

Exercise walk-through

Electric Charge and the Process of Charging ■ 8.2

eXercise

You must be able to

- distinguish **conductors** 导体 from **insulators** 绝缘体
- explain charging by **friction** 摩擦, **conduction** 接触, and **induction** 感应
- explain the role of **grounding** 接地 in charging
- account for charge distributions using **conservation of charge**

Method — Conductors and insulators

Charge moves freely in a **conductor**, but stays put in an **insulator**.

Method — Three ways to charge

Friction (transfers electrons), conduction (contact shares charge), and induction (a nearby charge rearranges charge, then grounding removes some).

Method — Grounding

A **ground** is a huge charge reservoir: it can supply or drain electrons, fixing the sign of an induced charge before the connection is broken.

Practice 2.1 ■ 2 marks

State the three methods of charging an object.

Solution 2.1

Worked steps

friction, conduction (contact), and induction **B1** **B1** *for any two; for all three.*

Practice 2.2 ■ 2 marks

Explain the role of grounding when charging a conductor by induction.

Solution 2.2

Method: Three ways to charge

Worked steps

grounding lets electrons flow in or out **B1**, leaving the conductor with a net induced charge once the ground is removed **B1**.

Practice 2.3 ■ 1 mark

State where excess charge sits on an isolated solid conductor.

Solution 2.3

Method: Conductors and insulators

Worked steps

entirely on its outer surface **B1**.

Exam-style 3.1 ■ 1 mark

Charging by induction requires

- A** direct contact only
- B** rubbing two materials
- C** a nearby charge and a ground connection
- D** heating the object

Solution 3.1

- A** direct contact only
- B** rubbing two materials
- C** a nearby charge and a ground connection 
- D** heating the object

Worked steps

C.

Exam-style 3.2 ■ 1 mark

Grounding a conductor allows it to

A gain or lose electrons

B melt

C become an insulator

D store light

Solution 3.2

A gain or lose electrons



B melt

C become an insulator

D store light

Worked steps

A.

Exam-style 3.3 ■ 1 mark

A positively charged rod is held near a neutral metal sphere; the sphere is then grounded, and the ground is removed before the rod.

- (a) State the sign of the final charge on the sphere.
- (b) Explain the sequence of steps that produces it.

Solution 3.3

Method: Grounding

Worked steps

(a) negative **B1**. (b) the positive rod attracts electrons to the near side; grounding lets more electrons flow onto the sphere; removing the ground traps this extra negative charge, then removing the rod leaves the sphere negatively charged **B1 B1 B1**.