

**SIR ARTHUR LEWIS COMMUNITY COLLEGE
SCIENCE, TECHNOLOGY, INNOVATION AND SUSTAINABILITY**

**2024 – 2025 ACADEMIC YEAR - SEMESTER I
END OF SEMESTER EXAMINATION**

COURSE TITLE : FOUNDATION IN CHEMISTRY

COURST CODE : CHM115

LECTURER : LERALYN HUNTE-MARTY

DATE : Tuesday 10th December 2024

TIME : 9.00 – 11.00 am

DURATION : 2 HRS

STUDENT ID# :

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Write your student's ID number on all the work you hand in.
2. This paper consists of TWO Sections.
3. SECTION 1 consists of 60 multiple-choice questions. SECTION 2 consists of 2 compulsory structured questions. Answer on the question paper.
4. The use of a silent, non-programmable, scientific calculator is permitted
5. Show all calculations. You may lose marks if you do not show your working or if you do not use appropriate units.
6. Draw structural and displayed formulae using a blue or black pen
7. Do not use correction fluid.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION 1 – MULTIPLE CHOICE QUESTIONS.

Instruction: Circle the correct on your question paper.

- The ammonia molecule has one lone pair of electrons, while the water molecule has two lone pairs of electrons. Which of the following are true about these molecules?
 - The shape of the ammonia molecule is trigonal pyramidal
 - The bond angle in the ammonia molecule is 109.5°
 - The bond angle in the water molecule is 105°
 - The shape of the water molecule is V-shaped.
 - I, II, and III only
 - II and III only
 - I and II only
 - I, III, and IV only
- Which of the following statements are true?
 - The 1s and 2s orbitals are spherical in shape
 - The p orbitals are shaped like dumb-bells
 - The 3d orbitals have slightly more energy than the 4s orbital
 - The 2s orbital has slightly lower energy than the 2p orbital
 - II, III and IV only
 - I and III only
 - I and II only
 - I, II, III, IV
- Nitrogen gas can be prepared by passing gaseous ammonia over solid copper (II) oxide at high temperatures. The other products of the reaction are solid copper and water vapor. How many grams of N_2 are formed when 18.1 g of NH_3 is reacted with 90.4 g CuO ?
$$2\text{NH}_3(\text{g}) + 3\text{CuO}(\text{s}) \rightarrow \text{N}_2(\text{g}) + 3\text{Cu}(\text{s}) + 3\text{H}_2\text{O}(\text{g})$$

Ar: N - 14.0; H- 1.0; Cu- 63.5; O - 16.0

 - 10.6 g
 - 10.64 g
 - 29.7 g
 - 44.5 g
- Which of the following term does not involve the ideal gas law?
 - Temperature
 - Pressure
 - Volume
 - Time
- A Brønsted-Lowry base is defined as a substance that
 - increases $[\text{H}^+]$ when placed in water.
 - acts as a proton donor.
 - decreases $[\text{H}^+]$ when placed in water.
 - acts as a proton acceptor.
- What is a saturated solution? A saturated solution is a:
 - heterogeneous mixture
 - solution that can dissolve additional quantities of solute
 - solution that cannot dissolve additional quantities of solute
 - diluted solution

7. The Equation of the Ideal gas is represented by
- $PV = nRT$
 - $P/V = nRT$
 - $PV = RT$
 - $nV = P/RT$
8. When butanone is treated with Fehling's solution, there is
- a negative test with Tollen's reagent
 - a silver mirror formed
 - No colour change
 - a colour change from blue to red/orange
9. Alkenes convert into alcohols by:
- hydration of alkene by alkaline $KMnO_4$
 - hydration of alkene by aqueous KOH
 - hydrolysis by water vapour and conc. HNO_3
 - hydrolysis by dilute H_2SO_4
10. All radioactive sources have a half-life. Which statement about the half-life of a source is correct?
- It is half the time for the radioactive source to become safe
 - It is half the time it takes the activity of the source to decrease to zero
 - It is half the time it takes for an atom to decay
 - It is the time it takes the activity of the source to decrease by half
11. _____ $HOOC-COOH$ is one of the most acidic of carboxylic acids
- oxalic acid
 - citric acid
 - hydrochloric acid
 - lactic acid
12. Saturated hydrocarbons are referred to as
- alkanes
 - alcohols
 - alkynes
 - alkenes
13. The process of nuclear change in an atom of radioactive material is called.
- Nuclear change
 - radon
 - isotopes
 - Nuclear mass
14. _____ is when two smaller atoms combine to form a larger, more stable atom
- Fission
 - sedimentation
 - Covalent
 - fusion
15. Which one of the following statements regarding alkanes is false?
- Alkanes have low boiling points.
 - Alkanes are non-polar molecules
 - Alkanes are soluble in water
 - Alkanes experience dispersion forces

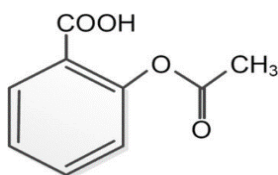
16. What would be the remaining concentration of 300g of radioactive substance after 18 hours if the half-life is 3 hours?
- A. 4.68 g
 - B. 3.34 g
 - C. 9.37 g
 - D. 2.34 g
17. From what plant are naturally - occurring opiates derived?
- A. go pompon
 - B. tobacco
 - C. poppy plant
 - D. Cannabis Sativa
18. Radiation can cause what?
- A. cancer
 - B. headaches
 - C. flu
 - D. super-powers
19. In alkenes, the Carbon atoms are connected by a _____
- A. triple bond
 - B. not connected
 - C. single bond
 - D. double bond
20. A nucleus X has 17 protons and 18 neutrons. Which notation is correct for this nucleus?
- A. $^{17}_{18}\text{X}$
 - B. $^{17}_{35}\text{X}$
 - C. $^{18}_{17}\text{X}$
 - D. $^{35}_{17}\text{X}$
21. Propane contains how many carbon atoms?
- A. 9
 - B. 5
 - C. 2
 - D. 3
22. How do you test for an alkene?
- A. they turn lime water cloudy
 - B. they turn Bromine water colourless
 - C. they form a silver mirror in Tollen's solution
 - D. They turn the universal indicator purple
23. The molality of a solution containing 1.8g of glucose dissolved in 250g of water is
- A. 0.04 M
 - B. 0.02 M
 - C. 0.01 M
 - D. 0.2 M
24. Esterification is the reaction of a ----- with an alcohol
- A. Ester
 - B. Amine
 - C. Amide
 - D. carboxylic acid

25. Which of the following is not true about ideal gas molecules?
- A. they do not have attractive forces
 - B. they move in random motion
 - C. they have a negligible size
 - D. they do not apply pressure
26. What process is used to synthesize ethanol for drinking?
- A. hydration
 - B. hydrogenation
 - C. fermentation.
 - D. Esterification
27. If too much acid enters the blood and the pH begins to drop, a condition known as:
- A. Alkalosis
 - B. Buffer
 - C. Acidosis
 - D. diabetes
28. What occurs when a primary alcohol undergoes oxidation?
- A. Esters
 - B. Ketones
 - C. Carboxylic acids
 - D. Alkenes
29. An example of a compound with functional group -O- is
- A. diethyl ether
 - B. acetone
 - C. methyl alcohol
 - D. acetic
30. Which reagent will give similar results with both butanone and butanal?
- A. an alkaline solution containing complexed Cu^{2+} ions (Fehling's solution)
 - B. acidified aqueous potassium dichromate (VI)
 - C. 2,4-dinitrophenylhydrazine reagent
 - D. an aqueous solution containing $[\text{Ag}(\text{NH}_3)_2]^+$ (Tollen's reagent)
31. A solution is prepared by mixing 1.00 g of ethanol, $\text{C}_2\text{H}_5\text{OH}$, with 100.0 g of water. Calculate the mass percent of ethanol in this solution.
- A. 0.99 %
 - B. 1 g
 - C. 0.990 %
 - D. 1.0 g
32. A concentrated solution contains a lot of _____ and little _____.
- A. solute, suspension
 - B. solvent, solute
 - C. suspension, solvent
 - D. solute, solvent
33. Which of the following structures displays cis-trans isomerism?
- A. $\text{C}_6\text{H}_5\text{ClCH}=\text{CHBr}$
 - B. $\text{CH}_3\text{CHBrCH}_3$
 - C. $(\text{CH}_3)_2\text{C}=\text{CH}_3$
 - D. $\text{CH}_3\text{ClCH}=\text{CHCl}$

34. What is the conjugate base of HCO_3^- ?
- A. HCO_3^+
 - B. OH^-
 - C. CO_3^{2-}
 - D. H_2CO_3
35. Butane and methyl propane both have the same molecular formula C_4H_{10} but different structural formula. What type of isomerism do they display?
- A. positional isomerism
 - B. chain isomerism
 - C. functional group isomerism
 - D. optical isomerism
36. Which of the following is not a part of the ideal gas law equation?
- A. None - that are all are part of it
 - B. Avogadro's law
 - C. Charles law
 - D. Boyle's law
37. Colligative properties depend on _____.
- A. the physical properties of the solute particles dissolved in solution.
 - B. the nature of solvent particles.
 - C. the nature of the solute particles dissolved in solution.
 - D. the number of solute particles in solution
38. Calculate the number of moles of oxygen required to react exactly with 4.30 mol of propane, C_3H_8 in the reaction described by the following balanced equation:
- $$\text{C}_3\text{H}_8 (\text{g}) + 5\text{O}_2 (\text{g}) \longrightarrow 3\text{CO}_2 (\text{g}) + 4\text{H}_2\text{O} (\text{g})$$
- A. 22 mol
 - B. 4.30 mol
 - C. 21.5 mol
 - D. 4.3 mol
39. A substance that does not conduct electricity in solution.
- A. Electrolyte
 - B. non-electrolyte
 - C. metal
 - D. non-metal
40. When propanal is heated with Fehling's solution, there is
- A. a colour change from green to orange
 - B. a negative test with Tollen's reagent
 - C. a colour change from blue to red/orange
 - D. No colour change
41. Which of the following is not a colligative property?
- A. solubility
 - B. freezing point depression
 - C. osmotic pressure
 - D. boiling point elevation
42. At constant pressure, the volume of the gas is directly proportional to its absolute temperature. This is the statement of
- A. Gay Lussac's Law
 - B. Boyle's Law
 - C. Charles Law
 - D. Faraday's Law

43. Which two functional groups are present in an aspirin molecule?

Aspirin has the structure.



- A. aldehydes and ketones
- B. hydroxyl and carboxyl
- C. carboxyl and ester
- D. ester and aldehyde

44. What kind of force is present in ionic bond?

- A. repulsive force
- B. electrostatic force
- C. neutral force
- D. retentive force

45. The atoms in the nitrogen molecule N_2 are held together by

- A. a single covalent bond
- B. a double covalent bond
- C. a triple covalent bond
- D. an ionic bond

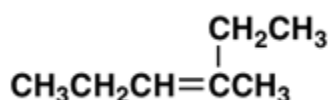
46. Solubility is the amount of solute dissolved in

- A. 200 g of solvent
- B. 100 g of solvent
- C. 1.50 g of solvent
- D. 250 g of solvent

47. What kind of orbital must an electron with the principal quantum number $n = 2$ occupy?

- A. a spherically-shaped orbital
- B. either an s or p orbital
- C. the orbital closest to the nucleus
- D. a dumb-bell shaped orbital

48. Which of (a)-(d) is the correct IUPAC name of the following compound?



- A. 3-methylhex-3-ene
- B. 4-methylhex-3-ene
- C. 4-ethylpent-3-ene
- D. 2-ethylpent-2-ene

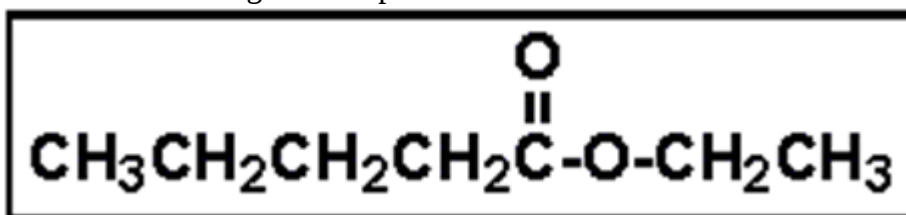
49. Acetone $(CH_3)_2CO$, is an excellent solvent. Acetone is also used to produce dyes, chloroform, and explosives. In what homologous series is Acetone a member of?

- A. Ethers
- B. Carbonyl
- C. Carboxylic acids
- D. Esters

50. In beta decay a _____ is emitted from the nucleus.

- A. neutron
- B. proton
- C. electron
- D. waves

51. Which of the following radiations is the most penetrating?
- Positron
 - Alpha
 - beta
 - gamma
52. What is emitted during gamma radiation?
- Beta rays
 - Particles
 - Gamma rays
 - protons
53. A ----- is a solution whose concentration is accurately known
- Saturated solution
 - Super-saturated
 - Standard solution
 - Non-electrolyte
54. Cis-trans isomerism in alkenes is due to
- free rotation about single bond
 - restricted rotation about the double bond
 - free rotation about the double bond
 - chiral carbon
55. How does ionic bonding take place?
- Two non-metallic elements of different kinds form strong forces of attraction.
 - Two non-metallic elements of the same kind form strong forces of attraction.
 - A non-metallic element like fluorine is attracted to a metallic element like sodium.
 - A metallic element like sodium transfers an electron to a non-metallic element like fluorine.
56. The name of the organic compound with the structure shown below



- butyl acetate
 - propyl pentanoate
 - butyl ethanoate
 - ethyl pentanoate
57. In a certain experiment, the expected yield is 1.352 g. The actual yield was 1.279 g. Determine the percent yield.
- 94.6 %
 - 92.3 %
 - 95 %
 - 94.60 %
58. Which type of radiation can be stopped by a sheet of paper or clothing?
- gamma
 - all of the above
 - alpha
 - beta

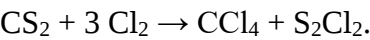
59. Which of the following is true if there is an increase in pressure for the reaction below?
- $$\text{N}_2\text{O}_4 < \text{-----} > 2 \text{NO}_2$$
- A. The equilibrium will shift to the left
 - B. The value of K_p will increase
 - C. The equilibrium will shift to the right
 - D. More NO_2 will be formed

60. Which property is the same for the two nuclides $^{40}_{18}\text{Ar}$ and $^{40}_{19}\text{K}$?
- A. The number of electrons
 - B. The number of neutrons
 - C. The number of nucleons
 - D. The number of protons

SECTION II – COMPULSORY STRUCTURED QUESTION

Question 1

- a) Carbon tetrachloride (CCl_4) was prepared by reacting 100. 0g of carbon disulphide (CS_2) and 100. 0 g of chlorine (Cl_2).



- i. Complete the table below [6]

	CS_2	Cl_2
Mass (g)		
Molar mass (g/mol)		
(1) Number of moles		
(2) Coefficient		
(3) $\frac{\text{moles}}{\text{coefficient}}$		

- ii. Which reactant is the limiting reagent? [1]
- iii. Which reactant is in excess? [1]
- iv. Calculate the mass of carbon tetrachloride produced.[2]

TOTAL 10 MARKS

Question 2

a) Represent the compound 2-hydroxypropanoic acid using the following types of formulae: [5]

i. molecular

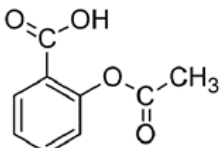
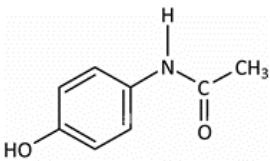
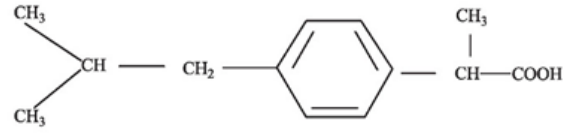
ii. structural/condensed

iii. displayed

iv. skeletal

v. three-dimensional

- b) The following compounds are the active ingredients in over-the-counter drugs used as analgesics (to relieve pain without decreasing sensibility or consciousness), antipyretics (to reduce the body temperature when it is elevated), and anti-inflammatory agents (to counteract swelling or inflammation of the joints, skin, and eyes). Identify the functional groups in each molecule by circling and naming them. [5]

Over-the-counter drugs	Names of Functional Groups
i. 	
ii. 	
iii. 	

TOTAL 10 MARKS

END OF EXAMINATION

The Periodic Table of Elements

Group																																
1	2	1 H hydrogen 1.0												13	14	15	16	17	18													
		Key																														
		atomic number atomic symbol name relative atomic mass																														
3	Li lithium 6.9	4	Be beryllium 9.0															5	6	7	8	9	10	11	12	13	14	15	16	17	18	
																		B boron 10.8	C carbon 12.0	N nitrogen 14.0	O oxygen 16.0	F fluorine 19.0										
11	Na sodium 23.0	12	Mg magnesium 24.3															13	14	15	16	17	18									
																		Al aluminium 27.0	Si silicon 28.1	P phosphorus 31.0	S sulfur 32.1	Cl chlorine 35.5										
19	K potassium 39.1	20	Ca calcium 40.1															31	32	33	34	35	36									
																		Ga gallium 69.7	Ge germanium 72.6	As arsenic 74.9	Se selenium 79.0	Br bromine 79.9										
37	Rb rubidium 85.5	38	Sr strontium 87.6															49	50	51	52	53	54									
																		In indium 114.8	Sn tin 116.7	Sb antimony 121.8	Te tellurium 127.6	I iodine 126.9										
55	Cs caesium 132.9	56	Ba barium 137.3															81	82	83	84	85	86									
																		Tl thallium 204.4	Pb lead 207.2	Bi bismuth 209.0	Po polonium —	At astatine —										
87	Fr francium —	88	Ra radium —															114	116													
																		Fl flerovium —	Lv livermorium —													