

Charge, fields and sparks

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Worksheet

Name: _____ Date: _____ Class: _____

These 20 problems train you to explain charging by friction, draw electric field patterns, and use $Q = I \times t$ and the electron charge in calculations. They move from simple rules to multi-step problems on lightning, generators and industrial uses.

The set suits GCSE, IGCSE, O Level, CBSE Class 9-10 and NGSS high school physics. Convert prefixes such as mA, μC and nC before using any equation.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE P2, HS-PS2-4

Problem 1 Attract or repel (easy)

State whether each pair of charged balloons attracts or repels.

1. Two positive balloons
2. One negative and one positive balloon
3. Two negative balloons

Problem 2 Rubbing a rod (easy)

Emma in Leeds rubs a polythene rod with a woollen cloth. The rod becomes negatively charged.

1. Name the particles that move.
2. State whether they move from the rod to the cloth or from the cloth to the rod.
3. State the charge on the cloth.

Problem 3 Charge from current (easy)

A phone charger in Pune carries a current of 2.0 A for 5.0 s.

1. Write the equation linking charge, current and time.
2. Calculate the charge that flows.

Problem 4 Milliamps and minutes (easy)

A small motor carries 250 mA for 2.0 minutes.

1. Convert the current to amps and the time to seconds.
2. Calculate the charge that flows through the motor.

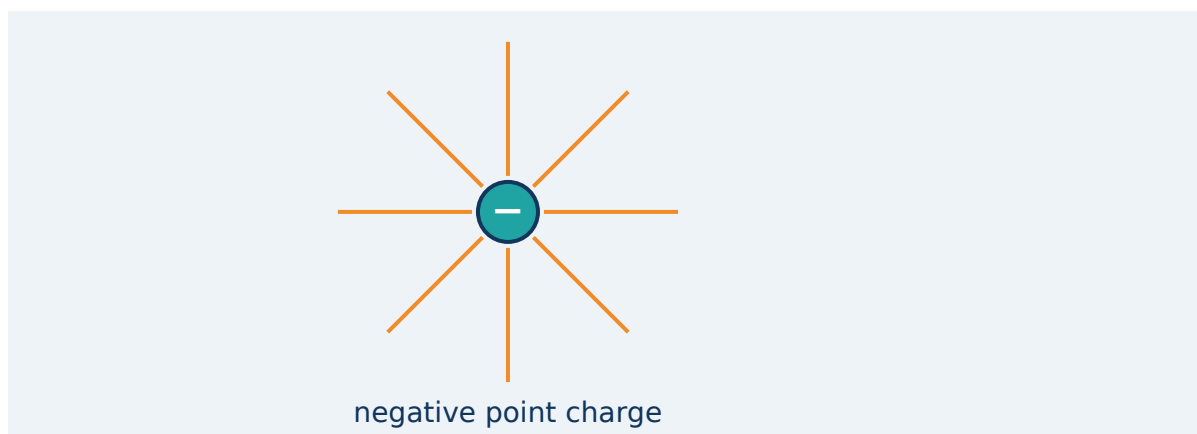
Problem 5 Conductor or insulator (easy)

Classify each material as a conductor or an insulator: copper, polythene, steel, rubber, glass, aluminium.

Problem 6 Add the arrows (easy)

Complete the field diagram for a negative point charge.

1. State the direction in which the field lines point.
2. Copy the diagram and add an arrowhead to each line.
3. Describe how the field strength changes as you move away from the charge.



Field lines around a negative charge. The arrowheads are missing.

Problem 7 Counting electrons (medium)

A dusty plastic sheet carries a charge of 4.0 nC ($4.0 \times 10^{-9} \text{ C}$). The charge on one electron is $1.6 \times 10^{-19} \text{ C}$.

1. Write the equation for the number of electrons.
2. Calculate how many extra electrons the sheet holds.

Problem 8 How long does it take (medium)

A charger delivers 36 C at a steady current of 1.5 A .

1. Rearrange $Q = I t$ to make t the subject.
2. Calculate the time.

Problem 9 Current from charge (medium)

In a school lab in Kampala, 90 C of charge flows past a point in a wire in 3.0 minutes.

1. Convert the time to seconds.
2. Calculate the current.

Problem 10 The balloon on the wall (medium)

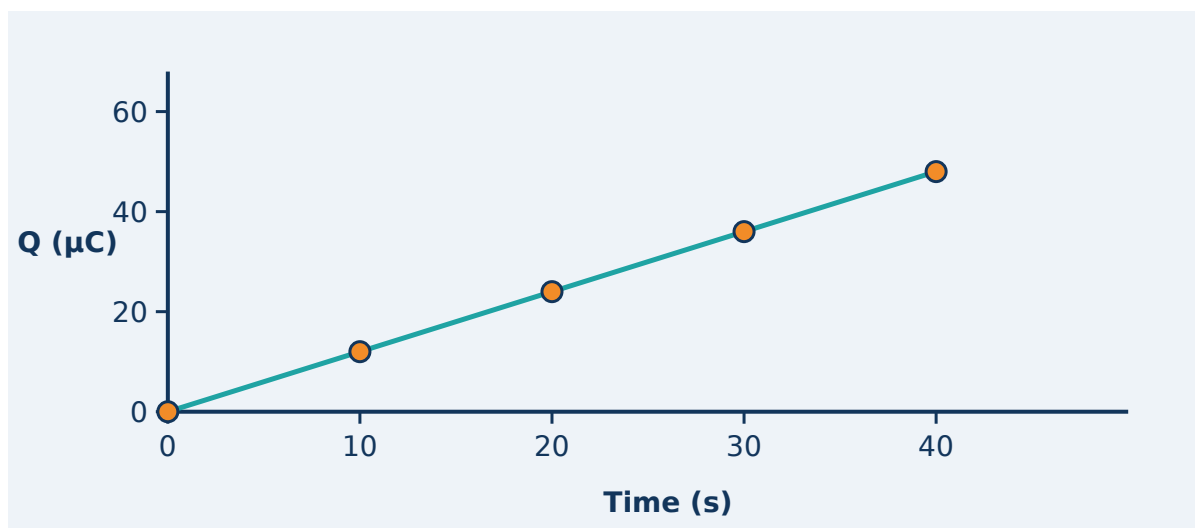
After being rubbed on hair, Mei's balloon sticks to a neutral wall.

1. State the charge on the balloon.
2. Explain, using the movement of charge in the wall, why the balloon is attracted.

Problem 11 Charging graph (medium)

The graph shows the charge collected on a metal dome in a lab.

1. State the charge collected after 30 s.
2. Calculate the gradient of the graph.
3. State what the gradient represents and give its unit.



Charge collected on a metal dome against time.

Problem 12 Refuelling safely (medium)

Kofi in Accra watches a fuel lorry. A metal wire joins the lorry to the ground before the pipe is connected.

1. Explain how charge could build up on the lorry.
2. Explain why the earthing wire makes refuelling safer.

Problem 13 Spray painting a bicycle frame (medium)

A factory in Singapore sprays a metal bicycle frame. All the paint droplets are given the same charge and the frame is earthed.

1. Explain why the droplets spread out evenly in the air.
2. Explain why paint is attracted to the frame.

Problem 14 Gold-leaf electroscope (medium)

Chiamaka in Lagos holds a negatively charged rod near the metal cap of a neutral gold-leaf electroscope, without touching it. The gold leaf rises away from the metal stem.

1. Explain why the leaf and stem now carry the same sign of charge.
2. State what happens when she moves the rod away.

Problem 15 Spot the errors (medium)

Bilal wrote three statements. Correct each one.

1. "When a rod is rubbed, protons move onto it."
2. "Like charges attract."
3. "A current of 5 A for 2 s carries 2.5 C."

Problem 16 A lightning flash (hard)

A lightning flash transfers 6.0 C in 0.20 ms (2.0×10^{-4} s).

1. Calculate the average current.
2. Calculate how many electrons move.
3. Explain why lightning is far more dangerous than a spark from a jumper.

Problem 17 Van de Graaff dome (hard)

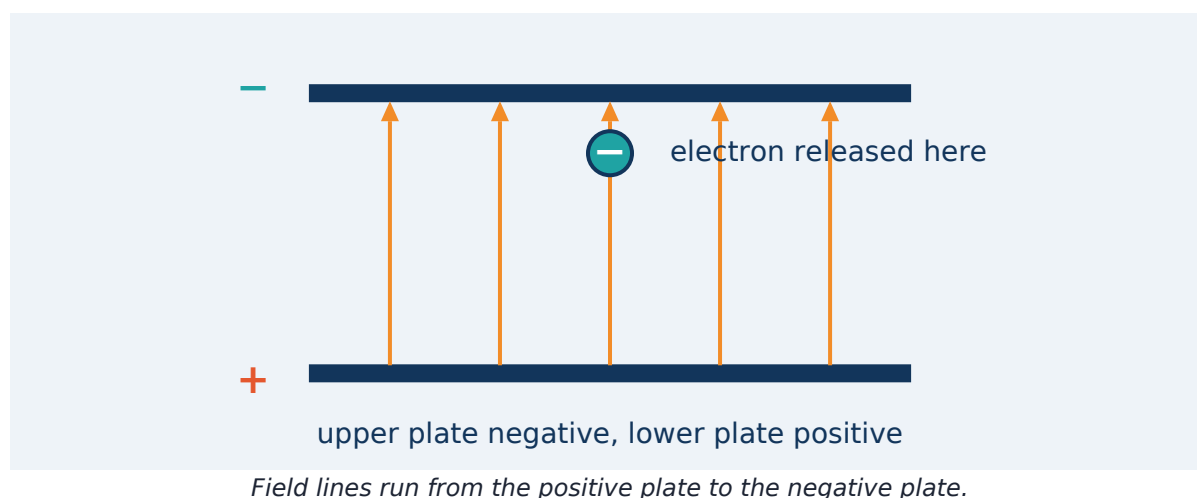
A belt in a school generator carries charge to the dome at a steady current of $2.5 \mu\text{A}$ (2.5×10^{-6} A).

1. Calculate the time to collect 50 μC .
2. Calculate how many electrons arrive each second.
3. Explain why the dome stops charging when a spark leaves it.

Problem 18 Electron between plates (hard)

An electron is released just below the negative upper plate of a pair of parallel plates (see figure).

1. State the direction of the field lines.
2. State the direction of the force on the electron and explain your answer.
3. Predict the motion of a proton released at the same place.



Problem 19 Dust in a chimney (hard)

A cement factory cleans smoke with a precipitator. Dust particles pick up 20 electrons each and then pass between plates.

1. Calculate the charge on one dust particle.
2. State the sign of the charge on the plate that attracts them.
3. Explain why the dust sticks to the plate and how it can be removed.

Problem 20 Rod and discharge (hard)

A rod gains 5.0×10^{10} electrons when rubbed. It is then touched to earth, and the charge flows away in 0.040 s.

1. Calculate the charge on the rod before discharging.
2. Calculate the average current during discharge.
3. Explain why the person holding the rod feels nothing.