Atomic Structure:

Tuesday, February 01, 2011 2:03 PM

electron orbitals

-1 elementary charge

-1.6×10^{-19} Coulomb

Atomic Structure and charges:

Atoms are composed of protons p, neutrons n and electrons e⁻.
Of which p is positively charged and found at the center of the atom in a place called the nucleus.
Located here are the n which have an electrical charge of 0.
Orbiting the center are the e⁻ in valence levels and they have a charge of negative.

The smallest possible charge on an item is called the elementary charge, there are 2 types of elementary charge. A positive elementary charge is found on the p, a negative elementary charge is found on the e⁻.

The size of an elementary charge is +/- 1.6 x 10^{-19} C where C is for coulombs, the unit of charge.

effects

Objects can become negatively charged by acquiring excess e⁻.
Objects can become positively charged by giving up e⁻.

$Q = ne$

Total charge on an object Q = the excess or short number of e times the size of the elementary charge. Q
Q = ne

Objects with opposite electric charges will attract each other.
Objects with similar electric charges will repel each other.
This is known as Coulomb's Law.`
The magnitude of the Force is given by the equation ________________

F_e roughly 10^{47} times bigger than F_g

Direction of force depends on the sign of charges.
The mass of a proton is 1.67×10^{-27} kg or 1 amu.
The mass of a neutron is 1.68×10^{-27} kg or 1 amu.
The mass of an electron is 9.11×10^{-31} kg or 0 amu. $\frac{1}{1834}$

atomic mass units

Chemistry is about the joining of molecular bonds, all this is a reconfiguring of electrons into stable levels around nuclei based on Coulomb's Law. If some physical force is greater than the molecular bonds an object can rip apart, bend, or compress. Almost Every 'contact force' is an expression of Coulomb's Law using electron configurations.

Ag ← argentum
atomic #47 ← #protons
nuclear mass 93 ← #p + #n
neutral #p = #e

$93 - 47 = 46$ neutrons

spdf

Conductors: a class of materials which allow electrical charges to transfer easily across their surfaces.
(These materials also tend to transfer heat energy easily.)
Metals are good conductors: palladium the best of conductors, Ag, Pt, Au, Cu
Some metalloids are decent conductors, graphite being the best example. Why are metals (generally) good conductors? The outer (valence) electrons are weakly bonded to the Nucleus, and are readily released to pass to the next atom. "A sea of loosely bonded e⁻s"

ionic bonds ← between positive ions (usually metal) + negative ions (usually non-metal) (generally) good conductors? The outer (valence) electrons are weakly bonded to the Nucleus, and are readily released to pass to the next atom. "A sea of loosely bonded e-s"

ionic bonds ← between positive ions + negative ions ← usually non-metal / metal

covalent bonds ← almost exclusive by non-metals ← the electron configurations move to a lower potential than in un-bound atoms ← Coulombs Law

Strachan

a
b
C
D

Insulators: a class of materials which do not allow easy passage of electrical charges. Typical examples: covalent compounds. (Glass, wood, ceramix, rubber, styrofoam…)[non-conductive b/c electrons are strongly bonded in chemical bonds to multiple atoms]

Uncharged objects (common state) have equal numbers of protons and electrons, for example an oxygen atom O-16, has atomic # 8 = # of protons

mass - #p = #n = 8

8 e

F_g

The Law of Conservation of Charge: the total charge in the universe must be conserved, the total charge before an event must equal the total charge after the event.

Coulomb's Law: $F = k q_1 q_2$ $= G m m$

always attractive

2 types of charge

attraction ← opposite charges

Repulsion ← similar charges

+ side & - side

Polarized

Charging by conduction: contact between objects strips outer valence electrons off one object onto The other objects

you

Charging by induction: tricking an object into being charged by exposing to another already charged object

Typical sizes of charges: 2 main scales of charges:

Single particle (e-, nuclei) C

larger point charges ? 10^{-6} C

μC

μC

COULOMB'S LAW

$$F_e = \frac{k q_1 q_2}{r^2}$$

6μC (+) 8μC (+)

similar repel ← if F = +

opposites attract ← if F = −

Draw arrows

$$F_g = \frac{G m_1 m_2}{r^2}$$

Coulomb constant

$$k = 9.00 \times 10^9 \ \frac{N m^2}{C^2}$$

based on a different constant

$$k = \frac{1}{4\pi \varepsilon_0}$$

permittivity of free space

6μC (+) — 3m — −3μC (−)

2m

(+) 4μC

find the net force on the −3μC charge

$$F = \frac{k q_1 q_2}{r^2} = \frac{9 \times 10^9 (6\times10^{-6})(3\times10^{-6})}{3^2} = 18 \times 10^{-3}\ N$$

$$F = \frac{k q_1 q_2}{r^2} = \frac{9\times10^9 \ 4\times10^{-6} \ 3\times10^{-6}}{2^2} = 27 \times 10^{-3}\ N$$

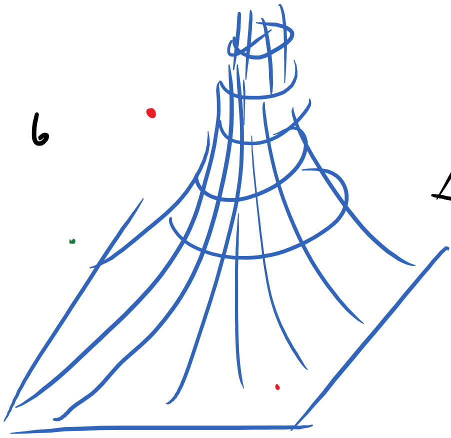
1-4, 7 p 145

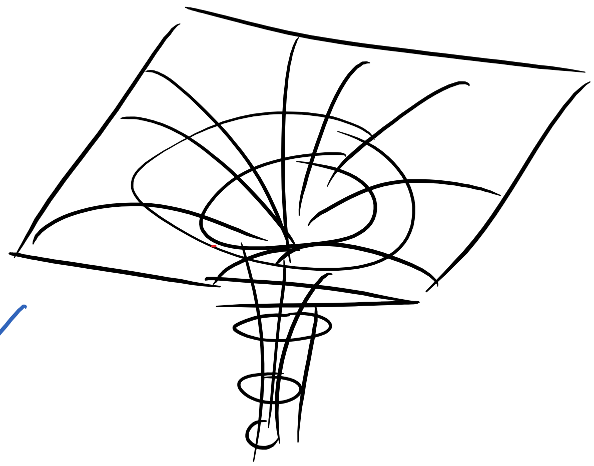
#7 hint

+ +

1 - 3, 6, 7, 10
p. 145

6





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