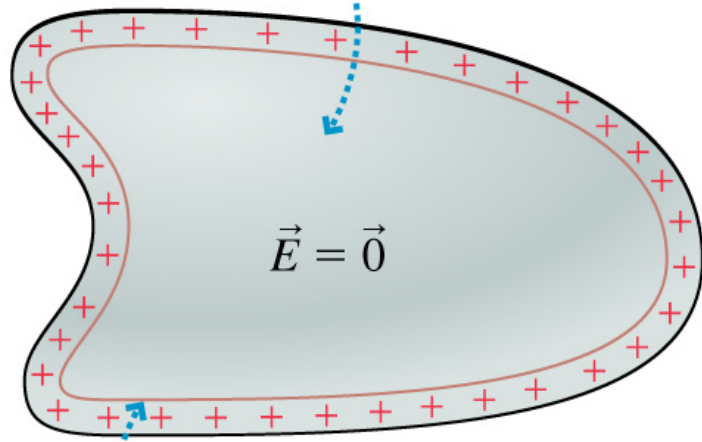


Lecture 7: Chapter 27, September 15 2005

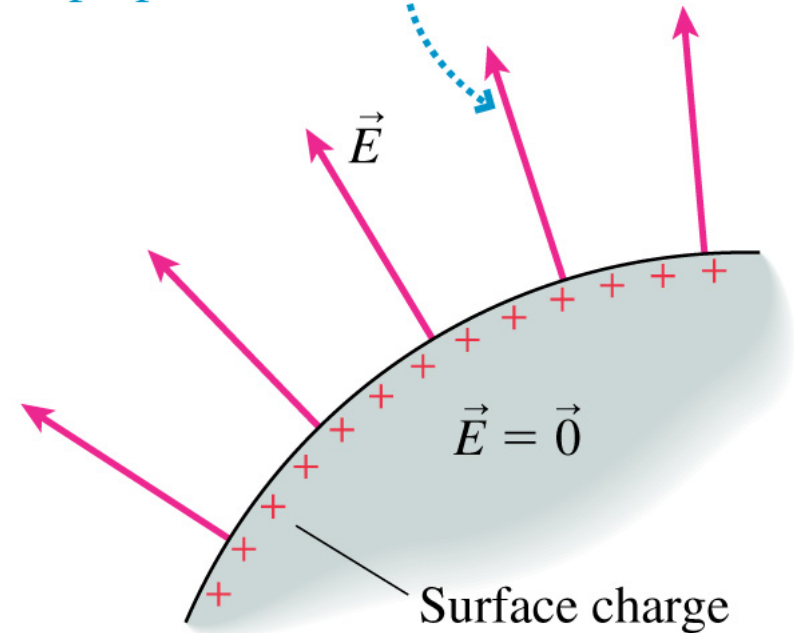
Conductors in Electric Field: Related to Quiz 3

The electric field inside the conductor is zero.



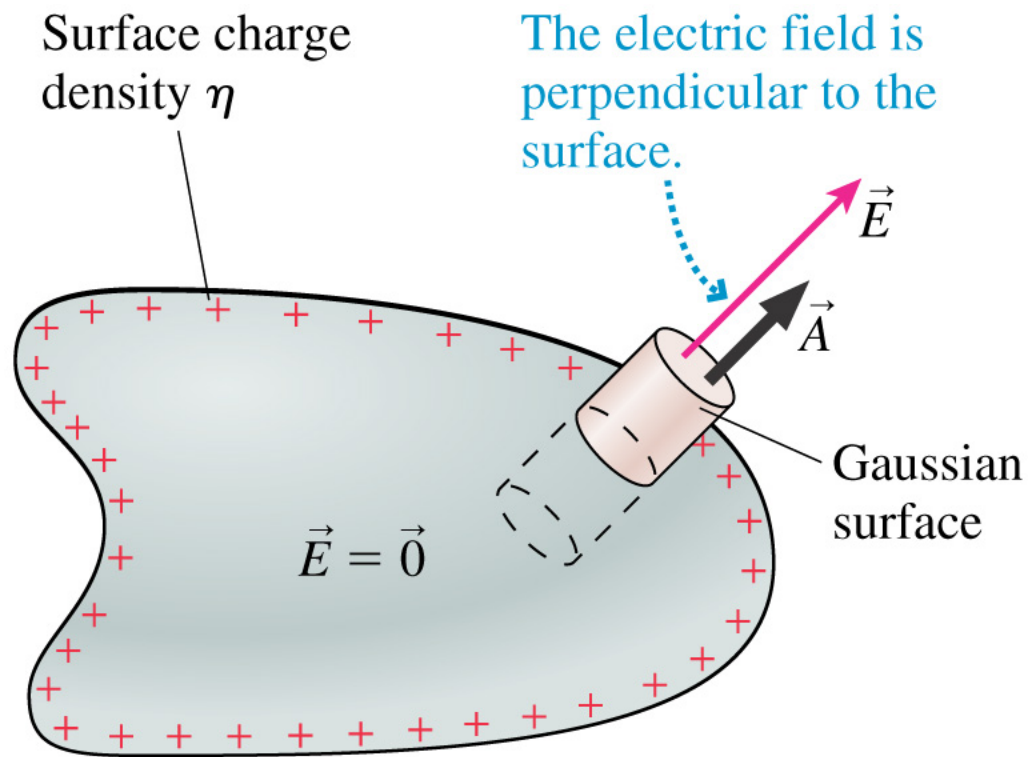
The flux through the Gaussian surface is zero. There's no net charge inside the conductor. Hence all the excess charge is on the surface.

The electric field at the surface is perpendicular to the surface.



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Electric Field at the Surface of Conductor



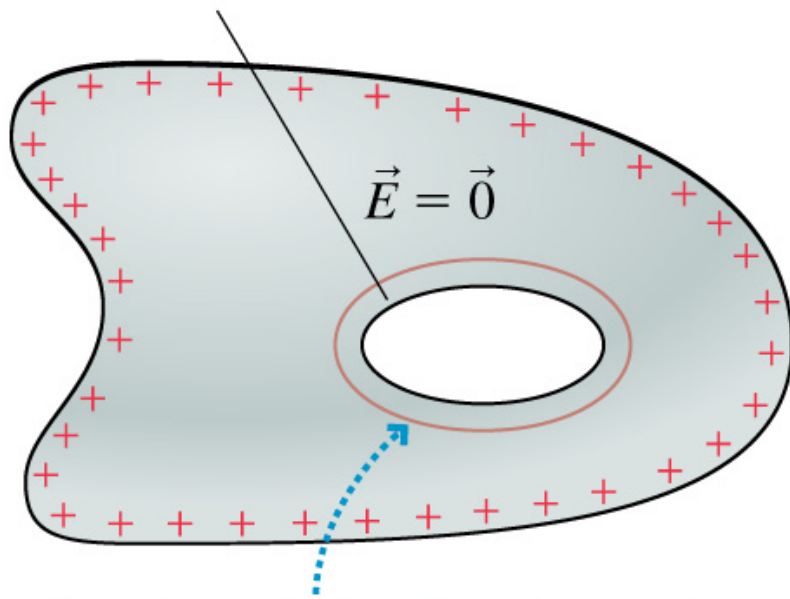
$$\Phi_e = A E_{\text{surface}} = Q_{\text{in}} / \epsilon_0 = \eta A / \epsilon_0$$

$$E_{\text{surface}} = \eta / \epsilon_0, \text{ perpendicular to surface}$$

Conductor with a Cavity

Can there be charge on this interior surface?

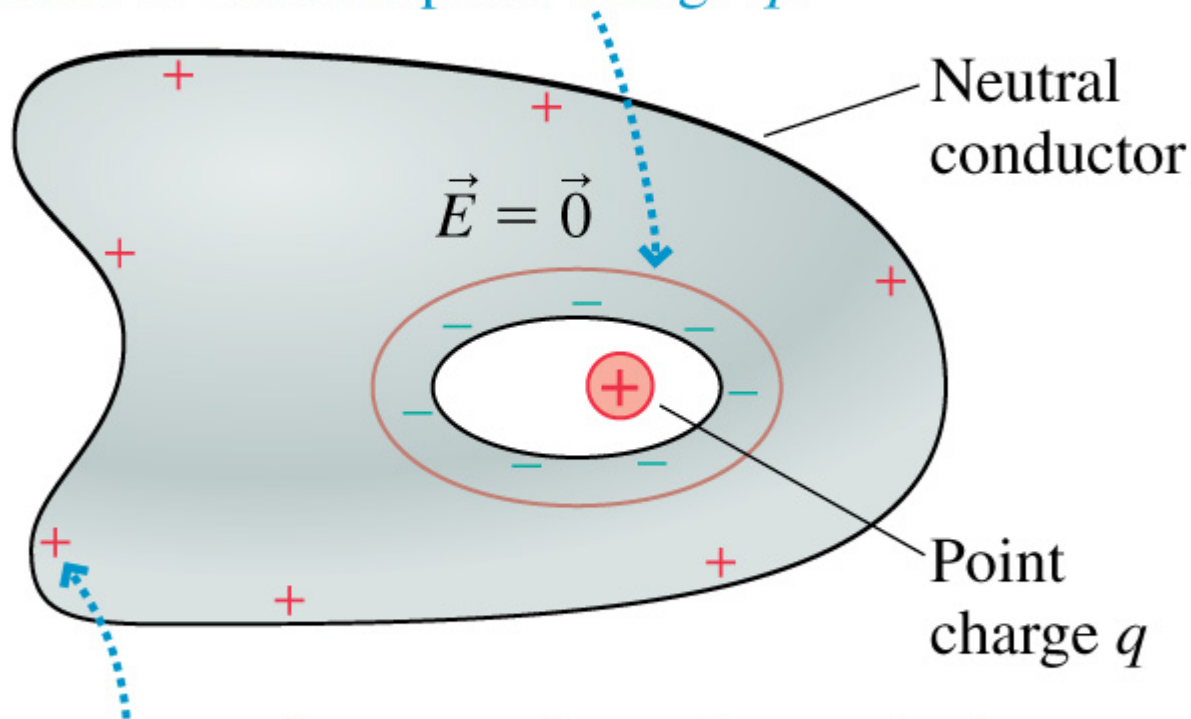
A hollow completely enclosed by the conductor



The flux through the Gaussian surface is zero. There's no net charge inside, hence no charge on this interior surface.

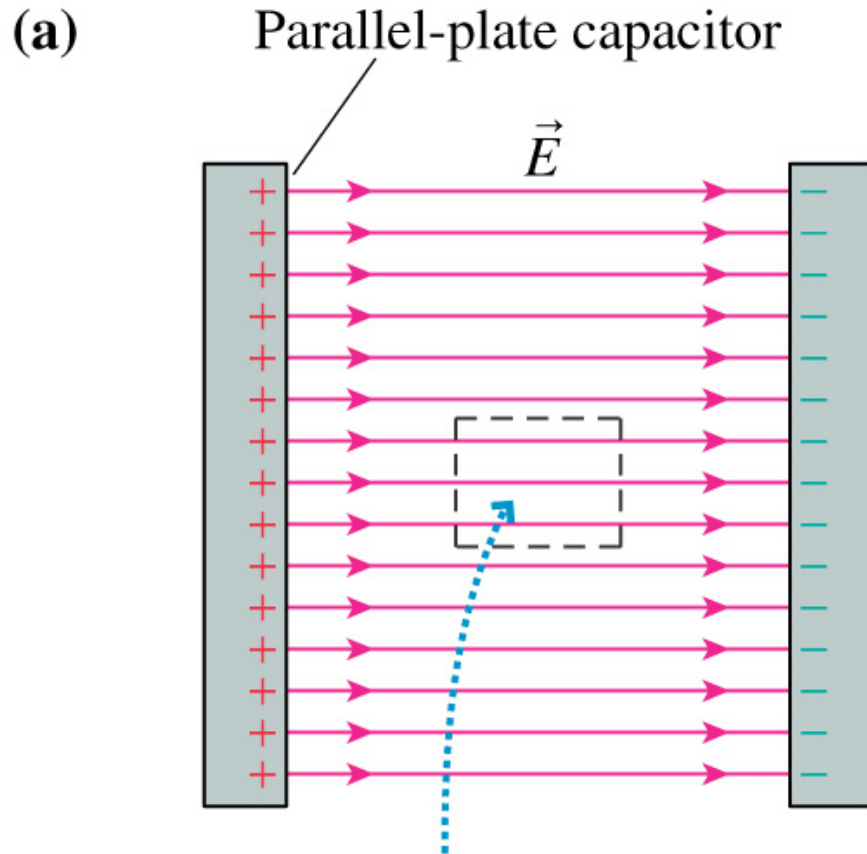
Charge Inside Cavity

The flux through the Gaussian surface is zero, hence there's no *net* charge inside this surface. There must be charge $-q$ on the inside surface to balance point charge q .



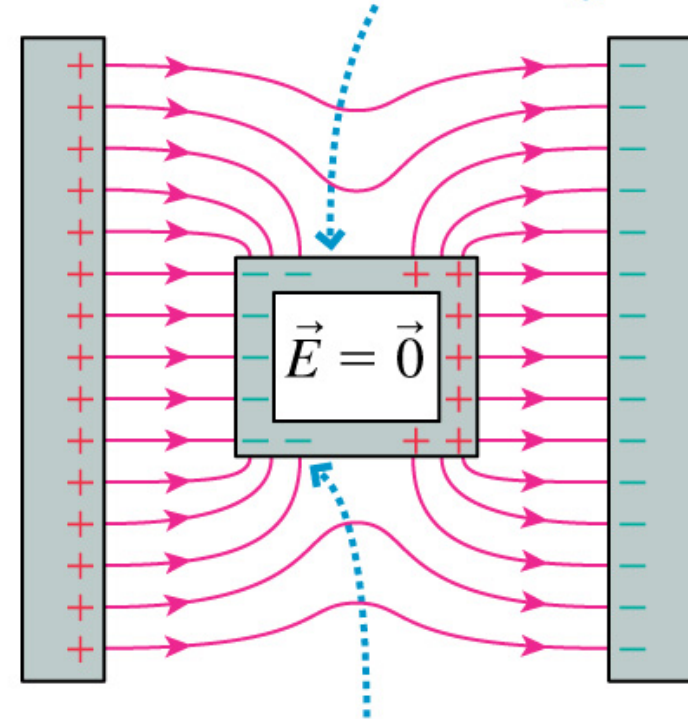
The outer surface must have charge $+q$ in order that the conductor remain neutral.

Screening of Electric Field



We want to exclude the electric field from this region.

(b) The conducting box has been polarized and has induced surface charges.



The electric field is perpendicular to all conducting surfaces.

Chapter 29 (Electric Potential) begins...

Mechanical Energy, Potential Energy

Energy conservation: Mechanical energy $E_{\text{mech}} = K + U$ is conserved for particles that interact via **conservative forces**

K - kinetic energy: $K = \sum K_i$, where $K_i = m_i v_i^2 / 2$

U - potential energy that is the *interaction* energy of the system

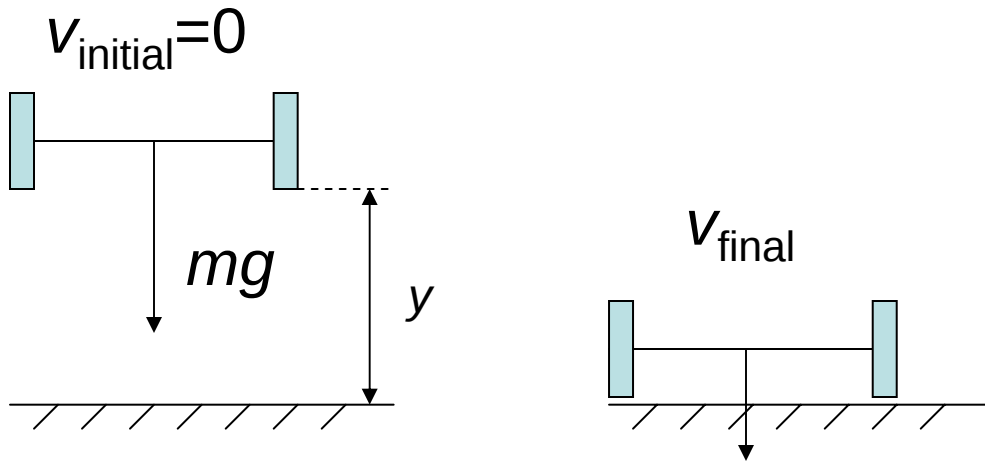
$$\Delta U = U_f - U_i = -W$$

Example - gravity: $U_{\text{grav}} = mgy$

Each U_{grav} is uniquely described by height y

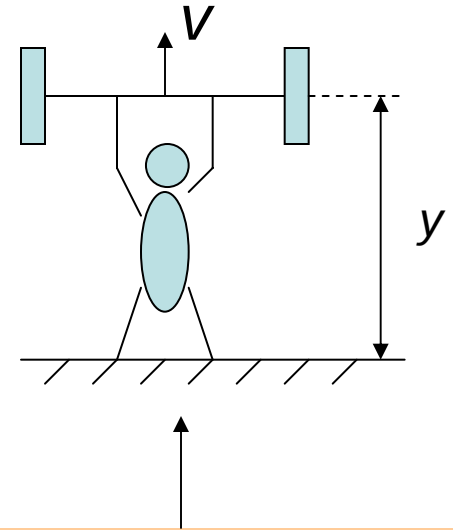
Each y has a unique $U=mgy$, however what happens to the total mechanical energy in these two cases?

Case 1: Gravity



- Is gravity a conservative force?
- Is mechanical energy conserved?
- What happens to mechanical energy on impact?

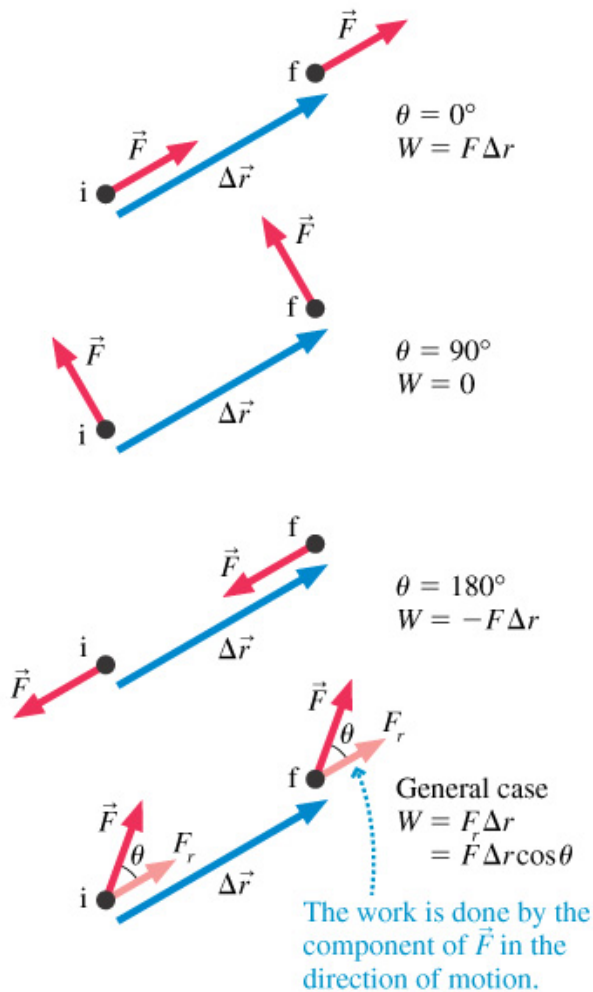
Case 2: Man



- Is the man's force a conservative force?
- Is mechanical energy conserved?
- What happens to mechanical energy as weight lifts?

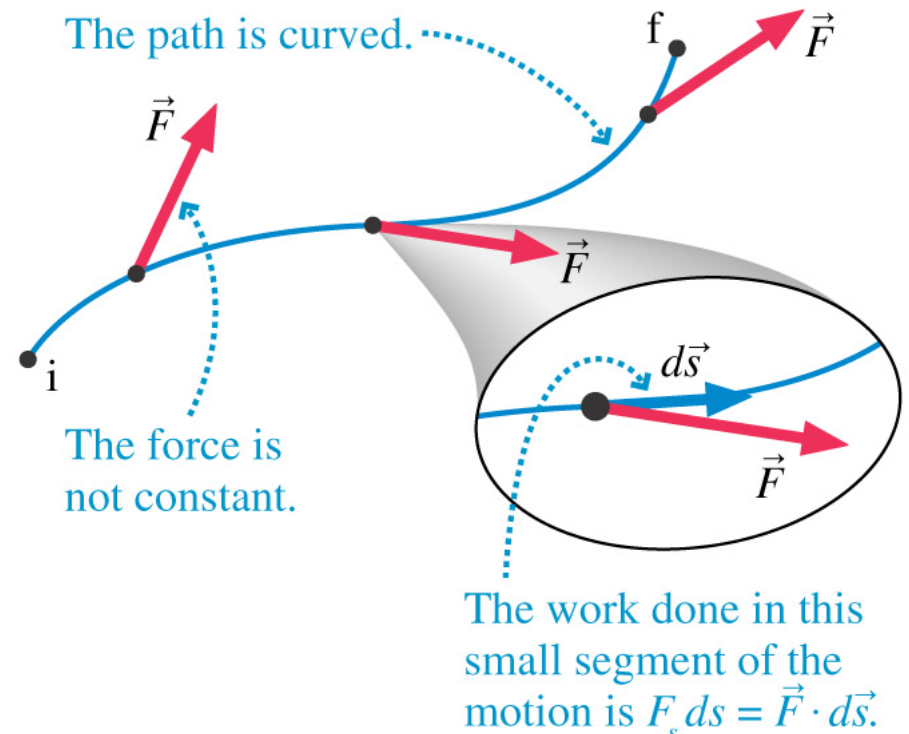
Change of the potential energy: $\Delta U = U_f - U_i = -W$

Constant Force



$$W = F \Delta r = F \Delta r \cos \theta$$

Not Constant Force



$$W = \sum_j (F_s)_j \Delta s_j \rightarrow \int_{s_i}^{s_f} F_s ds = \int_i^f \vec{F} d\vec{s}$$

End of Lecture 7
Reading: Chapter 29
Home Work 3