

# Structure and Properties of Matter Unit Review Guide

## I. Write the scientific term for each of the following definitions:

1. The smallest particle of a given element that retains an elements chemical properties.  
(\_\_\_\_\_)
2. The process by which a substance is able to change from one state to another. (\_\_\_\_\_)
3. The temperature at which a solid becomes a liquid. (\_\_\_\_\_)
4. Molecules which contain different types of atoms. (\_\_\_\_\_)
5. The negatively charged particle found outside the nucleus of an atom. (\_\_\_\_\_)
6. The subatomic particle which has no charge/is neutral (\_\_\_\_\_)
7. The number of protons contained in an atom (\_\_\_\_\_)
8. Variations of the same element which have the same number of protons but differ in their number of neutrons.(\_\_\_\_\_)
9. Differing distances from the nucleus of an atom which are occupied by electrons. (\_\_\_\_\_)
10. The number of protons and neutrons contained in the nucleus of an atom. (\_\_\_\_\_)
11. Electrons found in the outermost energy level of an atom. (\_\_\_\_\_)
12. A positively charged ion (\_\_\_\_\_)
13. A negatively charged ion (\_\_\_\_\_)
14. The vertical columns found in the periodic table (\_\_\_\_\_)
15. The horizontal rows in the periodic table. (\_\_\_\_\_)

## II. Multiple Choice: Select the letter which best finishes the statement.

1. The atomic number of the element chlorine is:

a) 6  
b) 17  
c) 20  
d) 27

2. The number of electrons found in the element sodium is:

a) 11  
b) 14  
c) 16  
d) 21

# Structure and Properties of Matter Unit Review Guide

3. Magnesium forms a \_\_\_\_\_ ion:
  - a) Positive 1
  - b) Positive 2
  - c) Negative 1
  - d) Negative 2
  
4. Oxygen forms a \_\_\_\_\_ ion.
  - a) Positive 1
  - b) Positive 2
  - c) Negative 1
  - d) Negative 2
  
5. The number of carbon atoms found in 2 molecules of glucose ( $C_6H_{12}O_6$ ) is:
  - a) 6
  - b) 12
  - c) 24
  - d) 48
  
6. \_\_\_\_\_ refers to the tendency of atoms to prefer eight electrons in their outer most shell.
  - a) Electronegativity
  - b) Octet rule
  - c) Valency
  - d) Orbital notation
  
7.  $1s^22s^22p^5$  is the orbital notation for:
  - a) Oxygen
  - b) Fluorine
  - c) Carbon
  - d) Nitrogen
  
8. The element with the smallest atomic radius is:
  - a) Oxygen
  - b) Boron
  - c) Carbon
  - d) Nitrogen
  
9. The element with the strongest metallic character is:
  - a) Lithium
  - b) Sodium
  - c) Potassium
  - d) Rubidium
  
10. The element with the highest level of electronegativity is:
  - a) Oxygen
  - b) Sulfur
  - c) Carbon
  - d) Nitrogen

### III. Give one difference between:

1. Metals and non-metals.

---

---

---

---

# Structure and Properties of Matter Unit Review Guide

2. Protium , deuterium and tritium isotopes.

---

---

---

---

---

3. Anions and Cations.

---

---

---

---

4. Evaporation and condensation.

---

---

---

---

5. Thomson's model of the atom and Rutherford's model.

---

---

---

---

---

---

---

---

---

---

# Structure and Properties of Matter Unit Review Guide

IV. Draw the orbital notation diagram for sodium.

V. Outline valence electron numbers across a period versus down a group in the periodic table

---

---

---

---

---

---

---

---

---

---

VI. Match the beginning of the statement in column A with its correct ending in column B.

Column A	Column B
1. When energy is supplied to a substance...	A. the particles move at a slower rate.
2. A change in state occurs when...	B. bonds in a substance are either broken or new ones are formed.
3. When energy is removed from a substance...	C. the particles are able to move about more freely
4. Particles in a gas move faster than in a liquid or solid because...	D. they have a greater amount of kinetic energy.

# Structure and Properties of Matter Unit Review Guide

VII. What is a semi-metal? How do they differ from metals and non-metals?

---

---

---

---

---

---

---

---

VIII. Match the ion from (Column A) with its correct symbol in (Column B).

Column A	Column B
1. Fluoride	A. $Al^{+3}$
2. Sodium	B. $S^{-2}$
3. Oxide	C. $Na^{+1}$
4. Sulfide	D. $F^{-1}$
5. Aluminum	E. $O^{-2}$

IX. Explain how an atom becomes an ion. How do different types of ions form?

---

---

---

---

---

---

---

---

# Structure and Properties of Matter Unit Review Guide

## I. Write the scientific term for each of the following definitions:

1. The smallest particle of a given element that retains an elements chemical properties. (**atom**)
2. The process by which a substance is able to change from one state to another. (**phase change**)
3. The temperature at which a solid becomes a liquid. (**melting point**)
4. Molecules which contain different types of atoms. (**compound**)
5. The negatively charged particle found outside the nucleus of an atom. (**electron**)
6. The subatomic particle which has no charge/is neutral (**neutron**)
7. The number of protons contained in an atom (**atomic number**)
8. Variations of the same element which have the same number of protons but differ in their number of neutrons. (**isotope**)
9. Differing distances from the nucleus of an atom which are occupied by electrons. (**energy level**)
10. The number of protons and neutrons contained in the nucleus of an atom. (**atomic weight**)
11. Electrons found in the outermost energy level of an atom. (**valence electrons**)
12. A positively charged ion (**cations**)
13. A negatively charged ion (**electrons**)
14. The vertical columns found in the periodic table (**groups**)
15. The horizontal rows in the periodic table. (**periods**)

## II. Multiple Choice: Select the letter which best finishes the statement.

1. The atomic number of the element chlorine is:  
a) 6  
**b) 17**  
c) 20  
d) 27
2. The number of electrons found in the element sodium is:  
**a) 11**  
b) 14  
c) 16  
d) 21

## Structure and Properties of Matter Unit Review Guide

3. Magnesium forms a \_\_\_\_\_ ion:
- a) Positive 1
  - b) **Positive 2**
  - c) Negative 1
  - d) Negative 2
4. Oxygen forms a \_\_\_\_\_ ion.
- a) Positive 1
  - b) Positive 2
  - c) Negative 1
  - d) **Negative 2**
5. The number of carbon atoms found in 2 molecules of glucose ( $C_6H_{12}O_6$ ) is:
- a) 6
  - b) **12**
  - c) 24
  - d) 48
6. \_\_\_\_\_ refers to the tendency of atoms to prefer eight electrons in their outer most shell.
- a) Electronegativity
  - b) **Octet rule**
  - c) Valency
  - d) Orbital notation
7.  $1s^2 2s^2 2p^5$  is the orbital notation for:
- a) Oxygen
  - b) **Fluorine**
  - c) Carbon
  - d) Nitrogen
8. The element with the smallest atomic radius is:
- a) **Oxygen**
  - b) Boron
  - c) Carbon
  - d) Nitrogen
9. The element with the strongest metallic character is:
- a) Lithium
  - b) Sodium
  - c) Potassium
  - d) **Rubidium**
10. The element with the highest level of electronegativity is:
- a) **Oxygen**
  - b) Sulfur
  - c) Carbon
  - d) Nitrogen

# Structure and Properties of Matter Unit Review Guide

## III. Give one difference between:

### 1. Metals and non-metals.

Metals give away electrons while non-metals accept electrons

Metals are found on the left hand-side of the periodic table while non-metals are generally on the right hand-side.

Metals form positive ions while non-metals tend to form negative ions

Metals conduct heat/ electricity while non-metals do not

Metals are ductile/malleable/sonorous while non-metals are not.

### 2. Protium, deuterium and tritium isotopes.

Protium has a mass number of 1, deuterium has a mass number of 2 and tritium has a mass number of 3.

Protium has one neutron, deuterium has two and tritium has three.

### 3. Anions and Cations.

Anions accept electrons to form negative ions, while cations lose electrons to form positive ions.

### 4. Evaporation and condensation.

Evaporation requires heat energy to be added, while condensation requires the removal of heat energy.

Evaporation occurs when a liquid changes to a gas, while condensation occurs when a gas becomes a liquid.

### 5. Thomson's model of the atom and Rutherford's model.

Thomson's model - the atom consists of negative electrons that float in a sphere of positive charge.

Rutherford's model - the atom was a dense, positively charged core called a nucleus which was orbited by lighter, negatively charged electrons in a circular motion.

# Structure and Properties of Matter Unit Review Guide

## IV. Draw the orbital notation diagram for sodium.

Notation for sodium is  $1s^2 2s^2 2p^6 3s^1$



## V. Outline valence electron numbers across a period versus down a group in the periodic table. Use and example from the periodic table to illustrate your answer.

The number of valence electrons increases by one from left to right across a period. For example, moving across the second period, lithium has one valence electron, beryllium has two, boron has three etc. The number valence electrons in a group on the periodic table will remain the same. For example all metals in group one will have one valence electron.

## VI. Match the beginning of the statement in column A with its correct ending in column B.

Column A	Column B
1. When energy is supplied to a substance...	A. the particles move at a slower rate.
2. A change in state occurs when...	B. bonds in a substance are either broken or new ones are formed.
3. When energy is removed from a substance...	C. the particles are able to move about more freely
4. Particles in a gas move faster than in a liquid or solid because...	D. they have a greater amount of kinetic energy.

Answer key: 1/C, 2/B, 3/A, 4/D

# Structure and Properties of Matter

 Unit Review Guide

## VII. What is a semi-metal? How do they differ from metals and non-metals?

Semi-metals or metalloids are the group of elements which separate the metals and non-metals in the periodic table. These elements have some properties which are similar to those seen in metallic elements, such as conducting electricity and some which are similar to those seen in non-metals such as being dull and not sonorous.

## VIII. Match the ion from (Column A) with its correct symbol in (Column B).

Column A	Column B
1. Fluoride	A. $\text{Al}^{+3}$
2. Sodium	B. $\text{S}^{-2}$
3. Oxide	C. $\text{Na}^{+1}$
4. Sulfide	D. $\text{F}^{-1}$
5. Aluminum	E. $\text{O}^{-2}$

Answer key: 1/D, 2/C, 3/E, 4/B, 5/A

## IX. Explain how an atom becomes an ion. How do different types of ions form?

An atom becomes an ion when it either gains or loses electrons. Non-metals typically gain electrons in a chemical reaction and form negative ions. This is because their valence shells contain 4 or more electrons and so it's easier for them to gain electrons rather than lose them. Metals lose electrons in a chemical reaction. This is because they have almost empty (less than 4) valence shells, so it is much easier to lose these electrons rather than gain them.