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COURSE: CHEM 102

### QUESTION 1

A)  $M/2 = 105$

formula mass = 105

Given: C = 12.0107 g/mol

H = 1.00794 g/mol

O = 15.999 g/mol

N = 14.0067 g/mol

a)  $C_2H_3NO_4$  (Acetyl nitrate) =  $(2 \times 12.0107) + (3 \times 1.00794) + (14.0067) + (4 \times 15.999)$   
 $= 105.05 \text{ g/mol}$

b)  $C_5H_3N_3$  =  $(5 \times 12.0107) + (3 \times 1.00794) + (3 \times 14.0067)$  - Pyrazine carbonitrile  
 $= 105.1 \text{ g/mol}$

c)  $C_3H_7NO_3$  =  $(3 \times 12.0107) + (7 \times 1.00794) + (14.0067) + (3 \times 15.999)$   
- 2-Nitro-1-propanol  
 $= 105.093$

d)  $C_7H_5O$  =  $(7 \times 12.0107) + (5 \times 1.00794) + (15.999)$  - Phenyl methanone  
 $= 105.116 \text{ g/mol}$

### B) IMPORTANCE OF ORGANIC CHEMISTRY

1. They are used / can be used as sterilizing agents
2. They are used as Analytical substances
3. Certain valuables are made of them e.g. diamonds, petroleum e.t.c
4. They solely make up food substances
5. They are used in medicine for the production of drugs for curative diseases

Study of diseases, and to diagnose diseases.

### c) DIFFERENCES BETWEEN HOMOCYCLIC AND HETEROCYCLIC COMPOUNDS

HOMOCYCLIC	HETEROCYCLIC
a. They are cyclic compounds having atoms of the same element as ring members.	They are compounds having atoms of at least two different elements including carbon atoms as ring members.
b. Ring contains same atoms of elements	Ring contains atoms of different elements including oxygen, sulphur, nitrogen and carbon
c. Examples are: Benzene, toluene, cyclohexane, phenol, naphthalene e.t.c	Examples are: quinine, thiocane, pyran, pyridine e.t.c

### QUESTION 2

A) Retardation factor =  $\frac{\text{Distance moved by substance}}{\text{Distance moved by solvent front}}$

Given: solvent front = 12.2cm

Band A = 2.4cm

Band B = 5.6cm

Band C = 8.9cm

Retardation factor (R<sub>F</sub> A) =  $\frac{2.4\text{cm}}{12.2\text{cm}} = 0.196$

Retardation factor (R<sub>F</sub> B) =  $\frac{5.6\text{cm}}{12.2\text{cm}} = 0.459$

Retardation factor (R<sub>F</sub> C) =  $\frac{8.9\text{cm}}{12.2\text{cm}} = 0.73$

B) Tollen's test gives a positive test for Aldehydes

Thus, A is an aldehyde

Bromination/Bromine water test gives a positive test for Unsaturated compounds

Thus, ~~B is~~ B is an Unsaturated compound (Alkene or Alkyne)

c) 2,4-Dinitrophenylhydrazine is employed for, or to qualitatively test or detect for the carbon functionality of a ketone or Aldehyde Functional group

D) Functional groups

- ① Alkanol / ROH - Ethanol ( $C_2H_5OH$ ), Butanol ( $C_4H_9OH$ )
- ② Ethers / RO-R' - Ethoxyethane ( $C_2H_5OC_2H_5$ ), methoxyethane ( $CH_3OC_2H_5$ )
- ③ Alkyl halide / R-X - Ethyl fluoride ( $C_2H_5F$ ), methyl chloride ( $CH_3Cl$ )
- ④ Alkanals / Aldehydes / RCHO - pentanal ( $C_5H_{10}O$ ), propanal ( $C_3H_6O$ )
- ⑤ Alkanone / ketones / RCOOR' - ethyl propanoate ( $CH_3CH_2COOC_2H_5$ ), butyl butanoate ( $CH_3CH_2CH_2COOC_4H_9$ )
- ⑥ Alkanones / ketones / RCO-R - 2-hexanone ( $C_6H_{12}O$ ), 2-pentanone ( $C_5H_{10}O$ )
- ⑦ Alkanoic / carboxylic acids / RCOOH - propanoic acid ( $C_3H_7COOH$ ), butanoic acid ( $C_4H_9COOH$ )