Chapter 6

Naming Compounds

Writing Formulas

Systematic Naming

- There are too many compounds to remember the names of them all.
- Compound is made of two or more elements.
- Put together atoms.
- Name should tell us how many and what type of atoms.

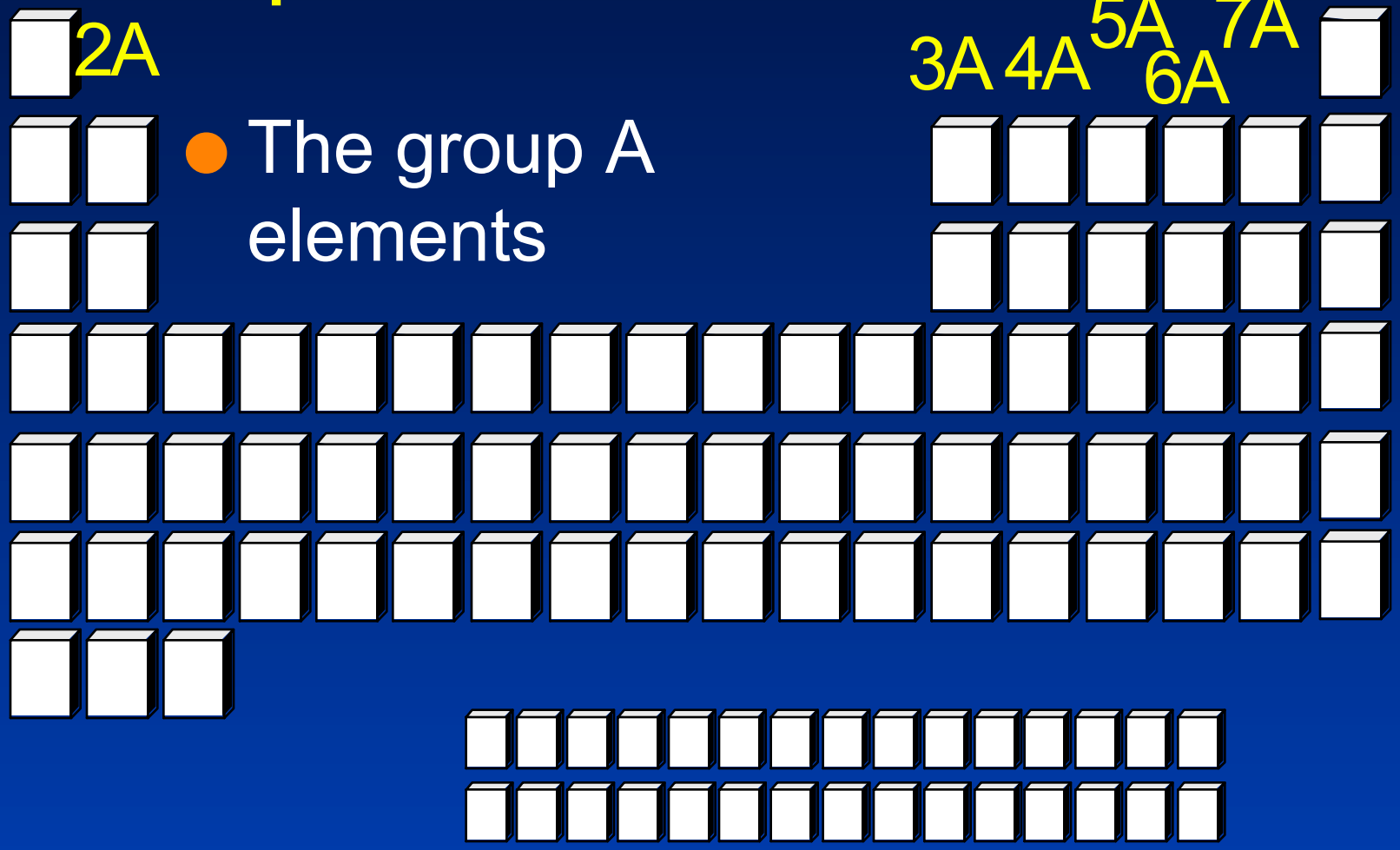
Periodic Table

- More than a list of elements.
- Put in columns because of similar properties.
- Each column is called a group.

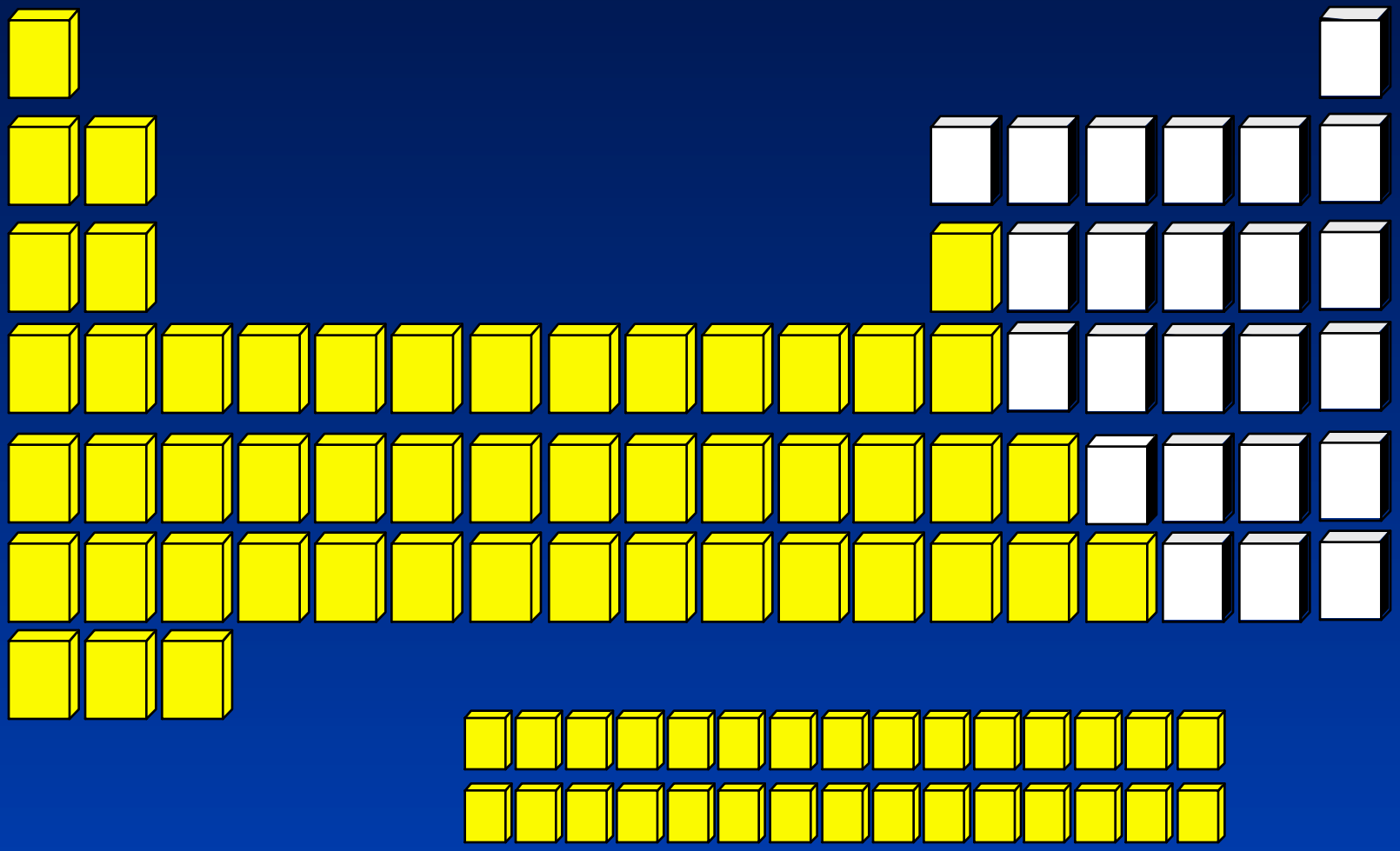
Representative elements

1A 2A 3A 4A 5A 6A 7A 0

- The group A elements



Metals

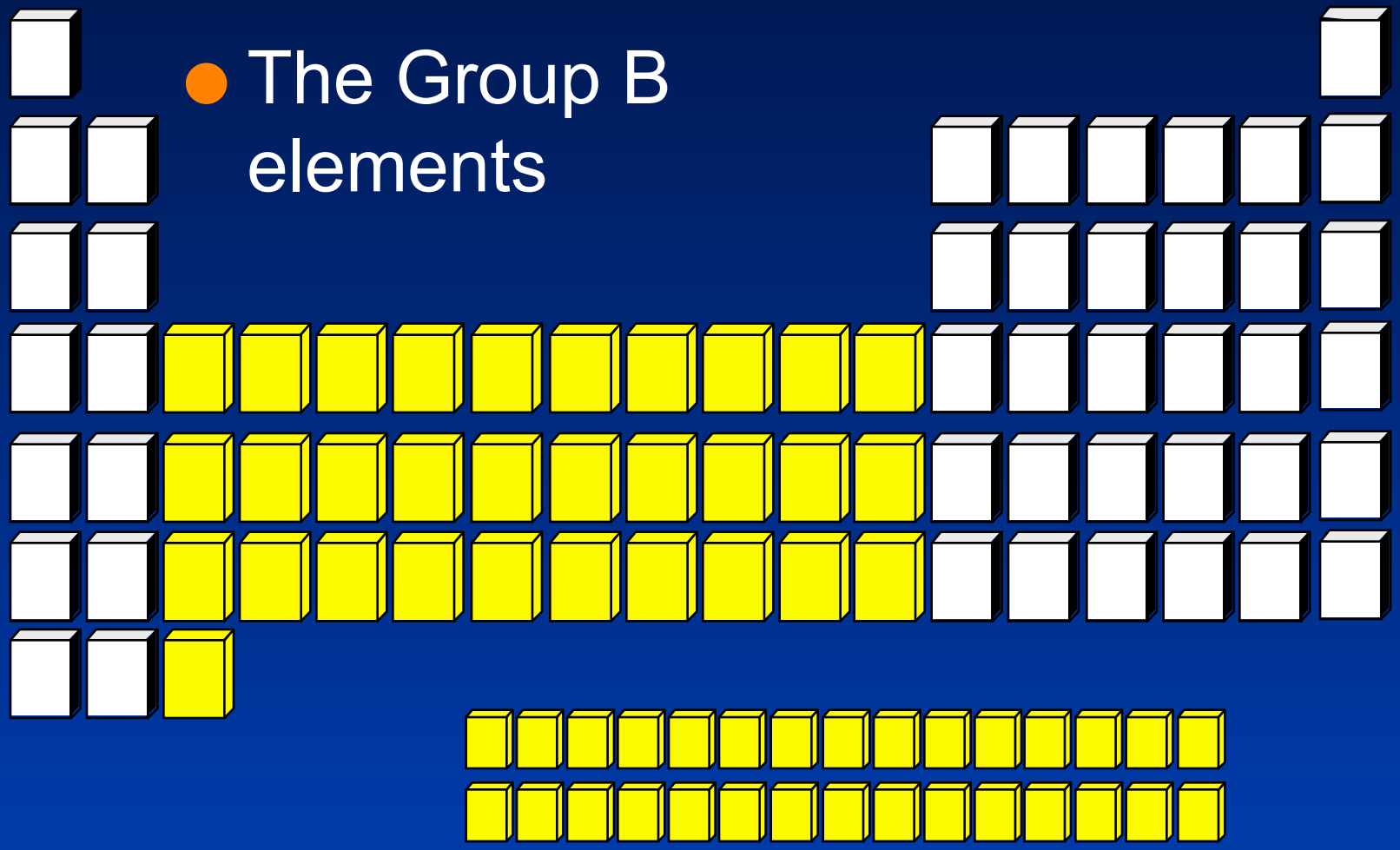


Metals

- Luster – shiny.
- Ductile – drawn into wires.
- Malleable – hammered into sheets.
- Conductors of heat and electricity.

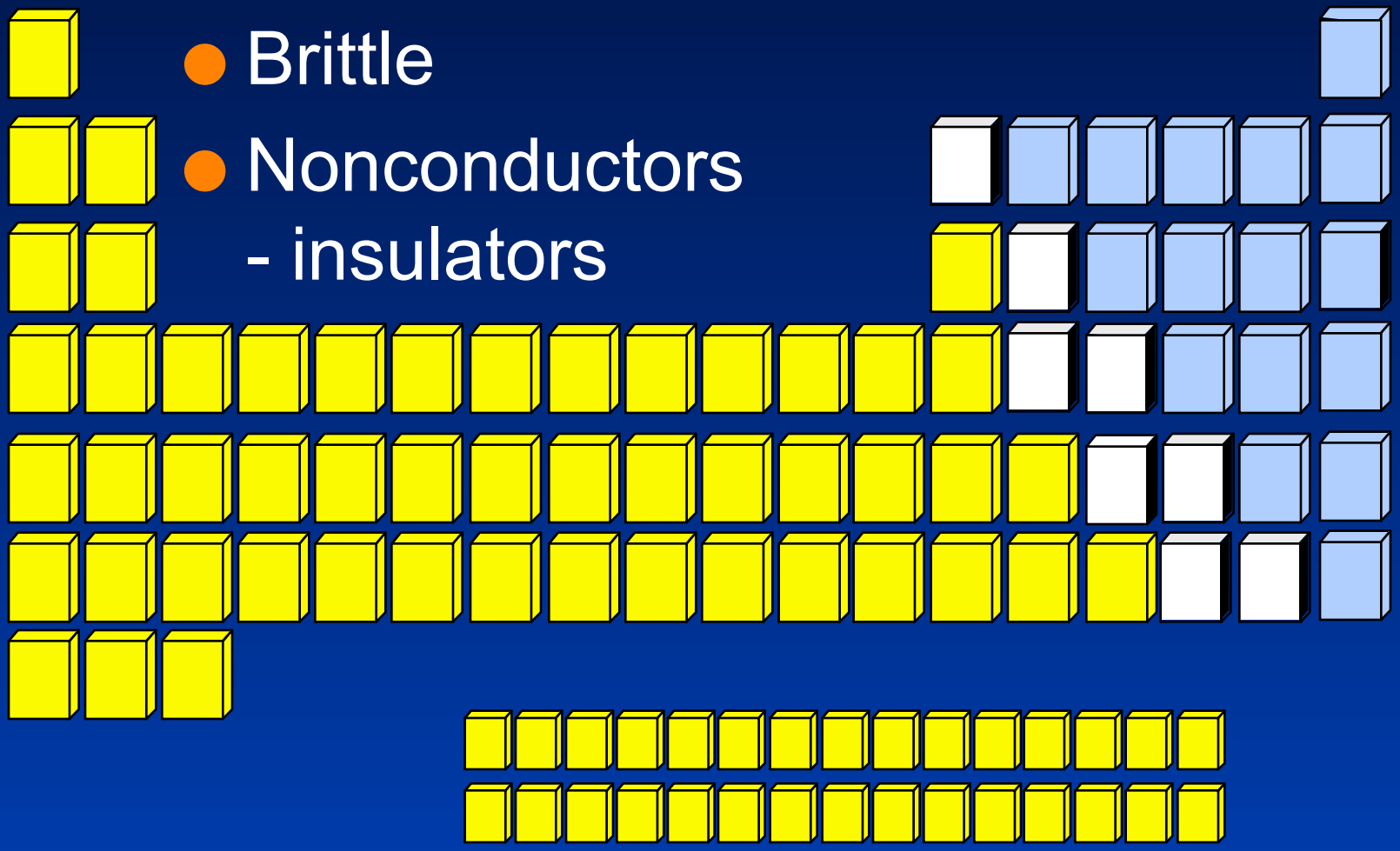
Transition metals

- The Group B elements



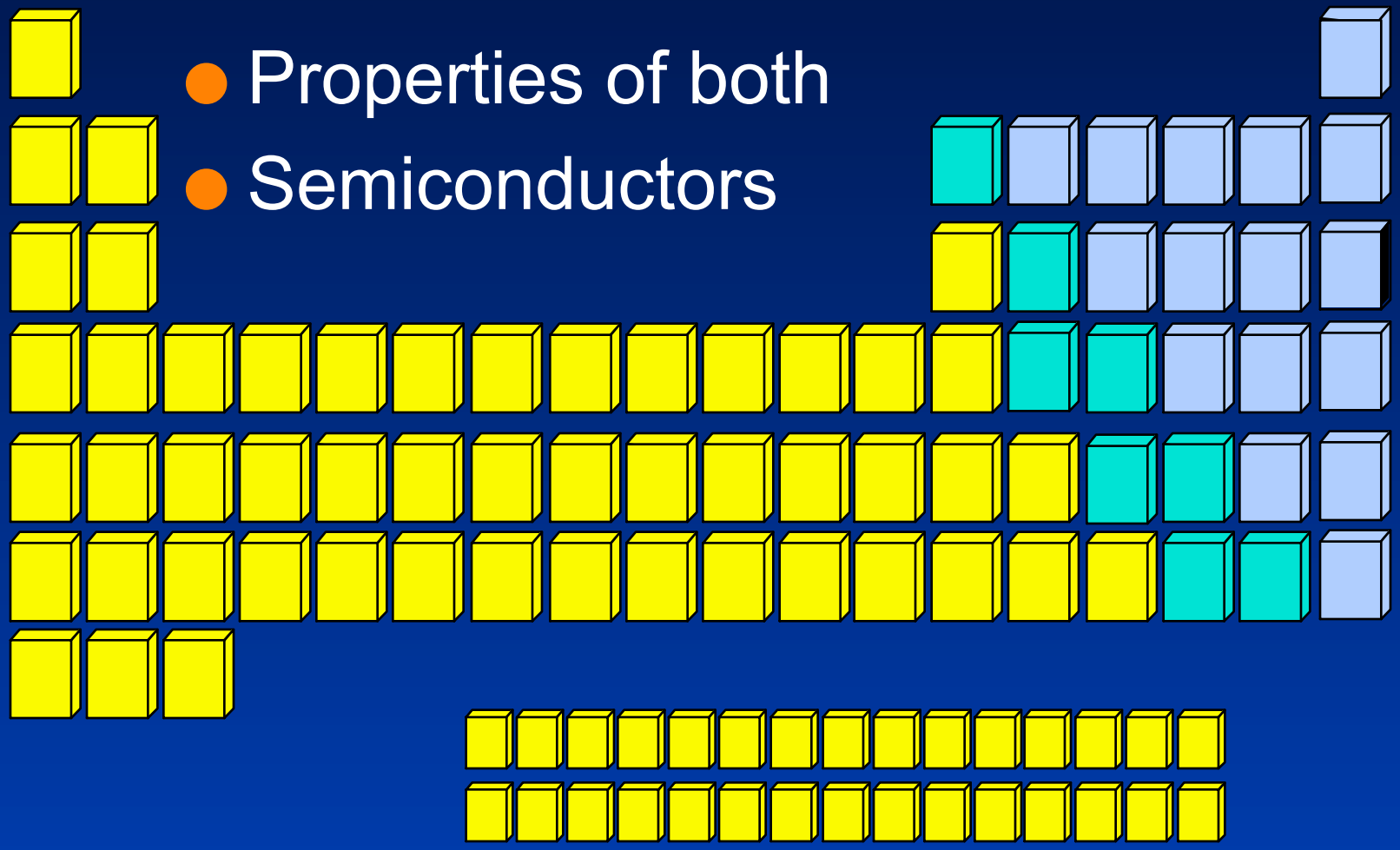
Non-metals

- Dull
- Brittle
- Nonconductors - insulators



Metalloids or Semimetals

- Properties of both
- Semiconductors



Atoms and ions

- Atoms are electrically neutral.
- Same number of protons and electrons.
- Ions are atoms, or groups of atoms, with a charge.
- Different numbers of protons and electrons.
- Only electrons can move.
- Gain or lose electrons.

Anion

- A negative ion.
- Has gained electrons.
- Non metals can gain electrons.
- Charge is written as a super script on the right.

F^{-1} Has gained one electron

O^{-2} Has gained two electrons

Cations

- Positive ions.
- Formed by losing electrons.
- More protons than electrons.
- Metals form cations.

K^{+1} Has lost one electron

Ca^{+2} Has lost two electrons

Compounds

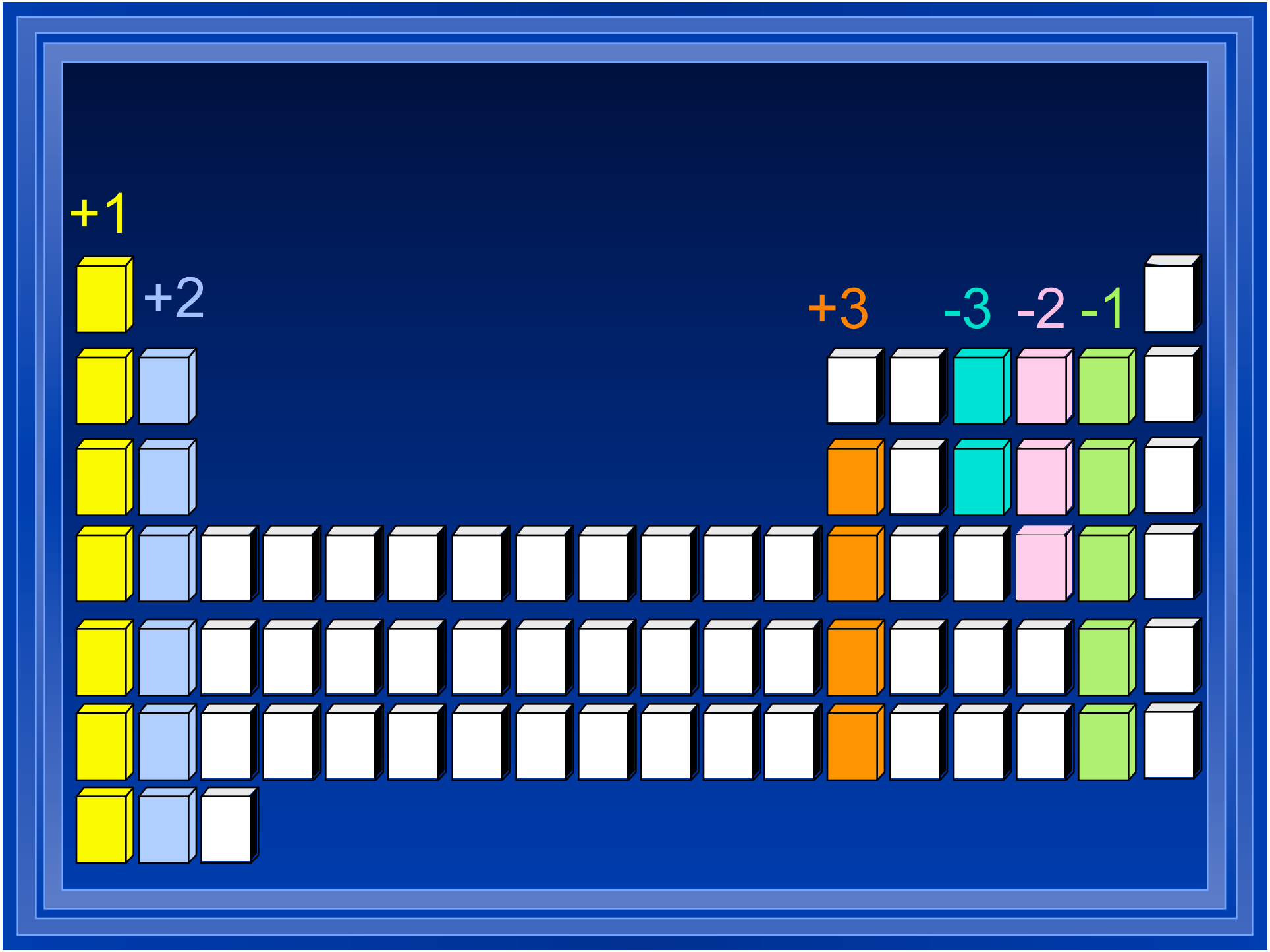
- Follow the Law of Definite Proportion.
- Have a constant composition.
- Have to add the same number of atoms every time.
- Two types.

Formula Unit

- The smallest whole number ratio of atoms in an ionic compound.
- Ions surround each other so you can't say which is hooked to which. (pg 91)

Charges on ions

- For most of the Group A elements, the Periodic Table can tell what kind of ion they will form from their location.
- Elements in the same group have similar properties.
- Including the charge when they are ions.


+1
+2
+3
-3
-2
-1

Chemical Formulas

- Shows the kind and number of atoms in the smallest piece of a substance.
- Molecular formula- number and kinds of atoms in a molecule.
- CO_2
- $C_6H_{12}O_6$
- Na_2SO_4

Naming ions

- We will use the systematic way.
- Cation- if the charge is always the same (Group A) just write the name of the metal.
- Transition metals can have more than one type of charge.
- Indicate the charge with roman numerals in parenthesis.

Name these

- Na^{+1}
- Ca^{+2}
- Al^{+3}
- Fe^{+3}
- Fe^{+2}
- Pb^{+2}
- Li^{+1}

Write Formulas for these

- Potassium ion
- Magnesium ion
- Copper (II) ion
- Chromium (VI) ion
- Barium ion
- Mercury (II) ion

Naming Anions

- Anions are always the same.
- Change the element ending to – ide
- F^{-1} Fluorine

Naming Anions

- Anions are always the same.
- Change the element ending to – ide
- F^{-1} Fluorin

Naming Anions

- Anions are always the same
- Change the element ending to – ide
- F^{-1} Fluori

Naming Anions

- Anions are always the same
- Change the element ending to – ide
- F^{-1} Fluor

Naming Anions

- Anions are always the same
- Change the element ending to – ide
- F^{-1} Fluori

Naming Anions

- Anions are always the same
- Change the element ending to – ide
- F^{-1} Fluoride

Naming Anions

- Anions are always the same
- Change the element ending to – ide
- F^{-1} Fluoride

Name these

- Cl^{-1}
- N^{-3}
- Br^{-1}
- O^{-2}

Write these

- Sulfide ion
- iodide ion
- phosphide ion
- Strontium ion

Polyatomic ions

- Groups of atoms that stay together and have a charge.
- Acetate $C_2H_3O_2^{-1}$
- Nitrate NO_3^{-1}
- Nitrite NO_2^{-1}
- Hydroxide OH^{-1}
- Permanganate MnO_4^{-1}
- Cyanide CN^{-1}

Ions in Ionic Compounds

Naming Binary Ionic Compounds

- Binary Compounds - 2 elements.
- Ionic - a cation and an anion.
- To write the names just name the two ions.
- Easy with Representative elements.
- Group A
- NaCl = Na^{+} Cl^{-} = sodium chloride
- $MgBr_2$ = Mg^{+2} Br^{-} = magnesium bromide

Naming Binary Ionic Compounds

- The problem comes with the transition metals.
- Need to figure out their charges.
- The compound must be neutral.
- same number of + and – charges.
- Use the anion to determine the charge on the positive ion.

Naming Binary Ionic Compounds

- Write the name of CuO
- Need the charge of Cu
- O is -2
- copper must be +2
- Copper (II) oxide
- Name $CoCl_3$
- Cl is -1 and there are three of them = -3
- Co must be +3 Cobalt (III) chloride

Naming Binary Ionic Compounds

- Write the name of Cu_2S.
- Since S is -2, the Cu_2 must be +2, so each one is +1.
- copper (I) sulfide
- Fe_2O_3
- Each O is -2 3 x -2 = -6
- Fe must = +6/2, so each is +3.
- iron (III) oxide

Naming Binary Ionic Compounds

- Write the names of the following
- KCl
- Na_3N
- CrN
- Sc_3P_2
- PbO
- PbO_2
- Na_2Se

Ternary Ionic Compounds

- Will have polyatomic ions
- At least three elements
- name the ions
- $NaNO_3$
- $CaSO_4$
- $CuSO_3$
- $(NH_4)_2O$

Polyatomic ions

- Sulfate SO_4^{-2}
- Sulfite SO_3^{-2}
- Carbonate CO_3^{-2}
- Chromate CrO_4^{-2}
- Dichromate $Cr_2O_7^{-2}$
- Phosphate PO_4^{-3}
- Phosphite PO_3^{-3}
- Ammonium NH_4^{+1}

Ternary Ionic Compounds

- LiCN
- $Fe(OH)_3$
- $(NH_4)_2CO_3$
- $NiPO_4$

Writing Formulas

- The charges have to add up to zero.
- Get charges on pieces.
- Cations from name of table.
- Anions from table or polyatomic.
- Balance the charges by adding subscripts.
- Put polyatomics in parenthesis.

Writing Formulas

- Write the formula for calcium chloride.
- Calcium is Ca^{+2}
- Chloride is Cl^{-1}
- $Ca^{+2}\ Cl^{-1}$ would have a +1 charge.
- Need another Cl^{-1}
- $Ca^{+2}\ Cl_2^{-1}$

Write the formulas for these

- Lithium sulfide
- Tin (II) carbonate
- Tin (IV) oxide
- Magnesium fluoride
- Iron (III) phosphate
- Iron (III) sulfide

- Li_2S
- $SnCO_3$
- SnO_2
- MgF_2
- $FePO_4$
- Fe_2S_3

Write the names for these

- NH_4Cl
- $(NH_4)_2S$
- $Ba(NO_3)_2$
- Sb_2O_3
- MnS_2

- Ammonium chloride
- Ammonium sulfide
- Barium nitrate
- Antimony (III) oxide
- Manganese (IV) sulfide

Things to look for

- If cations have (), the number is their charge. Electrons lost
- If anion ends in -ate or -ite it is polyatomic

Molecular Compounds

Writing names and Formulas

Molecular compounds

- made of just nonmetals (sharing e-)
- smallest piece is a molecule
- can't be held together because of opposite charges.
- can't use charges to figure out how many of each atom

Easier

- Ionic compounds use charges to determine how many of each.
  - Have to figure out charges.
  - Have to figure out numbers.
- Molecular compounds name tells you the number of atoms.
- Uses prefixes to tell you the number

Prefixes

- 1 mono-
- 2 di-
- 3 tri-
- 4 tetra-
- 5 penta-
- 6 hexa-
- 7 hepta-
- 8 octa-
- 9 nona
- 10 deca

Prefixes

- 9 nona-
- 10 deca-
- To write the name write two words

Prefix name Prefix name -ide

Name These

- N_2O
- NO_2
- Cl_2O_7
- CBr_4
- CO_2
- $BaCl_2$

Write formulas for these

- diphosphorus pentoxide
- tetraiodine nonoxide
- sulfur hexaflouride
- nitrogen trioxide
- Carbon tetrahydride
- phosphorus trifluoride
- aluminum chloride

Acids

Writing names and Formulas

Acids

- Compounds that give off hydrogen ions when dissolved in water.
- Must have H in them.
- will always be some H next to an anion.
- The anion determines the name.

Naming acids

- If the anion attached to hydrogen ends in -ide, put the prefix hydro- and change -ide to -ic acid
- HCl - hydrogen ion and chloride ion
- hydrochloric acid
- H_2S hydrogen ion and sulfide ion
- hydrosulfic acid

Naming Acids

- If the anion has oxygen in it
- it ends in -ate of -ite
- change the suffix -ate to -ic acid
- HNO_3 Hydrogen and nitrate ions
- Nitric acid
- change the suffix -ite to -ous acid
- HNO_2 Hydrogen and nitrite ions
- Nitrous acid

Name these

- HF
- H_3P
- H_2SO_4
- H_2SO_3
- HCN
- H_2CrO_4

Writing Formulas

- Hydrogen will always be first
- name will tell you the anion
- make the charges cancel out.
- Starts with hydro- no oxygen, -ide
- no hydro, -ate comes from -ic, -ite comes from -ous

Write formulas for these

- hydroiodic acid
- acetic acid
- carbonic acid
- phosphorous acid
- hydrobromic acid

Two Types of Compounds

1. Molecular compounds

- Made of molecules.
- Made by joining nonmetal atoms together into molecules.
- Electrons are shared