



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV/DEC 2018

COURSE NO: RN 171

COURSE NAME: INTRODUCTION TO GREEN CHEMISTRY

CLASS: RN I

TIME: 2 HRS 30 MIN

Name: _____ Index Number: _____

ANSWER ALL QUESTIONS IN YOUR ANSWER BOOKLET

SECTION A

Choose the correct answer from the list of options given for each question. Indicate the correct answer in your answer booklet. The question paper must be tied loosely into the answer booklet and therefore not leaving the Examination Room.

- Bio-polymers exemplify Green chemistry principle number 10, which is?
 - Catalysis
 - Prevent waste
 - Benign solvents and auxiliaries
 - Design for degradation
- Which of the following is among the twelve Principles of Green Chemistry?
 - Design commercially viable products
 - Use only new solvents
 - Use catalysts, not stoichiometric reagents
 - Re-use waste
- The first of the twelve principles of Green chemistry is?
 - Atom economy
 - Prevent waste
 - Catalysis
 - Benign solvents
- Business benefits of green chemistry include:
 - Reduced costs associated with waste treatment and disposal
 - Innovating 'greener' products to entice customers
 - Greater compliance with environmental legislation
 - All the above
- Cellulose and lignin are all types of _____
 - Enzymes
 - Catalysts
 - Bio-based feedstocks
 - Anti-cancer compounds
- _____ is an excellent 'green' solvent as well as a greenhouse gas?
 - Methanol
 - CFC's
 - Carbon monoxide
 - Carbon dioxide

7. Soybean is used to replace traditional inks in printer cartridges, highlighting which of the Green chemistry principles?
- Atom economy
 - Use of Renewable Feedstocks
 - Reduce derivatives
 - Prevent waste
8. Identify the INCORRECT statement.
- Helium in a balloon: an element
 - Paint: a mixture
 - Tap water: a compound
 - Mercury in a barometer: an element
9. Which of the following processes do not undergo chemical changes?
- Aerobic and anaerobic respiration
 - Dropping a piece of iron into hydrochloric acid
 - Rusting of iron
 - Sublimation of dry ice
10. Which of the following element is a halogen?
- Astatine
 - Nitrogen
 - Aluminum
 - Carbon
11. The simplest alkene is
- Methylene
 - Butylene
 - Ethylene
 - Propylene
12. For Alkadienes with double bonds separated by more than one single bond are _____
- Isolated
 - Conjugated
 - Cumulated
 - Isolated and conjugated
13. Which of the following groups of organic compounds is not an example of Aliphatic compounds.
- Aldehydes
 - Ethers
 - Pyrrole
 - Thioalcohols
14. The general formula for Alkadienes is _____
- C_nH_{2n-2}
 - C_nH_{2n+2}
 - C_nH_{2n-1}
 - $C_{n-1}H_{2n-2}$
15. Alcohols are considered as the primary oxidation product of
- Acids
 - Hydrocarbons
 - Ethers
 - Arenes
16. Natural rubber is one of the naturally occurring polymers of _____
- 2-Dimethylhexane
 - 1,4-pentadiene
 - 2-Methyl-1,3-butadiene
 - 2,3-pentadiene
17. The general formula for alcohols is _____
- $R-COOH$
 - $R-OOH$
 - $R-OH$
 - $R-COH$

18. *Clostridium acetobutylicum* is a microorganism used in the fermentation of _____
- a. Isopropanol
 - b. Ethanol
 - c. Butanol
 - d. Methanol
19. Acids with one carboxyl group are known as _____
- a. Dicarboxylic acids
 - b. Tricarboxylic acids
 - c. Polycarboxylic acids
 - d. Monocarboxylic acids
20. Esters are compounds formed by the reaction of _____
- a. Acids and hydrocarbons
 - b. Alcohols and hydrocarbons
 - c. Acids and alcohols
 - d. Acids and Alkadienes
21. Aromatic compounds undergo substitution reaction with _____
- a. Hydrocarbons
 - b. Alkyl halides
 - c. Benzene
 - d. Arenes
22. If the carbonyl group of a monosaccharides is located at an internal position the sugar is a/an _____
- a. Ketose
 - b. Aldose
 - c. Pentoses
 - d. Hexoses
23. Which one of the following macromolecules is not a polymer
- a. Proteins
 - b. Lipids
 - c. Nucleic acids
 - d. Carbohydrates
24. The general formula for Hexoses is _____
- a. $C_5H_{10}O_5$
 - b. $C_6H_{12}O_6$
 - c. $C_5H_{12}O_6$
 - d. $C_5H_{22}O_{11}$
25. Which one of the following simple sugars is a ketose?
- a. Glucose
 - b. Mannose
 - c. Fructose
 - d. Galactose
26. _____ $NADH_2$ are generated during glycolysis of glucose.
- a. 2
 - b. 40
 - c. 24
 - d. 38
27. What is the percentage constituent of amylose and amylopectin in starch?
- a. 70% amylopectin, 30% amylose
 - b. 40% amylopectin, 60% amylose
 - c. 50% amylopectin, 50% amylose
 - d. 70% amylose, 30% amylopectin
28. The total possible yield of ATP in aerobic respiration during the glycolysis stage is _____
- a. 38
 - b. 2
 - c. 4
 - d. 34

29. The total possible yield of ATP in aerobic respiration during the electron transport stage is _____
- | | |
|-------|-------|
| a. 38 | c. 2 |
| b. 5 | d. 34 |
30. The rate at which microorganism degrade contaminants in water is influenced by all the following factors except _____
- | | |
|----------------|--------------------|
| a. Temperature | c. Nutrient supply |
| b. Irradiation | d. Oxygen supply |

SECTION B

ANSWER TRUE OR FALSE in your answer booklet. Half mark will be deducted for every wrong answer given.

31. All enzymes are catalyst but not all catalysts are enzymes.
32. Biological treatment of pollutants in contaminate soil involves only with the use of vegetation.
33. If microbes are isolated from elsewhere and brought to the contaminated site is refer to as bio-augmentation.
34. In enhanced bioremediation, indigenous microorganisms are used to degrade contaminants without any amendments.
35. Aerobic bioventing can be used in treating highly chlorinated compounds such as PCE, TCE.
36. Methane is 23 times more effective in trapping heat than CO₂.
37. Organic acids are weak acids and dissociate completely in water.
38. Acids represent the highest oxidation state that an organic compound can attain.
39. The function of the enzyme catalase is to break down hydrogen peroxide.
40. When the third phosphate split from Adenosine Diphosphate (ADP) leaving Adenosine Triphosphate (ATP), energy is released to drive anabolic reactions.
41. Lactate dehydrogenase catalyzes the conversion of pyruvic acid to lactic acid.
42. Glucose is the only hexose sugar that can be prepared in relatively pure form by the hydrolysis of monosaccharides.
43. In hydrolysis of sugar cane one molecule of fructose and two molecules of glucose are formed from each molecule of sucrose.
44. Large complex proteins are formed due to the ability to form linkages between the amino group and the hydroxyl group.
45. Amino acids with one amino group and two carboxyl groups are basic in reaction.

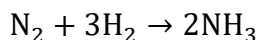
SECTION C

QUESTION 1

- a) i) State and explain the factors affecting enzyme action **(4 marks)**
ii) State four characteristics of enzymes **(2 marks)**
iii) What is redox reaction? **(1 mark)**
iv) List the classes of macromolecules and indicates their monomers **(3 marks)**
- b) i) What is Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) **(2 marks)**
ii) Determine the 2-day BOD and the ultimate first-stage BOD for wastewater whose 5-day, 20°C BOD is 300mg/L. The reaction constant K (base e) = $0.23d^{-1}$ **(3 marks)**

QUESTION 2

- a) i) What is environmental remediation? **(1 marks)**
ii) State and explain two chemical soil remediation technologies. **(3 marks)**
ii) Define the following as used in biological treatment of contaminated soil.
Phytoaccumulation
Phytovolatilization
Phytostabilisation **(3 marks)**
- b) i) State the functional groups of the following organic compounds; Alcohols, Acids and Esters. **(3 marks)**
ii) State six properties of organic compounds **(3 marks)**
- c) Nitrogen gas (N_2) react with hydrogen gas (H_2) to form Ammonia (NH_3) as shown in the equation below



Determine:

- i) The greatest amount of NH_3 (in moles) that can be made with 3.2 moles of N_2 and 5.4 moles of H_2 **(1 mark)**
ii) Which reactant is in excess and how many moles of it are left over? **(1 mark)**

Examiners: I. Osei/K.B. Owusu