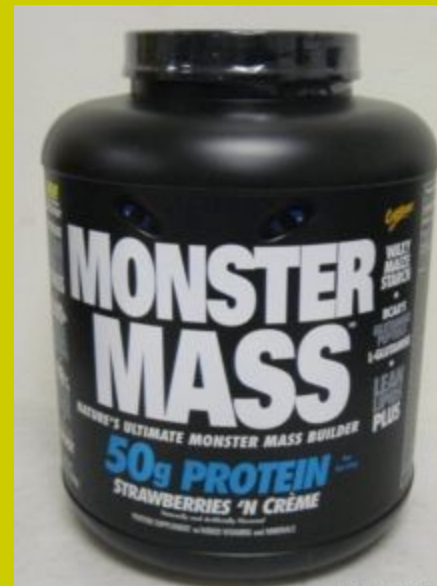


# Mass and Weight

# What is Mass????

- Mass is a measure of matter (inertia)
- Mass depends on the number and kind of atoms
- The mass of an object is the mass of an object regardless of where the object is
- Units: Kg



# What is Weight?????

- Weight is a measure of gravitational attraction of an object (g)
- Weight depends on where the object is (your weight on Earth is not the same as your weight on the moon).
- Weight = mass x g
- Units: Newtons ( $\text{kg m/s}^2$ )



# Weight

Weight is a  
*sensation*

of force we get as we press against other objects. You press against a scale to measure your weight. What pulls you against the scale?



# Gravity!

Gravity keeps trying to accelerate us toward the earth and we get pressed against things. This gives us the feeling of weight. Our perception of weight can be altered by our environment.



Really?

# That's Right

- Our perception of weight may be different in different circumstances.

What about if you're on the moon?



- The moon has less mass, therefore less gravity associated with it. There is less attraction between your body and the moon. The moon pulls on your body less than the earth...
- SOOOO...
- you would press down on a scale with less force. Your weight on the moon would be about  $1/6$  of your earthly weight.



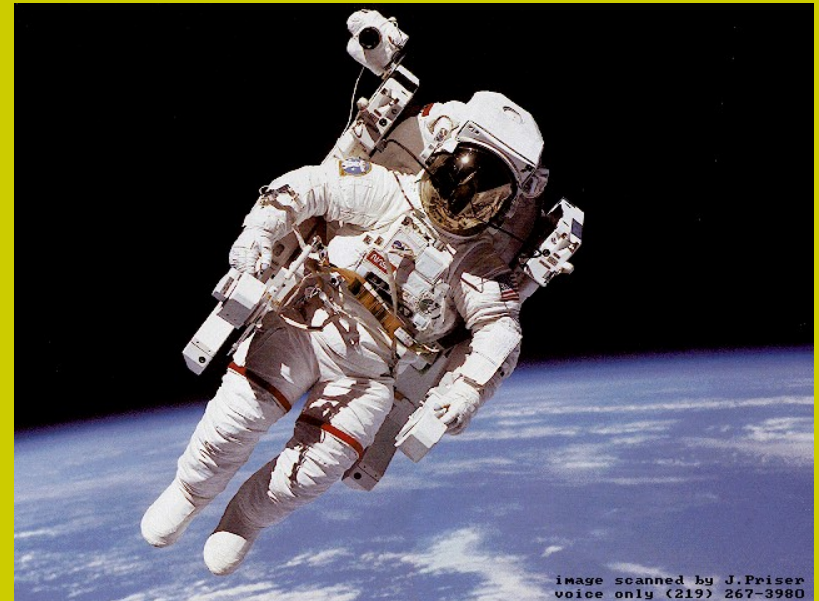
What about weightlessness?





# What about weightlessness?

- Astronauts in space feel weightless because they aren't forced against the floor.
- **But they still have mass!**





# We feel weight as a force!

- You typically measure your weight in pounds (lb)
- In the metric system (SI), weight is measured in newtons (N)
- $4.45 \text{ N} = 1 \text{ lb}$ .

ALSO...



Since weight is a product of mass and gravity the equation for calculating weight is...

$$w = mg$$

And what are these units you love so much?



$$w = mg$$

- Weight in newtons

Mass in kg

- Acceleration of gravity, symbolized by “g” is equal to ...

9.8 m/s<sup>2</sup>

At or near the earth's surface, gravity tries to accelerate objects 9.8 m/s faster each second

Um.. Excuse me, isn't that...?



$$N = \text{kg} \times 9.8 \text{ m/s}^2$$

weight

mass

acceleration  
of gravity (g)

# Yeah that's right!

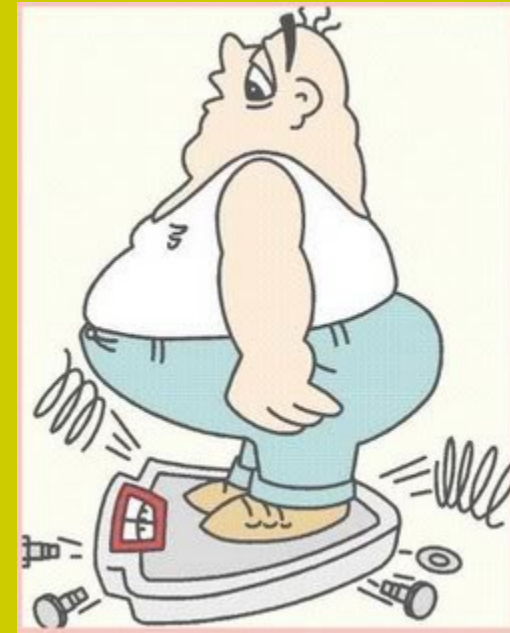
- It's the equation for force.
- Weight is a force!
- When we talk about the “force of gravity” we're really talking about the force of **WEIGHT!**
- Gravity is an acceleration.



That's what  
I thought!

# Important example problem

- Mr. O has a mass of 88.64Kg. What is Mr. O's weight on Earth
- $W = mg = 88.64\text{Kg} \times 9.8 \text{ m/s}^2 =$
- 868.7 N



# Example problem #2

- My first car was a 1964 International Harvester C1000 truck.
- It had a mass of 1814 Kg on earth.
- What would the mass be on the moon ( $g = 1.2 \text{ m/s}^2$ )?



The mass will be the same regardless of  $g$  on the moon !!!!!!!!!!!!!

Mine never looked this good!



- Then what will the truck's weight on the moon be?
- $W = mg = 1814 \text{ kg} \times 1.2 \text{ m/s}^2 =$
- 2,177 N



# COMPARE AND CONTRAST

## MASS

- Amount of matter
- Always remains constant
- Does not depend on gravity
- Measured in Kg

## WEIGHT

- Force gravity exerts on the matter
- Depends on gravity
- $\text{weight} = \text{mass} \times \text{gravity}$
- weight of an object changes if the gravity changes
- Measured in N

I feel so smart now!

