

Use with textbook pages 189–193.

Multivalent metals and polyatomic ions

1. Define the following terms:

(a) ionic compound

(b) multivalent metal

(c) polyatomic ion

2. Write the formulae and names of the compounds with the following combination of ions. The first row is completed to help guide you.

	Positive ion	Negative ion	Formula	Compound name
(a)	Pb ²⁺	O ²⁻	PbO	lead(II) oxide
(b)	Sb ⁴⁺	S ²⁻	Sb ₂ S ₃	Antimony (IV) sulfide
(c)	Tl ⁺	Cl ⁻	TlCl	Thallium (I) Chloride
(d)	Sn ²⁺	F ⁻	SnF ₂	tin(II) fluoride
(e)	Mo ³⁺	S ²⁻	Mo ₂ S ₃	Molybdenum (III) Sulfide
(f)	Rh ⁴⁺	Br ⁻	RhBr ₄	Rhodium (IV) Bromide
(g)	Cu ⁺	Te ²⁻	Cu ₂ Te	copper(I) telluride
(h)	Nb ⁵⁺	I ⁻	NbI ₅	Niobium (V) Iodide
(i)	Pd ²⁺	Cl ⁻	PdCl ₂	Palladium (II) chloride

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Answers.

3. Write the chemical formula for each of the following compounds.

(a) manganese(II) chloride _____	MnCl ₂	(f) vanadium(V) oxide _____	V ₂ O ₅
(b) chromium(III) sulphide _____	Cr ₂ S ₃	(g) rhenium(VII) arsenide _____	Re ₃ As ₇
(c) titanium(IV) oxide _____	TiO ₂	(h) platinum(IV) nitride _____	Pt ₃ N ₄
(d) uranium(VI) fluoride _____	UF ₆	(i) nickel(II) cyanide _____	Ni(CN) ₂
(e) nickel(II) sulphide _____	NiS	(j) bismuth(V) phosphide _____	Bi ₃ P ₅

4. Write the formulae for the compounds formed from the following ions. Then name the compounds.

	Ions	Formula	Compound name
(a)	K^+ NO_3^-	KNO_3	potassium nitrate
(b)	Ca^{2+} CO_3^{2-}	$CaCO_3$	calcium carbonate
(c)	Li^+ HSO_4^-	$LiHSO_4$	Lithium Hydrogen sulfate
(d)	Mg^{2+} SO_3^{2-}	$MgSO_3$	Magnesium sulfite
(e)	Sr^{2+} CH_3COO^-	$Sr(CH_3COO)_2$	Strontium acetate
(f)	NH_4^+ $Cr_2O_7^{2-}$	$(NH_4)_2Cr_2O_7$	Ammonium dichromate
(g)	Na^+ MnO_4^-	$NaMnO_4$	Sodium permanganate
(h)	Ag^+ ClO_3^-	$AgClO_3$	Gold hypochlorite
(i)	Cs^+ OH^-	$CsOH$	Cesium hydroxide
(j)	Ba^{2+} CrO_4^{2-}	$BaCrO_4$	Barium chromate

5. Write the chemical formula for each of the following compounds.

(a) barium bisulphate <u>$Ba(HSO_4)_2$</u>	(f) calcium phosphate <u>$Ca_3(PO_4)_2$</u>
(b) sodium chlorate <u>$NaClO_3$</u>	(g) aluminum sulphate <u>$Al_2(SO_4)_3$</u>
(c) potassium chromate <u>K_2CrO_4</u>	(h) cadmium carbonate <u>$CdCO_3$</u>
(d) calcium cyanide <u>$Ca(CN)_2$</u>	(i) silver nitrite <u>$AgNO_2$</u>
(e) potassium hydroxide <u>KOH</u>	(j) ammonium hydrogen carbonate <u>NH_4HCO_3</u>

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Chemical names and formulas of ionic compounds

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1. Write the name for each of the following compounds.

- | | | | |
|---|------------------------|---|----------------------|
| (a) BeS | Beryllium sulfide | (k) Ni(OH) ₂ | Ni (II) Hydroxide |
| (b) Hg ₃ N ₂ | Mercury(II) Nitride | (l) K ₂ Cr ₂ O ₇ | Potassium dichromate |
| (c) Cu(NO ₃) ₂ | Copper (II) Nitrate | (m) ScF ₃ | Scandium Fluoride |
| (d) Ag ₂ O | Silver Oxide | (n) NaI | Sodium iodide |
| (e) CoBr ₂ | Cobalt (II) Bromide | (o) Pb(CO ₃) ₂ | Lead (II) Carbonate |
| (f) Bi ₃ (PO ₄) ₅ | Bismuth (V) Phosphate | (p) RbClO ₂ | Rubidium chlorite |
| (g) CaF ₂ | Calcium Fluoride | (q) K ₃ P | Potassium phosphide |
| (h) Mn ₂ O ₃ | Manganese (III) Oxide | (r) Mg(CN) ₂ | Magnesium cyanide |
| (i) Cr ₂ (SO ₄) ₃ | Chromium (III) sulfate | (s) SnS | Tin (II) Sulfide |
| (j) ZnCl ₂ | Zinc Chloride | (t) NaHCO ₃ | Sodium bicarbonate |

2. Write the chemical formula for each of the following compounds.

- | | | | |
|--------------------------------|---|----------------------------|---|
| (a) aluminum bromide | AlBr ₃ | (k) cadmium(II) hydroxide | Cd(OH) ₂ |
| (b) platinum(II) sulphide | PtS | (l) zinc phosphate | Zn ₃ (PO ₄) ₂ |
| (c) strontium sulfite | SrSO ₃ | (m) barium chloride | BaCl ₂ |
| (d) scandium oxide | Sc ₂ O ₃ | (n) tin(II) permanganate | Sn(MnO ₄) ₂ |
| (e) titanium(IV) nitrite | Ti(NO ₂) ₄ | (o) lithium hypochlorite | LiClO |
| (f) ammonium sulphate | (NH ₄) ₂ SO ₄ | (p) gold(III) sulphate | Au ₂ (SO ₄) ₃ |
| (g) lithium selenide | Li ₂ Se | (q) sodium nitrate | NaNO ₃ |
| (h) lead(II) hydrogen sulphate | Pb(HSO ₄) ₂ | (r) chromium(III) chloride | CrCl ₃ |
| (i) sodium acetate | NaCH ₃ COO | (s) potassium carbonate | K ₂ CO ₃ |
| (j) cesium chloride | CsCl | (t) iron(III) bisulphate | Fe(HSO ₄) ₃ |

Use with textbook pages 193–197.

Chemical names and formulas of covalent compounds

1. What is a covalent compound?

2. What type of bond is formed in a covalent compound?

3. What is used in naming covalent compounds?

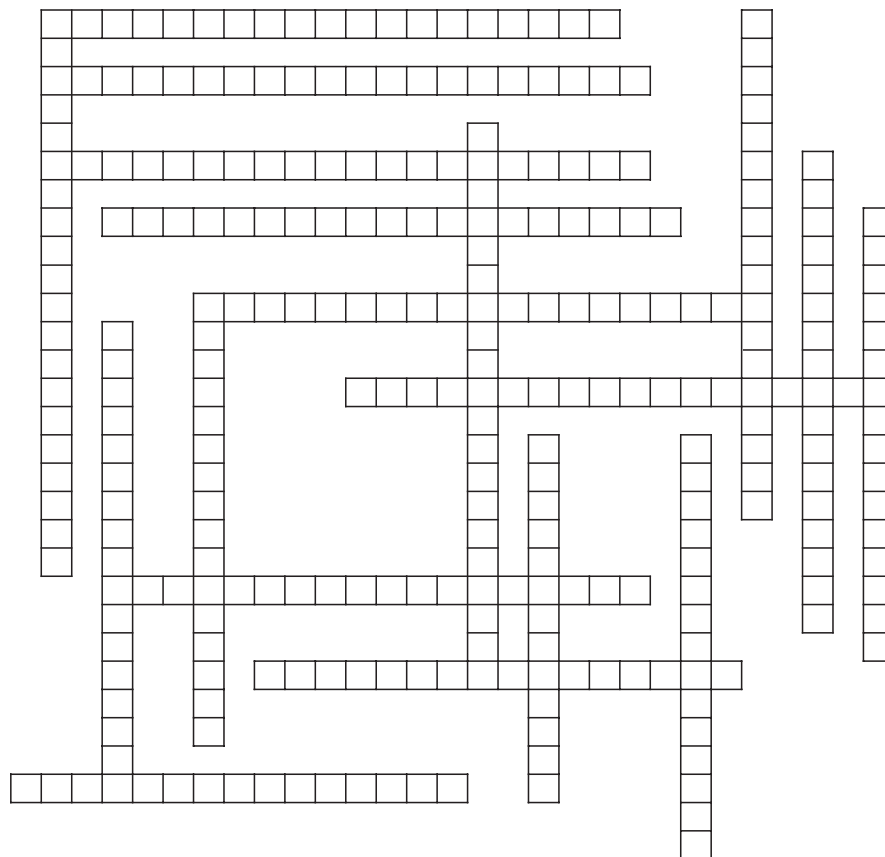
4. Write the chemical formula for each of the following compounds.

(a) silicon dioxide <u>SiO₂</u>	(i) dinitrogen pentoxide <u>N₂O₅</u>
(b) chlorine dioxide <u>ClO₂</u>	(j) dinitrogen monoxide <u>N₂O</u>
(c) tellurium dioxide <u>TeO₂</u>	(k) arsenic tetrabromide <u>AsBr₄</u>
(d) selenium trioxide <u>SeO₃</u>	(l) arsenic pentachloride <u>AsCl₅</u>
(e) carbon disulphide <u>CS₂</u>	(m) disulphide pentoxide <u>S₂P₅</u>
(f) arsenic trichloride <u>AsCl₃</u>	(n) sulphur monochloride <u>SCl</u>
(g) chlorine heptoxide <u>ClO₇</u>	(o) phosphorus trichloride <u>PCl₃</u>
(h) selenium difluoride <u>SeF₂</u>	(p) diphosphorus pentoxide <u>P₂O₅</u>

5. Complete the following crossword puzzle. Given the chemical formula, what is the name for the covalent compound?

COVALENT COMPOUNDS**Word List**

Arsoenic trioxide
 Boron monoxide
 Carbon disulphide
 Chlorine monoxide
 Diarsenic pentoxide
 Dichlorine heptoxide
 Dinitrogen trioxide
 Disulphur dichloride
 Iodine trichloride
 Nitrogen dioxide
 Nitrogen monoxide
 Phosphorus tribromide
 Silicon tetrafluoride
 Sulphur tetrachloride
 Tellurium dibromide
 Tellurium trioxide

**ACROSS**

1. S_2Cl_2
3. PBr_3
5. SiF_4
7. Cl_2O_7
9. ClF_3
11. N_2O_3
14. $TeBr_2$
15. ClO
16. AsO_3

DOWN

1. P_2O_3
2. As_2O_5
4. SCl_4
6. ICl_3
8. NO
9. CS_2
10. TeO_3
12. BO
13. NO_2

Use with textbook pages 184–197.

Names and formulas of compounds

Match each Chemical Name on the left with the correct Chemical Formula on the right.

Chemical Name	Chemical Formula
1. _____ tin(II) chlorate	A. SCl
2. _____ sulphur dichloride	B. S ₂ Cl
3. _____ strontium perchlorate	C. SCl ₂
	D. SnClO
	E. Sn(ClO ₂) ₂
	F. Sn(ClO ₃) ₂
	G. Sn(ClO ₄) ₂
	H. Sr(ClO ₃) ₂
	I. Sr(ClO ₄) ₂

4. Which of the following is a covalent compound?
- A.** SrO **C.** SnO₂
B. SeO₂ **D.** Sc₂O₃
5. In which of the following do covalent bonds hold the atoms together?
- A.** silver
B. calcium carbonate
C. silicon tetrafluoride
D. magnesium bromide
6. What is the total number of atoms that make up iodine pentachloride?
- A.** 2 **C.** 5
B. 4 **D.** 6
7. Which of the following occurs when carbon forms a compound with oxygen?
- A.** oxygen and carbon share electrons
B. both oxygen and carbon lose electrons
C. oxygen gains electrons, while carbon loses electrons
D. carbon gains electrons, while oxygen loses electrons

8. In the chemical reaction $\text{CuO} + \text{CO}_2 \rightarrow \text{CuCO}_3$, which of the following are ionic compounds?

I.	CO ₂
II.	CuO
III.	CuCO ₃

- A.** I and II only **C.** II and III only
B. I and III only **D.** I, II, and III
9. Which of the following is the formula for the compound formed by ammonium and dichromate?
- A.** NH₄Cr₂O₇
B. (NH₄)₂CrO₄
C. NH₄(Cr₂O₇)₂
D. (NH₄)₂Cr₂O₇
10. In which of the following compounds does manganese have the highest ion charge?
- A.** MnO₃ **C.** MnSO₃
B. MnBr₂ **D.** Mn(OH)₄
11. In which of the following compounds is the ion charge on copper the same?

I.	Cu ₂ O
II.	CuCl ₂
III.	CuCO ₃

- A.** I and II only **C.** II and III only
B. I and III only **D.** I, II, and III
12. In the name arsenic(III) chloride, what does the Roman numeral reveal about arsenic?
- A.** it has an ion charge of 3–
B. it has an ion charge of 3+
C. it has gained three electrons
D. it can form three positive ions