

Exercise walk-through

10.2

Redistribution of Charge Between Conductors

AP Physics C: Electricity and Magnetism

Redistribution of charge

Touch two conductors and charge flows until they reach a **common potential**:

- **conservation of charge**
fixes the total
- a bigger conductor holds more at the same V
- an external field induces opposite charges on the two sides

Worked example – identical spheres

12 nC touched to a neutral twin:

each ends with 6 nC

Touch a much larger sphere instead and most charge flows onto it.

Worked example – two spheres touch and separate

A sphere of radius R carrying $+6.0 \mu\text{C}$ touches a distant sphere of radius $2R$, then they separate. Find each charge.

- in contact they are one conductor, so their potentials are **equal**: $\frac{kq_1}{R} = \frac{kq_2}{2R}$
- so $q_2 = 2q_1$, and $q_1 + q_2 = 6.0 \mu\text{C}$
- $q_1 = 2.0 \mu\text{C}$ (small), $q_2 = 4.0 \mu\text{C}$ (large)

Charge splits in proportion to **radius**, not equally.

Ground is the limiting case: an idealised reference at $V = 0$ that can absorb or supply any amount of charge, so grounding near an external charge leaves an **induced charge** behind.

Exercises 2.1-2.3

2.1 A metal sphere with $+8.0 \mu\text{C}$ touches an identical neutral sphere, then they separate. Find the charge on each. [2]

2.2 State what becomes equal on two conductors joined by a wire at equilibrium. [1]

2.3 State the conservation law used in charge sharing. [1]

Exercises 2.1-2.3

2.1 A metal sphere with $+8.0 \mu\text{C}$ touches an identical neutral sphere, then they separate. Find the charge on each. [2]

2.1

- they are identical, so the charge splits equally: $\frac{8.0}{2} = 4.0 \mu\text{C}$ each

2.2 State what becomes equal on two conductors joined by a wire at equilibrium. [1]

2.2

- their electric potential

2.3 State the conservation law used in charge sharing. [1]

2.3

- conservation of charge

Exercises 3.1-3.2

3.1 Two conductors connected by a wire reach a common

[1]

☐

A charge

B potential

C mass

D field

3.2 When two identical charged spheres touch, the total charge is

[1]

☐

A doubled

B conserved and shared equally

C reduced to zero

D lost to the surroundings

Exercises 3.1-3.2

3.1 Two conductors connected by a wire reach a common

[1]

☐

A charge

B potential

C mass

D field

3.1 B

- potential.

3.2 When two identical charged spheres touch, the total charge is

[1]

☐

A doubled

B conserved and shared equally

C reduced to zero

D lost to the surroundings

3.2 B

- conserved and shared equally.

Exercise 3.3 (a)

3.3 A sphere carrying $+12\ \mu\text{C}$ briefly touches an identical neutral sphere.

(a) Find the charge on each sphere after they separate.

[2]

Exercise 3.3 (a)

3.3 A sphere carrying $+12 \mu\text{C}$ briefly touches an identical neutral sphere.

(a) Find the charge on each sphere after they separate.

[2]

(a)

- $\frac{12}{2} = 6.0 \mu\text{C}$ on each

Exercise 3.3 (b)

3.3 A sphere carrying $+12\ \mu\text{C}$ briefly touches an identical neutral sphere.

(b) State the principle you used.

[1]

Exercise 3.3 (b)

3.3 A sphere carrying $+12\ \mu\text{C}$ briefly touches an identical neutral sphere.

(b) State the principle you used.

[1]

(b)

- conservation of charge (with equal sharing between identical spheres)