Directed Reading for Content Mastery

Section 3 ▪ The Periodic Table

Periodic Table of the Elements

Key

6
C
Carbon
12.011

← Atomic number
← Element's symbol
← Element's name
← Atomic mass

1—New designation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H Hydrogen 1.008																	2 He Helium 4.003
2	3 Li Lithium 6.941	4 Be Beryllium 9.0122											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
3	11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.98	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
4	19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.9059	40 Zr Zirconium 91.224	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium 97.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.60	53 I Iodine 126.904	54 Xe Xenon 131.29
6	55 Cs Cesium 132.905	56 Ba Barium 137.327	57 La Lanthanum 138.906	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium 208.982	85 At Astatine 209.987	86 Rn Radon 222.018
7	87 Fr Francium 223.020	88 Ra Radium 226.025	89 Ac Actinium 227.028	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 Uun Ununnilium (269)	111 Uuu Unununium (272)	112 Uub Ununbium (277)		114 Uuq Ununquadium (285)		116 Uuh Ununhexium (289)		118 Uuo Ununodium (293)

Rare-Earth Elements

Lanthanide Series	58 Ce Cerium 104.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.965	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
Actinide Series	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium 252.083	100 Fm Fermium 257.095	101 Md Mendelevium 258.099	102 No Nobelium 259.101	103 Lr Lawrencium 260.105

Directions: *Use the periodic table above to answer the following questions.*

1. List two types of information that are given in each box of this periodic table.

a. _____

b. _____

2. In this table, where are the metals located? _____

3. Where are the nonmetals located? _____

4. What are the elements in Groups 3 through 12 called? _____

5. What are the elements called that are next to the stairstep-shaped line on the right side of the table? _____

6. What do we call the letter or letters that represents an element?

_____

7. How many elements are included in the modern periodic table? _____

8. What name is given to the elements in Group 18? _____

Meeting Individual Needs

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SECTION 3 Enrichment

Predicting an Element's Group and Period

Several scientists, including Newlands, Meyer, and Mendeleev worked on classification systems that grouped elements according to their properties. They found that these properties repeated in a regular or periodic manner. This fact was used to predict properties of undiscovered elements.

Review electron arrangement from your textbook. In Table 1, write the maximum number of electrons that can fill each energy level on the blanks in the table heading. Write the total number of electrons for each element in the first column labeled Total. For each element, assign the correct number of electrons to each energy level. Complete Table 2 by using the information from the six elements studied.

Table 1

Element		Electrons		
	Total	Level 1	Level 2	Level 3
1. Argon				
2. Carbon				
3. Helium				
4. Lithium				
5. Silicon				
6. Sodium				

Table 2

Element	Energy level of outer electrons	Located in period	Number of outer electrons	Located in group
7. Ar				
8. C				
9. He				
10. Li				
11. Si				
12. Na				

13. How is the element's period related to the number of energy levels over which its electrons are spread? _____

14. How can you predict an element's group and period? _____

_____

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Note-taking Worksheet

Properties of Atoms and the Periodic Table

Section 1 Structure of the Atom

A. _____ are abbreviated in scientific shorthand—first letter or two of element's name

B. _____—smallest piece of matter that still has the properties of the element

1. _____ have electrical charge of 1+.
2. _____ do not have an electrical charge.
3. _____ have electrical charge of 1-.
4. Protons and neutrons are in the _____ of an atom; electrons surround the nucleus.

C. Protons and neutrons are made up of smaller particles called _____.

1. Six quarks are known to exist; the sixth is called the _____ quark.

D. Scientists use scaled-up _____ to represent atoms.

1. Early models of atoms used a solid _____.
2. Current _____ model shows electrons traveling in specific energy levels around a nucleus of protons and neutrons.

Section 2 Masses of Atoms

A. _____—composed mostly of the protons and neutrons in the nucleus

1. Unit of measurement for atomic particles is _____ (amu) which is one-twelfth the mass of a carbon atom containing six protons and six neutrons.
2. _____—the number of protons in an atom; number of protons also identifies the element
3. The sum of the number of protons and neutrons in the nucleus of an atom is the _____.

B. _____—atoms of the same element with different numbers of neutrons

1. Different isotopes have different _____.
2. Number of _____ is equal to mass number minus atomic number.
3. Name of _____ followed by mass number identifies the isotope.
4. _____ is the weighted-average mass of an element's isotopes.
5. Average atomic mass is closest to its most _____ isotope.

Meeting Individual Needs

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Note-taking Worksheet (continued)

Section 3 The Periodic Table

A. Elements are organized in the _____ by increasing atomic number.

1. In the late 1800's, Dmitri Medeleev devised the first periodic table based on _____.
2. In 1913, Henry G. J. Moseley arranged the elements by _____ rather than atomic mass.

B. Vertical columns in the periodic table are _____ of elements with similar properties.

1. Elements in the same group have the same number of _____ in their outer energy level.
2. Each of the seven energy levels can have a _____ number of electrons.
   - **a.** Energy level one can contain at most _____ electrons.
   - **b.** Energy level two can contain at most _____ electrons.
3. Each row in the periodic table ends when an outer energy level is _____.
4. _____ use the element symbol and dots to represent outer energy level electrons.

C. _____—horizontal rows of elements that contain increasing numbers of protons and electrons.

1. Elements are _____ as metals, nonmetals, or metalloids (semimetals).
2. Elements are _____ in laboratories all over the world.

D. The _____ elements exist all over the universe.

1. Hydrogen and helium are the _____ of other naturally occurring elements.
2. _____ spread heavier elements throughout the universe.

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SECTION 1 Reinforcement

Structure of the Atom

Directions: *Answer the following questions on the lines provided.*

1. How is the chemical symbol of an element determined?

_____

_____

2. What are atoms composed of?

_____

_____

3. Are electrons, protons, or neutrons the smallest particles? If not, what are?

_____

_____

4. How many types of quarks are there and what is the name of one of them?

_____

_____

5. Why do scientists use models to study atoms?

_____

_____

6. Why has the atomic model changed over time?

_____

_____

7. Why is the current atomic model called the "Electron Cloud Model"?

_____

Directions: *Match the term in Column I with the definition in Column II. Write the letter of the correct definition in the blank at the left.*

Column I

_____ **8.** electron

_____ **9.** neutron

_____ **10.** nucleus

_____ **11.** proton

_____ **12.** quark

Column II

a. positively charged particle

b. negatively charged particle

c. neutral particle

d. smaller particles that make up protons and neutrons

e. positively charged center of an atom

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SECTION 2 Reinforcement

Masses of Atoms

Directions: *Answer the following questions on the lines provided.*

1. What are isotopes?

2. How do Boron-10 and Boron-11 differ?

3. What is the average atomic mass of an element?

4. Compare and contrast the atomic structure of the chlorine-35 and chlorine-37 isotopes.

5. Suppose that a newly discovered element called centium has three isotopes that occur in nature. These are centium-200, centium-203, and centium-209. Assume that these isotopes occur in equal amounts in nature. What will be the average atomic mass of this element?

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Name ____________________ Date ____________ Class ____________

SECTION 3 Reinforcement

The Periodic Table

Directions: *You will need a scientist's patience to find the names of the 70 elements hidden in the grid. The lanthanides and the actinides have been excluded. The same letters may appear in more than one element name. Draw a line through the letters that correctly spell the name of an element.*

A	Y	M	R																																A	S	S	M
R	N	U	E																																B	L	U	E
G	N	T	N																																E	I	R	G
O	O	S	I																																T	T	O	S
N	C	A	D	M	I	U	M	N																	D	E	F	L	U	O	R	I	N	E	H	L	H	U
A	I	N	O	E	O	B	O	C																	G	H	P	B	R	O	M	I	N	E	D	A	P	L
I	L	O	I	J	E	N	L	H																	K	L	M	U	I	N	E	H	T	U	R	C	S	P
M	I	D	N	Z	E	L	Y	O																	P	M	Q	R	T	S	C	M	U	V	H	E	O	H
W	S	A	Y	X	M	D	B	Z																	Y	D	U	R	X	E	U	A	S	L	B	L	H	U
L	C	R	N	U	R	B	D	D																	P	E	N	I	T	I	F	G	O	H	O	I	P	R
E	J	K	I	O	R	L	E	M																	O	E	N	O	D	V	P	R	D	N	L	Q	T	H
K	N	D	G	A	R	T	N	R																	T	H	H	N	I	A	I	S	I	I	A	A	H	E
C	N	E	D	S	T	I	U	H	Y	A	H	E	M	P	E	R	B	E	N	I	T	A	T	S	A	I	A	O	G	N	L	U	U	D	N	I	A	N
I	N	I	O	B	I	U	M	O	C	L	E	I	D	E	T	A	N	A	B	E	L	E	G	O	S	C	F	F	E	A	M	L	M	T	T	T	L	I
N	U	H	T	N	E	E	L	D	E	U	L	M	B	O	R	O	N	M	L	E	N	N	T	S	S	I	S	L	N	D	L	I	A	G	H	H	L	U
M	N	O	B	R	A	C	M	I	S	M	U	I	N	I	T	C	A	L	C	I	U	M	M	U	I	N	O	C	R	I	Z	L	T	P	A	S	I	M
O	R	M	M	M	O	U	T	U	E	I	D	B	U	P	U	T	U	N	E	T	T	V	E	R	U	E	E	O	T	U	U	H	I	E	N	I	U	L
E	S	U	L	U	N	G	C	M	N	N	R	M	Y	M	M	R	O	R	N	T	A	H	T	U	M	S	I	B	I	M	N	M	I	U	U	L	M	N
G	M	I	I	I	I	E	E	A	V	U	E	R	M	U	I	R	T	T	Y	N	T	Y	I	F	I	R	I	A	I	R	I	D	I	U	M	V	V	E
R	U	N	T	S	E	C	M	N	B	M	K	L	I	U	E	M	E	C	H	R	O	M	I	U	M	A	N	L	T	S	U	O	X	Y	G	E	N	M
E	I	A	H	E	L	R	N	I	C	E	M	N	M	D	E	S	E	N	A	G	N	A	M	A	M	P	S	T	R	O	N	T	I	U	M	R	A	N
P	L	T	I	N	E	A	D	A	N	B	E																											
P	E	I	U	G	M	I	U	A	R	L	A																											
O	H	T	M	A	U	D	R	M	E	F	D																											
C	M	U	A	M	U	I	M	S	O	L	D																											

Directions: *Complete the following paragraphs about the periodic table by filling each blank with the correct term.*

In the modern periodic table, elements are listed by increasing **1.** ________________. Each box represents an **2.** ________________. A box contains the name, atomic number, **3.** ________________, and **4.** ________________ for the element.

Vertical columns in the table are called **5.** ________________. Most elements in a column have the same number of **6.** ________________ in the outer energy level and tend to have similar **7.**________________.

Horizontal rows in the table are called **8.** ________________. The elements on the left side of the table are **9.** ________________. Groups 3–12 contain metals known as **10.** ________________. Elements on the right side are **11.** ________________.

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Directed Reading for Content Mastery

Key Terms
Properties of Atoms and the Periodic Table

Directions: *Match the term in Column II with the definition in Column I. Write the letter of the correct term in the blank at the left.*

Column I

_____ **1.** sum of the number of protons and neutrons in the nucleus

_____ **2.** region around the nucleus where the electrons are found

_____ **3.** positively charged center of an atom

_____ **4.** vertical column in the periodic table

_____ **5.** neutral particles in the nucleus of an atom

_____ **6.** weighted average mass of the mixture of its isotopes

_____ **7.** positively charged particles in an atom

_____ **8.** table of the elements arranged according to repeated changes in properties

_____ **9.** represents the electrons in the outer energy level of an element

_____ **10.** negatively charged particles in an atom

_____ **11.** atoms of the same element that have different numbers of neutrons

_____ **12.** number of protons in an atom's nucleus

_____ **13.** horizontal row in the periodic table

_____ **14.** smallest known particle that makes up protons and neutrons

_____ **15.** the smallest peice of matter that still retains the properties of the element

_____ **16.** developed an early periodic chart

_____ **17.** approximately 1.67×10^{-24}g

Column II

a. nucleus

b. electrons

c. protons

d. neutrons

e. quark

f. atomic number

g. mass number

h. isotope

i. average atomic mass

j. electron cloud

k. periodic table

l. atom

m. atomic mass unit

n. group

o. electron dot diagram

p. period

q. Dmitri Mendeleev

Meeting Individual Needs

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