

**4 • Atoms and Elements****4.1 WORKSHEET - ATOMS, IONS, ISOTOPES**

1. For each of the following, indicate whether it describes the proton (P), neutron (N), or electron (E). Each description may refer to one or more subatomic particle.

<u>  P  </u> Has a charge of +1.	<u>  P  </u> Determines the identity of an atom.
<u>  PN </u> Determines the mass of an atom.	<u>  E  </u> Has a mass of approximately $\frac{1}{1800}$ amu.
<u>  E  </u> Removed when forming a cation.	<u>  E  </u> Determines the size of an atom.
<u>  N  </u> Is different between isotopes.	<u>  PN </u> Located in the nucleus.

2. Write the following in isotopic notation.

(a) 35 protons, 42 neutrons, 35 electrons $^{77}\text{Br}$	(b) 47 protons, 64 neutrons, 47 electrons $^{111}\text{Ag}$
(c) 12 protons, 14 neutrons, 12 electrons $^{26}\text{Mg}$	(d) 19 protons, 21 neutrons, 18 electrons $^{40}\text{K}^+$
(e) 53 protons, 78 neutrons, 54 electrons $^{131}\text{I}^-$	(f) 7 protons, 8 neutrons, 10 electrons $^{15}\text{N}^{3-}$

3. Find the number of protons, neutrons, and electrons for each of the following.

(a) $^{37}\text{Cl}$ <b>17 p<sup>+</sup>, 20 n<sup>0</sup>, 17 e<sup>-</sup></b>	(b) $^{53}\text{Cr}$ <b>24 p<sup>+</sup>, 29 n<sup>0</sup>, 24 e<sup>-</sup></b>
(c) $^{19}\text{F}^-$ <b>9 p<sup>+</sup>, 10 n<sup>0</sup>, 10 e<sup>-</sup></b>	(d) $^{23}\text{Na}^+$ <b>11 p<sup>+</sup>, 12 n<sup>0</sup>, 10 e<sup>-</sup></b>
(e) $^{81}\text{Br}^-$ <b>35 p<sup>+</sup>, 46 n<sup>0</sup>, 36 e<sup>-</sup></b>	(f) $^{26}\text{Al}^{3+}$ <b>13 p<sup>+</sup>, 13 n<sup>0</sup>, 10 e<sup>-</sup></b>

4. What do the pairs have in common? What is/are different?  
 [Use: number of protons, number of electrons, number of neutrons, mass number, atomic number, net charge]

(a)  $^{208}\text{Pb}$  and  $^{210}\text{Pb}$

Similarities: **Same  $p^+$ ,  $e^-$ , atomic number, charge**

Differences: **Different  $n^0$ , mass number**

(b)  $^{14}\text{N}$  and  $^{14}\text{C}$

Similarities: **Same mass number, charge**

Differences: **Different  $p^+$ ,  $n^0$ ,  $e^-$ , atomic number**

(c)  $^{37}\text{Cl}^-$  and  $^{39}\text{K}^+$

Similarities: **Same  $e^-$ ,  $n^0$**

Differences: **Different  $p^+$ , atomic number, mass number, charge**

5. Complete the following table.

Atom	Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons	Net Charge
$^{31}\text{P}$	15	31	15	16	15	0
$^{18}\text{O}$	8	18	8	10	8	0
$^{39}\text{K}^+$	19	39	19	20	18	+1
$^{58}\text{Ni}^{2+}$	28	58	28	30	26	+2

6. In a sample of bromine (Br) atoms, approximately 51% are the  $^{79}\text{Br}$  isotope and 49% are the  $^{81}\text{Br}$  isotope. Calculate the average atomic mass of Br.

$$\frac{(51)(79) + (49)(81)}{100} = 79.98 \text{ amu}$$

7. In a sample of potassium (K) atoms, approximately 93% are the  $^{39}\text{K}$  isotope and 7% are the  $^{41}\text{K}$  isotope. Calculate the average atomic mass of K.

$$\frac{(93)(39) + (7)(41)}{100} = 39.14 \text{ amu}$$