

4A**Atomic Structure**
Extra Practice Problems**What the Numbers Mean**

Numbers, numbers everywhere! The numbers associated with atoms and atomic structure are: atomic number, mass number, and atomic mass. This worksheet gives practice in using these numbers.

Example A

What is the atomic number of an element that contains 19 protons, 19 electrons, and 20 neutrons?

4.4

Solution Since the atomic number is the number of protons in the nucleus of the atom of that element, the atomic number of the element must be 19 (the number of protons).

You Try It

1. What is the atomic number of an element that contains 12 protons, 12 electrons, and 13 neutrons?

4.4

Your Solution**Example B**

Calculate the mass number of the potassium atom discussed in Example A.

4.5

Solution The mass number is the total number of protons and neutrons in the nucleus. These two types of particles contribute to the bulk of the mass in any atom. Thus this atom has a mass number of 39 (19 protons and 20 neutrons).

You Try It

2. Calculate the mass number of the carbon atom containing 6 protons and 6 neutrons.

4.5

Your Solution**Example C**

Use the following information to determine the atomic mass of chlorine. Two isotopes are known: chlorine-35 (mass = 35.0 amu) and chlorine-37 (mass = 37.0 amu). The relative abundances are 75.4% and 24.6%, respectively.

4.7

Solution Recall that the text defines atomic mass as the weighted average of the masses of the isotopes of that element. To solve the problem:

Contribution of masses by each isotope	= mass of isotope × relative abundance (expressed as a decimal fraction)
= 35.0 amu	× 0.754 = 26.4 amu
= 37.0 amu	× 0.246 = 9.10 amu

The sum of the individual isotope mass contributions will equal the atomic mass.

$$26.4 \text{ amu} + 9.10 \text{ amu} = 35.5 \text{ amu}$$

You Try It

3. Use the following information to determine the atomic mass of carbon. Two isotopes are known: carbon-12 (mass = 12.00 amu) and carbon-13 (mass = 13.00 amu). Their relative abundances are 98.9% and 1.10%, respectively.

4.7

Your Solution

Problems For You To Try

4. How many protons are found in an atom of each of the following?

4.4

- a. boron _____ b. sulfur _____ c. strontium _____ d. gold _____

5. Name the element which has:

- a. 1 proton (p^+) _____ c. 4 n^0 , 3 p^+ , 3 e^- _____
 b. 30 n^0 , 26 e^- , 26 p^+ _____ d. 18 e^- , 22 n^0 , 18 p^+ _____

6. Complete the following table:

4.5

Element Name	Symbol	Number of Protons	Number of Electrons	Number of Neutrons	Atomic Number	Mass Number
_____	_____	25	_____	30	_____	_____
_____	_____	_____	11	_____	_____	23
_____	_____	35	_____	45	_____	_____
_____	_____	_____	_____	_____	39	89
_____	_____	_____	33	_____	_____	75
_____	Ac	_____	_____	_____	_____	227

7. Determine the atomic mass of an element which has 2 isotopes with mass numbers of 6 (mass = 6.02) and 7 (mass = 7.02). The relative abundances are 7.42% and 92.6%, respectively.

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Extra Practice Problems

KEY

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Example A

What is the atomic number of an element that contains 19 protons, 19 electrons, and 20 neutrons?

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Solution Since the atomic number is the number of protons in the nucleus of the atom of that element, the atomic number of the element must be 19 (the number of protons).

You Try It

1. What is the atomic number of an element that contains 12 protons, 12 electrons, and 13 neutrons?

4.4

Your Solution

$$\text{ATOMIC \#} = \text{PROTONS} = \text{(12)}$$

Example B

Calculate the mass number of the potassium atom discussed in Example A.

4.5

Solution The mass number is the total number of protons and neutrons in the nucleus. These two types of particles contribute to the bulk of the mass in any atom. Thus this atom has a mass number of 39 (19 protons and 20 neutrons).

You Try It

2. Calculate the mass number of the carbon atom containing 6 protons and 6 neutrons.

4.5

Your Solution

$$\text{MASS \#} = \text{PROTONS} + \text{NEUTRONS} = 6 + 6 = \text{(12)}$$

Example C

Use the following information to determine the atomic mass of chlorine. Two isotopes are known: chlorine-35 (mass = 35.0 amu) and chlorine-37 (mass = 37.0 amu). The relative abundances are 75.4% and 24.6%, respectively.

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Solution Recall that the text defines atomic mass as the weighted average of the masses of the isotopes of that element. To solve the problem:

Contribution of masses by each isotope	= mass of isotope	relative abundance (expressed as a decimal fraction)
	= 35.0 amu	× 0.754 = 26.4 amu
	= 37.0 amu	× 0.246 = 9.10 amu

The sum of the individual isotope mass contributions will equal the atomic mass.

$$26.4 \text{ amu} + 9.10 \text{ amu} = 35.5 \text{ amu}$$

You Try It

3. Use the following information to determine the atomic mass of carbon. Two isotopes are known: carbon-12 (mass = 12.00 amu) and carbon-13 (mass = 13.00 amu). Their relative abundances are 98.9% and 1.10%, respectively.

4.7

Your Solution

$$(12.00 \text{ AMU})(.989) = 11.9 \text{ AMU}$$

$$(13.00 \text{ AMU})(.0110) = .143 \text{ AMU} +$$

$$12.0 \text{ AMU}$$

Problems For You To Try

4. How many protons are found in an atom of each of the following?

4.4

a. boron 5 b. sulfur 16 c. strontium 38 d. gold 79

5. Name the element which has:

a. 1 proton (p^+) HYDROGEN c. 4 n^0 , 3 p^+ , 3 e^- LITHIUM
 b. 30 n^0 , 26 e^- , 26 p^+ IRON d. 18 e^- , 22 n^0 , 18 p^+ ARGON

6. Complete the following table:

4.5

Element Name	Symbol	Number of Protons	Number of Electrons	Number of Neutrons	Atomic Number	Mass Number
<u>Manganese</u>	<u>Mn</u>	<u>25</u>	<u>25</u>	<u>30</u>	<u>25</u>	<u>55</u>
<u>Sodium</u>	<u>Na</u>	<u>11</u>	<u>11</u>	<u>12</u>	<u>11</u>	<u>23</u>
<u>Bromine</u>	<u>Br</u>	<u>35</u>	<u>35</u>	<u>45</u>	<u>35</u>	<u>80</u>
<u>Yttrium</u>	<u>Y</u>	<u>39</u>	<u>39</u>	<u>50</u>	<u>39</u>	<u>89</u>
<u>Arsenic</u>	<u>As</u>	<u>33</u>	<u>33</u>	<u>42</u>	<u>33</u>	<u>75</u>
<u>Actinium</u>	<u>Ac</u>	<u>89</u>	<u>89</u>	<u>138</u>	<u>89</u>	<u>227</u>

7. Determine the atomic mass of an element which has 2 isotopes with mass numbers of 6 (mass = 6.02) and 7 (mass = 7.02). The relative abundances are 7.42% and 92.6%, respectively.

$$(6.02 \text{ AMU})(.0742) = .447 \text{ AMU}$$

$$(7.02 \text{ AMU})(.926) = 6.50 \text{ AMU} +$$

$$6.95 \text{ AMU}$$