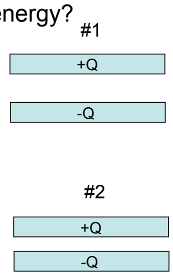
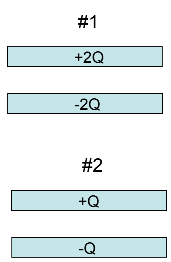
2.50 You have two very large parallel plate capacitors, both with the same area and the same charge Q.
Capacitor #1 has twice the gap of Capacitor #2.
Which has more stored potential energy?



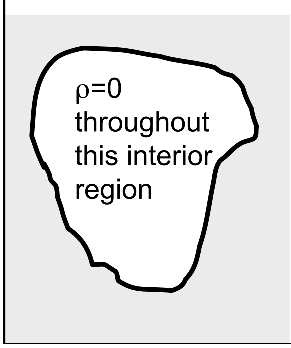
A) #1 has twice the stored energy
B) #1 has *more* than twice
C) They both have the same
D) #2 has twice the stored energy
E) #2 has more than twice.

2.51
You have two parallel plate capacitors, both with the same area and the same gap size.
Capacitor #1 has twice the charge of #2.
Which has more capacitance? More stored energy?



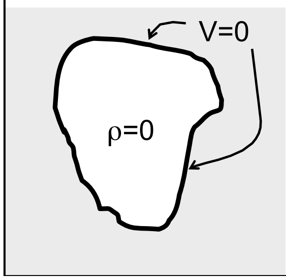
A) C1>C2, PE1>PE2
B) C1>C2, PE1=PE2
C) C1=C2, PE1=PE2
D) C1=C2, PE1>PE2
E) Some other combination!

3.1 A region of space contains no charges.
What can I say about V in the interior?



A) Not much, there are lots of possibilities for V(r) in there
B) V(r)=0 everywhere in the interior.
C) V(r)=constant everywhere in the interior

3.2 A region of space contains no charges. The *boundary* has V=0 everywhere.
What can I say about V in the interior?

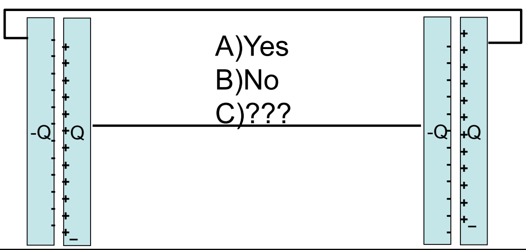


A) Not much, there are lots of possibilities for V(r) in there

B) V(r)=0 everywhere in the interior.

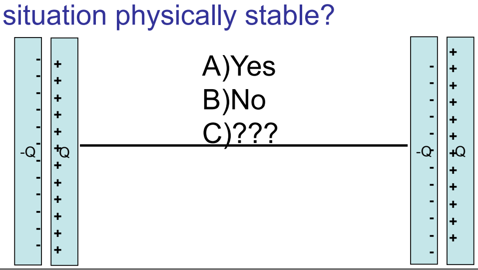
C) V(r)=constant everywhere in the interior

3.3 Two very strong (big C) ideal capacitors are well separated.
If they are connected by 2 thin conducting wires, as shown, is this electrostatic situation physically stable?



A)Yes
B)No
C)???

3.4 Two very strong (big C) ideal capacitors are well separated.
What if they are connected by one thin conducting wire, is this electrostatic situation physically stable?



A)Yes
B)No
C)???

General properties of solutions of ∇^2 V=0

(1) V has no local maxima or minima inside. Maxima and minima are located on surrounding boundary.

(2) V is boring. (I mean "smooth & continuous" everywhere).

(3) V(**r**) = average of V over any surrounding sphere:

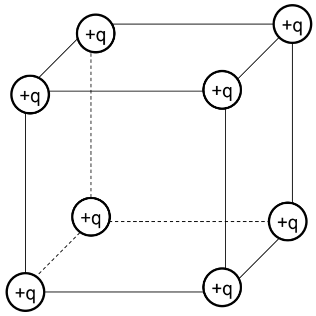
$$V(\vec{r}) = \frac{1}{4\pi R^2} \oint_{\substack{\text{Sphere with}\\ \text{radius } R\\ \text{around } \vec{r}}} V\, da$$

(4) V is unique: The solution of to the Laplace eq. is uniquely determined if V is specified on the boundary surface around the volume.

3.5 If you put a + test charge at the *center* of this cube of charges, could it be in stable equilibrium?

A) Yes
B) No
C) ???

Earnshaw's Theorem

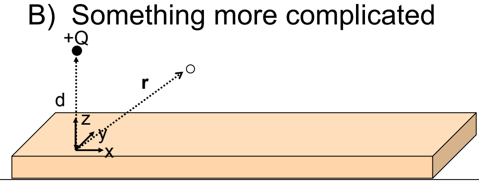


3.7 A point charge +Q sits above a *very large* conducting slab. What is **E**(**r**) for other points *above* the slab?

A) Simple Coulomb's law:

$$\vec{E}(\vec{r}) = \frac{Q}{4\pi\varepsilon_0}\frac{\vec{\Re}}{\Re^3} \quad \text{with } \vec{\Re} = (\vec{r} - d\,\hat{z})$$

B) Something more complicated



Whiteboard:

Calculate voltage (everywhere in space!) for 2 equal/ opposite point charges a distance "d" above and below the origin. Where is V(r)=0?

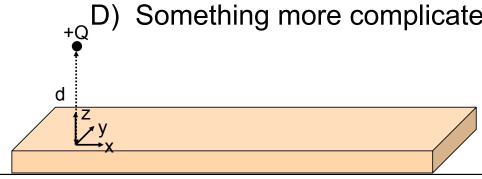
3.8 A point charge +Q sits above a *very large* conducting slab. What is the electric force on this charge?

A) 0

B) $\frac{Q^2}{4\pi\varepsilon_0(2d)^2}$ downwards

C) $\frac{Q^2}{4\pi\varepsilon_0 d^2}$ downwards

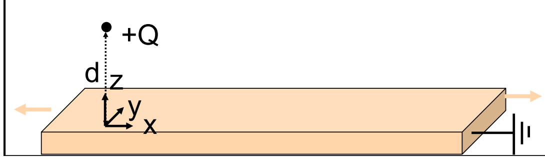
D) Something more complicated



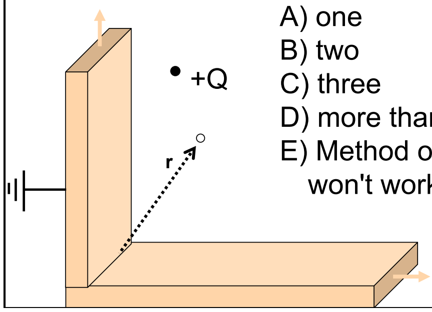
3.8b A point charge +Q sits above a *very large grounded* conducting slab. What's the energy of this system?

A) $\frac{-Q^2}{4\pi\varepsilon_0(2d)}$

B) Something else.

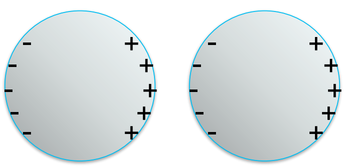


3.9 Two ∞ grounded conducting slabs meet at right angles. How many image charges are needed to solve for V(**r**)?



A) one
B) two
C) three
D) more than three
E) Method of images won't work here

Is this a stable charge distribution for two neutral, conducting spheres?



A) Yes
B) No

C) ???