

SI Worksheet (Answers)

2/10/22

Agenda:

Kahoot on parts of periodic table

Worksheet

1. Write the corresponding name or symbol

Name	Symbol
Silicon	Si
Sulfur	S
Phosphorus	P
Sodium	Na
Magnesium	Mg
Potassium	K
Chlorine	Cl
Calcium	Ca
Argon	Ar
Aluminum	Al

Name	Symbol
Boron	B
Beryllium	Be
Carbon	C
Fluorine	F
Hydrogen	H
Helium	He
Lithium	Li
Nitrogen	N
Neon	Ne
Oxygen	O

2. Is the following elements cations or anions? Did they lose/gain electrons or protons?

Na^+
Cation/lost 1 electron

O^{2-}
anion/gained 2 electrons

Mg^{2+}
Cation/gained 2 electrons

F^-
anion gained 1 electron

C^{4+}
cation lost 4 electrons

Br^-
anion gained 1 electron

P^{3-}
anion gained 3 electrons

*remember an element can NEVER lose/gain protons, only electrons!!

3. Fill in the table

Element Symbol	Shorthand Representation ${}^A\text{X}$	X-A	${}^A_Z\text{X}$	Atomic Number	Mass Number	# of protons	# of neutrons	# of electrons
F	${}^{19}\text{F}$	F-19	${}^{19}_9\text{F}$	9	19	9	10	9
Ca	${}^{40}\text{Ca}$	Ca-40	${}^{40}_{20}\text{Ca}$	20	40	20	20	20
Si	${}^{29}\text{Si}$	Si-29	${}^{29}_{14}\text{Si}$	14	29	14	15	14
Au	${}^{197}\text{Au}$	Au-197	${}^{197}_{79}\text{Au}$	79	197	79	118	79
Mg^{2+}	${}^{25}\text{Mg}^{2+}$	Mg^{2+} -25	${}^{25}_{12}\text{Mg}^{2+}$	12	25	12	13	10
O^-	${}^{16}\text{O}^-$	O^- -16	${}^{16}_8\text{O}^-$	8	16	8	8	9

4. Calculating atomic weight

$$\text{atomic weight} = \left\{ \left(\text{atomic mass of each isotope} \right) \times \left(\% \text{ abundance of isotope} \right) \right\}$$

- a. Naturally occurring europium (Eu) consists of two isotopes. ${}^{151}\text{Eu}$ (atomic mass of 150.919 amu) has an abundance of 48.03% and ${}^{153}\text{Eu}$ (atomic mass of 152.921 amu) has an abundance of 51.97%. What is the atomic weight of europium?

Atomic mass (amu)	${}^{151}\text{Eu}$ 150.919	${}^{153}\text{Eu}$ 152.921
Percent abundance	48.03%	51.97%

atomic weight = ?

$$\begin{aligned} \text{atomic weight} &= \left[(150.919) \times (48.03) \right] + \left[(152.921) \times (51.97) \right] \\ &= 72.49 \text{ amu} + 79.47 \text{ amu} \\ &= 151.96 \text{ amu} \end{aligned}$$

- b. Nitrogen is made up of two isotopes, ${}^{14}\text{N}$ (atomic mass 14.00 amu) and ${}^{15}\text{N}$ (atomic mass of 15.00). Given nitrogen's atomic weight of 14.007, what is the percent abundance of each isotope?

	${}^{14}\text{N}$	${}^{15}\text{N}$
atomic mass (amu)	14.00	15.00
% abundance	x	1-x

atomic weight 14.007

$$14.007 = (14.00x) + (15.00(1-x))$$

$$14.007 = 14.00x + 15.00 - 15.00x$$

$$14.007 = 15.00 - x$$

$$-15.00 \quad -15.00$$

$$-0.99 = -x$$

0.99 = x
percent abundance of ${}^{14}\text{N}$ (99%)

Then plug into 1-x

$$1 - 0.99 = 0.01$$

percent abundance of ${}^{15}\text{N}$ (1%)

- c. Naturally occurring silicon consists of 3 isotopes, ^{28}Si , ^{29}Si and ^{30}Si , whose atomic masses are 27.9769, 28.9765 and 29.9738 amu respectively. The most abundant isotope is ^{28}Si which accounts for 92.23% of naturally occurring silicon. Given that the observed atomic mass of silicon is 28.0855 calculate the percentages of ^{29}Si and ^{30}Si in nature.

	^{28}Si	^{29}Si	^{30}Si
atomic mass (amu)	27.9769	28.9765	29.9738
percent abundance	92.23%	x	y

Let x = isotopic abundance of ^{29}Si
 Let y = isotopic abundance of ^{30}Si

atomic weight = 28.0855

1) write your equations

$$(27.9769)(.9223) + (28.9765)(x) + (29.9738)(y) = 28.0855$$

AND

$$0.9223 + x + y = 1.000$$

2) rearrange, so equation can be plugged in

$$\begin{array}{r} 0.9223 + x + y = 1.000 \\ - 0.9223 - x \quad - 0.9223 - x \end{array}$$

$$y = 0.0777 - x$$

3) plug in to first equation + solve for x

$$(27.9769)(.9223) + 28.9765x + (29.9738)(0.0777 - x) = 28.0855$$

$$25.80 + 28.9765x + 2.33 - 29.9738x = 28.0855$$

$$-0.9973x + 28.13 = 28.0855$$

$$-0.9973x = -0.041$$

$$x = 0.0401 = 4.01\% \text{ (w/ sig figs } \sim 4\%)$$

4) plug in x, to get y

$$y = 0.0777 - 0.0401$$

$$y = 0.0376 = 3.76\%$$

Check

$$4.01 + 3.76 + 92.23 = 100 \checkmark$$

*I may have rounded differently! If your answer is close and you set up the problem correctly, Nice job!!