Electric Fields 4

① $q = \pm Ne$

$$N = \frac{q}{e} = \frac{2.4 \times 10^{-6}}{1.6 \times 10^{-19}} = \boxed{1.5 \times 10^{13}}$$

② $q = \pm Ne$

$$= +(4 \times 10^{11})(1.6 \times 10^{-19})$$

$$q = \boxed{+6.4 \times 10^{-8}\ C}$$

③ a) $F_e = F_g$

$$qE = F_g$$

$$q = \frac{F_g}{E}$$

$$= \frac{1.9 \times 10^{-15}}{6 \times 10^{3}}$$

$$q = \boxed{-3.2 \times 10^{-19}\ C}$$

{ Charge is negative b/c F_e is up while E is down

b) $$N = \frac{q}{e} = \frac{3.2 \times 10^{-19}}{1.6 \times 10^{-19}} = \boxed{2}$$

c) $F_g = mg$

$$1.9 \times 10^{-15} = m(9.8)$$

$$m = 1.939 \times 10^{-16}\ kg$$

③ c) continued

$$\Sigma F = F_e - F_g$$

$$ma = qE - F_g$$

$$(1.939 \times 10^{-16})a = (-3.2 \times 10^{-19})(-9 \times 10^3) - (1.9 \times 10^{-15})$$

$$a = \boxed{5.05 \text{ m/s}^2 \text{ [up]}}$$

④ a) $F_e = F_g$

$$qE = F_g$$

$$q = \frac{F_g}{E}$$

$$= \frac{6.4 \times 10^{-13}}{4 \times 10^6}$$

$$q = \boxed{+1.6 \times 10^{-19} \text{ C}}$$

{ Charge is positive b/c it said so in the question.

b) $$n = \frac{q}{e} = \frac{1.6 \times 10^{-19}}{1.6 \times 10^{-19}} = \boxed{1}$$

c) up. F_e has to be up to balance F_g.

For a positive charge, F_e and E have the same direction, so E is up.

⑤ $m = \frac{F_g}{g} = \frac{6.4 \times 10^{-13}}{9.8} = 6.531 \times 10^{-14}\ kg$

$\Sigma F = F_e - F_g$

$ma = qE - F_g$

$(6.531 \times 10^{-14})(-0.75) = (1.6 \times 10^{-19})E - 6.4 \times 10^{-13}$

$E = 3\ 693\ 877.6\ N/C$

or

$\boxed{3.69 \times 10^6\ N/C\ [Up]}$

⑥ $q = \pm Ne = +(4)(1.6 \times 10^{-19}) = +6.4 \times 10^{-19}\ C$

$F_e = F_g$

$qE = F_g$

$E = \frac{F_g}{q} = \frac{6.4 \times 10^{-13}\ N}{6.4 \times 10^{-19}\ C}$

$E = 1\ 000\ 000\ N/C$

or

$\boxed{1 \times 10^6\ N/C\ [Up]}$

⑦ $F_e = F_g$

$qE = mg$

$q(100) = (2 \times 10^{-15})(9.8)$

$q = \boxed{+ 1.96 \times 10^{-16} \text{ C}}$

q is positive b/c F_e has to be up (in order to balance F_g). Since E is up and F_e is up, the charge has to be positive.

⑧ $\Sigma F = F_e - F_g$

$ma = qE - mg$

$ma + mg = qE$

$m(a+g) = qE$

$m(1 + 9.8) = (8 \times 10^{-19})(4.25 \times 10^5)$

$m = \boxed{3.15 \times 10^{-14} \text{ kg}}$