



## Weight or Mass?

**Q:** Aren't "weight" and "mass" the same?

**A:** Not really.

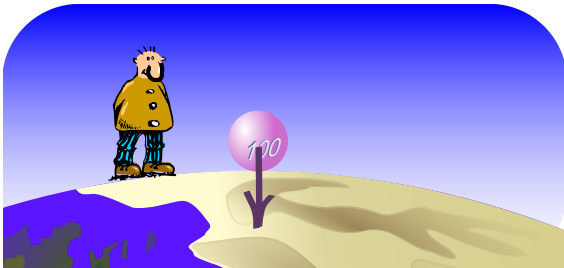


An object **has mass** (say 100 kg).

This makes it heavy enough to show a **weight** of "100 kg".

But the scales are only showing a guess of the mass above them!

## Gravity causes Weight



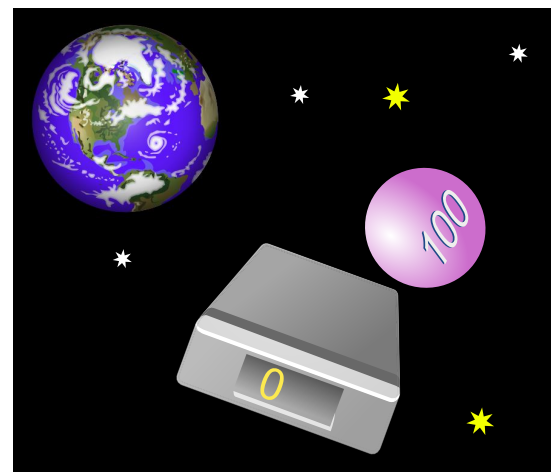
An object's **weight** is how hard gravity is pulling on it.

We think the weight is the same everywhere ...  
because we all live on the surface of the planet Earth!

**But** in orbit it would not push on the scales at all.

The scales would show **0** ...  
... but the mass is still **100 kg** !

An object's **mass doesn't change** (unless you remove some!), but its **weight can change**.



On the Moon the scales would *wrongly* show **16.6**  
for a mass of **100 kg**

Because the pull of gravity on the Moon  
is much less than on Earth



## So Why Do People Say Weight instead of Mass?

People often use "weight" to mean "mass", and vice versa, because **Gravity** is almost the same everywhere on Earth and we don't notice a difference.

*But remember .. they do not mean the same thing,  
and they **can** have different measurements.*

## Weight is a Force

So ... if weight and mass are different, why are they both in kilograms?

**Well, weight should not really be in kilograms!**

I have used "kilogram" so far because that is what you see on a pair of scales, but it is **technically wrong to talk about weight in kilograms ...**

... weight is a **force** ...

... which is measured in **Newtons**

## Newtons

The correct **unit** for force is the **Newton** ( $=1 \text{ kg}\cdot\text{m}/\text{s}^2$ ) which is abbreviated **N**.



On the Earth's surface gravity makes a  
**1 kilogram mass** exert about **9.8 Newtons of force**

So a 100 kg mass really weighs about 980 Newtons on Earth.



## Why Do Scales Show Kilograms?

Scales show Kilograms because that is what people understand best ...

... but it is really just an **estimate of the mass** above them.

Scales should really show Newtons, but that might confuse people!

*Question: how many Newtons should the scales show when **you** stand on them (hint: multiply kg by 9.8)?*

- So the scales show an **estimate of your mass** based on the force your body exerts on it.
- And to find out how much force your body is exerting on the scales, multiply by 9.8 (to convert kg into Newtons).

## Apparent Weight

But scales can be fooled ... because they measure a "downwards force" and don't know if it is gravity or some other force!

*Just jump up and down (gently!) on your scales at home to see your apparent weight change, while your mass stays the same.*

So your **mass** is the same, and your **weight** is the same (because the force of gravity hasn't changed), but your "**apparent**" **weight changes**. Read more at [Apparent Weight](#)

## Conclusion

- **Mass** is a measure of how much **matter** something contains
- **Weight** is a measure of how strongly gravity pulls
- **Apparent Weight** is a measure of downwards force

- **Force** is measured in **Newtons**, not kilograms
- When scales show "kg" it is just an **estimate** of the mass above them

[Question 1](#) [Question 2](#) [Question 3](#) [Question 4](#) [Question 5](#)  
[Question 6](#) [Question 7](#) [Question 8](#) [Question 9](#) [Question 10](#)

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