

Electric fields

4.2.5.2 · Electricity · revision notes

A charged object creates an electric field around it, and another charged object in that field experiences a force. You need to draw the field pattern of an isolated charged sphere and use the idea of an electric field to explain non-contact forces and sparking. This is in GCSE Physics only, not Combined Science.

Key facts

- A charged object creates an electric field around itself
- The field is strongest close to the object and weaker further away
- Field lines show the direction of the force on a small positive charge
- A second charged object in the field experiences a force
- Closer together → bigger force
- Isolated sphere: straight radial lines; outwards for positive, inwards for negative

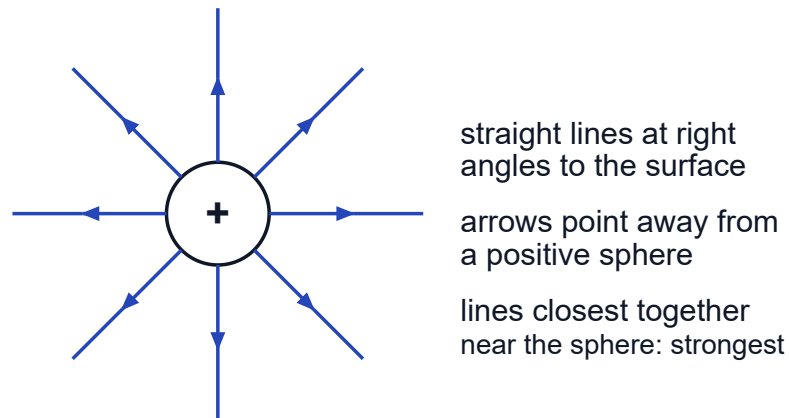
Notes

What an electric field is

- A charged object creates an **electric field** around itself.
- The electric field is the region where a second charged object **experiences a force**.
- The field is **strongest close** to the charged object. The further away from the object, the **weaker** the field.
- So the force between two charged objects gets **stronger as the distance between them decreases**.

Drawing the field of an isolated charged sphere

- Draw straight **field lines** going out from the surface of the sphere in all directions, evenly spaced, like the spokes of a wheel (radial lines).
- Each line meets the surface at right angles, as if it came from the centre of the sphere. Field lines never cross.
- The arrows show the direction of the force on a small **positive** charge placed in the field.
- **Positive** sphere: arrows point **away** from the sphere. **Negative** sphere: arrows point **towards** the sphere.
- The lines are closest together near the sphere, which shows the field is strongest there.



Positive sphere: radial lines, arrows outwards. For a negative sphere the arrows point inwards.

Using fields to explain forces and sparks

- Two charged objects are each in the other's electric field, so each experiences a force without touching: a **non-contact force**.
- Moving them closer puts each one in a stronger part of the other's field, so the force increases.

How to answer each type of question

Draw the electric field pattern

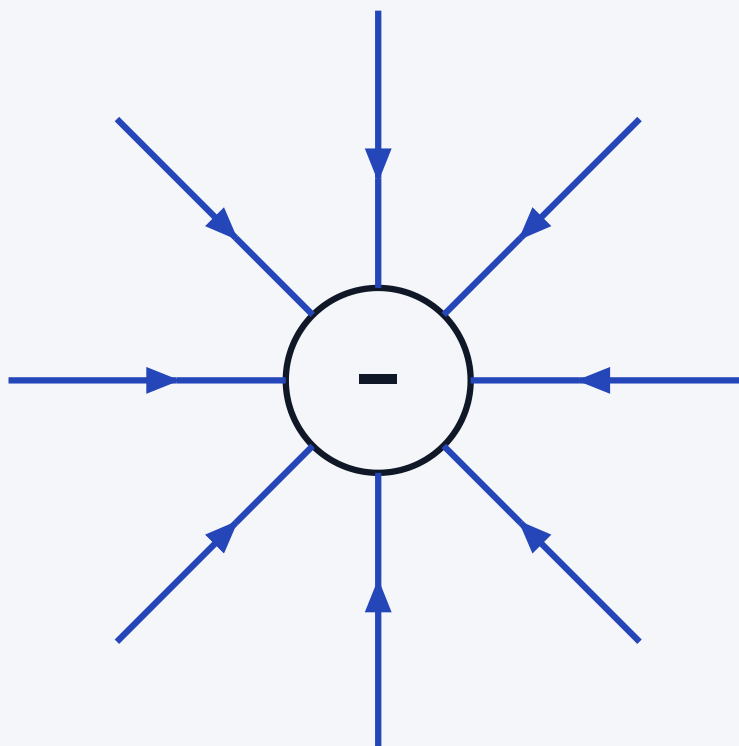
2 marks

Grade 5

1. Use a ruler. Draw at least four evenly spaced straight lines starting at the surface of the sphere and pointing radially (as if from the centre).
2. Add an arrow on every line: away from a positive sphere, towards a negative sphere.

Example. Draw the electric field pattern around an isolated negatively charged sphere.

Model answer.



At least four straight, evenly spaced lines drawn radially from the surface of the sphere (1). Arrows on the lines pointing towards the sphere (1).

Don't lose marks

- ✗ Drawing curved or crossing lines around a single sphere, or forgetting the arrows.
- ✗ Drawing arrows the wrong way: outwards is for a positive sphere, inwards for a negative sphere.
- ✗ Saying the field is the same strength everywhere, or strongest far from the object.
- ✗ Explaining a non-contact force without saying that the second object is in the first object's electric field.

More tips

Memory tricks

- The arrows show where a small positive charge would be pushed: away from +, towards -.
- An isolated charged sphere looks like the spokes of a bicycle wheel.
- Closer field lines = stronger field.

Exam technique

- When a question says 'use the idea of an electric field', the words 'electric field' and 'experiences a force' must appear in your answer.
- For field drawings, use a ruler and draw at least four evenly spaced lines with arrows.
- For sparking, build the chain: large charge → very strong field → air ionised → charge flows → spark.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4

Describe what an electric field is

The region around a charged object where another charged object experiences a force.

Grade 5

Describe how field strength changes with distance

The field is strongest close to the charged object and weaker further away.

Grade 5

Draw the field of a charged sphere

Straight radial lines: arrows point outwards for a positive sphere and inwards for a negative sphere.

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