Moorpark College  
Chemistry 11 Mock Final Examination ANSWERS  
Professor Torres

1. What is the pH of a solution that is \(1.7 \times 10^{-5}\) M H⁺?

   - A. 4.77
   - B. 10.98
   - C. 0.22
   - D. 9.23
   - E. 1.70

2. Which combination below will form a buffer solution?

   - A. HCl and NaCl
   - B. HNO₃ and NaNO₃
   - C. HC₂H₃O₂ and NaC₂H₃O₂
   - D. NaBr and NaOH
   - E. All of the above are true

3. A sample of helium gas initially at 37.0 °C, 785 torr, and 2.00 L was heated to 58.0 °C while the volume expanded to 3.24 L. What is the final pressure in atm?

   - A. 517 atm
   - B. 0.681 atm
   - C. 1.79 atm
   - D. 3.21 atm
   - E. None of the above

4. Consider the reaction of an aqueous solution of lead(II) nitrate with an aqueous solution of potassium iodide. Which of the following represents the correctly balanced net ionic equation?

   - A. \(\text{Pb}^{2+} + \text{NO}_3^- + \text{K}^+ + \text{I}^- \rightarrow \text{PbI}_2(s) + \text{KNO}_3(aq)\)
   - B. \(2\text{NO}_3^-(aq) + 2\text{K}^+(aq) \rightarrow 2\text{KNO}_3\)
   - C. \(\text{Pb}^{2+}(aq) + 2\text{NO}_3^-(aq) + 2\text{K}^+(aq) + 2\text{I}^-(aq) \rightarrow \text{PbI}_2(s) + 2\text{K}^+(aq) + 2\text{NO}_3^-(aq)\)
   - D. \(\text{Pb}^{2+}(aq) + 2\text{I}^-(aq) \rightarrow \text{PbI}_2(s)\)
   - E. None of the above

5. What is the molecular geometry of sulfur dioxide, \(\text{SO}_2\)?

   - A. bent
   - B. linear
   - C. tetrahedral
   - D. trigonal pyramidal
   - E. octahedral

\[
\text{SO}_2
\]
6. Which of the following elements has the lowest ionization energy?
   A. Rb
   B. Na
   C. C
   D. F
   E. He

7. Which of the following represents the correct electron configuration of At^2+
   A. 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^10 4p^6 5s^2 5d^10 5p^6 6s^2 6d^10 6p^6
   B. 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^10 4p^6 5s^2 4d^10 5p^6 6s^2 5d^10 6p^6
   C. 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^10 4p^6 5s^2 5d^10 5p^6 6s^2 6d^10 6p^6
   D. 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^10 4p^6 5s^2 4d^10 5p^6 6s^2 4f^14 5d^10 6p^6
   E. 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^10 4p^6 5s^2 4d^10 5p^6 6s^2 4f^14 5d^10 6p^6

8. A 15.0 g lead ball at 25.0 °C was heated with 40.5 J of heat. Given the specific heat of lead is 0.128 J/g °C, what is the final temperature of the lead?
   A. 21.1 °C
   B. 46.1 °C
   C. 77.8 °C
   D. 0.844 °C
   E. 0.0 °C

   \[ Q = m \times \Delta T \]
   \[ 40.5 \text{ J} = (15.0 \text{ g}) \left( \frac{0.128 \text{ J}}{\text{g} \cdot \text{°C}} \right) (T_f - 25.0 \text{ °C}) \]

   \[ T_f = 46.1 \text{ °C} \]

For Questions 9 – 10, consider the reaction of 10.0 g of Al and 19.0 g of O_2 to produce aluminum oxide.

\[ 4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3 \]

9. How many grams of aluminum oxide are produced?
   A. 40.4 g
   B. 5.00 g
   C. 0.185 g
   D. 18.9 g
   E. 26.4 g

   \[ 9 \text{ Al}_2\text{O}_3 = 10.0 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \times \frac{2 \text{ mol Al}_2\text{O}_3}{4 \text{ mol Al}} \times \frac{10.96 \text{ g Al}_2\text{O}_3}{1 \text{ mol Al}_2\text{O}_3} \]

   \[ = 18.9 \text{ g Al}_2\text{O}_3 \]

10. If 16.0 g of aluminum oxide were actually produced, what is the percent yield of the reaction?

   \[ \text{Yield} = \frac{\text{Actual}}{\text{Theor.}} \times 100 \]

   \[ = \frac{16.0 \text{ g}}{18.9 \text{ g}} \times 100 \]

   \[ = 84.7\% \]
11. Determine which of the chemical formulas shown below is INCORRECT?

A. $\text{K}_3\text{PO}_4$
B. $\text{HCO}_3$
C. $(\text{NH}_4)_2\text{SO}_4$
D. $\text{Ca(OH)}_2$
E. $\text{Al(NO}_3)_3$

Should be $\text{H}_2\text{CO}_3$!

12. The correct scientific notation for the number $0.00050210$ is:

A. $5.0210 \times 10^{-4}$
B. $5.021 \times 10^{-4}$
C. $5.021 \times 10^{-4}$
D. $5.0210 \times 10^{-4}$
E. $5.02 \times 10^{-4}$

13. Which compound listed below is miscible in carbon tetrachloride, $\text{CCl}_4$?

A. $\text{CH}_2\text{Cl}_2$
B. $\text{CS}_2$
C. $\text{NH}_3$
D. $\text{CH}_3\text{CH}_2\text{OH}$
E. $\text{NaCl}$

14. Which molecule listed below is a NONPOLAR molecule?

A. $\text{CHCl}_3$
B. $\text{CH}_3\text{CH}_2\text{OH}$
C. $\text{CH}_3\text{COOH}$
D. $\text{CH}_2\text{Cl}_2$
E. $\text{CH}_3\text{CH}_2\text{CH}_3$

15. Which compound in liquid form will have the highest vapor pressure?

A. $\text{CH}_4$
B. $\text{CH}_3\text{CH}_3$
C. $\text{CH}_3\text{C(O)}\text{CH}_3$
D. $\text{CH}_3\text{CH}_2\text{OH}$
E. None of the above
16. Which compound will have the highest boiling point?
   A. CH₄
   B. CH₃CH₃
   C. CH₃C(O)CH₃
   D. CH₃CH₂OH
   E. None of the above

17. How many molecules of nitrogen monoxide are in a 22.5 g sample?
   A. 5.86 x 10²³
   B. 7.33 x 10²³
   C. 4.52 x 10²³
   D. 0.974
   E. 6.022 x 10²³

18. What is the final concentration (in M) of a solution prepared by diluting 50.0 mL of a 6.00 M KCl solution to a volume of 0.500 L?
   A. 1.67
   B. 0.600
   C. 0.0167
   D. 3.0
   E. 12.0

19. Increasing the intermolecular forces of a liquid will do which of the following?
   A. increase the viscosity
   B. decrease the evaporation rate
   C. increase the surface tension
   D. decrease the vapor pressure
   E. All of the above

20. Which of the following is NOT part of the Kinetic Molecular Theory of gases?
   A. Gas particles do not repel each other.
   B. There is a large distance between gas particles as compared to their relative size.
   C. The size of the actual gas particles is small compared to the volume of the whole gas.
   D. The average energy of the particles changes at constant temperature.
   E. All of the above statements are part of the Kinetic Molecular Theory.
21. The titration of 25.00 mL of a 0.125 M HClO₄ solution required 27.07 mL of KOH to reach the endpoint. What is the concentration of the KOH?

\[ \text{HClO}_4 + \text{KOH} \rightarrow \text{KClO}_4 + \text{H}_2\text{O} \]

A. 0.230 M
B. 0.0846 M
C. 0.115 M
D. 0.169 M
E. 0.254 M

22. Determine the molecular geometry of Ni₃.

A. bent
B. linear
C. tetrahedral
D. trigonal pyramidal
E. octahedral

23. The correct number of significant figures in the number 0.002320 is:

A. 7
B. 6
C. 5
D. 4
E. 3

24. A plastic block has dimensions 2.2 cm x 3.0 cm x 1.5 cm and has a mass of 12.4 grams. Will the block float in water and why?

\[ \rho = \frac{m}{V} = \frac{12.4 \text{ g}}{2.2 \times 3.0 \times 1.5 \text{ cm}^3} = 1.25 \text{ g/cm}^3 \]

A. Yes, because the density of the block is 1.3 g/mL, which is less than the density of water.
B. Yes, because the density of the block is 0.80 g/mL, which is less than the density of water.
C. No, because the density of the block is 1.3 g/mL, which is greater than the density of water.
D. No, because the density of the block is 0.8 g/mL, which is greater than the density of water.
E. None of the above

25. How many protons and electrons are present in O²⁻?

A. 8 protons and 8 electrons
B. 10 protons and 8 electrons
C. 8 protons and 10 electrons
D. 16 protons and 8 electrons
E. 10 protons and 10 electrons
26. What is the value of 27 °C on the Fahrenheit temperature scale?

A. -6.8
B. 106
C. 300
D. 81
E. 42

27. Which of the following atoms is the largest?

A. Li
B. Na
C. K
D. Rb
E. Cs

28. What is the initial temperature of a gas if the volume changed from 1.00 L to 1.10 L, and the final temperature was determined to be 255.0 °C?

\[ \frac{V_i}{T_i} = \frac{V_f}{T_f} \]

A. 480 °C
B. 241 °C
C. 232 °C
D. 207 °C
E. 255.10 °C

29. Which of the 7 diatomic elements would have a mass of 19.08 g stored in a 3.82 L container at 3632 mm Hg and 100 °C?

A. \( \text{H}_2 \)
B. \( \text{Br}_2 \)
C. \( \text{F}_2 \)
D. \( \text{O}_2 \)
E. \( \text{N}_2 \)

30. Sodium borohydride, NaBH\textsubscript{4}, is responsible for converting which of the following?

A. Both the C=C and C=O bonds are reduced.
B. The C=C bond is reduced, but the C=O bond is not.
C. The C=O bond is reduced, but the C=C bond is not.
D. A primary alcohol is oxidized to an aldehyde.
E. A secondary alcohol is oxidized to a ketone.
For Questions 31 – 33, consider the structure of *Erythromycin A* shown below, an antibiotic used to treat a wide variety of bacterial infections.

![Erythromycin A structure](image)

31. Which of the following functional groups is NOT present in *Erythromycin A*?

A. ketone  
B. alcohol  
C. ester  
D. ether  
E. amide

32. Determine the total number of chiral centers (if any) present in *Erythromycin A*.

A. 0  
(See chiral centers labeled above)  
B. 15  
C. 16  
D. 17  
E. 18

33. How many cyclic components (if any) are present in *Erythromycin A*?

A. 0  
B. 1  
C. 2  
D. 3  
E. 4
34. Which of the following TWO structures are not correctly named? **A and D**

A. 3-Ethyl-7-propylcycloheptene
   *Should be:* 7-ethyl-3-propylcycloheptene

B. 4,4-Dimethyl-2-pentyne

C. m-Ethylpropylbenzene

D. 1,5-Difluoro-4,4,5,5-tetramethyl-2-pentyne
   *Should be:* 1,5-Difluoro-4,4,5-trimethyl-2-hexyne

E. trans-10-Bromo-3,6-dimethyl-3-decene

35. Determine the appropriate IUPAC name for the following compound:

![Compound Image]

A. *trans*-3-hepten-5-ol
B. *cis*-3-hepten-5-ol
C. *trans*-4-hepten-3-ol
D. *cis*-4-hepten-3-ol
E. *trans*-1-methyl-3-hexen-2-ol

36. Which of the following will give a positive test with Tollens' reagent?

A. aldehyde
B. ketone
C. carboxylic acid
D. amine
E. Both A and B
37. Select the MOST STABLE conformation for the molecule shown below: D

A. 

B. 

C. 

38. What type of alcohol (if any) is formed by the hydration of 2-methyl-2-butene under acidic conditions?

A. primary
B. secondary
C. tertiary
D. quarternary
E. No alcohol is formed

39. Suppose you carried out two reactions in sequence. In the first reaction, you hydrated 1-butene, and in the second reaction, you dehydrated the MAJOR product of the first reaction. Which of the following would NOT be found in the equilibrium mixture present after this sequence of reactions?

A. 1-butene
B. 2-butene
C. 1-butanol
D. 2-butanol
E. None; all of these are found in the equilibrium mixture

40. Which of the following correctly describes the relationship between the R/S system and the +/- designations associated with optically active compounds?

A. All R-enantiomers are (+).
B. All S-enantiomers are (+).
C. All R-enantiomers are (+), and all S-enantiomers are (-).
D. No S-enantiomers are (+), but some R-enantiomers are (-):
E. There is no general relationship between the R/S system and the +/- designations.
41. Determine the relationship (if any) between the following compounds:

A. structural isomers
B. enantiomers
C. diastereomers
D. identical
E. unrelated

42. Which of the following alkenes is the MOST STABLE?

A. 2-methyl-1-pentene
B. 4-methyl-1-pentene
C. 2-methyl-2-pentene
D. All of the above are equally stable
E. Impossible to tell which is most stable

43. Ketamine “Special K” exists as enantiomers with (S)-ketamine being the more potent anesthetic, while (R)-ketamine produces hallucinogenic side effects. Determine which enantiomer is drawn below.

A. R
B. S
For Questions 44 – 46, use the following answer choices to describe the relationship between the pair of compounds below:

A. structural isomers \#44
B. enantiomers
C. diastereomers \#45
D. identical \#46 (no chiral center is present; tricky!)
E. unrelated

44. 

\[
\text{Br} \quad \text{Cl} \\
\text{Cl} \quad \text{Br}
\]

45. 

\[
\begin{array}{c}
\text{CH}_2\text{CH}_3 \\
\text{H-OH} \\
\text{H-OH} \\
\text{CH}_2\text{CH}_3
\end{array}
\quad \begin{array}{c}
\text{CH}_2\text{CH}_3 \\
\text{H-OH} \\
\text{H-OH} \\
\text{CH}_2\text{CH}_3
\end{array}
\]

46. 

\[
\text{internal plane of symmetry!} \\
\therefore \text{no chiral center}
\]

For Questions 47 – 50, match the following characteristics to the polysaccharides shown:

A. amylopectin \#47
B. amylase \#49 and \#50
C. glycogen \#47
D. cellulose \#48 and \#50
E. All of the above

47. Contains both a(1→4) and a(1→6) glycosidic linkages

48. Contains only β(1→4) glycosidic linkages

49. Contains only a(1→4) glycosidic linkages

50. Composed of unbranched molecular chains
For Questions 51 – 54, determine whether the following statements apply to:

A. primary protein structure
B. secondary protein structure
C. tertiary protein structure
D. quartenary protein structure
E. None of the above

51. A disulfide bond forms between amino acids with acidic and basic side chains.  
52. A salt bridge forms between amino acids with acidic and basic side chains.  

53. Hydrogen bonding between carbonyl oxygen atoms and nitrogen atoms of amino groups cause a peptide to coil into a helix.  

54. Peptide linkages hold amino acids together in a polypeptide chain.

55. Determine the type of glycosidic linkage that is present for the disaccharide shown below:

A. (a1 → b1)  
B. (a1 → b2)  
C. (b1 → a1)  
D. (b1 → a2)  
E. a(1 → 2)
56. Consider the sugar below:

\[
\begin{align*}
\text{CH}_2\text{OH} & \quad \text{CH}_2\text{OH} \\
\text{HO} & \quad = \quad = \quad \text{HO} \\
\text{HO} & \quad \text{H} \quad \text{H} \\
\text{HO} & \quad \text{H} \quad \text{H} \\
\text{CH}_2\text{OH} & \quad \text{HO-H}_2\text{C} \quad \text{OH}
\end{align*}
\]

Draw the cyclic structures for the \( \alpha \) and \( \beta \) anomers of this sugar.

57. Predict the product(s) formed when the triglyceride below undergoes:

\[
\begin{align*}
\text{CH}_2\text{OC}(&\text{CH}_2)_{14}\text{CH}_3 \\
\text{CHO} & \quad \text{CHOC}(&\text{CH}_2)_{7}\text{CH} = \text{CH}(\text{CH}_2)_{7}\text{CH}_3 \\
\text{CH}_2\text{OC}(&\text{CH}_2)_{12}\text{CH}_3
\end{align*}
\]

A. hydrolysis  
B. saponification

A. 
\[
\begin{align*}
\text{CH}_2\text{OC}(&\text{CH}_2)_{14}\text{CH}_3 & \quad \text{CH}_2\text{OC}(&\text{CH}_2)_{7}\text{CH} = \text{CH}(\text{CH}_2)_{7}\text{CH}_3 + 3\text{H}_2\text{O} \quad \text{H}^+ \\
\text{CH}_2\text{OC}(&\text{CH}_2)_{12}\text{CH}_3
\end{align*}
\]

B. 
\[
\begin{align*}
\text{OH} + \text{HO} & \quad \text{Na}^+ \quad \text{HO} \\
\text{OH} & \quad \text{Na}^+ \quad \text{OH}
\end{align*}
\]

\[
\begin{align*}
\text{OH} + 3\text{NaOH} \rightarrow \\
\text{OH} + \text{Na}^+ \quad \text{OH}
\end{align*}
\]
58. Draw the tetrapeptide Asp-His-Arg-Ser

59. The following is a sequence of bases for an exon portion of a strand of a gene:

5' CATACAGCCTGGAAGCTA 3'

A. What is the sequence of bases on the strand of DNA complementary to this segment?
B. What is the sequence of bases on the mRNA molecule synthesized from this strand?
C. What codons are present on the mRNA molecule from part B?
D. What anticodons will be found on the tRNA molecules that interact with the codons from part C?
E. What is the sequence of amino acids in the peptide formed using these protein synthesis instructions?

A. 3' GTATGTCCGACC TTCGAT 5'
B. 3' GUAGUGCCGGACC UUCGUA 5'
   (notice that for RNA, uracil is substituted for thymine)
C. 3' GUAGUGCCGGACC UUCGUA 5'
D. 5' CAU-ACA-GCC-UGG-AAG-CUA 3'
   (notice complementary base pairing for anticodons)
E. Going back to the codons from Part C, use the provided Genetic Code chart to determine that the codons correspond to:
   3' Val - Cys - Arg - Thr - Phe - Asp 5'
60. Provide the appropriate curved arrow notation for formation of the final product.

\[
\text{HO-} \quad \text{CH}_3\text{OH} \overset{\text{H}_2\text{SO}_4}{\xrightarrow{\text{H}^+}} \text{CH}_2\text{OH} \quad \text{(hemiacetal)}
\]

61. Design a synthetic sequence using the appropriate reagents discussed this semester to account for the following chemical transformation.

\[
\text{CH}_3\text{CH}_2\text{CHO} \xrightarrow{???} \text{CH}_3\text{COCH}_3
\]

\[
\text{CH}_3\text{CH}_2\text{CHO} \xrightarrow{\text{NaBH}_4, \text{H}_2\text{O}} \text{CH}_3\text{CH(OH)}\text{CH}_2\text{OH} \xrightarrow{\text{H}^+, \Delta} \text{CH}_3\text{CH}_2\text{C} = \text{CH}_2 \xrightarrow{\text{H}_2\text{O}, \text{H}^+} \text{CH}_3\text{CH}_2\text{CH(OH)}\text{CH}_2\text{OH} \xrightarrow{\text{PCC}, \text{CH}_2\text{Cl}_2} \text{CH}_3\text{CH(OH)}\text{(or K_2\text{Cr}_2\text{O}_7, H}_2\text{SO}_4)} \text{CH}_3\text{COCH}_3
\]
62. Predict the MAJOR and MINOR products for the reaction listed below AND give the appropriate curved arrow notation for formation of each final product.

63. Consider the molecule shown below.

A. Draw ONE enantiomer for this molecule.
B. Draw TWO diastereomers for this molecule.
C. Convert the molecule to its appropriate Fischer projection.

A. Several possible diastereomers such as: