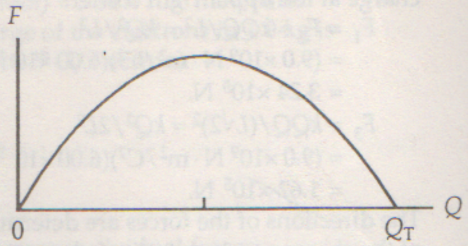
17. If the separation is r and one charge is Q_1, the other charge will be $Q_2 = Q_T - Q_1$.
For the repulsive force, we have
$F = kQ_1Q_2/r^2 = kQ_1(Q_T - Q_1)/r^2$.

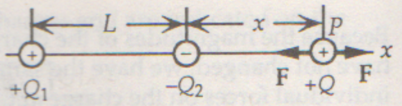


(*a*) If we plot the force as a function of Q_1, we see that the maximum occurs when
$\boxed{Q_1 = \tfrac{1}{2}Q_T,}$
which we would expect from symmetry, since we could interchange the two charges without changing the force.

(*b*) We see from the plot that the minimum occurs when either charge is zero:
$\boxed{Q_1 \text{ (or } Q_2) = 0.}$

18. The attractive Coulomb force provides the centripetal acceleration of the electron:
$ke^2/r^2 = mv^2/r$, or $r = ke^2/mv^2$;
$r = (9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)(1.60 \times 10^{-19}\ \text{C})^2/(9.11 \times 10^{-31}\ \text{kg})(1.1 \times 10^6\ \text{m/s})^2 = \boxed{2.1 \times 10^{-10}\ \text{m.}}$

19. If we place a positive charge, it will be repelled by the positive charge and attracted by the negative charge. Thus the third charge must be placed along the line of the charges, but not between them. For the net force to be zero, the magnitudes of the individual forces must be equal:



$F = kQ_1Q/r_1^2 = kQ_2Q/r_2^2$, or $Q_1/(L + x)^2 = Q_2/x^2$;
$(5.7\ \mu\text{C})/(0.25\ \text{m} + x)^2 = (3.5\ \mu\text{C})/x^2$, which gives $x = 0.91$ m, – 0.11 m.
The negative result corresponds to the position between the charges where the magnitudes and the directions are the same. Thus the third charge should be placed $\boxed{\text{0.91 m beyond the negative charge.}}$
Note that we would have the same analysis if we used a negative charge.

20. If one charge is Q_1, the other charge will be $Q_2 = Q - Q_1$. For the force to be repulsive, the two charges must have the same sign. Because the total charge is positive, each charge will be positive. We account for this by considering the force to be positive:
$F = kQ_1Q_2/r^2 = kQ_1(Q - Q_1)/r^2$;
$12.0\ \text{N} = (9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)Q_1(80.0 \times 10^{-6}\ \text{C} - Q_1)/(1.06\ \text{m})^2$, which is a quadratic equation:
$Q_1^2 - (80.0 \times 10^{-6}\ \text{C})Q_1 + 1.50 \times 10^{-9}\ \text{C}^2 = 0$, which gives $Q_1 = \boxed{50.0 \times 10^{-6}\ \text{C}, 30.0 \times 10^{-6}\ \text{C.}}$
Note that, because the labels are arbitrary, we get the value of both charges.
For an attractive force, the charges must have opposite signs, so their product will be negative. We account for this by considering the force to be negative:
$F = kQ_1Q_2/r^2 = kQ_1(Q - Q_1)/r^2$;
$-12.0\ \text{N} = (9.0 \times 10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)Q_1(80.0 \times 10^{-6}\ \text{C} - Q_1)/(1.06\ \text{m})^2$, which is a quadratic equation:
$Q_1^2 - (80.0 \times 10^{-6}\ \text{C})Q_1 - 1.50 \times 10^{-9}\ \text{C}^2 = 0$, which gives $Q_1 = \boxed{-15.7 \times 10^{-6}\ \text{C}, 95.7 \times 10^{-6}\ \text{C.}}$

21. The acceleration is produced by the force from the electric field:
$F = qE = ma$;
$(1.60 \times 10^{-19}\ \text{C})(600\ \text{N/C}) = (9.11 \times 10^{-31}\ \text{kg})a$, which gives $a = \boxed{1.05 \times 10^{14}\ \text{m/s}^2.}$
Because the charge on the electron is negative, the direction of force, and thus the acceleration, is $\boxed{\text{opposite to the direction of the electric field.}}$
The direction of the acceleration is $\boxed{\text{independent of the velocity.}}$

22. If we take the positive direction to the east, we have
$F = qE = (-1.60 \times 10^{-19}\ \text{C})(+3500\ \text{N/C}) = -5.6 \times 10^{-16}\ \text{N}$, or $\boxed{5.6 \times 10^{-16}\ \text{N (west).}}$