

CHEMICAL FORMULAE HELP SHEET

IONS: These are charged particles, formed when atoms lose or gain electrons.

Metals form positive ions: $_{11}\text{Na}$: 2,8,1 loses one electron to become Na^+ ; $_{12}\text{Mg}$: 2,8,2 loses two electrons to become Mg^{2+} .

Non metals form negative ions: $_{17}\text{Cl}$: 2,8,7 gains one electron to become Cl^- ; $_{8}\text{O}$: 2,6 gains 2 electrons to become O^{2-} .

WRITING FORMULAE: You will be given a table of ions. From the ions we can work out formulae. Note: all compounds must have no overall charge.

To write formulae,
number of + charges must equal the number of - charges

Eg sodium chloride

- the sodium ion is Na^+ the chloride ion is Cl^-
- if we have one of each, the charge will be $+1-1 = 0$
- So the formula is NaCl

Eg sodium carbonate

- the sodium ion is Na^+ the carbonate ion is CO_3^{2-}
- we need two sodium ions (Na^+ and Na^+) to "cancel" out the 2- charge on the carbonate ion as $+1+1-2 = 0$
- So the formula is Na_2CO_3

Further examples:

- zinc oxide Zn^{2+} and $\text{O}^{2-} = \text{ZnO}$
- zinc chloride Zn^{2+} and $\text{Cl}^- = \text{ZnCl}_2$
- aluminium oxide Al^{3+} and $\text{O}^{2-} = \text{Al}_2\text{O}_3$

The following ions are made up of two or more types of atoms "grouped" together: hydroxide OH^- , nitrate NO_3^- , hydrogen carbonate HCO_3^- , carbonate CO_3^{2-} , sulfate SO_4^{2-} . The formula is worked out in exactly the same way, by considering the charges on the ions. However when a "group" is used *more than once*, you must put it in brackets.

Eg zinc hydroxide

- the zinc ion is Zn^{2+} the hydroxide ion is OH^-
- to "cancel" out the 2+ charge on the zinc ion we need two hydroxide ions since $+2-1-1=0$, so the formula is $\text{Zn}(\text{OH})_2$

But NaOH (only uses one OH^- ion) does not need brackets but $\text{Al}(\text{OH})_3$ does; KNO_3 (only uses one nitrate ion NO_3^-) does not need brackets but $\text{Cu}(\text{NO}_3)_2$ does.

WHAT'S WRONG HERE?

Example	Error	Correct formula
$\text{Cu}(\text{OH})^2$	The 2 should be a subscript, not a superscript	$\text{Cu}(\text{OH})_2$
$\text{Cu}^{2+}\text{SO}_4^{2-}$	The final formula should not contain the ion charges	CuSO_4
Fe_3Cl	Check the ions Fe^{3+} and Cl^- . We need 1 " Fe^{3+} " and 3 " Cl^- "	FeCl_3
$(\text{OH})_2\text{Mg}$	It's normal to write the metal part first	$\text{Mg}(\text{OH})_2$
NACl	It should be Na , (2 nd letter is lower case)	NaCl
AlOH_3	Ions Al^{3+} and OH^- , we need 3 " OH^- " groups	$\text{Al}(\text{OH})_3$
NaNO	Student means sodium nitrate but omitted the 3 of nitrate ion	NaNO_3

TRY THESE EXAMPLES:

Print and then fold the page over on the dotted line to hide the answers, then open it up to mark your work. Good luck!!!

Name	Ions	Formula	Answer
1. potassium chloride	$K^+ Cl^-$		KCl
2. sodium hydrogen carbonate	$Na^+ HCO_3^-$		$NaHCO_3$
3. magnesium carbonate	$Mg^{2+} CO_3^{2-}$		$MgCO_3$
4. calcium oxide	$Ca^{2+} O^{2-}$		CaO
5. copper sulfate	$Cu^{2+} SO_4^{2-}$		$CuSO_4$
6. iron(II) sulfate	$Fe^{2+} SO_4^{2-}$		$FeSO_4$
7. zinc oxide	$Zn^{2+} O^{2-}$		ZnO
8. calcium hydroxide	$Ca^{2+} OH^-$		$Ca(OH)_2$
9. zinc chloride	$Zn^{2+} Cl^-$		$ZnCl_2$
10. calcium hydrogen carbonate	$Ca^{2+} HCO_3^-$		$Ca(HCO_3)_2$
11. sodium hydroxide	$Na^+ OH^-$		NaOH
12. potassium nitrate	$K^+ NO_3^-$		KNO_3
13. copper nitrate	$Cu^{2+} NO_3^-$		$Cu(NO_3)_2$
14. lead oxide	$Pb^{2+} O^{2-}$		PbO
15. aluminium oxide	$Al^{3+} O^{2-}$		Al_2O_3
16. copper carbonate	$Cu^{2+} CO_3^{2-}$		$CuCO_3$
17. aluminium nitrate	$Al^{3+} NO_3^-$		$Al(NO_3)_3$
18. potassium hydroxide	$K^+ OH^-$		KOH
19. calcium chloride	$Ca^{2+} Cl^-$		$CaCl_2$
20. potassium carbonate	$K^+ CO_3^{2-}$		K_2CO_3
21. copper hydroxide	$Cu^{2+} OH^-$		$Cu(OH)_2$
22. calcium nitrate	$Ca^{2+} NO_3^-$		$Ca(NO_3)_2$
23. potassium oxide	$K^+ O^{2-}$		K_2O
24. sodium hydrogen carbonate	$Na^+ HCO_3^-$		$NaHCO_3$

25. zinc carbonate	$\text{Zn}^{2+} \text{CO}_3^{2-}$		ZnCO_3
26. copper oxide	$\text{Cu}^{2+} \text{O}^{2-}$		CuO
27. iron(III) chloride	$\text{Fe}^{3+} \text{Cl}^-$		FeCl_3
28. iron(II) oxide	$\text{Fe}^{2+} \text{O}^{2-}$		FeO
29. magnesium hydroxide	$\text{Mg}^{2+} \text{OH}^-$		Mg(OH)_2
30. lead sulfate	$\text{Pb}^{2+} \text{SO}_4^{2-}$		PbSO_4

EXTRA – if you can do these three you can do any!!

The ammonium ion is NH_4^+

The phosphate ion is PO_4^{3-}

Now try these formulae

1. ammonium chloride	$\text{NH}_4^+ \text{Cl}^-$		NH_4Cl
2. calcium phosphate	$\text{Ca}^{2+} \text{PO}_4^{3-}$		$\text{Ca}_3(\text{PO}_4)_2$
3. ammonium phosphate	$\text{NH}_4^+ \text{PO}_4^{3-}$		$(\text{NH}_4)_3\text{PO}_4$

This is the table of ions you will get in the exam – make sure you know the names of all the ions.

+1	+2	+3	-3	-2	-1
NH_4^+	Ca^{2+}	Al^{3+}		O^{2-}	OH^-
Na^+	Mg^{2+}	Fe^{3+}		S^{2-}	Cl^-
K^+	Cu^{2+}			CO_3^{2-}	NO_3^-
Ag^+	Pb^{2+}			SO_4^{2-}	HCO_3^-
H^+	Fe^{2+}				
	Ba^{2+}				
	Zn^{2+}				

Barium

Don't confuse sulfide S^{2-} and sulfate SO_4^{2-}

Hydrogen carbonate is also called "bicarbonate".