Tori S

Chem 101 Chapter 5 and 10 Models of the atom- Answer Key

Multiple Choice:

1. A neutron has what charge? C

a) +1

b) 1/2000th

c) 0

d)-1

e) None of these

2. A cation is formed when? C

a) One or more electrons are added to a neutral atom

b) When electrons are attracted to a positive electrode

c) When one or more electrons are lost from a neutral atom

d) None of these

3. Which answers below are components of Dalton's atomic model? (Circle all that apply) B, D

a) Atoms of the same element are alike in size and mass.

b) Chemical compounds are formed by the union of two or more atoms of different elements.

c) Atoms of the same element are different in size.

d) Elements are composed of minute, indivisible particles called atoms.

4. What is the charge of a cation? C

a) neutral

b) Negative

c) positive

d) None of the above

5) What is the charge of an anion? B

a) neutral

b) Negative

c) positive

d) None of the above

6. The relative mass of an electron according to the textbook is: D

a) ¼ amu

b) 1 amu

c) 3 amu

d) 1/1837 amu

e) None of these

7. Which scientist is responsible for showing that atoms have neutrons? D

a) Thomson

b) Einstein

c) de Bouglie

d) Chadwick

8. What was Lavoisier's major contribution to Chemistry? A

a) Conservation of mass

b) Gold Foil Experiment

c) Cathode Ray Tube

d) Plum Pudding Model

9. What did the Rutherford Model explain, circle all that apply? A, B

a) Protons

b) Electrons are allowed to be anywhere

c) Line spectra

d) None of the above

10. Which scientist was famous for the plum pudding model? D

a) Bohr

b) Rutherford

c) de Broglie

d) None of these

11. Which is a flaw in the Dalton model: C

A) Elements are composed of minute, indivisible particles called atoms

b) Chemical compounds are formed by the union of two or more atoms of different elements

c) Not all atoms of a specific element have the same mass (isotopes)

d) Atoms combine to form compounds in simple numerical ratios

12. The Bohr model (select all that are true): A, D

a) Came before the Schrodinger in the progression of atomic models

b) Can't explain line spectra

c) Fails for < than 1e-

d) Specific color of light is emitted because only specific orbitals are permitted

13. When an electron falls from one energy level to a lower one, _____ is emitted: D

a) Radiation

b) Gamma particle

c) Alpha particle

d) Light

e) None of the above

14. Thomson was famous for: B, C, D

A) Crooks tube

B) Plum Pudding model

C) Chocolate chip model

D) Properties of protons

E) all of these

15. A proton: D

a) Is a subatomic particle that exists inside the nucleus of an atom and carries a positive electrical charge

b) Has a mass of about 1 amu

c) Protons have slightly less mass than the neutrons

d) All of these

16. An isotope: D

a) Is one member of a family of chemical elements that has the same chemical properties but differs in mass

b) Have the same number of protons and electrons

c) Have different number of neutrons

d) All of these

e) None of these

17. The atomic mass unit is equal to _____ the mass of a carbon -12 atom: A

a) 1/12

b) ¼

c) 1/16

d) 1/1837

18. A neutron: (select all that apply): A, B, C

a) Has charge of zero

b) Has relative mass of approximately 1 amu

c) Has a symbol of n

d) Is attracted to a cathode

19. Lavoisier is famous for: B

a) Proposing the atomic model

b) Determining that chemical reactions in a closed container do not alter total mass (Law of Conservation of Mass)

c) Establishing the conservation of energy

d) Discovery of the neutron

20. Rutherford's Gold Foil Experiment disproved the _____model by demonstrating that the positive charge of mass of an atom is concentrated in small, central atomic nucleus. B

a) Bohr model

b) Thomson Plum pudding model

c) Dalton model

d) de Broglie model

21) Protons are located in the _____, electrons are located in the _____ and neutrons are located in the _____. C

a) Nucleus, nucleus, nucleus

b) Large cloud mostly empty space, nucleus, nucleus

c) Nucleus, large cloud mostly empty space, nucleus

d) None of these

22) A neutron has _____ the mass of an electron. D

a) 1/2

b) 1/4

c) 2/3

d) None of the above

23. _____ are responsible for the formation of cations and anions. C

a) Protons

b) Neutrons

c) Electrons

d) Isotopes

24. The Thomson model of the atom states that negative electrons are embedded in a _____ atomic sphere. B

a) Negative

b) Positive

c) Neutral

d) None of these

25. Rutherford's Gold Foil Experiment modified the Thompson model to a nuclear model of the atom: A

a) Atoms are composed of a nucleus containing protons and are surrounded by electrons which occupy mostly empty space

b) Electrons are in quantized orbitals

c) a and b

d) None of these

26. Atoms are characterized by their: D

a) Number of orbitals

b) Mass

c) a and b

d) Atomic number

27. Which scientist proposed that atoms are made up of protons, neutrons and elections? C

a) Dalton

b) Thomson

c) Chadwick

d) Einstein

28. de Broglie's work focused on wave-particle duality and: D

a) Explained why electrons are in orbits

b) Stated that if light can behave like a wave and a particle, than an e- can behave like a particle of light and can therefore be quantized

c) Fails for greater than 1 electron

d) All of the above

29. Which are facts as it pertains to Schrodinger's quantum mechanics? D

a) Derived mathematics to describe the formation of electrons around nucleus

b) Does not allow for momentum and position of electrons to be known at the same time

c) 4 principle quantum numbers result

d) All of the above

30) Atomic theory has changed over the past 200 years, which is the correct progression? C

a) Early Greek ideas, Thomson, Rutherford, de Broglie, Bohr, Schrodinger

b) Early Greek ideas, Rutherford, Thomson, Bohr, de Broglie, Schrodinger

c) Early Greek ideas, Thomson, Rutherford, Bohr, de Broglie, Schrodinger

d) None of these are in the correction order of progression

True or False: If false, state the truth.

a. T or **F** Thomson stated that most of an atoms mass is concentrated in a small nucleus surrounded by electrons. **(F, Rutherford stated that most of an atoms mass is concentrated in a small nucleus surrounded by electrons).**

b) **T** or F Isotopes of an element always have the same atomic number

c) **T** or F Neutrons and protons have approximately the same mass

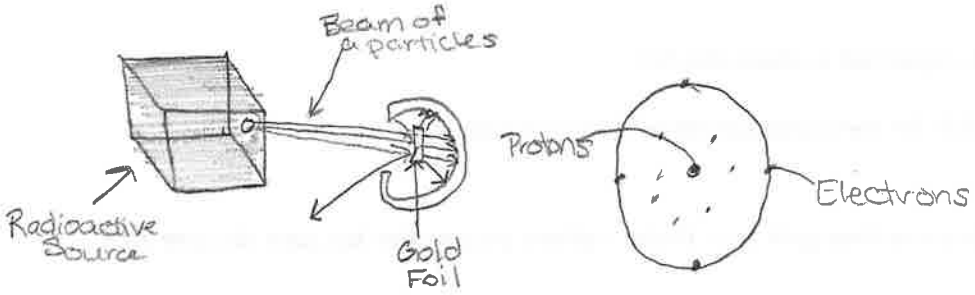
d) **T** or F A proton has a positive charge

e) T or **F** A neutron forms bonds between atoms to form molecules? **(False, An electron forms bonds between atoms to form molecules)**

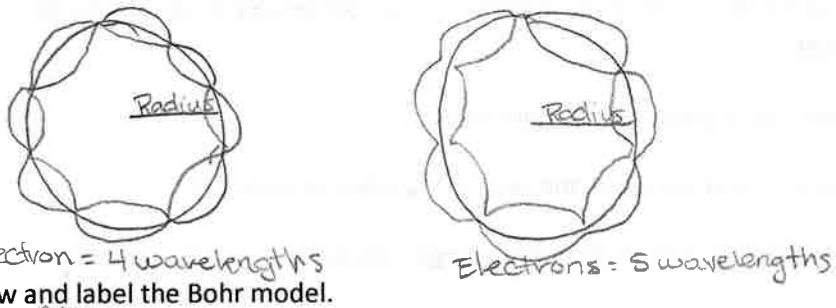
f) **T** or F Thomson won the Nobel Prize for the discovery of the electron

g) T or **F** de Broglie stated that if light can behave like a wave and a particle, then a proton can behave like a particle and a wave. **(False, de Broglie stated that if light can behave like a wave and a particle, then an electron can behave like a particle and a wave**)

Draw and label the Rutherford model:



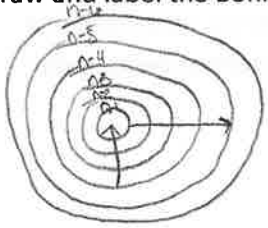
Draw and label the de Broglie model. Wave Particle Duality



Electron = 4 wavelengths

Electrons = 5 wavelengths

Draw and label the Bohr model.



- Electrons are quantitized in the orbits.
- Protons in central nucleus.

Isotope Notation:

1. The isotope notation for Nitrogen-15 is: ^{15}N

   a. What does 15 represent? **A mass number**

   b. The number 7 is the atomic number **(7)**

   c. How many neutrons does it have? 8 **(8)**

2. Write the following in isotope notation:

   a. Helium-4 $^{4}_{2}He$ 4 = mass # from periodic table; 2 = Atomic # from periodic table

   b. Oxygen -16 $^{16}_{8}O$ 16 = mass # from periodic table; 8 = Atomic # from periodic table

   c. Chlorine-35 $^{35}_{17}Cl$ 35 = mass # from periodic table; 17 = Atomic # from periodic table.

   d. Atom with 6 protons and 7 neutrons

   $^{13}_{6}C$ 6p+7n = mass # of 13

h) **T** or F Bohr was a scientist that said that electrons exist in orbitals at different distances from the nucleus.

i) **T** or F A neutron is not really important in Chemistry 101

j) **T** or F Schrodinger is responsible for the Statistical model using wave equations to describe the location of the electron

k) T or **F** Cations are positive because they gain an e- **(False, cations are positive because the lose an electron).**

l) **T** or F Dalton was responsible for the law of Definite Composition.

m) T or **F** Chadwick is famous for his discovery of the proton in 1932. **(Chadwick is famous for his discovery of the neutron in 1932).**

n) **T** or F Anions have a negative charge because they gain an e-

o) **T** or F The Gold Foil Experiment is also known as the Geiger-Marsden experiment.

p) **T** or F The nature of electrical charge states that unlike charges attract and like charges repel

q) T or **F** Schrodinger's conservation of mass states that matter is neither created nor destroyed in a chemical reaction. **(False, Lavoisier's conservation of mass states that matter is neither created nor destroyed in a chemical reaction).**

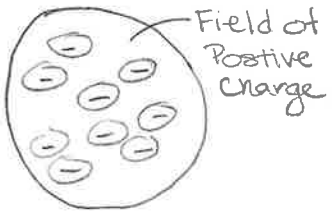
r) **T** or F Protons and neutrons have similar masses

s) T or **F** The charge of an atom is positive **(False, the charge of an atom is neutral).**

t) **T** or F de Broglie's experiments focused on wave particle duality.

Drawing of important models:

Draw, label and describe the Thomson model, include the locations of the protons, neutrons and electrons where appropriate: Plum Pudding Model



Corpuscles (electrons) distrubuted in an even field of postive Charge.

e. Z=26, A=55 $^{55}_{26}Fe$

f. What isotope contains 11 protons, 10 electrons, and 12 neutrons?

$^{23}Na^{+}$ ^{23}

G, How many protons, electrons, and neutrons does the following isotope contai.. $^{23}_{11}Na^{+1}$

$^{23}_{11}Na^{+1}$

1). Protons 11 (atomic mass)

2) Neutrons 12 (23 - 11 = 12)

3) Electrons 10 (11-10 = +1)

H. How many protons, electrons, and neutrons does the following isotope contain: $^{35}_{17}Cl^{-1}$

$^{35}_{17}Cl^{-1}$

1) Protons 17 (atomic mass)
2) Neutrons 18 (35-17)
3) Electrons 18 (17-18 = -1)

I. There are two isotopes of Cu, calculate the average atomic mass in amu: **63.55 amu**

Isotope	Isotopic Mass	Abundance
$^{63}_{29}Cu$	62.9298	69.09
$^{65}_{29}Cu$	64.9278	30.91

The average atomic mass =
atomic mass of each isotope
x Fraction of each isotope

Then add.

62.9298amu x 0.6909 = 43.48amu
64.9278amu x 0.3091 = 20.07amu
} + 62.9298 / 64.9278 = 63.55amu

Matching: (Some answers may be used more than once and others not at all)

1. __C___The number of _____ in an atom is the atomic number of the atom

2. __C ____ The number of _____is what determines that name of that particular atom
3. __I ___ The mass number of an atom is the number of protons plus the number of _____in the nucleus of the atom.
4. __A ___ Which scientist discovered that electrons are located in orbitals or regions of probability around the nucleus of an atom
5. __B__ _Proposed that electrons are found in quantized energy levels in an atom
6. __A __ Who created a mathematical model to describe electrons as waves.
7. __J ___ Who determined that the nucleus of an atom is small
8. __H___ Who stated that all objects have wave properties
9. __N__ Who measured the mass of reactions inside a sealed jar?
10. __E___ Who developed the law of definite composition?
11. __E or O___ Atoms of two or more elements may combine in different ratios to produce more than one compound
12. _E or M_ States that a given chemical compound always contains the same elements in the exact same proportion by mass.

13. __G____A unit of mass equal to 1/12 the mass of a carbon-12 atom
14. __S____Is the mass of a single atom of a chemical element. It includes the masses of the 3 subatomic particles that make up the atom (protons, neutrons and electrons).
15. __P____ Multiply the atomic mass of each isotope by the fraction of each isotope present and then add the results.
16. __ H____ Scientist whose work explained quantization of electron orbitals.
17. __K____ Demonstrated that Cathode rays were negatively charged
18. __J____ Postulated the nuclear structure of the atom
19. __L____ Discovered the neutron, student of Rutherford, won the Nobel prize in 1935

Matching possible answers:

A. Schrodinger
B. Bohr
C. Protons
D. Heisenberg
E. Dalton
F. Goldstein
G. Atomic Mass Unit
H. De Broglie
I. Neutron
J. Rutherford
K. Thomson
L. Chadwick
M. Law of Definite Proportions
N. Lavoisier

O. Law of multiple proportions
P. How to calculate average atomic mass in amu
Q. Einstein
R. Isotope
S. Atomic Mass