Comb vs spoon

Conductor	Insulator
charge leaks	charge stays

Rubbing moves **electrons** from one object to another.

A rubbed plastic comb keeps its charge; a hand-held steel spoon **loses it to the earth**.

Conductors

Cu, Al, Fe, Ag

free electrons move

Metals have **free electrons** (≈ 1 per Cu atom).

Charge on a conductor **spreads over its whole surface**. The human body and the earth are conductors too.

Insulators

glass, plastic, nylon, wood

electrons stay bound

Electrons stay **bound to their atoms**.

Charge **stays where it was put**: that is why rubbed plastic works.

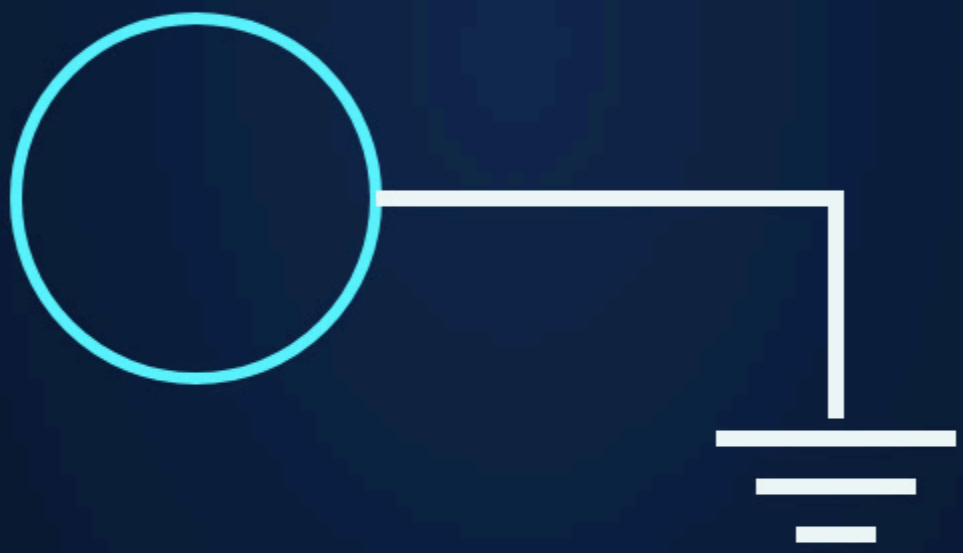
How big is the gap?

1.7×10^{-8} $\Omega \cdot m$ · ratio $\approx 10^{18}$ $\geq 10^{10}$

Resistivity: copper $\approx 1.7 \times 10^{-8}$ $\Omega \cdot m$, glass $\geq 10^{10}$ $\Omega \cdot m$.

In between: **semiconductors** such as silicon.

Earthing



Joining a charged body to the earth lets its extra charge flow away: **earthing** (grounding).

The earth is so big that it is a **giant reservoir of charge**: its own state does not change.

Safety at home

earth wire (green)

metal body → plate in the ground

Appliances like an iron or fridge have their metal body joined to the **earth wire**.

In a fault, current goes to earth instead of through you, and the **fuse blows**. Fuel tankers are earthed to stop static sparks.

Your turn

nylon thread vs **copper wire**

which ball stays charged?

Which ball **keeps its charge**? Answer in the comments.

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