

Chemical Bonding

↓ WHY?

to attain stable noble gas electronic configuration

octet
8e⁻

duplet
2e⁻

- inert → used in light bulbs
- unreactive
- stable

↓ HOW?

Lose, gain or share e⁻

form ions

charged particle

take part in chemical reactions (nucleus does not)

only no. of e⁻ changes

← IONS

charged (+ve or -ve)

no. of protons ≠ no. of e⁻
(+ve) (-ve)

if: no of p > no. of e⁻
↳ +vely charged

CATION

Ca(+) ion

if: no. of e⁻ > no. of p
↳ -vely charged

ANION

positively charged
can have various charges on ions

transition metals

ATOMS

neutral

no. of protons = no. of e⁻
(+ve) (-ve)

takes part in covalent bonding (chapter 5)

doesn't really react

noble gases

1+ 2+

3+

3-

2-

1-

★ link to periodic table

written above are charges on the ions that the elements in that group have.

1+, 2+, 3+ → Metals (cations)

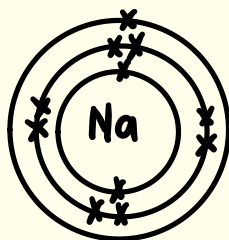
3-, 2-, 1- → non-metals (anions)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen 1.008	Atomic Symbol																2 He Helium 4.0026
3 Li Lithium 6.94	4 Be Beryllium 9.0122	[C] Solid															
11 Na Sodium 22.990	12 Mg Magnesium 24.305	[Hg] Liquid															
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
55 Cs Caesium 132.91	56 Ba Barium 137.33	57-71															
87 Fr Francium (223)	88 Ra Radium (226)	89-103															
For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.																	
57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97			
89 Ac Actinium (227)	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (288)	102 No Nobelium (289)	103 Lr Lawrencium (260)			

eg.

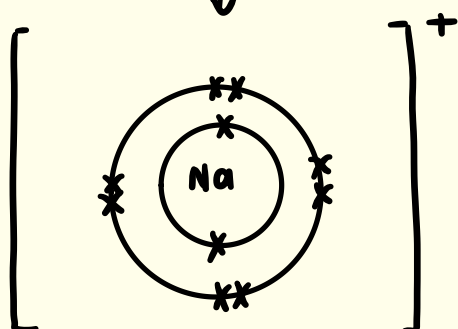
Na (sodium)

electronic configuration: 2, 8, 1



↓ -1e⁻
2, 8
↓
Stable
(looks like electron config of Ne)

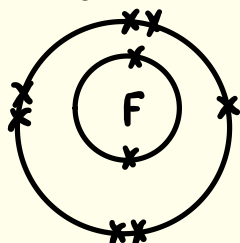
-e⁻ → in ionic bonding this e⁻ can be given to a non-metal so it can form an anion



since no. of p = 11, and now no. of e⁻ = 10,
no. of p > no. of e⁻
↳ +vely charged
↳ cation

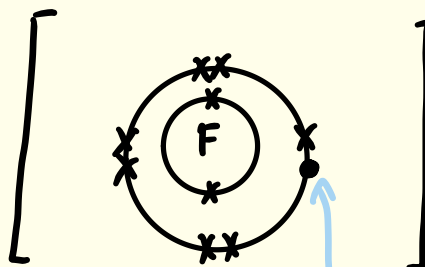
F (fluorine)

elec. config: 2, 7 $\xrightarrow{+e^-}$ 2, 8



+e⁻

=



don't need to put
charge written outside bracket

no. of p = 9, no. of e = 10

no. of e > no. of p

↓
anion

e⁻ given by metal during ionic bonding

TRY: draw dot-and-cross diagram of the ions of Nitrogen and magnesium. Include all electrons (ans at the end)

IONIC BONDING

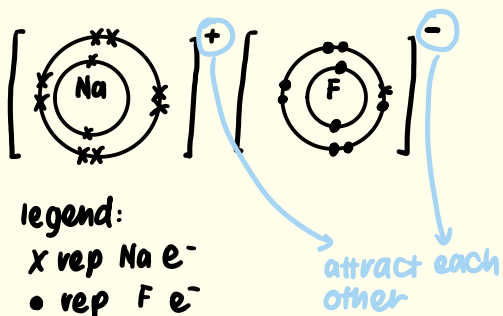
metal + non-metal

gain and loss of e^-

opposite charges attract

eg. NaF (sodium fluoride)

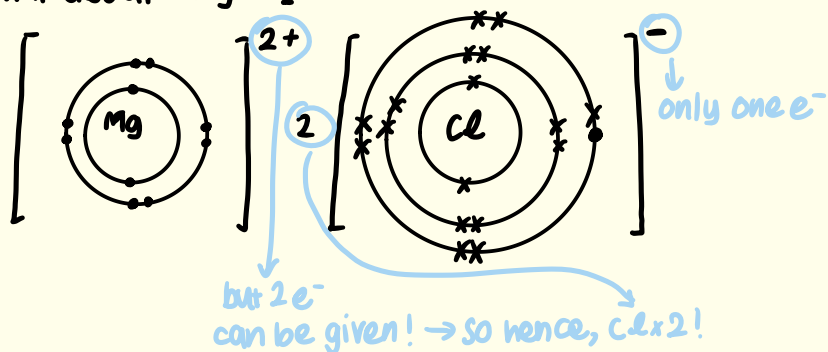
take note of spelling



ionic compounds have no net charge

+ve = -ve

What about $MgCl_2$?



because ionic compounds are NEUTRAL

VS

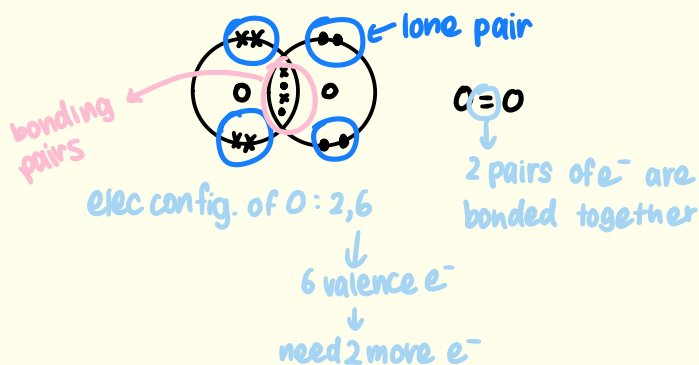
COVALENT BONDING

non-metal + non-metal

sharing of e^-

diatomic molecule

Eg. O_2 (only valence shells will be shown)



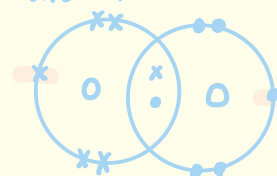
if 2 electrons (1 pair) is given from each O atom, they can share them, allowing them to each attain stable

noble gas electronic configuration.

↓ how?

electrons move very quickly in their valence shells → the 2 valence shells are interconnected → all 4 e^- move from one valence shell to another very quickly → both atom's valence shell will always have 8 e^-

What if only one e^- is given by each O atom?



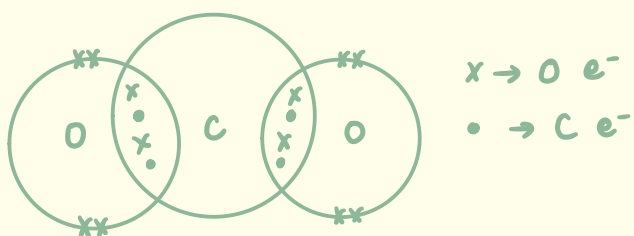
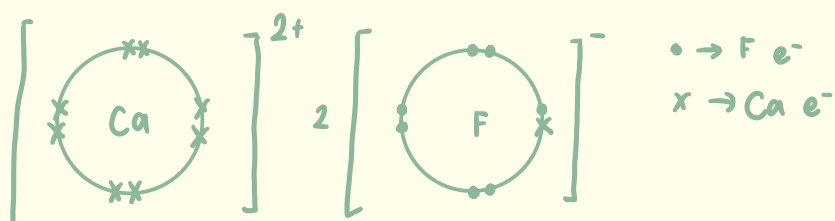
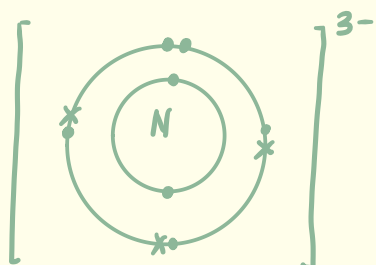
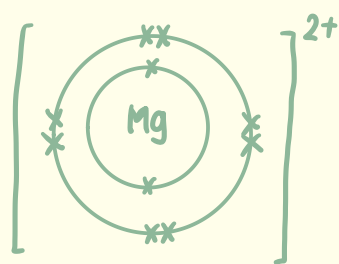
→ one pair still unbonded

TRY: Draw the dot-and-cross diagram of bonding between Ca and F, and CO_2 .

(show only valence electrons)

ionic covalent

ANSWERS



trick for checking your answer of covalent bonding:

cover the atoms until only one is seen (make sure bonding pairs can be seen). Count no. of e^- and make sure there are 8. do this for each atom.