

1. State whether each of the following is a chemical change or a physical change.

Toasting Bread	chemical
Cutting bread	physical
Frying an egg.	chemical
Boiling Water	physical

groups to refer to with

2. What period are the following elements in?

- a. He 1
- b. Ge 4
- c. Rb 5
- d. I 5

period refer to row #

3. What group are the following elements?

- a. Sulfur 16 OR VIA
- b. Ca 2 OR IIA
- c. Iodine 17 OR VIIA
- d. Fe 8 OR VIII B

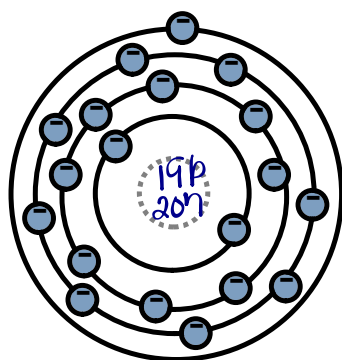
4. Give me an atom with the following characteristics.

- a. Halogen F, Cl, Br, I, At
- b. Alkali metal Li, Na, K, Rb, Cs, Fr
- c. Alkaline Earth metal Be, Mg, Ca, Sr, Ba, Ra

- d. Transition metal V, Cr, Zn, Rh, ...
- e. Nobel gas Ne, Ar, Kr, Xe or Rn

5. a. Draw a Bohr diagram for a *potassium atom*b. Draw a Bohr diagram for a *magnesium ion*c. Draw a Bohr diagram for a *fluorine atom*d. Draw a Bohr diagram for a *phosphide ion*

(a)



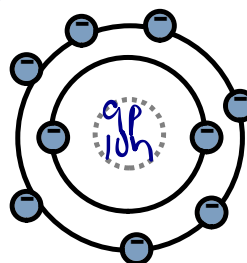
K (atom)

$$p = 19$$

$$n = 20$$

$$e = 19$$

(c)



F atom

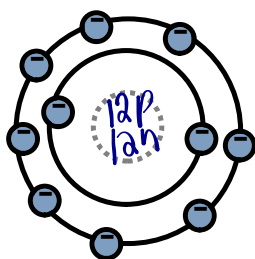
F

$$p = 9$$

$$n = 10$$

$$e = 9$$

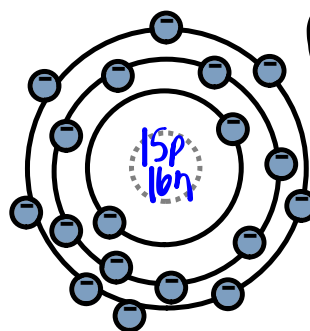
(b)

Mg ion = Mg^{2+}

$$p = 12$$

$$n = 12$$

$$e = 10$$

Phosphide ion:
 P^{3-}

$$p = 15$$

$$n = 16$$

$$e = 18$$

6. Fill in the blanks:

- a. An ion has 44 protons and 42 electrons, is this ion an ANION or CATION $\frac{44}{42}$ / overall 2+ cation
- b. An ion has a net charge of 3-, if it has 33 protons identify the ion As^{3-}
- c. An ion has a net charge of 6+, if it has 74 protons, how many electrons does it have 68. Identify the ion as W^{6+} $74, 68 \rightarrow 6+$
- d. Identify the element that has a mass number of approximately 91 and contains 51 neutrons Zr .
 $Sn: 40$ protons

7. Complete the following chart

Name	Symbol	Atomic Number	Mass Number	Number of protons	Number of neutrons	Number of electrons
Barium Atom	Ba	56	137	56	81	56
Tin(IV) Ion	Sn^{4+}	50	119	50	69	46
Silicon Atom	Si	14	28	14	14	14
Phosphide Ion	P^{3-}	15	31	15	16	18
Zinc Ion	Zn^{2+}	30	65	30	35	28
Radium Ion	Ra^{2+}	88	226	88	138	86

Molybdenum Ion	Mo^{6+}	42	96	42	$96-42=54$	36-
Iron Atom	Fe	26	56	26	$56-26=30$	26

8. What is the difference between an atom and an ion?
9. a. How do metals form ions? b. How do non-metals form ions?
10. What is an ionic compound made up of?
11. Define the law of conservation?

**8. An atom has an equal number of protons and electrons...an atom is not charged
An ion has an unequal number of protons and electrons...an ion is charged**

**9. a. Metals lose electrons to become positive ions
b. Non-Metals gain electrons to become negative ions**

10. An ionic compound is made up of a cation and an anion .

11. The law of conservation of mass states that mass is neither created nor destroyed by chemical reactions or physical transformations. According to the law of conservation of mass, the mass of the products in a chemical reaction must equal the mass of the reactants.

(That is why chemical equations must be balanced)

12. Fill in the Chart

Chemical Formula	Chemical name
A. CuBr_2	Copper (II) bromide
B. CoCl_2	Cobalt(II) chloride
C. FeSO_4	iron (II) sulfate
D. BaO	Barium oxide
E. Zr_3P_4	zirconium phosphide
F. Ag_3PO_4	silver phosphate
G. Zr_3P_4	zirconium phosphide
H. Ca(OH)_2	calcium hydroxide
I. Al_2S_3	aluminum sulfide
J. IrN Ir_3N_4	iridium nitride
K. SnI_2	tin(II) iodide
L. AlI_3	aluminum iodide

CaBr_2 "calcium bromide"

Fe_2S_3 **iron(III) sulfide**
 ↑ multivalent $\text{Fe}_2^{3+} \text{S}_3^{6-}$

$\text{Li}_3(\text{PO}_4)$ lithium phosphate

Zinc hydroxide

$\text{Zn}^{2+} \text{OH}^-$
 Zn(OH)_2

Iron(II) nitride

$\text{Fe}_2^{2+} \text{N}_3^{3-}$
 Fe_3N_2

Aluminum Sulfate

$\text{Al}_2^{3+} (\text{SO}_4)_3^{2-}$ $\text{Al}_2(\text{SO}_4)_3$

Tin(IV) sulfide

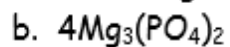
$\text{Sn}^{4+} \text{S}_2^{2-}$ SnS_2

13. Count the atoms in each of the following:



$$Zn = 3$$

$$N = 2$$



$$Mg = 12$$

$$P = 2$$

$$O = 8$$

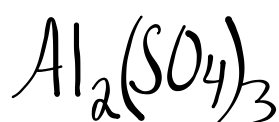


$$N = 4$$

$$H = 16$$

$$Cr = 2$$

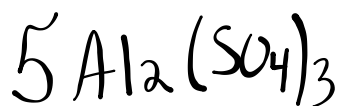
$$O = 7$$



$$Al = 2$$

$$S = 3$$

$$O = 12$$



$$Al = 10$$

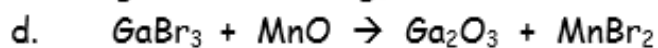
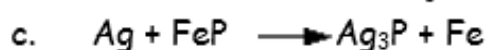
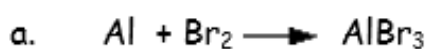
$$S = 15$$

$$O = 60$$

Law of conservation
of mass

Count atoms
to ensure the
same number of
atoms on reactant
& product side

14. Balance each reaction



15. For each of the following:

Write the complete chemical equation, Balance the chemical equation. Classify the reaction

- A. Barium and chlorine react to produce barium chloride
- B. Beryllium hydroxide reacts with potassium nitrate to produce beryllium nitrate and potassium hydroxide
- C. Copper (I) nitrate reacts with gallium sulfate to produce gallium nitrate and copper (I) sulfate
- D. zirconium and manganese (IV) carbonate are produced when manganese reacts with zirconium carbonate.

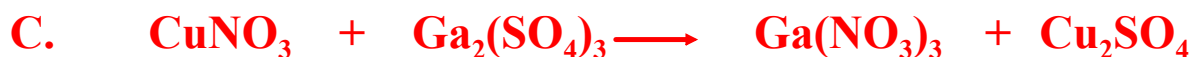


already balanced

classification: synthesis



classification: double displacement



classification: double displacement



classification: single displacement

16. Identify each type of reaction below: [synthesis, decomposition, single displacement, double displacement]

- $\text{Na}_2\text{SO}_4 \rightarrow \text{Na} + \text{S}_8 + \text{O}_2$
- $\text{Ca} + \text{Cl}_2 \rightarrow \text{CaCl}_2$
- $\text{Na}_2\text{CO}_3 + \text{Mg} \rightarrow \text{Na} + \text{MgCO}_3$
- $\text{Cu} + \text{O}_2 \rightarrow \text{CuO}$
- $\text{MgSO}_4 + \text{NaCl} \rightarrow \text{MgCl}_2 + \text{Na}_2\text{SO}_4$

a. decomposition

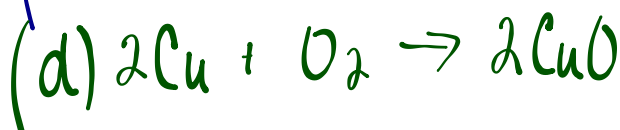
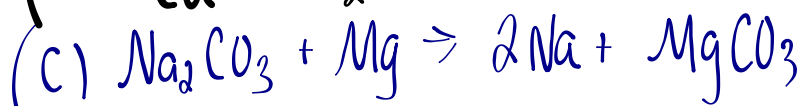
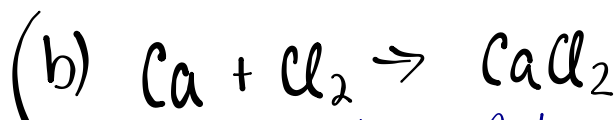
b. synthesis

c. single displacement

d.) synthesis

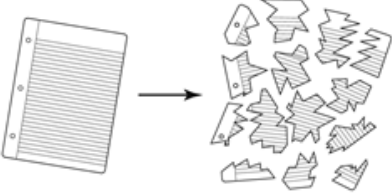
e.) double displacement

Now Balance each



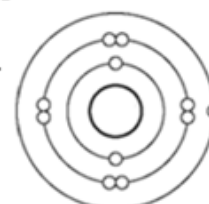
1. **j** a particle in an element
2. **a** the study of matter, its properties and its changes or transformations
3. **n** a written representation of a chemical reaction
4. **k** a chemical reaction in which two or more elements or compounds combine to form a single compound
5. **f** a neutral particle found in the nucleus of an atom
6. **l** a chemical reaction in which a compound is broken down into elements or smaller compounds
7. **v** total number of protons and neutrons in the nucleus of an atom
8. **p** the substance produced in a chemical reaction
9. **z** a positive ion
10. **e** a positively charged particle that is found in the nucleus of an atom
11. **o** the starting material in a chemical reaction
12. **g** the outer electron shell of an atom where the valence electrons are found
13. **m** a chemical reaction in which one element displaces another element in a compound
14. **u** number of protons in the nucleus of an atom
15. **b** a pure substance that cannot be broken down into a simpler substance
16. **aa** compound consisting of non metal covalently bonded
17. **c** a pure substance that contains two or more different elements in a fixed proportion
18. **w** an element that can have more than one charge
19. **h** a diagram used to represent the arrangement of electrons for an element
20. **y** a negative ion
21. **dd** When a substance is changed into a new substance
22. **t** elements that possess both metallic and nonmetallic properties
23. **q** anything that has a mass and takes up space
24. **x** a charged particle composed of two or more elements
25. **i** a structured arrangement of elements with similar chemical & physical properties in the same column
26. **d** a negatively charged particle that moves around the nucleus of an atom at different energy levels orbits

Multiple Choice Practice

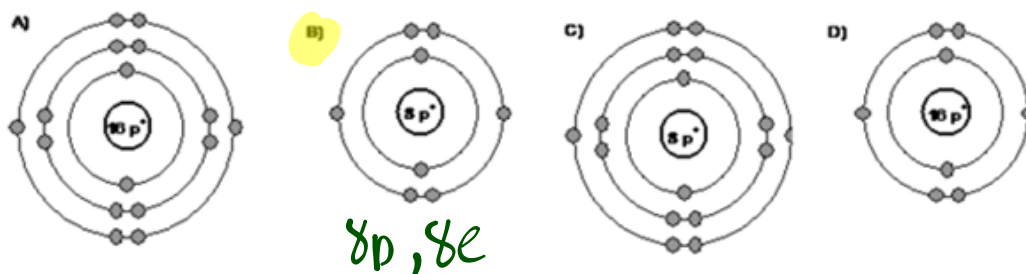
1. What three sub-atomic particles make up an atom?
A. protons, electrons & neutrals
B. protons, electrons & neutrons
C. positives, negatives & neutrals
D. chocolate chips, nuts & raisins
2. Bob tears a piece of notebook paper into smaller pieces, as shown below.
Tearing paper into pieces is an example of what kind of change?
A. a change in mass
B. a physical change
C. a chemical change
D. a change in energy

3. There are several differences between chemical and physical changes. Which process is an example of a chemical change?
A. steam rising from a boiling pot of soup
B. alcohol evaporating from a cotton swab
C. a metal railing rusting in damp weather
D. a piece of wood shrinking as it dries out
4. Which process is an example of a physical change?
A. Burning
B. rusting
C. Flattening
D. rotting
5. Which change can easily be reversed?
A. Chemical change
B. Both chemical and physical change
C. Physical change
D. Neither chemical or physical change

6. What do elements found in the same group have in common?
 A. the same number of valence electrons. C. the same number of protons
 B. the same number of energy levels D. the same number of electrons
7. What do element found in the same period have in common?
 A. the same number of valence electrons C. the same chemical reactivity
 C. the same number of energy levels D. the same number of electrons

8. The following diagram is a Bohr diagram of an element from the periodic table.
 To which group and period does this element belong?
 A. Period 3, group 4 C. Period 4, group 4
 B. Period 3, group 1 D. Period 1, group 3



9. Oxygen is a gas important for life and represents about 21% of the Earth's atmosphere. Which of the illustration below best represent a Bohr diagram of an oxygen atom?



10. The ion which has 55 protons and 54 electrons is represented by
 a. Cs^{+1} b. Ba^{+2} c. Cs^{+2} d. Ba^{+3}

11. The electron energy level diagram of Rb^{+1} is most similar to which noble gas
a. Kr b. Xe c. Ar d. Ne
12. What is the net charge on the ion of an element located in Period 3 and Group 16?
a. +2 b. +3 c. -3 d. -2
13. In order for an atom to become an ion it must:
a. lose or gain protons b. lose or gain neutrons c. share electrons d. lose or gain electrons
14. Energy levels contain:
a. Electrons b. protons c. Neutrons d. both protons and neutrons
15. The cation with 24e⁻ and a net charge of +3 is represented by
a. Cr⁺² b. Co⁺³ c. Sc⁺³ d. Fe⁺³
16. The unreactive nature of the elements in the noble gas family is explained by the
a. Fact that they are all gases at SATP c. Lack of isotopes of each member of the family
b. Presence of an even number of protons d. Presence of completely filled outer energy levels

17. How many electrons are contained in a chloride ion
a. 14 b. 15 c. 16 d. 18
18. Elements belonging to which group of the periodic table form ions with a 2+ charge?
a. alkaline earth metals b. halogens c. noble gases d. alkali metals
19. Metals tend to...
a. gain electrons and form positive ions c. gain electrons and form negative ions
b. lose electrons and form positive ions d. lose electrons and form negative ions
20. How many oxygen atoms are present in: $5 \text{Ca}_3(\text{PO}_4)_2$?
a. 4 b. 8 c. 30 d. 40
21. Which of the following is an ionic compound?
a. H₂ b. NH₃ c. CO₃ d. ZnCO₃
22. An equation is balanced by
a. Adding subscripts b. Adding coefficients c. Adding elements d. Adding subscripts and coefficients.
23. Which of the following elements does not exist naturally as a diatomic molecule?
a. chlorine b. helium c. iodine d. nitrogen
24. The following reaction: $2\text{Cs} + \text{Br}_2 \rightarrow 2\text{CsBr}$ would be best classified as a...
a. single displacement b. decomposition c. double displacement d. synthesis

25. Which of the following are the products of the following **single displacement** reaction: $\text{Li} + \text{Ni}_3\text{P}_2 \rightarrow$
 a. $\text{Ni} + \text{Li} + \text{P}$ **b. $\text{Ni} + \text{Li}_3\text{P}$** c. $\text{P} + \text{Li}_2\text{Ni}$ d. $\text{Li}(\text{PNi})_3$
26. Which concept is taken into account when balancing chemical equations?
 a. **atoms/ions are neither created or destroyed** c. formation of any gases are ignored completely
 b. products always outweigh the reactants d. compounds and elements remain unchanged
27. What is the coefficient of oxygen after the following equation is balanced? $\text{C}_4\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 a. 2 b. 4 c. 8 d. 1 **e. 6**
28. What is the name of the compound MnS_2 ?
 a. manganese sulphide b. magnesium sulphide c. manganese(II) sulphide **d. manganese(IV) sulphide**
29. An atom's ability to undergo chemical reactions is determined by its
 a. protons b. innermost electrons c. neutrons **d. outermost electrons**
30. What are the PRODUCTS in the following chemical equation: $\text{Ca} + \text{KCl} \rightarrow \text{K} + \text{CaCl}_2$
 a. **potassium and calcium chloride** c. only calcium
 b. Calcium and potassium chloride d. only potassium
21. What is the net charge on the ion of an element located in Period 3 and Group 15?
 a. 2+ b. 3+ **c. 3-** d. 1-
32. The electron energy level diagram of S^{2-} is most similar to which noble gas?
 a. Neon **b. Argon** c. Krypton d. Xenon
33. The halogens can be found in
 a. Group 1 b. Group 2 **c. Group 17** d. Group 18
34. In order for an atom to become an ion it must
 a. Lose or gain protons b. Lose or gain neutrons c. Share electrons **d. Lose or gain electrons.**

35. Which of the following elements occurs naturally as diatomic molecules?

- a. hydrogen gas b. neon gas c. helium gas d. argon gas

36. Which is taken into account when balancing equations?

- a. atoms are neither created nor destroyed b. formation of any gasses are ignored
c. products always have higher mass than reactants d. compounds and elements remain unchanged

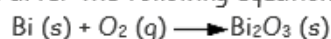
~~37.~~ What are the products of a complete combustion reaction involving oxygen and a hydrocarbon such as butane?

- a. salt and water b. carbon dioxide and water c. carbon monoxide and carbon dioxide d. water only

~~38.~~ Which product indicates an incomplete combustion reaction?

- a. Water b. carbon dioxide c. sulfur dioxide d. carbon monoxide

39. What is the coefficient of oxygen gas after the following equation is balanced?



- a. 1 b. 2 c. 3 d. 4

40. What are the products of the following double-replacement reaction? $\text{BaCl}_2 \text{ (aq)} + \text{Na}_2\text{SO}_4 \text{ (aq)} \rightarrow ?$

- a. BaSO_4 and NaClO_4 b. BaSO_4 and NaCl c. BaSO_3 and NaCl d. BaS and NaClO_4

41. Classify the reaction type: $\text{Cu}_{(s)} + 2 \text{HNO}_{3(aq)} \rightarrow \text{Cu}(\text{NO}_3)_{2(aq)} + \text{H}_2\text{(g)}$

- a. Formation b. Combustion c. Single replacement d. Double replacement

42. Determine the number of oxygen atom in $5\text{Cu}(\text{NO}_3)_2$

- a. 3 b. 5 c. 25 d. 30

43. The coefficients that would go in front of each molecule in order to properly balance this equation would be: $\text{Al}_4\text{C}_3\text{(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Al(OH)}_3\text{(s)} + \text{CH}_4\text{(g)}$

- a. 1,3,4,1 b. 1,6,4,1 c. 1,12,4,1 d. 1,12,4,3

44. What is the name of the molecular compound Cl_2O_5

- a. chloride oxide b. dichloride pentaoxide c. chlorine oxygen d. bichloride oxide