MODERN PERIODIC TABLE

Lecture 4.

Write the electronic configuration for:

1. $_{87}Fr$ – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^1$
2. $_{53}I$ – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^5$

Q.1 – Where does the element with the given valence shell electronic configuration lie in the periodic table?



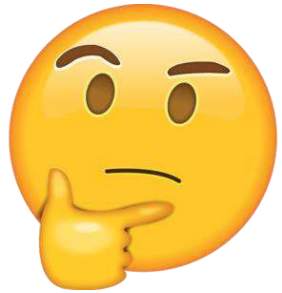
i. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

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

iii. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^5$

iv. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^3$

Answer:



1. i. S – block element; 4th period & 1st group (Potassium – K).

ii. P – block element; 4th period & 18th group (Krypton – Kr).

iii. D – block element; 5th period & 7th group (Technetium – Tc).

iv. P – block element; 5th period & 15th group (Antimony – Sb).

Periodic Table of the Elements

1 IA 11A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 168.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

Lanthanide Series	57 La Lanthanum 138.906	58 Ce Cerium 140.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.966	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
Actinide Series	89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Alkali Metal | Alkaline Earth | Transition Metal | Semimetal | Nonmetal | Basic Metal | Halogen | Noble Gas | Lanthanide | Actinide

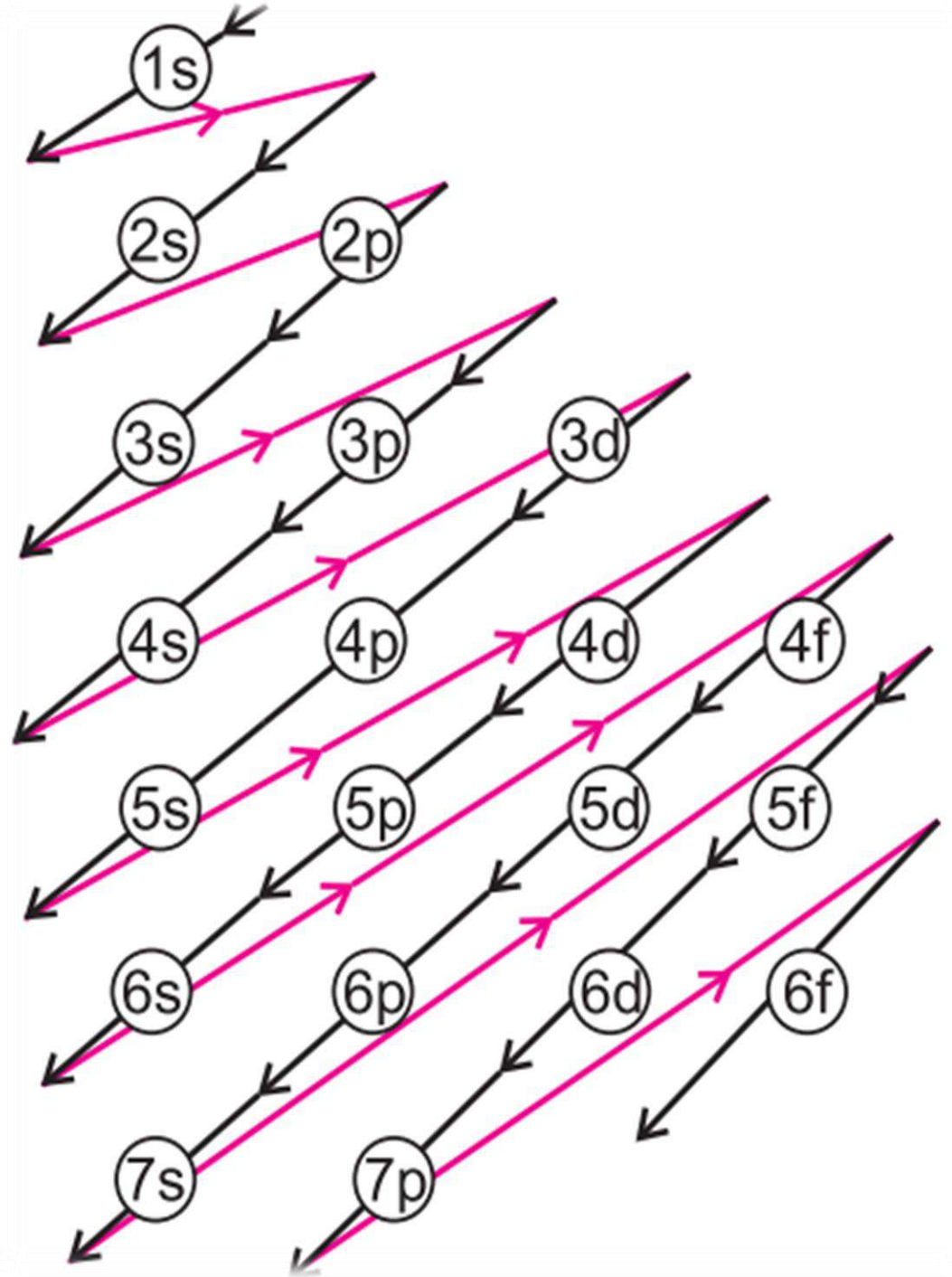
AUFBAU's PRINCIPLE

S = 2

P = 6

D = 10

F = 14



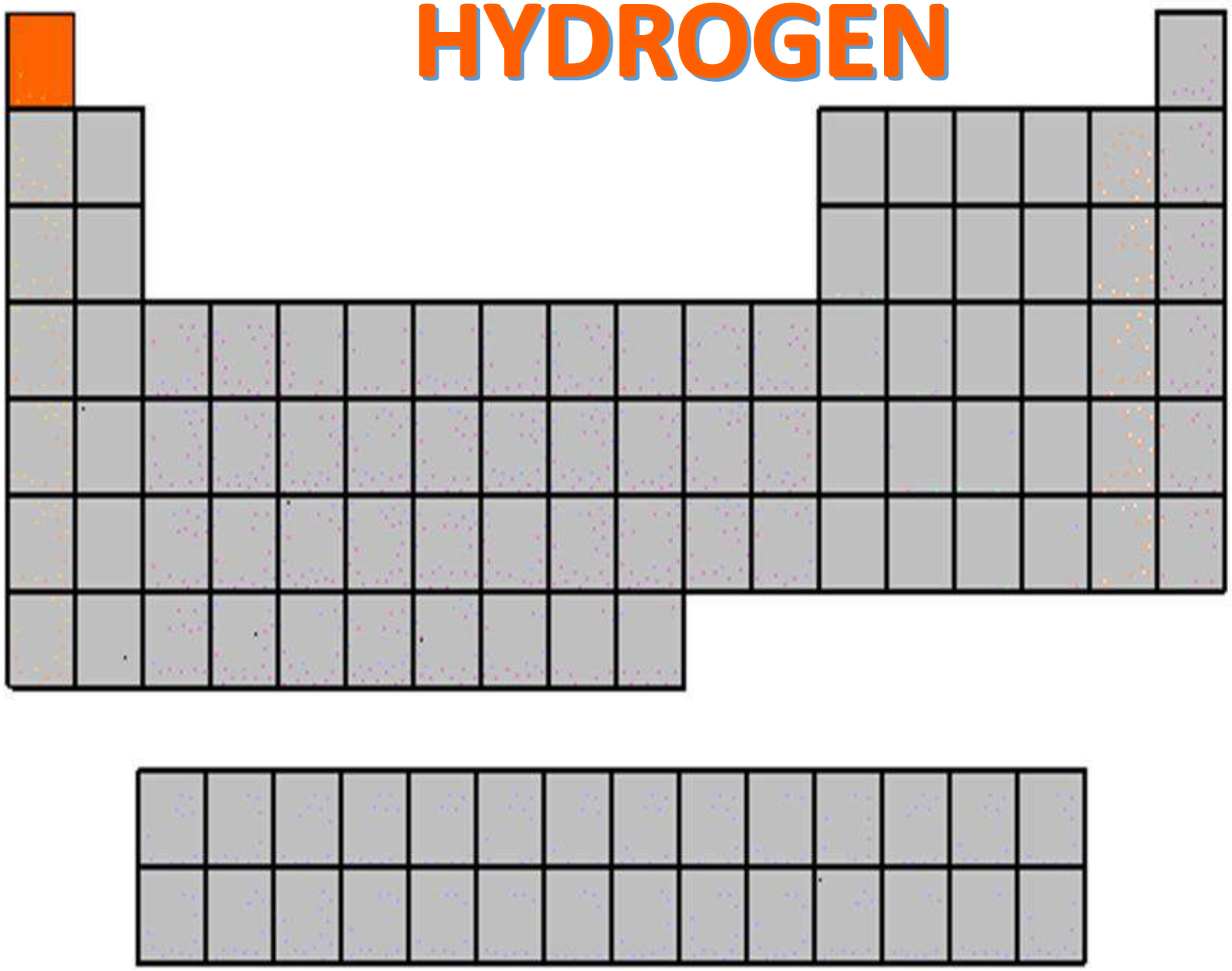
VALENCE ELECTRONS

- The electrons the occupy the highest energy level of an atom.
- Valence electrons play a key role in the chemical properties of an element.
- Electrons in the valence shell.
- Example: $_{20}Ca$ – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
- valence shell = 4s
- valence electrons = 2

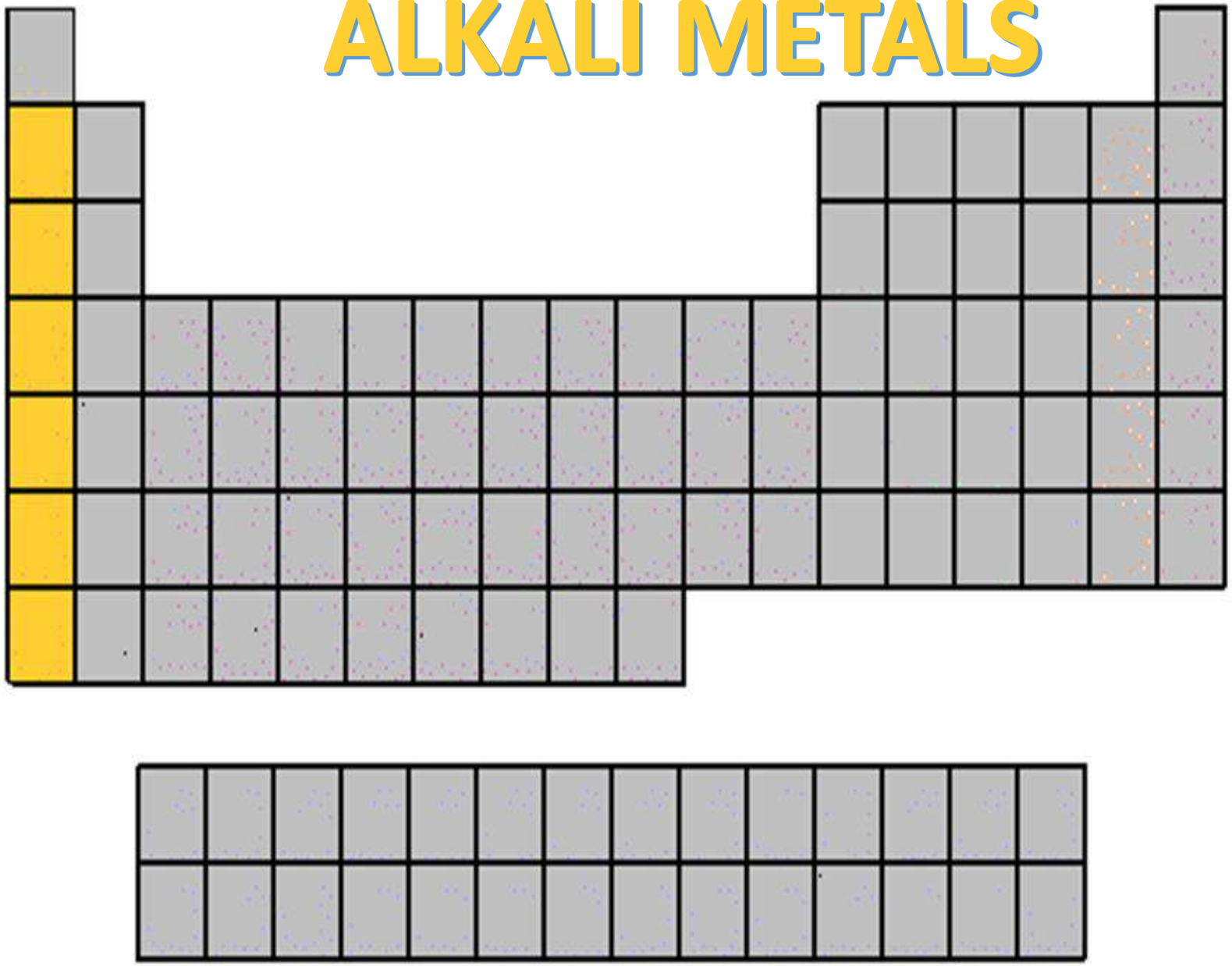
PERIODIC TABLE
ELECTRONIC CONFIGURATION

	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	H $1s^1$																	He $1s^2$
2	Li $2s^1$	Be $2s^2$											B $2p^1$	C $2p^2$	N $2p^3$	O $2p^4$	F $2p^5$	Ne $2p^6$
3	Na $3s^1$	Mg $3s^2$											Al $3p^1$	Si $3p^2$	P $3p^3$	S $3p^4$	Cl $3p^5$	Ar $3p^6$
4	K $4s^1$	Ca $4s^2$	Sc $3d^1$	Ti $3d^2$	V $3d^3$	Cr $4s^1 3d^5$	Mn $3d^5$	Fe $3d^6$	Co $3d^7$	Ni $3d^8$	Cu $4s^1 3d^{10}$	Zn $3d^{10}$	Ga $4p^1$	Ge $4p^2$	As $4p^3$	Se $4p^4$	Be $4p^5$	Kr $4p^6$
5	Rb $5s^1$	Sr $5s^2$	Y $4d^1$	Zr $4d^2$	Nb $4d^3$	Mo $5s^1 4d^5$	Tc $4d^5$	Ru $4d^6$	Rh $4d^7$	Ni $4d^8$	Ag $5s^1 4d^{10}$	Cd $4d^{10}$	In $5p^1$	Sn $5p^2$	Sb $5p^3$	Te $5p^4$	I $5p^5$	Xe $5p^6$
6	Cs $6s^1$	Ba $6s^2$	La $5d^1$	Hf $5d^2$	Ta $5d^3$	W $6s^1 5d^5$	Re $5d^5$	Os $5d^6$	Ir $5d^7$	Ni $5d^8$	Au $6s^1 5d^{10}$	Hg $5d^{10}$	Tl $6p^1$	Pb $6p^2$	Bi $6p^3$	Po $6p^4$	At $6p^5$	Rn $6p^6$
7	Fr $7s^1$	Ra $7s^2$	Ac $6d^1$	Rf $6d^2$	Db $6d^3$	Sg $7s^1 6d^5$	Bh $6d^5$	Hs $6d^6$	Mt $6d^7$									

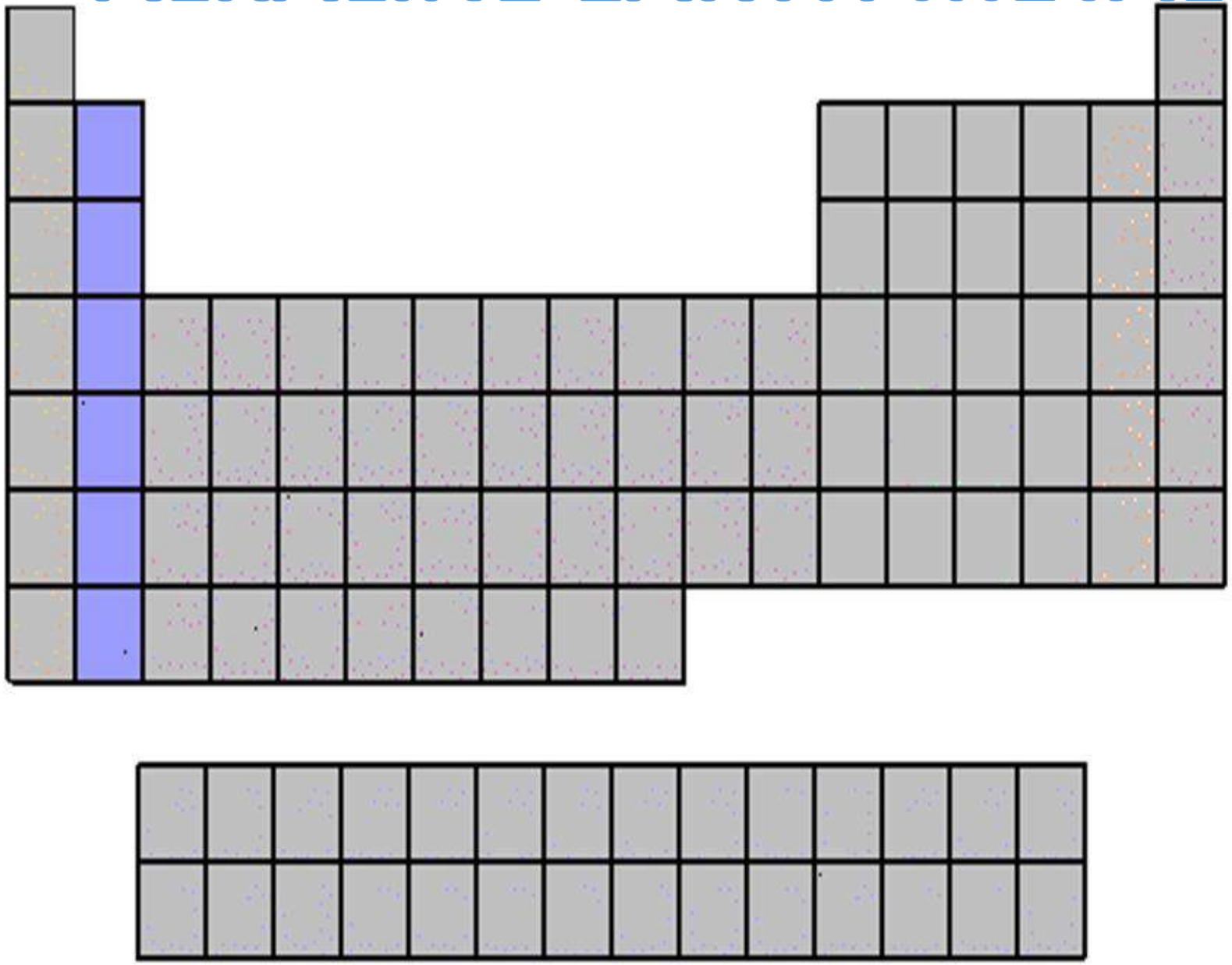
HYDROGEN



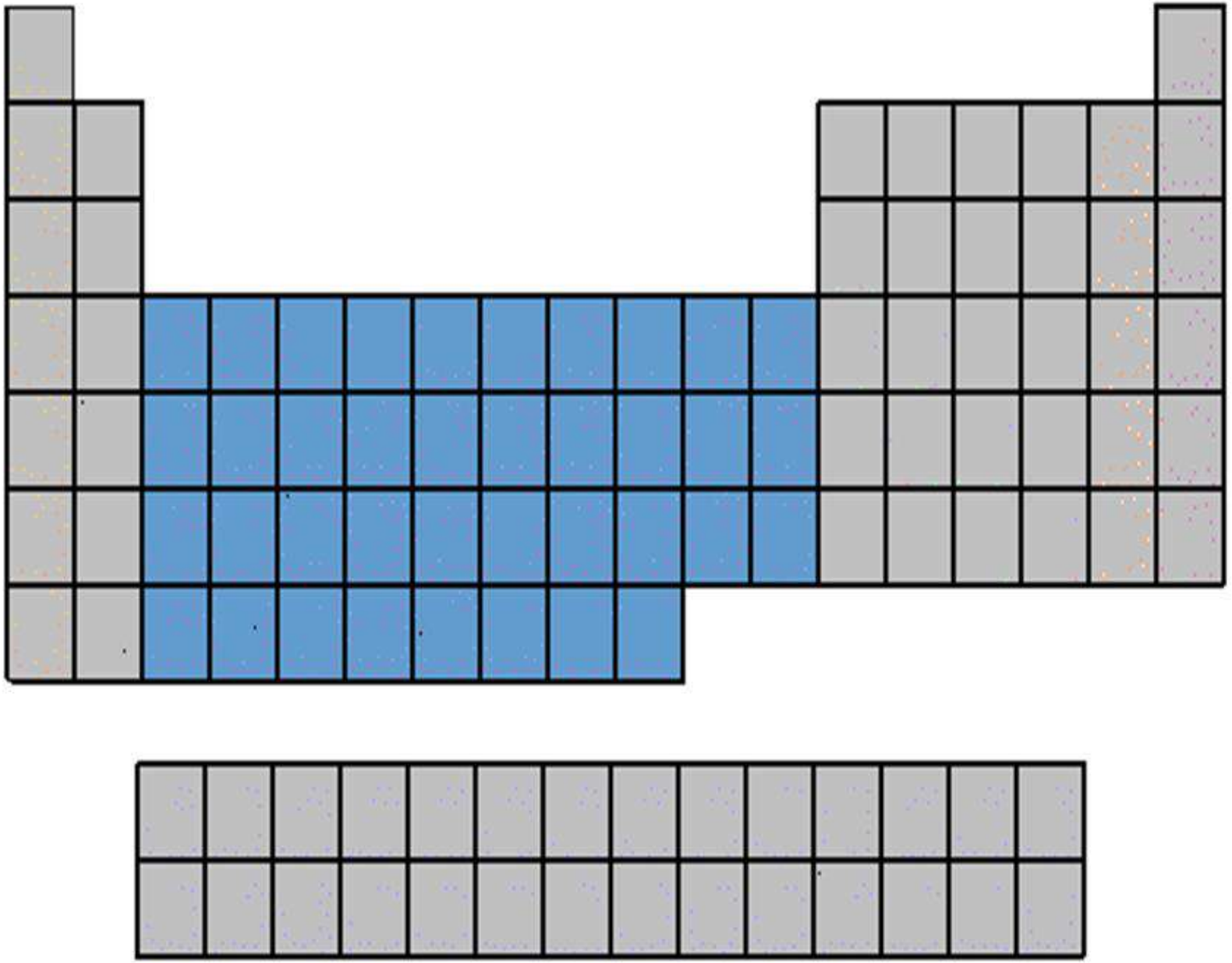
ALKALI METALS



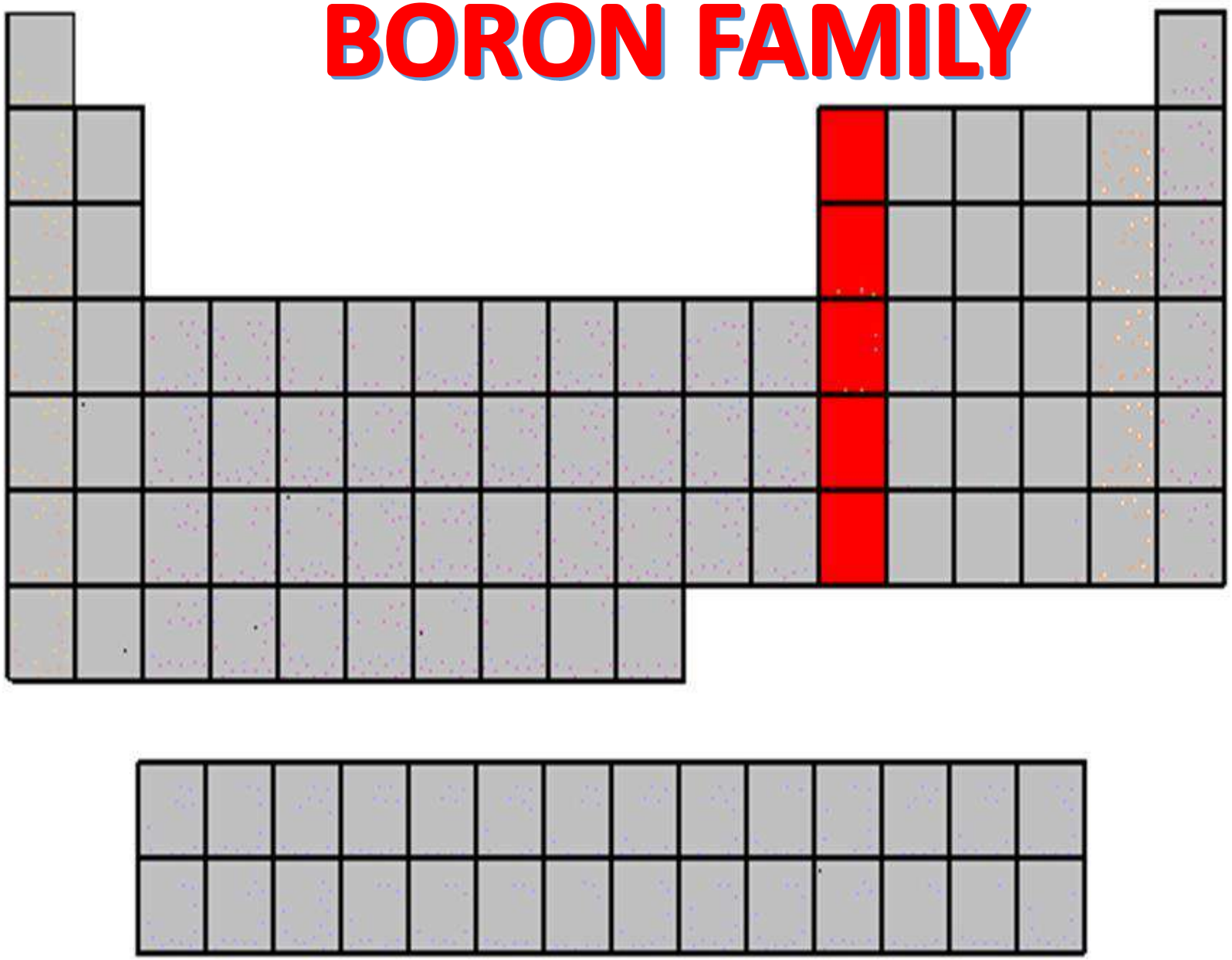
ALKALINE EARTH METALS



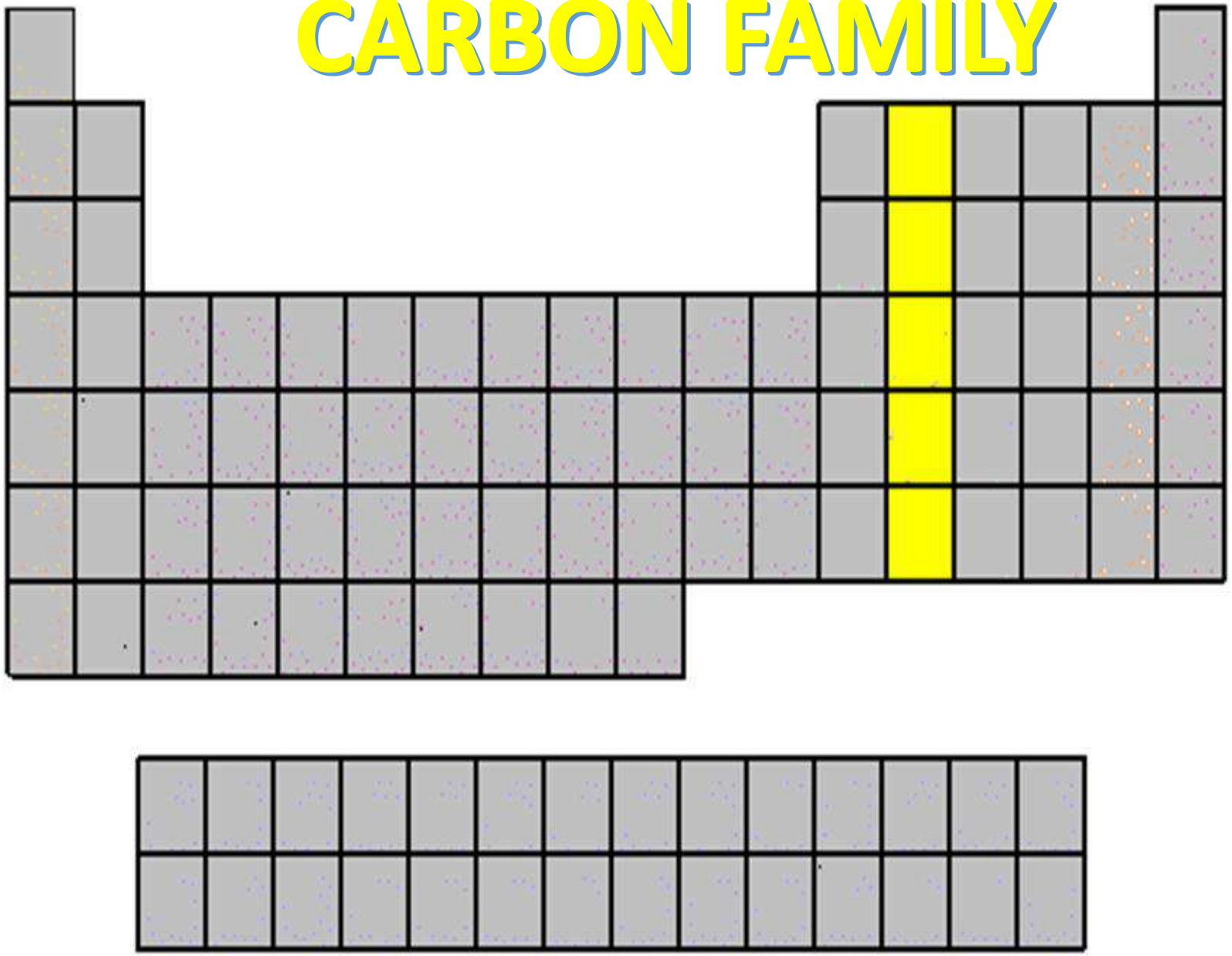
TRANSITION METALS



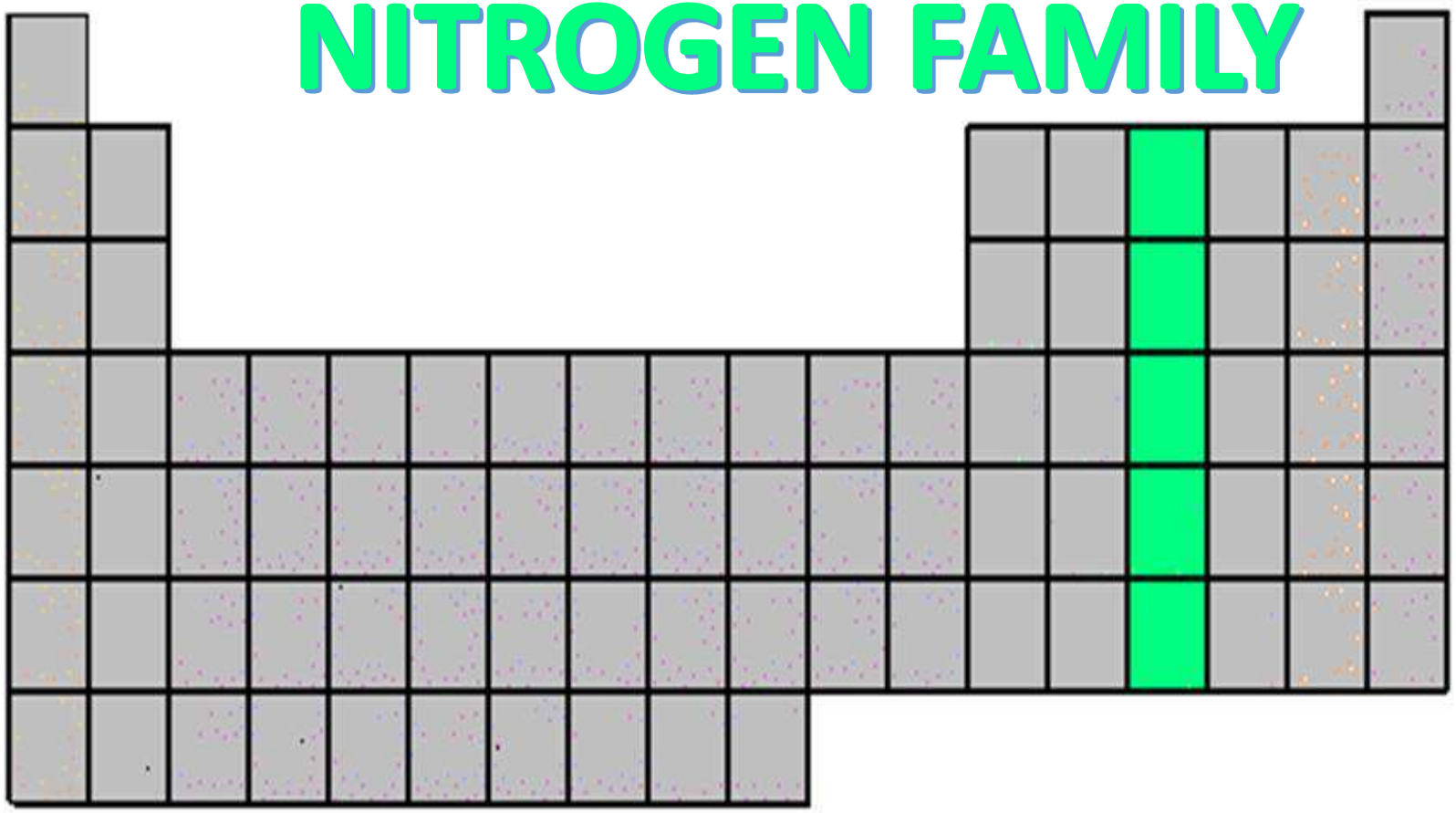
BORON FAMILY

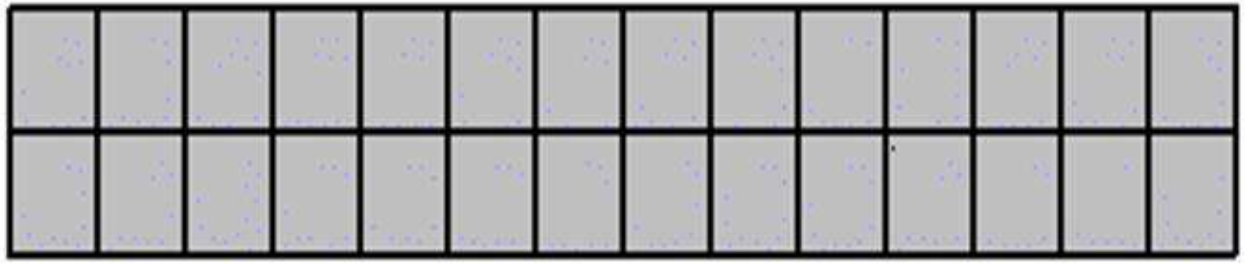


CARBON FAMILY

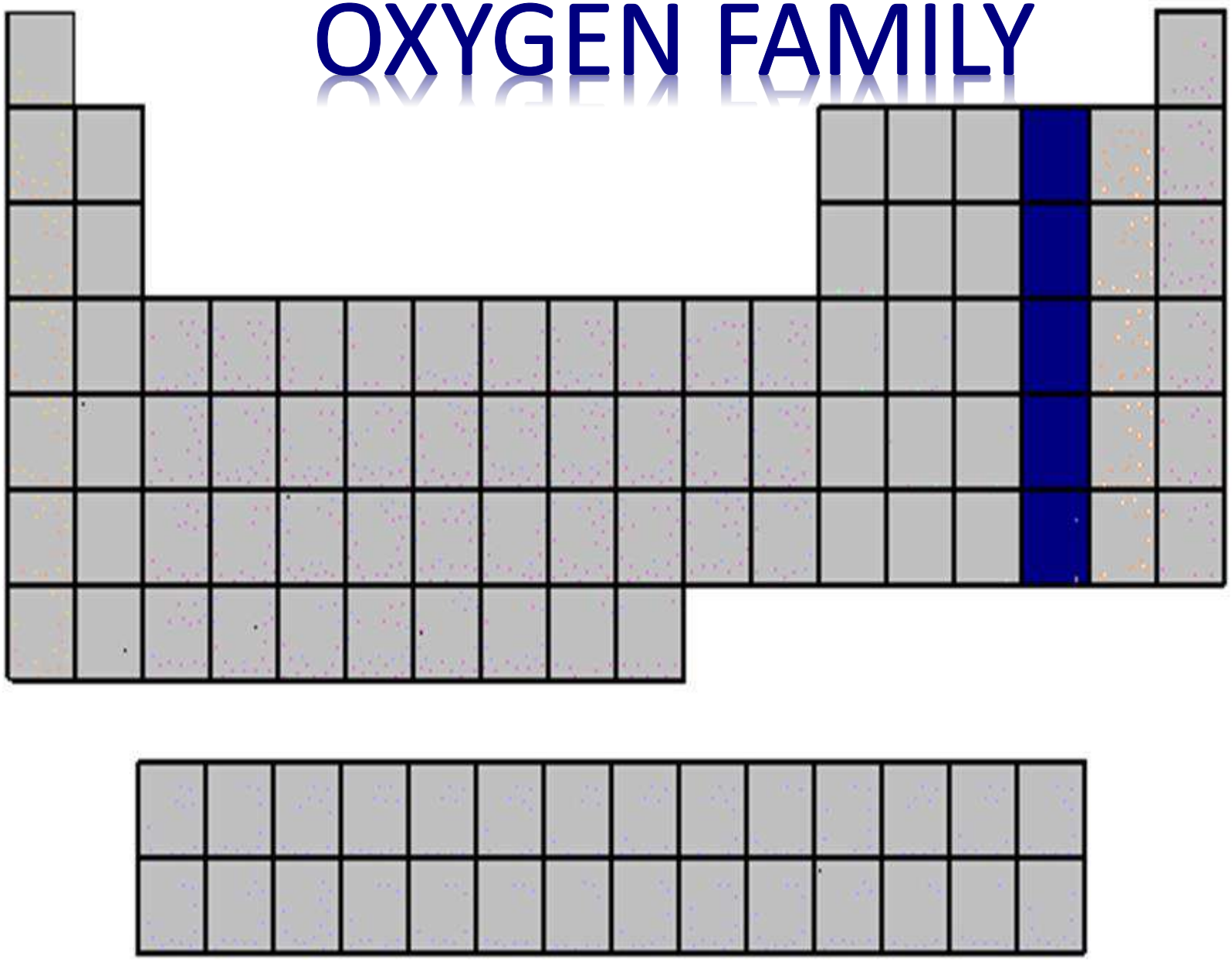


NITROGEN FAMILY

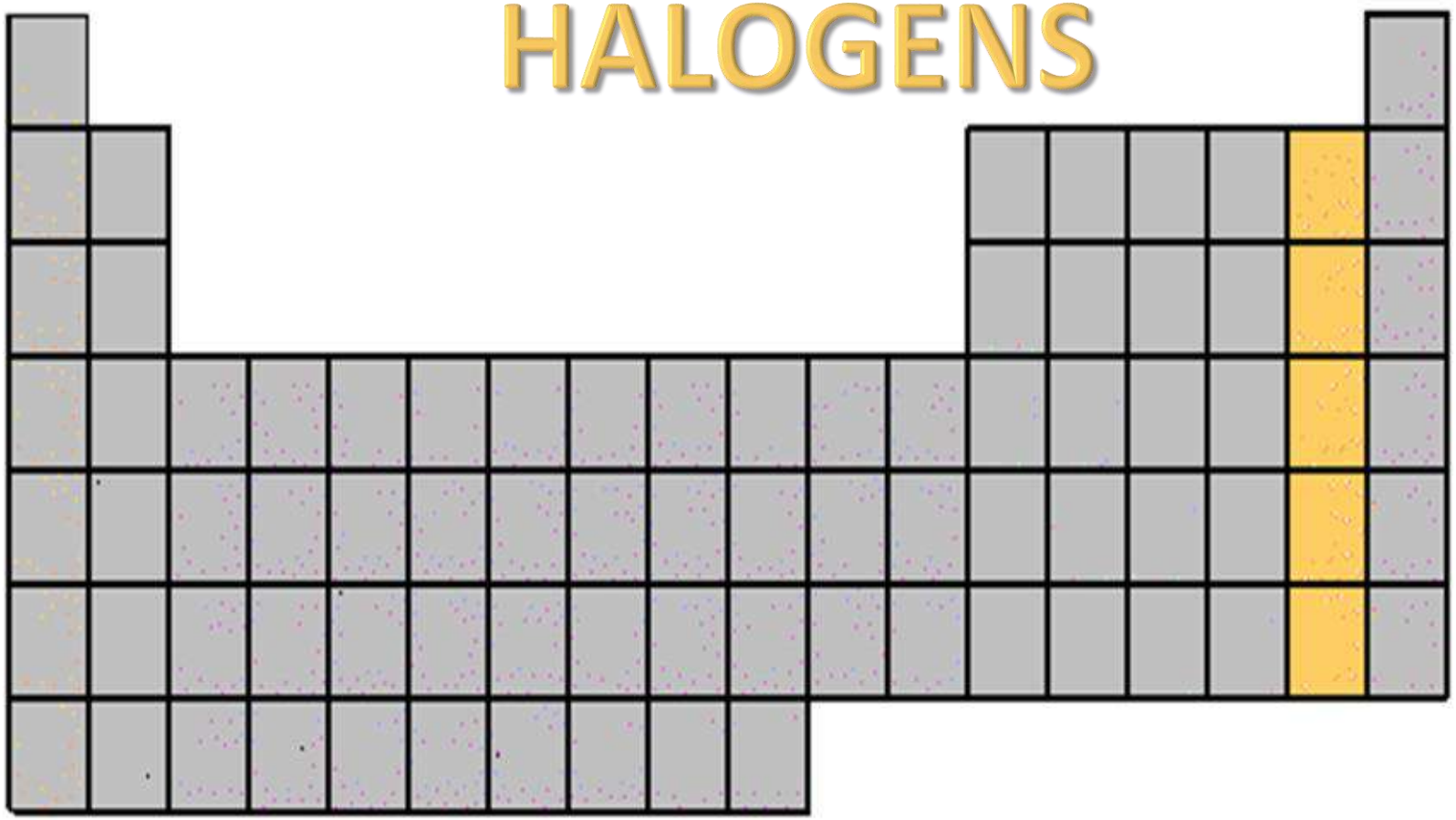


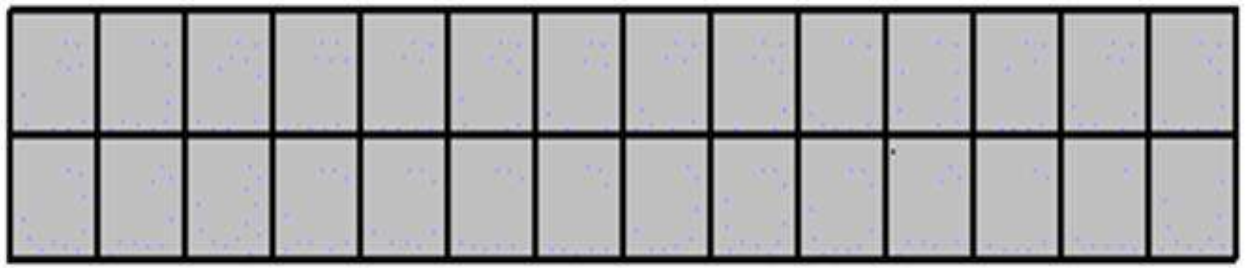


OXYGEN FAMILY

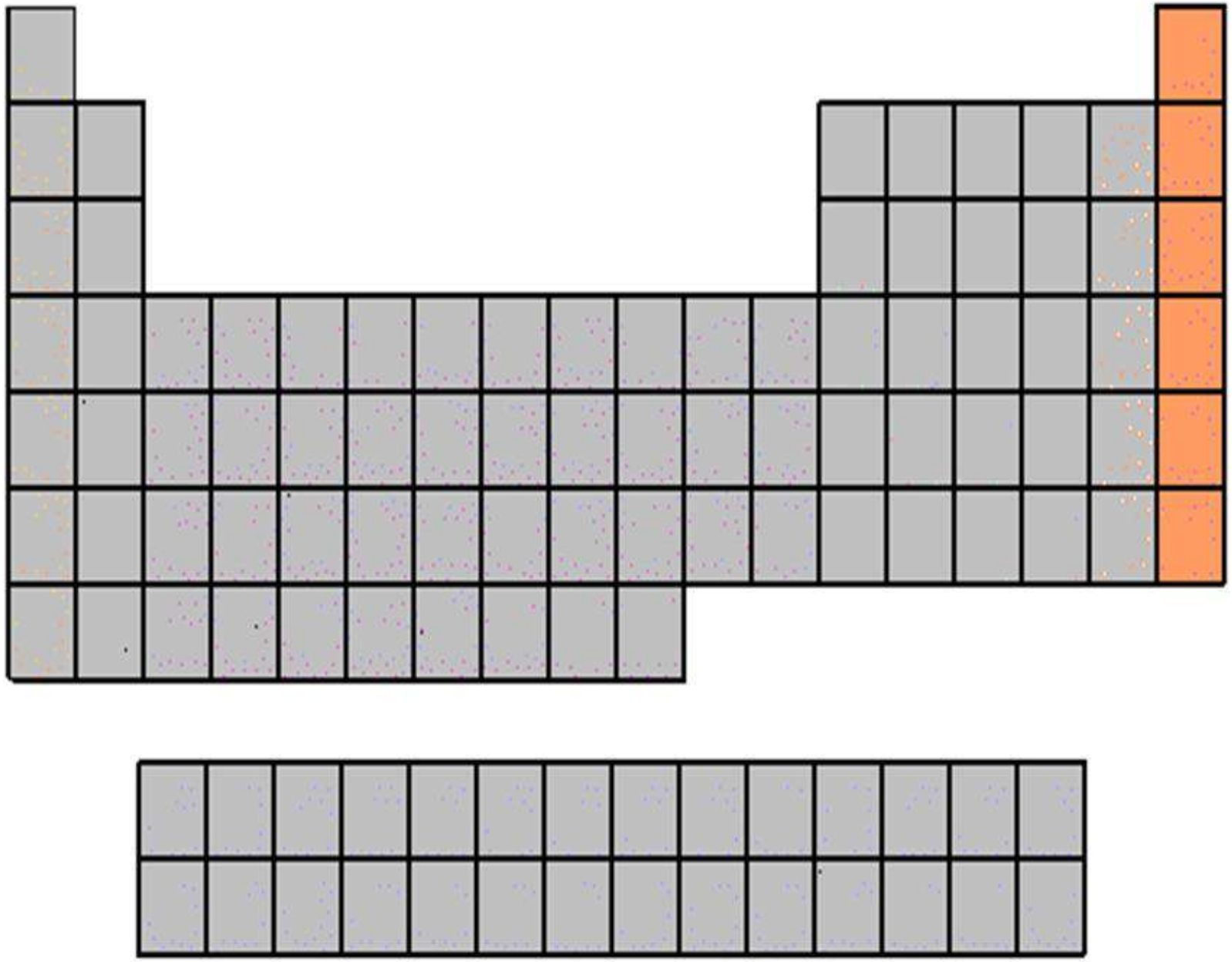


HALOGENS

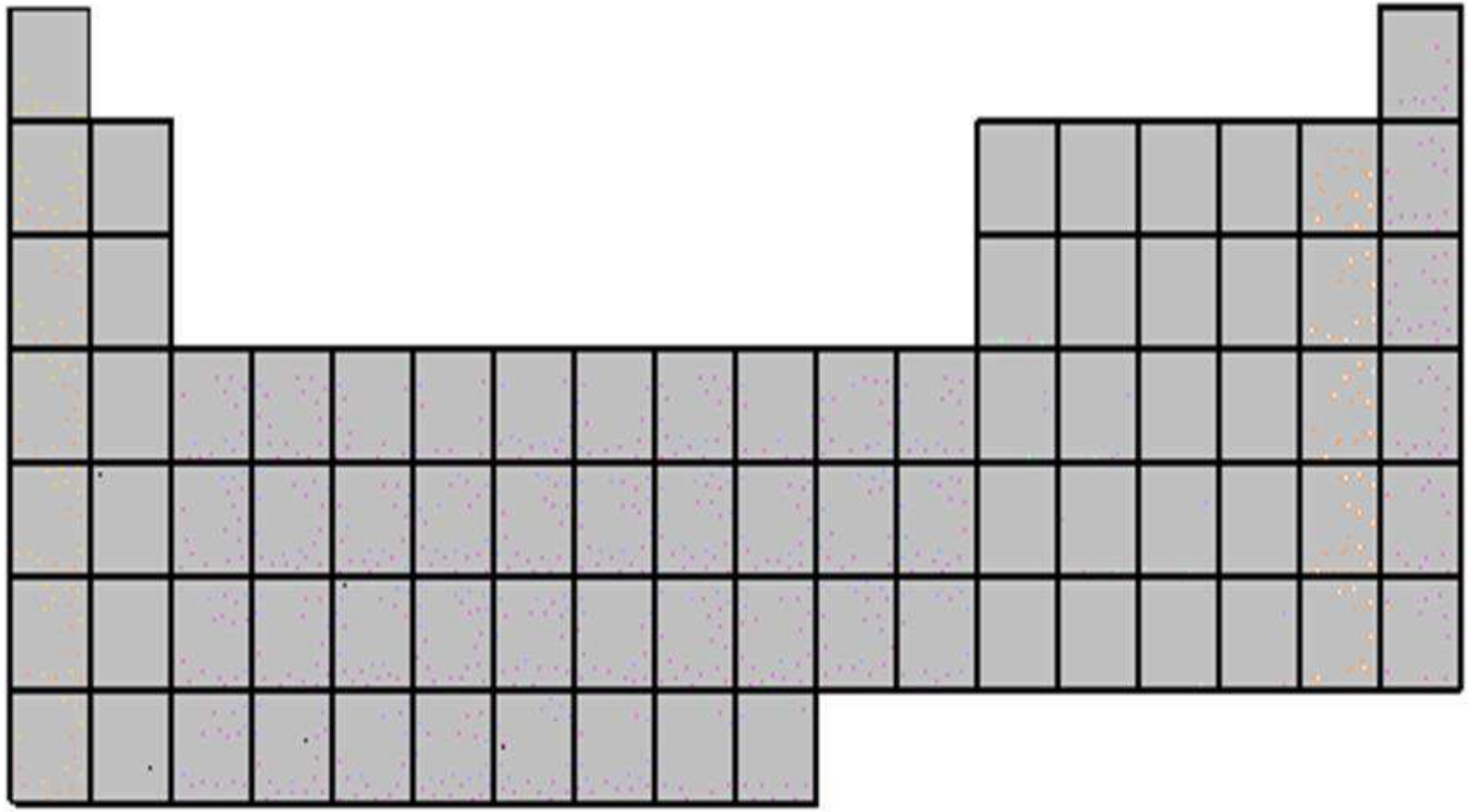


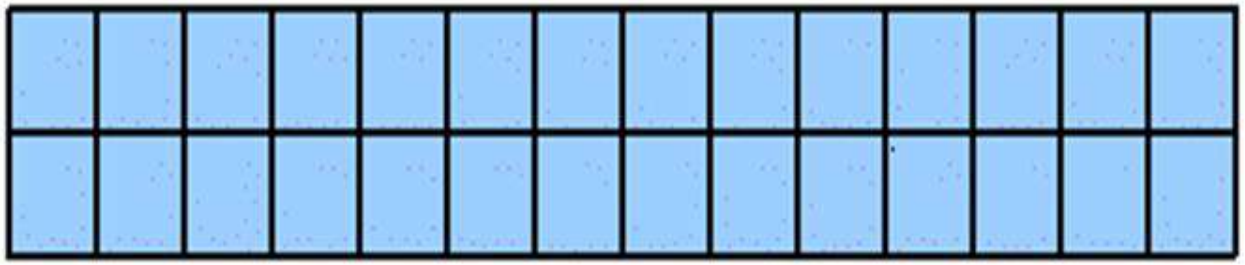


NOBLE GAS ELEMENTS



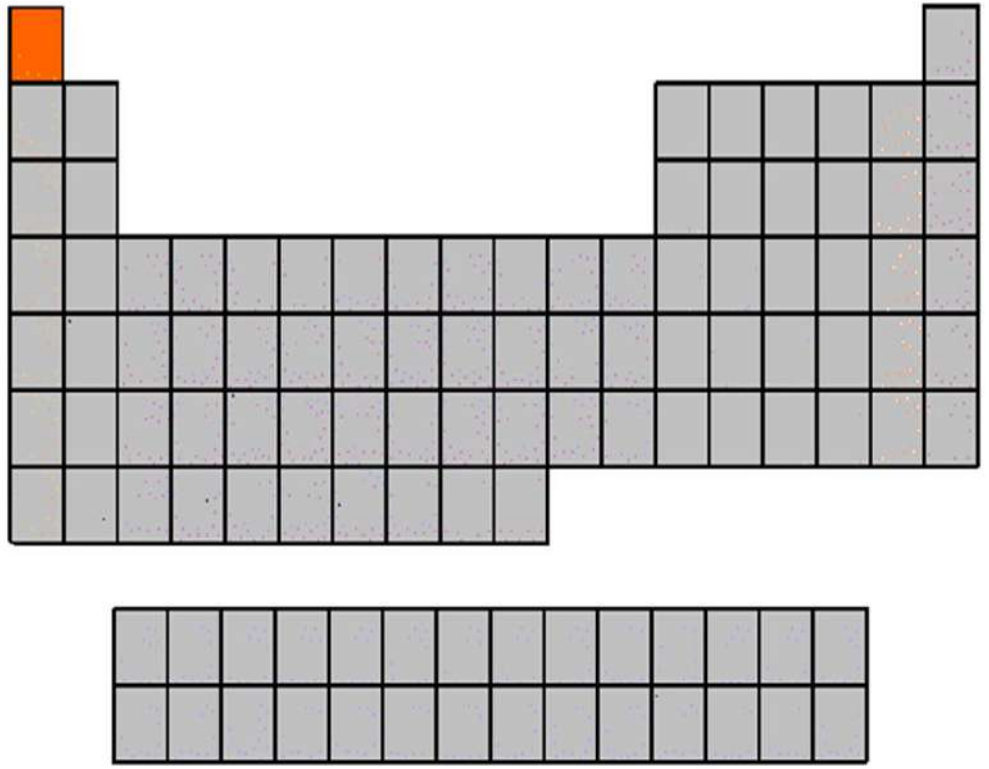
INNER TRANSITION METALS





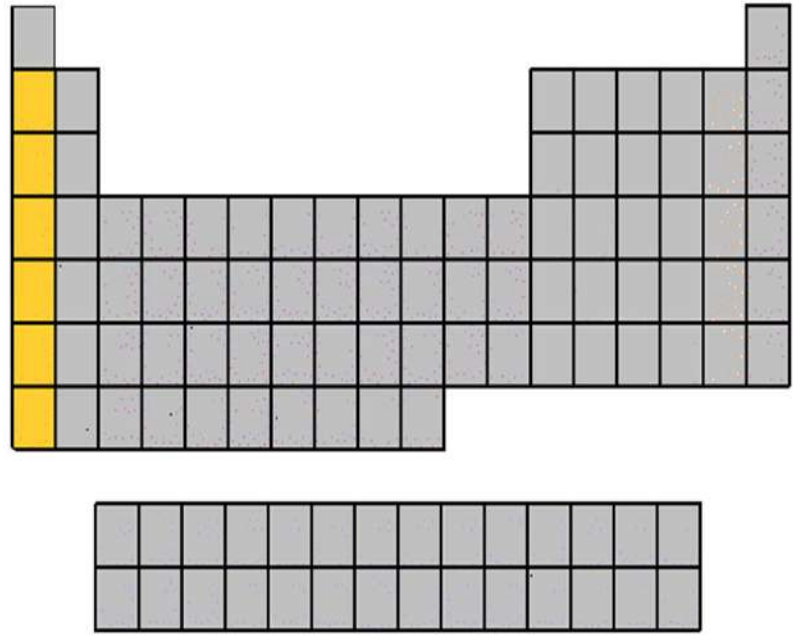
HYDROGEN

- The Hydrogen square sits atop Family A-1, but it is not a member of that family. Hydrogen is in a class of its own.
- It is a gas at room temperature.
- It has one proton and one electron in its one and only energy level.
- Hydrogen only needs 1 more electron to fill up its valence shell i.e. to achieve duplet.



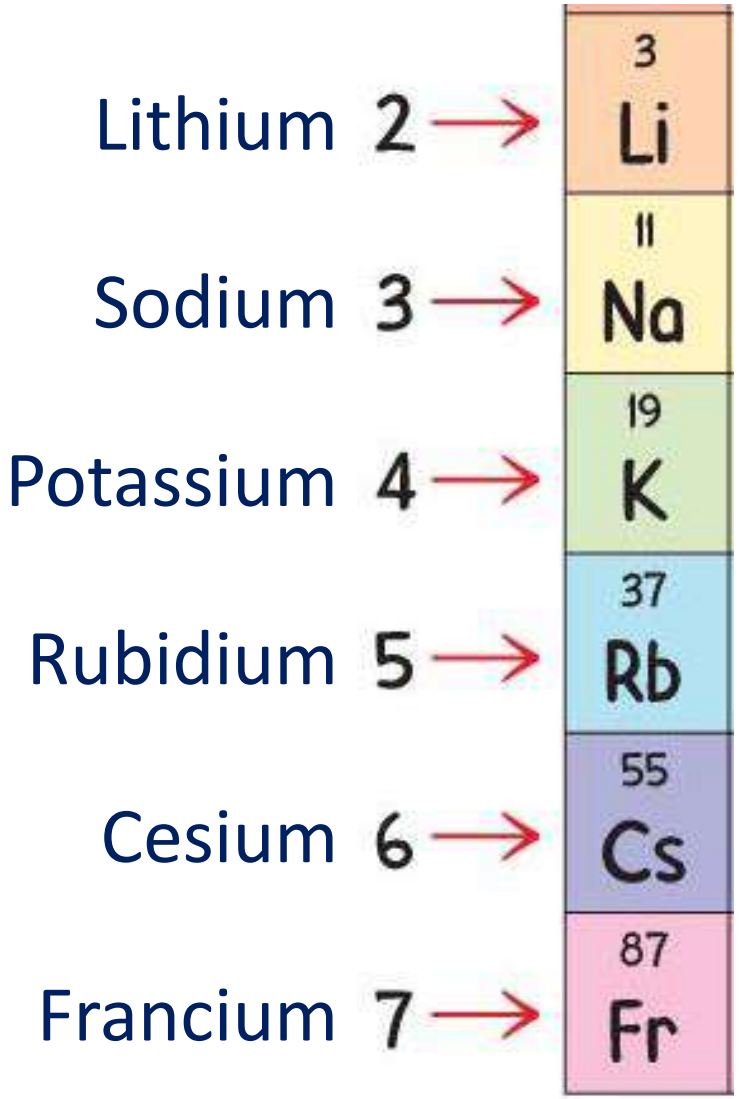
ALKALI METALS

- The alkali family is found in the first column of the periodic table.
- Atoms of the alkali metals have a single electron in their outermost level, in other words, 1 valence electron.
- They are shiny and are easily cut with a knife.
- They have general valence shell electronic configuration of $\mathbf{ns^1}$.



ALKALI METALS

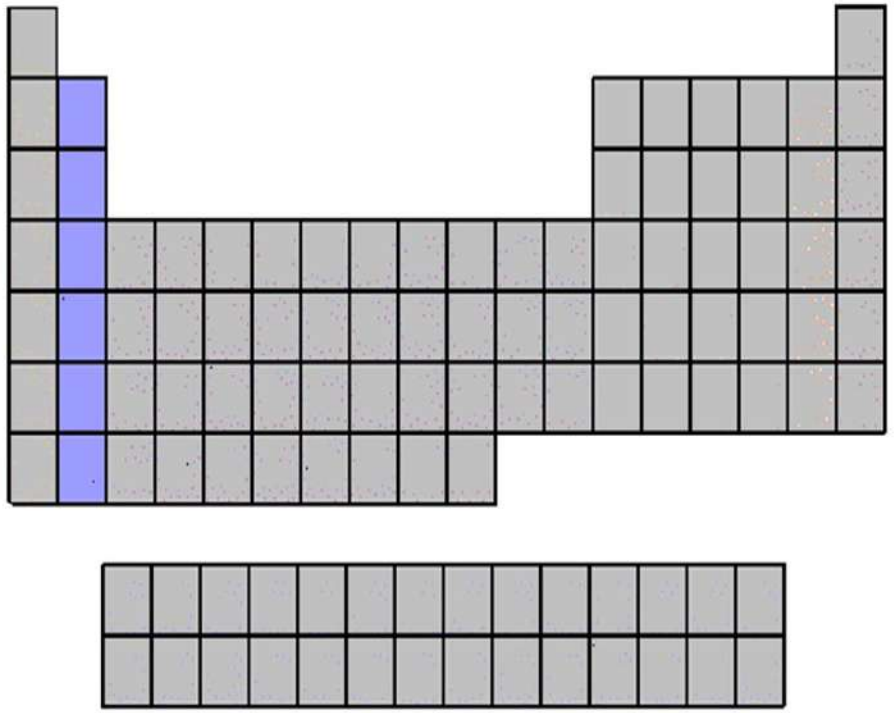
- They are the most reactive metals.
- They react violently with water.
- Alkali metals are never found as free elements in nature. They are always bonded with another element.



- Sodium and Potassium are stored in oil to keep them from reacting with oxygen and water in the air.
- Cesium is stored in glass tubes of argon gas (an inert gas).

ALKALINE EARTH METALS

- Atoms of the alkaline earths have two electrons in their outermost level, in other words, 2 valence electrons.
- They are never found uncombined in nature.
- They have general valence shell electronic configuration of $\mathbf{ns^2}$.



Beryllium 2 → 4 Be

Magnesium 3 → 12 Mg

Calcium 4 → 20 Ca

Strontium 5 → 38 Sr

Barium 6 → 56 Ba

Radium 7 → 88 Ra

- There is Mg in chrolophyll – $C_{55}H_{72}O_5N_4Mg$
- Calcium is in your bones, chalk, limestone, toothpaste, pearl (all as calcium carbonate).







HOMEWORK QUESTION:



Q.1 – Write electronic configuration for the given elements.

i. $_{30}Zn$

ii. $_{82}Pb$

iii. $_{54}Xe$

iv. $_{88}Ra$

Next Lecture:

1. Trends in the MPT.

Any Question



“It is not the answer that enlightens, but the question.”

- Eugene Ionesco