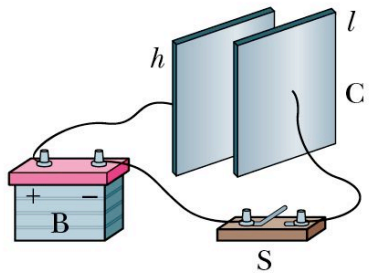
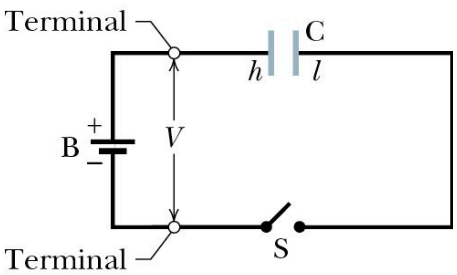
# List of Demos

- Super VDG
- Electrometer
- Voltmeter
- Circular parallel plate capacitor
- Cylindrical capacitor
- Concentric spherical capacitor
- Dielectric Slab sliding into demo
- Show how to calibrate electroscope

Show Demo Model, calculate its capacitance , and show how to charge it up with a battery.

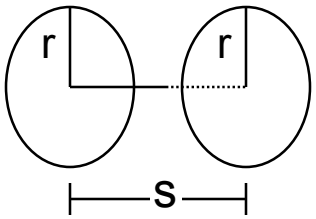



(a)




(b)

Circular parallel plate capacitor




r = 10 cm

$A = \pi r^2 = \pi(.1)^2$

$A = .03\ m^2$

S = 1 mm = .001 m

$$C = \frac{\varepsilon_0 A}{S}$$

$$C = (10^{-11})\frac{.03}{.001}\frac{Coulomb}{Volt} \Big\} Farad$$

$$C = 3\times 10^{-10}\, F$$

$$\boxed{C = 300\, pF}$$

p = pico = $10^{-12}$

# Demo Continued

## Demonstrate

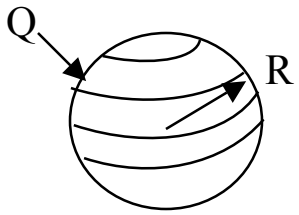
1. **As S increases, voltage increases.**

2. **As S increases, capacitance decreases.**

3. **As S increases, $E_0$ and q are constant.**

# Spherical capacitor or sphere

Recall our favorite example for E and V is spherical symmetry




The potential of a charged sphere is V = (kQ)/R with V = 0 at r = ∞

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The capacitance is

$$C = \frac{Q}{V} = \frac{Q}{kQ/R} = \frac{R}{k} = 4\pi\varepsilon_0 R$$

Where is the other plate (conducting shell)?

It's at infinity where it belongs, since that's where the electric lines of flux terminate.

k = $10^{10}$ and R in meters we have

$$C = \frac{R}{10^{10}} = 10^{-10} R(m) = 10^{-12} R(cm)$$

$$\boxed{C = R(cm)PF}$$

Earth: C = ($6\times10^8$ cm)PF = 600 μF

Marble: 1 PF

Basketball: 15 PF

You: 30 PF

**Demo**: Leyden jar capacitor

**Demo**: Show how you measured capacitance of electroscope

# Dielectrics

- The amount that the field is reduced defines the dielectric constant $\kappa$ from the formula $E = E_0 / \kappa$, where E is the new field and $E_0$ is the old field without he dielectric.

- Since the electric field is reduced and hence the voltage difference is reduced (since E = Vd), the capacitance is increased.

  - $C = Q / V = Q / (V_0 / \kappa) = \kappa C_0$

  - $\kappa$ is typically between 2 – 6 with water equal to 80

  - Show demo dielectric slab sliding in between plates. Watch how capacitance and voltage change. Also show aluminum slab.

# Model of coaxial cable for calculation of capacitance