Discussion: The Periodic Table

Discussion Topic, AP Chem

Imagine you are given a mystery element. It is, however, a discovered and known element. You may perform a maximum of two observations or tests to determine its identity. Time and money is critical, so you need to prioritize your tests. If you can get by with a single test, you get 100 super-geek points from your research lab team.

Pick your two tests, number them as #1 and #2, and justify why you think these two will certainly be enough (and why the first might well be enough all by itself.)

The available tests are classification into metal, non-metal, or metalloid, count of valence electrons, count of electron shells, atomic radius (error range: +/- 1 pm), electronegativity (error range: +/- 0.1), first ionization energy (error range: +/- 10 kJ/mole), melting point (error range: +/- 10 C), and boiling point (error range: +/- 20 C).

Choose from these available tests:

- classification into metal, nonmetal, or metalloid
- count of valence electrons
- count of electron shells
- atomic radius (error range: +/- 1 pm)
- electronegativity (error range: +/- 0.1)
- first ionization energy (error range: +/- 10 kJ/mole)
- melting point (error range: +/- 10 C)
- boiling point (error range: +/- 20 C)

Make it very clear what your two choices are and why you chose them.

These periodic tables may be helpful.

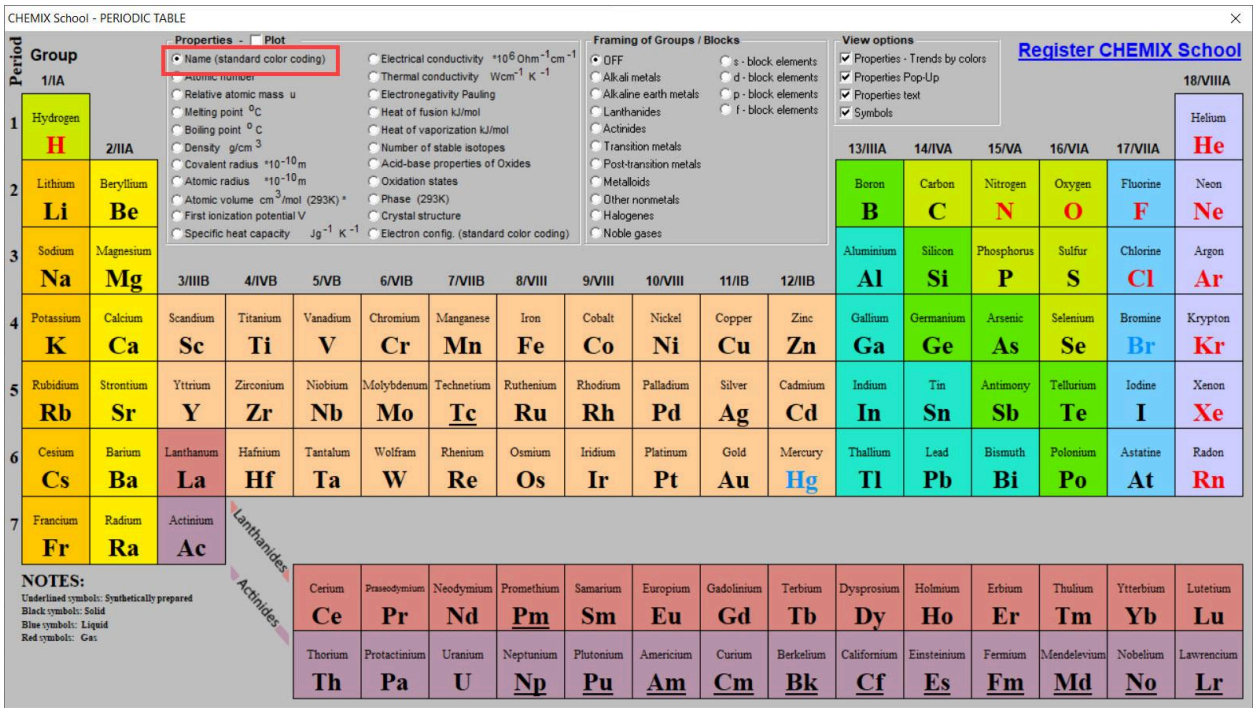
Element Data

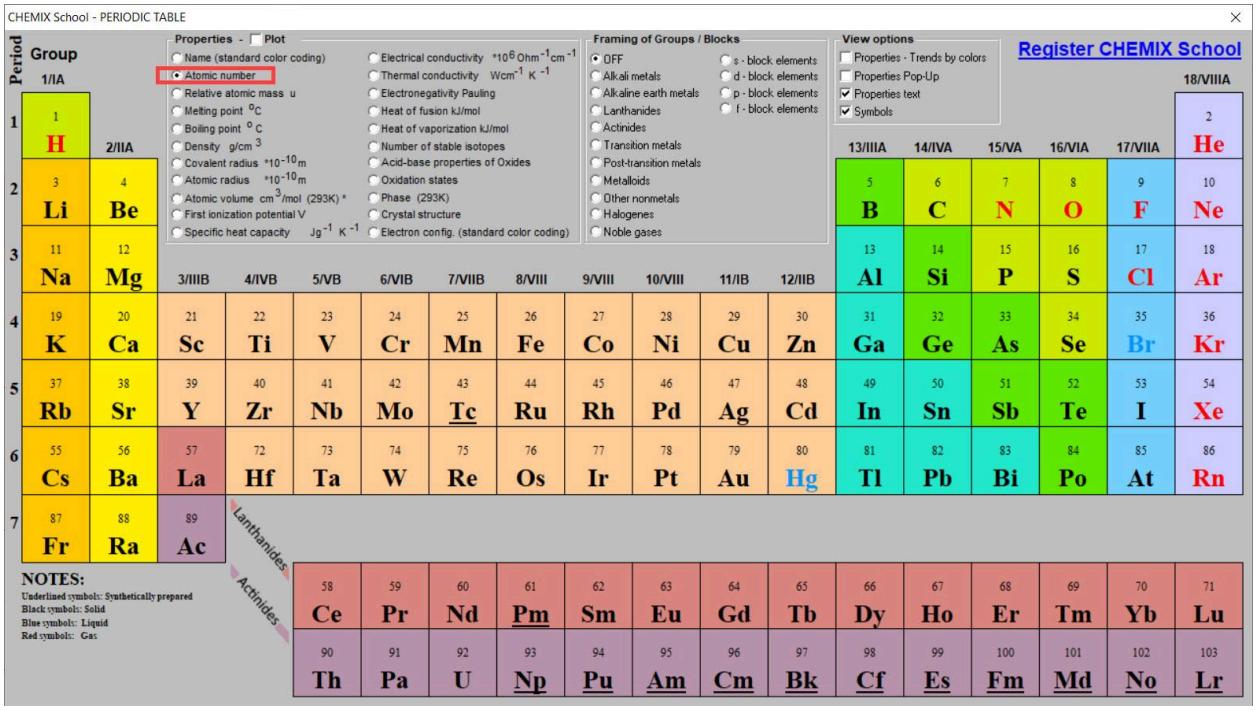
In the guide sheet, there is a link for Element Data. I set up this set of slides so you can look through element data to decide which type to choose so you can answer this discussion question. I think if you scroll down, you will also see screenshots of the software that are in the slides.

Other links that may be useful:
https://en.wikipedia.org/wiki/Molar_ionization_energies_of_the_elements As much as I dislike wikipedia, you can manipulate the table so it sorts based on the ionization energy
https://learnwithdrscott.com/electronegativity-table/
https://learnwithdrscott.com/wp-content/uploads/free-worksheets/Printable-Electronegativity-Table.pdf
https://sciencenotes.org/wp-content/uploads/2017/10/PeriodicTableElectronegativity.pdf
https://sciencenotes.org/wp-content/uploads/2015/06/ElementElectronegativities.pdf
https://www.lenntech.com/periodic-chart-elements/ionization-energy.htm
https://www.sciencegeek.net/tables/IonizationNRG.pdf
https://www.angstromsciences.com/melting-points-of-elements-reference
https://www.lenntech.com/periodic-chart-elements/boiling-point.htm
https://www.lenntech.com/periodic-chart-elements/atomic-number.htm
https://www.lenntech.com/periodic-chart-elements/atomic-mass.htm
https://www.lenntech.com/periodic-chart-elements/electronegativity.htm
https://www.lenntech.com/periodic-chart-elements/density.htm
https://www.lenntech.com/periodic-chart-elements/melting-point.htm
https://www.lenntech.com/periodic-chart-elements/vanderwaals.htm
https://www.lenntech.com/periodic-chart-elements/ionization-energy.htm A comma is used instead of a decimal point
https://environmentalchemistry.com/yogi/periodic/atomicradius.html 1 pm is 0.01 Angstrom
https://periodictable.com/Properties/A/Valence.al.html

https://www.webassign.net/question_assets/chang11/periodic_table.pdf
https://periodictable.com/Properties/A/IonizationEnergies.v.html has units of kJ/mol for ionization energies
https://www.colby.edu/chemistry/PChem/Hartree.html will convert units for you, so if you find a website not using the units you need, you can see how they convert at his website.
https://www.lenntech.com/periodic/name/alphabetic.htm
https://periodictable.com/Properties/A/Electronegativity.al.html

Images that may be useful:




CHEMIX School - PERIODIC TABLE
Properties - Plot
Name (standard color coding)
Atomic number
Relative atomic mass u
Melting point °C
Boiling point °C
Density g/cm 3
Covalent radius *10-10 m
Atomic radius *10-10 m
Atomic volume cm3/mol (293K) *
First ionization potential V
Specific heat capacity Jg-1 K-1
Electrical conductivity *10^6 Ohm-1cm-1
Thermal conductivity Wcm-1 K-1
Electronegativity Pauling
Heat of fusion kJ/mol
Heat of vaporization kJ/mol
Number of stable isotopes
Acid-base properties of Oxides
Oxidation states
Phase (293K)
Crystal structure
Electron config. (standard color coding)
Framing of Groups / Blocks
OFF
Alkali metals
Alkaline earth metals
Lanthanides
Actinides
Transition metals
Post-transition metals
Metalloids
Other nonmetals
Halogenes
Noble gases
s - block elements
d - block elements
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View options
Properties - Trends by colors
Properties Pop-Up
Properties text
Symbols
Register CHEMIX School
Period
Group
1/IA
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3/IIIB
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9/VIII
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14/IVA
15/VA
16/VIA
17/VIIA
18/VIIIA
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 Ac
Lanthanides
Actinides
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr
NOTES:
Underlined symbols: Synthetically prepared
Black symbols: Solid
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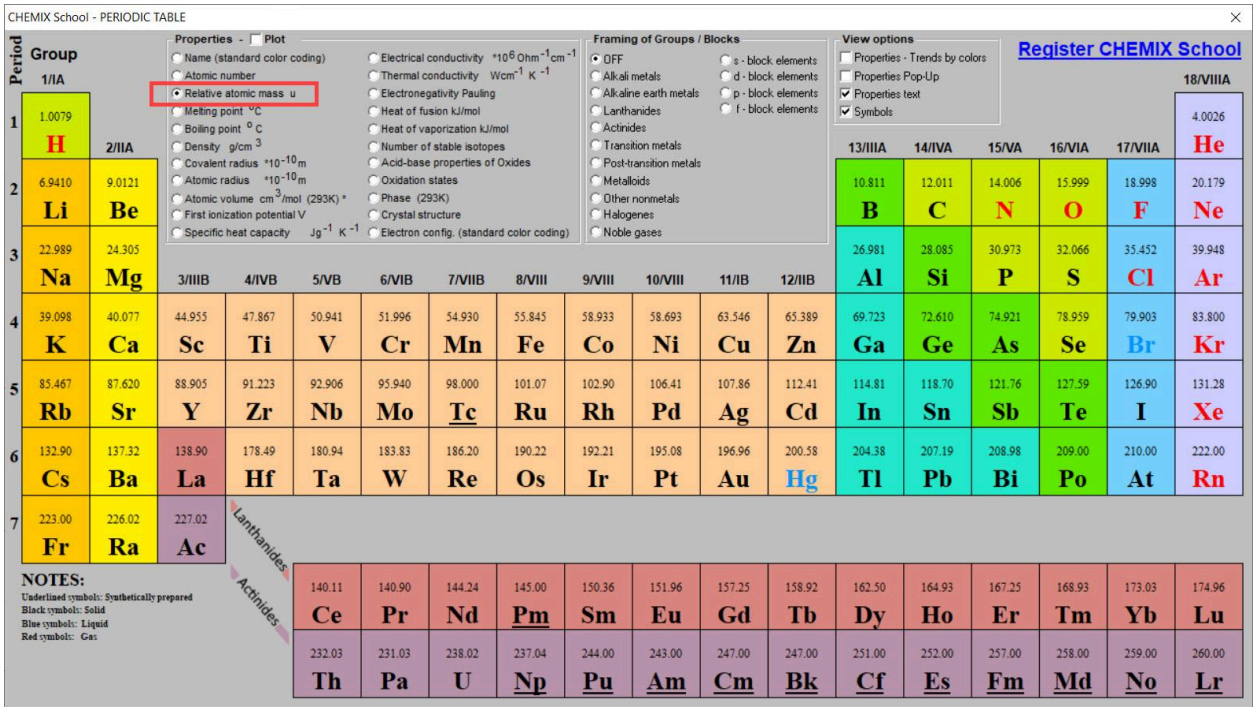
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10/VIII
11/IB
12/IIB
13/IIIA
14/IVA
15/VA
16/VIA
17/VIIA
18/VIIIA
1 1.0079 H
4.0026 He
2 6.9410 Li
9.0121 Be
10.811 B
12.011 C
14.006 N
15.999 O
18.998 F
20.179 Ne
3 22.989 Na
24.305 Mg
26.981 Al
28.085 Si
30.973 P
32.066 S
35.452 Cl
39.948 Ar
4 39.098 K
40.077 Ca
44.955 Sc
47.867 Ti
50.941 V
51.996 Cr
54.930 Mn
55.845 Fe
58.933 Co
58.693 Ni
63.546 Cu
65.389 Zn
69.723 Ga
72.610 Ge
74.921 As
78.959 Se
79.903 Br
83.800 Kr
5 85.467 Rb
87.620 Sr
88.905 Y
91.223 Zr
92.906 Nb
95.940 Mo
98.000 Tc
101.07 Ru
102.90 Rh
106.41 Pd
107.86 Ag
112.41 Cd
114.81 In
118.70 Sn
121.76 Sb
127.59 Te
126.90 I
131.28 Xe
6 132.90 Cs
137.32 Ba
138.90 La
178.49 Hf
180.94 Ta
183.83 W
186.20 Re
190.22 Os
192.21 Ir
195.08 Pt
196.96 Au
200.58 Hg
204.38 Tl
207.19 Pb
208.98 Bi
209.00 Po
210.00 At
222.00 Rn
7 223.00 Fr
226.02 Ra
227.02 Ac
Lanthanides
Actinides
140.11 Ce
140.90 Pr
144.24 Nd
145.00 Pm
150.36 Sm
151.96 Eu
157.25 Gd
158.92 Tb
162.50 Dy
164.93 Ho
167.25 Er
168.93 Tm
173.03 Yb
174.96 Lu
232.03 Th
231.03 Pa
238.02 U
237.04 Np
244.00 Pu
243.00 Am
247.00 Cm
247.00 Bk
251.00 Cf
252.00 Es
257.00 Fm
258.00 Md
259.00 No
260.00 Lr
NOTES:
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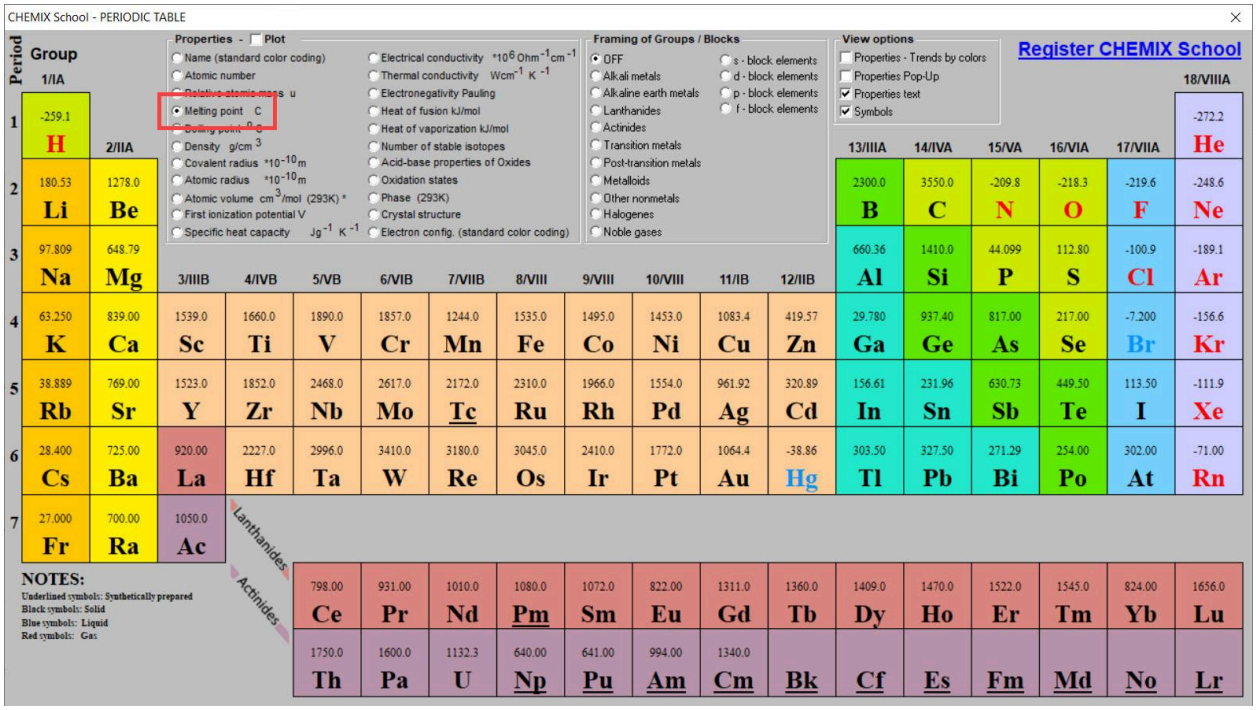
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11/IB
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13/IIIA
14/IVA
15/VA
16/VIA
17/VIIA
18/VIIIA
1 -259.1 H 2/IIA 13/IIIA 14/IVA 15/VA 16/VIA 17/VIIA 18/VIIIA -272.2 He
2 180.53 Li 1278.0 Be 2300.0 B 3550.0 C -209.8 N -218.3 O -219.6 F -248.6 Ne
3 97.809 Na 648.79 Mg 660.36 Al 1410.0 Si 44.099 P 112.80 S -100.9 Cl -189.1 Ar
4 63.250 K 839.00 Ca 1539.0 Sc 1660.0 Ti 1890.0 V 1857.0 Cr 1244.0 Mn 1535.0 Fe 1495.0 Co 1453.0 Ni 1083.4 Cu 419.57 Zn 29.780 Ga 937.40 Ge 817.00 As 217.00 Se -7.200 Br -156.6 Kr
5 38.889 Rb 769.00 Sr 1523.0 Y 1852.0 Zr 2468.0 Nb 2617.0 Mo 2172.0 Tc 2310.0 Ru 1966.0 Rh 1554.0 Pd 961.92 Ag 320.89 Cd 156.61 In 231.96 Sn 630.73 Sb 449.50 Te 113.50 I -111.9 Xe
6 28.400 Cs 725.00 Ba 920.00 La 2227.0 Hf 2996.0 Ta 3410.0 W 3180.0 Re 3045.0 Os 2410.0 Ir 1772.0 Pt 1064.4 Au -38.86 Hg 303.50 Tl 327.50 Pb 271.29 Bi 254.00 Po 302.00 At -71.00 Rn
7 27.000 Fr 700.00 Ra 1050.0 Ac
Lanthanides
Actinides
798.00 Ce 931.00 Pr 1010.0 Nd 1080.0 Pm 1072.0 Sm 822.00 Eu 1311.0 Gd 1360.0 Tb 1409.0 Dy 1470.0 Ho 1522.0 Er 1545.0 Tm 824.00 Yb 1656.0 Lu
1750.0 Th 1600.0 Pa 1132.3 U 640.00 Np 641.00 Pu 994.00 Am 1340.0 Cm Bk Cf Es Fm Md No Lr
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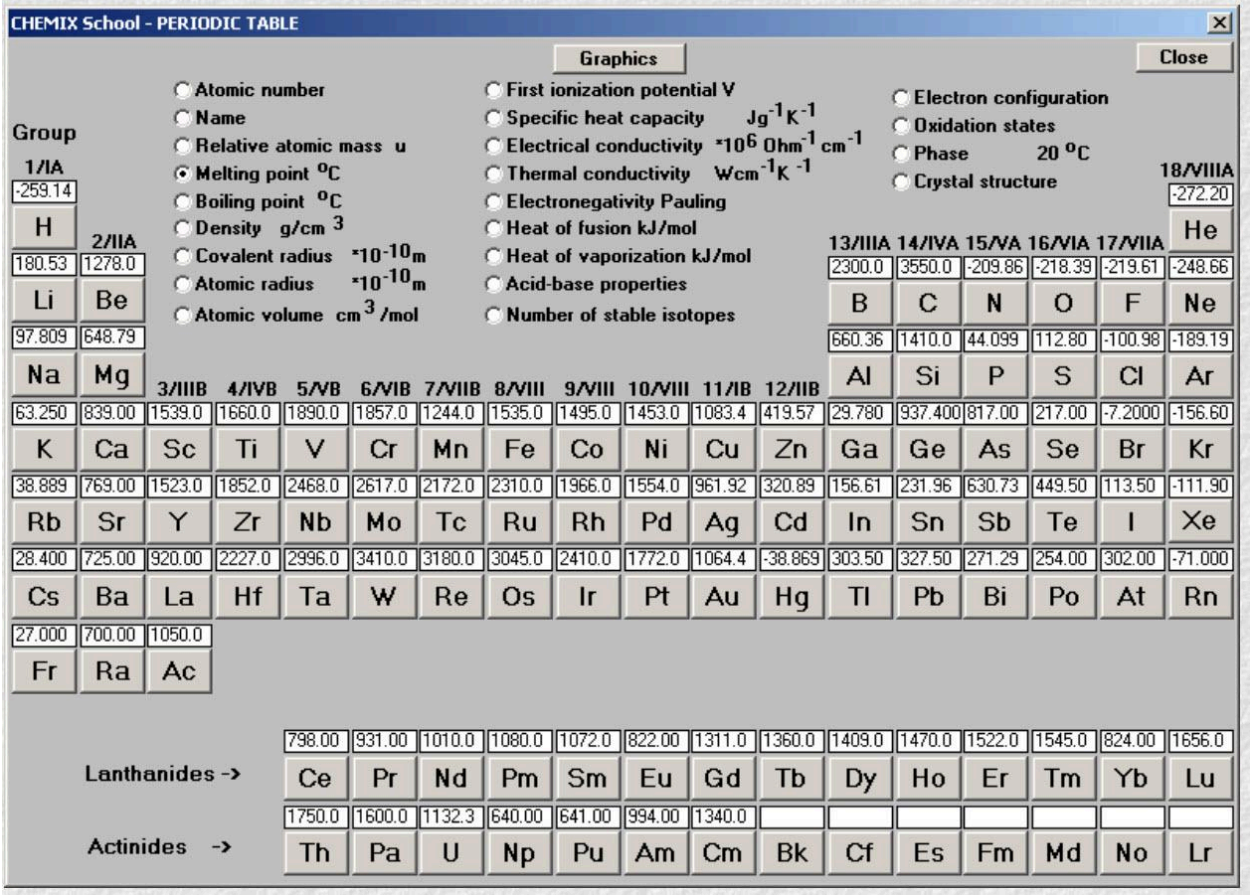
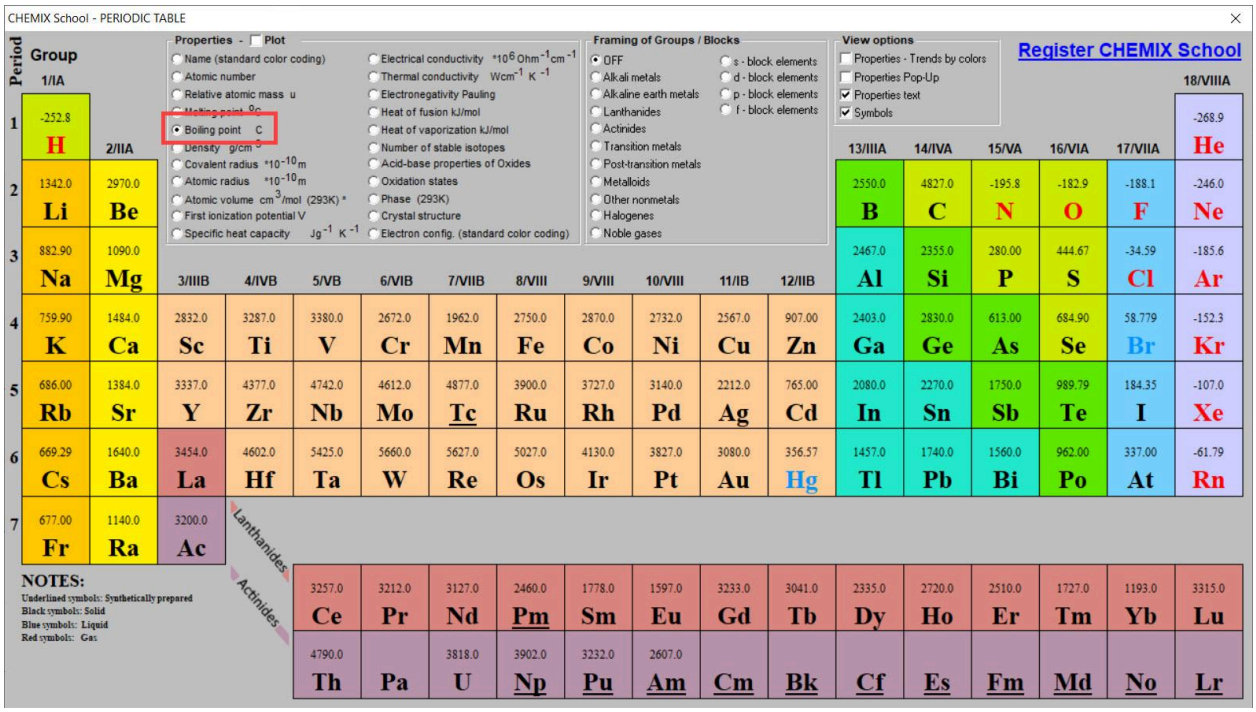
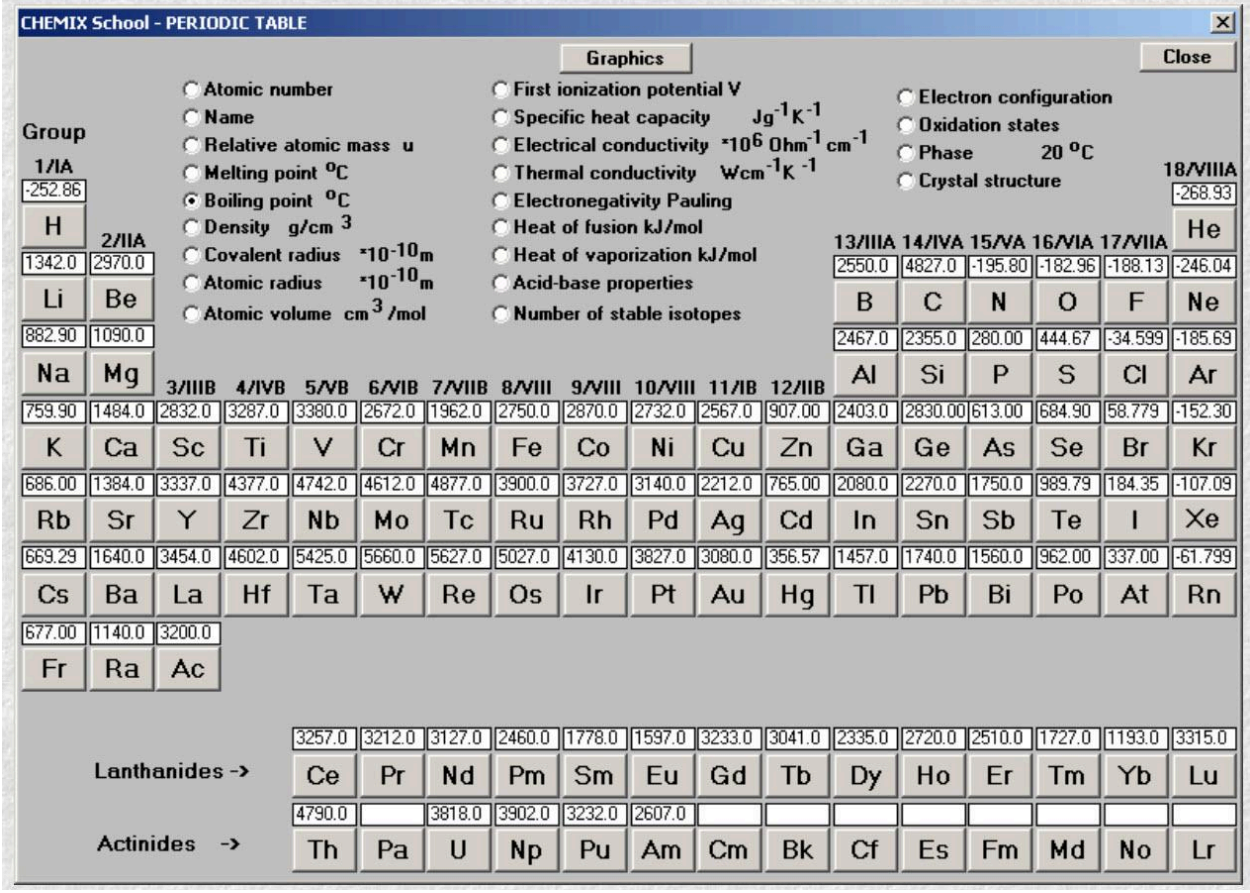
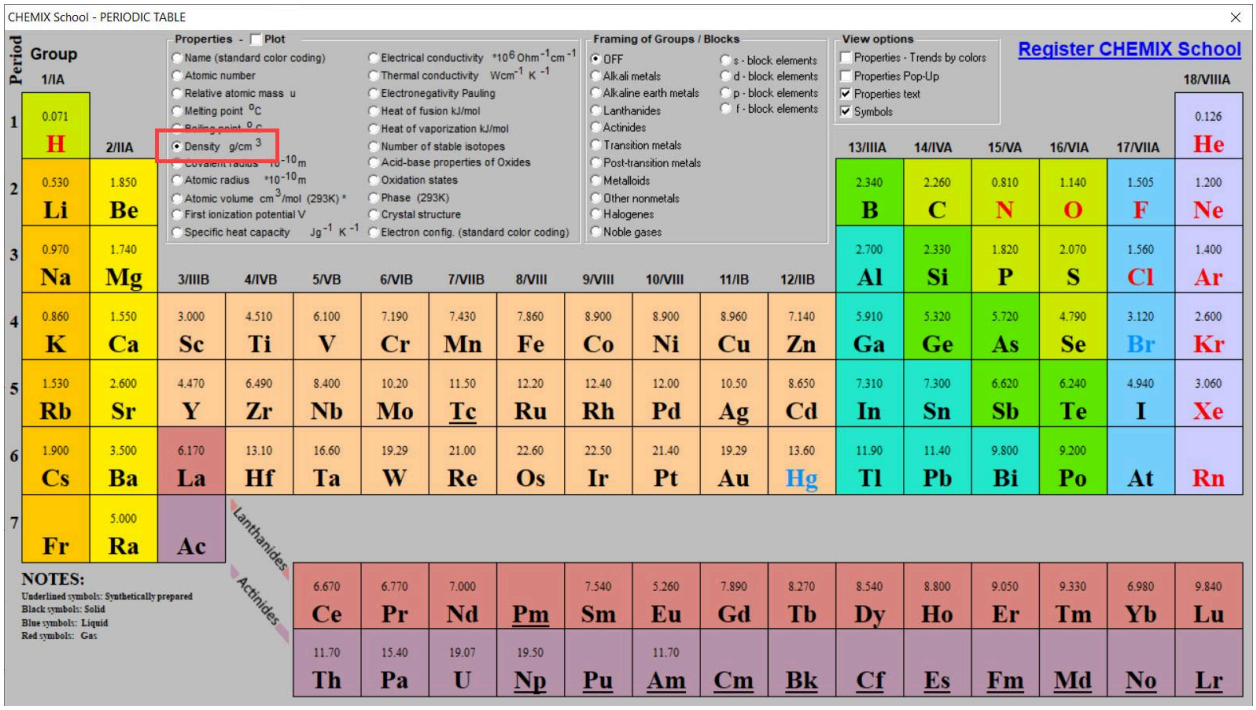
Melting points table of the elements





Boiling points table of the elements

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16/VIA
17/VIIA
18/VIIIA
Density g/cm 3
Atomic radius
Lanthanides
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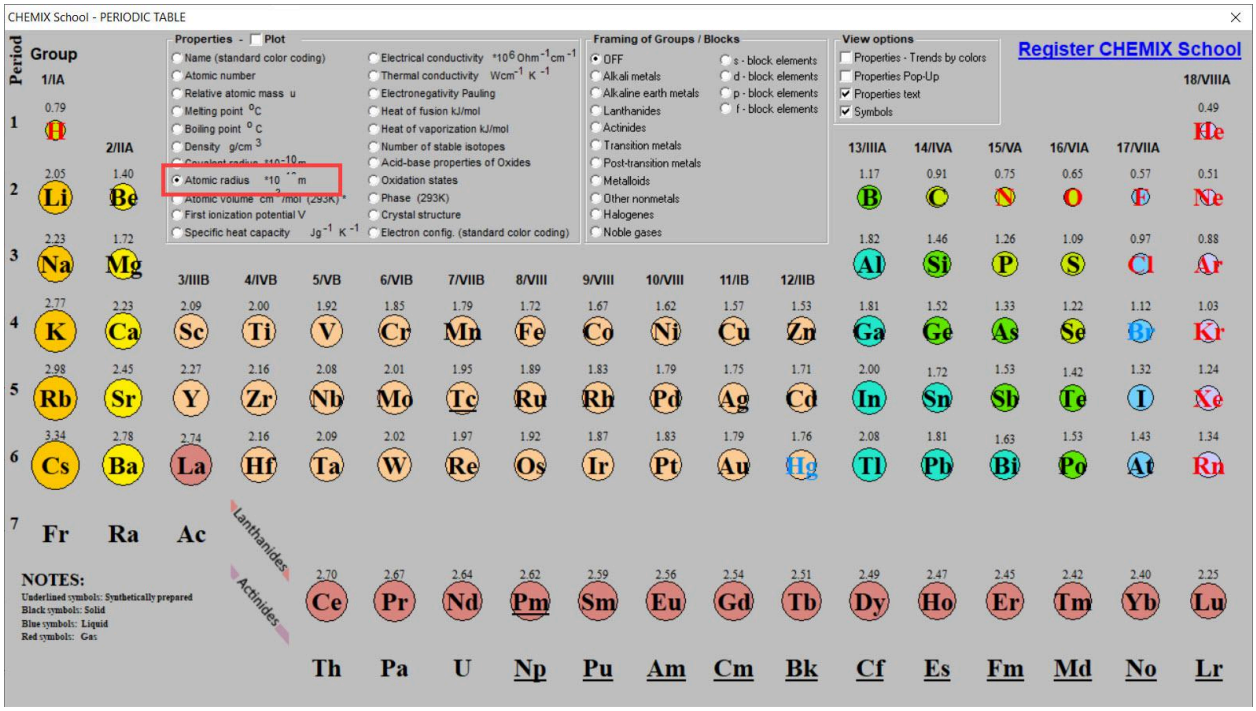
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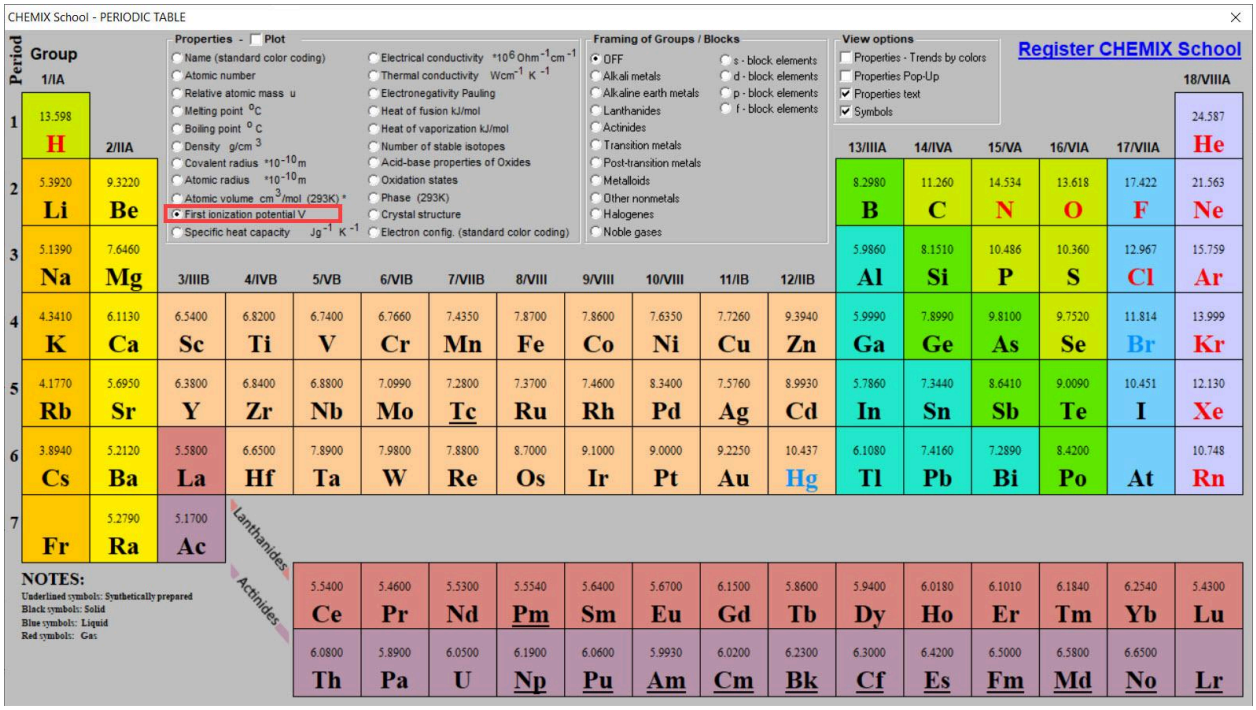
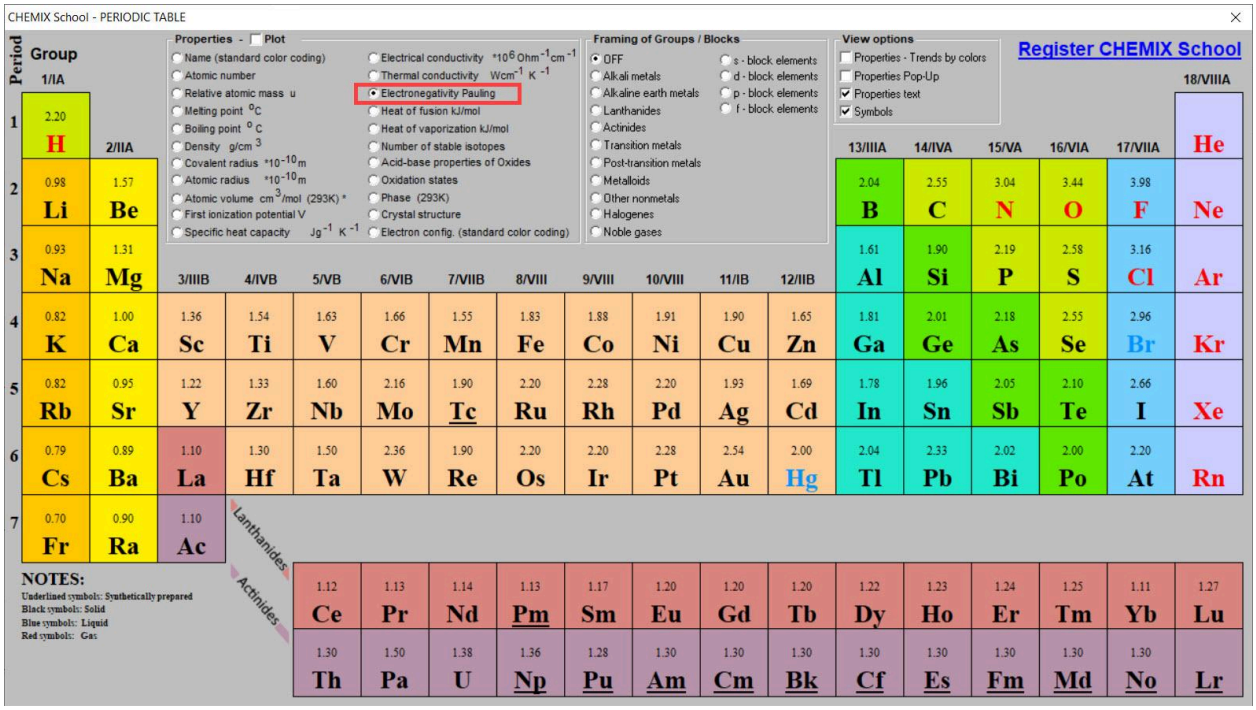


https://www.colby.edu/chemistry/PChem/Hartree.html

Energy Units Converter

Enter your energy value in the box with the appropriate units, then press "tab" or click outside of the input box.

0.00381	Hartrees
0.104	eV
10	kJ/mol
2.39	kcal/mol
836	cm^{-1}
0.104	V for $1e^-$ transfer
1200	K (equivalent temerature)
0.0177	Boltzman population ratio at 298.15K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Period
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9/VIII
10/VIII
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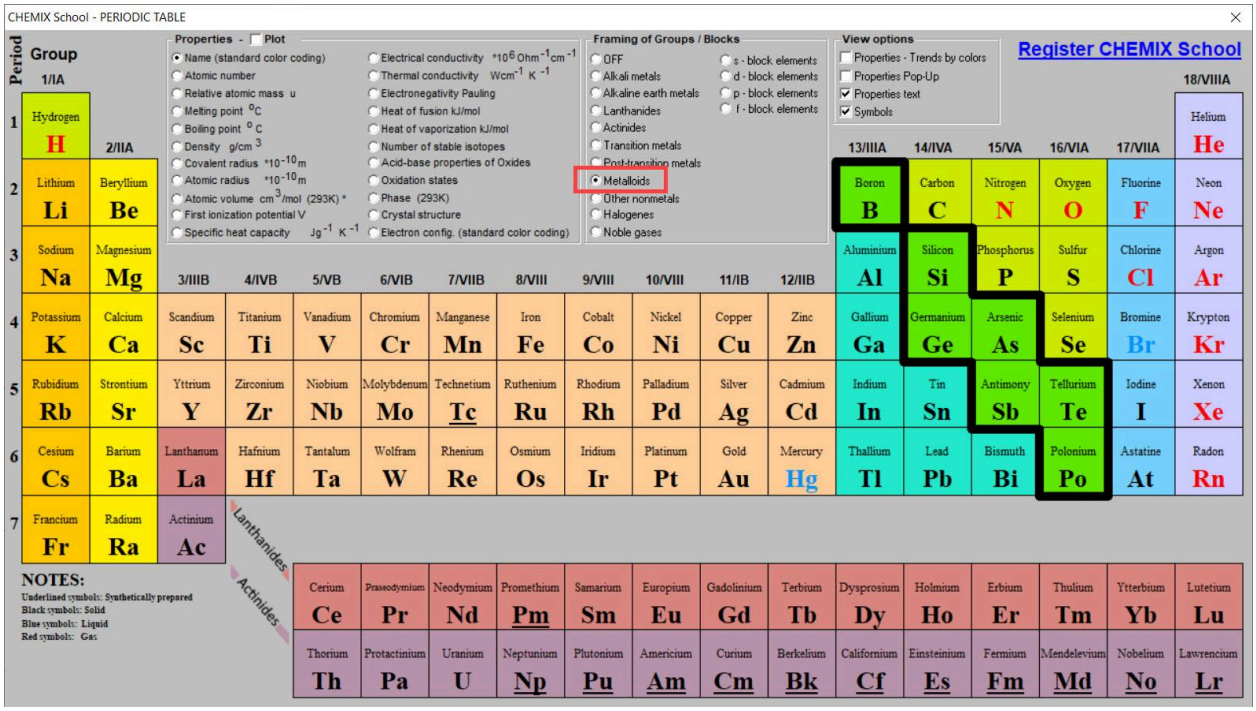
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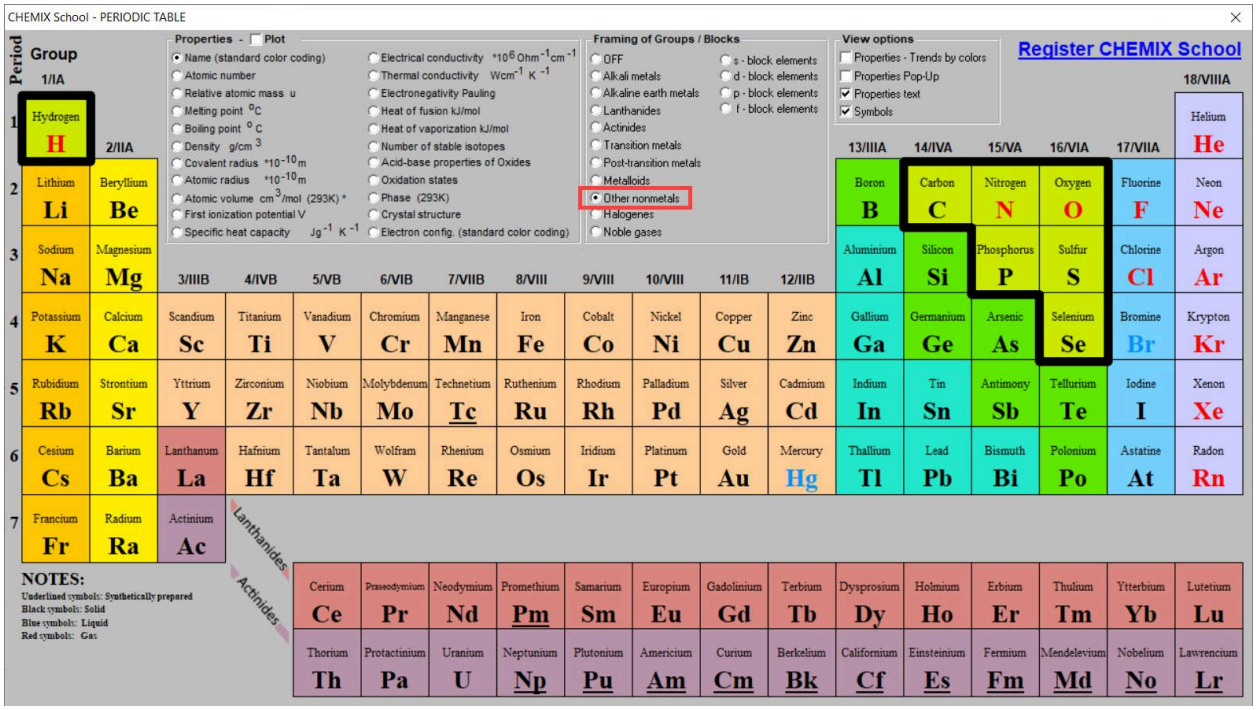
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Other nonmetals
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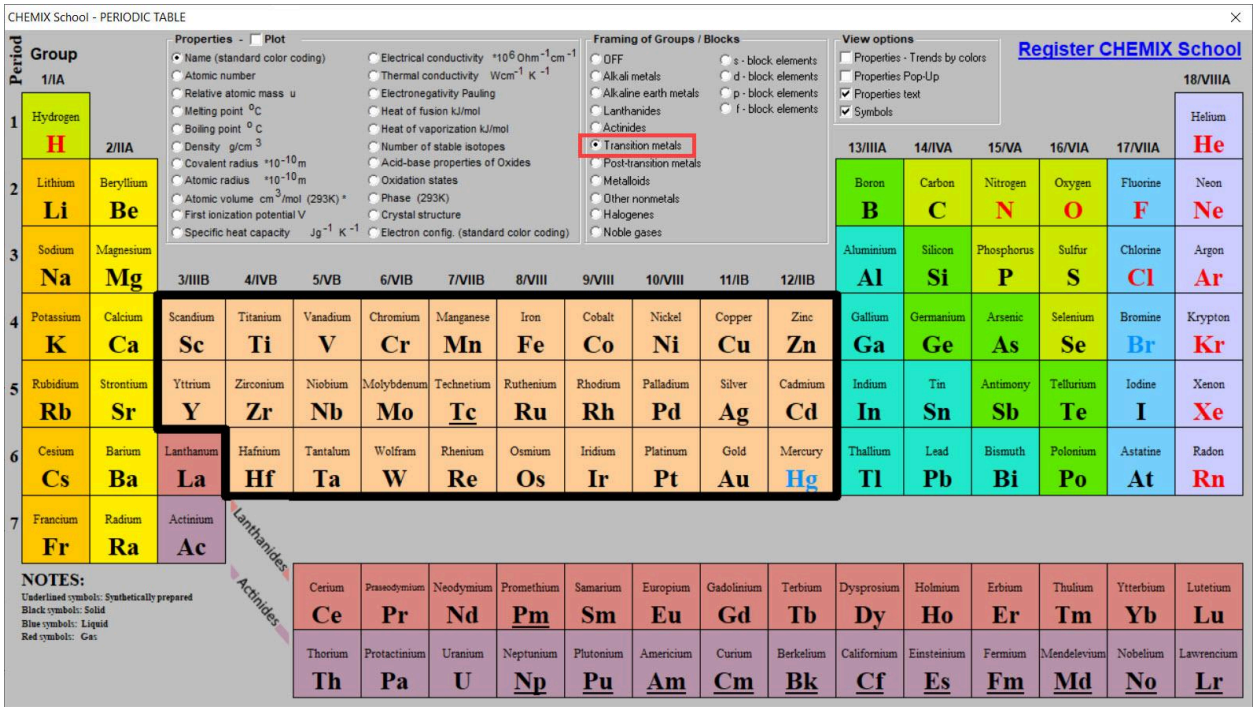
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Transition metals
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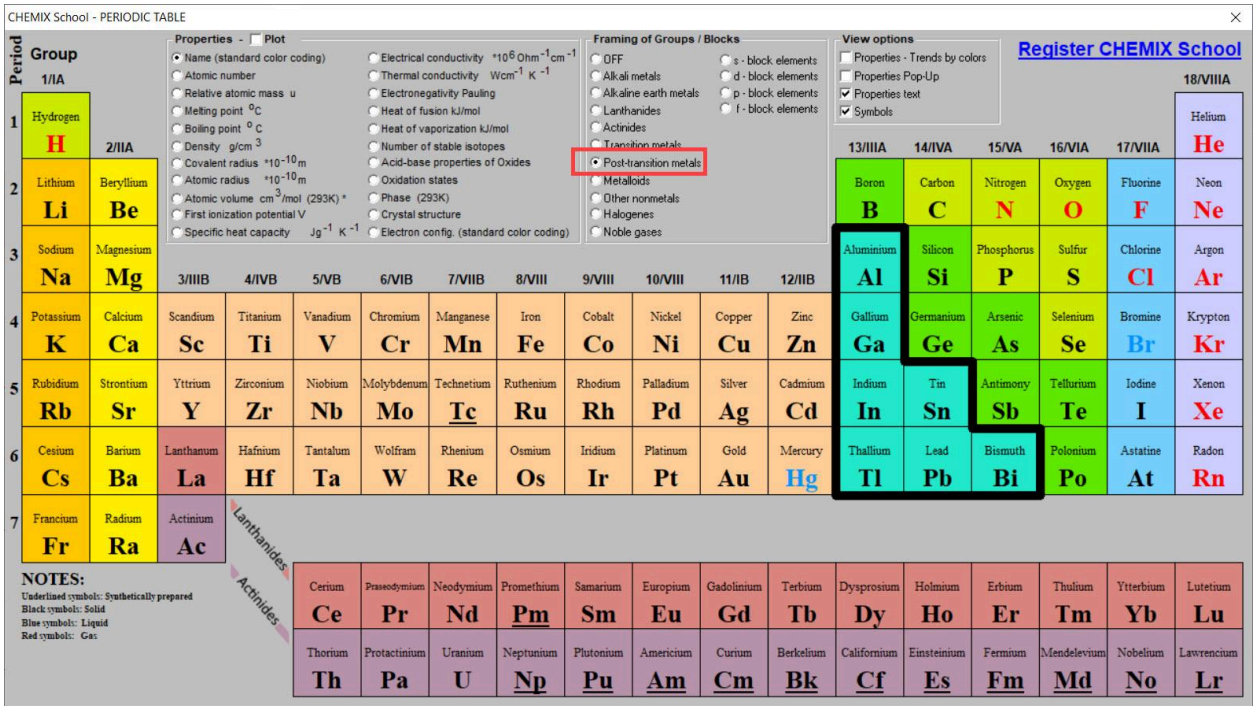

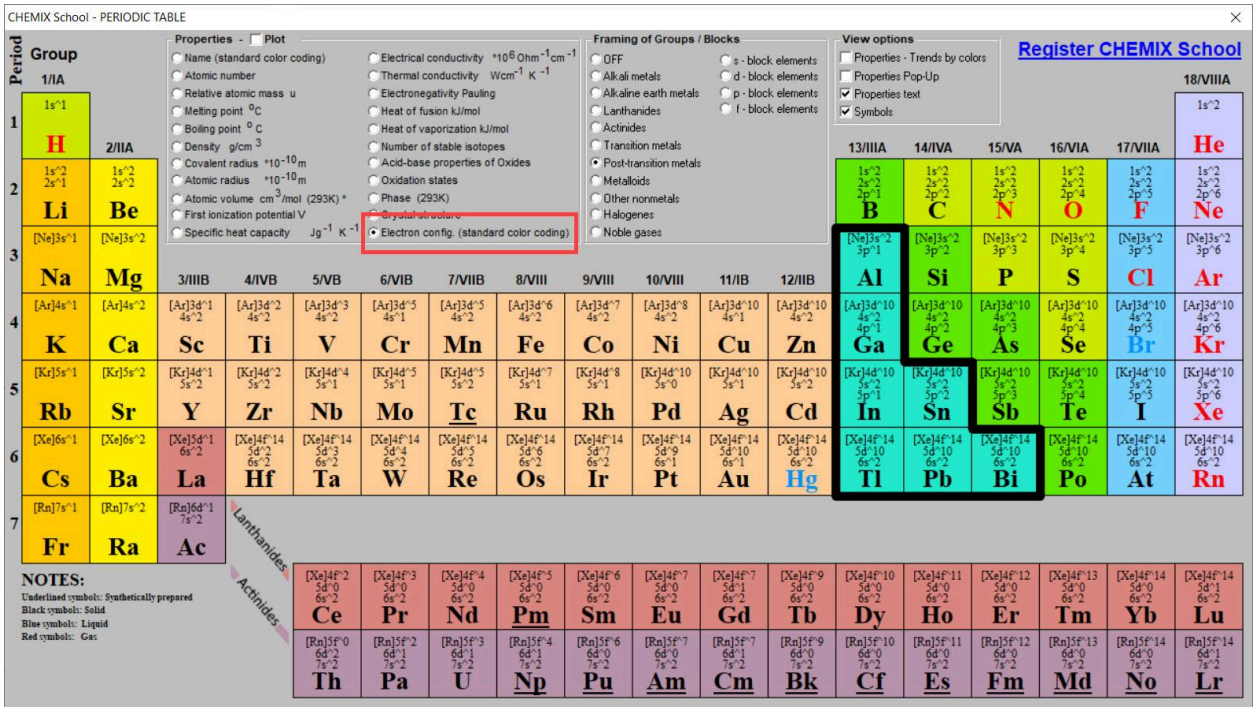

Include complete URLs for all of the websites you use to answer the discussion questions. If you use the Chemix software, mention which panels you used.