

CHEM 108

**Atoms/Elements
and
The Periodic Table**

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Periodic Table (August 2017)
Los Alamos National Lab
<http://periodic.lanl.gov/index.shtml>

Group 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 1	H																	
2	Li	Be	B	C	N	O	F	Ne										
3	Mg	Al	Si	P	S	Cl	Ar											
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Gd	Tb	Dy	Er	Tm	Yb
5	Rb	Sr	Y	Zr	Ta	W	Re	Pt	Ir	Pt	Au	Pt	Os	Ta	W	Re	Ir	Pt
6	Cs	Ba	*	Hf	Ta	W	Re	Os	Ir	Pt	Ag	Pt	Hg	Tl	Pb	Bi	Po	At
7	Fr	Ra	**	Rf	Db	Sg	Bh	Hs	Mt	Ds	Cn	Nh	Fl	Mc	Lv	Ts	Og	

Elements in Song
<http://chemconnections.org/general/movies/lehser-elements.swf>

**Scientists Name 4 New Elements
113, 115, 117 and 118
Completing the Periodic Table
(November, 2016)**

Kosuke Morita, who led a group of researchers that discovered element 113, speaks at a press conference in Japan. The name of the new element nihonium stems from the fact that element 113 was discovered in Japan, and Nihon is one way to say the country's name in Japanese.

Los Alamos National Laboratory Chemistry Division

Periodic Table of the Elements

1A	1	H	2A	2	He	8A	8	He
3A	3	Li	4A	4	Be	5A	5	Ne
6A	6	Na	7A	7	Mg	8A	8	Ar
11B	11	K	12B	12	Ca	13B	13	Fr
11B	11	Rb	12B	12	Sr	13B	13	Ra
11B	11	Cs	12B	12	Ba	13B	13	Fr
11B	11	Fr	12B	12	Ra	13B	13	Ra

What are the names of elements 113, 115, 117 and 118?

Los Alamos National Laboratory Chemistry Division

Periodic Table of the Elements

1A	1	H	2A	2	He	8A	8	He
3A	3	Li	4A	4	Be	5A	5	Ne
6A	6	Na	7A	7	Mg	8A	8	Ar
11B	11	K	12B	12	Ca	13B	13	Fr
11B	11	Rb	12B	12	Sr	13B	13	Ra
11B	11	Cs	12B	12	Ba	13B	13	Fr
11B	11	Fr	12B	12	Ra	13B	13	Ra

113: Nihonium, 115: Moscovium, 117: Tennessine and 118: Oganesson

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What are the names of 113, 115, 117 and 118?

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Periodic Table of the Elements

1A	1	H	2A	2	He	8A	8	He
3A	3	Li	4A	4	Be	5A	5	Ne
6A	6	Na	7A	7	Mg	8A	8	Ar
11B	11	K	12B	12	Ca	13B	13	Fr
11B	11	Rb	12B	12	Sr	13B	13	Ra
11B	11	Cs	12B	12	Ba	13B	13	Fr
11B	11	Fr	12B	12	Ra	13B	13	Ra

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element names in blue are liquids at room temperature
element names in red are gases at room temperature
element names in black are solids at room temperature

What are the names of 113, 115, 117 and 118?

Metals, Metalloids, and Nonmetals

Metals

Metalloids

Nonmetals

CHEMISTRY of the Atom

FUNDAMENTAL PARTICLES:			
	<u>Mass</u>	<u>Charge</u>	<u>Symbol</u>
Nucleus:			
δ PROTON	1 amu • 1.67×10^{-27} kg	+1	H^+ , H, p
δ NEUTRON	1 amu • 1.67×10^{-27} kg	0	n
δ ELECTRON	very small • $\sim 2000 \times$ smaller than a proton or neutron	-1	e^-
This particle is said to "hold" or "bond" atoms together in molecules.			

Modern Chronological History of the Atom

- δ 1909: Millikan determines charge and mass of e-
- δ 1913-19: Rutherford & Bohr's atom;
The proton.
http://www.yrbe.edu.on.ca/~mdhs/science/chemistry/ch2_2.htm
- δ 1926: Waves & Particles, Quantum Mechanics
<http://chemed.chem.psu.edu/genchem/history/schrodinger.html>
- δ 1932: James Chadwick "discovers" the neutron
<http://www.nmsi.ac.uk/on-line/electron/section3/1932a.html>

Modern History of the Atom

- 1897: J.J. Thomson "discovers" the electron:
<http://www.nmsi.ac.uk/on-line/electron/section2/>

Photo © The Nobel Foundation
<http://pl.nobel.se/laureates/physics-1906-1-bio.html>

Electron Mass & Charge

Milliken Oil Drop Experiment

Modern History of the Atom

Ernest Rutherford (1871-1937)

Rutherford Experiment: Nuclear Atom

CHEMISTRY of the Atom

https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

CHEMISTRY of the Atom

δ Periodic Table Atoms

- Atomic Number = # Protons
- Atomic Mass = # Protons + # of Neutrons

CHEMISTRY of the Atom

δ Atoms (neutral electrostatic charge: # protons = # electrons)

- # Protons = Atomic Number
- Atomic Mass = # Protons + # of Neutrons
- Isotope: same atomic number but different atomic mass (different # of neutrons)

QUESTION

Which among the following represent a set of isotopes? Atomic nuclei containing:

- 20 protons and 20 neutrons.
- 21 protons and 19 neutrons.
- 22 neutrons and 18 protons.
- 20 protons and 22 neutrons.
- 21 protons and 20 neutrons.

- a, b, c
- c, d
- a, e
- a, d and b, e
- No isotopes are indicated.