EXERCISES

1. Fill in the following table for each of the isotopes listed.

Symbol	~~Atomic~~ Mass	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
a) $^{23}_{11}Na$	23	11	11	12	11
b) $^{20}_{10}Ne$	20	10	10	10	10
c) $^{201}_{80}Hg$	201	80	80	121	80
d) $^{65}_{30}Zn$	65	30	30	35	30
e) $^{27}_{13}Al$	27	13	13	14	13

2. Complete the following table.

Symbol	~~Atomic~~ Mass	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
a) ^{84}Kr	84	36	36	48	36
b) ^{80}Br	80	35	35	45	35
c) $^{127}I^-$	127	53	53	74	54
d) ^{59}Co	59	27	27	32	27
e) ^{66}Zn	66	30	30	36	30
f) $^{112}Cd^{2+}$	112	48	48	64	46
g) ^{88}Sr	88	38	38	50	36
h) $X^{2-}_{127}Tc$	127	52	52	75	54
i) $X^{3+}_{103}Rh^{+3}$	103	45	45	58	42
j) $X^{-3}_{75}As^{-3}$	75	33	~~36~~ 33	42	36

3. The following mixtures of isotopes are found in nature. Calculate the exp atomic mass of a sample of each mixture.

Answers

1. a) 23, 11, 11, 12, 11
   b) 20, 10, 10, 10, 10
   c) 201, 80, 80, 121, 80
   d) 65, 30, 30, 35, 30
   e) 27, 13, 13, 14, 13
2. a) ^{84}Kr, 36, 48
   b) ^{80}Br, 80, 35
   c) $^{127}I^-$, 53, 74
   d) ^{59}Co, 59, 27
   e) ^{66}Zn, 66, 30, 30, 30
   f) $^{112}Cd^{2+}$, 48, 48, 64, 46
   g) ^{88}Sr, 88, 38
   h) $^{127}Te^{2-}$, 127, 52, 52
   i) $^{103}Rh^{3+}$, 45, 45, 58
   j) $^{75}As^{3-}$, 75, 33, 36
3. a) 10.8 u
   b) 69.8 u
   c) 108.0 u
   d) 72.7 u
   e) 65.5 u
   f) 91.3 u
   g) 95.9 u
4. a) 55% ^{107}Ag, 45% ^{109}Ag
   b) 6% ^{6}Li, 94% ^{7}Li
   c) 90% ^{20}Ne, 10% ^{22}Ne
   d) 55% ^{79}Br, 45% ^{81}Br
   e) 10% ^{113}In, 90% ^{115}In

answers

- a) $^{10}B = 18.8\%$, $^{11}B = 81.2\%$
- b) $^{69}Ga = 60.0\%$, $^{71}Ga = 40.0\%$
- c) $^{107}Ag = 51.8\%$, $^{109}Ag = 48.2\%$
- d) $^{70}Ge = 20.5\%$, $^{72}Ge = 27.4\%$, $^{73}Ge = 7.8\%$, $^{74}Ge = 36.5\%$, $^{76}Ge = 7.8\%$
- e) $^{64}Zn = 48.9\%$, $^{66}Zn = 27.8\%$, $^{67}Zn = 4.1\%$, $^{68}Zn = 18.6\%$, $^{70}Zn = 0.6\%$
- f) $^{90}Zr = 51.5\%$, $^{91}Zr = 11.2\%$, $^{92}Zr = 17.1\%$, $^{94}Zr = 17.4\%$, $^{96}Zr = 2.8\%$
- g) $^{92}Mo = 15.8\%$, $^{94}Mo = 9.0\%$, $^{95}Mo = 15.7\%$, $^{96}Mo = 16.5\%$, $^{97}Mo = 9.5\%$, $^{98}Mo = 23.8\%$, $^{100}Mo = 9.6\%$

~~Calculate the percentage of each isotope present in the following mixtures.~~

a) a mixture of ^{107}Ag and ^{109}Ag has an average mass of 107.9 u

b) a mixture of ^{6}Li and ^{7}Li has an average mass of 6.94 u

c) a mixture of ^{20}Ne and ^{22}Ne has an average mass of 20.2 u

d) a mixture of ^{79}Br and ^{81}Br has an average mass of 79.9 u

e) a mixture of ^{113}In and ^{115}In has an average mass of 114.8 u

Name _____ Date _____

Atomic Structure

An atom is composed of protons, neutrons, and electrons. The protons and neutrons are found in the nucleus of the atom. The electrons are found in the electron cloud, which is an area that surrounds the nucleus.

A standard periodic table of elements can provide you with a great deal of insight into the composition of an atom. The atomic number is equal to the number of protons. The mass number is equal to the number of protons and neutrons. In a neutral atom, the number of protons and electrons are equal. When an atom is in a charged state (ion), the charge indicates the imbalance between protons and electrons. Too many electrons produces a negative charge, too few electrons results in a positive charge.

Example:

O^{-2}	Explanation:
Mass Number = 16 Atomic Number = 8 8 protons, 8 neutrons (16-8), 10 electrons (8+2)	Protons = Atomic Number Neutrons = Mass Number – Atomic Number Electrons = Charge (+/-) Proton Number.

Complete the following chart.

Element or Ion	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
^{7}Li	3	7	3	4	3
$^{137}Ba^{+2}$	56	137	56	81	54
$^{27}Al^{+3}$	13	27	13	14	10
$^{9}F^{-}$	9	19	9	10	10
^{80}Br	35	80	35	45	35
$^{101}Ru^{+3}$	44	101	44	57	41
$^{52}Cr^{+2}$	24	52	24	28	22
$^{32}S^{-2}$	16	32	16	16	18
^{28}Si	14	28	14	14	14
^{12}C	6	12	6	6	6
$^{31}P^{-3}$	15	31	15	16	18

ATOMIC STRUCTURE WORKSHEET

Complete the table. There is enough information given for each element to determine all missing numbers.

Symbol	Atomic Number	~~Mass Number~~	Number of Protons	Number of Electrons	Number of Neutrons
^{22}Na	11	22	11	11	12
^{39}K	19	39	19	19	20
^{88}Sr	38	88	38	38	50
^{19}F	9	19	9	9	10
^{40}Ca	20	40	20	20	20
^{119}Sn	50	119	50	50	69
^{127}I	53	127	53	53	74
^{24}Mg	12	24	12	12	12
^{108}Ag	47	108	47	47	61
^{1}H	1	1	1	1	0
S	16	32	16	16	16
^{56}Fe	26	56	26	26	30
^{27}Al	13	27	13	13	14
He	2	4	2	2	2
^{52}Cr	24	52	24	24	28

Which atomic particle determines the identity of the atom?

proton

it's a mass #

ATOMIC STRUCTURE WORKSHEET

Complete the table. There is enough information given for each element to determine all missing numbers.

Symbol	Atomic Number	Mass Number	Number of Protons	Number of Electrons	Number of Neutrons
^{23}Na	11	23	11	11	12
^{40}K	19	40	19	19	21
$^{16}O^{2-}$	8	16	8	10	8
$^{14}N^{3-}$	7	14	7	10	7
$^{35}Cl^{1-}$	17	35	17	18	18
^{32}S	16	32	16	16	16

1. Please use the following table to calculate the average atomic mass of chlorine.

Isotope	% Abundance	Mass (amu)
^{35}Cl	75.78%	34.969
^{37}Cl	24.22%	36.966

$$\frac{75.78(35) + 24.22(37)}{100 \text{ atoms}} = 35.533...$$

OR

35.4844 amu

2. Ralderium (Cv) has three naturally occurring isotopes. Ralderium is 74.655% ^{44}Cv, which has an atomic mass of 43.064 amu, 24.958% ^{46}Cv, which has a mass of 46.125 amu, and 0.387% ^{48}Cv, which has an atomic mass of 47.982 amu. Please calculate the average atomic mass of Ralderium.

$$\frac{74.655(43.064) + 24.958(46.125) + 0.387(47.982)}{100 \text{ atoms}}$$

$$= 44.0326....$$

3) Fill in the table below. Remember to EITHER fill in Mass Number or Atomic Mass - NOT BOTH. (23 marks; 1/2 a mark each)

Symbol	Mass Number	Atomic Mass	Protons	Neutrons	Electrons	Charge	Anion, Cation or Atom
$^{90}Sr^{2+}$	90		38	52	36	+2	cation
Fe^{2+}		55.845	26	30	24	+2	cation
Os^{2-}		190.23	76	114	78	-2	anion
^{129}Xe	129		54	75	54	0	atom
^{100}Sb	100		51	49	51	0	atom
^{103}Sb	103		51	52	51	0	atom
$^{204}Tl^{+3}$	204		81	123	78	+3	cation
Se^{-2}		78.96	34	45	36	-2	anion

DESCRIBE THE EXPERIMENTAL OBSERVATIONS MADE BY THOMSON AND OUTLINE WHAT IT TOLD HIM ABOUT THE ATOM.

- saw a beam of particles
  → meant that atoms were made up of particles

- beam bent towards ⊕ end of magnet.
  → particles inside the atom were negative

DESCRIBE THE EXPERIMENTAL OBSERVATIONS MADE BY RUTHERFORD AND OUTLINE WHAT IT TOLD HIM ABOUT THE ATOM.

- most α particles went straight through.
  → atoms are mostly empty space

- some particles had path bent a bit
  → came close to something positive

- a few particles bounced straight back.
  → hit something big & dense