Practice Questions Honors Chem Semester 1 – A Proficiency Exam

Honors chemistry Fall final exam covering chapters 1, 3-6, and 9.
This practice includes example questions that you should know how to do. These questions are NOT identical to what you might see on the midterm and these questions are not the ***only*** types of questions you might see so please go back and review all material covered so far.

The purpose of the midterm is to see if you are proficient in the content up to this point. The midterm is meant to be taken after you have rigorously studied the course material up to this point. What does proficient mean? This means you are able to look at a question and answer it in less than 4 min WITHOUT using any external resources or notes. *Note: If you must look at your notes or look back at course materials to find the answer, you do not know the material well enough to do well on the midterm.*

Conversions: Conversions between the Metric-English system (bridges) will be provided on the test. These are included for practice.
1 in = 2.54 cm 1 mile = 1.6093 km 1 lb = 453.59 g 1 gal = 3.7854 L 1 qt = 946 mL
Know: 22.41 L = 1 mole gas @STP 1 mole = 6.02214×10^{23}
**You should know all Metric Conversions and English Conversions for the test.*

1. What type of substance has a fixed volume and fixed shape and the atoms are very close to one another?
   a. solid b. liquid c. gas

2. What is the physical change from gas to liquid? _____

3. For nitrogen to go from a gas to a liquid, energy must be put into the system or taken out of the system?

4. Which of the following would be considered a homogeneous mixture?
   a. air b. salsa c. sand and rock d. pure H_2O

5. What is the physical state for beryllium at room temperature?
   a. solid b. liquid c. gas

6. What term is used to describe a substance consisting of two or more different atoms in whole number ratios?
   a. element b. compound c. isotope d. heterogeneous

7. Which metal is a liquid at room temperature? _____

8. Which solid is diatomic at room temperature? _____

9. What is 0.0000000679886 g in scientific notation rounded to 3 s.f.? _____

10. How many significant figures are in this measurement: 0.054020 mL
    a. 4 b. 5 c. 6 d. 7

11. True or False. An isotope has a different number of protons but the exact same number of neutrons.

12. Given the following set of measurements, are the measurements precise? Accurate? Both accurate and precise or neither? The accepted value is d = 2.56 g/cm^3.

    1.36 g/cm^3, 1.45 g/cm^3, 1.50 g/cm^3, 1.41 g/cm^3

13. Which metric prefix is used for the conversion 1 m = 10 ____m?
    a. kilo b. centi c. deci d. milli

14. Which theory did Rutherford disprove with his gold foil experiment?
    a. The Big Bang Theory b. The Modern Atomic Theory c. The Plum Pudding Theory

15. What are the 7 diatomic elements?

16. The element arsenic, As, is a
    a. metal b. non-metal c. gas d. semi-metal

17. Is the following a physical or chemical change: $C(s) + 2\ H_2(g) \rightarrow CH_4(g)$? _____

18. Give an example of a physical change:

19. Give an example of a chemical change:

20. Which of the following methods can be used to separate a mixture of iron and copper fillings?
    a. Magnetic separation. b. Crystallisation c. Evaporation d. Distillation

21. The process in which the heavier impurities settle at the bottom is ____.

    a. Decantation b. Sedimentation c. Filtration d. Evaporation

22. The process in which a solid is separated from the filtrate.

    a. Decantation b. Sedimentation c. Filtration d. Evaporation

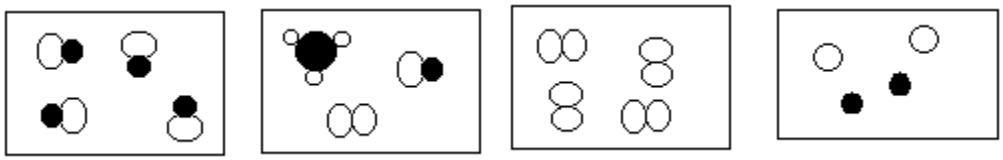
23. Which scientist determined the atom contained a tiny, dense nucleus? _____

24. Convert 86ºF into K. Show all work. ($°C = (°F - 32)x\ \frac{5}{9}$)

25. Complete the following table:

Isotope	Atomic # (Z)	Mass # (A)	neutrons, n^o	electrons, e^-	protons, p^+
	26		32	23	
		30		18	16

26. Label each sample as element, compound, or mixture:



A. _____ B. _____ C. _____ D. _____

Don't forget proper sig figs and units on ALL math problems!

1. A student placed an irregularly shaped metal object into a graduated cylinder that already contained 25.0 mL of DI water. The water level in the graduated cylinder rose to 34.5 mL. Calculate the density of the object if the mass is 4.5678 g.

2. What is the molar mas of strontium phosphate, $Sr_3(PO_4)_2$? _____ Show work:

3. What is the percent composition for carbon in C_2H_4? _____ Show work:

4. A container contains 5.0 L of oxygen gas at STP. What mass, in g, of oxygen gas is in the container?

5. A can of Meyer Lemon Dasani Sparkling water contains 300. cL of liquid. What is this volume in quarts?

6. Convert the distance 450.2 m into units of feet.

7. What is the mass, in g, of 4.56×10^{22} formula units of $Al_2(CO_3)_3$?

8. An explorer found 0.02165 lb diamond while hiking in Brazil. If the density of diamond is 3.51 g/cm^3, what is the volume, in cm^3, of the diamond that the explorer found?

9. How many hydrogen atoms are there in 35.6 g of C_8H_8?

10. If energy increases in the electromagnetic wave, what happens to the frequency and the wavelength?

27. Bluetooth technology uses frequencies in the radiowave region of the EM spectrum. Calculate the energy, in kJ, if the frequency is 2483.5 MHz for a pair of Bluetooth ear buds.

28. Fill in the table with correct units and significant figures:

Frequency, ν (s^{-1})	**Wavelength, λ (nm)**	**Energy, E (kJ)**
5.67×10^{14} s^{-1}		
	420.4 nm	
		5.965×10^{-26} kJ

29. Which quantum number defines the orientation in space of an atomic orbital?
    a. n b. l c. m_l d. m_s

30. How many subshells are there in the n=3 shell? _____

31. What is the correct set of quantum numbers for a 5f atomic orbital?

    n= _____ l = _____ m_l = _____ m_s = _____

32. Draw an example of the Bohr model of the atom for sodium: Label energy levels and draw electrons grouped into subshells.

11. What is an emission line spectrum? Describe Bohr's experiment and how the emission line spectrum supports his model?

12. What is the correct short hand notation for a chromium atom?
    a. $[Ar]4s^13d^{10}$ b. $[Ar]3d^6$ c. $[Ar]4s^13d^5$ d. $[Ar]4s^23d^4$

13. What is the symbol of the atom with the following short-hand electron configurations?
    b. $[Xe]\ 6s^24f^{14}5d^{10}$ _____
    c. $[He]\ 2s^22p^4$ _____
    d. $[Ar]\ 4s^13d^{10}$ _____

14. How many subshells are there in the n=3 shell? _____

15. How many orbitals are there in the n=3 shell? _____

16. How many electrons could fit into all of n=4 shell? _____

17. How many electrons could fit into one orbital? _____

18. How many electrons can fit into a D subshell? _____

19. What is the Pauli Exclusion Principle?

33. Which set of quantum numbers is allowed?
    a. n = 3, l = 2, m_l = 0, m_s = - ½
    b. n = 1, l = 1, m_l = 0, m_s = - ½
    c. n = 4, l = 2, m_l = -4, m_s = - ½
    d. n = 5, l = 0, m_l = 4, m_s = - ½

34. What is the deBroglie wavelength of a 120 mg honeybee traveling at 15 miles per hour?

20. Correctly complete the orbital filling diagram for the iron (III) ion: Start with 1s, label all orbitals and fill in electrons.

21. Using the above orbital filling diagram, describe how you may have used the Aufbau Principle and Hund's Rules.

22. Write the full electron configuration from the ground state for the following:

    a. P^{3-} _____

    b. Co^{2+} _____

    c. Ti^{3+} _____

23. What noble gas are the ions Ca^{2+}, P^{3-}, Cl^{-}, Sc^{3+} isoelectronic to? _____

24. Electron affinity is the amount of energy required to add an electron to the outermost valence shell of a gaseous atom. True or False?

25. Define Ionization Energy and write an equation using gaseous Na as your example. Write a second equation using gaseous Br.

26. Which one of the following alkali metal ions has the largest atomic radius?
    a. Rb^{+} b. K^{+} c. Na^{+} d. Li^{+}

27. Which element has the highest ionization energy?
    a. Na b. Al c. O d. He

28. Which of the following has the lowest metallic character?
    a. Li b. Sr c. Al d. Cs

29. Which element has the highest ionization energy?
    a. F b. Cl c. Br d. I

30. What is the correct Roman Numeral used for tin in $Sn(SO_4)_2$?
    a. I b. II c. III d. IV

31. Which of the following has the lowest metallic character?

a. Sr b. Te c. Mo d. Rb

32. Please name the following compounds *(spelling counts!)*:

a. SrO _____

b. HNO_2 (aq) _____

c. $Co_2(CO_3)_3$ _____

d. I_4O_9 _____

e. $KBrO_4$ _____

f. Cu_3N _____

g. $AgNO_3$ _____

h. Cu_2S _____

i. $BeSO_4 \cdot 4H_2O$ _____

j. $Sr(C_2H_3O_2)_2$ _____

k. C_2Cl_6 _____

33. Please write the correct formula for the following compounds:

a. hydrofluoric acid _____

b. manganese (II) nitrite _____

c. vanadium (V) phosphide _____

d. zinc hydroxide _____

e. silicon dioxide _____

f. manganese (IV) oxide _____

g. iron (II) acetate heptahydrate _____

h. hydroiodic acid _____

i. vanadium (II) phosphate _____

j. oxygen difluoride _____

k. silver sulfate _____

34. How many valence electrons are in the molecule SbF_5^{2-}? _____

35. What type of bond is present between atoms in a sample of ozone, O_3?
    a. nonpolar covalent b. polar covalent c. metallic d. Ionic

36. Draw the Lewis dot structure for the molecular ion, QR_3^-. Q has 6 VE and R has 7 VE. Q is the central atom

    What is the electron domain geometry?_____

    What is the molecular geometry (shape)?_____

    Bond angle? _____

37. What is the correct electron domain geometry for PBr_3?
    a. linear b. bent c. tetrahedral d. trigonal planar

38. What is the correct molecular shape for XeF_5^+?
    a. tetrahedral b. trigonal bipyramidal c. see-saw d. square pyramidal

39. What is the correct bond angle for a molecule that is tetrahedral in electron domain geometry and trigonal pyramidal in molecular shape?
    a. <180° b. <90° c. <120° d. <109.5°

40. How many resonance structures are possible for the molecule ozone, O_3?
    a. 1 b. 2 c. 3 d. 4

41. Draw the Lewis dot structure for the molecular ion, XR_4^-. X has 7 VE and R has 7 VE. X is the central atom.

    What is the electron domain geometry?_____

    What is the molecular geometry (shape)?_____

    Bond angle? _____

42. What is the formal charge on the carbon atom carbon monoxide, CO?
    a. 0 b. +1 c. -1 d. -2

43. Draw three Lewis dot resonance structures for QR_2. Q has 6 VE and R has 6 VE. Q is the central atom and can expand its octet. R cannot expand its octet. Include formal charges for full credit. Circle the structure with the best formal charge distribution.

44. How many valence electrons are there in the molecule N_2O_4?
    a. 34 b. 46 c. 92 d. 6

45. What is the correct bond angle for a molecule that is octahedral in electron domain geometry and square planar in molecular shape?
    a. <180° b. 90° c. <120° d. <109.5° e. <90°

Chapter 9 isn't included since we just finished it. Use your worksheets and test as a study guide.