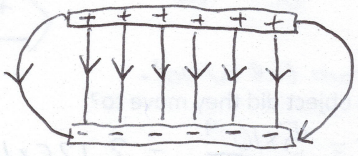
Honors Physics — Unit 8 Practice Test

Mr. McQuiston — Name:_____

Some electronics, like the Nintendo DS use touchscreens that work by having two layers of materials separated by a few millimeters. (Most phones use a different type of touchscreen where the screen detects changes in the electric field due to the presence of a conducting finger or stylus.)

4. The top layer has a positive charge and the lower layer has a negative charge. Draw the plates and the field between them.



5. The potential difference between the plates is +1.2V. If the plates are 0.002m apart, what is the electric field between the plates? ΔV for capacitors $\Rightarrow \Delta V = E \cdot d$

$$E = \frac{\Delta V}{d} = \frac{1.2}{0.002} = 600\ N/C$$

a. The screen can detect a change of +/- 30N/C, how much must the screen be pressed to register? Pressing the screen will increase E (since d decreases.)

So $E = 630\ N/C$, $\Delta V = 1.2\ V$ $\quad d = \frac{\Delta V}{E} = 0.0019m \Rightarrow \Delta d = 0.002 - 0.0019 = 0.0001m$ or $\frac{1}{10}mm$

6. Two identically charged objects (A and B) exert a force of -1.9×10^{-4}N on each other at a distance of 0.05m. How much charge is on each object?

$F_E = -1.9 \times 10^{-4}$, $r = 0.05\ m$, $q_1 = q_2 = ?$

$F_E = \frac{k q_1 q_2}{r^2} \Rightarrow$ get q_1 by itself $\Rightarrow$ $F_E r^2 = k q_1^2$

$q_1^2 = \frac{F_E r^2}{k}$ $\quad q_1 = \sqrt{\frac{F_E r^2}{k}}$

$$q_1 = \sqrt{\frac{-1.9 \times 10^{-4} \cdot .05^2}{9 \times 10^9}} = 7.26 \times 10^{-9}\ C$$

7. What is the electric field at a point directly in between the charges in #6?

$r = 0.025m$

q_1 ⊕ × ⊕ q_2

E-field will point Left from q_1 and right from q_2 so subtract

$$E = \frac{k q_1}{r^2} - \frac{k q_2}{r^2} = \frac{9 \times 10^9 \cdot 7.26 \times 10^{-9}}{0.0025^2} - \frac{9 \times 10^9 \cdot 7.26 \times 10^{-9}}{0.0025^2} = 0\ N/C$$

8. What is the electric field at a point 0.01m from object A and 0.04m from charge B?

Same formula, but r_1 and r_2 are different.

$$E = \frac{9 \times 10^9 \cdot 7.26 \times 10^{-9}}{0.01^2} - \frac{9 \times 10^9 \cdot 7.26 \times 10^{-9}}{0.04^2}$$

$$= \frac{65.34}{0.0001} - \frac{65.34}{0.0016} = 653400 - 40837.5$$

$$= 612562.5\ N/C$$