

UNIT 3 PROBLEM SETS

This material can be found in the textbook in case your notes, videos, prezis, and handouts are not sufficient.

Atomic Theory - Unit 4 in Book

1. Whose work is credited with the beginning of modern atomic theory? Dalton
2. Which subatomic particle was discovered by scientists working with cathode ray tubes? electrons Who is credited for this discovery and what was his model called? JJ Thompson; plum pudding model
3. Explain the importance of Rutherford's gold foil experiment. Discovered positive dense nucleus and most of atom was empty space where electrons are
4. Describe the Bohr model of the atom. Believed electrons orbited nucleus in fixed orbits much like planets orbit the sun
5. Describe the subatomic particles that make up an atom including location and charge.
6. How is an atom's atomic number related to its number of protons? To its electrons? all equal
7. Explain why atoms are electrically neutral. Number of + protons = -electrons
8. How do isotopes of a given element differ? different # neutrons & mass How are they similar? Same # protons and similar properties
9. Explain how to determine the number of neutrons an atom contains if you know the mass number and atomic number? subtract atomic number from mass number
10. What do the superscript and subscript numbers in symbol notation represent? superscript is mass number and subscript is atomic number
11. How many protons and electrons are contained in an atom of element 37? 37 of each
12. An isotope of mercury has 80 protons and 120 neutrons. What is the mass number of this isotope? 200
13. How many protons, neutrons and electrons are contained in the following isotopes?
 - a. gallium-54 31 p, 31 e, 33 n
 - b. fluorine-23 9 p, 9 e, 14 n
 - c. titanium-48 22 p & e, 26 n
 - d. helium-8 2 p & e, 6 n
14. Calculate the average atomic mass of magnesium. The three magnesium isotopes have atomic masses and relative abundances of 23.985 amu (78.99%), 24.986 amu (10.00%), and 25.982 amu (11.01%). 10.81 am

Periodic Table & Trends - Chapter 6 in book

15. Mendeleev is often called the father of the periodic table. Why did he arrange atoms by atomic

- mass instead of atomic number? Atom number (protons) hadn't been discovered yet.
16. Once protons were discovered, who used that information to arrange the elements by atomic number? Moseley
 17. Identify each of the following as a metal, nonmetal or metalloid
 - a. oxygen
 - b. barium
 - c. iron
 - d. germanium
 - e. neon
 - f. arsenic
 18. What is the purpose of the heavy stair-step line on the periodic table? separates metals from nonmetals; elements bordering it are metalloids
 19. Why do elements in the same group have similar chemical properties? same valence electrons
 20. What does the group number tell us about the number of valence electrons?
 21. Explain the difference between an atom and an ion. atoms have equal numbers of p and e; ions have unequal
 22. How is the energy level of an element determined by its placement on the periodic table? by period number
 23. What is the name for the following groups?
 - a. Group 17 Halogens
 - b. Group 1 Alkali metal
 - c. Groups 3-12 transition metals
 - d. Group 18 Noble gases
 - e. Group 2 Alkaline earth metals
 24. Give the chemical symbol for each of the following elements.
 - a. the noble gas with the greatest atomic mass Rn
 - b. any metal from group 14 Sn or Pb
 - c. the gas in group 1 H
 - d. the element in group 2, period 4 Ca
 - e. the element with atomic number 29 Cu
 25. How many valence electrons do each of the following elements have?
 - a. magnesium 2
 - b. oxygen 6
 - c. helium 2
 - d. argon 8
 - e. sodium 1
 - f. lithium 1
 - g. aluminum 3
 - h. carbon 4

26. An element forms a negative ion. Which side of the periodic table is it on and why? right side because nonmetals gain electrons to complete their octet & more electronegative
27. Given any two elements within a group, is the element with the larger atomic number likely to have a larger or smaller atomic radius than the other element? larger
28. According to periodic trends, would fluorine or sodium be more electronegative? F
29. Which group has the highest ionization energy and explain why? noble gases because they are most stable
30. Explain why atomic radius increases as you move down a group? each period adds energy level
31. Explain why atomic radius decreases as you move across a period. the increased attraction of the nucleus to its electrons pulls the electrons closer and there is the same shielding as previous groups
32. Explain why ionic radius decreases for metals but increases for nonmetals. metals lose outer energy level when valence electrons are lost; nonmetals gets larger when it gains electrons
33. Which element in each pair is more electronegative?
 - a. K, As As
 - b. N, Sb N
 - c. Sr, Be Be
34. An atom has lost electrons. Will the ion formed have a positive or negative charge? positive
35. Group 16 elements have 6 valence electrons. How many electrons must they gain to complete their octet? 2
36. Alkali metals have one valence electron to lose to become more stable. They will combine in a 2:1 ratio with group 16 elements. Name any pair of elements that will combine in that ratio. Any metal from group 1 with any group 16

EM Spectrum - Chapter 5 in book

37. Arrange the following types of EM radiation in order of increasing wavelength. ABC
 - a. ultraviolet light
 - b. microwaves
 - c. radio waves
 - d. X rays
38. What is the difference between an electron's ground state and excited state? ground state is lowest energy level/state while any state higher than ground is excited
39. As wavelength decreases, what happens to energy? increases
40. Calculate the frequency of a wave that has a wavelength of 1.54×10^{-4} meters. PSYW
41. Calculate the wavelength of a wave with energy 5.00×10^{-16} Joules. PSYW
42. Calculate the energy of a particle with a frequency of 2.34×10^{24} Hz.
43. What is the speed of an electromagnetic wave having a frequency of 1.33×10^{17} Hz and a wavelength of 2.25 nm? 3.0×10^8 m/s

44. What is the energy of a photon of red light having a frequency of 4.48×10^{14} Hz? 2.97×10^{-19} J
45. What is the frequency of light which has a wavelength of 4.90×10^{-7} meters? What color is it?
green light 6.12×10^{14} Hz
46. Explain how light is emitted from an excited electron. The energy it absorbed to rise to higher level is released as it falls back to lower energy. If it is within the visible light spectrum we see it.
47. What is a photon? Light behaving as a particle when interacting with matter (light behaves as a wave in absence of matter)
48. Use atomic emission spectra to explain how elements can be identified by the color light they produce. Due to electron configuration, which is unique to each element therefore producing light of differing energy, wavelength and frequency