

Chemistry 51

Final Exam

Part A

Name _____

Follow the directions and select the BEST answer for each section. Mark your answers on the scantron answer sheet carefully. Make sure you put your name on your scantron answer sheet- do so before you begin! Circle your name for 2 points extra credit. Clearly indicate which Scantron form is the **PRIMARY** and **SECONDARY** ones by writing **PRIMARY** and **SECONDARY** on the top-right hand corner of each Scantron.

There are 41 questions/problems for 150 pts. total.

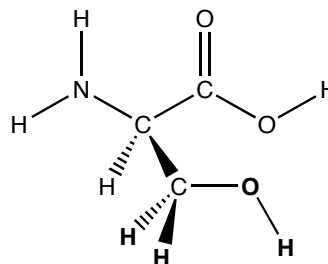
A. Match or fill in the blank. Remember to choose the "BEST" answer! 2 pts. each

- Which is not part of the Scientific Method?
 - observation of system
 - hypothesis of phenomenon
 - experiment design
 - questioning*
 - conclusion(s) report
- Which pair of elements tends to form covalent compounds?
 - any two elements of the same phase
 - elements found on opposite sides of the periodic table
 - elements found next to each other in the periodic table*
 - those found in the upper right hand side of the periodic table
 - metallic elements
- An individual aluminum-hydrogen bond is polar. Why is aluminum hydride, AlH_3 , non-polar?
 - the three aluminum-hydrogen bonds in AlH_3 are oriented 360° from each other
 - the three aluminum-hydrogen bonds in AlH_3 are oriented 120° from each other *
 - any molecule containing three polar bonds is always non-polar
 - the polarity of aluminum-hydrogen bonds result in a dipole moment
 - aluminum-hydrogen bonds are not polar
- If you change the number of protons, electrons and neutrons, respectively, you get a different ____, ____ & ____.
 - atom, ion & isotope*
 - isotope, atom & ion
 - atom, isotope & ion
 - ion, atom & isotope
 - ion, isotope & atom
- Lye contains Na, O and H. Which isotopes of each atom would most samples of marble contain?
 - sodium-22, oxygen-15 & hydrogen-1
 - sodium-22, oxygen-16 & hydrogen-1
 - sodium-23, oxygen-16 & hydrogen-2
 - sodium-23, oxygen-15 & hydrogen-1
 - sodium-23, oxygen-16 & hydrogen-1*

7. The periodic table groups elements according to what feature?
- similar chemical properties/reactivities*
 - similar atomic sizes
 - similar first ionization energies
 - groups and periods
 - similar number of electrons

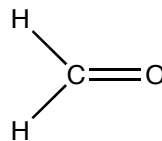
8. Which is the most polar bond in the chemical structure for the amino acid, serine, below?

- H-N
- N-C
- C-O
- C-C
- O-H*

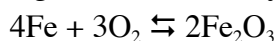


9. Acetone, H_2CO , is polar. In which direction is the dipole arrow pointing (tail + to head \rightarrow or \leftarrow)?

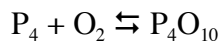
- Hs to C
- Hs to O*
- C to O
- O to C
- O to Hs



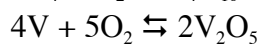
10. What are the charges for the non-oxygen atom in each of the products of the reactions below, respectively?



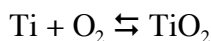
(one form of "rust")



(product of "white phosphorus" fires)



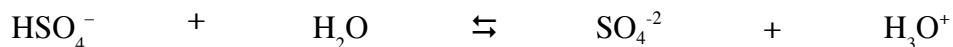
(dry form of vanadium and possible insulin drug source)



(whitening agent)

- +3, +5, +5, +4*
- +3, +4, +5, +5
- +2, +5, +10, +2
- +3, +5, +10, +2
- +3, +5, +5, +2

11. Which of the participants in the following reaction are the acid and its conjugate base, respectively?



- HSO_4^{2-} & H_3O^+
- H_2O & SO_4^{2-}
- HSO_4^- & SO_4^{2-} *
- H_3O^+ & H_2O
- There isn't a proper set!

12. What can you and what can you not change, respectively, when balancing a chemical equation?
- chemical formula & number of moles
 - molecular formula & mole ratio
 - coefficients & subscripts*
 - subscripts & superscripts
 - subscripts & coefficients
13. Which is a mole not equal to?
- 22.4 L of an ideal gas at standard temperature and pressure
 - 18.0 g of water (H₂O)
 - 35.45 g of chlorine (Cl₂) *
 - 6.02×10^{23} particles
 - 32.0 g of oxygen gas (O₂)
14. Which part of the phase diagram for water is different than that for all other substances?
- the deposition transition curve
 - the solidification transition curve*
 - the condensation transition curve
 - the triple point
 - the isobaric curve
15. Which is not true of acid/base chemistry?
- acids are sour
 - bases are bitter
 - neutralization reactions always make a salt and water
 - weak acids make good electrolytes*
 - water is amphiprotic
16. Which is not an example of a solution?
- fog
 - diamond*
 - bronze
 - whipped cream
 - a classroom full of students
17. What is the sum for the coefficients of the chemical equation below when it is balanced?
- $$\text{CO}_3^{-2} + \text{H}_3\text{O}^+ \rightleftharpoons \text{H}_2\text{CO}_3 + \text{H}_2\text{O}$$
- 3
 - 4
 - 5
 - 6*
 - 7

18. When converting from mass of reactant to mass of product, which conversion factor is always needed?
- gram of reactant and gram of product
 - mole of reactant and gram of product
 - gram of reactant to mole of product
 - mole of reactant to mole of product*
 - liter of reactant to liter of product
19. When the hydronium ion (H_3O^+) concentration increases, what also happens?
- the $[\text{H}_3\text{O}^+]$ increases*
 - the pH increases
 - the pOH decreases
 - the $[\text{OH}^-]$ increases
 - these all happen
20. Which of the following is not an example of a reversible processes/phenomenon?
- the buffering of blood at $\text{pH} = 7.35 \pm 0.05$
 - glass breaking*
 - any system in equilibrium
 - ability of hemoglobin to carry oxygen in blood
 - commuting to/from work
21. Which of the participants in the following reaction are the base and its conjugate acid, respectively?
- $$\text{NH}_4^+ + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{H}_3\text{O}^+$$
- H_3O^+ & H_2O
 - H_2O & H_3O^+ *
 - NH_4^+ & NH_3
 - NH_3 & NH_4^+
 - There isn't a proper set!
22. Which of the following does not require the presence of an indicator?
- change of color at the equivalence point
 - pH neutralization*
 - blue litmus paper
 - red litmus paper
 - universal pH paper
23. Why are trans double bonds favorable in edible fats?
- they taste bad
 - they taste good
 - they allow the fat molecules to "cake" and form a solid
 - they force the molecules to spread apart and form a liquid*
 - they are better for your health

24. Which is the generic name for a molecule containing repeating single units?
- A. peptide
 - B. amino acid
 - C. carbohydrate
 - D. polymer*
 - E. monomer
25. Which of the following causes cancer, genetic mutations and birth defects, respectively?
- A. carcinogen, mutagen & teratogen*
 - B. carcinogen, teratogen & mutagen
 - C. teratogen, carcinogen & mutagen
 - D. teratogen, mutagen & carcinogen
 - E. mutagen, teratogen & carcinogen
26. Which is not one of the three basic chemical food types?
- A. fat
 - B. protein
 - C. carbohydrate
 - D. these all are*
 - E. none of these are
27. Which class of compounds is not an example of a natural product?
- A. pheromone like musk oil
 - B. hormone like estrogen
 - C. fatty acid like oleic acid
 - D. artificial flavor like vanillin
 - E. surfactant like sodium dodecyl sulfate (SDS)*
28. Why should bleach never be mixed with any nitrogen based cleaning agents?
- A. they don't clean as well together
 - B. they produce toxic chlorine gas*
 - C. they produce toxic ammonia gas
 - D. they form an immiscible solution
 - E. they neutralize each other
29. Which is not a common food additive?
- A. surfactant*
 - B. antioxidant
 - C. artificial coloring
 - D. artificial flavor
 - E. artificial sweetener

Chemistry 51

Part B

Solve the following problems. Be sure to show all of your work if you want any credit- i.e. **NO WORK = NO CREDIT!**

30. What is the mass in grams of 28.2 mL of the liquid propylene glycol which is both a moisturizing agent in foods and "green" antifreeze in cars? ($d = 1.063 \text{ g/mL}$) /3 pts.

Chapter 1, Problem 74b

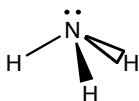
$$\frac{X \text{ g}}{1} = \left(\frac{1.063 \text{ g}}{\text{mL}} \right) \left(\frac{28.2 \text{ mL}}{1} \right) = 29.9766 \text{ g} = 30.0 \text{ g}$$

Answer goes here! 

30.0 g

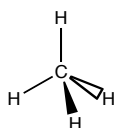
31. Draw the electron dot structures for the following molecules and polyatomic ion. What is the molecular geometry for each one? /8 pts.

ammonia (2)



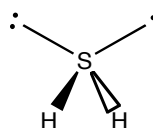
trigonal pyramidal

methane (2)



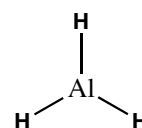
tetrahedral

hydrogen sulfide (2)



bent

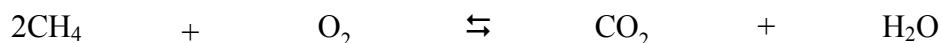
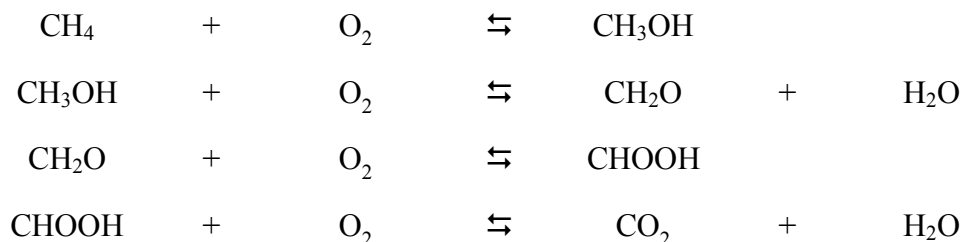
aluminum hydride (2)



trigonal planar

32. Balance the following reactions and determine the overall balanced reaction.

/5 pts.



33. In the following reaction identify which reactant is being oxidized and reduced by writing both of the half-reactions? /2 pts.



oxidation:

reduction:

/18 pts. Total

34. Fill in the table below with the missing information.

/12 pts.

moles of sample	mass of sample	molecules of sample
a)	b)	1.20 x 10 ²⁴ molecules of lye (NaOH)
c)	90.0 g of a simple sugar (C ₆ H ₁₂ O ₆)	d)
0.125 mole of water (H ₂ O)	e)	f)

a)

b)

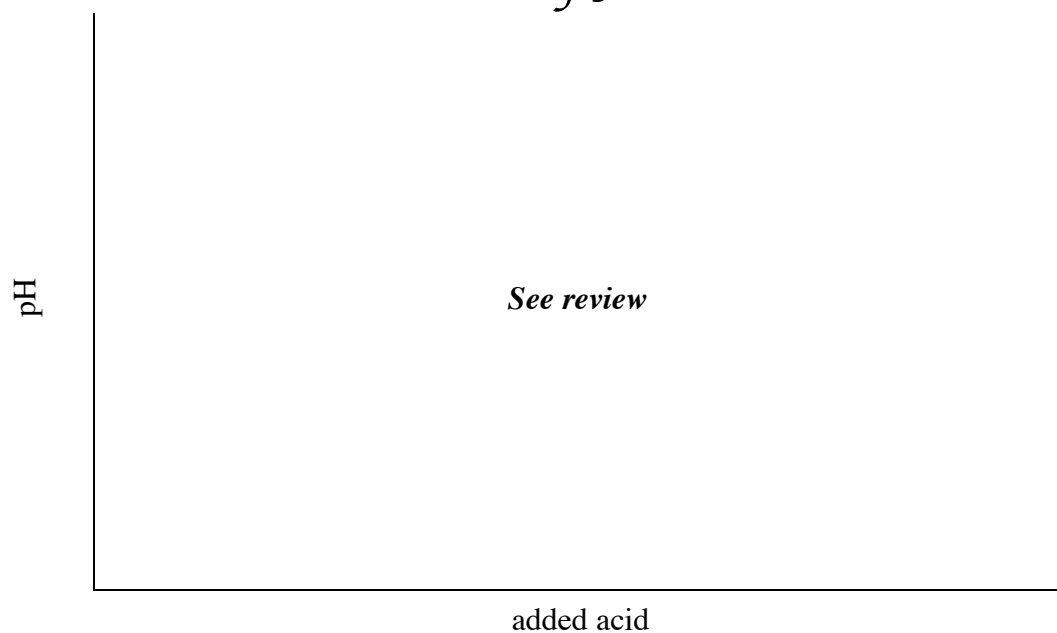
c)

d)

e)

f)

35. Draw a generic titration curve below for a strong monoprotic acid (like hydrochloric acid, HCl) in solution titrated with a strong base (like sodium hydroxide, NaOH). Label the region where each ionic species (*i.e.* H⁺, & OH⁻) exists. Also, label the equivalence point. /3 pts.

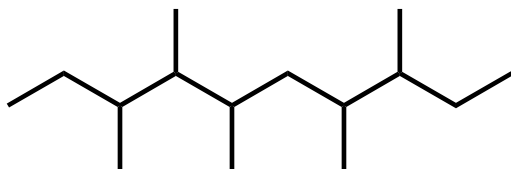


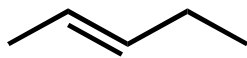
/15 pts. Total

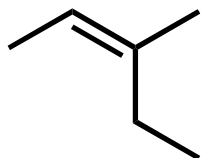
36. Name the following compounds

A. /2

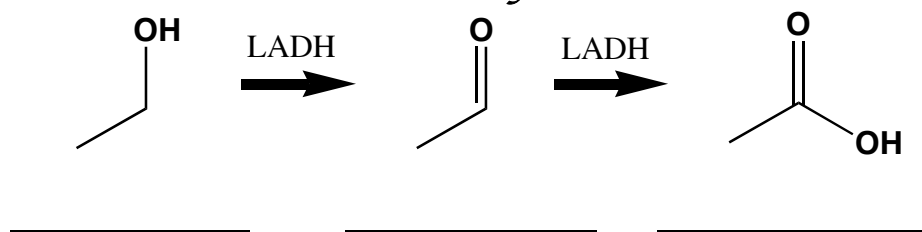
B. /2

C. /2

E. /2

F. /2

37. The metabolism of alcohol in the liver is illustrated below. Write the chemical names for each of the compounds involved. /3 pts.



38. Draw a cartoon representation of a homopolymer and one for a heteropolymer. Provide the names of materials that are examples of each. /3 pts.

homopolymer:

homopolymer example = _____

heteropolymer:

heteropolymer example = _____

/17 pts. total

39. Draw the fundamental structural unit for all amino acids.

/3

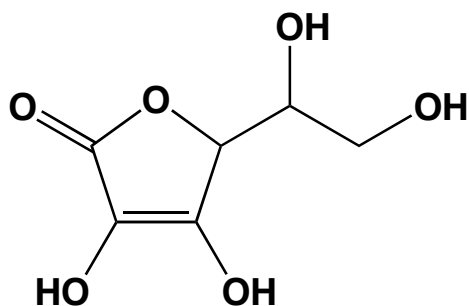
40. Draw an example of a dipeptide with an amide bond that joins two amino acids with R-groups R_1 and R_2 , respectively

/3

41. Identify **all** heteroatomic functional groups in the following molecules. Make sure you clearly label every one and account for all of them!

A. ascorbic acid (vitamin C)

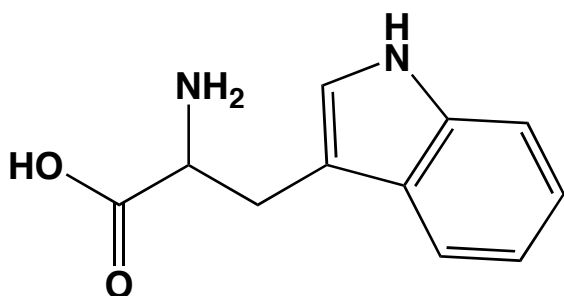
/2



a. _____
b. _____

B. tryptophan

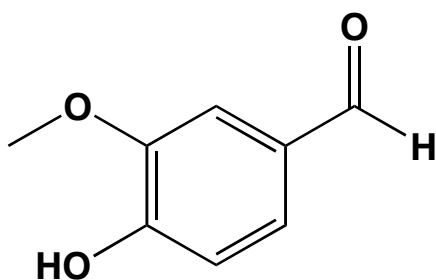
/2



a. _____
b. _____

C. vanillin (vanilla flavor)

/3



a. _____
b. _____
c. _____

/13 pts. total

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EXTRA CREDIT: Briefly define a chemical concept of your choice and explain how your understanding of it can directly benefit you. 10 pts max

/18 pts pg 6

/15 pts pg 7

/17 pts pg 8

/13 pts pg 9

/63 pts Total