

The Periodic Table

I		II										III		IV	V	VI	VII	VIII
1		2										13		14	15	16	17	18
1 H 1.008																		2 He 4.003
3 Li 6.941	4 Be 9.012	Periodic Table of the Elements										5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948	
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.82	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.905	54 Xe 131.29	
55 Cs 132.905	56 Ba 137.327	57 Lu 174.967	58 Hf 178.49	59 Ta 180.948	60 W 183.85	61 Re 186.207	62 Os 190.2	63 Ir 192.22	64 Pt 195.08	65 Au 196.967	66 Hg 200.59	67 Tl 204.383	68 Pb 207.2	69 Bi 208.980	70 Po (209)	71 At (210)	72 Rn (222)	
87 Fr (223)	88 Ra 226.025	89 Lr (260)	90 Rf (261)	91 Db (262)	92 Sg (263)	93 Bh (262)	94 Hs (265)	95 Mt (268)	96 (269)	97 (272)								
57 La 138.906	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.934	70 Yb 173.04					
89 Ac 227.028	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (288)	102 No (289)					



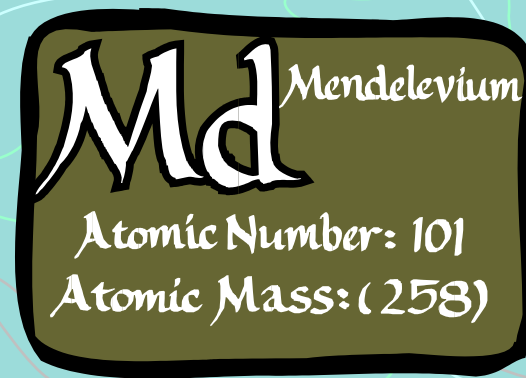
Dmitri Mendeleev: Father of the Table

HOW HE PUT IT TOGETHER...

- He wrote each element's name and properties on a separate card.
- He then tried to find a pattern in the properties of the elements that could be used to classify and keep information about them organized in a logical manner.

HOW HIS WORKED...

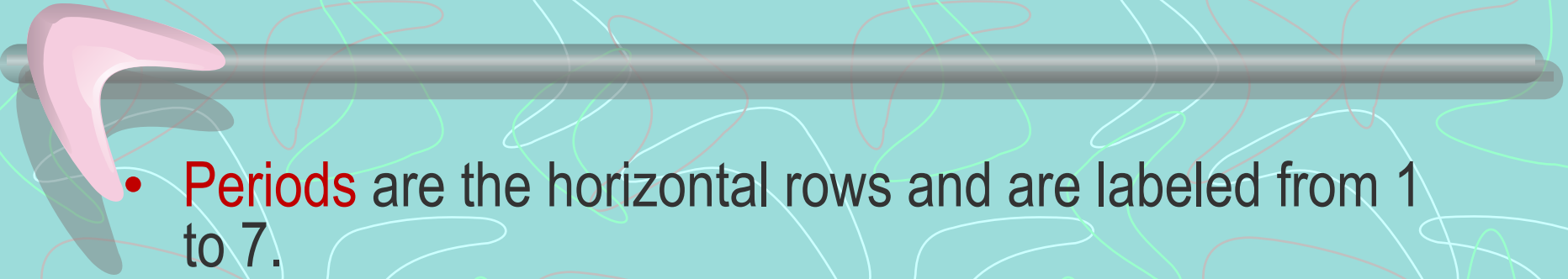
- Put elements in rows by increasing **atomic mass**.
- Put elements in columns **by the way they reacted**.





The Current Periodic Table

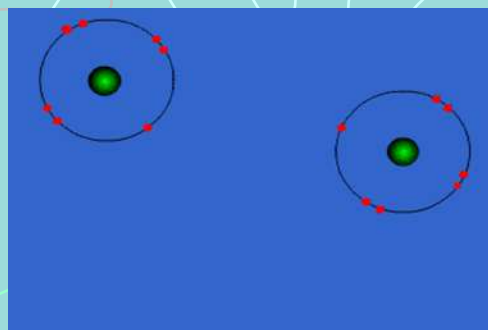
- Mendeleev wasn't too far off.
- Now the elements are put in rows by increasing **ATOMIC NUMBER!!**

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- **Periods** are the horizontal rows and are labeled from 1 to 7.

- Elements in the same period all have the number of electron clouds.

- **Groups/Families** are the vertical columns and are labeled from 1 to 18.

- They have the same valence electrons and similar physical and chemical properties. This means they have similar reactivity.





What does it mean to be reactive?

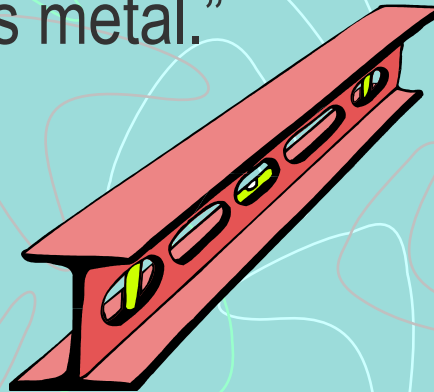
- We will be describing elements according to their reactivity.
- **Elements that are reactive bond easily with other elements to make compounds.**
- Some elements are only found in nature bonded with other elements.
- What makes an element reactive?
 - An incomplete **valence electron shell**.
 - All atoms (except hydrogen) want to have 8 electrons in their very outermost energy level (This is called the rule of octet.)
 - Atoms bond until this level is complete. Atoms with few valence electrons lose them during bonding. Atoms with 6, 7, or 8 valence electrons gain electrons during bonding.

Transition Metals

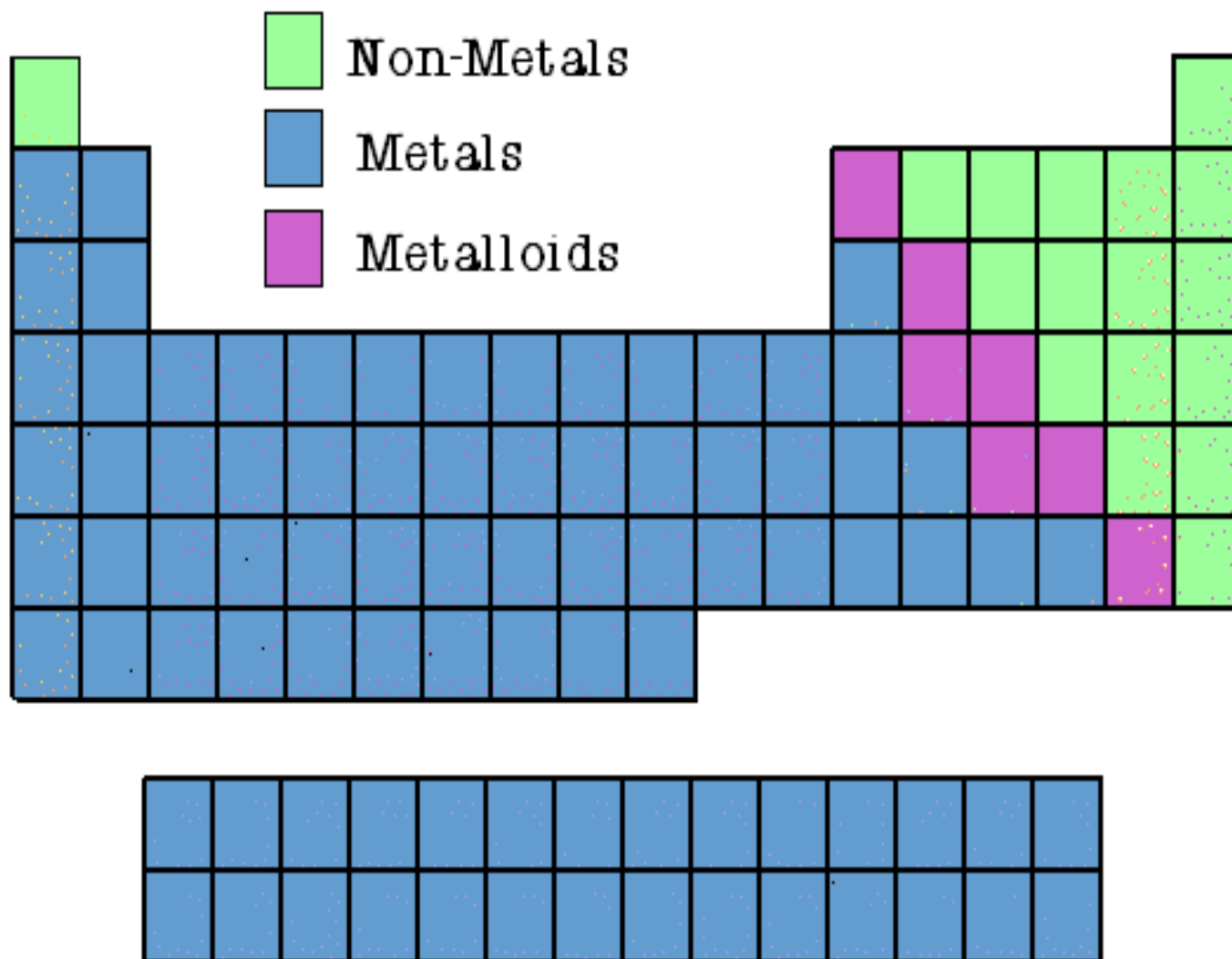
- Elements in **groups 3-12**
- Are generally **hard metals** with high melting points.
- Includes metals used in **jewelry and construction.**
- Metals used “as metal.”

Periodic Table of the Elements

The image shows a simplified periodic table. The central block, representing transition metals (groups 3-10), is highlighted in blue. This block consists of 10 columns and 10 rows. To the left of this block are two columns of 10 elements each, and to the right are two columns of 10 elements each. Below the main body of the table is a single row of 10 elements, representing the lanthanide and actinide series. The title 'Periodic Table of the Elements' is centered at the top of the table.



The elements of the periodic table can be divided into three main categories: Metals, Non-Metals, and Metalloids.





IN GENERAL...(but not always!)

- With the exception of HYDROGEN, the elements on the left side of the periodic table are **METALS**.
- Elements on the right side of the periodic table are **NONMETALS**.
- The **staggered stair step** on the periodic table divides the metals from the nonmetals. Metalloids are located on the stair step.

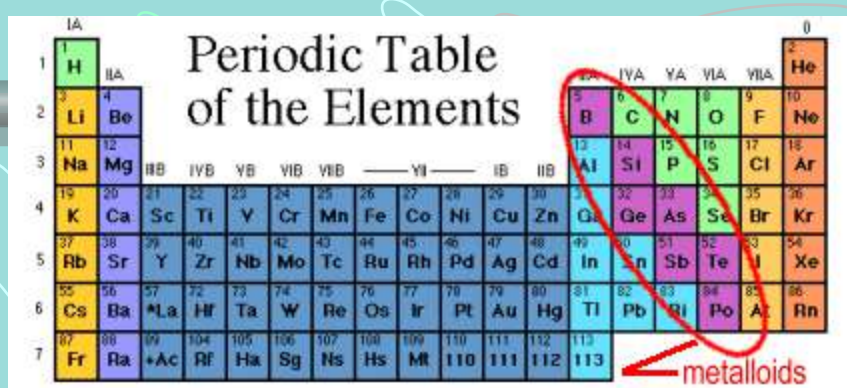


What's the difference?

Properties of Metals	Properties of Nonmetals
Solid at room temperature, except Mercury (liquid).	Most are gases, except Bromine (liquid)
Malleable and ductile – can be shaped and drawn into wire	Are brittle in the solid phase
Have luster – are shiny	Have a tendency to be dull, not shiny and bright
Have high conductivity – are good conductors of heat and electricity	Are poor conductors of heat and electricity
Tend to LOSE electrons in chemical reactions	Tend to GAIN electrons in chemical reactions

Metalloids

Periodic Table of the Elements



1	2																	18	19	20			
H	He																	Ar	Kr	Xe			
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	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
Fr	Ra	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Mn	Uu	Uub	Uut						

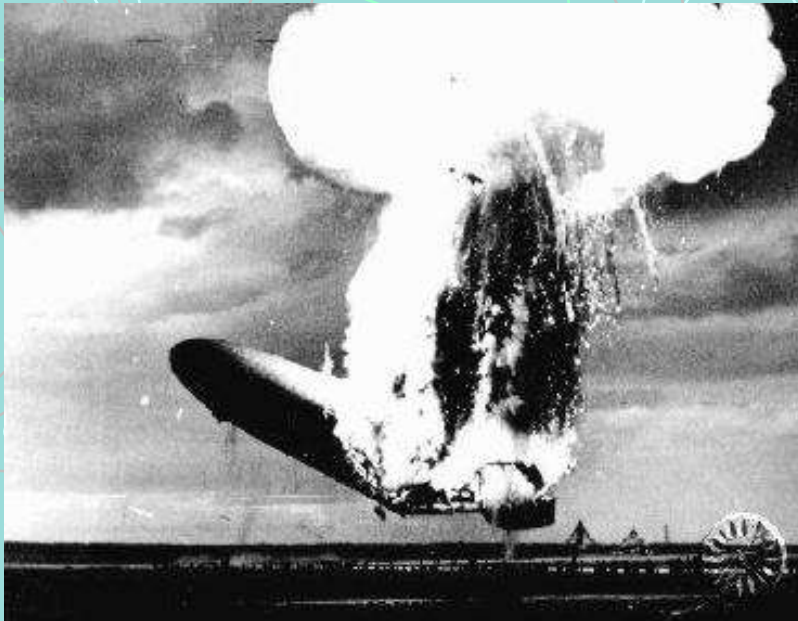
- metalloids are between those of the metals and nonmetals, so the metalloids exhibit characteristics of both.
- The reactivity of the metalloids depends on the element with which they are reacting. For example, boron acts as a nonmetal when reacting with sodium yet as a metal when reacting with fluorine.

Families on the Periodic Table

- Columns are also grouped into families.
- Families may be one column, or several columns put together.
- Families have names rather than numbers. (Just like your family has a common last name.)



The Hydrogen Family – the bachelor

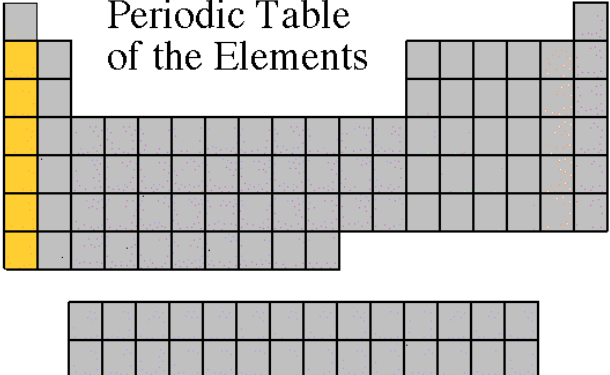


- Hydrogen belongs to a family of its own.
 - It's **properties** are different from all **other elements**.
 - However, it's still in GROUP 1 because it **has 1 valence electron**.
- Hydrogen is **very reactive gas**.
 - It's in **A LOT** of compounds!
- Hydrogen was involved in the explosion of the Hindenberg.
- Hydrogen is promising as an alternative fuel source for automobiles

Alkali Metals

- 1st column on the periodic table (Group 1) not including hydrogen.
- Most reactive metals
 - They have one valence electron, so they can combine with other elements very easily.
 - always combined with something else in nature (like in salt).
- Soft enough to cut with a butter knife

Periodic Table of the Elements



Alkaline Earth Metals

- Second column on the periodic table. (Group 2)
- Slightly reactive metals that are always combined with nonmetals in nature.
 - They do not combine as easily as the alkali metals (less reactive) and are harder.
- Several of these elements are important mineral nutrients (such as Mg and Ca)

Periodic Table of the Elements

The image shows a simplified periodic table with a grid of squares. The second column from the left is highlighted in blue, representing the alkaline earth metals. The table is titled 'Periodic Table of the Elements'.





Boron Family

- Boron Family (13)- are scarce in nature, Except **aluminum**, which is the most abundant metallic element.
- soft and have low melting points (except boron, which is hard and has a high melting point) - are chemically reactive at moderate temperatures ,except boron.



Carbon Family

- Element can gain, lose or share electrons.
- Carbon is the only nonmetal. Carbon is found in all living things.
- Most fuels that are burned also yield energy contained in carbon.



Nitrogen Family

- Contains 2 nonmetals that can gain, share, or lose electrons, nitrogen and phosphorus.
- 80% of atmosphere is nitrogen.
- Nitrogen is used in fertilizer.
- Most living things need nitrogen to live. Get from food.
- Phosphorus used to make matches because it reacts with oxygen.



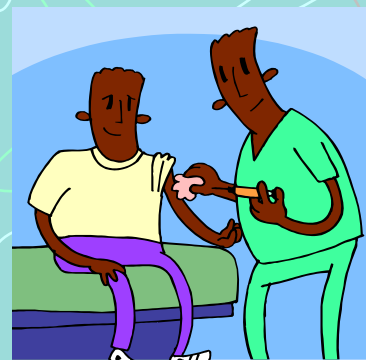
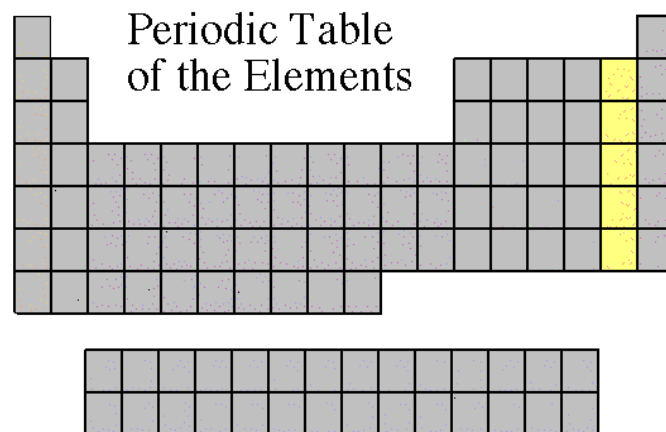
Oxygen Family

- Contains three nonmetals, oxygen, sulfur, and selenium.
- Gain lose or share electrons when reacting with other elements.
- Oxygen is highly reactive because it can bond with most other elements. Most abundant in earth's crust.
- Sulfur smells like rotten eggs. Used to make sulfuric acid, rubber bands and tires.

Halogens

- Elements in **group 17**
- **Most reactive and volatile nonmetals**
 - In nonmetals, reactivity increases as atomic number decreases.
- Always found combined with other element in nature .
- **The Halogen family has all three states of matter!**
- **Used as disinfectants and to strengthen teeth.**

Periodic Table of the Elements



The Noble Gases

- Elements in **group 18**
- **VERY un-reactive gases**
 - Once thought to be **inert** (unable to react chemically)
- **Used in lighted “neon” signs**
- Used in blimps to fix the Hindenberg problem (He).
- **Have a full valence shell.**

Periodic Table of the Elements

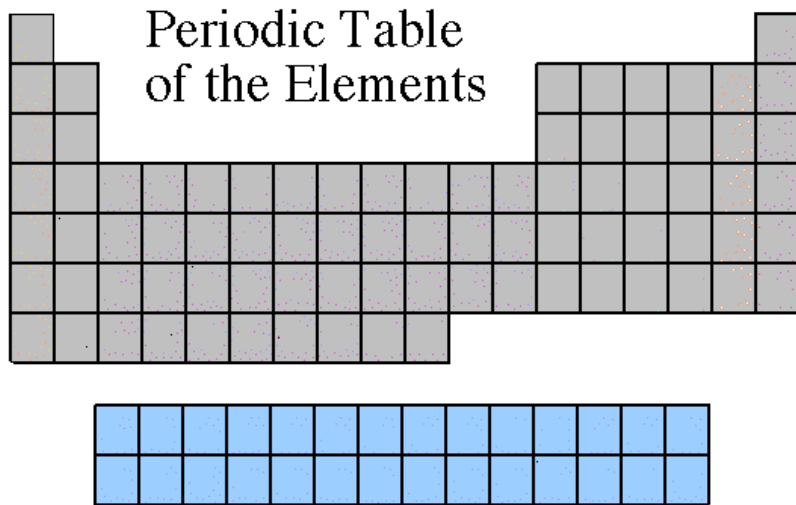
The diagram shows a simplified periodic table. The main body is a grid of gray squares. To the right of this grid is a vertical column of orange squares. Below the main grid is a separate horizontal row of gray squares.





Rare Earth Elements

Periodic Table
of the Elements



A simplified periodic table diagram. The main body is a grid of gray squares. To the right of the main grid is a separate column of gray squares. Below the main grid is a separate row of blue squares. The title 'Periodic Table of the Elements' is centered above the main grid.

- The thirty rare earth elements are composed of the **lanthanide and actinide series**.
- **Most Rare Earth Metals are synthetic or man-made.**



Ticket Out the Door

1. I am the most reactive metals and soft enough to cut with a butter knife. What group am I?
2. I am hard metals commonly used to make jewelry. What group am I?
3. I am Iron (Fe). My closest friend has characteristics similar to me. Osmium (Os), Manganese (Mn), and Ruthenium (Ru) all think they are my best friend. Do you know which one of them is truly my best friend?