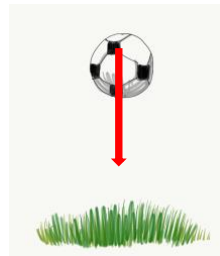# Newton's Laws

Newton's first law

If the forces acting on a body cancel each other out then the forces are said to be **balanced.** We say that there is **no resultant force** acting on the body.

If the resultant force on an object is zero it will either be at rest or travelling at a constant velocity

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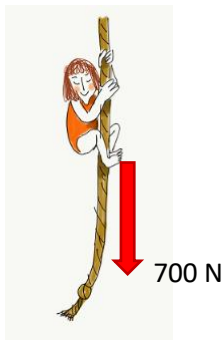A football with weight 6 N and mass 0.6 kg falls towards the Earth.

What is the acceleration of the ball?

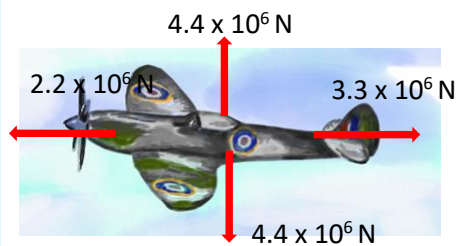A balloon is travelling downwards at constant speed. The buoyancy force is 2.5 N.

2.5 N

State the weight of the balloon?

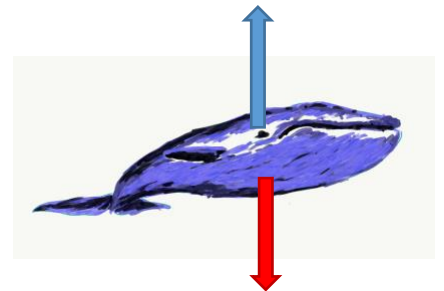A person with weight 700 N is hanging stationary on a rope

700 N

What is the tension in the rope?

A plane travels at 140 m/s with the following forces

4.4×10^6 N

2.2×10^6 N 3.3×10^6 N

4.4×10^6 N

What happens to the motion of the plane?

A whale has a mass of 5000 kg. If it is accelerating upwards at 2 m/s².*
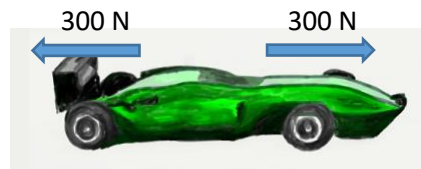
What is the size of the bouyancy force?

A parachutist falls downwards with the following forces. Her mass is 60 kg

800 N

600 N

Find the acceleration of the parachutist

A racing car is travelling at 40 m/s, and the thrust is 300 N and drag is 300 N.

300 N   300 N

Explain what happens to the motion of the car

Newton's second law

This deals with the case where the resultant is not zero, and relates the forces to the acceleration

$$Force = mass \times acceleration$$

N   kg   m/s²

Newton

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* The hardest question so a hint – find the resultant and then, remembering weight acts downwards, work out buoyancy

Newton's Laws

A rocket with a mass of 4000 kg and therefore weight of 40000N experiences an upwards force of 70000 N on takeoff. Sketch the rocket with forces

Find the acceleration of the rocket

Two minutes after takeoff the drag force has increased to 25000 N while the other forces remain the same. Sketch the rocket with forces

Find the new acceleration of the rocket

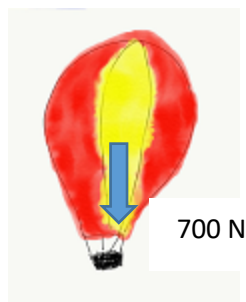What happens to the motion of the car if the thrust is larger than the drag?

A plane with weight 4.5×10^5 kg and thrust 5×10^6N is travelling at constant velocity. Draw the forces on the plane.
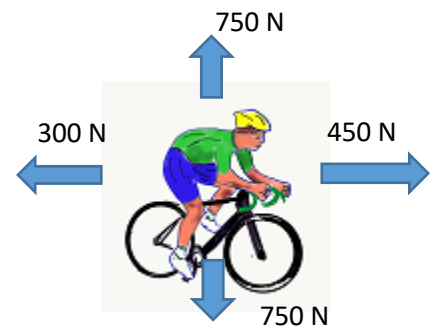

What is the air resistance?

What is the lift force?

A hot air balloon is stationary in the air. Its weight is 700 N.

700 N

What is the upthrust?

A cyclist with mass 75 kg experiences the following forces.

750 N

300 N   450 N

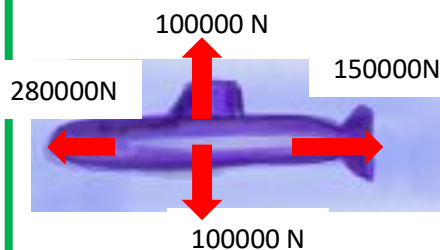

750 N

Find his acceleration

A car with mass 150 kg accelerates at 20 m/s². The drag force is 2000 N.

What is the resultant force?

What is the thrust from the engine?

A submarine with mass 10000 kg experiences the following forces.

100000 N

280000N   150000N

100000 N

Find the deceleration of the submarine.

A person with mass 65 kg is sliding down a rope with an acceleration of 0.1 m/s². Her weight is 650 N.

What is the tension in the rope?

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* The hardest question so a hint – find the resultant and then, remembering weight acts downwards, work out buoyancy