Unit 4 Lessons 1 – 8 Study Guide

Unit 4 Lesson 1-8 Vocabulary:

Lesson:	Term	Definition
1	Force	a push or pull
1	Friction	a force that resists motion between two objects that are in contact
1	Gravity	a universal force that exists between all objects with mass
2	Universal Law of Gravitation	the concept that gravitation occurs everywhere in the universe
2	Mass	the amount of matter in an object
2	Weight	The force of gravity on an object
3	Coordinate System	a set of reference points, lines, and/or directions by which the position of any point can be described
3	Displacement	the distance and the direction from a reference point of an object that has moved
3	Reference Point	a point from which the position of other objects can be described
3	Rotational Motion	when objects spin in place
3	Translational Motion	when an object moves from point A to point B
3	Vibrational Motion	When an object moves rapidly back and forth (like particles in a substance)
5	Speed	
5	Velocity	
8	Acceleration	
8	Deceleration	

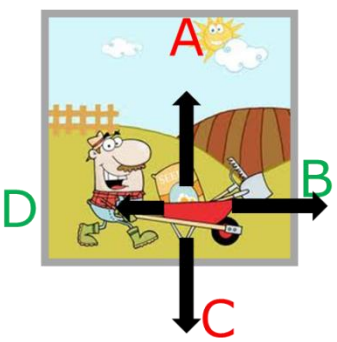
Lesson 1: Force

What is a Force?

- **Force:** a _____ or a_____
- It can cause an object to **move**, **stop** moving, _____ speed or direction
- Examples: friction, gravity, tension

Magnitude and Direction:

- Forces have **magnitude** (_____) and _____
- Measured in **Newtons**: 1 lb = 4.45 N
- Direction can be _____, down, forward, backward, **right**, left, _____, south, east or west (or even southeast!)



Multiple Forces Act on Objects:

- **Weight** is the _____ of gravity on an object
- **Gravity** is a _____ force between objects with mass
- **Friction** is a force that _____ motion between two objects in contact with each other

- **Example: Pushing a wheelbarrow**
  A. "Normal" Force (ground pushing up on wheelbarrow)
  B. Pushing force (you)
  C. Weight force (force of gravity on wheelbarrow)
  D. Friction force (ground resisting motion)

Net Force = "Unbalanced":

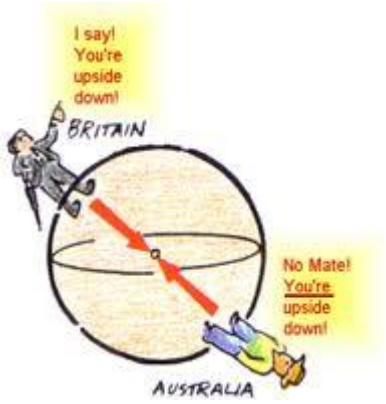
- When one force is larger than another, we say the forces are "_____" or that there is a "**net force**"
- **When there is a net force, the forces on an object are unbalanced.**
  - Unbalanced forces cause _____ in the direction of the _____ force
  - Example: Elevator – which way will the elevator move?
    ____ Up ____ Down

- When all the forces _____, we say the net force is **zero**, and the object will _____ change its motion

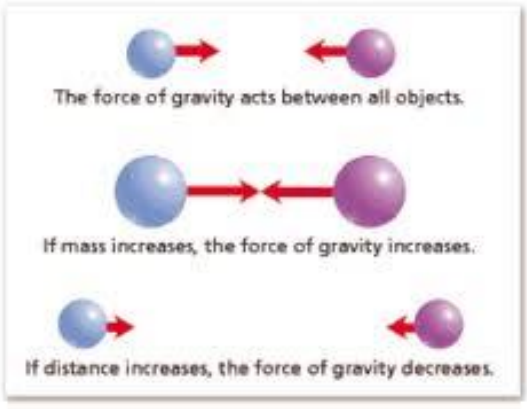
Lesson 2: Gravitational Force

Gravitational Pull

- Gravity is a universal _____ of attraction _____ all objects with mass.
- **Mass**: the amount of _____(atoms) in an object
- **Newton's 2nd Law** –
  - The object with _____ **mass** will _____ **MORE** (given the same force of gravity)
  - **Example**: Popcorn kernel and Earth pull on each other (gravity).
    - Which one moves? **Popcorn** (falls)
    - Why? Popcorn has _____ _____ than Earth



  - **Example 2: Car vs. Train**
    - In a collision between a car and a train, which one moves **more?** The **car**
    - Why? Because it has_____ _____



Law of Universal Gravitation

1. _____ **objects have gravity**
2. Force of gravity changes with _____ between objects
   - **Gravitational force decreases between objects as they move farther away**
3. Force of gravity changes with _____ of objects
   - **Gravitation force increases as mass increases.**

Mass vs. Weight

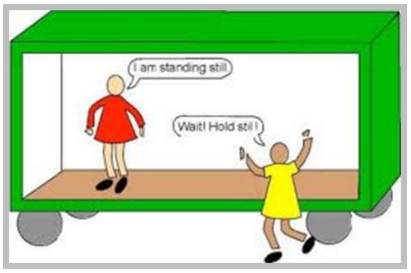
Mass	Weight
• **Mass** is the amount of _____ in an object	• **Weight** is the _____ of gravity on an object with mass.
• Measured in **kilograms (kg)**	• Measured in **Newtons** (N)
• Stays the _____, no matter where you go (Earth/Moon/Outer Space)	• _____ with location, because weight **depends** on gravity
• **Example:** On moon, you have the _____ **mass** as on Earth	• Example: On moon, your **weight is** _____ than on Earth (because moon has less mass than Earth)

Gravity and the Universe

- Discovered by **Sir Isaac Newton**
- Keeps moons in orbit around planets and planets in orbit around stars
- **Same force** that causes apples to fall to the ground on Earth

Lesson 3: Motion

Motion Compared to What?



- **All** motion is **relative**
- Scientists describe the motion of an object in relation to, that is to say, _____ **to**, some other object.

Different Kinds of Motion

- **Translational** Motion: when an object changes _____ from point A to point B
  Examples:
  - Bike going downhill
  - Earth moving in a path around the sun (yearly orbit)

- **Rotational** Motion: _____ in place
  Example:
  - Bike wheels turning as bike moves
  - Earth spinning on it axis (night/day)

- **Vibrational** Motion: the rapid _____ movement of the kind found in particles that make up a substance.
  Example:
  - The rapid "bumping" **up-and-down motion** of the seat as the bike travels over rough ground.
  - Earth experiencing an earthquake where the ground **shakes** up and down.

Describing Position

- **Coordinate System:** a set of reference points, lines, and/or directions by which the _____ of any point can be described (number line, or x/y system)

- **Reference Point:** a point from which the position of other objects can be described
  Examples:
  - _____on a number line
  - _____ on x/y graph

Displacement vs. Distance

- **Distance:** how far an object moves
  Example: I walked **2**_____ to my friend's house

- **Displacement:** the distance and direction from a _____ _____ of an object
  Example: I walked 2 blocks _____ to my friend's house

Lesson 5: Calculating Speed

Speed

- **Speed** is the _____ of motion, measured as distance divided by the time required to travel that distance.
- Speed = **distance/time**
  - HOW FAR you go / the time it takes to get there
  - **Examples**: miles per hour (mph), kilometers per hour (kph), or meters per second (m/s)

- **Calculating Average Speed - EXAMPLE**
  - Sarah is running at a track meet.
  - She ran **400 meters** in **80 seconds.**
  - What is Sarah's AVERAGE speed?
    s = d/t
    s = 400m / 80 s
    s = m/s

Velocity

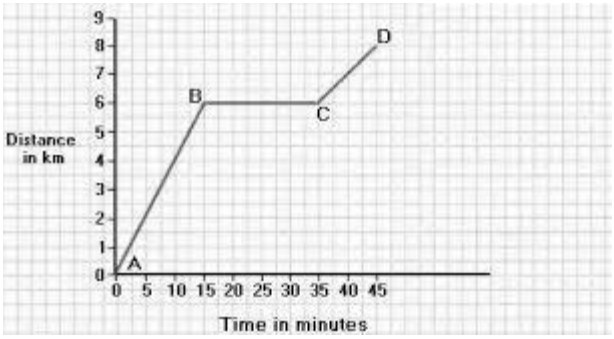
- **Velocity:** is **speed** in a specific _____.
  - Remember DIRECTION = positive/negative or North, South, East, West

- **Example**:
  - A jet airplane flying **720 km/hr** _____
  - A skydiver freefalling **30 meters per second** _____.

Lesson 6: Measuring Speed and Velocity

Interpreting Motion Graphs

- Speed Graph = Position vs. Time
  - Time goes on the __-axis
  - Position goes on the __-Axis
  - Slope tells the speed:
    - steep = _____
    - shallow = **slow**
    - flat = _____



Lesson 8: Acceleration

Acceleration

- **Acceleration:** How quickly _____ _____ over time
- **Acceleration** occurs when objects do ANY of the following:
  - Change speed (slow down or speed up)
  - Change direction
- **Examples:**
  - **A ball rolling a ramp is accelerating because BOTH speed and direction are changing**

Acceleration & Gravity

- REVIEW: _____ is a **force**
- Newton's 2nd Law: forces _____ **acceleration**
- On Earth, **gravity causes objects to accelerate** about 10 meters per second every second they are in freefall….this is the reason object go _____ the _____ they fall.

Time (s)	Velocity	Increase in velocity from previous second	Acceleration
0	0	—	—
1	9.8 m/s	9.8 m/s	9.8 m/s/s
2	19.6 m/s	9.8 m/s	9.8 m/s/s
3	29.4 m/s	9.8 m/s	9.8 m/s/s
4	?	?	?

Deceleration

- **Deceleration** is a way to say that an object is _____ **down.**
- Deceleration is a **decrease in velocity** over time.
- There must be a _____ applied to cause the change in speed (2^{nd} Law)