INTRODUCTION TO ORGANIC CHEMISTRY

MARKING GUIDE.

Q1 a) Alicyclic compounds: organic compounds that contain one or more carbon rings that may be saturated or unsaturated. **(2marks)**

b) Aliphatic compounds: are organic compounds in which the carbon atoms are arranged in a straight or branched chain. **(2marks)**

Reference: LO 1. Explain organic compounds, IC,1.1, Identify classes of organic compounds.

Q2 All are organic compounds except.

a. C_6H_{10} b. $CoCl_2$ c. $C_{12}H_{22}O_{11}$ d.C_2H_6 e. CH_4

Answer: All are organic compounds except: b. $CoCl_2$. **(2marks)**

Reference: LO 1. Explain organic compounds, IC1.2, Discussion of organic compounds

Q3. The following list represents the different types of bonds
A. Ionic bond B. Peptide bond C. Covalent bond D. Metallic bond.

Choose only one bond which can be formed between two amino acid molecules**.**

Answer: The bond formed between two amino acids is peptide bond. (**2marks)**

Reference: LO 3. Describe polymerization, IC,3.2, explain classes of polymers.

Q4 General formula of alkene is CnH2n: which of the following formulae represents an alkene?

(a) $CH_3CH_2CH_3$ (b) CH_3CH_3 (c) $CH_3CH_2CHCH_2$ (d) CH_3CH_2Cl

Answer: (c) $CH_3CH_2CHCH_2$ (**2marks)**

Reference: LO 1. Explain organic compounds, IC,1.1, Identify classes of organic compounds.

Q5.Methane used in , in making motor tyre and printing ink, in the production of light and energy, in making methyl alcohol, formaldehyde and chloroform etc.
(2marks)

Reference: LO 1. Explain organic compounds,IC, 1.3: Distinguish applications of organic chemistry

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Q6. Mach each of the following functional groups to their corresponding chemical compounds as they are provided in the table. **(5marks)**

Functional group	**Chemical compounds**
1.Alcohol	a)CH_3COCH_3
2.Amine	b)CH_3COOCH_3
3.Carboxylic acid	c)$CH_3CH_2NH_2$
4.ketone	d)CH_3CH_2OH
5.Ester	e)CH_3CH_2COOH

Answer: 1=d

2=c

3=e

4=a

5=b

Reference: LO 2. Describe biochemical, IC,2.1,characterize carbohydrates

Q7 Identify four classes of carbohydrates. **(4marks**)

Answer: the four major classes of carbohydrates:

-Monosaccharaides

-Disaccharides

Oligosaccharides

-Polysaccharides

Reference: LO 2 Describe biological macromolecules, IC,2.1, characterize carbohydrates.

Q8. Give IUPAC name for each of following compounds. **(3 marks)**

a) $CH_3CH_2CH_2CH_3$ b) $CH_3CH_2CH_2OH$ c) CH_3COCH_3

Answer:

a) $CH_3CH_2CH_2CH_3$: Butane

b) $CH_3CH_2CH_2OH$: Propanol

c) CH_3COCH_3: Propanone or acetone

Reference: LO 1. Explain organic compounds, IC,1. 2,.Discussion of organic compounds.

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Q9. i) Lipids are hydrophobic set: explain briefly.

ii)Lipids are hydrophilic set: explain briefly.

Answer: I) Lipids are hydrophobic set : means they do not dissolve in water(water fearing) **(2marks)**

ii) Lipids are hydrophilic set: means lipids dissolve in water(water-loving)

Q10) Write two hydrophobic lipids. **(0.5mark for each)**

These lipids involve: Triglycerides, carotenoids, phospholipids and steroids.
Reference: LO 2. Describe biochemical molecules,IC, 2.1 Characterize carbohydrates.

Q11 Write two uses of the Cellulose (**2marks for each)**

Answer:

1Cellulose is mainly useful in paperboard and paper production. Its smaller amounts are converted into its derivatives like cellophane and rayon

2. It is useful as a fibre supplement in our diet.

3. Also, it helps as an additive in various food items.

4. It is useful as a preservative in cheese as it plays the role of an anti-clumping agent.

5. Cellulose is useful for making explosives and for the manufacturing of nitrocellulose.

6. It is useful as a stationary phase in chromatography.

7. Cellulose is also important industrially, from its presence in wood, paper, cotton, cellophane, rayon, linen, nitrocellulose (guncotton), photographic films (cellulose acetate), etc.

Reference: LO 2. Describe biochemical molecules,IC 2.1 Characterize carbohydrates.

Q12 Identify any two sources of nucleic acids. (**1mark for each)**

Answer: Meat, fish, legumes, seafood,mushrooms,organ meats, rapidly growing tissues like liver etc

Reference: LO 2. Describe biochemical molecules,IC 2.3: Describe nucleic acids and vitamins

Q13 Identify 2 main sources of protein**.**

Answer: a) Two main sources of protein are: **(1mark of each)**

• Animal sources:

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. Plant sources

b) Write one example for each source of protein**.**

Answer:

i) Animal sources: Milk, eggs, meat, fish, cheese etc. **(One example:1marks)**
ii)Plant sources: Pulses, cereals, beans. nuts, soya bean etc**(One example:1marks)**

Reference: LO 2. Describe biochemical molecules,IC 2.2: Explain lipids and proteins

Q14 Write in full word the following terms

a) DNA

b) RNA

Answer:

a) DNA: Deoxyribonucleic acid. **(1mark)**

b) RNA: Ribonucleic acid (RNA). **(1mark)**

Reference: LO 2. Describe biochemical molecules,IC, 2.3: Describe nucleic acids and vitamins

Q15. What is the meaning of the following terms:

a) Monomer b) Polymer

Answer:

a) Monomer is a small molecule that reacts with a similar molecule to form a larger molecule. It is the smallest unit in a polymer. **(1 mark)**
b) Polymer also known as a macromolecule is a molecule that results from the pairing of one or more monomers. **(1 mark)**

Reference: LO 3. **Describe polymerization IC,3.1: Identify properties of polymers**

Q16. Write four (4) types of biological macromolecules.

Answer:

Types of biological macromolecules. **(1mark for each)**

Carbohydrates ✓

Lipids ✓

Proteins ✓

Nucleic acids

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Reference: LO 2: Describe biochemical molecules ,IC, 2.1 Characterize carbohydrates

Q17a) Polymers can be classified based on the origin/source: Write three types of polymers based on the origin**.**

Answer:

➢ Natural polymers. **(1mark)**

➢ Semi-synthetic polymers (**1mark)**

➢Synthetic polymers**.** **(1mark)**

b) Differentiate homopolymer from heteropolymer.

i) Homopolymer: is a polymer made of single/same type of monomer unit. For example, Polyethene. **(1mark)**

ii) ➢ Heteropolymer or co-polymer: It consists of different type of monomer units. For example, nylon -6, 6. **(1mark)**

Reference: LO 3 Describe polymerization IC,3.2: Explain classes of polymers

Section B: Among the five (5) questions, attempt any three (3) (30 marks)

Q18 Methane is a member of homologous series of alkanes.

A. Define the term homologous series. **(2marks)**

B. Identify four characteristics of homologous series. **(4marks**

C. Draw the structure formula of the following organic compounds. **(4marks)**

i. Pent-1-ene or 1-pentene
ii. Methoxide ethane or ethyl, methyl ether

Answer:

A. Homologous series is a series of compounds with similar chemical properties and some functional group differing from the successive member by CH2. **(2marks)**

B. Four characteristics of homologous series. (**4marks)**

: • The members of the homologous series have same functional group.

• Members have the same general formula.

• Members have the almost same chemical properties due to same functional group.

• Members have common general method of preparation.

a) The structure formula of the following organic compounds: **(4marks)**

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i) pent-1-ene or 1-pentene: $H_2C=CHCH_2CH_2CH_3$

ii) methoxy ethane or ethyl, methyl ether: CH_3CH_2-O-CH_3

Reference: LO 1. Explain organic compounds, IC1.2. **Illustrate the organic compounds**

Q19)

A. Differentiate empirical formula from molecular formula.

B. An organic compound on analysis gave the following data: carbon(C)=57.82%, hydrogen(H)=3.6% and the rest is oxygen. Its vapor density is 83. Found its empirical and molecular formula.

C=12, H=1, O=16.

Answer: a) Empirical formula is the simplest formula which expresses the ratio of number of atoms of elements present in a molecule **(2 marks)**

while molecular formula is a formula expressing the true number of atoms of various elements present in a molecule. **(2 marks)**

b)

Element	**C**	**H**	**O**
Mass	**57.82**	**3.6**	**100-(57.82+3.6)=38.58**
Moles	$\frac{57.82}{12}$**=4.8**	$\frac{3.6}{1}$**=3.6**	$\frac{38.58}{16} = 2.4$
Simplest mole ratio	$\frac{4.8}{2.4}$**=2**	$\frac{3.6}{2.4}$**=1.5**	$\frac{2.4}{2.4}$**=1**
Simplest atomic ratio	**2*2=4**	**1.5*2=3**	**1*2=2**

Empirical formula is $C_4H_3O_2$ **(4marks)**

Empirical mass=(4*12)+(1*3)+(2*16)=83

Molecular mass=2*vapor density=2*83=166

Empirical formula*n=molecular formula=83n=166

n=166/83

n=2

Molecular formula=($C_4H_3O_2$)2=$C_8H_6O_4$ **(2marks)**

Reference: LO1 Explain organic compounds, IC1.2, illustrate the organic compounds,

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Q20.) a) What are nucleic acids?

b) Write three main types of RNA.

c) Identify any three functions of RNA.

d)List any two function of DNA.

Answer: a) What are nucleic acids?

a) Nucleic acids are large biomolecules that play essential roles in all

cells and viruses**.** **(2marks)**

b) Three types of RNA are:

- mRNA (messenger RNA) **(1 mark)**
- tRNA (transfer RNA) **(1mark)**
- rRNA (ribosomal RNA) **(1 mark)**

c) Identify any three functions of RNA.**(any 3 function 3marks)**

- Facilitate the translation of DNA into proteins.
- Functions as an adapter molecule in protein synthesis
- Serves as a messenger between the DNA and the ribosomes.
- They are the carrier of genetic information in all living cells
- Promotes the ribosomes to choose the right amino acid which is required in building up of new proteins in the body.

d)List any two function of DNA.

- Replication process: Transferring the genetic information from one cell to its daughters and from one generation to the next and equal distribution of DNA during the cell division.
- Mutations: The changes which occur in the DNA sequences
- Transcription
- Cellular Metabolism **(any two functions ,2marks)**
- DNA Fingerprinting
- Gene Therapy

Reference: LO 2 Describe biological macromolecules, IC,2.1, characterize

Q21.a) Differentiate addition polymerization from condensation polymerization**.**

b) Discuss the application of polymers. **/6marks**

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Answer:

a) Addition polymerization: is a process where monomers are linked together to form a polymer, without the loss of atoms from the molecules **(2 marks)**

while condensation polymerization: is a process where two or more monomers chemically combine to form a polymer with elimination of simple molecules like water, ammonia, hydrogen chloride, alcohol. **(2 marks).**

b) Discuss the application of polymers. **(6marks)**

Category	**Applications**
Packaging	Food packaging, garbage bags, wrappers
Housewares	Medical devices, surgical implants, absorbable sutures, tissue engineering,
Biomaterials	Controlled release of drugs, homeostatic agents, drugs delivery, tablet
Pharmaceuticals	Controlled release of drugs, homeostatic agents, drugs delivery, tablet
Agriculture	Mulch, Mulch films, plant covering, pots, bags, trays and containers, controlled release of fertile
Personal care	Combs, diaper backing, shampoos

Q22. a) Identify three (3) classes of alcohols. **/ 3marks**

b) Match the compounds in column A with their corresponding general formulae B**/5marks**

A.compounds	B.Function group
1.Alkanes	a)RCOR
2.Alkenes	b)C=C
3.Alcohols	c)RH
4.Ethers	d)ROH
5 Ketones	e)ROR

c) . Draw the structure formula of the following organic compounds. **/2marks**

i) 3,4-dimethylpentanal

ii) 4-methylpent-1-ene

Answer:

a) Identify three (3) classes of alcohols.

Primary alcohol **(1mark)**

Secondary alcohol **(1mark)**

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Tertiary alcohol **(1mark)**

b) Match the compounds in column A with their corresponding general formulae B

1)Alkanes = (c)

2)Alkenes= (b)

3)Alcohols= (d)

4)Ethers= (e)

5)Ketones= (a) **(1mark for each)**

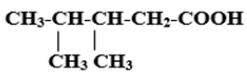
c) . Draw the structure formula of the following organic compounds.

i) 3,4-dimethylpentanal

ii) 4-methylpent-1-ene

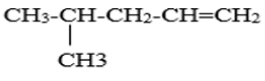
Answer:

I)



(1mark)

ii)



/1mark

Reference: LO 1 Explain organic compounds, IC,1.3, distinguish applications of organic chemistry.

Section C: Among the two (2) questions, attempt any one (1) (15 marks

Q23 a) Describe vitamins.

b) Vitamins comprise different classes.

i) Differentiate fat-soluble vitamins from water-soluble vitamins**.**

ii) Given the following vitamins A, B, C, D, E and K. Classify each of these vitamins as:

. Fat-soluble

. Water-soluble

c)Identify two sources of vitamins.

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Answer:

a) Describe vitamins.

Vitamins are organic substances that help the body grow and function normally. They are assentation nutrients that come from food and dietary supplements**.**

Answer: **(3marks**)

b) Vitamins comprise different class.

i)Fat-soluble vitamins –are soluble in organic solvents **(2 marks)**

while water soluble vitamins are vitamins that are soluble

in water. **(2 marks)**

ii) Fat-soluble: A, D, E, K **(4marks)** (**1 mark for each correct vitamin.)**

c) Four Sources of vitamins: Milk, egg, nuts, avocado,meats,bananas cheeses,…**/2marks(0.5 for each correct source of vitamin)**

Reference: LO,2. Describe biological macromolecules, IC,2.3, Describe nucleic acid and vitamins.

Q24 a) Define the term polymerization.

b) Identify four types of monomers.

c)Explain any four properties of polymers.

Answer:

a) Polymerization is any process in which relatively small molecules, called monomers, combine chemically to produce a very large chainlike or network molecule, called a polymer. **(2marks)**

b) . Types of monomers. **(5marks)**

✓ Simple sugar monomers (Monosaccharide)

✓ Monomers of fats (Lipids: glycerol, fatty acids)

✓ Nucleotides as monomers (nucleic acids: DNA, RNA)

✓ Monomers of plastics (HDPE, LDPE)

✓ Monomers of proteins (Amino-acids)

b) The any four properties of a polymer:**(8marks),(2marks of each of the 4)**

➢ Heat capacity/ Heat conductivity: this is the extent to which the plastic or polymer acts as an effective insulator against the flow of heat.

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➢ Thermal expansion: is the extent to which the polymer expands or contracts when heated or cooled.

➢ Crystallinity: is the extent to which the polymer chains are arranged in a regular structure instead of a random fashion.

➢ Permeability: is the tendency of a polymer to pass extraneous materials

➢ Elastic modulus: is the force it takes to stretch the plastic in one direction.

➢ Tensile strength: is the strength of the plastic or the force that must be applied in one direction to stretch the plastic until it breaks.

➢ Resilience: is the ability of the plastic to resist abrasion and wear.

➢ Refractive index: is the extent to which the plastic affects light as it passes through the polymer.

➢ Resistance to electric current: is the material an insulator.

Reference: LO, 3 Describe polymerization IC,3.1: Identify properties of polymers.

END OF ASSESSMENT!!!

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