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 = 6.02×10^{23} R = $0.0821 \text{ Latm} \text{K}^{-1} \text{mol}^{-1}$ = $8.314 \text{ J} \text{K}^{-1} \text{mol}^{-1}$ $0^{\circ}\text{C} = 273 \text{ K}$, 1 atm = 760 torr

K_w at 25 °C = 1.0 x 10^{-14}

<u>PART-1</u>

| 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 | | | | | | | | | | |
| 2. | A doctor's order is 0.12 How many milliliters o | octor's order is 0.125 g of ampicillin. The liquid suspension on hand contains 250 mg/5.0 mL. v 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 | | | | | | | | | | |
| 3. | A nugget of gold with a volume of 77.0 mL. Wi | nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a plume 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 | | | | | | | | | | |
| 4. | The number 0.000402 | expressed in expon | ential notation is | | | | | | | | | | | | |
| | A) 4.02 X 10 ⁻² | B) 4.02 X 10 ⁻⁵ | C) 4.02 X 10 ⁴ | D) 4.02 X 10 ⁻⁴ | E) 402 | | | | | | | | | | |
| 5. | 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 | | | | | | | | | | |
| 6. | Which of the following is an example of a physical change? | | | | | | | | | | | | | | |
| | A) grinding coffee bear | ns B | b) baking a cake | (| C) burning coal | | | | | | | | | | |
| | D) digesting a cheeseb | urger E | E) converting water to hydrogen and oxygen | | | | | | | | | | | | |
| 7. | 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. | | | | | | | | | | |
| 8. | Which of the following A) A group is a horizo B) A period is a vertic C) The elements in ea D) The elements in ea | 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 (A) $\frac{41}{19}$ K B) $\frac{19}{41}$ K | c) $\frac{37}{15}$ P D) | is ¹⁵ ₃₇ P E) ²² ₁₉ K | | | | | | | | | | | |
|--|---|---|--|--|--|--|--|--|--|--|--|--|--|
| 10. The Electron configuration for aluminum (Z = 13) is | | | | | | | | | | | | | |
| A) 1s ² 2s ² 2p ⁶ 3p ³ C) 1s ² 2s ² 2p ⁶ 3s ² 3p ¹ | B) 1s ² 2s ² 2p ³ 3s ² 3d ⁴ D) 1s ² 2s ² 2p ³ 3s ² 3p ³ 3 | _{Ls} 2 _{2s} 2 _{2p} ³ 3s ² 3d ⁴ 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) IonizationC) electronegativety | B) polarity D) electropositivety | | | | | | | | | | | | |
| 12. The correct name for the compound NA) nitrogen oxide.C) dinitride trioxide.E) dinitrogen trioxide. | 2O3 is B) nitrogen trioxide. D) dinitrogen oxide. | | | | | | | | | | | | |
| 13. The shape of BCl3 molecule isA) linearB) bentC) pyramidalD) trigonal planerE) tetrahedral | | | | | | | | | | | | | |
| 13. The shape of BCl₃ molecule is A) linear B) l D) trigonal planer E) t | pent C) tetrahedral | pyramidal | | | | | | | | | | | |
| 13. The shape of BCl3 molecule is A) linear B) I D) trigonal planer E) 1 14. Washing soda powder is primarily consodium carbonate is | pent C) tetrahedral mposed of sodium carbonat | pyramidal e. The chemical formula for | | | | | | | | | | | |
| 13. The shape of BCl3 molecule is A) linear D) trigonal planer 14. Washing soda powder is primarily consodium carbonate is A) NaCO3 B) Na₂CO3 | cent C) tetrahedral mposed of sodium carbonat C) Na(CO ₃) ₂ | pyramidal e. The chemical formula for D) Na ₂ CO ₆ | | | | | | | | | | | |
| 13. The shape of BCl3 molecule is A) linear D) trigonal planer E) f 14. Washing soda powder is primarily consodium carbonate is A) NaCO3 B) Na2CO3 15. The bonds C-H, H-O, and Ca-Cl are, results (A) ionic, polar covalent, and nonpolar B) nonpolar covalent, ionic, and ionic C) polar covalent, nonpolar covalent, polar c | pent C) tetrahedral mposed of sodium carbonat C) Na(CO ₃) ₂ pectively covalent and ionic and ionic | pyramidal e. The chemical formula for D) Na ₂ CO ₆ | | | | | | | | | | | |
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| 13. The shape of BCl3 molecule is A) linear D) trigonal planer 14. Washing soda powder is primarily consodium carbonate is A) NaCO3 B) Na2CO3 15. The bonds C-H, H-O, and Ca-Cl are, reseading a second se | tetrahedral C) tetrahedral C) mposed of sodium carbonat C) Na(CO ₃) ₂ pectively covalent and ionic and ionic $_2$ CO ₃ on a weighing machine ol C) 0.10 mol the coefficient for H ₂ O woul \rightarrow Ca ₃ (PO ₄) ₂ + H ₂ O | pyramidal e. The chemical formula for D) Na ₂ CO ₆ to do an experiment. The D) None of these d be: | | | | | | | | | | | |

- 18. The number of water molecules in 3.6 g of water is
 - A) 6.02 x 10²³
 - B) 12.0 x 10²³
 - C) 1.20 x 10²³
 - D) 6.02 x 10²²
 - E) none of the above

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

- 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 = nRTE) $P_T = P_1 + P_2 + P_3$
- 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, $C_6H_{12}O_6$, 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.
- C) hypertonic to the blood.

- B) hypotonic to the blood.
- D) nontonic to the blood.

E) molar to the blood.

B) Temperature of system

D) All of these

- 27. Which of the following factors affects the rate of a reaction?
 - A) Concentration of reactants
 - C) Addition of Catalyst
- 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 HPO_4^{-2} is
 - A) $H_2PO_4^-$ B) H_3PO_4 C) PO_4^{2-} D) PO_4^{3-} E) HPO_4

30. What is the [OH⁻] in a solution that has a $[H_3O^+] = 5.0 \times 10^{-3} \text{ M}$?

- A) 0.2×10^{-10} M
- B) 5.0 × 10⁻¹¹ M
- C) 2.0×10^{-12} M
- D) 2.0 × 10⁻¹¹ M
- E) 2.0 × 10⁻¹⁰ M
- 31. Which of the following is the weakest acid?
 - A) HF (K_q for HF is 7.2 × 10⁻⁴)
 - B) HCN (K_q for HCN is 4.9×10^{-10})
 - C) CH₃COOH (K_a for CH₃COOH is 1.8×10^{-5})
 - D) H_2CO_3 (K_a for H_2CO_3 is 4.5×10^{-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? CH₃ Cl A) 4-chloro-4,5-dimethyl-2-hexene L L B) 3-chloro-1,3,4-trimethyl-1-pentene $CH_3 - CH - C - CH = CH$ C) 3-chloro-2,3-dimethyl-4-hexene D) 3-chloro-2,3,5-trimethyl-4-pentene CH3 CH_3 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?



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



<u> PART- 2</u>

Filling in Questions:



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_2 gas and is stored in a room where the temperature is 25°C and a pressure of 1.0 atm. (R= 0.0821 LatmK⁻¹mol⁻¹)
 - (A) Calculate the number of moles of O₂ 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)

4. The chemical reaction for the combustion of propane, C_3H_8 , is shown below:



- (A) Write a balanced chemical equation for the above reaction (5 points)
- (B) Calculate the amount of O_2 needs to burn 5.0 g of propane completely. (5 points)

(C) Calculate the amount of CO_2 produced during this process. (5 points)

(D) If we need 100 mg of CO₂ 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_3PO_4 solution. What volume, in milliliters, of KOH solution is required for complete neutralization of the acid? (Show all working)

 $H_3PO_4(aq) + 3KOH(aq) \rightarrow 3H_2O(l) + K_3PO_4(aq)$

| | | **Acti | | Lann | * 2n+F | | 223 | ۲ŗ | , N | francium 07 | 132.91 | Cs | 55 | 85,468 | Rb | rubiqium 37 | 39.098 | ス | 19 | 22.990 | Na | sodium 11 | 6.941 | | 3 | 1.0079 | T | hydrogen 1 | |
|--------|----|--------------------|--------|---------|--------------------|--|-------|--------|--------|----------------|--------|----|-----------|--------------------|----|------------------|--------|----|-----------------|--------|----------|-----------------|--------|----|--------------|--------|----|---------------|----|
| | | inide se | | Idilluc | abide | | 226 | Ka |) a | radium | 137.33 | Ba | 56 | 87.62 | Sr | 38 | 40.078 | Ca | 20 | 24.305 | Mg | magnesium 12 | 9.0122 | Be | eryilum 4 | | | |) |
| | | eries | | 201102 | corioc | | | * | 201-68 | 00 400 | | * | 57-70 | | | | | | | -12 | | | | | | | | | |
| 1227 | Ac | actinium 89 | 138.91 | , | lanthanum 57 | | [262] | Ę | cul | lawrencium | 174.97 | 2 | 71 | 88.906 | ~ | 39 | 44.956 | Sc | 21 | | | | | | | | | | ł |
| 232.04 | Th | 90 | 140.12 | 2 | cerium | | [261] | 3 | | rutherfordium | 178.49 | Ηŕ | 72 | 91.224 hofnium | Nr | zirconium 40 | 47.867 | Ħ | 22 | | | | | | | | | | • |
| 231.04 | Pa | protactinium 91 | 140.91 | | praseodymium 59 | | [262] | DD | 5 | dubnium | 180,95 | Та | 73 | 92.906 | Np | 41 | 50.942 | < | 23 | | | | | | | | | | ł |
| 238.03 | C | uranium 92 | 144.24 | | neodymium 60 | | [266] | 0 V | 5 | seaborgium | 183.84 | ≶ | 74 | 95.94 hungeten | Mo | moiybdenum 42 | 51.996 | Cr | chromium 24 | | | | | | | | | | 5 |
| 1237 | Np | neptunium 93 | [145] | 0 | promethium 61 | | [264] | BU | | bohrium | 186.21 | Re | 75 | [98] | Тс | 43 | 54.938 | Mn | manganese 25 | | | | | | | | | | P |
| [244] | Pu | plutonium 94 | 150.36 | 2 | samarium 62 | | [269] | HS | 50 I | hassium | 190.23 | 0s | 76 | 101.07 | Ru | rumenium 44 | 55,845 | Fe | 110n | | | | | | | | | | h |
| [243] | Am | americium 95 | 151.96 | Π | europium 63 | | [268] | INIT | E01 | meitnerium | 192.22 | r | 77 | 102.91 | Rh | 45 | 58,933 | Co | cobalt 27 | | | | | | | | | | |
| 12471 | Cm | 96 | 157.25 | 2 | gadolinium 64 | | [271] | unn | | ununnilium | 195.08 | Pŧ | 78 | 106.42 | Pd | 46 | 58,693 | Z | nickel 28 | | | | | | | | | | i, |
| 12471 | Bk | berkelium 97 | 158.93 | Ţ | terbium 65 | | [272] | nnn | Ξ | unununium | 196.97 | Au | 900 79 | 107.87 | Ag | silver 47 | 63,546 | Cu | 29 | | | | | | | | | | 1 |
| [251] | Ç | californium 98 | 162.50 | | dysprosium 66 | | [277] | ann | 711 | ununbium | 200.59 | Hq | 80 | 112.41 | Cd | 48 | 65.39 | Zn | ZINC 30 | D | | | | | | _ | | | i |
| [252] | Es | einsteinium 99 | 164.93 | E | holmium 67 | | | | | | 204.38 | | 81 | 114.82 thallism | h | 49 | 69,723 | Ga | gallium 31 | 26.982 | Þ | aluminium 13 | 10.811 | ω | 5 | | | | |
| 12571 | Fm | 100 fermium | 167.26 | Ţ | erbium 68 | | [289] | puq | 114 | ununquadium | 207.2 | Pb | 82 | 118.71 | Sn | 50 | 72.61 | Ge | germanium 32 | 28.086 | S | silicon 14 | 12.011 | ဂ | 6 | | | | ; |
| [258] | Md | mendelevium 101 | 168.93 | H | 69 | | | | | 50 | 208.98 | 0 | 83 | 121.76 | gS | 51 | 74.922 | As | arsenic 33 | 30.974 | P | 15 | 14.007 | Z | nuogen 7 | | | | 1 |
| 12591 | No | nobelium 102 | 173.04 | 5 | ytterbium 70 | | | | | 2 1000-00 | [209] | Po | 84 | 127.60 | Te | 52 | 78.96 | Se | selenium 34 | 32.065 | ഗ | 16 | 15.999 | 0 | 0xygen 8 | | | | į |
| | | | | | | | | | | | [210] | At | 85 | 126.90 | - | 53 | 79.904 | Br | 35 | 35,453 | <u>೧</u> | chlorine 17 | 18,998 | Π | 9 | | | | 8 |
| | | | | | | | | | | 100 OK | [222] | Rn | 86 | 131.29 | Xe | 54 | 83.80 | Ā | 36 | 39.948 | Ar | argon 18 | 20,180 | Ne | 10 | 4,0026 | He | helium 2 | ł |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |