List of chemistry mnemonics

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A mnemonic is a memory aid used to improve long term memory and make the process of consolidation easier.

Many chemistry aspects, rules, names of compounds, sequences of elements, their reactivity, etc., can be easily and efficiently memorized with the help of mnemonics. This article contains the list of certain mnemonics in chemistry.

Orbitals

Sequence of orbitals

`spdfghik`

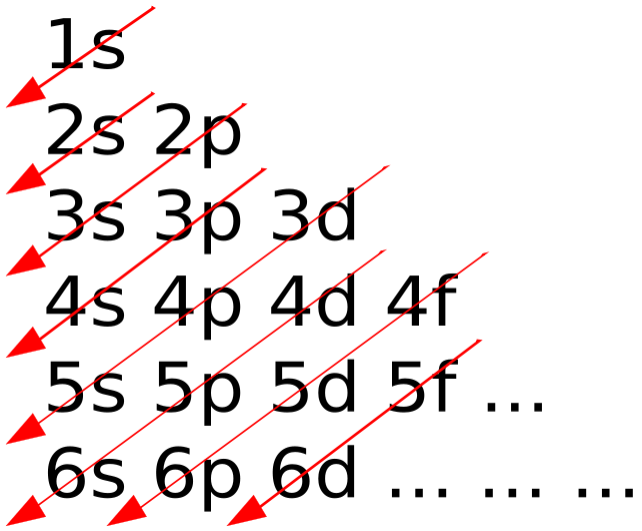
- Spd force great hik
- ***S**ober **P**hysicists **D**on't **F**ind **G**iraffes **H**iding **I**n **K**itchens.*

Note: After the k shell, they follow alphabetical order (skipping s and p as they came earlier).[1]

```
    Aufbau principle
```

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$ ...

The order of sequence of atomic orbitals (according to Madelung rule or Klechkowski rule) can be remembered by the following.[2]



Order in which orbitals are arranged by increasing energy according to the Madelung rule. Each diagonal red arrow corresponds to a different value of n + l.

Periodic table

Periods

Periods 1, 2 and 3

H	He	Li	Be	B	C	N	O	F	Ne	Na (sodium)	Mg	Al	Si	P	S	Cl	Ar

Na*tive* ***Mag****pies* ***Al****ways* ***Si****t* ***P****eacefully* ***S****earching* ***Cl****ear* ***Ar****eas.*[3]

Na*val* ***Mag****istrates* ***Al****ways* ***Si****gnal* ***P****er* ***S****iren,* ***Cl****aiming* ***A****dequacy.*[4]

Na*ughty* ***Marg****aret* ***Al****ways* ***Si****ghs, "****P****lease* ***S****top* ***Cl****owning* ***Ar****ound."*[5]

Ne*llie's* ***Na****ughty* ***Mag****pie* ***Al****ways* ***Si****ngs* ***P****op* ***S****ongs* ***Cl****early* ***A****fter* ***K****illing* ***C****athy.*[5]

***Al**l **Si**licon **P**orts. **S**uperman **Cl**ean **Ar**gon's **K-Ca**pture.*[6]

- ***H**appy **H**arry **Li**stens **B B C N**etwork **O**ver **F**rance **Ne**vertheless **N**othing **M**ore **A**rose **S**o **P**eter **S**topped **Cl**eaning **Ai**rgun **K Ca**.*[7]
- ***H**a. **He**althy **Li**ttle **Be**ggar **B**oys **C**atching **N**ewts **O**r **F**ish.*[8]
- ***H**ell, **He**re **Li**ttle **B**eatniks **B**randish **C**ountless **N**umber **O**f **F**lick k**N**ive**e**s.*[9] ***Na**gging **Ma**ggie **Al**ways **Si**ghs, "**P**lease **S**top **Cl**owning **Ar**ound."* [5] (adapted)
- **H**a **He** **L**ittle **B**enny **B**oy **C**alled **N**aughty **O**ssie **F**oolish **N**ellie **N**ancy **M**argaret **A**lica's **S**ister **P**oured **S**ugar **C**loves **A**round **K**it **C**at

Period 4

K (**P**otassium) **Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr**

- **K**indly **Ca**nnibals **Sc**are **Ti**mid **V**isitors, 'n' **Cr**uelly **M**enace **Fe**male **Co**mmunist **Ni**twits **Cu**ddling **Z**a**n**y **Ga**bbling **Ge**ese **A**stride **S**everal **B**rutal **K**anga**r**oos.[4]
- In reverse order: ***Kr**y **Br**other! **SeAs** of **Ge**rmany and **Ga**ul **sink copper** ships **Ni**ce and **Co**ld **F**rom **Man**x to **Cr**imea, **V**ancouver to **Ti**mor, and **Sc**andinavia to the **Ca**lifornia **K**oast.*[10]

Transition metals

First

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn

- ***Sc**ary **Ti**ny **V**icious **Cr**eatures are **M**ea**n; Fe**males **Co**me to **Ni**ght to **Cl**u**b Zen**.*[11]*
- ***SucTi**on **V**el**Cr**o **Ma**n **Fe**ars **CoNiC uZ**i.*
- **Sc**ience **Ti**cher (actually Teacher) **V**ery **Cr**azy**Ma**n **Fe-Co-Ni-Cu-Zn** (pronounce fe-ko-ni-ku-zen)

Second

Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd

- ***Y**es S**(Z)**i**r**, **N**io**b**i and **Mo**st **T**e**c**hnicians **Ru**b **Rh**onda **Pa**d**d**illa's silver(**Ag**) **C**a**d**illac.*[11]

Third

La ...	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg

- ***La**rry's **Ha**lf **Ta**ken, **W**endy **Re**ached **O**ut H**(I)**e**r** **P**la**t**e **Au**dibly, **H**el**g**a.*[11]

Lanthanides and actinides

Lanthanides

(La)	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu

- ***La**dies **C**an't **P**ut **Nipples** P**roperly in** S**lot-**m**achines.** E**very** G**irl** T**ries** D**aily**, Ho**wever**, E**very** T**ime** Y**ou** L**ose.***[12]
- ***La**nguid **Ce**ntaurs **Pr**aise **N**e**d**'s **P**ro**m**ise of **Sm**all **Eu**ropean **G**ar**d**en **T**u**b**s; **D**inosaurs **Ho**bble **Er**ratically **T**hru**m**ming **Y**ellow **Lu**tes.*[13]

Actinides

(Ac)	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

- ***~~Ra**diant~~* ***Ac**ting **Th**oroughly **P**rotects yo**U**r **N**e**p**otism, **P**l**u**tocratic **Am**erica **C**ures-**m**e & **B**er**k**eley **C**ali**f**ornia, **E**in**s**tein **F**ir**m**ly **M**en**d**ed **No**ble **L**aw**r**eins.*[14]

- ***Th**ree **Pl**anets: **U**ranus, **N**e**p**tune, and **Plu**to. **Am**y **C**ured **B**er**k**eley, **C**ali**f**ornia. **E**in**s**tein and **F**er**m**i **Mad**e **No**ble **L**aws.*[11]
- **Ac**cidently **Th**ore **Pa**cked **U**ranium **Np Pu**t **Amount** to **C**o**M**mon of **B**an**k** of **C**ali**f**ornia **E**in**s**tein **Fm M**o**d**el number(**No.**) **103(Lawrencium)** [15]

56 elements in sequence

He Li Be B C N O F Ne Na Mg Al Si P S Cl Ar K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe Cs Ba

***In**dian **Son**s **Sob**bing **Te**ars **I**n **X**c**e**ss **C**ea**s**e **Ba**wling.*[6]

Groups

Group 1 (alkali metals)

Li Na K Rb Cs Fr

Lithium, Sodium, Potassium, Rubidium, Caesium, Francium

- **Li**ttle **Na**sty **K**ids **R**u**b** **C**at**s** **F**u**r**
- **LI**ttle **NA**ughty **K**ids **R**uin **B**en's **C**onvenient **S**tore **F**orev**er**
- **Li**ttle **Na**than **K**new **R**u**b**ies **C**o**s**t **F**o**r**tunes

Group 2 (alkaline earth metals)

Be Mg Ca Sr Ba Ra

Beryllium, Magnesium, Calcium, Strontium, Barium, Radium

- ***Be**arded **Mu**g**g**ers **Ca**me **S**t**r**aight **Ba**ck **Ra**pidly.*
- ***Be**er **Mu**g**s** **Ca**n **S**e**r**ve **Ba**r **Ra**ts.*[11]
- ***Be**n* Meg & **Ca**s**ia** S**t**r**oll** away to **B**ar of **Ra**d**iu**m

Group 13

B Al Ga In Tl

Boron, Aluminium, Gallium, Indium, Thallium

- **Bo**wler **Al**i **Ga**ve **In**stant **T**ea
- ***B A G I T*** (Bag it)

Group 14

C Si Ge Sn Pb

Carbon, Silicon, Germanium, Tin, Lead

- ***C****an* ***Si****mple* ***Ge****rmans* ***Sn****are (****Tin****y)* ***P****u****b****lic (****Lead****)?*[11]

Group 15 (Pnictogens)

N P As Sb Bi

Nitrogen, Phosphorus, Arsenic, Antimony, Bismuth, Moscovium.

I'll Never Play A Saxophone By Myself . N. P. As Sb. Bi. Mc

Group 16 (Chalcogens)

O S Se Te Po

Oxygen, Sulfur, Selenium, Tellurium, Polonium

- ***O**ld T**S**angpo **Se**em **Te**rribly **Po**lluted.*[11]

Group 17 (Halogens)

F Cl Br I At Uus

Fluorine, Chlorine, Bromine, Iodine, Astatine, Tennessine

- **F**unny **Cl**owns **Br**oil **I**nnocent **A**n**t**s.[11]
- **F**ast **Cl**ouds **Br**eak **I**n **At**lantis.[14]

Group 18 (noble gases)

He Ne Ar Kr Xe Rn

Helium, Neon, Argon, Krypton, Xenon, Radon, Oganesson

- ***He**ro **Ne**eds **Ar**guable **Kr**yptic **Xe**s. **R**ight-o**n**.*[14]
- ***He Ne**ver **Ar**rived; **K**a**r**en e**X**ited with **R**o**n**.*[11]
- He Needs A Kickin', Xylophone-playin' Racehorse! (And... Oh, gee, now we need to add Oganesson (Og)!)

Properties of elements

Abundance of elements on earth's crust

[Oxygen(**O**)] > [Silicon(**Si**)] > [Aluminium(**Al**)] > [Iron(**Fe**)] > [Calcium(**Ca**)] > [Sodium (**Na**)] > [Potassium(**K**)] > [Magnesium (**Mg**)]
(The rest makes only 1%)

- **O**nly **S**trong **A**thletes **I**n **C**ollege **S**tudy **P**ast **M**idnight
- **O**h, see(**Si**), **Al**fie(**Fe**) **Ca**nnot(**Na**) **K**iss Meg(**Mg**)

As they are present in trace quantities they are measured in *parts per million*(**ppm**).

Activity series of metals

Potassium>**S**odium>**C**alcium>**M**agnesium>**A**luminium>(**C**arbon)*>**Z**inc>**I**ron>**T**in>**L**ead>(**H**ydrogen)*>**C**opper>**M**ercury>**S**ilver>**G**old>**P**latinum

- ***P**lease **S**top **C**alling **M**e **A** **C**ute **Z**ebra **I** **L**ike **H**er **C**all **S**mart **G**oat*
- ***P**lease **S**top **C**alling **M**e **A** **Car**less **Z**ebra **I**nstead **T**ry **L**earning **H**ow **C**opper **M**iners **S**ave **G**old **P**it*

Another way to memorize the Reactivity series in order is by Using the Story-Link Memory Technique.[16]

Note that Carbon and Hydrogen are non-metals, used as a baseline.

```
K > Na > Mg > Al > Zn > Cr > Fe > Pb > H > Cu > Au
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- ***K**angaroos **N**aturally **M**uck **A**bout in **Z**oos **F**or **P**urple **H**ippos **C**hasing **A**ardvarks.*[17]
- ***K**atty's **Na**ughty **Ca**t **M**ingled with **Al**ice and **Z**arina; **Fe**arlessly **P**lundering **H**er **Cu**pboard of **Gold**.*[18]

- ***P**apa **S**aid **C**all **M**e **A**fter **Z**inc **I**nteracts **T**in **L**eading **H**ydrogen **C**o-operate **M**r. **S**ylvester to **G**ain **P**opularity*.[19]

K > Na > Ca > Mg > Al > Zn > Fe > Ni > Sn > Pb > Cu > Ag > Au >Pt

- ***P**retty(Potassium) **S**ally(Sodium) **C**ould(Calcium) **M**arry(Magnesium) **A**(Aluminium) **C**razy(Carbon) **Z**ulu(Zinc) **IN**(**I**ron/**N**ickel) **T**ree(Tin) **L**ined(Lead) **H**ouse(Hydrogen) **C**ausing(Copper) **S**trangely(Silver) **G**lancing(Gold) **P**eople(Platinum).*

Li > K > Ba > Sr > Ca > Na > Mg > Al > Mn > Zn > Cr > Fe > Cd > Co > Ni > Sn > Pb

- Li K Ba Sr Ca Na. Mg Al Mn Zn. Cr Fe Cd, Co Ni Sn Pb. That is.

Electronegativity

Fluorine > **O**xygen > **Cl**orine > **N**itrogen > **Br**omine > **I**odine > **S**ulfur > **C**arbon > **H**ydrogen ≥ **P**hosphorus

- Pronounce: **FOClN BrIS CHP**.[20]

(F)irst (O)ff, (Cl)od (N)ow; (Br)ing (I)n (S)ome (C)aps, (H)ats, and (P)ants. (First off, cold now. Bring in some caps, hats {and} pants.)

Electrochemical series

Potassium > **S**odium > **C**alcium > **M**agnesium > **A**luminium > **Z**inc > **I**ron > **T**in > **L**ead > **H**ydrogen > **C**opper > **S**ilver > **G**old

- **P**opular **S**cientists **Ca**n **M**ake **A** **Z**oo **I**n **T**he **L**ow **H**umid **C**ountry More(Mercury) **S**atisfactorily (Gold).
- ***P**addy **S**till **C**ould **M**arry **A** **Z**ulu **I**n **T**he **L**ovely **H**onolulu **C**ausing **S**trange **G**azes*.
- **P**lease **S**top **C**alling **M**e **A** **C**razy **Z**ombie **I**f **T**hat **L**arge **H**ippo **C**an’t **S**wim, **G**lug, glug.
- **P**assive **S**arcasm **C**an **M**utate **A**ngry **Z**ombies **I**n**T**o **L**arge **H**ypocritical **C**old **S**exy **G**uys.
- **P**lease **S**end **C**harlie's **M**onkeys **A**nd **Z**ebras **I**n **C**ages **S**ecurely **G**uarded

Reactions and ions

Redox reactions

A redox reaction is a chemical reaction in which there is a change in oxidation state of atoms participating in the reaction.

Ions

An atom (or ion) whose oxidation number increases in a redox reaction is said to be oxidized (and is called a reducing agent). It is accomplished by loss of one or more electrons. The atom whose oxidation number

decreases gains (receives) one or more electrons and is said to be reduced. This relation can be remembered by the following mnemonics.

- ***Leo*** *says* ***Ger!*** or ***Leo*** *the lion,* ***Ger!*** can be used to represent ***L****oss of* ***e****lectron is* ***o****xidation;* ***G****ain of* ***e****lectron is* ***r****eduction*.[21][22]
- ***Oil Rig: O****xidation* ***i****s* ***l****oss;* ***R****eduction* ***i****s* ***g****ain (of electrons)*.[23]

Cations and anions

Cations are positively (+) charged ions while anions are negatively (−) charged. This can be remembered with the help of the following mnemonics.

- ***Cat**s have **paws** ⇔ **Cat**ions are **paws**itive.*[24]
- **Ca+ion**: *The letter **t** in ca**t**ion looks like a **+** (plus) sign.*[25]
- *An **anion** is **a n**egative **ion**. (**An**~~*egative*~~**ion** ⇒ **Anion**).*[26]

Cation vs. anion: positive vs. negative

The **t** in ca**t**ion looks like a plus sign: "ca+ion".

Cation is positive, anion is negative.[27]

Oxidation vs. reduction: electrochemical cell and electron gain/loss

AN OIL RIG CAT:

At the **AN**ode, **O**xidation **I**nvolves **L**oss of electrons.

Reduction **I**nvolves **G**aining electrons at the **CAT**hode.[27]

LOAN - **L**eft **A**node **O**xidation **N**egative. In written representation of galvanic cell, *anode* is written on the *left*. It is the electrode where *oxidation* takes place. It is the *negative* electrode. Obviously, the opposite properties

(Right/Cathode/Reduction/Positive) are found on the cathode. Hence, by remembering LOAN mnemonic, we can arrive at the corresponding properties for the cathode.

LEO says GER:

"**L**oss of **E**lectrons, **O**xidation; **G**ain of **E**lectrons, **R**eduction".[28]

Electrodes

An electrode in which oxidation takes place is called an anode while in that which reduction takes place is called cathode. This applies for both electrolytic and electrochemical cells, though the charge on them reverses. The *red cat* and *an ox* mnemonics are useful to remember the same.

- ***Red cat: Red****uction at* ***cat****hode*
  An ox: An*ode for* ***ox****idation*.[29]
- The words ***o****xidation* and ***a****node*, both begin with vowels. Also, both ***r****eduction* and ***c****athode* begin with consonants.[26]

- **Fat Cat**: electrons flow **F**rom **A**node **T**o **Cat**hode
- **LOAN**: **L**eft side;**O**xidation;**A**node;**N**egative.

Compounds

Diatomic molecules

Molecules exhibiting diatomic structures can be remembered through the following mnemonics.

Hydrogen, **O**xygen, **N**itrogen, **F**luorine, **C**hlorine, **Br**omine, **I**odine

- ***H**ave **N**o **F**ear **O**f **I**ce **C**old **B**eer*. [30]
- ***H**orses **N**eed **O**ats **F**or **Cl**ear **Br**own Eyes (**I**'s)*.

- ***H**er **N**ana's **O**nly **F**unctioning **Cl**icker **Br**oke **I**nstantly.*[31]
- **BrINClHOF:** *say **Brinkelhof**.*[32]
- ***I Br**ing **Cl**ay **F**or **O**ur **N**ew **H**ouse.*[11]

Hydrogen bonds

Hydrogen forms hydrogen bonds with three elements which are nitrogen (**N**), oxygen (**O**) and fluorine (**F**). The names of these elements can be remembered by the following mnemonic.

- *Hydrogen is **FON**! (fun).*[26]

Polyatomic ions: −ate and -ite ions

Sulfate, **P**hosphate, **C**arbonate, **C**hlorate, **B**romate, **I**odate, **N**itrate

- ***S**uper **P**opeye **C**onstantly **C**lubbed **B**rutus **I**n **N**evada.*

Nitrate, **B**romate, **C**arbonate, **I**odate, **C**hlorate, **C**hromate, **S**ulfate, **P**hosphate

- ***N**ick **B**rit the **C**amel ate an **I**nky **C**lam with **C**rêpes for **S**upper in **P**hoenix.*

Number of consonants denotes number of oxygen atoms.

Number of vowels denotes negative charge quantity.

Inclusion of the word "ate" signifies that each ends with the letters a-t-e. To use this for the -ite ions, simply subtract one oxygen but keep the charge the same.

Organic chemistry

Carboxylic acids

Common names of homogeneous aliphatic carboxylic acids,

Formic, Acetic, Propionic, Butyric, Valeric, Caproic

- ***F**rogs **A**re **P**olite, **B**eing **V**ery **C**ourteous.*[33]

Dicarboxylic acids

The sequence of dicarboxylic acids can be remembered with following mnemonics.

Oxalic, **M**alonic, **S**uccinic, **G**lutaric, **A**dipic, **P**imelic, **S**uberic, **A**zelaic, **S**ebacic

- ***O**h **M**y, **S**uch **G**ood **A**pples.*[34]
- ***O**h **M**y **S**tars, **G**reen **A**pples.*
- ***O**h **M**y, **S**uch **G**ood **A**pple **P**ie, **S**weet **A**s **S**ugar.*[35][36]
- ***O**h **M**y **S**tars, **G**o **A**head **P**lease*[26]
- **OMSGAP** - is a phonetic word for the first letters of the first six dicarboxylic acids above in sequence.

Aromatic compounds

m-directing groups

Quaternary amino	Ester	Sulfonic acid	Nitro	Carbonyl	Carboxyl	Cyano
($-NR_3^+$)	(-COOR)	($-SO_3H$)	($-NO_2$)	(-CHO)	(-COOH)	(-CN)

- ***Q**ueen **E**lizabeth **S**econd's **N**avy **C**ommands, **C**ontrols, **C**ommunicates.*[37]

o,*p*-directing groups

Alkyl	Halogen	Alkoxyl	Amino			Hydroxyl	Amide	Phenyl
(R)	(X)	(OR)	($-NH_2$	-NHR	$-NR_2$)	(OH)	(NHCOR	(C_6H_5)

- **AHA AHA P.**[37]

Note: $-NH_2$,-NHR and NR_2 are para directing groups but not $-NR_3^+$

E-Z notation for isomers

"E" for enemies. i.e higher priority groups on opposite sides. Z form has higher priority groups on same side.[27]

"Z zame zide" i.e. high priority groups on same side.

Cis–trans isomerism

Cis starts with a **C** and the functional groups form a **C**.

Trans, therefore is the other one by default.[27]

Benzene ring: order of substitutes

From R group moving around the ring:[27]

R group, **O**rtho, **M**eta, **P**ara

- *Benzene likes to **ROMP**.*

Biochemistry

Essential amino acids

Isoleucine, **L**eucine, **L**ysine, **A**rginine, **M**ethionine, **P**henylalanine, **T**hreonine, **T**ryptophan, **H**istidine, **V**aline

- **PVT TIM HaLL**[38] and **TT HALL V**ery **IMP**ortant.[39]
- **MATT HILL, VP** Matt Hill is the Vice President
- **LIFT HIM KIW(V)I**

- **TV FILM HW(R)K.**
- ***A**ny **H**elp **I**n **L**earning **T**hese **L**ittle **M**olecules **P**roves **T**ruly **V**aluable*.[40] This method begins with the two amino acids that need some qualifications as to their requirements.
- *There as [a] fat man [that] hated vanilla icing, [but] loved Kit-Kats.*

Krebs cycle

To remember Krebs cycle (citric acid cycle, tricarboxylic acid cycle);

Citrate → **A**conitate → **I**socitrate → **O**xalosuccinate → α-**K**etoglutarate → **S**uccinate → **F**umarate → **M**alate → **O**xaloacetate

- ***C**aesar's **A**rmies **I**nvaded **O**ther **K**ingdoms **S**earching **F**or **M**any **O**ranges.*[20]
- **C**itric **A**cid **I**s **O**ne **K**ey **S**ubstrate **F**or **M**itochondrial **O**xidation

Plant nutrients

To remember the elements necessary for agriculture;

Carbon, **H**ydrogen, **Ca**lcium, Iron (**Fe**), Magnesium (**Mg**), Manganese (**Mn**), Copper (**Cu**), **Mo**lybdenum, Chlorine (**Cl**), **B**oron

- ***C** (see) **H**opkins **CaFe**, **M**ighty-**g**ood **Man**, **Cu** (see your) **Mo**ney, hope they are **Cl**osed or out of **B**usiness.*[41]

For remembering macronutrients;

Carbon, **H**ydrogen, **O**xygen, **P**hosphorus, **P**otassium, **N**itrogen, **S**ulfur, **Ca**lcium, and **Mag**nesium

- ***C. HOPKiN'S Ca Mg*** *(C. Hopkins coffee mug).*

C H O N P K Ca Mg S {CHO "N"ever "P"unch "K"ittens they'll "Ca"ll aunt "Mag" and then you are "S"crewed.

See also

- List of medical mnemonics
- List of mnemonics

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Further reading

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- https://www.amazon.in/Memory-Aids-Chemistry-Salt-Analysis/dp/8191003503

External links

Wikibooks has a book on the topic of: ***Structural Biochemistry/Helpful Mnemonics***

- "Mnemonics for the Entire Periodic Table"

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