

Practice Test - Chapter 2 - Atoms, Molecules and Ions

Directions: Answer each of the following questions. No calculators are allowed.

Target 1: I can differentiate between protons, neutrons, and electrons in terms of charge, mass and location in an atom.

For #1-3, choose proton, neutron and/or electron.

- | | |
|-----------------------------|--|
| <u>PROTON & NEUTRON</u> | 1. Particle(s) located in the nucleus. <i>e⁻ is in electron cloud</i> |
| <u>ELECTRON</u> | 2. The particle with the least mass. <i>e⁻ is about 1800x less massive than pt or n⁰</i> |
| <u>PROTON</u> | 3. The particle with a positive charge. |

Target 2: I can determine the number of protons, neutrons and electrons in isotopes and in ions.

For #4-7, choose the correct vocabulary term from the list below:

atomic number, mass number, isotope, cation, anion

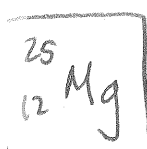
- | | |
|----------------------|---|
| <u>MASS NUMBER</u> | 4. The number of protons + the number of neutrons |
| <u>ATOMIC NUMBER</u> | 5. Indicates the number of protons in a nucleus. |
| <u>ISOTOPE</u> | 6. Atoms of the same element with different number of neutrons. |
| <u>ANIONS</u> | 7. Negatively charged ions. |

8. The isotope Mg-25 contains 12 protons and 13 neutrons.
 a. 12, 24.30 b. 13, 24.30 c. 12, 25 d. 13, 25 **e. 12, 13** f. 13, 12

9. An oxygen atom contains 8 protons and an oxide ion (O²⁻) contains 8 protons. *O atom: 8e⁻*
a. 8, 8 b. 8, 10 c. 10, 8 d. 8, 16 e. 10, 18 f. 10, 16 *O²⁻ ion: 10e⁻*

10. Which one group below do all members contain the same number of electrons?
 a. H, He, Li b. H⁺, Li⁺, Na⁺ c. Li⁺, He, H d. Li, Li⁺, Li²⁺ **e. He, Li⁺, Be²⁺**
 1 2 3 0 2 10 2 2 1 3 2 1 2 2 2

11. Circle all of the following that have exactly 18 electrons.
a. Ar **b. P³⁻** **c. K⁺** d. O²⁻ **e. Sc³⁺**
 18 18 18 10 18



Target 3: I can describe the works of John Dalton, J.J. Thomson (cathode ray tube), Robert Millikan (Oil Drop Experiment) and Ernst Rutherford (Gold Foil Experiment).

12. In 1808, John Dalton developed the first modern atomic theory. Which one of his postulates was not exactly true? Explain.

Dalton said all atoms of the same element are identical to one another. This was proven FALSE in 1932 when the neutron was discovered. We now know that there are ISOTOPES of elements!

C-12

6pt, 6n^o

13. Dalton used his theory to explain the Law of Multiple Proportions. Assume that a certain mass of carbon reacts with 13.6 grams of oxygen to form CO. How many grams of oxygen would react with the same mass of carbon when forming CO₂? Explain your answer using the Law of Multiple Proportions.

C-14

6pt, 8n^o

$13.6\text{g} \times 2 = \boxed{27.2\text{g}}$ Law of Multiple Proportions says that if 2 compounds contain the same elements and you have equal masses of one of the elements, the ratio of masses of the other element will be whole numbers... in this case 1:2 ratio of oxygen masses.

14. Which ONE of the following statements is NOT true concerning cathode rays?

- They originate from the negative electrode.
- They travel in straight lines in the absence of electric or magnetic fields.
- They impart a negative charge to metals exposed to them.
- They are made up of electrons.
- The properties of cathode rays depend upon the material from which they are emitted. Thomson used the CATHODE RAY TUBE to discover the electron!

15. The Gold Foil Experiment . . .

- confirmed the plum-pudding model of the atom.
- led to the discovery of the nucleus. —————> and he discovered that the nucleus was POSITIVE! He also found that the nucleus was relatively small compared to the rest of the atom!
- was the basis for Thomson's model of the atom.
- utilized the deflections of beta particles by gold foil.
- proved the Law of Multiple Proportions.

16. The Oil Drop Experiment by Robert Millikan was able to calculate the . . .

- mass of the electron by first determining its charge.
- mass of the proton.
- mass of the proton AND the mass of the neutron.
- charge of both the electron and the proton.
- atomic mass of H-3 (called tritium!).

1A	+1
2A	+2
3A	+3
4A	+/-4
5A	-3
6A	-2
7A	-1
8A	0

Target 4: I can use the periodic table to predict the charges of monatomic ions.

17. Use the periodic table to predict the charges of the following ions:

- a. hydrogen ion +1 b. nitride ion -3 c. aluminum ion +3

Target 5: I can use the periodic table to predict whether an element is a metal, nonmetal or a metalloid.

18. Classify each of the following elements as either a metal, nonmetal or metalloid.

- METALLOID a. Si NONMETAL c. Br
METAL b. Ag METAL d. Al

Target 6: I can write the names and formulas of ionic compounds, molecular/covalent compounds and acids.

19. Name or write the formulas for each of the following compounds.

- iron (II) sulfate a. FeSO₄ SO e. sulfur monoxide
magnesium sulfide b. MgS NaH f. sodium hydride
dinitrogen tetroxide c. N₂O₄ covalent Pb(CN)₄ g. lead(IV) cyanide
copper (II) acetate d. Cu(C₂H₃O₂)₂ Zn₃(PO₄)₂ h. zinc phosphate

Be sure to memorize your polyatomic ions.

20. Name or write the formulas for each of the following acids.

- sulfuric acid a. H₂SO₄ H₂S e. hydrosulfuric acid
phosphorous acid b. H₃PO₃ H₂CO f. hypocarbonous acid

Be sure to memorize rules for naming acids.

Target 7: I can calculate the atomic weight of an element given the abundances and masses of its isotopes.

21. The atomic masses on the periodic table are not integral numbers. For example, carbon is listed as 12.01115 instead of 12.00000. Why?

- Our technology does not allow for exact measurement of such a small quantity.
- Atoms gain and lose electrons easily and that changes their masses significantly.
- Atomic masses are weighted averages of isotopic masses. *averages are usually decimals.*
- Atomic masses are measured in real samples that are contaminated with other elements.
- There is a theoretical uncertainty in the masses of atoms.

22. Element "X" has an atomic mass of 221.4 amu. Given the information below, calculate the mass of the third isotope. (No calculators are ever allowed on multiple choice questions!)

isotope	% abundance	mass (amu)
#1	75.00	220.9
#2	12.00	220.0
#3	13.00	???

- a) 217.9 b) 220.9 c) 220.3 d) 221.5 e) 225.7

Both smaller than the average.
Isotope #3 must have a bigger mass than the average. You can eliminate choices a, b & c!

no calc's needed... only logical choice!

23. An element has two isotopes. 69.1 % of the isotopes have a mass of 134 amu. The other 30.9 % of the isotopes have a mass of 137 amu. Estimate the atomic mass of this element. (Remember... no calculators!)

Average must be between 134 & 137... this eliminates choices a & e.
 a) 133.8 amu *too low* b) 134.2 amu c) 134.9 amu d) 136.1 amu e) 137.7 amu *too high*

Target 8: I can distinguish between empirical formulas, molecular formulas and structural formulas.

24. An empirical formula is to a molecular formula as ...

- a. a car is to a truck.
 b. a car is to an automobile.
 c. a color is to white.
 d. 100 is to 1,000
 e) 1/2 is 3/6.

EMPIRICAL FORMULA is the reduced formula!

25. List the empirical formula for each of the following:



26. What is the difference between a molecular formula and a structural formula?
 Please provide an example to aid in your answer.

H₂O ⇒ molecular formula shows only number and kind of atoms



⇒ structural formula shows which atoms are attached to one another.