Forces Notes
Chapter 11.3 and Chapter 12

Section 11.3 Force

- What are the 4 types of forces?

- What is Force?
    - ________________ that one body ________ on another
    - It is cause of ________________ or ___________ in object's ___________
    - Can cause a change in __________, __________, & ______________
    - There can be ________________ without a __________

Net Forces

Type of Forces	Definition	Example/Diagram
	The ______ of all the ________________ on an __________.	
	Opposing forces are ___________ & completely ______________________; net force of ________	
	Forces acting on object, _____________ its ___________ due to ________________: Net force is ___________	

The Force of Friction

- _____________- force that opposes motion between ______________________ in ___________ with ____________________________
    - Causes a ___________________________
- Depends upon:
    - ____________________________
    - ____________________________________ surfaces together
- **What is this unbalanced force that acts on an object in motion?**

Types of Friction	**Definition**	**Example**
1.	_________________________- between surfaces that are _________________(at rest). ________________________ when moving an object	
2.	________________________- _____________the motion of two ____________________ past each other.	
3.	_________________________- the force _______________ the motion when a body (such as a ball, tire, or wheel) ______________________________. Causes _______________.	

Friction and Motion

- Friction is necessary for many _________________________ to work correctly.
  - Ex:
- ________________________: add ________________ or other low-friction materials.
  - Ex:
- ____________________________: make surface ___________
  - Ex:

Section 12.1

Newton's First Law

- What does Newton's First Law of Motion state?
  - What is it also called?
- __________: the tendency of an object to remain at _______ or in ________ until acted upon by an ____________________
- If object is moving, it keeps moving at ________________ & in same direction unless unbalanced force acts on it

Newton's Second Law

- What does Newton's Second Law state?
- Larger ________ requires greater _______ than smaller mass to achieve the __________________________
- Acceleration depends on the _______ of the __________ and the _________________ applied
  - more mass, harder to______________
  - ___________________, faster acceleration

Calculating Newton's Second Law

- Formula: _____________________
- Unit of force: ______________
  - What does 1 N equal? ______________________

F =
m =
a =

What's the formula when finding acceleration?

What's the formula when finding mass?

Problem: Newton's Second Law

1. Zookeepers lift a stretcher that holds a sedated lion. The total mass of the lion and stretcher is 175 kg, and the upward acceleration of the lion and stretcher is 0.657 m/s^2. What force is needed to produce this acceleration of the lion and the stretcher?

List the given and unknown values.

Insert the known values into the equation, and solve.

Write the equation for Newton's second law.

Newton's Second Law Practice Problems

2. What net force is needed to accelerate a 1.6×10^3 kg automobile forward at 2.0 m/s^2?

3. A baseball accelerates downward at 9.8 m/s^2. If the gravitational force is the only force acting on the baseball and is 14 N, what is the baseball's mass?

4. A sailboat and its crew have a combined mass of 655 kg. If a net force of 895 N is pushing the sailboat forward, what is the sailboat's acceleration?

5. The net forward force on the propeller of a 3.2 kg model airplane is 7.0 N. What is the acceleration of the airplane?

Section 12.2

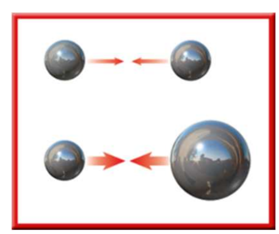
Gravity

- Gravity: ___________________________________ any two objects in the universe
    - Acts on all objects with _________
- The strength of the force depends on the __________ of the objects and the distance
    - increases as...
        - ___________increases
        - ___________ decreases

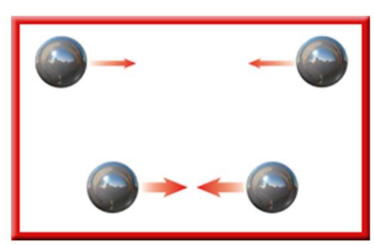
Law of Universal Gravitation

- What does the Law of Universal Gravitation state?

- Not only limited to _________, but also acts between all objects in the universe.
- Any two objects, from ________________________to the _______________________, experience a gravitational attraction.
- You are attracted to the ___________, but the Earth is attracted to ______!
- You also share an attractive force with all the other objects around you, but they are __________________________.



- If the mass of either of the objects increases, the __________________________ between them increases



- If the objects are _____________________, the gravitational force between them _________________

- Which exerts more gravity - the Earth or the moon?

Weight

- The ______________________________ on an object is called the object's _______
- Larger _________, larger ___________
- Different planets different ________________ (*g*)
  - so you would ___________different ___________
- Earth's gravity= ______ Moon's gravity= ______

Mass vs Weight

- Mass is ____
- Since an object's force of gravity depends on its mass, the ________________________ has, the __________________________ of gravity it exerts.
- ___________*always the same (___)*
- ____________ *depends on gravity (__)*

Calculating Weight

- Weight Formula=
- W=
- *g*=
- SI unit of weight is ______________

W: ***m***:   ***g***:

What's the formula when finding mass?

What's the formula when finding gravity?

Weight Practice Problems:

1. Jimmy has a mass of 37.5 kilograms here on earth. What is his weight?

2. What is the weight of a person with a mass of 72 kg on Earth?

3. A boy weighs 400 N. What is his mass?

4. An astronaut has a mass of 100 kg and has a weight of 370 N on Mars. What is the gravitational strength on Mars?

Air Resistance

- Type of _______________
- _____________________ exerts on moving object; type of friction
- Acts in opposite _____________________________________
- Air resistance pushes up as ________________________________.
- Amount of air resistance depends on ___________, __________,______________, & density of an object
- ________________________ = Large amount of air resistance

Free Fall

- When the force of gravity is the _______________________ on an object
- If there was ____________, all objects would fall at the same ________
    - **Why do astronauts in orbit seem weightless?**
- The acceleration caused by gravity (g) is __________
- Is the same for all _____________ on ________.
    - **Which objects will fall to the ground first when placed in a vacuum (absence of air)?**

Terminal Velocity

- What is terminal velocity?

- Force of gravity is constant
- Eventually gravity will balance with ________________
- Air resistance increases as you ______________ until the force is equal
- Equal forces, no _______________
- Constant _________________ = terminal velocity

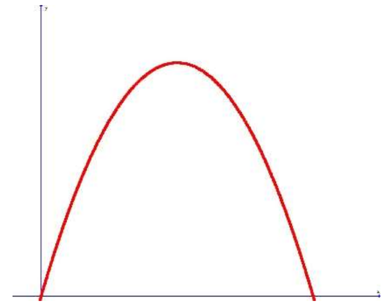
Projectile Motion

- Things can move _______________ and ________________ at the same time
- If no force other than gravity acts, the sideways velocity will __________________
- The vertical velocity ________________
- _____________________________

Horizontal and Vertical Motions

- When you throw a ball, the force exerted by your hand pushes the ball ____________.
- This __________________ the ball _________________________.
- No force accelerates it forward, so its horizontal velocity is constant, if you ignore air resistance.
- However, when you let go of the ball, _________________________________, giving it vertical motion.
- The ball has constant horizontal velocity but ______________________________

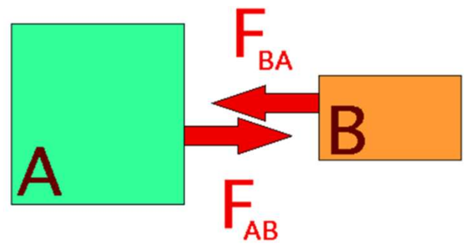
- Gravity exerts an __________________ on the ball, changing the direction of its path from only forward to ______________________________.
- The result of these two motions is that the ball ______________________________.



Section 12.3

Newton's Third Law

- What does Newton's Third Law State?
  - For every force, there is an _______________________________________
  - For every action there is an __________________________________.



Action and Reaction

- When a force is applied in nature, a _____________________ occurs at the same time.
- When you jump on a trampoline, for example, you exert a __________________ on the trampoline.
- Simultaneously, the trampoline exerts an _____________________________ sending you high into the air.
- According to the third law of motion, ___________ and ___________ forces act on different objects.
- Thus, even though the forces are equal, they are __________________________ they act on different objects.

Example:

- A swimmer "acts" on the water, the "reaction" of the water pushes the swimmer forward.
- Thus, ________________, or _____________________, acts on the swimmer so a change in his or her motion occurs.

Example:

- In a rocket engine, burning fuel produces hot gases. The rocket engine exerts a ____________________ and causes them to escape out the back of the rocket.
- By Newton's third law, the gases exert a force on the rocket and push it _______.

Momentum

- A moving object has a property called momentum that is related to _____________________ is needed to _____________________.
- The momentum of an object is the product of its ________________________