

Unit 2: Chemical Reactions Answer Key

Chemical Nomenclature - Naming Ionic Compounds

1. Give the metal its full name
2. Give the non-metal its ion name (with the ide ending)

Ex: NaCl sodium chloride

BaF₂ barium fluoride

Writing Ionic Compound Formulas: Crossover method

1. Find the charge on each element
2. Cross over the charges (oxidation numbers)
3. Reduce if needed

Ex: magnesium fluoride MgF₂

Classic and Stock System for Ionic Compounds

Most transition metals (group B metals) and some other metals are multivalent, which means that they can have more than one valence, or charge. Ionic compounds with multivalent metals are named using either the classic or stock system.

A stock system name contains the charge of the metal in Roman numerals.

Ex: copper (I) chloride copper (II) chloride

CuCl

CuCl₂

To name a compound with a multivalent metal, follow these steps:

1. Reverse criss-cross
2. Check that the charge on the negative non-metal makes sense.
3. If needed, multiply both positive and negative charges by the same number so that the non-metal has the correct negative charge.
4. Write the name showing the metal's valence in brackets, using Roman numerals.

Examples:

PbO

PbO₂

Pb₃N₂

lead (II) oxide

lead (IV) oxide

lead (II) nitride

The classic system is an old system that uses the Latin name for the metal and the following 2 suffixes:

"ous" for the lower charge

"ic" for the higher charge

Examples:

cupric fluoride

cuprous fluoride

CuF₂

CuF

Writing Formulas and Naming Compounds Practice Sheet

Ionic Compounds

magnesium sulfide	MgS	Ba ₃ P ₂	barium phosphide
rubidium selenide	Rb ₂ Se	Al ₂ S ₃	aluminum sulfide
sodium sulfide	Na ₂ S	KCl	potassium chloride
calcium fluoride	CaF ₂	NaF	sodium fluoride
strontium oxide	SrO	MgF ₂	magnesium fluoride
aluminum chloride	AlCl ₃	MgO	magnesium oxide
barium bromide	BaBr ₂	SrCl ₂	strontium chloride
lithium iodide	LiI	Li ₂ O	lithium oxide

Classic System for Ionic Compounds

auric chloride	AuCl ₃	cobaltous oxide	CoO
cuprous bromide	CuBr	ferrous sulfide	FeS
antimonic carbide	Sb ₄ C ₅	cupric oxide	CuO
arsenic phosphide	As ₃ P ₅	stannous oxide	SnO
mercurous bromide	HgBr	arsenous oxide	As ₂ O ₃
mercuric bromide	HgBr ₂	ferrous nitride	Fe ₃ N ₂
cuprous oxide	Cu ₂ O	stannic oxide	SnO ₂
mercuric oxide	HgO	arsenic oxide	As ₂ O ₅

Stock System for Ionic Compounds

lead (II) sulfide	PbS	FeCl ₂	iron (II) chloride
iron (III) oxide	Fe ₂ O ₃	SnO ₂	tin (IV) oxide
nickel (II) chloride	NiCl ₂	CuBr	copper (I) bromide
copper (I) oxide	Cu ₂ O	FeCl ₃	iron (III) chloride
gold (III) sulfide	Au ₂ S ₃	CrCl ₃	chromium (III) chloride
chromium (II) phosphide	Cr ₃ P ₂	CuCl ₂	copper (II) chloride
cobalt (II) iodide	CoI ₂	CuO	copper (II) oxide
tin (IV) bromide	SnBr ₄	CdS	cadmium sulfide
manganese (IV) oxide	MnO ₂	Sb ₂ S ₅	antimony (V) sulfide
mercury (II) chloride	HgCl ₂	As ₂ O ₃	arsenic (III) oxide
lead (II) iodide	PbI ₂	Hg ₂ O	mercury (I) oxide
** zinc phosphide	Zn ₃ P ₂	Pb ₃ N ₄	lead (IV) nitride
**silver nitride	Ag ₃ N	Zn ₃ P ₂	zinc phosphide

Naming Polyatomic Ion Compounds (a metal and a group of non-metals)

Polyatomic ion: groups of non-metals that are covalently linked, but have an overall charge

They are usually treated as a single element because they move as a group.

If there is more than one polyatomic ion, then it is put in brackets, and a subscript outside the brackets indicates how many polyatomic ions are in the compound.

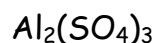
Examples:

1. Find the chemical formulas for:

silver nitrate



aluminum sulfate



2. Name the following compounds:



potassium permanganate



copper (II) sulfate

Naming Molecular (Covalent) Compounds (2 or more non-metals)

Step 1: Give the first atom its full name and the second atom its ion name ("ide" ending)

Step 2: Use prefixes to indicate the number of each atom

No mono if the first has only one

# of atoms	Prefix
1	Mono
2	Di
3	Tri
4	Tetra
5	Penta
6	Hexa
7	Hepta
8	Octa
9	Nona
10	Deca

Ex. CO_2 carbon dioxide

NO_3 nitrogen trioxide

N_2O_2 dinitrogen dioxide

N_2O_4 dinitrogen pentoxide

Writing Molecular Compound Formulas

Use the prefixes to determine how many of each atom you have.

Ex. diphosphorous pentoxide P_2O_5

Diatomic Gases (7): H_2 N_2 O_2 F_2 Cl_2 Br_2 I_2

*don't indicate the number of H atoms for binary compounds (2 elements) name like ionic

Ex. H_2S hydrogen sulfide

Polyatomic Ions

sodium iodate	NaIO_3	Ba(OH)_2	barium hydroxide
potassium sulfate	K_2SO_4	$\text{Mg(ClO}_3)_2$	magnesium chlorate
magnesium nitrate	$\text{Mg(NO}_3)_2$	KNO_3	potassium nitrate
calcium bromate	$\text{Ca(BrO}_3)_2$	KMnO_4	potassium permanganate
lithium phosphate	Li_3PO_4	$\text{NaC}_2\text{H}_3\text{O}_2$	sodium acetate
ammonium sulfate	$(\text{NH}_4)_2\text{SO}_4$	Al(CN)_3	aluminum cyanide
ammonium thiosulfate	$(\text{NH}_4)_2\text{S}_2\text{O}_3$	$\text{Ca}_3(\text{PO}_4)_2$	calcium phosphate
ammonium nitrate	NH_4NO_3	H_2O_2	hydrogen peroxide

Polyatomic Ions - where metal are multivalent

copper (II) sulfate	CuSO_4	CuSO_4	copper (II) sulfate
iron (II) chlorate	$\text{Fe(ClO}_3)_2$	Cu_2SO_4	copper (I) sulfate
cobalt (II) carbonate	CoCO_3	$\text{Pb(NO}_3)_2$	lead (II) nitrate
iron (III) phosphate	FePO_4	$\text{Pb(NO}_3)_4$	lead (IV) nitrate
gold (II) acetate	$\text{Au(C}_2\text{H}_3\text{O}_2)_3$	$\text{Fe(ClO}_3)_2$	iron (II) chlorate
antimony (III) thiosulfate	$\text{Sb}_2(\text{S}_2\text{O}_3)_3$	HgSO_4	mercury (II) sulfate
tin (II) hydroxide	Sn(OH)_2	$\text{Sn(CO}_3)_2$	tin (IV) carbonate
copper (II) phosphate	$\text{Cu}_3(\text{PO}_4)_2$	$\text{Pb(SO}_4)_2$	lead (IV) sulfate
copper (I) nitrate	CuNO_3	Pb(OH)_2	lead (II) hydroxide
nickel (II) carbonate	NiCO_3	ZnSO_4	zinc sulfate
iron (III) bromate	FeBr_3	Hg_2O_2	mercury (I) peroxide
copper (I) acetate	$\text{CuC}_2\text{H}_3\text{O}_2$	$\text{Cu}_3(\text{PO}_4)_2$	copper (II) phosphate
mercury (I) hydroxide	HgOH	AgNO_3	silver nitrate
antimony (V) acetate	$\text{Sb(C}_2\text{H}_3\text{O}_2)_5$	NiC_2	nickel (II) carbide
iron (III) cyanide	Fe(CN)_3	$\text{Sn(NO}_3)_2$	tin (II) nitrate
iron (III) chlorate	$\text{Fe(ClO}_3)_3$	FePO_4	iron (III) phosphate
lead (IV) carbonate	$\text{Pb(CO}_3)_2$	$\text{Au}_2(\text{CO}_3)_3$	gold (III) carbonate
manganese (II) oxalate	MnC_2O_4	PbS_2O_3	lead (II) thiosulfate
manganese (III) phosphate	MnPO_4	CrC_2O_4	chromium (II) oxalate
mercury (I) nitrate	HgNO_3	$\text{Ni(IO}_3)_2$	nickel (II) iodate
tin (II) bromate	$\text{Sn(BrO}_3)_2$	$\text{Co(BrO}_3)_3$	cobalt (III) bromate
antimony (V) phosphate	$\text{Sb}_3(\text{PO}_4)_5$	FeCO_3	iron (II) carbonate
nickel (II) thiocyanate	Ni(SCN)_2	MnPO_4	manganese (III) phosphate
lead (IV) hydroxide	Pb(OH)_4	SbPO_4	antimony (III) phosphate
gold (I) sulfate	Au_2SO_4	MoSO_4	molybdenum (II) sulfate

Molecular/Covalent Compounds

Diatomic Molecules

hydrogen	H ₂	Cl ₂	chlorine
nitrogen	N ₂	Br ₂	bromine
oxygen	O ₂	I ₂	iodine
fluorine	F ₂		

Noble Gases

helium	He	Kr	krypton
neon	Ne	Xe	xenon
argon	Ar	Rn	radon

Molecular Compounds

nitrogen dioxide	NO ₂	AsCl ₃	arsenic trichloride
carbon dioxide	CO ₂	PS ₅	phosphorus pentasulfide
carbon tetrachloride	CCl ₄	PO ₅	phosphorus pentoxide
sulfur trioxide	SO ₃	AsCl ₅	arsenic pentachloride
phosphorous triiodide	PI ₃	P ₂ S ₅	diphosphorus pentasulfide
dinitrogen tetroxide	N ₂ O ₄	P ₂ O ₅	diphosphorus pentoxide
carbon monoxide	CO	SO ₂	sulfur dioxide
silicon dioxide	SiO ₂	NO ₂	nitrogen dioxide
diarsenic pentasulfide	As ₂ S ₅	H ₂ O	water
dinitrogen monoxide	N ₂ O	NH ₃	ammonia
carbon monoxide	CO	SiBr ₂	silicon dibromide
sulfur dioxide	SO ₂	PBr ₅	phosphorus pentabromide
sulfur trioxide	SO ₃	B ₄ H ₉	tetraboron nonahydride
nitrogen monoxide	NO	CO	carbon monoxide
phosphorus pentabromide	PBr ₅	P ₂ O ₃	diphosphorus trioxide
dinitrogen trioxide	N ₂ O ₃	Cl ₂ O ₇	dichlorine heptoxide
selenium disulfide	SeS ₂	CBr ₄	carbon tetrabromide
iodine heptafluoride	IF ₇	SeO ₂	selenium dioxide
dinitrogen pentoxide	N ₂ O ₅	Br ₃ O ₈	tribromine octoxide
diboron nonoxide	B ₂ O ₉	CS ₂	carbon disulfide