Gen Chem I REVIEW

STRATEGY: Start by reading through your notes to refresh your memory on these topics. Then, use this review sheet as a starting point to identify the areas on which you need to spend more study time.

Atomic Structure

1. Identify the scientists who made the following discoveries.
   a. Atoms contain negative particles called electrons
   b. Atoms contain neutral particles called neutrons.
   c. Atoms contain a dense, positive nucleus.
   d. Atoms are indivisible and resemble billiard balls.

2. Write the isotope symbol, including atomic number & mass number, for the following isotopes.
   a. carbon-14   c. nickel-63

   b. chromium-53   d. zirconium-92

3. Complete the table for the following isotopes.(assume neutral atoms)

Symbol	Zn			
Atomic #		20		
Mass #	65		74	40
# of protons			34	
# of neutrons		21		
# of electrons				18

4. How many electrons are in:
   a. N^{-3} b. Ca^{+2} c. K^+

5. Calculate the average atomic mass of copper if 69.17% of the copper atoms occurring in nature are ^{63}Cu and 30.83% are ^{65}Cu.

Matter

6. Classify the following substances as *solid*, *liquid*, *gas,* based on their properties.
   a. flexible volume, high KE, particles can disperse freely.
   b. fixed volume, very low KE, orderly particles.
   c. fixed volume, low KE, particles can move past each other.

7. Compare and contrast a solution and suspension.

8. Classify the following as element, compound, heterogeneous mixture, or solution.
   a. graphite (carbon)
   b. grape juice
   c. table salt (NaCl)
   d. pepper

9. Classify the following as *chemical* or *physical changes*.
   a. cutting wire
   b. ripening tomato
   c. apple slices turning brown
   d. compressing a gas

10. Classify the following properties as *physical* or *chemical*.
   a. melts at 68.0°C
   b. corrosive
   c. reacts violently with water
   d. decomposes in air

Measurement

11. In a lab, the average measured density for Pre-1982 pennies was 7.98 g/cm³. Given that the literature value for the density is 8.92 g/cm³, calculate the percent error.

12. How many sig figs are in the following numbers?
   a. 2.35   c. 89.70
   b. 34,000   d. 0.0052

13. Convert the following numbers into or out of scientific notation.
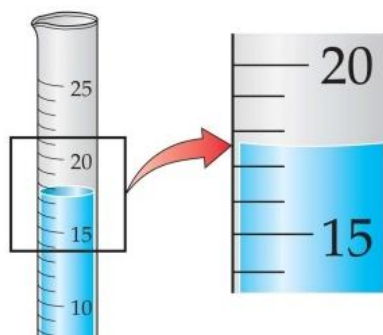   a. 548,000   c. 1.200×10^{-3}

   b. 0.0000770   d. 9.25×10^{7}

14. Osmium is the densest element with a density of 22.57 g/cm³. Find the mass of a 56.2 cm³ sample of osmium.

15. Perform the following SI prefix conversions using dimensional analysis.
   a. 65.2 mm = ? dm

   b. 2.3 kg = ?g

   c. 65,000 µL = ? mL

   d. 0.502 km = ?cm

16. How many milliliters are in a 2.0 quart jug of milk?

17. Record the appropriate # of SigFigs when measuring.

Electrons in Atoms

18. Calculate the wavelength if the frequency is 2.5×10^5 Hz.

19. Find the energy of a photon if frequency is 7.31×10^{14} Hz.

20. What is the primary difference between the *modern* model of the atom and *Bohr's* model?

21. Draw orbital diagrams and write long hand configurations for the following elements:

    Na

    F

    V

22. Explain why chromium's electron configuration is [Ar] $4s^1 3d^5$

23. Give the shorthand electron configuration for:

Symbol	# e⁻	Shorthand e⁻ Configuration
Pd		
At		

Periodic Table

24. How did Mendeleev and Mosely arrange the elements in the periodic table?

25. Circle the atom with the LARGER radius.

    a. Ra   N   c. Ba   As

    b. Ne   Xe

26. Circle the particle with the LARGER radius.

    a. Cl   Cl⁻

    b. Mg Mg^{2+}

27. Circle the atom with the HIGHER first ionization energy.

    a. Li or F   b. Li or Cs

Chemical Bonding

28. Are the following properties characteristics of ionic, covalent, or metallic bonding?

    a. Involve a transfer of electrons.

    b. Formed by sharing electrons

    c. Nonmetal + Nonmetal

29. Write formulas for the following compounds (HINT: First determine ionic/acid/covalent).
   a. calcium bromide   d. silicon dioxide

   b. iron(III) sulfate   e. dinitrogen tetroxide

   c. hydrofluoric acid   f. sulfurous acid

30. Draw Lewis structures for
   a. diatomic oxygen

   b. nitrate ion

   c. sulfur hexafluoride

31. Draw the Lewis structure and predict the VSEPR shape for
   a. BH_3

   b. PH_3

   c. carbon dioxide.

32. Write names for the following compounds (HINT: First determine ionic/acid/covalent).
   a. $CrCl_3$ d. $MgSO_4$

   b. Cu_2CO_3 e. P_4O_6

   c. $AsCl_5$ f. $HClO_3$

Moles   –

33. How many formula units of magnesium sulfate are in 25.0 g?

34. Find the molarity of a 750 mL solution containing 346 g of potassium nitrate.

35. Calculate the number of grams required to make a 50.0 mL solution of $6.0M$ NaOH.
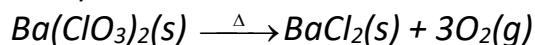
36. Find the % composition of copper(II) chloride.

37. The percent composition of a compound is 40.0% C, 6.7% H, and 53.7% O. The molecular mass of the compound is 180.0 g/mol. Find its empirical and molecular formulas.

Chemical Reactions

38. Write a word equation for the following reaction (incl. how many? of what? what state?).

$Ba(ClO_3)_2(s) \xrightarrow{\Delta} BaCl_2(s) + 3O_2(g)$

39. Rewrite and balance the following word equation using chemical formulas, physical states, and energy. – *When solid sodium chlorate absorbs energy, it produces solid sodium chloride and oxygen gas.*

Predict the products and balance the reactions below. Specify whether it is a combustion, synthesis, decomposition, single replacement, or double replacement.

40. __Mg(s) + __CuSO$_4$(aq) →

41. __ C_5H_{12}(l) + __ O_2(g) →

42. __ NH$_4$Cl(aq) + __ Pb(NO$_3$)$_2$(aq) →
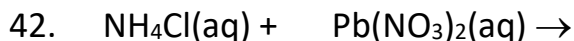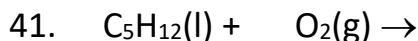
Stoichiometry

43. How many grams of copper would be produced from 49.48 g of chromium? Cr + CuSO$_4$ → Cu + Cr$_2$(SO$_4$)$_3$

44. How many grams of chromium are required to react with 125 mL of 0.75*M* CuSO$_4$. (same reaction as #43)

45. 6.45 g of lithium reacts with 9.20 g of oxygen gas to produce lithium oxide. How many grams of Li$_2$O are formed?

46. What are the limiting and excess reactants in #45?

47. The actual yield of the reaction in the previous problem is 12.5 g. What is the percent yield of this reaction?

Solutions

48. Explain the effect of adding more solute to unsaturated, saturated, and supersaturated solutions.

49. Explain how temperature and pressure affect solubility of a solid dissolved in a liquid and also a gas dissolved in a liquid.

50. What is the percent by mass of NaCl if 4.23grams of salt are dissolved in 145.00g water?

51. How many grams of $AlCl_3$ are required to make a 2.25m solution in 30.0 g of water?

52. What volume of 12M HCl is needed to prepare 250 mL of 0.20M HCl?

Thermodynamics

53. Calculate ΔH for IF_5 → IF_3 + F_2 given:

   IF + F2 → IF3   ΔH= -390kJ
   IF + 2F2 → IF5   ΔH= -745 kJ

54. It takes 487.5 J to heat 25 grams of copper from 25 °C to 75 °C. What is the specific heat in Joules/g·°C?

55. If a system absorbs 32kJ of energy while doing 40. kJ of work, what is the change in energy of the system?