

Then the stronger the magnet, the larger the region around it that will be affected.

1. Explain, using examples including magnetism, the differences between contact and non-contact forces.
2. Someone states that 'magnets stick together'. What would be a better explanation of the behaviour of magnets?
3. Explain the similarities and differences between the Earth's gravitational and magnetic forces.

- i. Describe the rules about magnets attracting and repelling each other.
- ii. Describe what will happen in each of these situations:
 - a) The N pole of a magnet is brought towards the S pole of another magnet.
 - b) The S pole of a magnet is brought towards a piece of magnetised iron.
 - c) The N pole of a magnet is brought towards a piece of copper.
- i. Explain why a magnet hanging on a thread will respond to magnetic forces more easily than a magnet laying on a bench.

higher the strength of the field. The direction of the field lines is the direction in which a magnet would move if placed in the field – from north (N) pole towards south (S). This is the way a compass would point.

1. What does the pattern of iron filings around a magnet show? What does it not show?
2. Why are the lines of force closer together near the magnet poles?
3. Tiny fragments of substances other than iron could be used to show the force lines in a magnetic field. Choose which ones would work from this list: scraps of paper, steel, pepper, plastic, sawdust, nickel, house dust, copper, carbon.

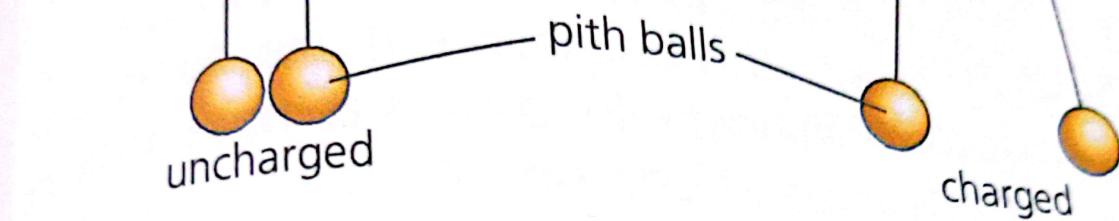


FIGURE 2.5.4.C: Repulsion between two identical charged objects

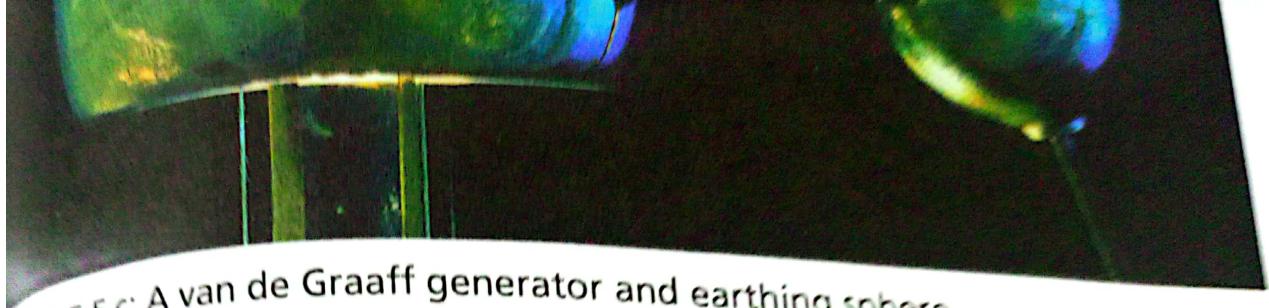
4. What could small pieces of dust and paper experience when a charged object is brought close?
5. What evidence supports the idea that static electricity exerts a non-contact force?
6. How could you find out if two charged combs repel each other?

Comparing static electricity and magnetism

in force

When an object becomes very highly charged with static electricity the charge usually escapes through contact with other objects or into the air. Lightning occurs when a large charge escapes quickly from clouds that have become charged during a storm.

1. Thinking about forces, in what ways are magnetism and static electricity similar?
2. Devise a method for finding out which can give the greater force of attraction – magnetism or static electricity.
3. Suggest why TV screens often attract more dust than walls that are close by.



2.5.5.c: A van de Graaff generator and earthing sphere

1. Explain why experiments with static electricity give better effects in dry weather.
8. a) When a van de Graaff generator is turned on, explain what effect it has on the electrons in a person's body when they touch the globe.
b) Using your answer from question 8a suggest why the person's hair stands on end.
c) Explain the process of discharging the globe of a van de Graaff generator.

The rest of the metal from the surroundings. Normally the electroscope hangs downwards against the copper strip, but when it becomes charged it is repelled from the copper strip and lifts up.

1. Explain why it is important for the insulated body of the copper strip to be
2. In an experiment a negatively charged rod is gradually brought closer to the cap of the electroscope. At first the gold leaf hangs down against the copper strip, but the closer the rod comes to the cap, the further the gold leaf is deflected.
 - a) Explain why the gold leaf hangs down against the copper strip when the rod is far away from the electroscope.
 - b) Explain why the gold leaf is deflected when the rod is close to the cap of the electroscope.
 - c) Explain what you would expect to happen if the rod was taken away again.

flat surface is easy, but when spray-painted it is hard to reach into all the corners. Furthermore, a small paint can end up missing its target when sprayed.

Paint spraying can be improved by using spray guns that give a positive charge to the paint. The object being painted is negatively charged. The **electrostatic attraction** pulls the mist of paint onto the object.

1. State two advantages of using electrostatics in paint spraying.
 2. When paint spraying uses electrostatics, how is the paint attracted to the object being painted?

Printers and photocopiers

hotocopiers work by using an electrostatic effect. Figure 5.7b shows how this works. Inside a hotcopier there is a drum which is covered in a thin layer of static electricity. The drum is charged with a negative charge. A beam of light from a laser passes through a lens and onto the drum. The beam of light is focused onto the drum so that it creates a positive charge on the drum at that point. This positive charge attracts the toner particles which are positively charged. The toner particles are attracted to the drum and stick to it. The drum then rotates and the toner particles are transferred to the paper. The paper is then heated to melt the toner particles and they stick to the paper.

"plate" heated to make it stable



QURE 2.5.7b: Static charge attracts the ink to create an image in a photocopier.



3. From the information in Figure 2.5.7b, deduce what the charge on the toner in a photocopier is.
4. Suggest how a photocopier can be made to print shades of grey as well as black. Use the idea of static charge in your answer.
5. Even though printers and photocopiers use static charge, explain why it is unusual to get a shock from them.
6. Explain how an image can be copied accurately by a photocopier.

think about someone dropping an object (Figure 2.5.8c) – it falls to fall and gets faster. By the end of the first second it is falling at 10 m/s. During the next second the object continues to accelerate and by the end of that second it is falling at 20 m/s. For every one second of free fall the speed increases by 10 m/s. We say that the acceleration due to gravity (at the Earth's surface) is 10 metres per second, per second (10 m/s/s or 10 m/s^2).

1. Explain why the gaps between the object's positions in Figure 2.5.8c get bigger each time.
2. Imagine a situation where gravity on Earth could be magically turned off. Explain what would happen to the movement of an object if it was allowed to drop for one second and then gravity was turned off.

still receive signals from other planets and the Sun. Signals from the scientists on Earth allow Voyager 1 and 2 to be controlled by tiny thrusters and provide enough force to keep the spacecraft heading in the right direction. The thrusters are tiny jet engines that burn fuel, and the waste gases ejected from them provide pushing force. They use very small amounts of fuel, but because there is no chance of refuelling, Voyager spacecraft will eventually drift uncontrolled through space.

6. Explain why Voyager spacecraft only need very weak thrusters to keep on track.
7. Suggest what might happen to the Voyager spacecraft if they had no thrusters.
8. Suggest why the Voyager spacecraft have jet engines rather than propellers.

Explain the problems that a downhill ski racer and powder skier would encounter if they swapped skis.

Suggest how the design of a hand-operated tin opener could be improved. Use scientific ideas to explain how your improvement would work.

Sketch a design for a rucksack showing how its features make it comfortable to carry.

- Newton's Law of Pressure
1. An engineer wants the floor of a car to be able to take a total force of 12000 N from all the seats. The floor can take a pressure of 24000 Pa. What area must the seat supports be?
2. When someone is on a trampoline they may be sitting down or on their feet.
- a) Explain whether the pressure on the trampoline is higher when sitting or standing.
 - b) How could you calculate the difference in the pressures exerted when sitting or standing?
 - c) Explain why the pressure exerted on a trampoline is greater when a person bounces rather than stands still.

What would the atmosphere be like in an area of low pressure compared to that in an area of high pressure?

Look at Figure 2.5.15c and suggest what the weather over Britain might be.

i. Name some areas on the map where you would expect there to be a lot of cloud.

Climbing mountains

Early all organisms depend on a readily available supply of oxygen so that they can release energy during respiration. At high altitude

complicated to day and place to place. To give an atmospheric pressure reading of height a pilot needs to set the altimeter reading of the airport. Even with this, the pressure altitude of the flight cause errors in the height reading. Planes also have GPS (global positioning system), which uses satellites to indicate position and altitude.

Explain how a barometer could be affected by:

a) a leak in the flexible container

b) a rigid container of air instead of a flexible one.

Explain why even a top-quality altimeter will not always be accurate.

See how well you have understood the ideas in ...
... by trying to ... **see which of these statements is true? [11]**

- Thinking about electrostatics...
 - positive (+) charge repels negative (-) charge
 - positive (+) charge attracts positive (+) charge
 - negative (-) charge attracts positive (+) charge.
 - negative (-) charge attracts negative (-) charge.
 - Which is the correct explanation of pressure? [1]
 - Pressure is higher when the force applied is smaller.
 - Pressure reduces when the area that a force is applied to is decreased.
 - When you push a drawing pin into a board, the pressure is the same on both ends.
 - Pressure depends on the size of a force and the area over which it is acting.
 - Which of the units is correct for pressure? [1]
 - Pa
 - Nm²
 - N
 - force
 - Which of these statements is not true? [1]
 - The gravitational field of a planet is stronger on its surface than 100 km away.
 - Gravity exists throughout the Solar System.
 - Small objects have very weak gravitational fields.
 - The acceleration caused by gravity is larger for heavy masses.
 - Why does a wooden block float but a steel one sink? [2]
 - Explain how the pressure that a chair exerts on the floor would be affected if table mats were put under all the legs. [2]
 - Explain, with the help of diagrams, how to... [4]

forces in paper, are not nearly as strong.

5. Use ideas about intermolecular forces to explain why you can put your hand through air but not through wood.
6. What can you say about the intermolecular forces between the particles of jelly compared with those of a metal?
7. Describe the relationship between the energy of the particles and the intermolecular forces holding them together.
8. What do you think is in between the particles of a gas?

They are ... used to represent the different types of atoms in the particle model.

Duralumin is an alloy made from 96 per cent aluminium (very light) and 4 per cent copper (heavy). What might the particle model look like?

Use the particle model to explain why some alloys are less ductile than the metals they are made from.