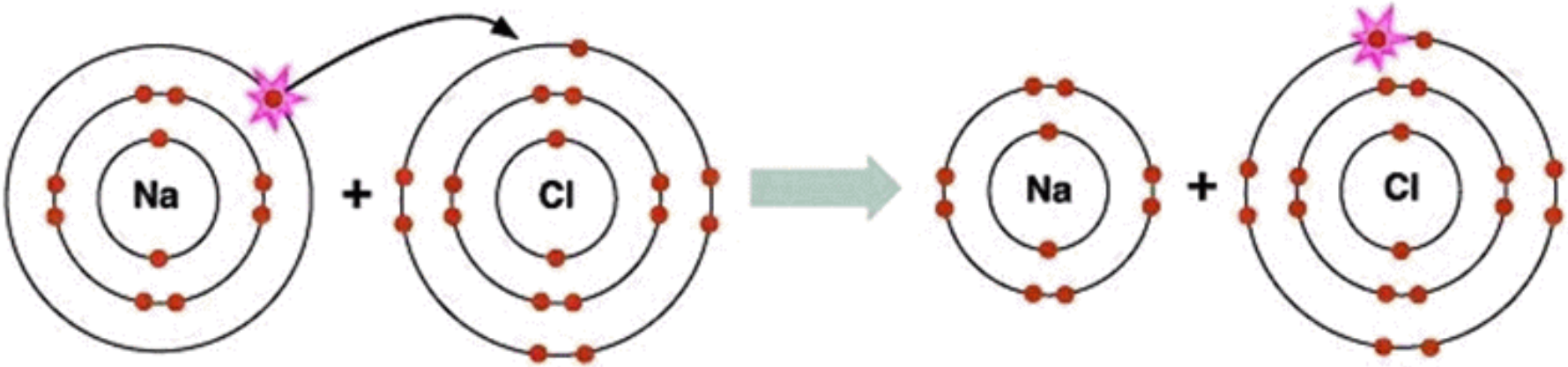
Section 2: Ionic Bonding



A sodium atom

A chloride atom

A sodium cation

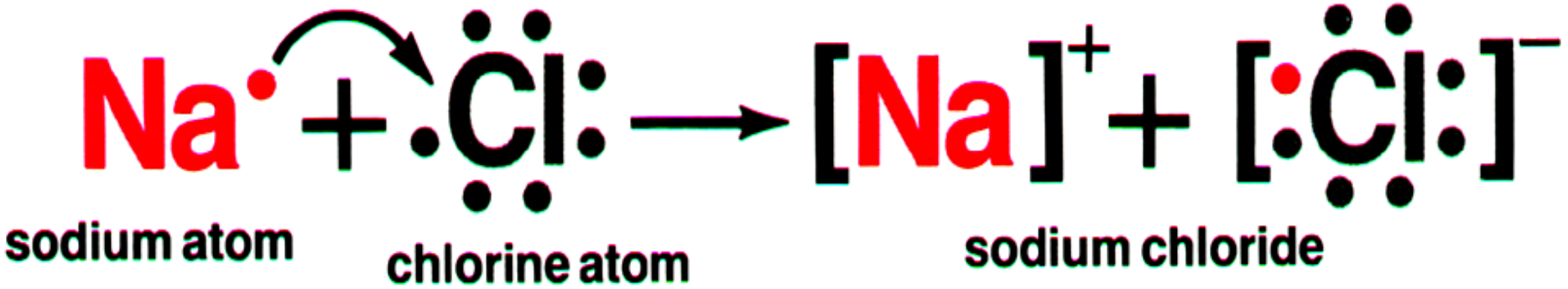
A chloride anion

Na + Cl → Na^+ + Cl^-

Ionic Compounds:

-composed of **+ cations** and **– anions** but…

they are **electrically neutral** (**net charge = 0**)



Na^+ **NaCl** Cl^-

Ionic Bonds:

electrostatic attraction between **+** & **– ions** in ionic compounds.

Binary Compounds:
contain *only* two *different* atoms

Chemical Formula:
shows *type* & *number* of atoms in substance.

Formula Unit:
the *lowest* whole-number *ratio* of atoms in an ionic compound.

$NaCl$ CaS PbO_2

~~Na_2Cl_2~~ ~~Ca_2S_2~~ ~~Pb_2O_4~~

Writing Formulas of Ionic Compounds:

1. Write **symbol** of **cation** (+) 1st, then **anion** (–).

2. Write **charge** of each ion as a *superscript*.

3. Write ***subscripts*** to **balance** the **charges** (***crisscross* charges**)

4. **Erase charges** (**neutral** compound).

potassium oxide

K^+

$K^+ \rightarrow O^{2-}$

$K^+ O^{2-}$

+2 –2

K_2O

magnesium nitride

$Mg^{2+} N^{3-}$

Mg^{2+} N^{3-}

Mg^{2+}

+6 –6

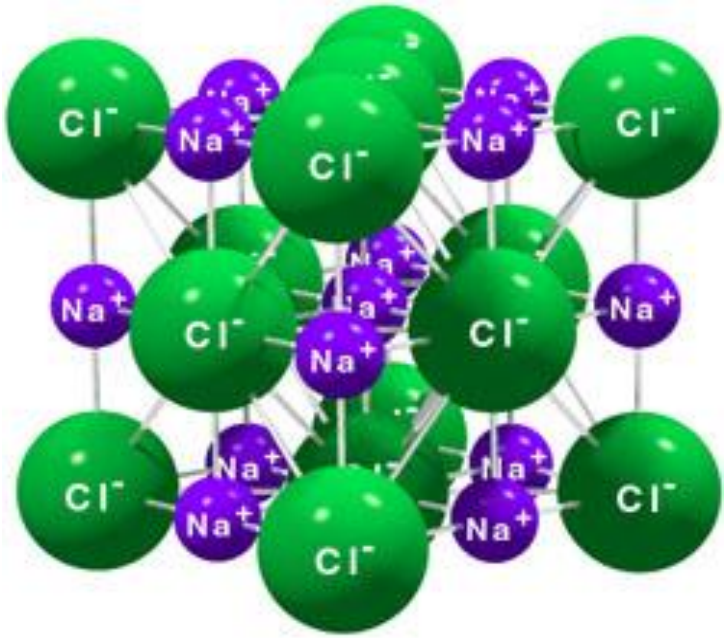
Mg_3N_2

Writing Formulas of Ionic Compounds:

NAME		FORMULA
calcium oxide	$Ca^{2+}\ O^{2-}$	**CaO** *(lowest ratio)*
aluminum oxide	$Al^{3+}\ O^{2-}$	**Al_2O_3**
magnesium phosphide	$Mg^{2+}\ P^{3-}$	**Mg_3P_2**
lithium sulfide	$Li^{+}\ S^{2-}$	**Li_2S**

Properties of Ionic Compounds

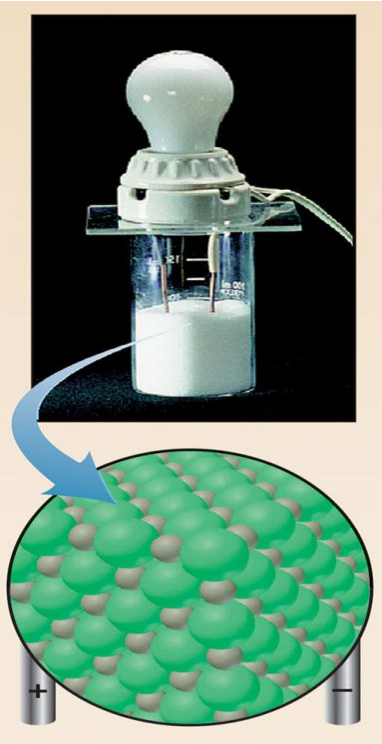
Strong attractions form a **3-D crystal lattice**



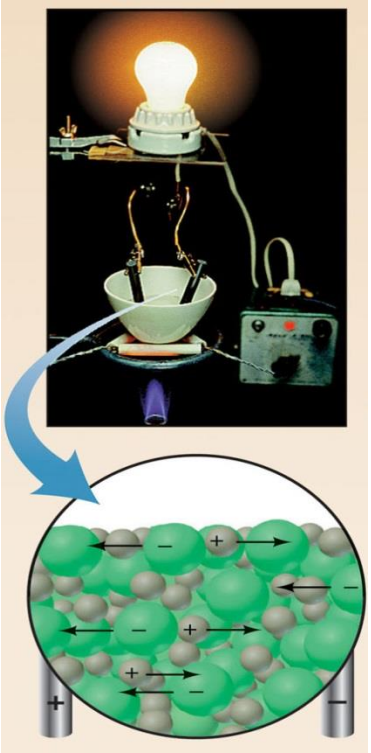
The ions are packed into a regular repeating pattern of oppositely charged ions.

Properties of Ionic Compounds

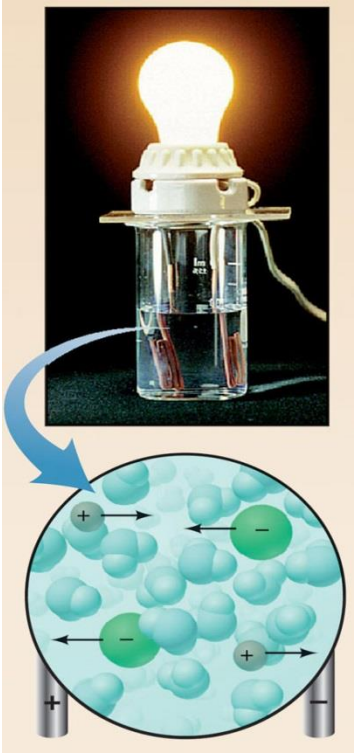
- **good conductors when melted or dissolved (ions must be able to move)**



Solid ionic compound



Molten ionic compound

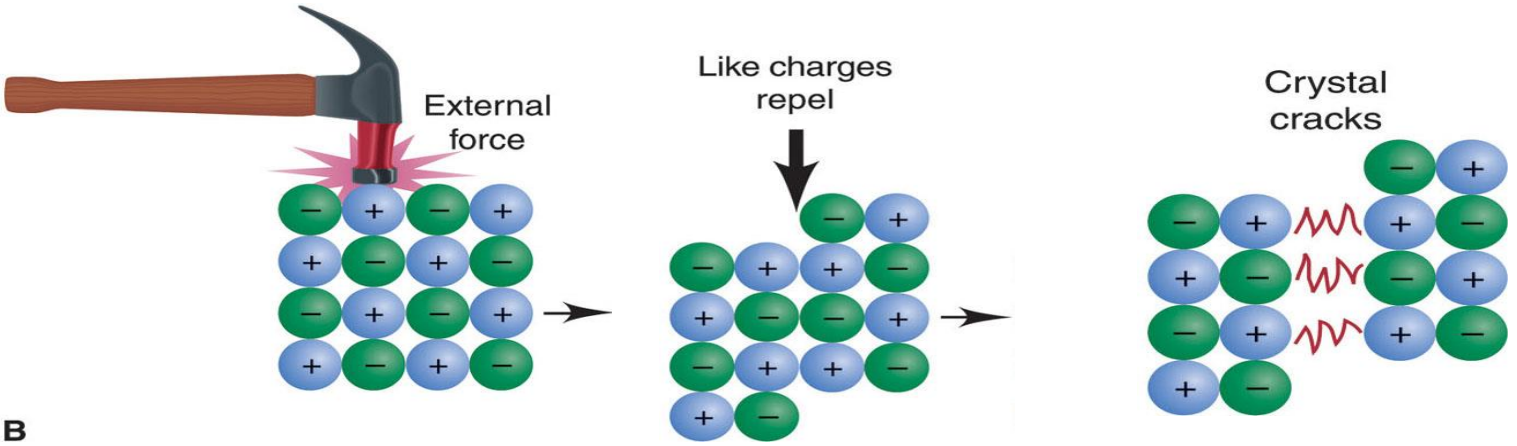


Ionic compound dissolved in water

Properties of Ionic Compounds

- **Hard, rigid, and brittle (crack when enough force is applied)**

A



B

Properties of Ionic Compounds

- Hard, rigid, and brittle (crack when enough force is applied)
- High melting points (lots of energy is needed to break electrostatic forces)
- Many are soluble (dissolve in water)

The orderly arrangement of component ions produces the beauty of crystalline solids.

Rutile (TiO_2)

1. Which is true about ionic compounds?

A. they all have a net charge

B. they are poor conductors

C. they form crystalline solids

D. they are electrically neutral

2. Predict the formula for magnesium chloride.

Mg *loses* 2 electrons for a +2 *cation*

Cl *gains* 1 electron for a -1 *anion*

$Mg^{+2}Cl^{-1}$ is not electrically *neutral*

$MgCl_2$ has a +2 and a -2 to be neutral

3. Which chemical formula is incorrect?

A. KF_2

B. CaS

C. MgO

D. NaBr

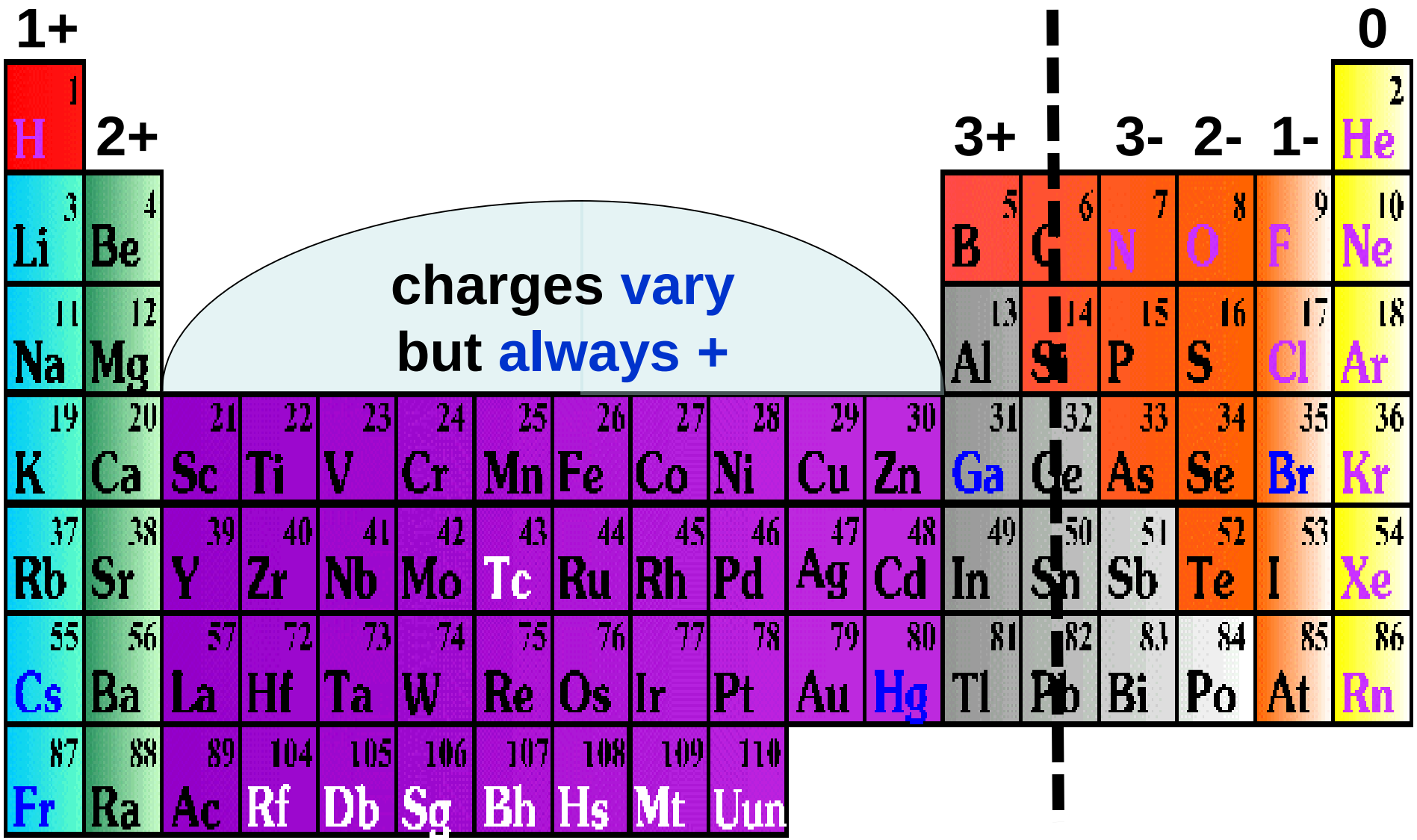
4. Which chemical formula is correct?

A. KO

B. MgS_2

C. CaO

D. Na_2Br


1+
2+
3+
3-
2-
1-
0
charges vary
but always +
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 Ac
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Uun