PHY152 – Practice Problem Set #5 Solutions
Winter 2018

See posted Midterm Solutions on the Course Materials page for more detailed solutions.

1. Midterm Test 2015 – Q1: C = D > A > B

2. Midterm Test 2014 – Q5: ~28 N/C m²

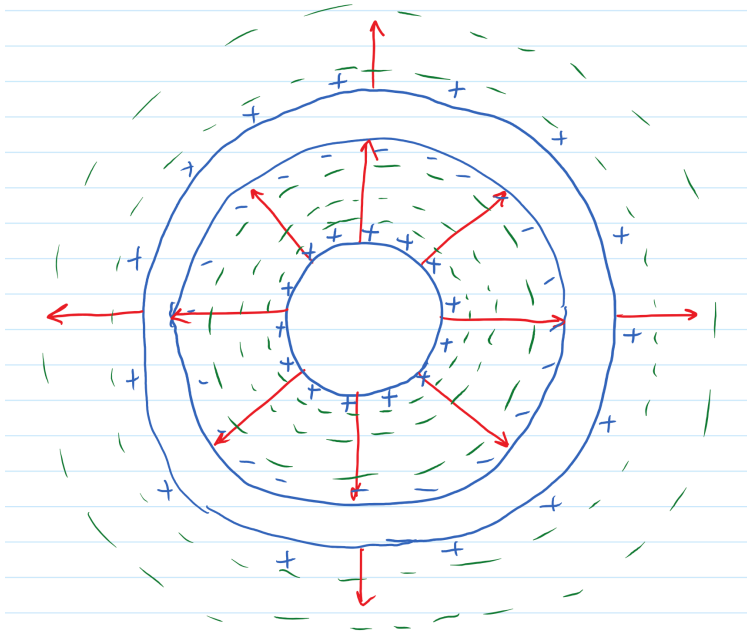3. Midterm Test 2015 – Q9

(a) the magnitude of the electric field is:

$$\text{for A: } \frac{kq}{R^2}; \quad \text{for B: } \frac{2kq}{\pi R^2}; \quad \text{for C: } 0;$$

(b) the electric potential for all distributions is:

$$V = \frac{kq}{R}$$

4. Midterm Test 2017 – Q7

(a)

The electric field is shown by the red lines, the blue + and − indicate the locations of charges, and the green dashed lines are the equipotentials.

(b) Charges on the solid sphere and inner and outer surface of the spherical shell are:

$$\sigma_{solid} = 1.1\text{x}10^2 \text{ nC/m}^2 \text{ (positive)}; \sigma_{inner} = 40 \text{ nC/m}^2 \text{ (negative)};$$

$$\sigma_{outer} = 5.5 \text{ nC/m}^2 \text{ (positive)}$$

(c) direction of the electric field is away from the centre of the solid sphere, r is this distance

$$r \leq 60 \text{ mm} \qquad E = 0 \text{ } (conductor)$$

$$60 \text{ mm} < r < 100 \text{ mm} \quad E = \frac{kq_1}{r^2} \text{ } (q_1 = 5.0 \text{ nC})$$

$$100 \text{ mm} \leq r \leq 120 \text{ mm} \quad E = 0 \text{ } (conductor)$$

$$120 \text{ mm} < r < 200 \text{ mm} \quad E = \frac{kq_2}{r^2} \text{ } (q_2 = 1.0 \text{ nC})$$

$$\frac{kq_1}{(0.060 \text{ m})^2} = 12,500 \text{ N/C}$$

$$\frac{kq_1}{(0.100 \text{ m})^2} = 4,500 \text{ N/C}$$

$$\frac{kq_2}{(0.120 \text{ m})^2} = 625 \text{ N/C}$$

$$\frac{kq_2}{(0.200 \text{ m})^2} = 225 \text{ N/C}$$

E↑

0

60   100 120   200   r [mm]

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