

CHM 151 Practice Final Exam

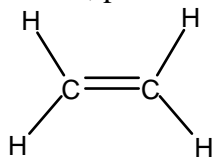
1. How many *significant figures* are there in the result of 5.52 divided by 3.745.
2. How many *significant figures* are there in the answer when 9.021 is added to 0.82.
3. What is the *mass* of 7.80×10^{18} carbon atoms?
4. How many *moles* are in 12.0 g of P atoms?
5. How many *moles* are in 1.0×10^{19} Hg atoms?
6. The density of bromine liquid is 3.12g/mL. Since it is a liquid it is easier to measure in a graduated cylinder than to weigh out on a balance. If we needed 28.1 g of Br₂ for a reaction, what *volume* would we measure?
7. Referring to question 6, what *volume* of Br₂ do we need to put in 500 mL of solution to make a 2.50 M solution of bromine?
8. $^{35}_{17}\text{Cl}^-$ has how many protons, neutrons, and electrons?
9. What is the *percent by mass* of Na, C, and O in sodium carbonate?
10. 1.52 g of a compound of N and O contains 0.96 g oxygen. What is the *empirical formula*?
11. What is the *formula* of sodium sulfide?
12. For the reaction $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$, how many *molecules* of oxygen are produced when 0.82 moles of potassium chlorate decompose?
13. Fool's gold is based on a iron sulfide compound and can be made by $\text{Fe} + \text{S} \rightarrow \text{FeS}$. If there are 9.42 g Fe and 8.5 g S, how much FeS (in g) can be made?
14. What is the *molarity* of an 85.0 mL ethanol solution containing 1.77 g of ethanol (CH₃CH₂OH)?
15. What is the *molarity* of pure water at 20°C. Density = 1.00 g/mL
16. $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl(aq)} + \text{water}$. If we started with 25.0 mL of 0.100 M HCl, how many *mL* of 0.200 M NaOH would it take to react exactly with the HCl?
17. A quantity of 25.0 mL of a 0.866 M KNO₃ solution is poured into a 500 mL volumetric flask. Water is added to make the solution exactly 500.00 mL. What is the *molar concentration* of the final solution?
18. Na(s) reacts with water to form aqueous NaOH and hydrogen gas. Write a *balanced equation* using the smallest whole numbers as coefficients.
19. Calculate the *volume* (in L) occupied by 7.40 g of carbon dioxide gas at STP.

20. The density of a gaseous compound is 3.38 g/L at 40°C and 1.97 atm. What is its *molar mass*?
21. Sodium azide (NaN_3) is used in air bags for automobile safety. The impact triggers the decomposition of NaN_3 to form nitrogen gas, filling the bag as follows: $2\text{NaN}_3 \rightarrow 2\text{Na(s)} + 3\text{N}_2\text{(g)}$. Calculate the *volume* of N_2 produced at 21°C and 823 mmHg if 60.0 g of sodium azide reacted?
22. All gases at a given temperature travel at the same average velocity. (T or F)
23. If the atmospheric pressure in Flagstaff is 603 mmHg. What is the pressure of O_2 ? O_2 is 20.0% of the atmosphere.
24. The ΔH_f of any substance in its natural state at standard conditions is always zero. (T or F)
25. Benzene (C_6H_6) burns in air to produce CO_2 and liquid water. Write a balanced equation and calculate the ΔH of the reaction in kJ/mol of benzene reacting with oxygen.
 $\Delta H_f(\text{Benzene}) = 49.04 \text{ kJ/mol}$; $\Delta H_f(\text{CO}_2) = -393.5 \text{ kJ/mol}$; $\Delta H_f(\text{H}_2\text{O}) = -285.8 \text{ kJ/mol}$.
26. 466 g of water is heated from 8.50°C to 74.60°C. What is the heat *absorbed* (in kJ) by the water.
Specific heat of water = 4.184 J/g·°C
27. Calculate the *frequency* of red light of wavelength $6.50 \times 10^2 \text{ nm}$.
28. What is the energy of a *mole* of photons having a wavelength of 700 nm (red light)?
29. Which orbital is filled *last* in the silver atom?
30. Which *atom* corresponds to the electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$?
31. Which *atom* has the same electronic configuration as Mg^{2+} ?
32. Arrange the atoms in order of *increasing* radius: P, Si, N.
33. Which is *largest* in size Fe^{3+} or Fe^{2+} ?
34. Which is the most *electronegative*? P, S or Cl?
35. An ionic bond is typically formed between a metal cation and a non-metal anion. (T or F)
36. An aqueous solution of barium chloride is mixed with an aqueous solution of sodium sulfate. A precipitate forms. Identify the *precipitate*.
37. Hydrochloric acid [HCl(aq)] is reacted with potassium hydroxide [KOH]. Write the *net ionic* equation for this reaction.
38. Classify the type of *bond* in HCl, KF, and the CC bond in C_2H_4 .
39. In the nitrate ion, NO_3^- , what hybrid orbitals are used by nitrogen in bonding?
40. Molecules with no dipole (no net charge direction) *cannot* have polar bonds? (T or F)

41. What are the *molecular geometries* of BH_3 , CH_4 , SF_5^+ , BeH_2 , SF_4 , H_2S , and CO_3^{2-} ?

42. What are the approximate *bond angles* of the molecules in question 41?

43. How many sigma bonds, pi bonds, and lone pairs are there in



44. Which has the highest *first* ionization energy O or S? highest *2nd* ionization energy Li or Be?

45. The boiling point of I_2 is higher than F_2 because of what type of intermolecular force?

46. Comparing a polar and a nonpolar molecule with similar molar mass, the polar one always has a *higher* boiling point. (T or F)

47. Hydrogen bonding is the main intermolecular attraction in ammonia. (T or F)

48. Draw a phase diagram; label all the regions.

49. How many *ions* does magnesium chloride dissociate into when dissolved in water?

50. Diamond is so hard because it is a covalent-network solid. (T or F)

51. A crystalline solid is hard, has a high melting point, and is a good conductor of electricity when molten. What type of crystalline solid is this?

52. Which of the following substances would be the *most* soluble in CCl_4 ? $\text{CH}_3\text{CH}_2\text{OH}$, H_2O , NH_3 , $\text{C}_{10}\text{H}_{22}$.

53. A solution is prepared by dissolving 50.0 g of cesium chloride (CsCl) in 50.0 g of water. The density of the solution is 1.58 g/mL. Calculate the molarity, and molality of the cesium chloride solution.

Answers

(1) 3; (2) 3; (3) 1.56×10^{-4} g; (4) 0.387 mol; (5) 1.7×10^{-5} mol; (6) 9.01 mL; (7) 64 mL ; (8) 17p, 18n, 18e;
(9) Na=43.4%, C=11.3%, O=45.3%; (10) N_2O_3 ; (11) Na_2S ; (12) 7.4×10^{23} O_2 molecules; (13) 14.8g;
(14) 0.452M; (15) 55.5M; (16) 12.5mL; (17) 0.0433M; (18) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$; (19) 3.77L;
(20) 44.1g/mol; (21) 30.8L; (22) F; (23) 121 mmHg; (24) F; (25) -3267.4 kJ/mol benzene reacted;
(26) 129kJ; (27) 4.61×10^{14} Hz (28) 1.71×10^5 J; (29) 4d; (30) Mn; (31) Ne; (32) $\text{N} < \text{P} < \text{Si}$; (33) Fe^{2+} ;
(34) Cl; (35) T; (36) BaSO_4 , barium sulfate; (37) $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$; (38) polar covalent, ionic, covalent;
(39) sp^2 ; (40) F; (41) trig. planar, tetrahedral, trig. bipy., linear, distorted tetrahedron (see-saw), bent,
trigonal planar; (42) $120^\circ, 109.5^\circ, 90/120^\circ, 180^\circ, 90/120^\circ, 109^\circ, 120^\circ$; (43) 5 sigma, 1 pi, 0 LP; (44) O, Li;
(45) dispersion forces; (46) T; (47) T; (48) page 471 Chang; (49) 3; (50) T; (51) ionic solid; (52) $\text{C}_{10}\text{H}_{22}$;
(53) 4.69 M, 5.94 m