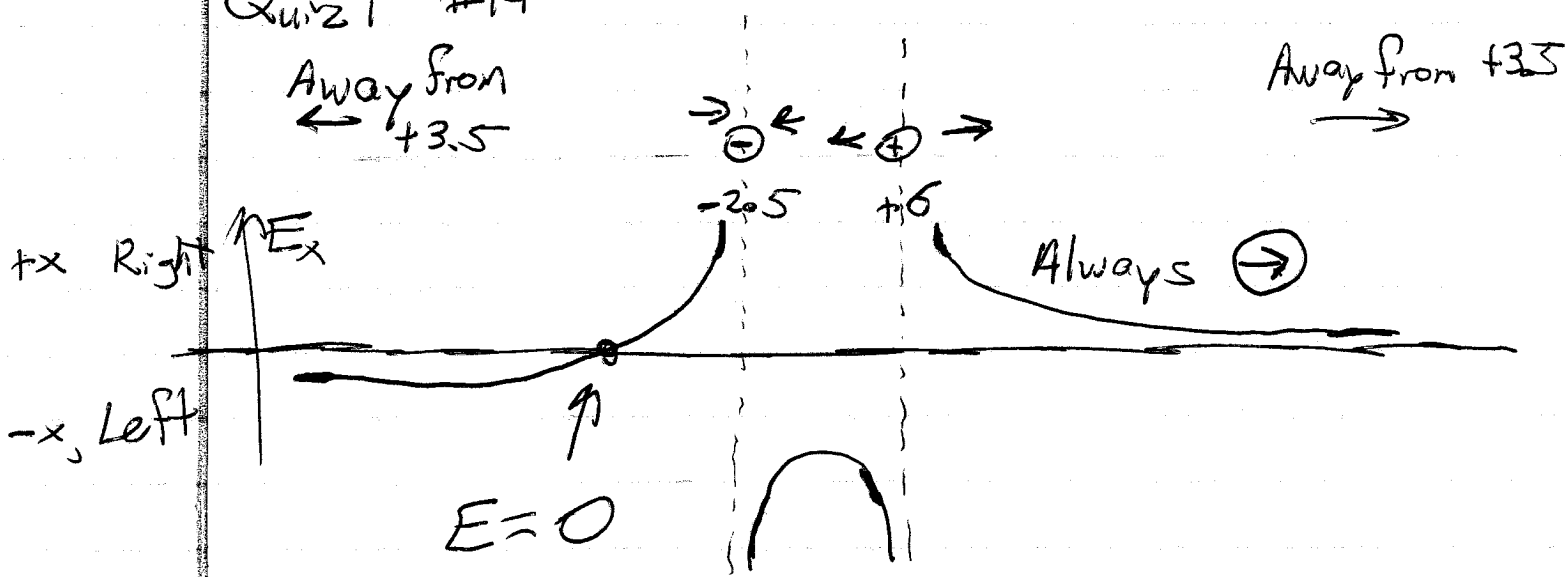
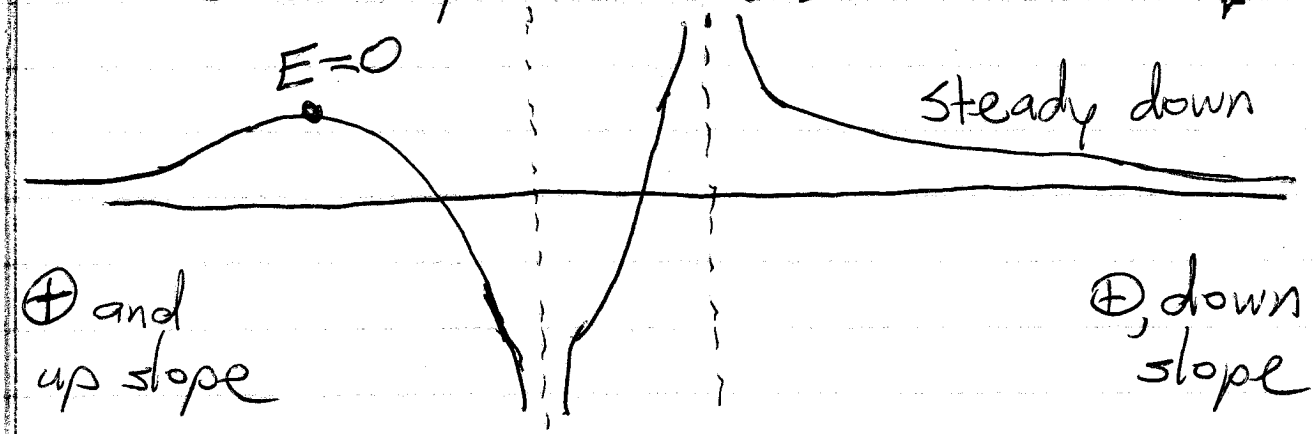
Phys 2426 2017-07-13 Lec 7

Quiz 1 #14



Far away, they "look like" a single +3.5 μC.

Can also draw potential (V): $V = \frac{kQ}{r}$



Either way, E=0 to left of ⊖

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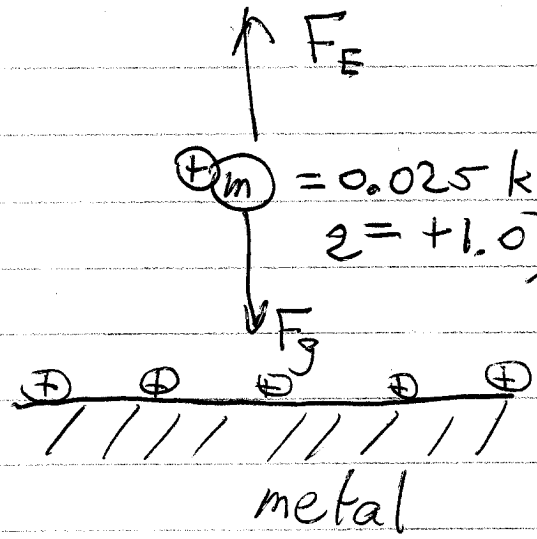


$F_E = F_g$

$qE = mg$

$E = 2.45 \times 10^5\ N/C$

How is E created? ⊕ spread on metal

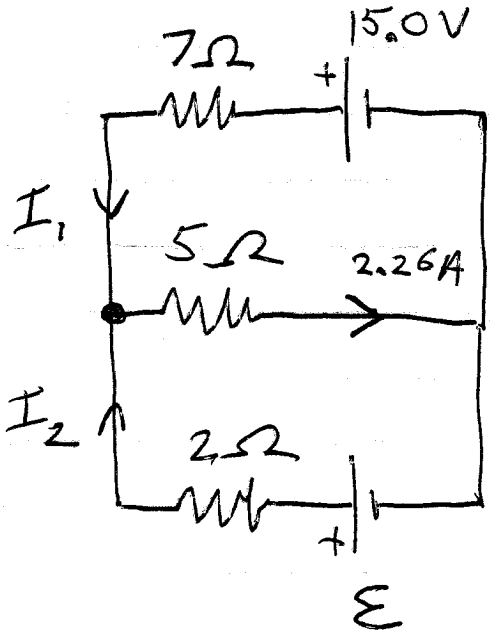
Surface charge σ = charge per area

$E = \begin{cases} 2\pi k\sigma & \text{split flux} \\ 4\pi k\sigma & \text{directed flux} \end{cases}$

- Surface of metal
- Inside Capacitor

$\sigma = \frac{E}{4\pi k} = 2.17 \times 10^{-6}\ C/m^2$

HW2-13



Left Node:

$$I_1 + I_2 = 2.26\ A$$

Upper Loop, CCW:

$$+(15\ V) - (7\Omega)I_1 - (5\Omega)(2.26A) = 0$$

$$(15\ V) - (7\Omega)I_1 - (11.3\ V) = 0$$

$$(3.7\ V) = (7\Omega)I_1$$

$$0.529\ A = I_1$$

$$(0.529\ A) + I_2 = 2.26\ A$$

$$I_2 = 1.73\ A$$

Bottom Loop: $I_2(2\Omega) = 3.46\ V$

$(2.26A)(5\Omega) = 11.3\ V$

$$\varepsilon = 11.3 + 3.46$$

$$= 14.76\ V$$

$$\varepsilon - V_{2\Omega} - V_{5\Omega} = 0$$

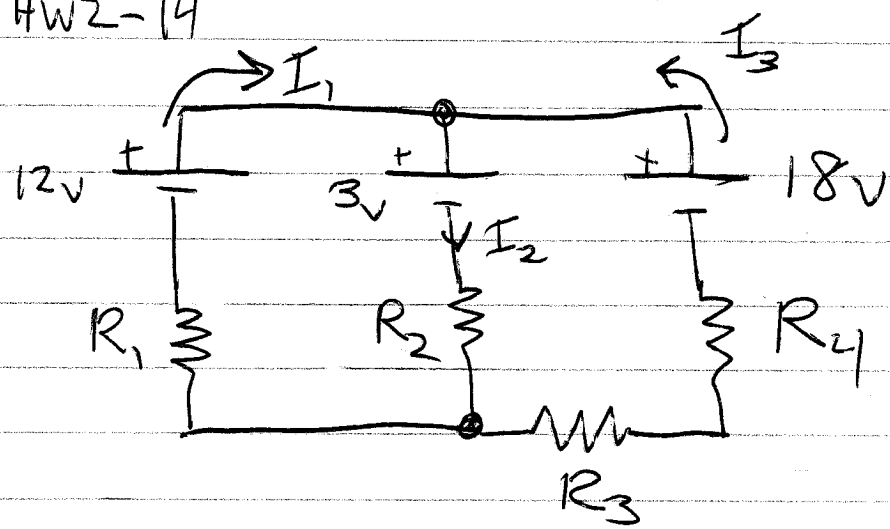
Top: $15.0 - 3.7 = 11.3\ V$

Mid: $11.3\ V$

Bot: $14.76 - 3.46 = 11.3\ V$

④

HW2-14



$$-3v + 18v - I_2R_2 - I_3R_3 - I_3R_4 = 0$$

$$12v - 3v - I_2R_2 - I_1R_1 = 0$$

$$I_1 + I_3 = I_2$$

$$0 - R_2 I_2 - (R_3 + R_4) I_3 = 3 - 18$$

$$-R_1 I_1 - R_2 I_2 + 0 = 3 - 12$$

$$I_1 - I_2 + I_3 = 0$$

Edit a 4x3 matrix

0	$-R_2$	$-(R_3+R_4)$	-15
$-R_1$	$-R_2$	0	-9
1	-1	1	0

[Matrix op rrev([A])

~~Sro~~ Scroll right for answers.

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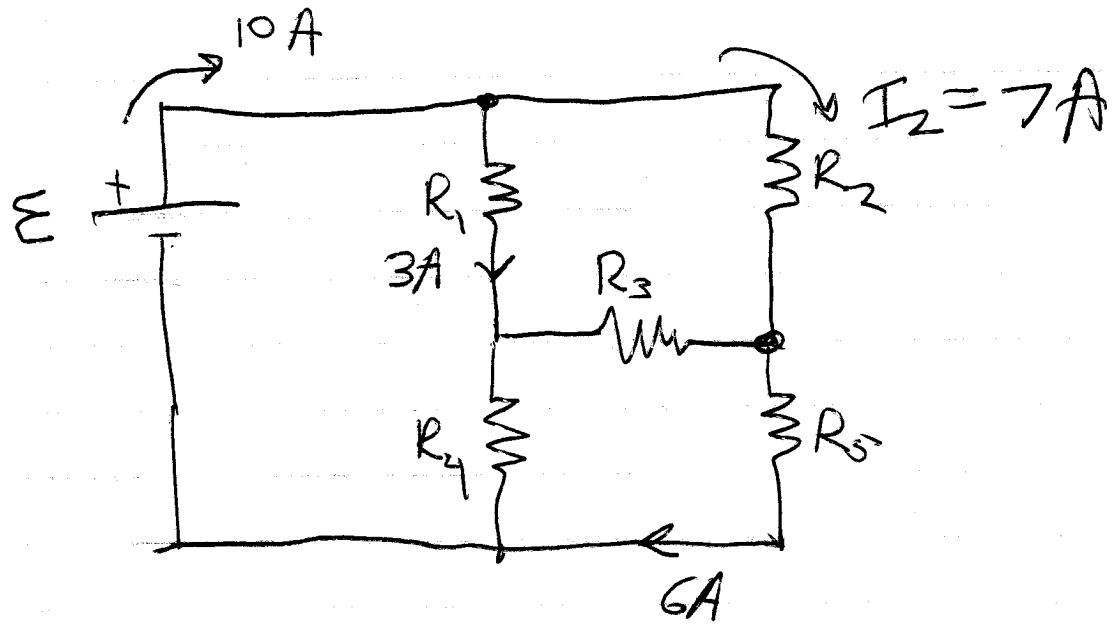

What is I_3?

- 0A
- 1A
- 2A
- 3A

Alt method taught in EE: Thevenin Equivalent

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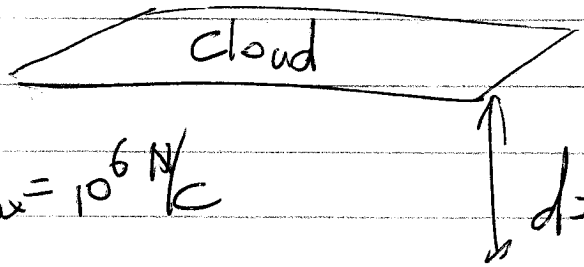
Thunderstorm as a capacitor



Lightning bolt flows for 0.1 s
What is resistance of atmosphere during lightning?

K = dielectric const
Let $K = 1$

$$C = \frac{K\varepsilon_0 A}{d}$$

$$C = \frac{(8.85 \times 10^{-12})(9 \times 10^6)}{2400} = 3.32 \times 10^{-8}\ F$$

$$= 33.2\ nF$$

$$\tau = RC$$

$$(0.1\ s) = R(3.32 \times 10^{-8}\ F)$$

$$3 \times 10^6\ \Omega = R$$

Current: $$I = \frac{V}{R} = \frac{E\Delta Y}{R} = \frac{(10^6\ V/m)(2400\ m)}{3 \times 10^6\ \Omega}$$

$$I = 800\ A$$