PHY3063 Spring 2018

HOMEWORK D

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Due: March 15, 2018

1. In class we calculated the resistance of a conductor in various shapes. Review the strategy used in those calculations and apply it to calculate the resistance of a cylindrical shell of a conductor with conductivity σ for the current flowing in the radial direction. a and b are the inner and outer radius of the shell and L is the length of the cylinder.

$$R = \frac{\ln(b/a)}{2\pi\sigma L}$$

2. CH30 E-19.

3. CH30 E-22.

4. CH30 P-3.

5. CH30 P-6.
What is the charge on C_1 when the switch is thrown to the left. After the switch is flipped, the potential across and the charge on C_1 settle to new values. But there are two constraints: total charge is conserved and the potential across C_1 is the same as the potential across the series of C_2 and C_3.

6. CH30 P-8.
Consider the large plate as a collection of thin strips of width dx and varying thickness of differential capacitor, $\delta = d + x\sin\theta$. Apply Taylor expansion for $\theta \ll 1$ to simplify the integral.

7. CH30 P-9.

8. Ch30 P-10.
Follow the hint given in the textbook. The potential across $C_[2$ should be zero. Do you see why?

9. CH30 P-15.

10. CH30 P-18 19.

11. CH30 P-24.
Of course $b < d$. Let's say that the gap between one plate and the dielectric slab is g. Then there is a gap of $d - b - g$ on the other side. How many effective capacitors do you see? Should the total resulting capacitance depend on g?