

# Forces, Motion, and Energy Book M

## Matter in Motion Chapter 1

Name \_\_\_\_\_

Class \_\_\_\_\_

Test Date : *Tuesday, April 22, 2014*

## Section 1 Measuring Motion **pages 4-9**

### I. Observing Motion by Using a Reference Point

\* When you watch an object in motion, the object that appears to stay in place is a **reference point**.

#### A. Common Reference Points

### II. Speed Depends on Distance and Time

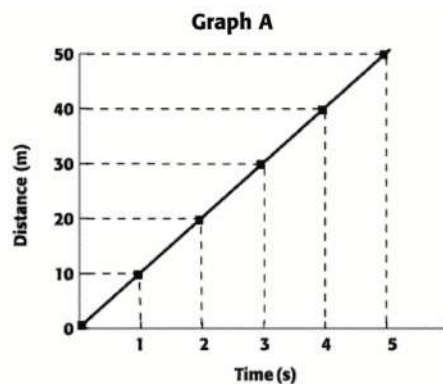
The SI unit for speed is **meters per second** m/s.

#### A. Determining Average Speed

\* Average speed = total distance traveled ÷ total time

#### B. Recognizing Speed on a Graph

\* Speed can be shown on a graph of **distance** versus **time**.



### III. Velocity: Direction Matters

\* Velocity is the speed of an object in a particular **direction**.

\* Speed is different from velocity. Velocity MUST include a reference **direction**.

#### A. Changing Velocity

#### B. Combining Velocities

### IV. Acceleration

\* Acceleration is the rate at which velocity changes over time; an object accelerates if its **speed**, **direction** or both change.

\* An increase in velocity or speeding up is called **positive** acceleration. **Gas pedal**

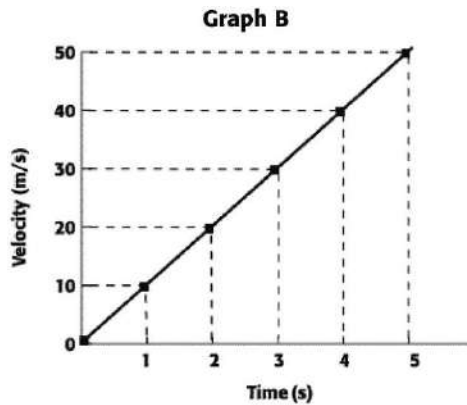
\* A decrease in velocity or slowing down is called **negative** acceleration. **Brakes!**

A. Calculating Average Acceleration

$$\text{Average acceleration} = \frac{\text{Final velocity} - \text{starting velocity}}{\text{Time it takes to change velocity}}$$

B. Recognizing Acceleration on a Graph

\*Acceleration can be shown on a graph of **velocity** versus **time**.



C. Circular Motion: Continuous Acceleration

\*An object traveling in a circular motion is always changing direction; therefore, the object is **accelerating**.  
(Centripetal force)

## Section 2 – What is a Force? Pages 10 - 13

\* Force is a **push** or **pull** exerted on an object. Its SI unit is **Newton** (N).

### I. Forces Acting on Objects

#### A. Unseen Sources and Receivers of Forces

### II. Determining Net Force

\* Net Force is the **combination** of all of the forces acting on an object.

#### A. Forces in the Same Direction

If forces go in the same direction, you need to **add** these forces together to find the net force.

#### B. Forces in Different Directions

\*If forces go in opposite directions, you need to **subtract** these forces to find the net force.

### III. Balanced and Unbalanced Forces

#### A. Balanced Forces

If forces are balanced, the net force is **zero (Newtons)**.

#### B. Unbalanced Forces

\*Unbalanced forces produce a change in **motion**, such as a change in **speed** or **direction**. They can cause a nonmoving object to **start** moving.

# Chapter 1 – Matter in Motion

## Section 3 – *Friction: A Force That Opposes Motion*

### Pages 14 - 19

\* Friction is a force that opposes **motion** between two surfaces that are in contact.

#### I. The Source of Friction

\* Friction occurs because of the object's **rough** surface.

- A. The Effect of Force on Friction
- B. The Effect of Rougher Surfaces on Friction

#### II. Types of Friction

##### A. Kinetic Friction

Kinetic means **moving**.

Sliding Kinetic Friction happens when you write with a **pencil**.

\*Rolling Kinetic Friction happens when you roll heavy furniture on **wheels**.

##### B. Static Friction

Static means **not moving**

#### III. Friction: Harmful and Helpful

Harmful friction would include erosion of soil by the wind.

\*Helpful friction would include tires pushing against the **ground** to move a car forward.

##### A. Some Ways to Reduce Friction

**Lubricants** such as motor oil and wax.

##### B. Some Ways to Increase Friction

# Chapter 1 – Matter in Motion

## Section 4 – Gravity: A Force of Attraction p. 20 - 25

\* Gravity is a force of attraction between objects that is due to their **masses**.

### I. The Effects of Gravity on Matter

#### A. The Size of Earth's Gravitational Force

Because of **gravitational force** items in a room stay in place, and dropped objects fall toward Earth.

### II. Newton and the Study of Gravity

#### A. The Core of an Idea

Newton proposed that the force that makes an apple fall to the ground and the force that keeps the moon moving in circles around Earth is called **gravity**.

#### B. The Birth of a Law

\* **Law of universal gravitation** describes the relationships between gravitational force, mass and distance.

### III. The Law of Universal Gravitation

\*The size of gravitation force depends on

1. **masses of the objects**
2. **the distance between the objects**

#### A. Part 1: Gravitational Force Increases as Mass Increases

\*The gravitational force is **large** when the mass of objects is large.

#### B. Part 2: Gravitational Force Decreases as Distance Increases

### IV. Weight as a Measure of Gravitational Force

\*Weight is a measure of the **gravitational** force exerted on an object.

#### A. The Differences Between Weight and Mass

\*Mass is a measure of the amount of **matter** in an object. Mass remains the **same** no matter the location of the object.

\* An astronaut's weight on the moon is about 1/6 of his weight on Earth, but his mass remains the same. If a person's weight on Earth is 720N, their weight on moon would be **120 N** (divide by 6).

#### B. Units of Weight and Mass

The SI unit for weight is **newtons (N)**.

The SI unit for mass is **kilogram (kg)**.