

KEY

Polyatomic ion quiz	
Name	Formula (with charge)
Ammonium	NH_4^+
Nitrate	NO_3^-
Hydroxide	OH^-
Bicarbonate	HCO_3^-
Permanganate	MnO_4^-
Acetate	$\text{C}_2\text{H}_3\text{O}_2^-$
Sulfate	SO_4^{2-}
Carbonate	CO_3^{2-}
Phosphate	PO_4^{3-}

quiz Th + Fri

- better of the two grades

- if both 100% - E.C in quiz grade

NAMING IONIC COMPOUNDS I

Ionic compounds are named by the following simple rule:

Name the cation; then name the anion.

For example, NaCl is named **sodium chloride**. "NaCl" is the formula for the compound; "sodium chloride" is the name of the compound.

Notes:

1. Cations are positive ions. The **sodium** ion is Na^+ .
2. Anions are negative ions. The **chloride** ion is Cl^- .
3. The positive ion is named before the negative ion.
4. Metals form cations, e.g., K^+ , Mg^{2+} , Al^{3+} .
5. Nonmetals form anions, e.g., I^- , O^{2-} , N^{3-} .
6. A metal ion is named simply with the name of the metal. Ag^+ is a **silver** ion.
7. A nonmetal ion ends with "ide". Br^- is a **bromide** ion. S^{2-} is a **sulfide** ion.
8. Subscripts in the formula do not appear in the name. CaCl_2 is named **calcium chloride**. Al_2O_3 is named **aluminum oxide**.

You should be able to name the following:

a. NaI	h. Na_2O	o. BeI_2
b. KBr	i. Li_3N	p. ZnBr_2
c. MgF_2	j. ZnS	q. CaF_2
d. CaO	k. AlN	r. Ag_2O
e. BaS	l. AgCl	s. BaO
f. CaI_2	m. KF	t. Na_3P
g. AlCl_3	n. Al_2S_3	

Answers are on the other side.

* answers to a → t
on the next page

WRITING IONIC FORMULAS I

Formulas for ionic compounds are written by these rules:

Rule 1 Write the formula (symbol) for the cation (without the charge) followed by a subscript;
write the formula (symbol) for the anion (without the charge) followed by a subscript.

Rule 2 Subscripts are chosen so that the charges in a compound add to zero.

Notes:

1. The charges on the ions must be known before the formula can be written.

The ionic charges are as follows:

Group IA metals always form +1 ions: Li^+ , Na^+ , K^+ , etc.

Group IIA metals always form +2 ions: Be^{2+} , Mg^{2+} , Ca^{2+} , Ba^{2+} , etc.

Aluminum (in IIIA) always forms a +3 ion: Al^{3+} .

Zinc (in IIB) always forms a +2 ion: Zn^{2+} .

Silver (in IB) always forms a +1 ion: Ag^+ .

Group VIIA always form -1 ions: F^- , Cl^- , Br^- , I^- .

Group VIA always form -2 ions: O^{2-} , S^{2-} .

Group VA always form -3 ions: N^{3-} , P^{3-} .

2. The subscript after the ionic formula indicates the number of those ions in the compound.

3. A subscript of one (1) is not written.

4. The cation charge times its subscript plus the anion charge times its subscript must equal zero.

5. Usually the subscripts can be determined by making the charge on an anion the subscript on the cation (leave off the minus sign) and making the charge on the cation the subscript on the anion.

6. Subscripts should be reduced to the lowest integer numbers.

To write the formula for magnesium fluoride,

Determine the charges: magnesium ion is Mg^{2+} and the fluoride ion is F^- .

Try subscripts 1 (the |charge| of the anion) and 2 (the charge of the cation)

The formula is: MgF_2

The sum of the charges equals zero: $1 \times (+2) + 2 \times (-1) = 0$

You should be able to write formulas for the following:

a. sodium iodide

b. potassium bromide

c. magnesium fluoride

d. calcium oxide

e. barium sulfide

f. calcium iodide

g. aluminum chloride

h. sodium oxide

i. lithium nitride

j. zinc sulfide

k. aluminum nitride

l. silver chloride

m. potassium fluoride

n. aluminum sulfide

o. beryllium iodide

p. zinc bromide

q. calcium fluoride

r. silver oxide

s. barium oxide

t. sodium phosphide

* answers to a → t on
previous page

Nomenclature Practice: Binary Ionic Compounds

name:

Name the following compounds:

1. NaBr sodium bromide
2. BaS barium sulfide
3. MgCl₂ magnesium chloride
4. CaS calcium sulfide
5. Ag₂S silver sulfide
6. AlF₃ aluminum fluoride
7. Cs₂O cesium oxide
8. AlP aluminum phosphide
9. Ca₃P₂ calcium phosphide
10. KF potassium fluoride

11. ZnI₂ zinc iodide
12. NaBr sodium bromide
13. AgF silver fluoride
14. BeI₂ beryllium iodide
15. Sr₃N₂ strontium nitride
16. Al₂S₃ aluminum sulfide
17. MgO magnesium oxide
18. Na₂O sodium oxide
19. RbCl rubidium chloride
20. Ba₃P₂ barium phosphide

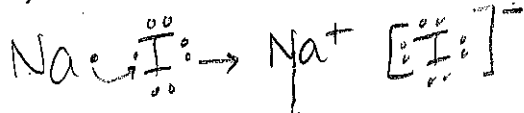
Write the formulas for the following compounds:

21. sodium bromide NaBr
22. barium sulfide BaS
23. magnesium chloride MgCl₂
24. calcium sulfide CaS
- silver sulfide Ag₂S
26. lithium fluoride LiF
27. cesium oxide Cs₂O
28. aluminum phosphide AlP
29. rubidium sulfide Rb₂S
30. potassium fluoride KF

31. zinc iodide ZnI₂
32. sodium bromide NaBr
33. aluminum oxide Al₂O₃
34. beryllium iodide BeI₂
35. strontium nitride Sr₃N₂
36. aluminum sulfide Al₂S₃
37. magnesium oxide MgO
38. silver oxide Ag₂O
39. rubidium chloride RbCl
40. barium phosphide Ba₃P₂

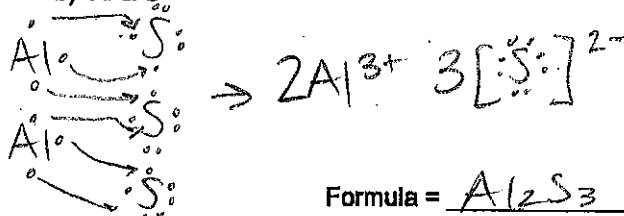
Write out the Lewis dot structure and determine the formula for the ionic compound made by the following combinations of atoms, using arrows and dots to show where the electrons come from and go to:

a) Na & I



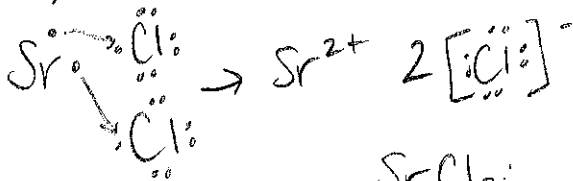
Formula = NaI

b) Al & S



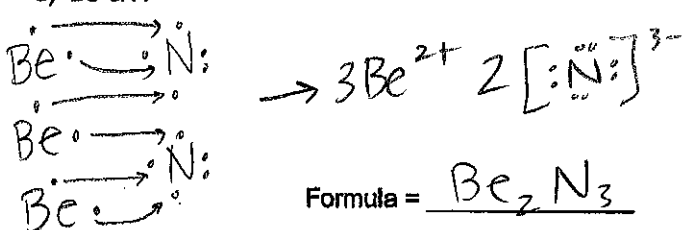
Formula = Al₂S₃

c) Sr & Cl



Formula = SrCl₂

d) Be & N



Formula = Be₃N₂

WRITING IONIC FORMULAS II

Formulas for ionic compounds are written by these rules:

Rule 1 Write the formula (symbol) for the cation (without the charge) followed by a subscript; write the formula (symbol) for the anion (without the charge) followed by a subscript.

Rule 2 Subscripts are chosen so that the charges in a compound add to zero.

These rules are the same as for IONIC FORMULAS I. However for these compounds the cation charge (oxidation number) is given in the name.

iron(II) chloride is written as follows:

iron(II) is Fe^{2+} (charge +2) chloride is Cl^- (charge -1)

try subscripts 1 (charge on anion) and 2 (charge on cation)

formula is FeCl_2

note: $(+2) \times 1 + (-1) \times 2 = 0$

chromium(III) oxide is written as follows:

chromium(III) is Cr^{3+} (charge +3) oxide is O^{2-} (charge -2)

try subscripts 2 and 3; so formula is Cr_2O_3

note: $(+3) \times 2 + (-2) \times 3 = 0$

lead(IV) sulfide is written as follows:

lead(IV) is Pb^{4+} (charge +4) sulfide is S^{2-} (charge -2)

try subscripts 2 and 4 so formula is Pb_2S_4

this should be reduced to simpler numbers PbS_2

note: $(+4) \times 1 + (-2) \times 2 = 0$

You should be able to write formulas for the following:

a. iron(II) sulfide

g. tin(II) iodide

m. chromium(III) phosphide

b. gold(III) oxide

h. cobalt(II) oxide

n. mercury(II) bromide

c. manganese(IV) oxide

i. iron(III) iodide

o. gold(III) chloride

d. tin(IV) fluoride

j. iron(III) oxide

p. mercury(II) sulfide

e. lead(IV) oxide

k. tin(II) sulfide

q. chromium(III) chloride

f. nickel(II) fluoride

l. copper(I) nitride

r. manganese(II) bromide

Answers are on the other side.

*answers to a → r on
next page

NAMING IONIC COMPOUNDS II

These ionic compounds are named by the simple rule:

Name the cation: then name the anion.

However, to avoid ambiguity the names of these cations must indicate the charge (oxidation number) on the metal ion.

1. The charge (oxidation number) is given by Roman numeral in parentheses after the name of the metal. Examples:

Cu^+ is copper(I) ion, so CuCl is named copper(I) chloride
 Cu^{2+} is copper(II) ion, so CuCl_2 is named copper(II) chloride
 Fe^{3+} is iron(III) ion, so FeCl_3 is named iron(III) chloride
 Sn^{4+} is tin(IV) ion, so SnCl_4 is named tin(IV) chloride

2. All metals not in groups IA, IIA, except Ag, Zn, and Al must include the charge (oxidation number) in the name.
3. The charge on the cation must be deduced from the formula using the subscripts and the charge on the anion so that all ionic charges sum to zero. Examples:

In CoCl_3 let Z = cobalt charge; -1 is the chloride charge;
since $Z + (-1) \times 3 = 0$, $Z = 3$; so cobalt is Co^{3+} or cobalt(III).
 CoCl_3 is named cobalt(III) chloride

In V_2O_5 let Z = vanadium charge; -2 is the oxide charge;
since $Z \times 2 + (-2) \times 5 = 0$, $Z = 5$; so vanadium is V^{5+} or vanadium(V).
 V_2O_5 is named vanadium(V) oxide.

You should be able to name the following:

a. FeS

g. SnI_2

m. CrP

b. Au_2O_3

h. CoO

n. HgBr_2

c. MnO_2

i. FeI_3

o. AuCl_3

d. SnF_4

j. Fe_2O_3

p. HgS

e. PbO_2

k. SnS

q. CrCl_3

f. NiF_2

l. Cu_3N

r. MnBr_2

Answers are on the other side.

* answers to a → r on previous page

Nomenclature Practice: Ionic Compounds

name:

Name the following compounds:

1. NaBr sodium bromide
2. BaS barium sulfide
3. MgCl_2 magnesium chloride
4. CaS calcium sulfide
5. Ag_2S silver sulfide
6. NiF_3 nickel (III) fluoride
7. Cs_2O cesium oxide
8. AlP aluminum phosphide
9. Cr_2S_3 chromium (III) sulfide
10. KF potassium fluoride
11. ZnI_2 zinc iodide
12. NaBr sodium bromide
13. CoO cobalt (II) oxide
14. BeI_2 beryllium iodide
15. Sr_3N_2 strontium nitride
16. Al_2S_3 aluminum sulfide
17. MnO_2 manganese (IV) oxide
18. NiO nickel (II) oxide
19. RbCl rubidium chloride
20. Ba_3P_2 barium phosphide
21. Ti_3P_2 titanium (III) phosphide
22. CrCl_3 chromium (III) chloride
23. Cu_2S copper (I) sulfide
24. V_2O_5 vanadium (V) oxide
25. Au_2O_3 gold (III) oxide
26. HgO mercury (II) oxide
27. CdO cadmium (II) oxide
28. UF_6 uranium (VI) fluoride
29. Cu_3P copper (I) phosphide
30. Sc_2O_3 scandium (III) oxide

Write the formulas for the following compounds:

31. sodium bromide NaBr
32. Barium sulfide BaS
33. Magnesium chloride MgCl₂
34. Calcium sulfide CaS
35. Silver sulfide Ag₂S
36. Nickel(III) fluoride NiF₃
37. cesium oxide Cs₂O
38. Aluminum phosphide AlP
39. Chromium (II) sulfide CrS
40. Potassium fluoride KF
41. Zinc iodide ZnI₂
42. Sodium bromide NaBr
43. Cobalt (II) oxide CoO
44. Beryllium iodide BeI₂
45. strontium nitride Sr₃N₂
46. Aluminum sulfide Al₂S₃
47. Manganese(IV) oxide MnO₂
48. nickel(II) oxide NiO
49. rubidium chloride RbCl
50. Barium phosphide Ba₃P₂
51. Titanium(II) phosphide Ti₃P₂
52. Chromium (III) chloride CrCl₃
53. copper(I) sulfide Cu₂S
54. vanadium (V) oxide V₂O₅
55. gold (III) oxide Au₂O₃
56. mercury(II) oxide HgO
57. cadmium(II) oxide CdO
58. uranium(VI) fluoride UF₆
59. Copper (I) phosphide Cu₃P
60. scandium(III) oxide Sc₂O₃

Binary Ionic Nomenclature Practice.

Name:
Hour:

Write the formula for every compound in the grid.

	F ⁻	S ²⁻	N ³⁻	Br ⁻	O ²⁻	Cl ⁻	P ³⁻
Na ⁺	1) NaF	2) Na ₂ S	3) Na ₃ N	4) NaBr	5) Na ₂ O	6) NaCl	7) Na ₃ P
Mg ²⁺	8) MgF ₂	9) MgS	10) Mg ₃ N ₂	11) MgBr ₂	12) MgO	13) MgCl ₂	14) Mg ₃ P ₂
K ⁺	15) KF	16) K ₂ S	17) K ₃ N	18) KBr	19) K ₂ O	20) KCl	21) K ₃ P
Al ³⁺	22) AlF ₃	23) Al ₂ S ₃	24) AlN	25) AlBr ₃	26) Al ₂ O ₃	27) AlCl ₃	28) AlP
Sr ²⁺	29) SrF ₂	30) SrS	31) Sr ₃ N ₂	32) SrBr ₂	33) SrO	34) SrCl ₂	35) Sr ₃ P ₂
Ca ²⁺	36) CaF ₂	37) CaS	38) Ca ₃ N ₂	39) CaBr ₂	40) CaO	41) CaCl ₂	42) Ca ₃ P ₂
Li ⁺	43) LiF	44) Li ₂ S	45) Li ₃ N	46) LiBr	47) Li ₂ O	48) LiCl	49) Li ₃ P
Ba ²⁺	50) BaF ₂	51) BaS	52) Ba ₃ N ₂	53) BaBr ₂	54) BaO	55) BaCl ₂	56) Ba ₃ P ₂
Cs ⁺	57) CsF	58) Cs ₂ S	59) Cs ₃ N	60) CsBr	61) Cs ₂ O	62) CsCl	63) Cs ₃ P
Be ²⁺	64) BeF ₂	65) BeS	66) Be ₃ N ₂	67) BeBr ₂	68) BeO	69) BeCl ₂	70) Be ₃ P ₂

On the back of this sheet, name all seventy compounds.

- (multiples of 5!)
- 5) sodium bromide
 - 10) magnesium nitride
 - 15) potassium fluoride
 - 20) potassium chloride
 - 25) aluminum bromide
 - 30) strontium sulfide
 - 35) strontium phosphide
 - 40) calcium oxide
 - 45) lithium nitride
 - 50) barium fluoride
 - 55) barium chloride
 - 60) cesium bromide
 - 65) beryllium sulfide
 - 70) beryllium phosphide

Binary Molecular Nomenclature

- Bonding between two **nonmetals**
- Unlike ionic bonding, there are no charges to balance and therefore multiple subscripts can be possible (ex. NO, NO₂, N₂O₂, etc)

Naming rules

- When naming, use the following prefixes for the subscripts

1- mono
2- di
3- tri
4- tetra
5- penta

6- hexa
7- hepta
8- octa
9- nona
10- deca

- Change the second name to end in "-ide"
- Do not use prefixes if the prefix on the first word is mono
- ALWAYS use prefixes on the second name

Ex. SO₂ is sulfur dioxide (since there is only one sulfur atom, you do not use the prefix mono)

N₂O₂ is dinitrogen dioxide

****NEVER USE PREFIXES WHEN NAMING A METAL****

Writing compounds: Use the prefixes to write the subscripts of the molecule, but do *NOT* reduce the subscripts

Try these:

1. NO

2. P₂O₅

3. CF₄

4. SO₂

5. CCl₄

6. CO

7. N₂O₄

8. PCl₅

9. SO₃

10. SiO₂

11. Nitrogen monoxide

12. Diphosphorus pentoxide

13. Carbon tetrafluoride

14. Sulfur dioxide

15. Carbon tetrachloride

16. Carbon monoxide

17. Dinitrogen tetraoxide

18. Phosphorus pentachloride

19. Sulfur trioxide

20. Silicon dioxide

← answers →

Polyatomic Ions

- Polyatomic ions are groups of atoms covalently bonded together that act as a single ion

Polyatomic ions you need to know (including charges!!):

- Ammonium: NH_4^+
- Nitrate: NO_3^-
- Hydroxide: OH^-
- Bicarbonate: HCO_3^-
- Permanganate: MnO_4^-
- Acetate: $\text{C}_2\text{H}_3\text{O}_2^-$
- Sulfate: SO_4^{2-}
- Carbonate: CO_3^{2-}
- Phosphate: PO_4^{3-}

Writing names

- Name the cation and then the anion
- If the polyatomic ion is an anion, simply name the polyatomic ion without the -ide ending
- Ex: NaNO_3
 - There are more than two capital letters so it must have a polyatomic ion.
 - Name: Sodium nitrate
- Ex: $\text{Al}_2(\text{SO}_4)_3$
 - Name: aluminum sulfate
- Ex: $(\text{NH}_4)_3\text{PO}_4$
 - Name: ammonium phosphate

Writing the formula

- Use the same rules as other ionic compounds. The rules of binary compounds and transition metals still apply.
- Ex: Iron (II) sulfate
 - Iron has a +2 charge, sulfate as a -2
 - Formula: FeSO_4
- Ex: Iron (III) sulfate
 - Iron has a +3 charge, sulfate has a -2
 - Crisscross to get Fe_2SO_4_3
 - Wait! You cannot have 43 oxygen atoms, so you must use parentheses
 - Formula: $\text{Fe}_2(\text{SO}_4)_3$

Try these

- | | |
|-----------------------------|----------------------------------|
| 1. Sodium nitrate | 11. NaNO_3 |
| 2. Aluminum phosphate | 12. AlPO_4 |
| 3. Potassium phosphate | 13. K_3PO_4 |
| 4. Ammonium sulfide | 14. $(\text{NH}_4)_2\text{S}$ |
| 5. Chromium (III) carbonate | 15. $\text{Cr}_2(\text{CO}_3)_3$ |
| 6. Magnesium hydroxide | 16. $\text{Mg}(\text{OH})_2$ |
| 7. Cobalt (II) carbonate | 17. CoCO_3 |
| 8. Iron (II) hydroxide | 18. $\text{Fe}(\text{OH})_2$ |
| 9. Ammonium carbonate | 19. $(\text{NH}_4)_2\text{CO}_3$ |
| 10. Zinc phosphate | 20. $\text{Zn}_3(\text{PO}_4)_2$ |

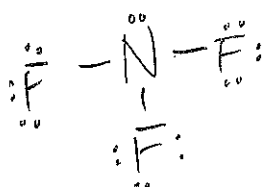
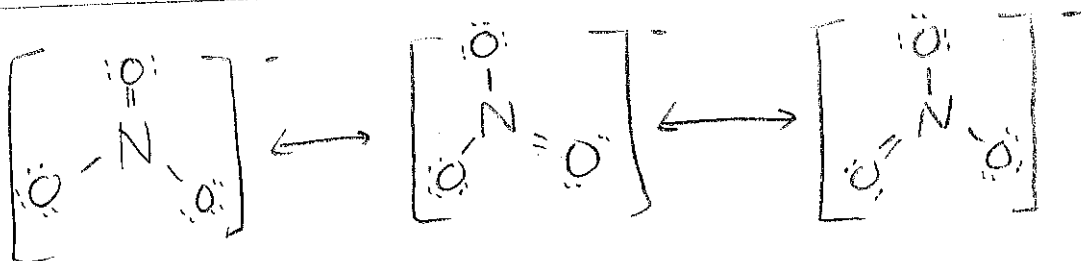
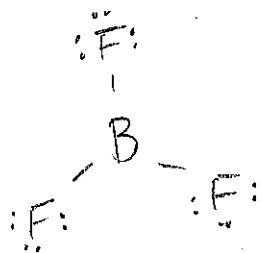
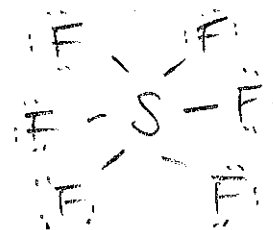
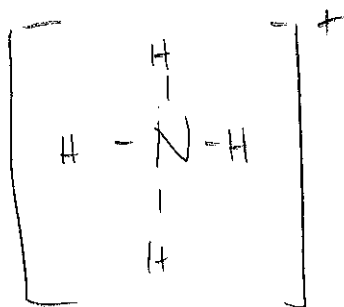
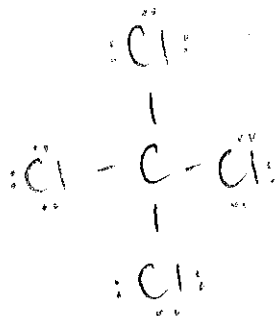
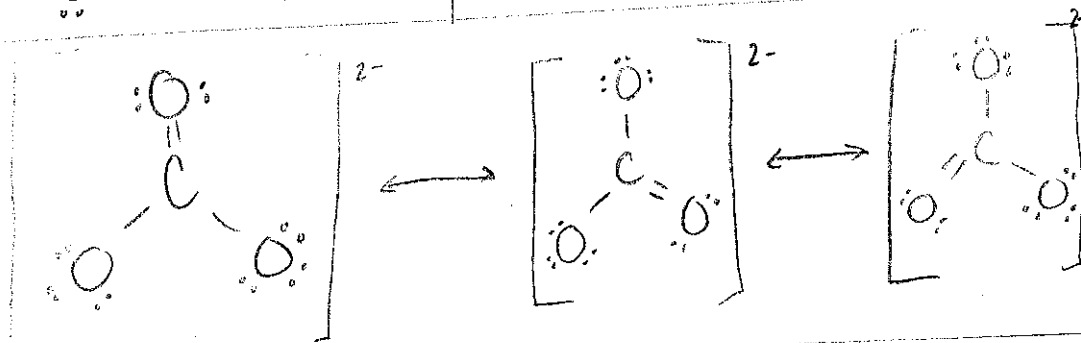
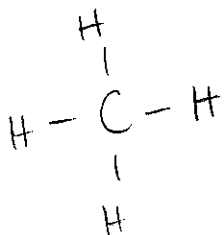
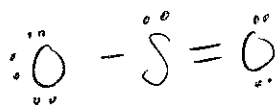
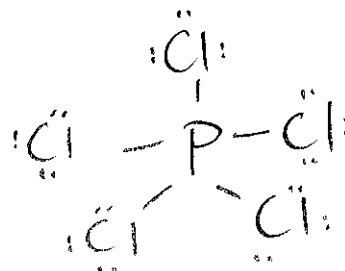
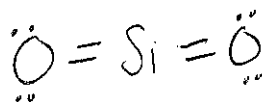
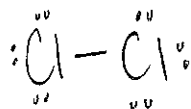
answers
←→

Lewis Structure Practice (1)

Draw Lewis Structures for the following molecules:

Cl₂ N₂ CH₄ CCl₄ BF₃ NF₃ SiO₂ SO₂ CO₃²⁻ NH₄⁺ NO₃⁻ PCl₅ SF₆

Be sure to show all of your work (adding electrons, etc)



Writing Formulas/Nomenclature Practice

Determine whether each compound is ionic or covalent and then write the formula

1. Na_2CO_3 sodium carbonate
2. P_2O_5 diphosphorous pentoxide
3. NH_3 nitrogen trihydride
4. FeSO_4 iron (II) sulfate
5. SiO_2 silicon dioxide
6. GaCl_3 gallium chloride
7. CoBr_2 cobalt (II) bromide
8. B_2H_4 diboron tetrahydride
9. CO carbon monoxide
10. P_4 phosphorous
11. NaBr sodium bromide
12. $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ calcium acetate
13. P_2O_5 diphosphorous pentoxide
14. $\text{Ti}(\text{SO}_4)_2$ titanium (IV) sulfate
15. FePO_4 iron (III) phosphate
16. K_3N potassium nitride
17. SO_2 sulfur dioxide
18. CuOH copper (I) hydroxide
19. $\text{Zn}(\text{NO}_2)_2$ zinc nitrite
20. V_2S_3 vandium (III) sulfide
21. BBr_3 boron tribromide
22. CaSO_4 calcium sulfate
23. C_2Br_6 dicarbon hexabromide
24. $\text{Cr}(\text{CO}_3)_3$ chromium (III) carbonate
25. Ag_3P silver phosphide
26. IO_2 iodine dioxide
27. VO_2 vandium (IV) oxide
28. PbS lead (II) sulfide
29. CH_4 carbon tetrahydride
30. N_2O_3 dinitrogen trioxide

Determine whether each formula is ionic or covalent and write the name

31. tetraphosphorus triselenide P_4Se_3
32. potassium acetate $KC_2H_3O_2$
33. iron (II) phosphide Fe_3P_2
34. disilicon hexabromide Si_2Br_6
35. titanium (IV) nitrate $Ti(NO_3)_4$
36. diselenium diiodide Se_2I_2
37. copper (I) phosphate Cu_3PO_4
38. gallium oxide Ga_2O_3
39. tetrasulfur dinitride S_4N_2
40. phosphorus P_4
41. silicon dioxide SiO_2
42. nickel (III) sulfide Ni_2S_3
43. manganese (II) phosphate $Mn_3(PO_4)_2$
44. silver acetate $AgC_2H_3O_2$
45. diboron tetrabromide B_2Br_4
46. magnesium sulfate $MgSO_4$
47. potassium carbonate K_2CO_3
48. ammonium oxide $(NH_4)_2O$
49. tin (IV) selenide $SnSe_2$
50. carbon tetrachloride CCl_4
51. dinitrogen trioxide N_2O_3
52. nitrogen dioxide NO_2
53. methane CH_4
54. lithium acetate $LiC_2H_3O_2$
55. phosphorus trifluoride PF_3
56. vanadium (V) oxide V_2O_5
57. aluminum hydroxide $Al(OH)_3$
58. zinc sulfide ZnS
59. silicon tetrafluoride SiF_4
60. silver phosphate Ag_3PO_4