

Chemistry 1st Semester Final Review

Atomic and Molecular Structure

1. What is atomic number?
2. How does increasing the atomic number affect the identity of an atom?
3. What is atomic mass? What two subatomic particles make up the majority of an atom's mass?
4. Describe the gold foil experiment. What was the important discovery in that experiment?
5. Where are the metals, nonmetals, and semimetals on the periodic table?
6. Identify the groups for alkali metals, alkaline earth metals, halogens, and transition metals?
7. Why do elements in the same group (family) have similar properties?
8. State the definition and trend for ionization energy.
9. State the definition and trend for electronegativity.
10. State the definition and trend for the size of atoms.
11. State the trends for the relative sizes of ions to atoms.
12. How many electrons do the following atoms have available for bonding: I, H, Ca, Al, Sb, Rb, S, and C?
13. What types of ions do metals form? Nonmetals?
14. What will be the most likely ion that the following atoms form: Na, P, Mg, Br, Al, and S?
15. Determine the number of protons, neutrons, and electrons in each atom or ion:

- a. ${}_{40}^{91}\text{Zr}$ b. ${}_{51}^{122}\text{Sb}$ c. ${}_{80}^{200}\text{Hg}^{2+}$ d. ${}_{15}^{31}\text{P}^{3-}$

Chemical Bonds

16. Define the octet rule.
17. What is a covalent bond? What types of elements form covalent bonds? How is the octet rule satisfied?
18. What is the difference between polar and nonpolar covalent bonds?
19. What is an ionic bond? What types of elements form ionic bonds? How is the octet rule satisfied?
20. What is a metallic bond?
21. What type of bond does a molecule have?
22. What type of bond does a salt have?
23. What type of bond has a repeating pattern of positive and negative ions? How are these ions held together?
24. Draw Lewis dot structures for the following:
 - a. H_2O
 - b. CCl_4
 - c. PH_3
 - d. CO_2
 - e. Br_2
 - f. H_2SO_4

Conservation of Matter and Stoichiometry

25. Balance the following equations:
 - a. $\text{Al}_2\text{O}_3 + \text{Cl}_2 + \text{C} \rightarrow \text{AlCl}_3 + \text{CO}$
 - b. $\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - c. $\text{P} + \text{O}_2 \rightarrow \text{P}_2\text{O}_5$

Organic Chemistry and Biochemistry

26. What are polymers?
27. Describe the bonding characteristics of carbon. How many bonds can carbon form? What types of covalent bonds can carbon form?
28. What type of bond is found in most large organic molecules?
29. What monomers make up proteins? What monomers make up DNA?
30. What is the chemical structure of an amino acid?
31. How many amino acids are found in the human body?

Nuclear Processes

32. What is the strong nuclear force?
33. What is the equation that allows us to calculate the energy released in nuclear reactions?
34. What are the three most common forms of radioactive decay? Describe each type of decay.
35. How does the nucleus change with each type of decay?
36. Complete and balance the following nuclear equations
 - a. ${}_{6}^{14}\text{C} \rightarrow {}_{7}^{14}\text{N} + \text{?}$
 - b. ${}_{84}^{218}\text{Po} \rightarrow {}_{2}^{4}\text{He} + \text{?}$
 - c. ${}_{11}^{22}\text{Na} \rightarrow {}_{10}^{22}\text{Ne} + \text{?}$
 - d. ${}_{88}^{226}\text{Ra} \rightarrow {}_{86}^{222}\text{Rn} + \text{?}$
 - e. ${}_{90}^{234}\text{Th} \rightarrow \text{?} + \text{?}$
37. Describe the different amounts and kinds of damage in matter produced by the different penetrations of each type of radioactive decay.
38. How does the energy release in a nuclear reaction compare to the energy release in a chemical reaction.

Investigation and Experimentation

39. What is the purpose of an experimental control?
40. Compare accuracy and precision of a measurement.
41. Why is it necessary to perform multiple trials of a scientific experiment?
42. What type of instrument is best for measuring mass, volume, and length?
43. How is the uncertainty of an instrument determined?
44. State the Atlantic-Pacific Rule for determining significant figures.
45. How many significant figures are in the following measurements?
 - a. 0.000653 g
 - b. 24 000 mL
 - c. 8.50×10^{-9} m
 - d. 0.025 060 s
46. The nucleus of an atom is much larger than the atom yet contains most of its mass.
47. Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.
48. The chemical bonds between atoms in molecules such as H_2 , CH_4 , NH_3 , H_2CCH_2 , N_2 , Cl_2 , and many large biological molecules are ionic.
49. Large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits.
50. The bonding characteristics of nitrogen result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.
51. The energy release per gram of material is much smaller in nuclear fusion or fission reactions than in chemical reactions.
52. Some naturally occurring isotopes are radioactive.
53. The isotopes formed in chemical reactions are radioactive.