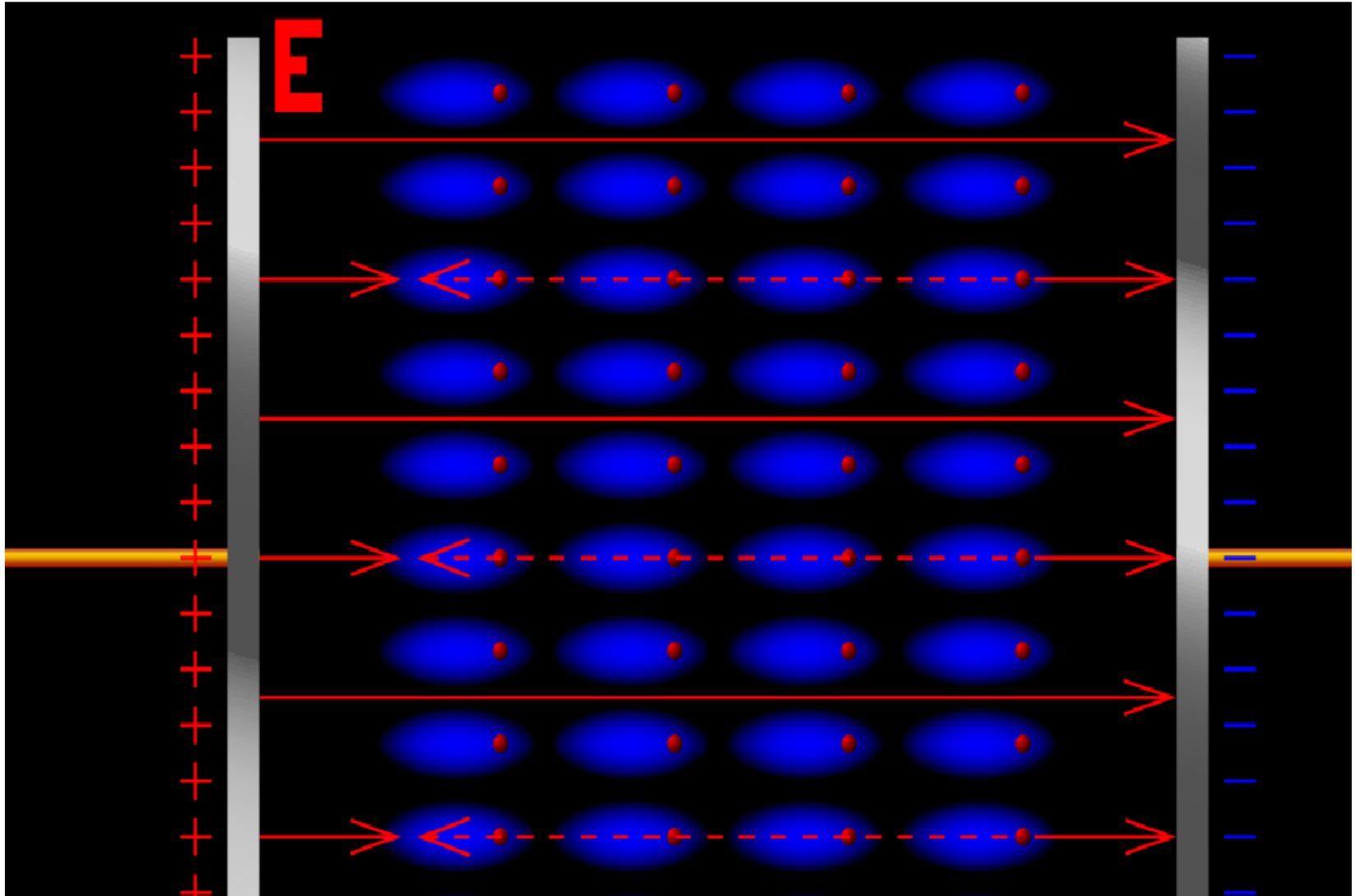
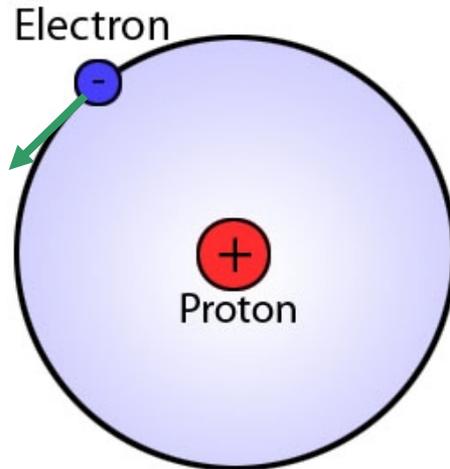


Electricidad

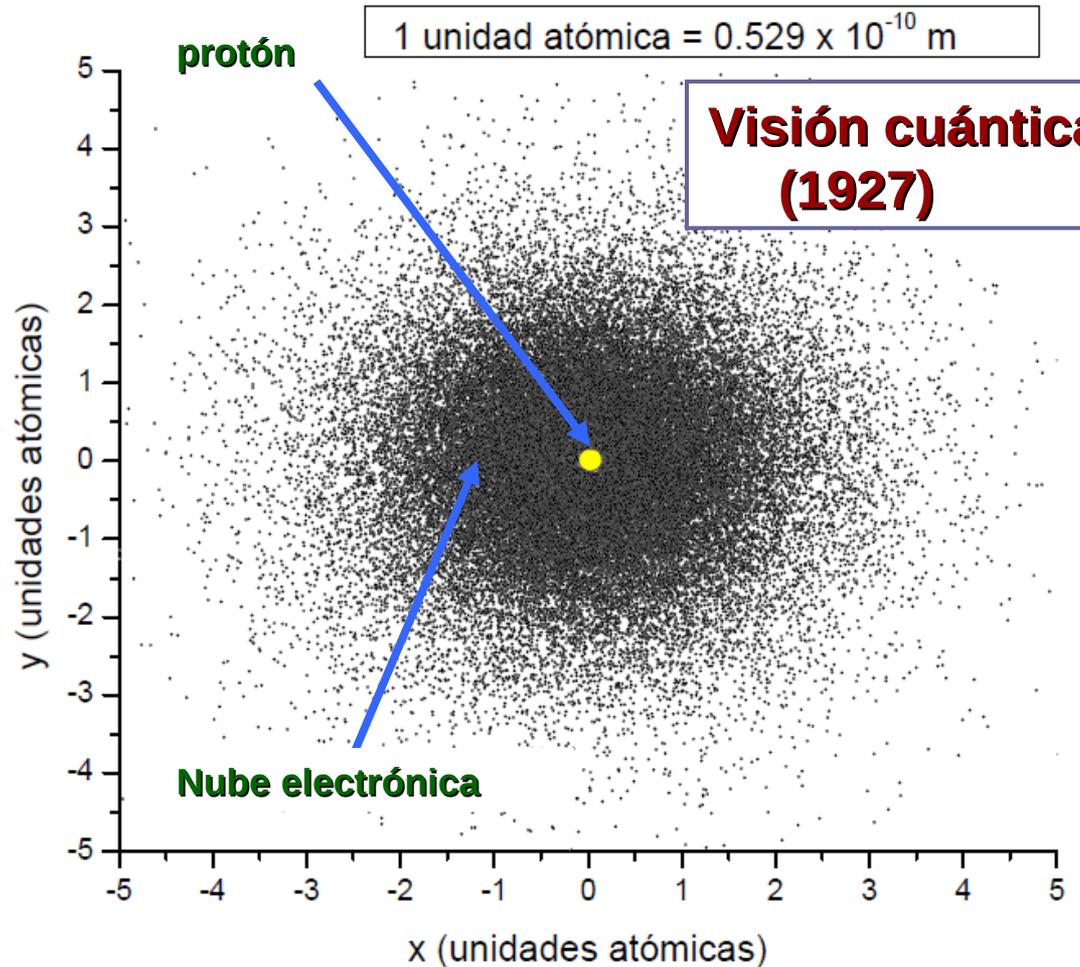


El átomo de hidrógeno

Visión Clásica (1913)



Analogía: imaginarse una gota de agua convertida en vapor. La masa es la misma pero distribuída sobre un mayor volumen espacial



Repaso

Tabla Periódica de los Elementos

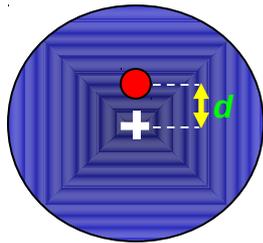
Atomic masses in parentheses are those of the most stable or common isotope.

$$\rho = \frac{q}{\frac{4}{3}\pi a^3}$$

$$E = \frac{qd}{4\pi\epsilon_0 a^3}$$



E



Polarizabilidad Atómica

$$\vec{p} = \alpha \vec{E}$$

Los metales alcalinos son fácilmente polarizables.

Tabla Periódica de los Elementos

Legend:

- Alcalinos (Yellow)
- Alcalinotérreos (Light Yellow)
- Metales de transición (Pink)
- Lantánidos (Light Blue)
- Actínidos (Light Purple)
- Metales del bloque p (Cyan)
- No metales (Light Green)
- Gases nobles (Light Blue)
- Solid (White box with 'c')
- Liquid (Green box with 'Br')
- Gas (Red box with 'H')
- Synthetic (Black box with 'Tc')

1 1A 1 H Hidrógeno 1.00794	2 IIA 4 Be Berilio 9.012182	3	4	5	6	7	8	9	10	11	12	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIII 2 He Helio 4.002602
3 1 Li Litio 6.941	4 2 B Boro 10.811	5 3 Na Sodio 22.989770	6 4 Mg Magnesio 24.3050	7	8	9	10	11	12	13 3 Al Aluminio 26.981538	14 4 Si Silicio 28.0855	15 5 P Fósforo 30.973761	16 6 S Azufre 32.066	17 7 Cl Cloro 35.463	18 8 Ar Argón 39.948		
4 2 K Potasio 39.0983	5 3 Ca Calcio 40.078	6 4 Sc Escandio 44.955910	7 5 Ti Titanio 47.867	8 6 V Vanadio 50.9415	9 7 Cr Cromo 51.9961	10 8 Mn Manganeso 54.938049	11 9 Fe Hierro 55.8457	12 10 Co Cobalto 58.933200	13 11 Ni Níquel 58.6934	14 12 Cu Cobre 63.546	15 13 Zn Zinc 65.409	16 14 Ga Galio 69.723	17 15 Ge Germanio 72.64	18 16 As Arsénico 74.92160	19 17 Se Selenio 78.96	20 18 Br Bromo 79.904	21 19 Kr Kriptón 83.798
5 3 Rb Rubidio 85.4678	6 4 Sr Estroncio 87.62	7 5 Y Itrio 88.90585	8 6 Zr Circonio 91.224	9 7 Nb Niobio 92.90638	10 8 Mo Molibdeno 95.94	11 9 Tc Technecio (98)	12 10 Ru Rutenio 101.07	13 11 Rh Rodio 102.90550	14 12 Pd Paladio 106.42	15 13 Ag Plata 107.8682	16 14 Cd Cadmio 112.411	17 15 In Indio 114.818	18 16 Sn Estaño 118.710	19 17 Sb Antimonio 121.760	20 18 Te Teluro 127.60	21 19 I Yodo 126.90447	22 20 Xe Xenón 131.293
6 4 Cs Cesio 132.90545	7 5 Ba Bario 137.327	8 6 La Lantano (57 to 71)	9 7 Hf Hafnio 178.49	10 8 Ta Tántalo 180.9479	11 9 W Wolframio 183.84	12 10 Re Renio 186.207	13 11 Os Osmio 190.23	14 12 Ir Iridio 192.217	15 13 Pt Platino 195.078	16 14 Au Oro 196.96655	17 15 Hg Mercurio 200.59	18 16 Tl Talio 204.3833	19 17 Pb Plomo 207.2	20 18 Bi Bismuto 208.98038	21 19 Po Polonio (209)	22 20 At Astatio (210)	23 21 Rn Radón (222)
7 5 Fr Francio (223)	8 6 Ra Radio (226)	9 7 Ac Actinio (227)	10 8 Rf Rutherfordio (261)	11 9 Db Dubnio (262)	12 10 Sg Seaborgio (266)	13 11 Bh Bohrio (264)	14 12 Hs Hassio (269)	15 13 Mt Meitnerio (268)	16 14 Ds Darmstadtio (271)	17 15 Rg Roentgenio (272)	18 16 Uub Ununbio (285)	19 17 Uut Ununtrio (284)	20 18 Uuq Ununquadio (289)	21 19 Uup Ununpentio (288)	22 20 Uuq Ununquadio (289)	23 21 Uuh Ununheptio (286)	24 22 Uuo Ununoctio (289)

Atomic masses in parentheses are those of the most stable or common isotope.

Gases Nobles

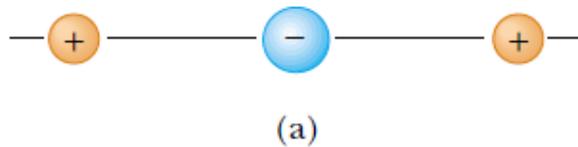
Alcalinos

in 1984 by the International Union of Pure and Applied Chemistry. The names of elements 112-118 are the Latin equivalents of those numbers.

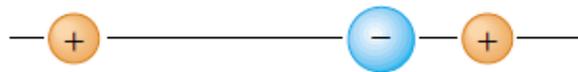
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58 Ce Cerio 140.116	59 Pr Praseodimio 140.90765	60 Nd Neodimio 144.24	61 Pm Prometio (145)	62 Sm Samario 150.36	63 Eu Europio 151.964	64 Gd Gadolinio 157.25	65 Tb Terbio 158.92534	66 Dy Disprosio 162.500	67 Ho Holmio 164.93032	68 Er Erbio 167.259	69 Tm Tulio 168.93421	70 Yb Iterbio 173.04	71 Lu Lutecio 174.967	
89 Ac Actinio (227)	90 Th Torio 232.0381	91 Pa Protactinio 231.03588	92 U Uranio 238.02891	93 Np Neptunio (237)	94 Pu Plutonio (244)	95 Am Americio (243)	96 Cm Curio (247)	97 Bk Berkelio (247)	98 Cf Californio (251)	99 Es Einstenio (252)	100 Fm Fermio (257)	101 Md Mendelevio (258)	102 No Nobelio (259)	103 Lr Lawrencio (262)

Polarización de moléculas



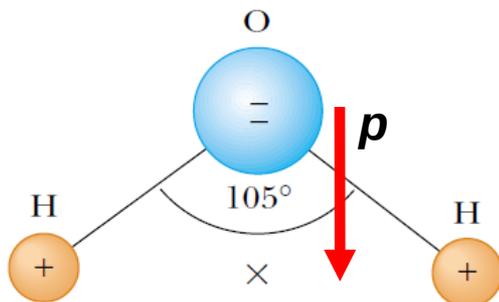
E



Molécula no polar

No polariza por igual en distintas direcciones:

p no es necesariamente paralelo a E

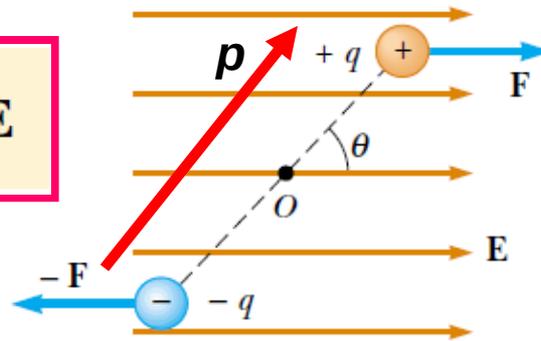


Molécula polar

momento dipolar permanente

Polarización de moléculas

$$\tau = \mathbf{p} \times \mathbf{E}$$

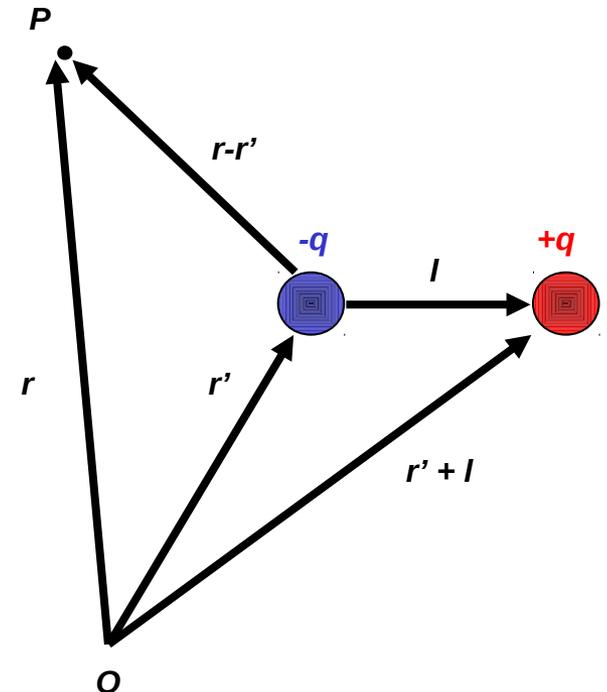


Una molécula polar se orienta ante un campo eléctrico externo

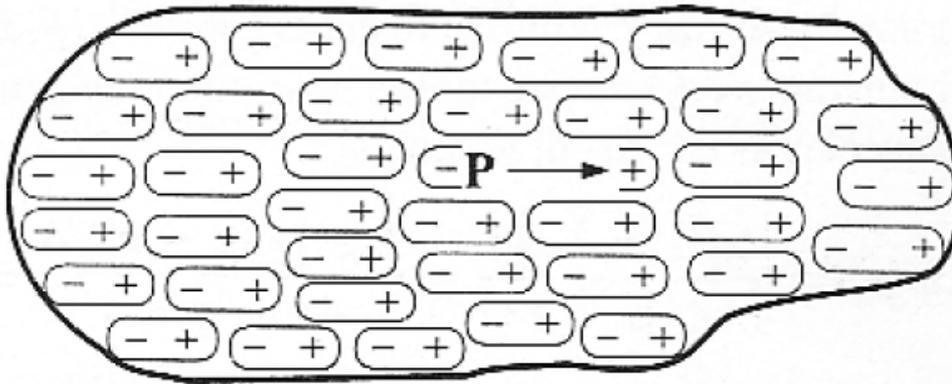
Recordemos

$$V(\mathbf{r}) = \frac{q}{4\pi\epsilon_0} \frac{(\mathbf{r} - \mathbf{r}') \cdot \mathbf{l}}{|\mathbf{r} - \mathbf{r}'|^3}$$

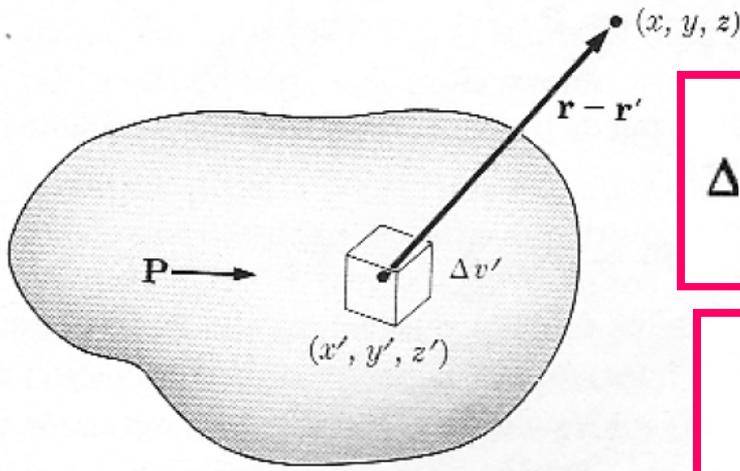
En el límite $l \ll |\mathbf{r} - \mathbf{r}'|$



Vector Polarización



$$\mathbf{P} = \frac{\Delta \mathbf{p}}{\Delta v}$$



Campo fuera de un medio dieléctrico

$$\Delta v(\mathbf{r}) = \frac{\Delta \mathbf{p} \cdot (\mathbf{r} - \mathbf{r}')}{4\pi\epsilon_0 |\mathbf{r} - \mathbf{r}'|^3} = \frac{\mathbf{P}(\mathbf{r}') \cdot (\mathbf{r} - \mathbf{r}') \Delta v'}{4\pi\epsilon_0 |\mathbf{r} - \mathbf{r}'|^3}$$

$$v(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int_{V_0} \frac{\mathbf{P}(\mathbf{r}') \cdot (\mathbf{r} - \mathbf{r}') dv'}{|\mathbf{r} - \mathbf{r}'|^3}$$

Polarización

$$v(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \oint_{S_0} \frac{\mathbf{P} \cdot \mathbf{n} da'}{|\mathbf{r} - \mathbf{r}'|} + \frac{1}{4\pi\epsilon_0} \int_{V_0} \frac{(-\nabla' \cdot \mathbf{P}) dv'}{|\mathbf{r} - \mathbf{r}'|}$$

$$\sigma_P \equiv \mathbf{P} \cdot \mathbf{n} = P_n \quad \rho_P \equiv -\nabla \cdot \mathbf{P}$$

*densidades de
carga de polarización*

$$v(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \left[\oint_{S_0} \frac{\sigma_P da'}{|\mathbf{r} - \mathbf{r}'|} + \int_{V_0} \frac{\rho_P dv'}{|\mathbf{r} - \mathbf{r}'|} \right]$$

$$\mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \left[\iint_{S_0} \sigma_P \frac{(\mathbf{r} - \mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|^3} da' + \int_{V_0} \rho_P \frac{(\mathbf{r} - \mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|^3} dv' \right]$$

$$Q_P = \int_{V_0} (-\nabla' \cdot \mathbf{P}) dv' + \oint_{S_0} \mathbf{P} \cdot \mathbf{n} da'$$

Carga de polarización

Polarización

