

28. If the relative difference between the proton and electron charges (in absolute value) were

$$\frac{q_p - |q_e|}{e} = 0.0000010$$

then the actual difference would be

$$q_p - |q_e| = 1.6 \times 10^{-25} \text{ C} .$$

Amplified by a factor of $29 \times 3 \times 10^{22}$ as indicated in the problem, this amounts to a deviation from perfect neutrality of

$$\Delta q = (29 \times 3 \times 10^{22}) (1.6 \times 10^{-25} \text{ C}) = 0.14 \text{ C}$$

in a copper penny. Two such pennies, at $r = 1.0 \text{ m}$, would therefore experience a very large force. Eq. 22-1 gives

$$F = k \frac{(\Delta q)^2}{r^2} = 1.7 \times 10^8 \text{ N} .$$