Name_____Block_____Date_____

Ch 4 Newton's 1st Law

Mrs. Peck

Objectives:

Describe Galileo's contribution to the science of motion. (4.3)
State Newton's first law of motion and explain it using "numeric" examples. (4.4)
Distinguish among mass, volume, & weight, & their SI and other units of measurement. (4.5)
Using the metric system, convert mass given in grams to kilograms and vice a versa. (4.6)
Determine the magnitude of the resultant of vectors in a free-body diagram. (concept dev. practice pg 4-2)
Use the concept of inertia to explain why a bowl of water does not fall when you pull a table cloth out from underneath it. (activity in class)

Vocabulary:

equilibrium	mass	newton	friction
Newton's First Law	weight	force	normal force
inertia	kilogram	net force	
law of inertia	volume		

	symbol	**SI unit**	**other unit(s)**
weight	w	N newton	kg m/s^2
force	F	N newton	kg m/s^2
mass	m	kg kilogram	g
volume	V	l liter	ml
gravitational acc.	g	m/ s^2	kg m/s^2

Formulas:

know and how to use: w=mg

4.1 Aristotle on Motion

Aristotle classified 2 types of motion: 1. natural motion
2. violent motion

natural motion- no force applied on earth

objects seek their natural resting places

proper state of objects is resting
eg. the earth does not move it is at rest

motion occurring naturally straight up and down
eg. boulders on the ground and smoke up in the air

violent motion- is a result of forces that pushed or pulled

is an imposed motion, motion that had an external cause

4.2 Copernicus and the Moving Earth 2

Copernicus stated that the earth (& oth planets) move around the sun

very controversial bcs it was believed the Earth was the center of the universe

4.3 Galileo on Motion

Galileo supported Copernicus

Galileo debunked theory that force is needed to keep object moving

force- any influence that tends to accelerate an object
a push or a pull
is a vector quantity

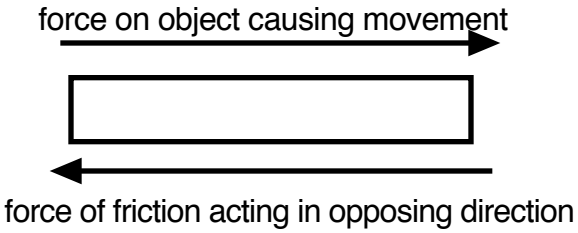
symbol- F SI unit- newton (N) other unit- kg m/ s^2

friction- force that acts to resist the relative motion of an obj. or materials that are in contact

caused by irregularities in surfaces that are touching

is a force.....therefore; it is a vector quantity Symbol F_f

frictional forces are 1. parallel to the surface in contact
2. act in direction to oppose motion



inertia- the reluctance of any body to change its state of motion
mass is a measure of inertia

inertia: inactivity, laziness, resistance to change state of motion

Galileo introduced inertia using incline planes in his experiments

Fig. 4.3 As the angle of the upward incline is reduced, the ball rolls a greater distance before reaching its initial height.

Galileo stated that the tendency of a moving body to keep moving is natural and that every material object resists change to its state of motion.....property to resist motion is inertia

a rolling ball would keep going forever (w/o friction)...not natural for it to come to rest

4.4 Newton's Law of Inertia 3

Newton's First Law or Law of Inertia- every body continues in its state of rest, or of motion in a straight line at constant speed, unless it is compelled to change that state by a net force exerted upon it

things tend to keep on doing what they're already doing

only a force can cause a change in the motion of a moving object

objects in a state of rest tend to remain at rest.....only a force will change that state

a moving object tends to move in a straight line indefinitely.....moving by its own inertia.....unless a force (eg. friction) acts upon it

forces are needed to overcome any friction that may be present and to set objects in motion initially.....once object is moving in a force free env. (peck's perfect world) it will move in a straight line indefinitely

? What would happen if threw a ball in outer space with no gravity or air molecules?

? A rock is swinging in a circle at the end of a string: what is the path of the rock when the string breaks?

4.5 Mass---A Measure of Inertia

the amount of inertia an obj. has depends on its mass

Mass is directly proportional to inertia

more mass------more inertia--- the more force it takes to change its state of motion

Mass is Not Volume

Volume- is amount of space that matter occupies

SI Unit: liters (L) other units: milliliters (ml), cubic centimeters (cm^3)

Mass- is amount of matter in an object

SI Unit: kilograms (kg) other units: grams (g)

4.5 Mass--A measure of Inertia 4
Mass is Not Weight

mass depends only on the number of and kind of atoms that compose it

mass does not depend on an object's location
inertia does not depend on an object's location

weight- is a measure of the gravitational force acting on an object

weight depends on an object's location

? An object has a mass of 150 kg, what would it's weight be in gravity-free outer space?

mass- is a measure of an object's inertia

is the quantity or amount of matter in an object

weight- the force on a body due to the gravitational attraction of another body (usually Earth)

is the force of gravity on an object

mass and weight are not equal to each other , they are not the same

*****mass and weight are proportional to each other in a given place

objects with little mass have little weight
objects with great mass have great weight

? In the same location: an object , A, has twice the mass of object, B. How does the weight of the two objects compare?

One Kilogram Weights 10 Newtons

newton- Si unit of force. One newton (N) is the force applied to a 1 kg mass that will produce an acceleration of 1 m/s^2

symbol- N 1 kg = 10 N

weight = mass X g (10 m/s^2) **w=mg** weight unit is a Newton for weight is a measure of gravitational force on obj.

? How much does a 2.5 kg ball weigh? How much does a 250 g ball weight?

4.6 Net Force

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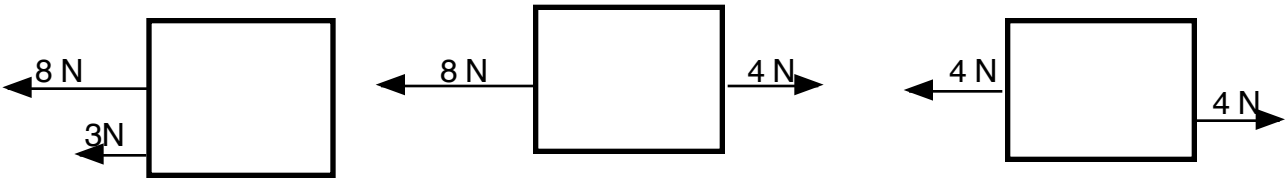
net force- the combination of all the forces that act on an object F_{net}

the net force is the vector sum of all forces.....the net force is the resultant force

in an absence of a net force objects do not change their state of motion

fig. 4.10 when more than one force acts on an object, the net force is the sum of the forces.

when forces act in the same direction, the net force is the sum of the forces
when forces act in opposite directions, the net force is the difference of the forces



? Net Force_____ **Net Force_____** **Net Force_____**

4.7 Equilibrium--When Net Force Equals Zero

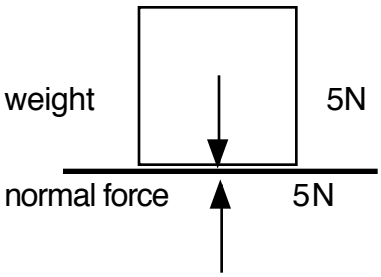
normal force- For an object resting on a horizontal surface, the upward force that balances the weight of the object

this force acts at right angles (normal) to the surface of object
normal to.....means at right angles to

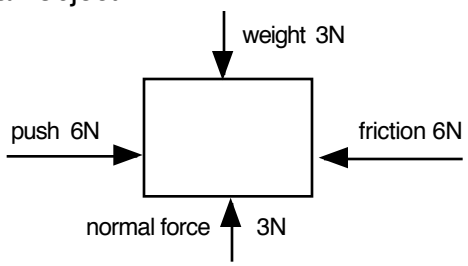
symbol for normal force is (F_n).....not a capital N which is symbol for a newton

fig. 4.11 an object at rest has a net force = 0 N = weight + normal force

equilibrium- A state of balance in which no net force acts on an object.

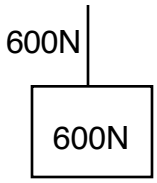


the net force (5N - 5N) = 0N
and the object remains at rest

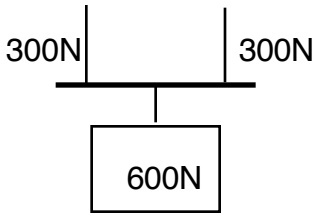


net force = (weight- normal) + (push - friction)
net force = (3N - 3N) + (6N - 6N) = 0 N obj. at rest

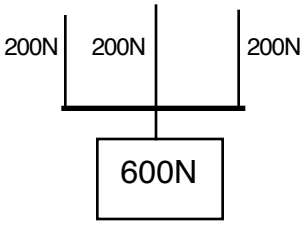
When you hang from a rope, the atoms in the rope are stretched apart. A **tension force** is created in the rope. The tension force in the rope (force acting upward) equals your weight (force acting downward). F_t



Net Force = 0N



Net Force = 0N



Net Force = 0N

? your mass is 80 kg. What is your weight?

? a block has a mass of 250g. What is its weight?

If you are hanging on a bar suspended by 2 ropes, what is the tension force of each rope? Draw a picture.