



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.

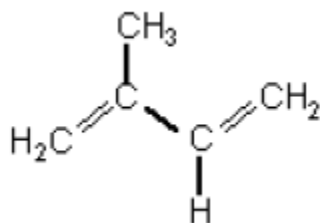
- Green chemistry aims to;
 - Design chemical products and process that maximize profits.
 - Design safer chemical products and processes that reduce or eliminate the use and generation of hazardous substances.
 - Design chemical products and processes that work most efficiently.
 - Utilize non-renewable energy.
- Green chemistry reduce risk by
 - Reducing the hazard inherent in a chemical product or process
 - Minimizing the use of all chemicals
 - Inventing technologies that clean up toxic sites
 - Developing recycled products
- The first of the twelve principles of Green chemistry is?
 - Atom economy
 - Prevent waste
 - Catalysis
 - Benign solvents
- Which among the following is the greenest solvent?
 - Formaldehyde
 - Benzene
 - Ethanol
 - Water
- 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?

- a. Methanol
b. CFC's
c. Carbon monoxide
d. Carbon dioxide
7. The use of solar energy is covered within green chemistry principle number six, which is?
a. Atom economy
b. Design for energy efficiency
c. Design benign chemicals
d. Less hazardous synthesis
8. Biodiesel demonstrates which of the twelve principles of green chemistry.
a. #1- waste prevention
b. #7- Use of renewable feedstocks
c. #9- Use of catalysts
d. #5- Safer solvents
9. Identify the INCORRECT statement.
a. Helium in a balloon: an element
b. Paint: a mixture
c. Tap water: a compound
d. Mercury in a barometer: an element
10. Which of the following processes undergo chemical changes?
a. Aerobic and anaerobic respiration
b. Dropping a piece of iron into hydrochloric acid
c. Rusting of iron
d. All the above
11. Which of the following element is a halogen?
a. Astatine
b. Nitrogen
c. Aluminum
d. Carbon
12. Reactions involving organic compounds are usually
a. Fast
b. Slow
c. Very slow
d. None of the above
13. What is the principal constituent atom of all organic compounds?
a. Sulphur
b. Carbon
c. Oxygen
d. Nitrogen
14. Which of the following is a minor element in naturally occurring organic compounds?
a. Hydrogen
b. Molybdenum
c. Carbon
d. Fluorine
15. Which of the following groups of organic compounds is not an example of Aliphatic compounds.
a. Aldehydes
b. Ethers

c. Alkyl Halides

d. None of the above

16. What is the nomenclature of the organic compound below.



a. 3-Methyl-1,3-butadiene

c. 2-Methyl-1,3-butene

b. 2-Methyl-1,3-butadiene

d. 3-Methyl-1,3-butene

17. The general formula for Alkynes is?

a. C_nH_{2n-2}

c. C_nH_{2n-1}

b. C_nH_{2n+2}

d. $C_{n-1}H_{2n-2}$

18. Alcohols are considered as the primary oxidation product of

a. Acids

c. Ethers

b. Hydrocarbons

d. Arenes

19. Natural rubber is one of the naturally occurring polymers of _____

a. 2-Dimethylhexane

c. 2-Methyl-1,3-butadiene

b. 1,4-pentadiene

d. 2,3-pentadiene

20. _____ is prepared by hydration of propylene derived from the cracking of petroleum.

a. Methanol

c. Butanol

b. Propanol

d. Isopropanol

21. *Clostridium acetobutylicum* is a microorganism used in the fermentation of _____

a. Isopropanol

c. Butanol

b. Ethanol

d. Methanol

22. Oxidation of acids results in the formation of _____

a. Only carbon dioxide

c. Carbon dioxide and water

b. Only water

d. All the above

23. Esters are compounds formed by the reaction of _____

a. Acids and hydrocarbons

c. Acids and alcohols

b. Alcohols and hydrocarbons

d. Acids and Alkadienes

24. The process of connecting two monomers together is called _____

a. Hydrolysis synthesis

c. Substitution reaction

b. Dehydration synthesis

d. None of the above

25. _____ is a functional group composed of a carbon atom double-bonded to an oxygen atom.
- a. Hydroxyl group
 - b. Carbonyl group
 - c. Monohydroxy group
 - d. Dicarbonyl group
26. The general formula for Pentoses is _____
- a. $C_5H_{10}O_5$
 - b. $C_6H_{12}O_6$
 - c. $C_5H_{12}O_6$
 - d. $C_5H_{22}O_{11}$
27. The constituent of pentosans present in plant fibre is _____
- a. Arabinose
 - b. Mannose
 - c. Xylose
 - d. Glucose
28. Alcohol production process through the fermentation of starch involves the conversion of starch to _____
- a. Glucose
 - b. Galactose
 - c. Mannose
 - d. Maltose
29. Hydrolysis of hemicellulose usually yield _____
- a. Glucose and Xylose
 - b. Glucose and mannose
 - c. Galactose and mannose
 - d. Maltose and Glucose
30. _____ $NADH_2$ are generated during glycolysis of glucose.
- a. 38
 - b. 5
 - c. 24
 - d. 2

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. Neodymium is used as a magnet in motors of wind turbines.
33. If the composition of a material is not completely uniform, then it is homogenous.
34. Methane is 15 times more effective in trapping heat than CO₂.
35. At room temperature all members of saturated hydrocarbons through C₅ are liquids, those from C₆ to C₁₇ are gases.
36. For tertiary alcohols the OH group is attached to a carbon atom that is joined to three other carbon atoms.
37. Derivatives of phenol can act as acids.
38. Glucose is the only hexose sugar that can be prepared in relatively pure form by the hydrolysis of monosaccharides.
39. In hydrolysis of sugar cane one molecule of fructose and two molecules of glucose are formed from each molecule of sucrose.
40. The general formula for disaccharide is C₁₂H₂₂O₁₁.
41. The glycerides of fatty acids that are liquid at ordinary temperatures are called oils.
42. Large complex proteins are formed due to the ability to form linkages between the amino group and the hydroxyl group.
43. Amino acids with one amino group and two carboxyl groups are basic in reaction.
44. Both DNA and RNA consist of nucleotide monomer, each of which contains three parts: a phosphate functional group, a six-carbon sugar and a nitrogenous base.
45. When a sugar is linked to a nitrogenous base, but the phosphate group is absent, it is known as a nucleoside.

SECTION C

ANSWER ONLY ONE question in this section.

QUESTION 1

- a) i) State four classifications of enzymes and indicate one example each. **(4 marks)**
- ii) State and explain two mechanisms for ATP generation. **(2 marks)**
- iii) Explain redox reaction. **(2 marks)**
- iv) List two classes of macromolecules and indicates their monomers. **(2 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 200mg/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 biological soil remediation technologies. **(3 marks)**
- iii) Define the following as used in chemical treatment of contaminated soil.
In-situ Chemical Immobilization
Critical Fluid Extraction
Oxidation technology **(3 marks)**
- b) i) State four properties of organic compounds **(2 marks)**
- ii) State the functional groups of the following organic compounds: Alcohols, Acids and Esters. **(3 marks)**
- iii) Write the molecular formula for the following molecules: Methane, Methyl Alcohol and Octane. **(3 marks)**

Examiner: Mr I. Osei/K. B. Owusu