

Section 1: Force diagrams and equilibrium

Crucial points

1. **Don't confuse mass and weight**

Mass is a scalar quantity. It is a measure of the amount of matter in an object. The mass of an object is the same on the moon as on the earth.

Weight is a vector quantity. It is the force that acts upon objects subject to gravity. On the earth, the force of weight is always directed downwards, towards the centre of the earth.

From Newton's second law, $W = mg$, where W is the weight of an object m is its mass and g is the acceleration due to gravity. On the moon, the acceleration due to gravity is less, so objects with the same mass weigh less on the moon than on the earth.

Students often forget to multiply the mass of objects by g to give their weight.

2. **Make sure that you know Newton's laws thoroughly**

Newton's three laws are fundamental to the whole of mechanics. If you know and understand them well, they can really help you to avoid mistakes in mechanics problems. You should learn them carefully. In particular, remember that Newton's first law deals with two possibilities: an object at rest, and an object moving at constant speed.

3. **Always draw large, simple force diagrams**

Force diagrams do not need to be artistic, they do need to be large enough to label easily and show all relevant forces (see the example in the Notes and Examples). Students often either do not draw diagrams at all, or draw small, confusing ones. Try to get into the habit of drawing good force diagrams; they will help you in all of your Mechanics work.

4. **Remember what is meant by equilibrium**

An object in equilibrium is either at rest, or moving at constant speed. In either case, the resultant force acting on the object is zero.