PHYS 102: General Physics 2 **KOÇ UNIVERSITY** **Fall Semester 2015**

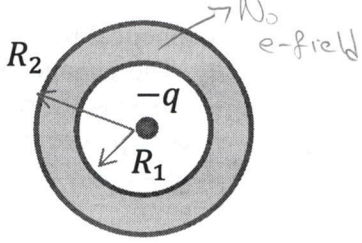
College of Arts and Sciences

Section **Quiz** **October 16, 2015**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: Ongun ARISEV **Student ID:** **Signature:** Ongun Arisev

A spherical hollow conductor has inner radius R_1 and outer radius R_2. The conductor is charge neutral. There is a point charge $-q$ fixed at the center of the hollow region. Determine and plot the electric potential as a function of radial distance r from the center ($0 \leq r < \infty$). (The constant in Coulomb's law is $\frac{1}{4\pi\varepsilon_0}$)

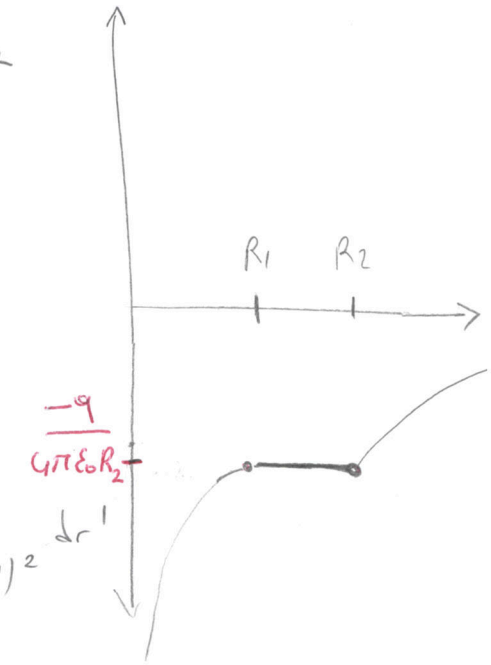


$r > R_2 \qquad V(r) = \frac{1}{4\pi\varepsilon_0}\left(-\frac{q}{r}\right)$

$r = R_2 \qquad V(R_2) = \frac{-q}{4\pi\varepsilon_0 R_2}$

$R_2 > r > R_1 \qquad V(r) = \frac{-q}{4\pi\varepsilon_0 R_2}$

$R_1 > r > 0 \qquad V(r) = V(R_1) + \int_{R_1}^{r} \frac{+q}{4\pi\varepsilon_0 (r')^2}\, dr'$



$V(r) = \frac{-q}{4\pi\varepsilon_0 R_2} + \frac{q}{4\pi\varepsilon_0}\left(-\frac{1}{r} + \frac{1}{R_1}\right) = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{R_1} - \frac{1}{R_2} - \frac{1}{r}\right)$

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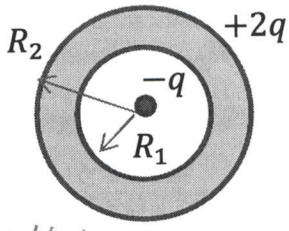
Name: **Student ID:** **Signature:**

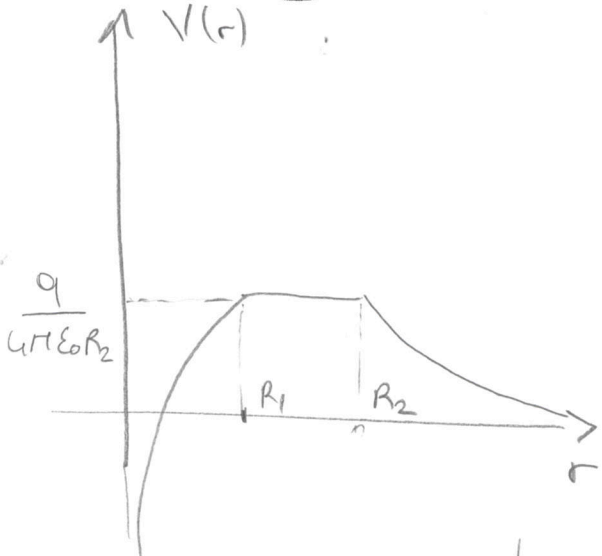
A spherical hollow conductor has inner radius R_1 and outer radius R_2. The conductor has total charge $+2q$. There is a point charge $-q$ fixed at the center of the hollow region. Determine and plot the electric potential as a function of radial distance r from the center ($0 \le r < \infty$). (The constant in Coulomb's law is $\frac{1}{4\pi\varepsilon_0}$)



$r > R_2$ $\quad Q_{enc} = +2q - q = +q$

$r > R_2$ $\quad V(r) = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

$r = R_2$ $\quad V(R_2) = \frac{1}{4\pi\varepsilon_0}\frac{q}{R_2}$



$R_2 > r > R_1$ $\quad V(r) = \frac{1}{4\pi\varepsilon_0}\frac{q}{R_2}$ conductor is equipotential

$R_1 > r > 0$ $\quad V(r) = V(R_1) + \int_{R_1}^{r} \frac{+q}{4\pi\varepsilon_0 (r')^2}\, dr'$

$$V(r) = \frac{1}{4\pi\varepsilon_0}\frac{q}{R_2} + \frac{q}{4\pi\varepsilon_0}\left(-\frac{1}{r} + \frac{1}{R_1}\right) = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{R_1} + \frac{1}{R_2} - \frac{1}{r}\right)$$

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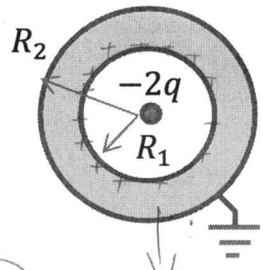
Name: **Student ID:** **Signature:**

A spherical hollow conductor has inner radius R_1 and outer radius R_2. The conductor is grounded. There is a point charge $-2q$ fixed at the center of the hollow region. Determine and plot the electric potential as a function of radial distance r from the center ($0 \leq r < \infty$). (The constant in Coulomb's law is $\frac{1}{4\pi\varepsilon_0}$)



$r > R_2$ $\quad Q_{enc} = -2q + 2q = 0$

No charge on outer surface

No e-field (no net charge)

$$V(r) = \begin{cases} 0 & r \geq R_2 \\ 0 & R_2 \geq r > R_1 \quad \text{(conductor is equipotential)} \\ 0 - \int_{R_1}^{r} \frac{-2q}{4\pi\varepsilon_0 (r')^2}\, dr' & R_1 \geq r > 0 \end{cases}$$

$$\frac{2q}{4\pi\varepsilon_0}\left(-\frac{1}{r} + \frac{1}{R_1}\right)$$