

Homework Solutions

17. How many neutrons are in each atom?

- a. ${}^{16}_8\text{O}$ b. ${}^{32}_{16}\text{S}$ c. ${}^{108}_{47}\text{Ag}$
d. ${}^{80}_{35}\text{Br}$ e. ${}^{207}_{82}\text{Pb}$

18. Use Table 4.2 to express the composition of each atom in shorthand form.

- a. carbon-12 b. fluorine-19 c. beryllium-9

$$\text{Mass\#} = p^+ + n^0$$

17. a. 8 b. 16 c. 61 d. 45 e. 125

18. a. ${}^{12}_6\text{C}$ b. ${}^{19}_9\text{F}$ c. ${}^9_4\text{Be}$ Mass # = 9

$$\text{AM} = 9.01 \text{ amu}$$

19. Three isotopes of oxygen are oxygen-16, oxygen-17, and oxygen-18. Write the symbol for each, including the atomic number and mass number.
20. Three isotopes of chromium are chromium-50, chromium-52, and chromium-53. How many neutrons are in each isotope, given that chromium has an atomic number of 24?

19. ${}^{16}_8\text{O}$, ${}^{17}_8\text{O}$, ${}^{18}_8\text{O}$ ← shorthand

20. Chromium-50 has 26 neutrons; chromium-52 has 28 neutrons; chromium-53 has 29 neutrons.

long hand — p+ + n^o

Element	Isotopes
Carbon (C)	$^{12}_6\text{C}$, $^{13}_6\text{C}$, $^{14}_6\text{C}$
Nitrogen (N)	$^{14}_7\text{N}$, $^{15}_7\text{N}$,
Oxygen (O)	$^{16}_8\text{O}$, $^{17}_8\text{O}$, $^{18}_8\text{O}$
Chlorine(Cl)	$^{35}_{17}\text{Cl}$, $^{37}_{17}\text{Cl}$
Uranium (U)	$^{235}_{92}\text{U}$, $^{238}_{92}\text{U}$, $^{239}_{92}\text{U}$
Sulphur (S)	$^{32}_{16}\text{S}$, $^{33}_{16}\text{S}$, $^{34}_{16}\text{S}$, $^{36}_{16}\text{S}$

Uranium is a very important element because it provides us with nuclear fuel used to generate electricity in nuclear power stations. It is also the major material from which other synthetic transuranium elements are made.

Naturally occurring uranium consists of 99% uranium-238 and 1% uranium-235. Uranium-235 is the only naturally occurring fissionable fuel (a fuel that can sustain a chain reaction). Uranium fuel used in nuclear reactors is enriched with uranium-235. The chain reaction is carefully controlled using neutron-absorbing materials. The heat generated by the fuel is used to create steam to turn turbines and generate electrical power.



C-12 isotope of carbon is most abundant isotope of carbon and mainly found in all living organisms.

C-14 is a radioactive isotope which is mainly used in carbon dating

1. Cobalt 60 - used for Teletherapy
2. Iodine 131- used to treat Thyroid Cancer
3. Iridium 192- used in head and breast
4. Strontium 89 and Samarium 153 - used for relief of Cancer induced Bone pain
5. Rhenium 186- newer product for above mentioned usage.
6. Lutetium-177 dotatate or octreotate - used for neuroendocrine tumors.
7. Boron 10 - for malignant brain tumors in Boron neutron capture therapy.
8. Bismuth 213 and Lead 212- for targeted Alpha therapy (It is a newer treatment for Ovarian, pancreatic and melanoma c:

Table 4.3

Natural Percent Abundance of Stable Isotopes of Some Elements

Name	Symbol	Natural percent abundance	Mass (amu)	Average atomic mass
Hydrogen	${}^1_1\text{H}$	99.985	1.0078	1.0079
	${}^2_1\text{H}$	0.015	2.0141	
	${}^3_1\text{H}$	negligible	3.0160	
Helium	${}^3_2\text{He}$	0.0001	3.0160	4.0026
	${}^4_2\text{He}$	99.9999	4.0026	
Carbon	${}^{12}_6\text{C}$	98.89	12.000	12.011
	${}^{13}_6\text{C}$	1.11	13.003	
Nitrogen	${}^{14}_7\text{N}$	99.63	14.003	14.007
	${}^{15}_7\text{N}$	0.37	15.000	
Oxygen	${}^{16}_8\text{O}$	99.759	15.995	15.999
	${}^{17}_8\text{O}$	0.037	16.995	
	${}^{18}_8\text{O}$	0.204	17.999	
Sulfur	${}^{32}_{16}\text{S}$	95.002	31.972	32.06
	${}^{33}_{16}\text{S}$	0.76	32.971	
	${}^{34}_{16}\text{S}$	4.22	33.967	
	${}^{36}_{16}\text{S}$	0.014	35.967	
Chlorine	${}^{35}_{17}\text{Cl}$	75.77	34.969	35.453
	${}^{37}_{17}\text{Cl}$	24.23	36.966	

Atomic Mass

How do you calculate the atomic mass of an element?

The **atomic mass** of an element is a weighted average mass of the atoms in a naturally occurring sample of the element.

A weighted average mass reflects both the mass and the relative abundance of the isotopes as they occur in nature.

Element	Atomic Mass	Mass#	Isotope?
a) Manganese	54.94 amu	$25 \text{ p}^+ + 32 \text{ n}^0 = 55$	manganese-55
b) potassium	39.10 amu	$19 \text{ p}^+ + 20 \text{ n}^0 = 39$	potassium-39

Using Atomic Mass to Determine the Relative Abundance of Isotopes

The atomic mass of copper is 63.546 amu. Which of copper's two isotopes is more abundant: copper-63 or copper-65?




↳ Copper-63 must be more abundant to allow the atomic mass to stay close to 63.

21. Boron has two isotopes: boron-10 and boron-11. Which is more abundant, given that the atomic mass of boron is 10.81?

Chlorine has two isotopes, **chlorine-35** [relative abundance of 75.77%] and **chlorine-37** [relative abundance of 24.23%] Calculate the atomic mass of chlorine

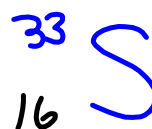
Show calculations:

Chlorine-35	Chlorine-37
75.77% of 35	24.23% of 37
0.7577×35	0.2423×37
26.5195	8.9651
	
35.48 amu	

1. Isotopes of an element have the same
 - A. mass number.
 - B. different atomic numbers.
 - C. the same number of protons but different numbers of neutrons.
 - D. the same number of protons but different numbers of electrons.

2. How many neutrons are in sulfur-33?

- A. 16 neutrons
- B. 33 neutrons
- C. 17 neutrons
- D. 32.06 neutrons



1) neutrons 17

2) is this the most abundant isotope of sulfur? why or why not?

Atomic mass of sulfur is 32.07 amu therefore the most abundant isotope of sulfur is most likely sulfur-32

3. If sulfur contained 90.0% sulfur-32 and 10.0% sulfur-34, its atomic mass would be

A. 32.2 amu.

B. 32.9 amu.

C. 33.0 amu.

D. 35.4 amu.

sulfur-32	sulfur-34
90% of 32	10% of 34
0.9×32	0.1×34
28.8	3.4
32.2 amu	

Homework

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25,26,27,30,31,32,33

Worksheet!