

# **Metallic bonding**

# **Metallic crystals**

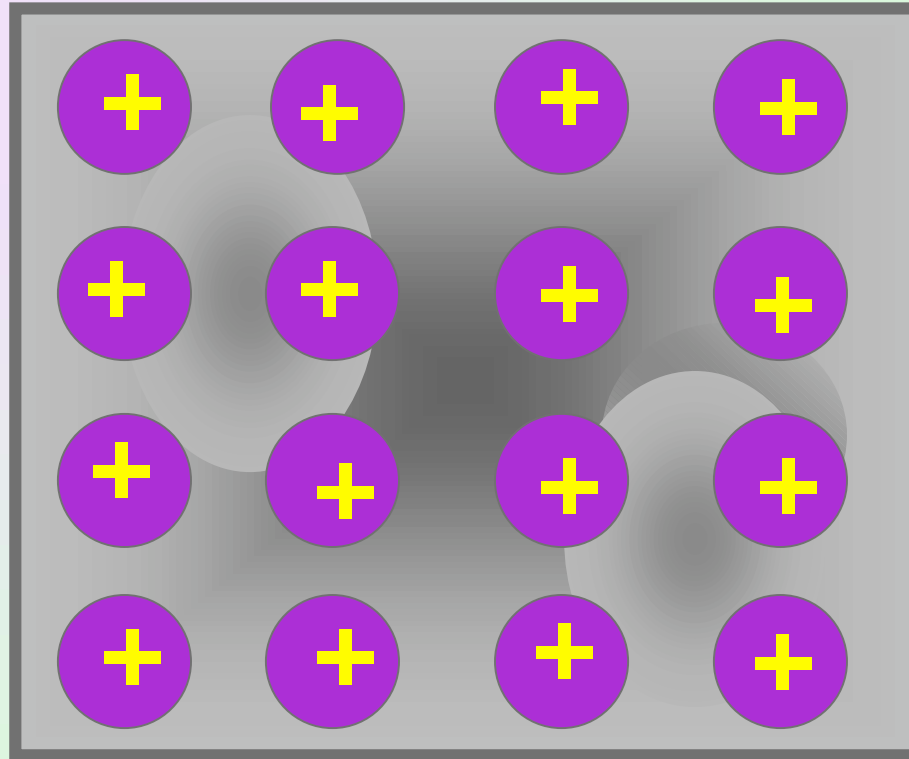
**lattice points occupied by metal atoms**

**nuclei and core electrons occupy lattice sites,  
valence electrons move throughout the lattice**

**electrons delocalized over many, if not all,  
atoms in the lattice**

**metal atoms are difficult to separate from one  
another but can be moved relative to each  
other**

# Metallic crystals (simple model)



**Each circled positive charge represents the nucleus and inner electrons of a metal atom. The gray area indicates a sea of mobile electrons**

# **Metallic crystals (Band model)**

**Electrons travel around the metal crystal in molecular orbitals formed from the valence atomic orbitals of the metal atoms**



$2s_A$



$2s^*$

$2s$



$2s_B$

**Li<sub>2</sub>**

Energy

# Band model

number of interacting atomic orbitals



MO's

2



4



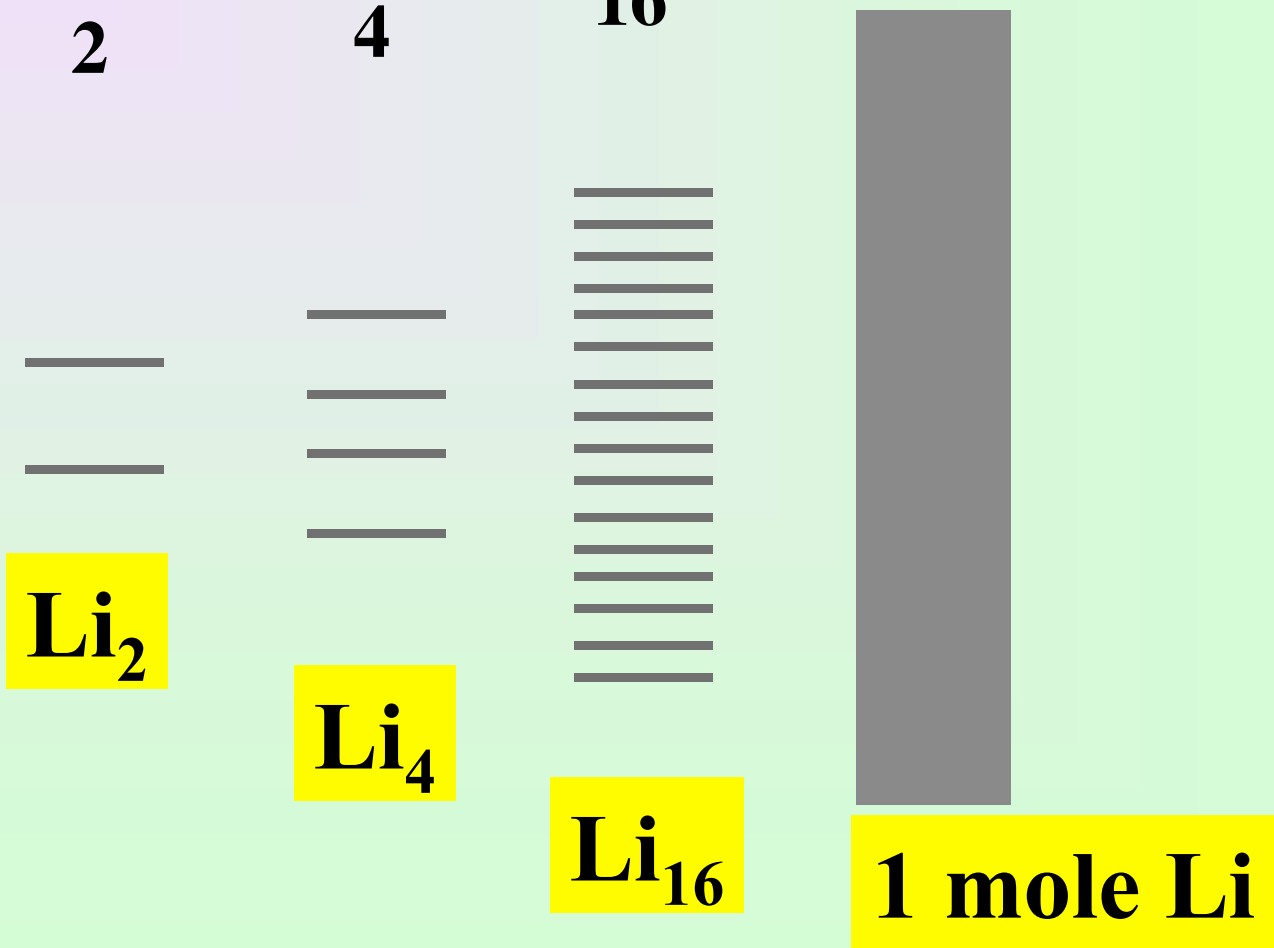
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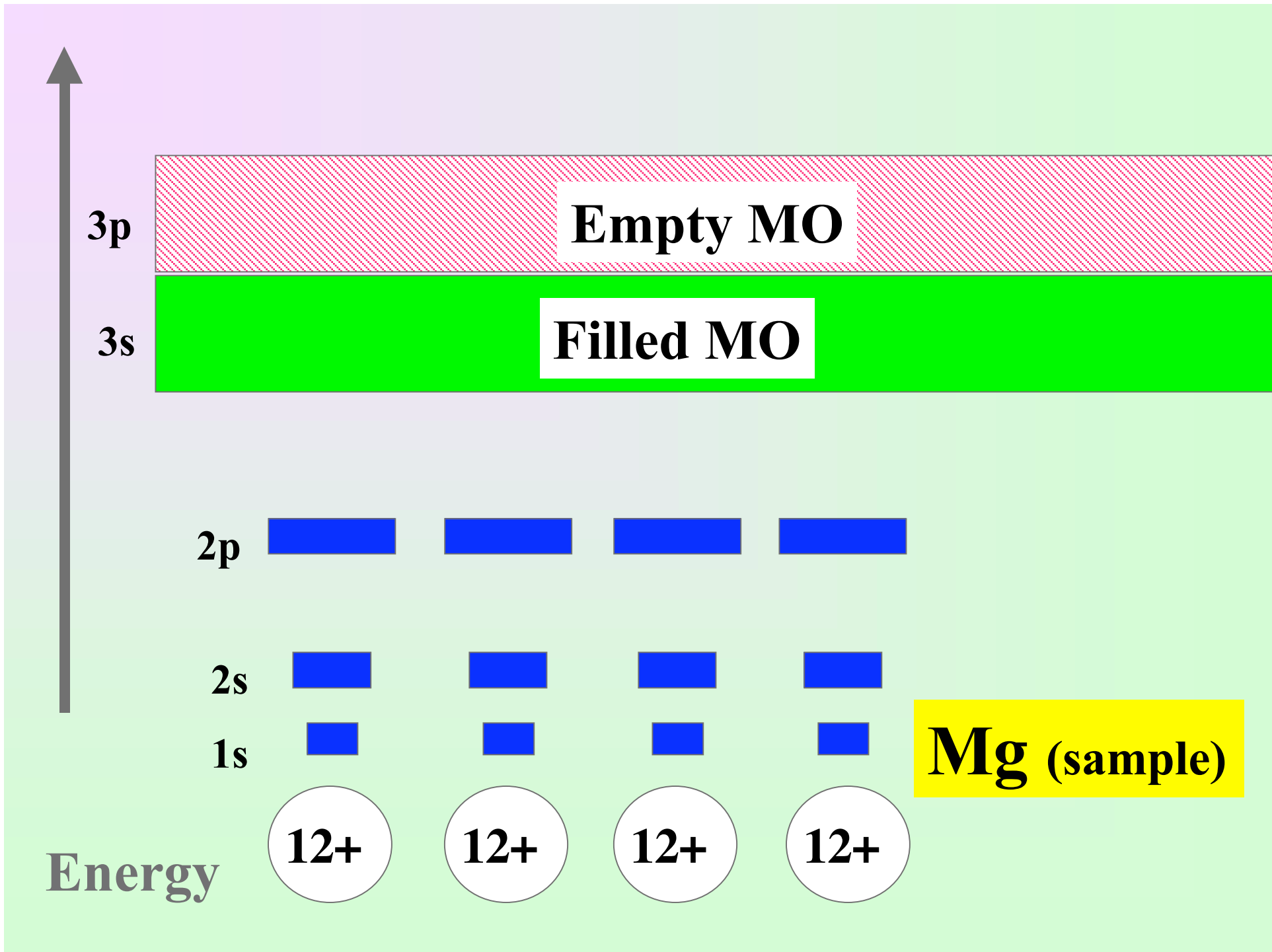


1 mole



Energy

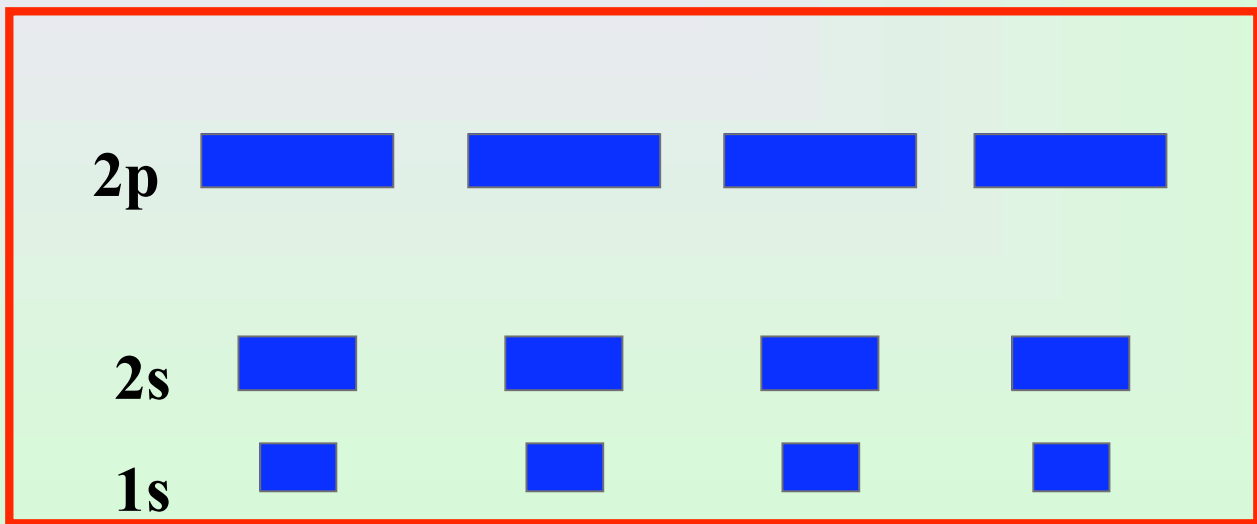






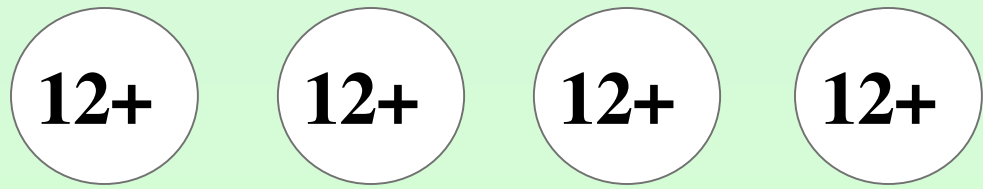
**conducting bands** - closely spaced and only partly filled MO's

3p  
3s



localized electrons inner

Energy



# Properties of Metals

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**Conduct electricity**

**malleable**

**ductile**

# **Metal Alloys**

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**Contain a mixture of elements and have metallic properties**

# Substitution Alloys

**Some of the host metal atoms are replaced by other metal atoms of similar size**

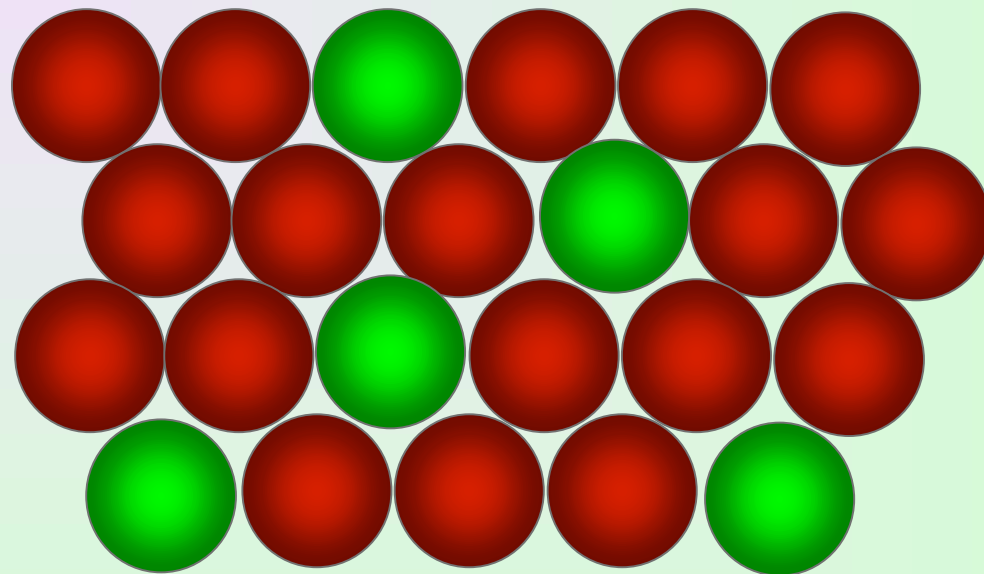
## **Brass**

**copper and 33.3% zinc**

## **Sterling silver**

**Silver and 7% copper**

# Substitution Alloys



## interstitial Alloys

Formed when some of the interstices (holes) in the closest packed metal structure are occupied by small atoms

### Steel

*carbon in the holes of iron*

low .2%

some what malleable

medium .2 - .6%

harder

high .6 - 1.5%

tool grade

# interstitial Alloys

