

10.1 Electrostatics with Conductors

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS outer surface 外表面 • conductor 导体 • perpendicular 垂直
• electrostatic equilibrium 静电平衡 • equipotential 等势体

Objective

Build the skills to answer exam questions on **electrostatics with conductors**.**You must be able to:**

- explain why the **electric field is zero** inside a conductor in electrostatic equilibrium
- show that excess charge resides on the **outer surface** 外表面
- describe how the field just outside is **perpendicular** to the surface
- explain why a conductor is an **equipotential** 等势体

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ A conductor in equilibrium

- The field **inside** is zero (free charges would move until it is).
- Any **excess charge** sits on the outer surface.
- Just **outside**, the field is **perpendicular** to the surface.
- The whole conductor is a single **equipotential**.

■ Surface field

$E = \frac{\sigma}{\epsilon_0}$ just outside. Charge crowds onto sharply curved regions (points), giving the strongest field there — the idea behind a lightning rod.

2 Practice

2.1 State the electric field inside a conductor in electrostatic equilibrium. [1]

2.2 State where excess charge sits on a solid conductor. [1]

2.3 State the direction of the field just outside a charged conductor's surface. [1]

3 Exam-style questions

3.1 Inside a conductor in electrostatic equilibrium, the field is [1]

A	B
C	D

A σ/ϵ_0

B zero

C at its maximum

D kq/r^2

3.2 A conductor in electrostatic equilibrium is [1]

A	B
C	D

A an equipotential

B at a varying potential

C an insulator

D charged throughout its volume

3.3 A hollow metal sphere carries a charge $+Q$.

(a) State the field inside the metal. [1]

(b) State where the charge sits. [1]

(c) Explain why the field just outside the surface is perpendicular to it. [2]