Forces & Interactions Notes

Force
* ______or______
* Has_______&___________(_______)

What is Balanced Force?
- _______Forces acting in_________directions
- ________does______change

How can you tell forces are balanced?
-A moving object’s Velocity (speed & direction) stays the same.
-A stationary (static) object does not move

What is an unbalanced force?
* __________________(strength) of forces
* __________changes

How can you tell forces are unbalanced?
*A moving object accelerates
*A stationary (static) object begins to move

Vector
-Has a direction & magnitude
-Represented by arrows drawn according to direction and magnitude

EX.
A) The gravitational field surrounding a clump of mass such as the Earth.  
B) The gravitational fields of the Earth and Moon superpose. Note how the fields cancel at one point.

Resultant vector * sum of the vectors

Net Force - _____ of ________

EX.
1. Opposite & Not Equal = ____________

If the vectors are in opposite directions, we subtract.

2. Opposite & Equal = ____________

Two balanced forces are equal in magnitude but opposite in direction

3. Same Direction = ____________

If the force vectors are in the same direction, they simply add together.
Newton’s 1st Law

- Unbalanced force will change the _______ or ___________ 

Inertia

* ______________ a change in motion or resist changes in velocity
* Amount depends on the _______ of the object

EX.
1. Have you ever experienced inertia in an automobile while it is braking to a stop?

2. While riding a skateboard or bicycle, you fly forward off the board when hitting a curb, a rock or another object which abruptly halts the motion of the skateboard.

Mass

* Amount of _________ in an object
  * more ________ = more ____________
  * less ________ = less ____________

Sumo Wrestler vs. Sponge Bob Square Pants

Q: Who has more inertia? Why?
A:
Q: Will their mass or weight change on the moon? Why?
A:
Newton's 2nd Law

Formulas

\[ F = \text{mass} \times \text{acceleration} \]

or

\[ a = \frac{F}{\text{mass}} \]

\[ F = ma \]

where:

- \( F \) is force
- \( m \) is mass
- \( a \) is acceleration due to the force

\( (\text{Force} = \text{mass} \times \text{acceleration}) \)

12 N = (3 kg)(4 m/s/s)

A force of 12 N could give

a mass of 3 kg

an acceleration of 4 m/s/s

Units of Force

\[ \text{N} \text{(for )} \]

Which units are not equal to Newtons?

\[ \text{*( / ) or N(for )} \]

\[ \text{*( )(m/s/s)} \]
Momentum

Momentum

*Product of ________ and __________________

Formula

Momentum = m x v (_______ x _____________)

Units

* _____________

EX.
1) A squirrel was gathering nuts in a pile. When he came back to add to the pile, a seagull was eating some peanuts. So he threw a 1.5g peanut 2m in 0.5 seconds at the seagull and it hit the gull in the head causing feathers to fly everywhere. (Make sure you show the equation, your work, the correct answer and the correct units. Round to the second decimal)

a) What was the speed/velocity of the peanut?

b) What was the momentum of the peanut?

c) Why did feathers fly everywhere? (Use momentum in your answer)

d) If the peanut was accelerating at 8m/s/s, what was the force of the peanut when it hit the gull?

EX.

A bus can have a large momentum even if it is moving very slowly, because it has a large mass.

(mass)(velocity) = momentum

Law of Conservation

of Momentum

*Total Momentum of objects that interact does not change=same _____ & _____

*It can be _____________to other object’s surfaces

Ex. Two marbles collide

EX. Newton’s Cradle
Friction

What is Friction?

*Force ______ on other surfaces

Are surfaces really as smooth as they appear?

EX.
Look closely at the surface of your desk

In which direction Does the force of friction act?

* __________ motion

Why Do objects Stop moving?

-Friction Opposes/____ motion

2 Factors affect the magnitude (strength)

1. _______of surface
2. How _____ the surfaces_____
   * __________ surface __________ friction

Ex.
Cat’s tongue or Sandpaper
What happens when surfaces push harder?

1. Force of friction________
2. Surface gets____________
   Ex. 1. Rub your hands together lightly then harder
       2. Start a fire by rubbing together 2 pieces of wood

4 Types of Friction

1. _________
   Ex. Downhill Skiing & Going down a slide

2. _________
   Ex. Riding a bicycle & Riding a roller coaster

3.__________
   (gas or liquid)
   Ex. Adding oil (liquid) reduces friction

Liquid - Fish swimming through water

Gas - Parachuting through the air =

Air Resistance
Which of the 4 types of friction has the greatest force? Least?

a) ___________

b) ___________

**Gravity**

- ___________ is a force that ______ objects towards the center of the Earth

Rate of Acceleration Due to Gravity on Earth

* ___________ / /

Rate of Acceleration Due to Gravity on The Moon

* ___________ / /

Freefall

- Object falls with only the force of ______ acting on the object

- All objects fall at the same rate

Projectile

* ______________
Weight = ______ ( )x ______ ( ___ / ___ / ___ )
-gravity ______ your mass
-___________ as you move further away from earth

Universal gravitation
*____ objects in the universe have and are attracted to each other
*______ mass=______ gravity
*Responsible for the shape of planets and Keeps planets and their moons in an Elliptical_______

Newton’s 3rd Law, Rockets & Satellites

Newton’s 3rd Law
*Each action has an _________ & Reaction/Force when one object exerts a force on another object
EX.

How do Rockets launch Up not the sky?

Fuel is expelled out as the ________ and the _______ is the rocket moves up

What is a satellite?
An object that ______ another object in space
EX.
Centripetal force
-Cause objects to move in a _______
-Acts_____________ to object’s motion

Ex.

How does gravity keep satellites in orbit?
- It is the centripetal force that pulls to the center rather than the object continuing to travel in the direction of its ___________ or ___________

Motion

How can you tell if an object is moving?
-Use a ___________ _______ to check if the __________ is changing

What is a Reference Point?
* An _______ or ______ used to tell if something is moving
Ex.

Speed
- _______ at which an object __________

Formula
*Speed = _______/_________
* S = ___/___ = m/s

Units
-m/s (_____/_______) or km/h (_______/_____
Ex. Work out each runner’s speed= (formula, work w/units & Answer w/units)

1.
2.
Constant Speed  
*Speed of an object remains ____________

Ex.

Do most objects move at a precise constant speed? - _____. There are small ____________ for most objects.

Ex.

**Interesting Fact:** If you could fly to the Moon at a constant speed of 1000 kilometers per hour, which is the speed of a fast passenger jet, it would take sixteen days to get there.

Why do we calculate Average Speed?  
-Speed usually ____________ during motion

Formula  
= _____ Dist./_____ Time

Units  
* ____/____ or ____/____

Ex.

How is Velocity Different from Speed?  
* It’s Speed plus a ______(N, S, E, W)

Ex.

Formula  
* \( V = \frac{\text{____/____}}{} \)  
(same formula as _____)

Units  
* m/s or km/h  
(same units as _____)
What does a horizontal line on a motion graph mean?

Key
___=A___=B___=C

Acceleration

Acceleration ______ at which ______ changes

Formula

A=________

Vf=_______ Velocity  
Vi=_______ Velocity  
T=________

Units

* ___/___ or ___/

Ex.

Characteristics

______speed

Ex.

EX. Acceleration Graph

Ex.