

## Sample Departmental Final Exam

LaGuardia Community College  
Dept. of Natural Sciences  
SCC 110: Foundations of Chemistry

Name of the student: \_\_\_\_\_ Section# \_\_\_\_\_

The final examination is worth a total of 200 points

The Final Examination is divided into two parts-Part 1 and Part 2.

Part 1 is 40 multiple-choice questions to be answered on a Scantron sheet and is worth a total of 120 points (3 points for each question)

Part 2 is 4 short-answer questions worth 20 points each for a total of 80 points

**Note: Report your answers to correct significant figures.**

### Department Policies During Final Examinations

1. Once the examination has begun no talking is allowed
2. Absolutely no borrowing or lending of equipment is allowed.
3. No bathroom breaks are allowed - if you leave the room, you must submit your paper.
4. No caps, hoodies, or earphones can be worn during the exam.
5. Cell phones must be turned off and put away.
6. Graphing calculators and other electronic devices are not allowed

**Failure to comply with the examination policies will be treated as intent to cheat.**

### Some useful information

Avogadro's constant =  $6.02 \times 10^{23}$

$R = 0.0821 \text{ LatmK}^{-1}\text{mol}^{-1} = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$

$0^\circ\text{C} = 273 \text{ K}$ ,  $1 \text{ atm} = 760 \text{ torr}$

$K_w \text{ at } 25^\circ\text{C} = 1.0 \times 10^{-14}$

## PART-1

- Which of the following measurements has three significant figures?  
A) 0.005 m                      B) 510 m                      C) 0.510 m                      D) 0.051 m                      E) 5100 m
- A doctor's order is 0.125 g of ampicillin. The liquid suspension on hand contains 250 mg/5.0 mL. How many milliliters of the suspension are required?  
A) 0.0025 mL                      B) 3.0 mL                      C) 2.5 mL                      D) 6.3 mL                      E) 0.0063 mL
- A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the density of the gold?  
A) 10.4g/mL                      B) 6.77g/mL                      C) 1.00g/mL                      D) 0.0518g/mL                      E) 19.3g/mL
- The number 0.000402 expressed in exponential notation is  
A)  $4.02 \times 10^{-2}$                       B)  $4.02 \times 10^{-5}$                       C)  $4.02 \times 10^4$                       D)  $4.02 \times 10^{-4}$                       E) 402
- According to New York, NY local weather channel, New York City had the warmest Christmas Eve of 2015 with a temperature of 67 °F. This temperature is same as  
A) 67 °C                      B) 35 °C                      C) 19 °C                      D) 55 °C                      E) 20 °C
- Which of the following is an example of a physical change?  
A) grinding coffee beans                      B) baking a cake                      C) burning coal  
D) digesting a cheeseburger                      E) converting water to hydrogen and oxygen
- The number of calories needed to raise the temperature of 32 g of water from 12 °C to 54 °C is..... ( given the specific heat of water = 1.00 cal/g. °C)  
A) 384 cal.                      B) 1.3 cal.                      C) 1300 cal.                      D) 1700 cal.                      E) 0.76 cal.
- Which of the following is a characteristic of the modern periodic table?  
A) A group is a horizontal row in the periodic table.  
B) A period is a vertical column in the periodic table.  
C) The elements in each group have similar properties.  
D) The elements in each period have similar properties.  
E) The atoms are arranged in the increasing order of their atomic mass

9. The correct symbol for the isotope of potassium with 22 neutrons is
- A)  ${}_{19}^{41}\text{K}$       B)  ${}_{41}^{19}\text{K}$       C)  ${}_{15}^{37}\text{P}$       D)  ${}_{37}^{15}\text{P}$       E)  ${}_{19}^{22}\text{K}$
10. The Electron configuration for aluminum ( Z = 13) is
- A)  $1s^2 2s^2 2p^6 3p^3$       B)  $1s^2 2s^2 2p^3 3s^2 3d^4$   
 C)  $1s^2 2s^2 2p^6 3s^2 3p^1$       D)  $1s^2 2s^2 2p^3 3s^2 3p^3 3d^1$
11. The physical property that measure the tendency of an atom in a covalent molecule to attract the shared pair of electrons is called \_\_\_\_\_
- A) Ionization      B) polarity  
 C) electronegativity      D) electropositivity
12. The correct name for the compound  $\text{N}_2\text{O}_3$  is
- A) nitrogen oxide.      B) nitrogen trioxide.  
 C) dinitride trioxide.      D) dinitrogen oxide.  
 E) dinitrogen trioxide.
13. The shape of  $\text{BCl}_3$  molecule is
- A) linear      B) bent      C) pyramidal  
 D) trigonal planer      E) tetrahedral
14. Washing soda powder is primarily composed of sodium carbonate. The chemical formula for sodium carbonate is
- A)  $\text{NaCO}_3$       B)  $\text{Na}_2\text{CO}_3$       C)  $\text{Na}(\text{CO}_3)_2$       D)  $\text{Na}_2\text{CO}_6$
15. The bonds C-H, H-O, and Ca-Cl are, respectively
- A) ionic, polar covalent, and nonpolar covalent  
 B) nonpolar covalent, ionic, and ionic  
 C) polar covalent, nonpolar covalent, and ionic  
 D) nonpolar covalent, polar covalent, and ionic
16. A student measured 5.30 grams of  $\text{Na}_2\text{CO}_3$  on a weighing machine to do an experiment. The mass of the compound is equal to
- A) 0.05 mol      B) 0.50 mol      C) 0.10 mol      D) None of these
17. If you balance the following equation the coefficient for  $\text{H}_2\text{O}$  would be:
- $$\text{Ca}(\text{OH})_2 + \text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{O}$$
- A) 3      B) 4      C) 6      D) 2

18. The number of water molecules in 3.6 g of water is

- A)  $6.02 \times 10^{23}$
- B)  $12.0 \times 10^{23}$
- C)  $1.20 \times 10^{23}$
- D)  $6.02 \times 10^{22}$
- E) none of the above

19. The process shown here is an example of,  $\text{Mg(s)} \longrightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^{-}$

- A) oxidation
- B) reduction
- C) REDOX process
- D. None of these

20. The mathematical expression of the ideal gas law is

- A)  $P_1V_1 = P_2V_2$
- B)  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
- C)  $\frac{P_1}{V_1} = \frac{P_2}{V_2}$
- D)  $PV = nRT$
- E)  $P_T = P_1 + P_2 + P_3$

21. Which of the following is **NOT** a postulate of the kinetic theory of gases?

- A) A gas is composed of very small particles.
- B) There is very little space occupied by gas molecules compare to the volume of container.
- C) Gas particles move rapidly.
- D) Gas particles do not attract or repel one another.
- E) Gas particles move faster when the temperature decreases.

22. The pressure exerted by the particles of vapor above a liquid is called the\_\_\_\_\_

- A) vapor pressure
- B) barometric pressure
- C) standard pressure
- D) molar pressure
- E) atmospheric pressure

23. How many grams of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , will be needed to prepare 250 mL of 0.1M sucrose solution in water?

- A) 180 grams
- B) 18.0 grams
- C) 1.80 grams
- D) 9.0 grams
- E) 4.5 grams

24. A Bronsted base is :

- A) A proton donor
- B) A proton acceptor
- C. A hydroxide donor
- D) A hydroxide acceptor
- E) An electron pair acceptor

25. 250.0 mL of 0.30 M NaCl are diluted with water to prepare 0.10 M NaCl solution. What will be the volume of the diluted solution ?
- A) 0.075 L
  - B) 0.25 L
  - C) 0.75 L
  - D) 0.083 L
  - E) 750 L
26. A solution with the same osmotic pressure as the blood is
- A) isotonic to the blood.
  - B) hypotonic to the blood.
  - C) hypertonic to the blood.
  - D) nontonic to the blood.
  - E) molar to the blood.
27. Which of the following factors affects the rate of a reaction?
- A) Concentration of reactants
  - B) Temperature of system
  - C) Addition of Catalyst
  - D) All of these
28. A reaction reached the equilibrium:
- A) When there is no reaction
  - B) When reactants reacts completely
  - C) When products reacts completely to give back the reactants
  - D) When speed of the forward reaction and reverse reaction are equal
29. The conjugate base of  $\text{HPO}_4^{2-}$  is
- A)  $\text{H}_2\text{PO}_4^-$
  - B)  $\text{H}_3\text{PO}_4$
  - C)  $\text{PO}_4^{2-}$
  - D)  $\text{PO}_4^{3-}$
  - E)  $\text{HPO}_4$
30. What is the  $[\text{OH}^-]$  in a solution that has a  $[\text{H}_3\text{O}^+] = 5.0 \times 10^{-3} \text{ M}$ ?
- A)  $0.2 \times 10^{-10} \text{ M}$
  - B)  $5.0 \times 10^{-11} \text{ M}$
  - C)  $2.0 \times 10^{-12} \text{ M}$
  - D)  $2.0 \times 10^{-11} \text{ M}$
  - E)  $2.0 \times 10^{-10} \text{ M}$
31. Which of the following is the weakest acid?
- A) HF ( $K_a$  for HF is  $7.2 \times 10^{-4}$ )
  - B) HCN ( $K_a$  for HCN is  $4.9 \times 10^{-10}$ )
  - C)  $\text{CH}_3\text{COOH}$  ( $K_a$  for  $\text{CH}_3\text{COOH}$  is  $1.8 \times 10^{-5}$ )
  - D)  $\text{H}_2\text{CO}_3$  ( $K_a$  for  $\text{H}_2\text{CO}_3$  is  $4.5 \times 10^{-7}$ )

32. The function of a buffer is to

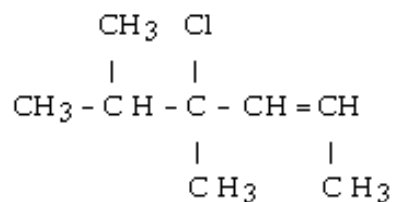
- A) change color at the end point
- B) maintain the pH of a solution
- C) be a strong base
- D) maintain a neutral pH
- E) act as a strong acid

33. Organic compounds are also known as hydrocarbons. In a typical hydrocarbon, the maximum number of covalent bonds that a carbon atom can form is \_\_\_\_\_

- A) one
- B) two
- C) three
- D) four
- E) five

34. What is the IUPAC name for the following compound?

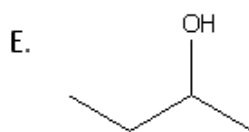
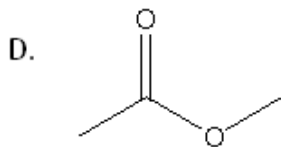
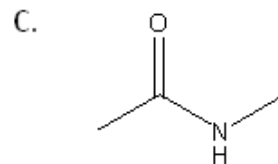
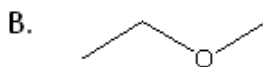
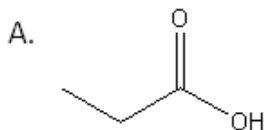
- A) 4-chloro-4,5-dimethyl-2-hexene
- B) 3-chloro-1,3,4-trimethyl-1-pentene
- C) 3-chloro-2,3-dimethyl-4-hexene
- D) 3-chloro-2,3,5-trimethyl-4-pentene
- E) 3-chloro-1,3,4,4-tetramethyl-1-butene



35. A carbohydrate that hydrolyzed under acidic medium to produce two molecules of simple carbohydrates is known as a.

- A) monosaccharide
- B) disaccharide
- C) polysaccharide
- D) starch

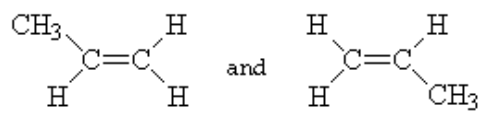
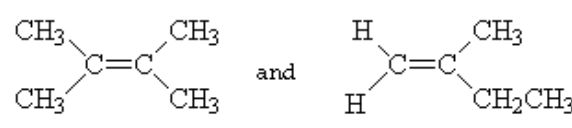
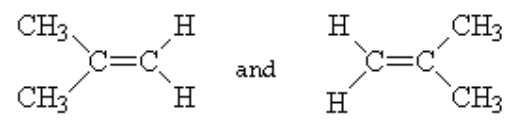
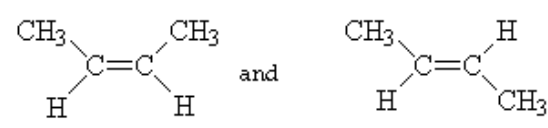
36. Which of the following structural formula represents an alcohol?



37. Amino acids are

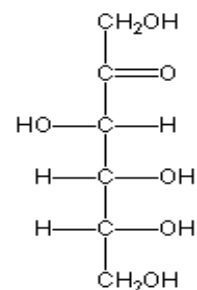
- A) building blocks of carbohydrates
- B) building blocks of nucleic acids
- C) building blocks of proteins
- D) building blocks of lipids

38. Which of the following pairs of compounds are cis-trans isomers?

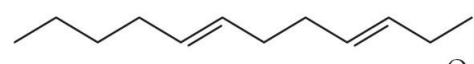
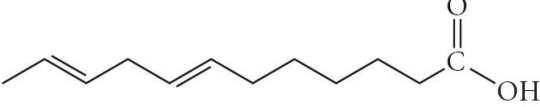
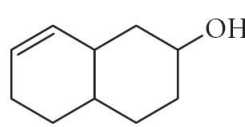
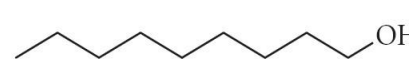
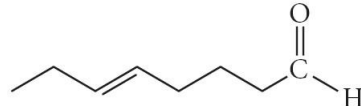
- A)  and
- B)  and
- C)  $\text{HC} \equiv \text{C} - \text{CH}_3$  and  $\text{CH}_3 - \text{C} \equiv \text{CH}$
- D)  and
- E)  and

39. The carbohydrate shown here are classified as a \_\_\_\_\_

- A) aldotrioses                      B) aldopentoses  
 C) ketotetroses                    D) ketohexoses  
 E. ketopentoses



40. Which of the followings represent an example of a polyunsaturated fatty acid.

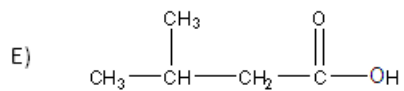
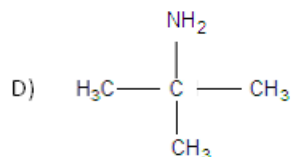
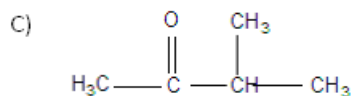
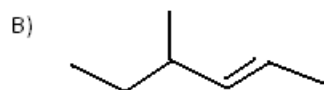
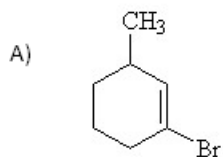
- A) 
- B) 
- C) 
- D) 
- E) 

## PART-2

### Filling in Questions:

1. A) Write the IUPAC name for the following compounds:

(2 x 5 = 10 points)



B) Write the structural formula for the following compounds:

(2x5 = 10 points)

(i) 3-Methylhexanoic acid

(ii) Benzaldehyde

(iii) Ethoxyethane

(iv) 2-Butyne

(v) 2-Methyl-2-propanol



2. A metallic gas container of fixed volume of 1275 mL is filled with O<sub>2</sub> gas and is stored in a room where the temperature is 25°C and a pressure of 1.0 atm. (R= 0.0821 LatmK<sup>-1</sup>mol<sup>-1</sup>)

(A) Calculate the number of moles of O<sub>2</sub> present in the container. (10 points)

(B) If the container is moved to another room where the temperature is 100 °C and pressure 2.0 atm. Can container hold the gas? Explain. (**show your work**) (10 points)

3. A sample of blood serum has a pH= 7.4.

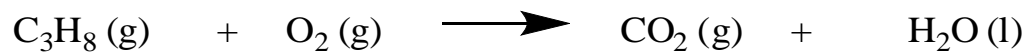
(A) Calculate the hydronium ion concentration,  $[H_3O^+]$  of blood serum? (8 points)

(B) Calculate the hydroxide ion concentration,  $[OH^-]$  in the blood serum. (10points)

(C) Is blood acidic, basic or neutral?

(2 points)

4. The chemical reaction for the combustion of propane, C<sub>3</sub>H<sub>8</sub>, is shown below:



- (A) Write a balanced chemical equation for the above reaction (5 points)
- (B) Calculate the amount of O<sub>2</sub> needs to burn 5.0 g of propane completely. (5 points)
- (C) Calculate the amount of CO<sub>2</sub> produced during this process. (5 points)
- (D) If we need 100 mg of CO<sub>2</sub> for an experiment then how much propane we should use, without wasting it. (5 points)

**Bonus Question: (5 Points)**

A solution of 0.312 M KOH is used to titrate 15.0 mL of a 0.186 M H<sub>3</sub>PO<sub>4</sub> solution. What volume, in milliliters, of KOH solution is required for complete neutralization of the acid? (Show all working)

