

Charge, fields and sparks

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

The model answers show the mark allocation. Allow equivalent wording, and give error carried forward when a wrong earlier value is used correctly in the next step.

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

Question 1 Forces between charges (2 marks)

- a. Like charges repel; unlike charges attract.
- b. **Electrons** moved; the cloth is **positive**.

Marking: 1 mark for the rule; 1 mark for both electrons and positive cloth.

Question 2 Charge in a circuit (3 marks)

- a. $t = 3.0 \times 60 = 180 \text{ s}$. $Q = It = 0.20 \times 180 = \mathbf{36 \text{ C}}$
- b. $N = 36 \div 1.6 \times 10^{-19} = \mathbf{2.3 \times 10^{20} \text{ electrons}}$

Marking: 1 mark for converting minutes to seconds; 1 for the answer; 1 for the electron count.

Question 3 Field lines (3 marks)

- a. Arrowheads point **towards** the sphere.
- b. Close lines show a **strong** field; lines spreading out show a weaker field.
- c. The positive charge is **attracted** and moves towards the sphere.

Marking: 1 mark for each part.

Question 4 Car door shock (3 marks)

Rubbing against the seat transfers electrons, so Wanjiru becomes charged. Her body is insulated from the ground by her shoes. When she touches the metal door, the charge flows through a spark, giving a small shock.

Marking: 1 mark for charging by friction (electron transfer); 1 for charge building up because she is insulated; 1 for sudden discharge to the conductor.

Question 5 Spark current (3 marks)

$$I = Q \div t = 6.0 \times 10^{-8} \div 2.0 \times 10^{-6} = \mathbf{0.030 \text{ A}} \text{ (30 mA)}$$

Marking: 1 mark for the equation; 1 for substitution; 1 for the answer with unit.

Question 6 Earthing aircraft (2 marks)

Fuel moving through the hose builds up charge by friction. Earthing lets the charge flow safely away, **so no spark can ignite the fuel vapour.**

Marking: 1 mark for charge building up; 1 mark for the safe discharge and no spark.

Question 7 Using static charge (2 marks)

Example: spray painting. The droplets are given the same charge, so they repel and spread out evenly, and the earthed object attracts them to give a smooth coat.

Marking: 1 mark for a correct use; 1 mark for explaining the role of charge. Accept smoke precipitators or inkjet printers.

Question 8 Number of electrons (2 marks)

$$N = Q \div e = 4.8 \times 10^{-9} \div 1.6 \times 10^{-19} = \mathbf{3.0 \times 10^{10} \text{ electrons}}$$

Marking: 1 mark for the method; 1 mark for the answer.