

Determining Number of Protons, Neutrons, and Electrons Practice

Symbol	Charge	Mass #	= Protons	+ Neutrons	Electrons
Mg	+3	25	12	13	9
Zn	-2	65	30	35	32
Rn	+2	224	86	138	84
Ra	-1	225	88	137	89
Sm	-2	149	62	87	64
Bk	0	251	97	154	97
B	+2	8	5	3	6
Ra	+3	225	88	137	85
Lu	0	174	71	103	71
Dy	-3	164	66	98	69
Am	+1	243	95	148	94
Sn	-2	118	50	68	52
Tb	+1	159	65	94	64
S	-1	33	16	17	17
H	0	1	1	0	1
Zr	+1	90	40	50	39
No	+3	252	102	150	99
S	+1	33	16	17	15
Fm	0	258	100	158	100
At	-3	213	85	128	88
Zr	+2	92	40	52	38
Cu	+3	63	29	34	26
Ta	-3	181	73	108	76

Electromagnetic Spectrum Problem Set

- A CD player uses light of frequency 3.85×10^{14} Hz to read the information on the disc.
 - What is the wavelength of the light? $\lambda = 7.79 \times 10^{-7} \text{ m}$
 - What portion of the electromagnetic spectrum does this wavelength correspond to? **Infrared**
 - What is the energy of one photon of this light? $E = 2.55 \times 10^{-19} \text{ J}$
- A sodium-vapor street light emits a yellow light at wavelength 589 nm.
 - What is the frequency of this wavelength? $\nu = 5.09 \times 10^{14} \text{ Hz}$
 - What is the energy change of the sodium atom involved in this emission? $E = 3.37 \times 10^{-19} \text{ J}$
- After absorbing x-rays of wavelength 53.7 nm, helium atoms emit light at wavelength 501.6 nm.
 - What is the frequency of the x-ray radiation? $\nu = 5.56 \times 10^{15} \text{ Hz}$
 - What is the energy of one photon of the x-ray radiation? $E = 3.68 \times 10^{-18} \text{ J}$
 - What portion of the electromagnetic spectrum does the light emitted from the helium atom correspond to? **Visible Light (Green)**
 - What is the frequency of the light emitted from the helium atom? $\nu = 5.98 \times 10^{14} \text{ Hz}$
 - What is the energy of one photon of this light? $E = 3.96 \times 10^{-19} \text{ J}$
- When an electron in a hydrogen atom falls from the third energy level to the second, a photon of wavelength 656 nm is emitted.
 - What is the frequency of this photon? $\nu = 4.57 \times 10^{14} \text{ Hz}$
 - What is the energy of this photon? $E = 3.03 \times 10^{-19} \text{ J}$
- When an electron in a hydrogen atom falls from the fourth energy level to the second, a photon of wavelength 486 nm is emitted.
 - What is the frequency of this photon? $\nu = 6.17 \times 10^{14} \text{ Hz}$
 - What is the energy of this photon? $E = 4.09 \times 10^{-19} \text{ J}$
 - Explain the energy difference between this photon and the photon in Problem 6b.
 $n=4 \rightarrow n=2$ requires more energy since jumping extra energy level
- Calculate the frequency of light emitted when each of the following energy transitions occurs in the hydrogen atom:
 - $n=3 \rightarrow n=2$ $\nu = 4.57 \times 10^{14} \text{ Hz}$
 - $n=4 \rightarrow n=1$ $\nu = 3.09 \times 10^{15} \text{ Hz}$
 - $n=2 \rightarrow n=1$ $\nu = 2.46 \times 10^{15} \text{ Hz}$
- Calculate the frequency of light that is absorbed when each of the following transitions occurs in the hydrogen atom:
 - $n=3 \rightarrow n=4$ $\nu = 1.76 \times 10^{15} \text{ Hz}$
 - $n=3 \rightarrow n=6$ $\nu = 1.22 \times 10^{15} \text{ Hz}$
 - $n=3 \rightarrow n=5$ $\nu = 1.35 \times 10^{15} \text{ Hz}$
- What wavelength of light must be absorbed by a hydrogen atom in order to raise it from the ground state to the third energy level? What is the energy of this light?

$n=1 \rightarrow n=3 \rightarrow 103 \text{ nm} = 1.03 \times 10^{-7} \text{ m}$

$\therefore \lambda = 1.03 \times 10^{-7} \text{ m}$

$c = \lambda \nu \rightarrow \nu = \frac{c}{\lambda} \rightarrow \nu = \frac{(3.00 \times 10^8 \text{ m/s})}{(1.03 \times 10^{-7} \text{ m})} \rightarrow \nu = 2.91 \times 10^{15} \text{ Hz}$

$E = h\nu \rightarrow E = (6.626 \times 10^{-34} \text{ Js})(2.91 \times 10^{15} \text{ Hz})$

$E = 1.93 \times 10^{-18} \text{ J}$

Write the electron configuration notation of the following elements:

- Calcium (Ca) 20 $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- Silicon (Si) 14 $1s^2 2s^2 2p^6 3s^2 3p^2$
- Zirconium (Zr) 40 $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$
- Barium (Ba) 56 $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2$
- Francium (Fr) 87 $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^2$

Write the orbital notation (orbital diagram) of the following elements:

- Boron (B) 5 $\uparrow \uparrow \uparrow _ _$
- Cobalt (Co) 27 $\uparrow \uparrow \uparrow$
- Copper (Cu) 29 $\uparrow \uparrow \uparrow$
- Chromium (Cr) 24 $\uparrow \uparrow \uparrow$
- Aluminum (Al) 13 $\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow _ _$

Write the noble gas notation of the following elements:

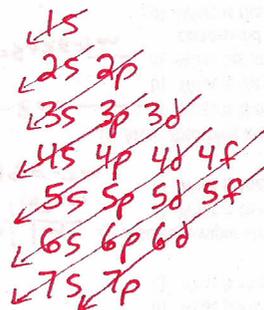
- Sulfur (S) 16 $[\text{Ne}] 3s^2 3p^4$
- Fluorine (F) 9 $[\text{He}] 2s^2 2p^5$
- Bromine (Br) 35 $[\text{Ar}] 4s^2 3d^{10} 4p^5$
- Tellurium (Te) 52 $[\text{Kr}] 5s^2 4d^{10} 5p^4$
- Iodine (I) 53 $[\text{Kr}] 5s^2 4d^{10} 5p^5$
- Astatine (At) 85 $[\text{Xe}] 6s^2 4f^{14} 5d^{10} 6p^5$
- Antimony (Sb) 51 $[\text{Kr}] 5s^2 4d^{10} 5p^3$
- Yttrium (Y) 39 $[\text{Kr}] 5s^2 4d^1$
- Tungsten (W) 74 $[\text{Xe}] 6s^2 4f^{14} 5d^4$
- Rubidium (Rb) 37 $[\text{Kr}] 5s^1$

Review: The valence electrons are the electrons in the outermost principle energy level (n). They are always the outermost "s" or "s and p" sub-shells. Since the maximum number of electrons possible in the "s" and "p" sub-shells is eight, there can be no more than eight valence electrons.

Directions: Write the element's Noble Gas Notation electron configuration, and determine its number of valence electrons (# of electrons in the "outermost" shell).

Example: Carbon: Noble Gas Notation electron configuration: $[\text{He}] 2s^2 2p^2$, therefore Carbon has 4 valence electrons.

- Fluorine - Noble Gas Notation: $[\text{He}] 2s^2 2p^5$ Valence Electrons: 7
- Phosphorus - Noble Gas Notation: $[\text{Ne}] 3s^2 3p^3$ Valence Electrons: 5
- Calcium - Noble Gas Notation: $[\text{Ar}] 4s^2$ Valence Electrons: 2
- Nitrogen - Noble Gas Notation: $[\text{He}] 2s^2 2p^3$ Valence Electrons: 5
- Iron - Noble Gas Notation: $[\text{Ar}] 4s^2 3d^6$ Valence Electrons: 2
- Argon - Noble Gas Notation: $[\text{Ne}] 3s^2 3p^6$ Valence Electrons: 8
- Potassium - Noble Gas Notation: $[\text{Ar}] 4s^1$ Valence Electrons: 1
- Helium - Noble Gas Notation: $[\text{He}]$ or $1s^2$ Valence Electrons: 2 - Exception
- Magnesium - Noble Gas Notation: $[\text{Ne}] 3s^2$ Valence Electrons: 2
- Sulfur - Noble Gas Notation: $[\text{Ne}] 3s^2 3p^4$ Valence Electrons: 6



Exceptions