

Nomenclature Guided Self-test.

Part 1. Names and charges of ions. Write the names or formulas for these ions.

1. ammonium	NH_4^+
2. bromide	
3. iodide	
4. hypochlorite	
5. chromate	
6. perchlorate	
	ClO_3^-
	ClO_2^-
	HSO_4^-
	SO_3^{2-}
	SO_4^{2-}
12. cyanide	
13. peroxide	
14. acetate	
15. carbonate	
16. bicarbonate or hydrogen carbonate	
	OH^-
	$\text{Cr}_2\text{O}_7^{2-}$
	MnO_4^-
	PO_4^{3-}
	NO_3^-
22. fluoride	
23. oxide	
24. nitride	
25. nitrite	
26. chlorate	
	HSO_3^-
	H_2PO_4^-
	HPO_4^{2-}
	BrO_3^-
	IO_3^-

32. periodate	
33. bromite	
34. perbromate	
35. chloride	
36. sulfide	

Check your work for 1 - 36. Minor misspellings such as flouride instead of fluoride or ammonium instead of ammonium or writing Fl^- for fluoride are $-\frac{1}{2}$. Other misspellings are -1 . If you missed 3 $\frac{1}{2}$ or fewer you are still in the game with $>90\%$. If you missed 4 or more, review, study and try again!

Part 2. Other ions. There are other ions that you should know. In the case of 38, 40 and 41, these formulas should be predictable from what you should already know. The anion H^- is called hydride; it is an important anion in chemistry. These ions will be on the practice quiz.

37. oxalate	$\text{C}_2\text{O}_4^{2-}$
38. phosphite	PO_3^{3-}
39. thiosulfate	$\text{S}_2\text{O}_3^{2-}$
40. arsenate	AsO_4^{3-}
41. arsenite	AsO_3^{3-}
42. thiocyanate	SCN^-
43. cyanate	OCN^-
44. hydride	H^-

Part 3. Acids and Bases. Here are the acids you should know. I always write the formula for an acid with the H first – this is the acidic hydrogen. The acidic hydrogen can be thought of as H^+ and the rest of the formula is an anion. Know the relationship in naming between acids and their anions:

nitrous acid, HNO_2	nitrite, NO_2^-
nitric acid, HNO_3	nitrate, NO_3^-
hypochlorous acid, HClO	hypochlorite, ClO^-
chlorous acid, HClO_2	chlorite, ClO_2^-
chloric acid, HClO_3	chlorate, ClO_3^-
perchloric acid, HClO_4	perchlorate, ClO_4^-

Try these and then check your answers:

45. hydrochloric acid	HCl
46. hypochlorous acid	
47. phosphoric acid	
48. chlorous acid	
49. nitrous acid	
50. ammonia (the only base in list)	
	HClO ₄
	HF
	HC ₂ H ₃ O ₂
	H ₂ SO ₃
	H ₂ SO ₄
56. nitric acid	
57. hydrofluoric acid	
58. hydrobromic acid	
59. hydroiodic acid	
60. hypobromous acid	
	HIO ₄
	HIO ₂
	HBrO ₄
	HBrO ₃
	HIO ₃
66. bromous acid	
67. chloric acid	
68. hypobromous acid	
69. hypoiodous acid	

Check your work for 45 - 69. Minor misspellings such as hydrofluoric acid instead of hydrofluoric acid or amonia instead of ammonia are -½. Other misspellings are -1. If you missed 2 ½ or fewer you are still in the game with >90%. If you missed 3 or more, review, study and try again!

Part 4. Other acids. There are other acids that you should know by analogy.

70. selenic acid	H ₂ SeO ₄
71. selenous acid	H ₂ SeO ₃
72. arsenous acid	H ₃ AsO ₃
73. arsenic acid	H ₃ AsO ₄
74. telluric acid	H ₂ TeO ₄
75. tellurous acid	H ₂ TeO ₃

Part 5. Names of ionic salts. Write the names or formulas for these salts. The most important thing to remember is that metals, except for Group 1 (alkali metals) and Group 2 (alkaline earths), must carry a charge indicated by Roman numerals. In naming Cr⁺³, one would write Cr(III) and then the anion. There are four exceptions among the metals: zinc, cadmium, silver and aluminum only form one ion each, so the charge of their cations is not in question. Zinc only forms Zn⁺², cadmium only forms Cd⁺², silver only forms Ag⁺, and aluminum only forms Al³⁺. For that reason, these metal cations do not use Roman numerals. Thus AgBr is silver bromide is, Cd(NO₃)₂ is cadmium nitrate, and ZnS is zinc sulfide.

The other weird cation is mercury(I), which exists as a dimeric cation of two mercury(I) atoms: Hg₂²⁺. Thus mercury(I) chloride would be Hg₂Cl₂. No other dimeric cation exists.

76. potassium peroxide	K ₂ O ₂
77. magnesium sulfide	
78. copper(I) perchlorate	
79. antimony(III) nitrate	
80. lead(IV) acetate	
81. lithium permanganate	
	V ₂ (SO ₄) ₃

	RbClO ₂
	ZnCO ₃
	Ti(OCN) ₄
	AgIO ₃
87. sodium bicarbonate	
88. calcium dichromate	
89. silver hypochlorite	
90. manganese(II) sulfite	
91. mercury(I) nitrate (Hg ₂ ²⁺ !)	
	Fe ₂ (HPO ₄) ₃
	Pb(H ₂ PO ₄) ₂
	Bi ₃ (PO ₄) ₅
	Ni(CN) ₂
	Cr ₂ (CO ₃) ₃
97. cadmium chromate	
98. iron(II) oxalate	
99. cobalt(II) peroxide	
100. aluminum oxide	
101. copper(I) iodide	
	NH ₄ MnO ₄
	Ba(MnO ₄) ₂
	BeCr ₂ O ₇
	VCl ₅
	Hg(NO ₂) ₂
107. tin(IV) oxide	
108. tin(II) chloride	
109. scandium(III) nitride	
110. gold(III) sulfide	

Check your work for 76 - 110. Minor misspellings such as writing nickle instead of nickel or cromium instead of chromium are -½. Other misspellings are -1. If you missed 3 ½ or fewer you are still in the game with >90%. If you missed 4 or more, review, study and try again!

Part 6. Ionic salts that form hydrates. Ionic salts sometimes crystallize with water molecules as part of their ionic lattice structure. Generally, the number of water molecules is stoichiometric, such as three waters per metal cation. The number of water molecules in the formula is expressed with prefixes mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, and so on, followed by the word hydrate, meaning water. Write the names or formulas for these salts. Use examples 111 and 112 as a pattern. The formulas are written with a dot and then a numerical coefficient in front of the number of waters. You might wonder why we do not write iron(II) sulfate pentahydrate as “FeSO₄(H₂O)₇” instead of as it is shown in the example 111. The answer is part historical and part of it is that the water molecules are participating in a variety of roles within the molecule and that often they join the solvent when dissolved in water – so they no longer are part of the formula in solution.

111. iron(II) sulfate heptahydrate	FeSO ₄ ·7H ₂ O
112. sodium acetate monohydrate	
113. nickel(II) iodide hexahydrate	
114. iron(III) cyanide trihydrate	
115. cobalt(II) bromide dihydrate	
	NaSO ₄ ·4H ₂ O
	Zn(NO ₃) ₂ ·H ₂ O
	CuCl ₂ ·2H ₂ O

A few hydrates will be on the practice quiz.

Part 7. Covalent moleculars. Binary covalent molecular compounds are easy to name. The word “binary” means two types of atoms, such as in CO₂. Covalent moleculars always involve two non-metals in the formula. The first atom is simply stated as the element’s name. This atom is almost always the leftmost or lower of the two atoms on the periodic table – examples: CO₂ and SO₃. The second atom is expressed using the –ide suffix. The number of each atom in the formula is expressed with prefixes mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, and so on. Mono- is not used regarding the first element, but is used with the second.

Compounds of semi-metals are named using these rules for covalent-moleculars.

For prefixes ending in “a” or “o” (all but di- and tri-), when the next atom is oxygen (oxide), the “a” or “o” is dropped for phonetic reasons.

Seven elements exist as diatomic molecules covalently bonded: H₂, N₂, O₂, F₂, Cl₂, Br₂, and I₂. These are named “molecular hydrogen”, etc.

119. carbon disulfide	CS ₂
120. dinitrogen monoxide	
121. silicon tetrachloride	
122. phosphorus pentachloride	
123. nitrogen monoxide	
124. sulfur trioxide	
	CCl ₄
	SF ₆
	NI ₃
	F ₂
	N ₂ O ₅
130. dinitrogen tetroxide	
131. carbon monosulfide	
132. chlorine monofluoride	
133. disulfur difluoride	

134. carbon dioxide	
	PBr ₃
	ClF ₃
	IBr
	BF ₃
	IF ₃
140. selenium dioxide	
141. dinitrogen trioxide	
142. carbon tetrabromide	
143. diphosphorus pentoxide	
144. silicon dioxide	
	Si ₂ N ₃
	SH ₂
	BrCl ₃
	O ₂ F ₂
	XeF ₄
150. oxygen dichloride	
151. chlorine dioxide	
152. selenium trioxide	
153. arsenic trichloride	
154. arsenic pentachloride	
	N ₂
	SBr ₄

Check your work for 119 - 156. Minor misspellings are -½. Other misspellings are -1. If you missed 3 ½ or fewer you are still in the game with >90% and ready to take the final practice quiz! If you missed 4 or more, review, study and try again!

Final Practice Quiz. This quiz combines ionic compounds, covalent molecular substances and acids. Hint: Start by identifying which each is! You may miss 6 and still pass with 90%. If you are not responsible for the acids, skip the acid questions and you can miss 5 and pass with 90%.

157. phosphorus trichloride	
158. sulfur trioxide	
159. potassium acetate	
160. chromium(II) carbonate	
161. silver iodide	
	HClO ₂
	Na ₂ CrO ₄
	XeF ₂
	N ₂ O ₅
	Ca(ClO ₂) ₂
167. sodium hypochlorite	
168. sulfuric acid	
169. periodic acid	
170. bromine monochloride	
171. nickel(II) cyanide dihydrate	
	Li ₂ O ₂
	SeO ₂
	SiBr ₄
	RbHCO ₃
	Ca(OH) ₂
177. nitrous acid	
178. oxygen dibromide	
179. copper(I) phosphate	
180. silver nitrate	
181. hydroiodic acid	
	NF ₃
	AsCl ₃
	NH ₄ NO ₂
	Hg ₂ (ClO ₄) ₂
	IF ₅
187. sodium dihydrogen phosphate	

188. calcium hydrogen phosphate	
189. magnesium bromate	
190. hypochlorous acid	
191. carbon monosulfide	
	Al(BrO ₂) ₃
	CuS ₂ O ₃
	Co(SCN) ₂
	Cr(ClO ₄) ₃
	KClO ₃
197. nitrogen dioxide	
198. carbon dioxide	
199. sodium chloride	
200. iron(II) sulfide	
201. ammonium sulfide trihydrate	
	V ₂ (SO ₄) ₃
	HCl
	Bi(IO ₃) ₃
	LiIO ₄
	NaHSO ₄
207. nitric acid	
208. bromic acid	
209. titanium(IV) sulfite	
210. ammonium dichromate	
211. potassium permanganate	
	ScBr ₃
	HF
	CS ₂
	F ₂
	Zn(HSO ₃) ₂
217. calcium nitride	
218. lithium perbromate	

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