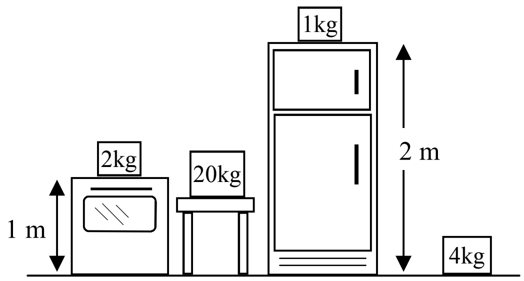
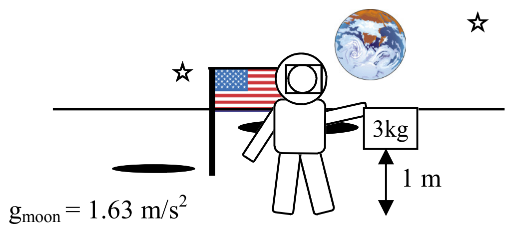
A-Day Due Mon., Jan 31
B-Day: Due Tues., Feb 1

2011 PreAP Electrostatics 8

1. E, V, F, PE, C, Q (q)?

A. _____ in coulombs.	E. _____ in Farads	I. ______in J/C	M. _____Electric potential
B. _____ Capacitance	F. _____ in Newtons	J. ______in C/V	N. _____= to work done
C. _____ in N/C	G. _____ Potential	K. ______Are vectors.	O. _____Scalars
D. _____ Potential difference	H. _____ in Joules	L. ______Also in V/m	



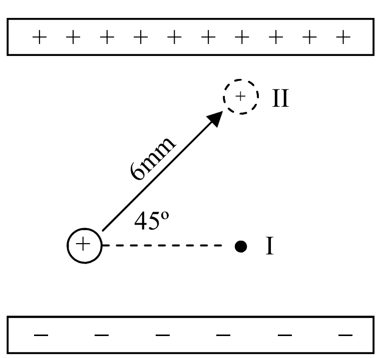


2. Five different masses are placed in different positions. One is on the moon. We are going to use this as an analogy for electrostatics. Many of the same principles and concepts apply.

   A. Which mass feels the smallest gravitational field?
   B. Which mass feels the greatest gravitational force? Why?
   C. Which mass has more PE the 2 kg or the 3 kg? Why?
   D. Which mass has the greater PE: 2 kg or 20 kg? Why?
   E. Which mass's position would give the greatest PE to any of the masses? Why?
   F. So, which mass's position has the greatest gravitational voltage (J/kg)?
   G. What is the PE of the 1 kg mass on the refrigerator?
   H. What would be the PE of the 2 kg mass if on the refrigerator?
   I. What would be PE for the 3 kg mass if it was on the refrigerator?
   J. So, the refrigerator gives _____ joules of PE for every kg put there.
   K. The stove (on the left) only gives on _____ joules of PE for every kg put there.

   So, the refrigerator gives more gravitational voltage: it's about position. This is like electrostatic voltage, which is in J per coulomb: how much energy each coulomb would have AT THAT POSITION!

E. The 1kg's (top of the refrigerator)
F. The 1 kg's



3. A positive charge is between the charged plates of a capacitor.

   A. Would the charge have more PE at I or II?
   B. So, the charge has more potential at I or II?
   C. The electric potential increases closer to a + charge (or plate) or closer to a − charge (or plate)?
   D. A +q naturally wants to go to higher or lower V?
   E. So, a −q wants to go to higher or lower V?
   F. Draw E between the plates.
   G. Is E changing (like around a point charge) or constant?
   H. Is the electric force on the +q stronger at I or II?

A. II
B. II (V ↑ where a +q has more PE)
C. Closer to + plate
D. Lower
E. Higher

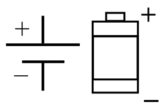
G. Constant (parallel)
H. Equal at both (constant field)

I. Draw three dashed equipotential lines between the plates.
J. Is E's direction + or −?
K. Calculate the charge's ΔV as it moves to position II if E = 12 N/C between the plates.

K. $\Delta V = -E\Delta d_{\parallel}$,
$= -(-12)6\text{mm}(\sin 45^{\circ})$
$= +.051$ V It gained V, just as we knew it would.

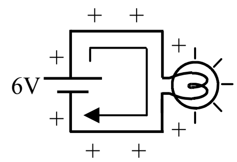
As you know a battery gives voltage. Actually, a battery creates a constant change of voltage (potential difference) between its + and − sides.

High voltage



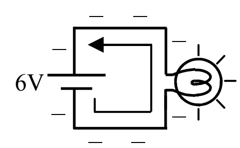
Low voltage

Conventional current.

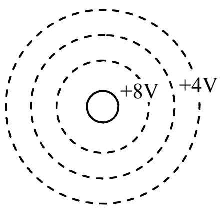


So, a battery makes it easy to remember that − charges go toward higher voltages (low to high V)...

What's really happening.



...and that + charges move toward lower voltages (high to low).



4. The dashed lines on the diagram at the left show the equipotential lines around a charge.
   A. Using what you learned about batteries: + charges move toward higher or lower electric potential?
   B. Remembering that electric field lines point the direction a + charge would move, draw the electric field lines around the charge.
   C. Is it a + or − charge?

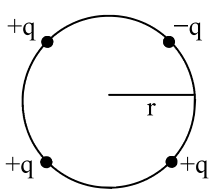
5. A 6μF capacitor is charged to 9 V. How much charge does it hold?

6. A 4C charge is placed at a position that has a potential of 12V.
   A. How much PE does the charge have?

   B. If released, how much KE would it have after a long time?

7. A point in space has an electric field strength of 0.75 N/C. A 2C charge is placed at that point. How much force does it feel?

8. E is in N/C or in V/m. If the plates of a capacitor are separated by 3mm and the plates are charged to 6V, how strong is the electric field between the plates?



9. Four charges are placed equidistance from a point.
   A. Write an expression for the potential due to the −q.

   B. Write an expression for V due to one of the + charges.

   C. Write an expression for the V_{net} at the center.

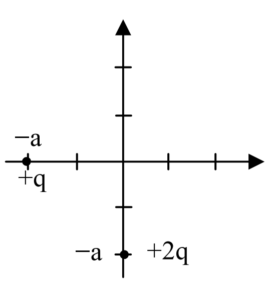
   D. If a fourth +q is placed at the center, its PE is:

D. PE = V(q)
= (2kq/r)q
= $2kq^2/r$

10. Two charges are placed near the origin, as shown on the diagram.
    A. Write an expression for the electric field due to each charge at the origin.
    B. Write an expression for the E_{net} at the origin. (*You should be able to figure out the actual angle, too.)*

E =

V =



E =

V =

$$E_{net} = \frac{kq}{s^2}\sqrt{5}$$

    C. Write expressions for the potential due to each charge at the origin.
    D. Write an expression for the net potential at the origin.