Science Trail

Fantastic Forces

This pack has been designed for teachers and adult group leaders to use while guiding groups around the Museum. Explore the topic of Forces and uncover the science and stories behind some of our amazing objects.

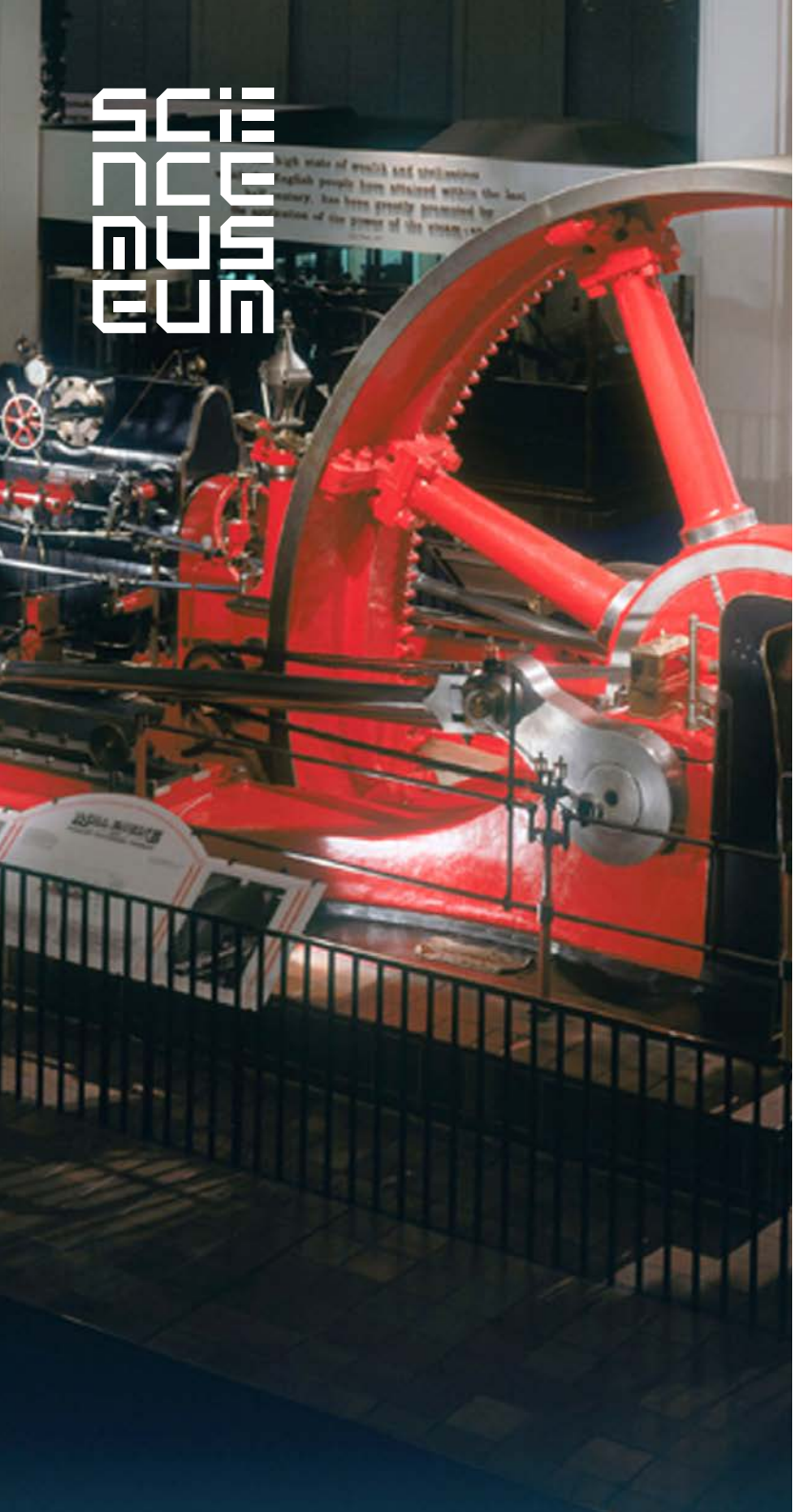
Tips for using this pack

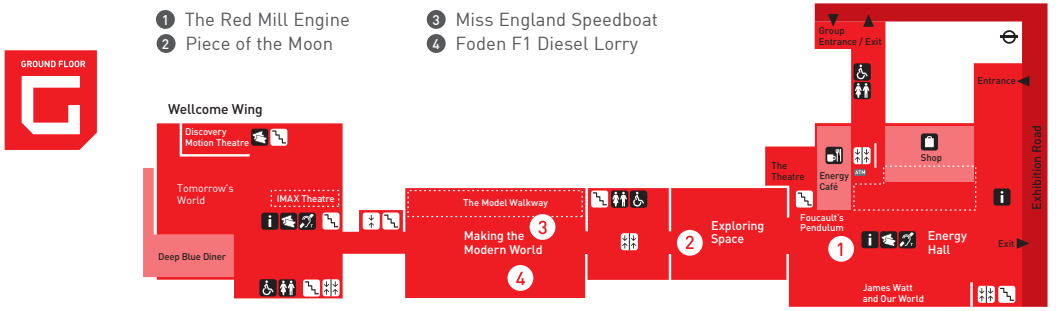
1. Use each page as your guide to help your students engage with an object – challenge them to find the object in its particular gallery and then take the lead on facilitating the activities.

2. You can use the pack as a trail, or dip in and out to fit around your schedule for the day. We recommend allowing at least 15mins for each object.

3. The activities work best with smaller groups, each lead by an adult. Give a pack to each adult in your group, the activities are easy to facilitate and don't require any pre-planning or prior knowledge.

4. The activities can be done in any order, so explore at your own pace.





The Red Mill Engine

Energy Hall, Ground Floor

This giant steam engine was used to power a huge cotton weaving mill during the 1900's. For the Victorians, steam power was at the heart of their daily lives – powering everything from huge factories to lawn mowers.

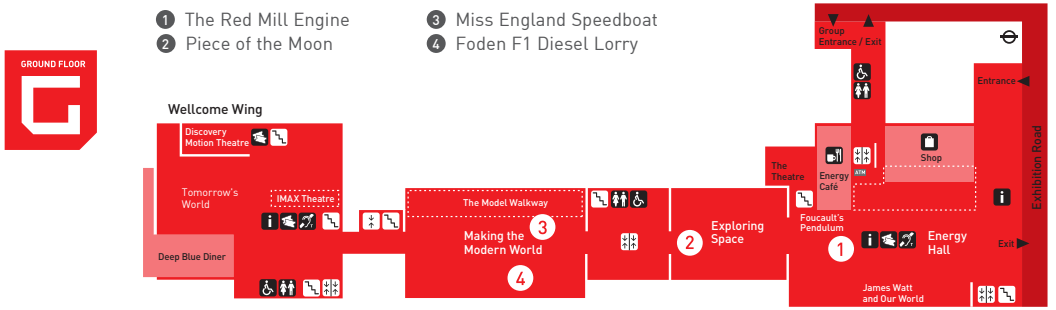
The Victorians got a lot of their energy from steam engines like this fuelled by coal, and believe it or not steam still plays a big part in providing us with power today. How many different energy sources can you name?

Fossil fuel: coal, oil, natural gas. Renewable energy: Solar power, wind, hydroelectric, biomass, tidal power, geothermal energy.

Look closely at the mill engine, can you find any mechanisms where specific forces are acting, like friction or gravity for example?

The engine uses steam power to work, the pistons drive the crankshaft which drives the flywheel which in turn would have powered the factory machinery. Can you identify the crankshaft and the flywheel? Use the animation nearby if you need help.

The flywheel is the huge red wheel, this would have transferred power to the factory via a belt.
The crankshaft connects the flywheel to the engine, the large long rods.



Piece of the Moon

Exploring Space, Ground Floor

This chunk of the Moon came back to Earth with astronaut David Scott after he landed on the Moon in 1971 as part of the Apollo 15 mission. It is around 3.3 billion years old.

This moon rock is kept in a special container filled with nitrogen so that it never comes into contact with the atmosphere on Earth. What do you know about the environment on the Moon? What do you think it is like there? How is it different from on Earth?

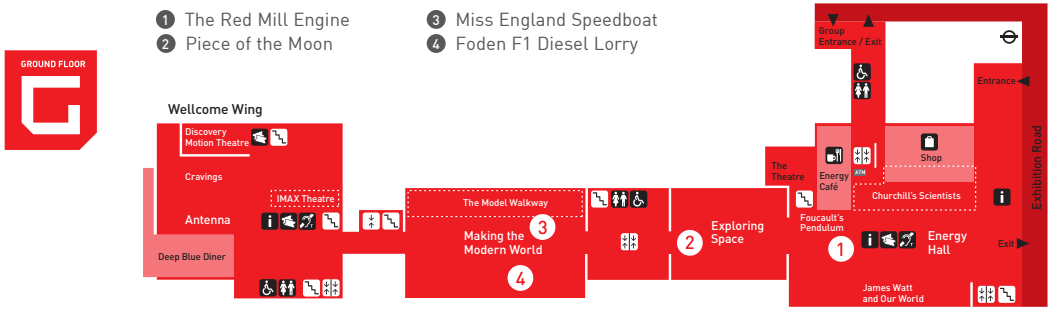
The ideas of weight and mass can be confusing – your weight is the force exerted on you by gravity, and your mass is how much of you there is. Look around the Exploring Space gallery, find the object you think has

a) The largest mass

b) The smallest mass

Gravity is the force that stops us floating away from the surface of Earth, but it is also the reason that objects (and people) have weight. Gravity on Earth acts more strongly than it does on the Moon.

Imagine you are walking on the Moon, demonstrate how you would move about, do you think your weight would be different there? What about the moon rock, would it feel heavier or lighter now that it is on Earth?



Miss England Speedboat

Making the Modern World, Ground Floor

The Miss England Speedboat became Britain's fastest boat in 1929, it reached a speed of 92mph and went head to head with its American rival Miss America VII.

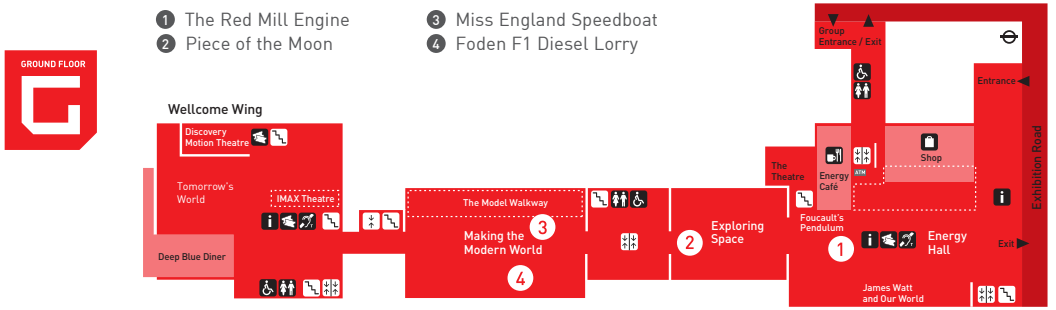
The pilot of Miss England, Sir Henry Segrave, was something of a thrill-seeker. He had already set the land speed record in his car Golden Arrow.

Have a look at Miss England, how many features can you find that helped her travel so fast? (Hint: It's not just the Engine) Can you think of any ways to make her travel even faster?

The hull was designed to be lightweight and to cut through the water. The engine in Miss England is a powerful aircraft engine.

Explore the MMW gallery, can you find anything else that looks like it could travel on water? Compare the design to Miss England, how many similarities and differences can you find?

The boat floats because 'upthrust' from the water balances the downward force from the weight of the boat. Experiment with balancing forces by getting into pairs, stand facing each other and push against each other hand to hand, keep your forces balanced or you might fall!



Foden F1 Diesel Lorry

Making the Modern World, Ground Floor

The Foden F1 was the first ever commercially successful diesel lorry. In 1931 when it was launched, truck makers still preferred to use petrol or steam power. This lorry is an important forerunner to the huge articulated lorries we see on motorways today.

This lorry has more than just 4 tyres, have a look at them, how are they designed? What are they made of? What are the advantages of these tyre design choices? Think about the force that stops us slipping around when we walk. You can also compare the soles of your own shoes, who is wearing the best shoes for walking on a slippery surface?

The F1 has 7 tyres including the spare. They are made of rubber and have a deep tread to increase friction.

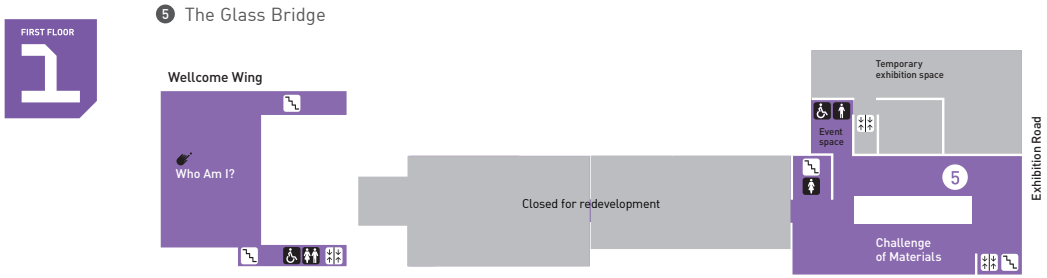
Friction is really important for the F1 Lorry to move around and for its brakes to work, but sometimes friction can be a disadvantage. Find something else in the MMW gallery that;

a) needs lots of friction to work best

b) needs to reduce friction to work best

Feel the effects of friction by rubbing your hands together quickly; can you feel the heat that is produced by the surfaces rubbing together? What happens if you press your hands together harder or more softly while rubbing them together?

The harder you press your hands together, the more difficult it will be to rub them together. The amount of friction will increase as you increase the force applied by your hands.



The Glass Bridge

Challenge of Materials, First Floor

The glass bridge sits 9.3m above the museum floor; it is suspended from many thin wires, the design of which was inspired by spider webs.

How many people do think this bridge can hold all at once? Would this number be the same if there were no wires suspending the bridge? Why?

The cables supporting the bridge spread the force so that it is not concentrated in the middle where it could become weak. This means it can take more weight than if the cables were not present.

What is the bridge made from and why do you think these materials were chosen? Explore the Challenge of Materials gallery and find another material that you think is good at withstanding lots of force.

Try looking for the bulletproof vest as a starting point!

How many wires do you think are holding up the bridge? Can you estimate by counting only the wires attached to one section of the bridge?

There are 372 wires supporting the bridge.

Supermarine Seaplane S.6B

Flight, Third Floor

In 1931 this Seaplane became the fastest vehicle on the planet; it set a world record speed of 407.5mph (at that speed you could get from London to Edinburgh in 1 hour!). It also competed in the prestigious Schneider Trophy race and won for Britain.

This design played a part in the development of the Spitfire used in World War II.

This plane was able to take off and land on water. Can you name any forces that would have been acting on the plane while it was in the air? What about after it had landed on the water?

In the air: Gravity, air resistance.

On the water: Gravity, up-thrust.

You could also discuss thrust from the plane's engine, friction between mechanical parts and surface tension.

Planes are designed to have an 'aerodynamic' shape; this helps to reduce air resistance and means they can travel faster. What features of the seaplane make it aerodynamic? Which aircraft in the gallery do you think is the most aerodynamic?

The Schneider Trophy is displayed somewhere not far from this plane, can you find it?

It's in the display case beneath the Seaplane's tail. The trophy shows the Spirit of Flight kissing the waves.