Chapter 4

Forces and Laws of Motion

4.1

Changes in Motion

Objectives

- **Describe** how force affects the motion of an object.
- **Interpret** and **construct** free body diagrams.

Force

- **Force** is an action exerted on an object that may change the object's state of rest or motion
  - It can cause something to start moving from rest, speed up, slow down, or change direction
  - It accelerates an object
- Examples
  - Catching a ball, moving a desk

Force

- The SI unit for Force is the Newton (N)
  - 1 N = 1 kg*(m/s^2)
  - So, F = ma
    - 1 lb = 4.448 N
    - 1 N = 0.225 lbs (about a ¼ lb)
- There are 2 types of forces
  - Contact
  - Field

Contact Forces

- Think about the different ways in which you could move a textbook.

Field Forces

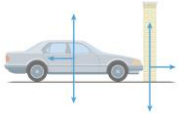
- If you drop a book, the gravitational force of Earth causes the book to accelerate, whether or not Earth is actually touching it. This is an example of a field force.
- Field forces are exerted **without** contact.
- What is an another example of a field force?

Force Diagrams

- The effect of a force depends on both **magnitude** and **direction.** So, force is a _____ quantity.
- Diagrams that show force vectors as arrows are called **force diagrams.**
- A physical model which represents the forces acting on a system, is called a **free-body diagram**

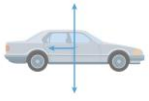
Force vs Free-Body

Force Diagram



In a force diagram, vector arrows represent all the forces acting in a situation.

Free-Body Diagram



A free-body diagram shows only the forces acting **on the object of interes**t - in this case, the car.

What would the FBD for the wall look like?

Drawing a Free-Body Diagram

Free-body Diagrams

- Draw the following free-body diagrams for the underlined word and bring this in tomorrow:
  - An apple hanging on a tree
  - A man standing on a box
  - A child pulling a wagon
  - A sign hanging from a pole
  - A horse pulling a cart

Assignment

- Q: 1-4, 6
- 4.1 Pack
- SP - A