negative Acceleration



Examples of accelerations:

- **4. A car slowing down in the backward direction.**
  - **If we designate the backward direction as negative (-) then the change in velocity is positive (+).**

$$\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-1\ m/s) - (-4\ m/s) = +3\,m/s = 3\,m/s \quad forward$$

  - **This means that the acceleration is positive (+) even though the car is decreasing its speed. Remember positive (+) and negative (-) refer to directions.**

Take the Section 9.1 Quiz

See pages 49 - 50