

Electrostatic Charge & Force

#1) $n = 29$
 $q_p = +e$

$$q = ne = 29(1.602 \times 10^{-19} \text{ C})$$
$$= 4.6458 \times 10^{-18} \text{ C}$$
$$= \boxed{4.646 \times 10^{-18} \text{ C}}$$

#2) $n = 29$
 $q_e = -e$

$$q = -ne = 29(1.602 \times 10^{-19} \text{ C})$$
$$= \boxed{-4.646 \times 10^{-18} \text{ C}}$$

#3) $Q = -4.936 \times 10^{-5} \text{ C}$
 $n = ?$
 $q_e = -e$

$$Q = nq_e \rightarrow n = \frac{Q}{q_e} = \frac{Q}{-e}$$
$$n = \frac{-4.936 \times 10^{-5} \text{ C}}{-1.602 \times 10^{-19} \text{ C}} = 3.0811 \times 10^{14} \text{ elec.}$$
$$= \boxed{3.081 \times 10^{14} \text{ electrons}}$$

#4) $n = 1583$
 $Q = ?$
 $q_p = +e$

$$Q = nq_p = ne = 1583(1.602 \times 10^{-19} \text{ C})$$
$$= 2.53597 \times 10^{-16} \text{ C}$$
$$= \boxed{2.536 \times 10^{-16} \text{ C}}$$

#5) $n_p = 8$
 $r = 5.88 \times 10^{-10} \text{ m}$
 $q_p = +e$
 $q_e = -e$

a) $Q = n_p q_p = n_p e$

$$= 8(1.602 \times 10^{-19} \text{ C})$$
$$= 1.2816 \times 10^{-18} \text{ C}$$
$$= \boxed{1.282 \times 10^{-18} \text{ C}}$$

$$\#5 \ b) \ F = \frac{Kq_1q_2}{r^2} = \frac{K(8e)(-e)}{r^2} = -\frac{8Ke^2}{r^2} \quad (\text{attraction})$$

$$= -\frac{8(9.0 \times 10^9 \text{ Nm}^2/\text{C}^2)(1.602 \times 10^{-19})^2}{(5.88 \times 10^{-10} \text{ m})^2} = -5.3444 \times 10^{-9} \text{ N}$$

$$= \boxed{5.34 \times 10^{-9} \text{ N}}$$

[towards]

$$\#6) \ q_1 = 3.89 \times 10^{-11} \text{ C}$$

$$q_2 = -6.87 \times 10^{-9} \text{ C}$$

$$F = -6.82 \times 10^{-4} \text{ N}$$

$$r = ?$$

$$F = \frac{Kq_1q_2}{r^2} \rightarrow r = \sqrt{\frac{Kq_1q_2}{F}}$$

$$r = \sqrt{\frac{(9.0 \times 10^9 \text{ Nm}^2/\text{C}^2)(3.89 \times 10^{-11} \text{ C})(-6.87 \times 10^{-9} \text{ C})}{(-6.82 \times 10^{-4} \text{ N})}}$$

$$= 1.8779 \times 10^{-3} \text{ m} = \boxed{1.88 \times 10^{-3} \text{ m}}$$

$$\#7) \ q_1 = ne \rightarrow n = \frac{q_1}{e} = \frac{3.89 \times 10^{-11} \text{ C}}{(1.602 \times 10^{-19} \text{ C})} = \boxed{2.43 \times 10^8 \text{ p}^+}$$

$$q_2 = -ne \rightarrow n = \frac{q_2}{-e} = \frac{-6.87 \times 10^{-9} \text{ C}}{1.602 \times 10^{-19} \text{ C}} = \boxed{4.29 \times 10^{10} \text{ e}^-}$$

$$\#8) \ r = 135.8 \text{ cm}$$

$$F = 2.84 \times 10^{-6} \text{ N}$$

$$F = \frac{Kq_1q_2}{r^2} = \frac{Kq^2}{r^2}$$

$$q = ?$$

$$q_1 = q_2$$

$$q = \sqrt{\frac{Fr^2}{K}}$$

$$q = \sqrt{\frac{(2.84 \times 10^{-6} \text{ N})(1.358 \text{ m})^2}{(9.0 \times 10^9 \text{ Nm}^2/\text{C}^2)}} = 2.4123 \times 10^{-8} \text{ C}$$

$$= \boxed{\pm 2.41 \times 10^{-8} \text{ C}}$$