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General Physics II, Quiz 7
PHYS10000AA, Class year 99
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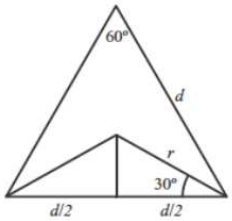
SN:_____, Name:_____

Chapter 25, Serway; ABSOLUTELY NO CHEATING!
Please write the answers on the blank space or on the back of this paper to save resources.

1.

***P25.13** By symmetry, a line from the center to each vertex forms a 30° angle with each side of the triangle. The figure shows the relationship between the length d of a side of the equilateral triangle and the distance r from a vertex to the center:



ANS FIG. P25.13

$$r\cos 30.0^\circ = d/2$$
$$\rightarrow r = d/(2\cos 30.0^\circ)$$

The electric potential at the center is

$$V = k_e \sum_i \frac{q_i}{r_i} = k_e\left(\frac{Q}{d/(2\cos 30.0^\circ)} + \frac{Q}{d/(2\cos 30.0^\circ)} + \frac{2Q}{d/(2\cos 30.0^\circ)}\right)$$
$$V = (4)\left(2\cos 30.0^\circ\ k_e\frac{Q}{d}\right) = \boxed{6.93k_e\frac{Q}{d}}$$

2.

P25.27 A cube has 12 edges and 6 faces. Consequently, there are 12 edge pairs separated by s, $2\times 6 = 12$ face diagonal pairs separated by $\sqrt{2}s$, and 4 interior diagonal pairs separated by $\sqrt{3}s$.

$$U = \frac{k_e q^2}{s}\left[12 + \frac{12}{\sqrt{2}} + \frac{4}{\sqrt{3}}\right] = \boxed{22.8\frac{k_e q^2}{s}}$$

3.

P25.45 Substituting given values into $V = \dfrac{k_e q}{r}$

$$7.50\times 10^3\ \text{V} = \frac{\left(8.99\times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2\right)q}{0.300\ \text{m}}$$

Substituting $q = 2.50\times 10^{-7}\ \text{C}$,

$$N = \frac{2.50\times 10^{-7}\ \text{C}}{1.60\times 10^{-19}\ \text{C}/e^-} = \boxed{1.56\times 10^{12}\ \text{electrons}}$$