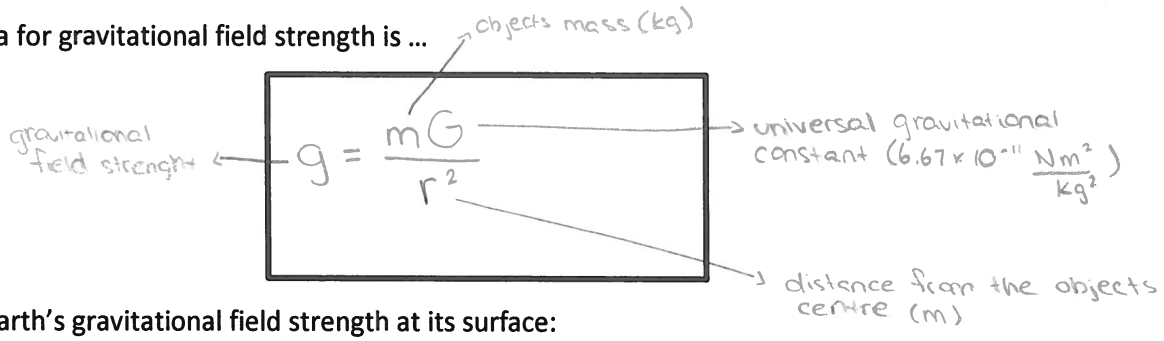
Section 5.2: Little "g"

The gravitational field strength is the magnitude of the gravity "force field" created by an object. It depends on how massive the object is and how far away it is.

The formula for gravitational field strength is ...



Calculate Earth's gravitational field strength at its surface:

$$g = \frac{(5.98 \times 10^{24})(6.67 \times 10^{-11})}{(6.38 \times 10^{6})^2} \rightarrow 9.8 \frac{N}{kg}$$

What are the units of "little g"?

$$g = \frac{mG}{r^2} = \frac{kg N m^2}{m^2 kg^2} = \boxed{\frac{N}{kg}}$$ can also be $\boxed{m/s^2}$

Unsurprisingly, we also call little g the acceleration due to gravity.

Little g can make our life easier, because it turns

$$F_g = \frac{m_1 m_2 G}{r^2}$$ into $\boxed{F_g = mg}$

Notable values of little g

Surface of Earth: 9.8 N/kg or m/s^2

Surface of Moon: 1.6 N/kg or m/s^2

Mass vs. Weight

F_g is also called weight. WEIGHT IS NOT THE SAME AS MASS !!!

	Mass amount of matter in something	Weight how hard gravity pulls on it
Metric System Units	kg	N
Imperial System Units	slugs	pounds

120 ÷ 2.2

Calculate your mass and weight on earth and the moon:

$F_g = mg$

	Mass	Weight	
Earth	55 kg	534 N	55 × 9.8
Moon	55 slugs	87 N	55 × 1.6

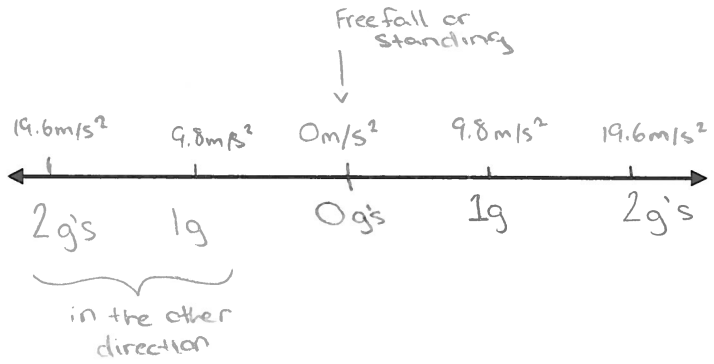
g-forces

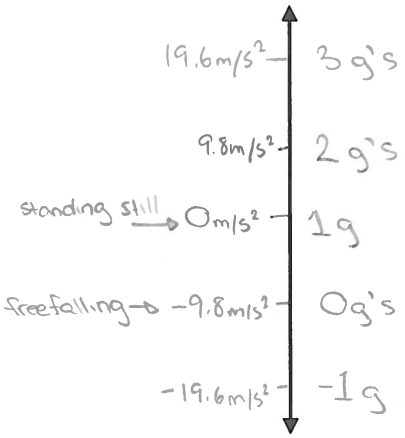
g-force is not a force. It is a measurement of how much acceleration an object has that is making it feel squished.

But not all acceleration makes you feel squished. For example, during free-fall on Earth, an object does not feel squished, even though it has an acceleration.

So, in most situations on Earth, g-force is acceleration relative to freefall, expressed as a multiple of $9.8 m/s^2$.

This gives us slightly different situations horizontally and vertically...





Example: An average person can handle about 4 g's upwards before blacking out. Astronauts and fighter pilots can handle about 9 g's. What acceleration does each of these correspond to?

4g's → $29.4 m/s^2$

9g's →