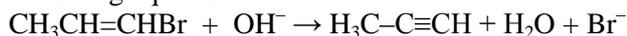


I. MULTIPLE CHOICE EXAM- ONLY ONE OF THE OFFERED ANSWERS IS CORRECT  
(Answer properly by circling **only one** of the offered answers A, B, C, D or E)

1. The triple bond between two carbon atoms is composed of:

- A) two  $\sigma$  and one  $\pi$  bond.  
**B) one  $\sigma$  and two  $\pi$  bonds.**  
 C) three  $\pi$  bonds.  
 D) three  $\sigma$  bonds.  
 E) one  $\delta$  and two  $\pi$  bonds.

2. What type of reaction is depicted with the following equation?

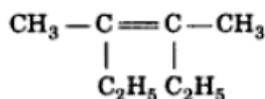


- A. Substitution.  
 B) Addition.  
 C) Condensation.  
**D) Elimination.**  
 E) Isomerization.

3. The compound 2-phenylpropene contains:

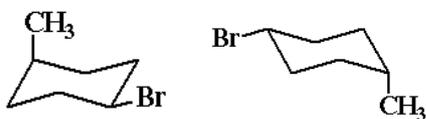
- A) 9 hydrogen atoms.  
**B) 10 hydrogen atoms.**  
 C) 11 hydrogen atoms.  
 D) 12 hydrogen atoms.  
 E) 13 hydrogen atoms.

4. What is the IUPAC name of the following compound?



- A) 2,3-diethylbut-2-ene.  
 B) 2-ethyl-3-methylpent-2-ene.  
**C) 3,4-dimethylhex-3-ene.**  
 D) 1,1-dimethyl-1,1-diethylethene.  
 E) 3-methyl-4-ethylpent-3-ene.

5. The compounds shown below are:



- A) the same compound.**  
 B) aromatic compounds.  
 C) conformers.  
 D) enantiomers.  
 E) skeletal isomers.

6. Which of the following compounds will not be obtained in the reaction between methane and chlorine in presence of ultraviolet light?

- A) HCl.      B)  $\text{CH}_2\text{Cl}_2$ .      C)  $\text{CH}_3\text{Cl}$ .  
**D)  $\text{CO}_2$ .**      E)  $\text{CHCl}_3$ .

7. Which of the following compounds is **not** an isomer of diethyl ether?

- A) Butan-1-ol.  
**B) Butanone.**  
 C) 2-methyl-propan-2-ol.  
 D) *n*-propyl methyl ether.  
 E) isopropyl methyl ether.

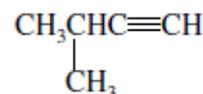
8. Which product(s) is/are obtained from the reaction given below?



- A) 1,2-dichloropentane and 2 HCl.  
 B) 2,2-dichloropentane and 2 HCl.  
 C) Pentane and HCl.  
**D) 1,1,2,2-tetrachloropentane.**  
 E) 1,2,3,4-tetrachloropentane.

9. Which of the following alkynes **cannot** form acetylides?

- A)  $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CCH}_3$**   
 B)  $\text{HC}\equiv\text{CCH}_2\text{CH}_3$   
 C)



- D)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{C}\equiv\text{CH}$   
 E) All of the above .

10. Which of the following statements about conjugated dienes is correct?

- A) They have two double bonds on the same C-atom.  
 B) They are less stable than the isolated dienes.  
**C) They can react via 1,4-addition.**  
 D) They do not react easily in addition reactions.  
 E) None of the above.

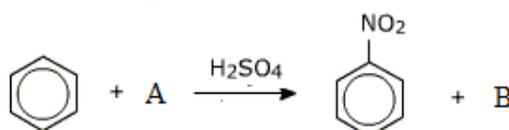
10. Which polymer can be obtained with chloroethene as starting material?

- A) Natural rubber.      B) Teflon.  
 C) Polyethene.      **D) PVC.**  
 E) polypropene.

11. What is true about aromatic compounds?

- A) The aromatic compounds have  $4n+2$   $\pi$ -electrons.**  
 B) The atoms that form the aromatic ring are not coplanar.  
 C) The aromatic rings can be consisted only from carbon atoms.  
 D) In the aromatic compounds there is no delocalization of electrons.  
 E) The atoms that form the aromatic ring are  $sp^3$  hybridized.

12. Which compounds are labeled with A and B in the reaction given below?



- A)  $\text{NO}_2$  and  $\text{H}_2$ .  
**B)  $\text{HNO}_3$  and  $\text{H}_2\text{O}$ .**  
 C)  $\text{NO}_2$  and  $\text{H}_2\text{O}$ .  
 D)  $\text{HNO}_3$  and  $\text{H}_2$ .  
 E)  $\text{HNO}_2$  and  $\text{H}_2$ .

13. Phenanthrene is:

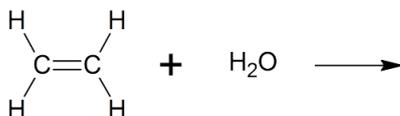
- A) alicyclic hydrocarbon.  
 B) not an aromatic compound.  
 C) isomer of naphthalene.  
 D) isomer of phenol.  
**E) isomer of anthracene.**

14. What is true about the compound given with the following structural formula?



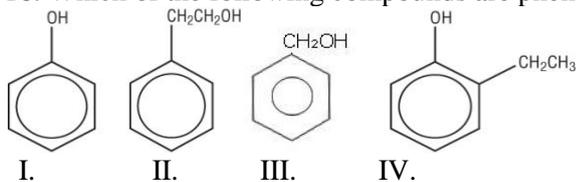
- A) The name of the compound is pyrrole.  
 B) This compound is not aromatic.  
**C) This compound is heterocyclic.**  
 D) This compound is carbocyclic.  
 E) This compound does not react via electrophilic aromatic substitution.

15. Which compound will be obtained in the reaction given below?



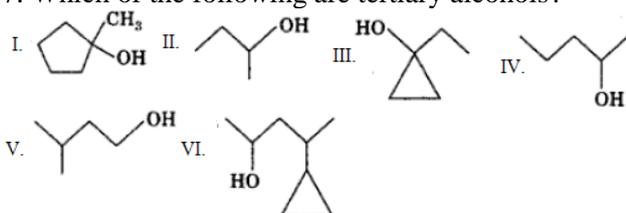
- A) Dimethyl ether.  
**B) Ethanol.**  
 C) Ethanoic acid.  
 D) Ethanal.  
 E) Methanol.

16. Which of the following compounds are phenols?



- A) All of the above.  
**C) I and IV.**  
 B) Only I.  
 D) II and III.  
 E) Only IV.

17. Which of the following are tertiary alcohols?



- A) I and III.**  
 C) IV and VI.  
 B) I, III and VI.  
 D) I, III, IV and VI.  
 E) None of the above.

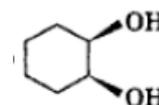
18. How many positional isomers are possible for *n*-butanol?

- A) 2.**  
 D) 4.  
 B) 1.  
 C) 3.  
 E) None of the above.

19. In terms of chemical properties, *phenols* behave as:

- A) bases.  
 B) salts.  
**C) weak acids.**  
 D) alicyclic compounds.  
 E) cycloalkenes.

20. What is the name of the following compound?

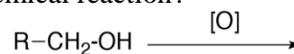


- A) Resorcinol.  
 B) Hydroquinone.  
 C) Catechol.  
 D) *trans*-1,2-dihydroxycyclohexane.  
**E) *cis*-1,2-cyclohexanediol.**

21. In the reaction between ethanol and sodium, which bond is cleaved in the ethanol molecule?

- A) C–O bond.  
 B) C–H bond.  
**C) O–H bond.**  
 D) C–C bond.  
 E) no bond(s) are cleaved.

22. Which type of compound can be obtained in the following chemical reaction?



- A) Alkane.  
 B) Ketone.  
**C) Aldehyde.**  
 D) Alkene.  
 E) Ether.

23. Which of the following compounds has molecular formula of  $\text{C}_4\text{H}_8\text{O}$ ?

- A) Acetone.  
 C) Propanal.  
 E) Butan-1-ol.  
**B) Butanone.**  
 D) Butan-2-ol.

24. The bond between carbon and oxygen in the carbonyl group is:

- A)  $sp^3-sp$ .  
 B)  $sp^3-sp^2$ .  
**C) polar.**  
 D) nonpolar.  
 E) triple.

25. Propanal and propanone are:

- A) Functional isomers.**  
 B) Enantiomers.  
 C) Homologues.  
 D) Positional isomers.  
 E) Conformers.

## II. PROBLEMS

(Write down the final answer in the rectangle provided bellow each given problem!)

(For full credit, neatly write down the relevant calculations on the provided sheets of paper!)

1. The relative molecular mass of the isomers A and B is 58. The mass fractions ("mass percent composition") of the elements in these compounds are  $w(\text{C}) = 62.1\%$ ;  $w(\text{H}) = 10.3\%$  and  $w(\text{O}) = 27.6\%$ . Write down the structural formulas and the names of the two isomers.

Answer:  $\text{C}_3\text{H}_6\text{O}$ ; propanal, propanon, prop-2-en-1-ol

2. A mixture of methane and chlorine reacts under certain specified conditions (appropriate catalyst). As a result of the reaction, 6.4 g of methane completely reacted and 34 g of certain organic product was obtained? What is the formula of the obtained product? Support your answer with appropriate calculations!

Answer:  $\text{CH}_2\text{Cl}_2$

3. Write down the equation for the dehydration reaction of *tert*-butyl alcohol and calculate what will be the mass of the obtained product if 22.2 g of *tert*-butyl alcohol are used.

Answer: 16 g 2-methylpropene

4. The constant of acidity for acetic acid (ethanoic acid) is  $K_a = 2 \cdot 10^{-5} \text{ mol/dm}^3$ . What will be the pH of the solution of acetic acid in which the equilibrium concentration of acetic acid is  $0.10 \text{ mol/dm}^3$ ?

Answer: pH = 4,7

5. The following equation is given:  $\text{A} + 5/2\text{O}_2 = 2\text{B} + 2\text{H}_2\text{O}$   
The compounds A and B have the same relative molecular mass. The compound A is organic and the compound B is inorganic compound. Identify the compounds A and B! Write down the structural formula of A. Support your answer with calculations and "chemical logic".

Answer:  $\text{A} = \text{CH}_3\text{CHO}$ ;  $\text{B} = \text{CO}_2$

Data that you may need:

$$A_r(\text{H}) = 1.0 \quad A_r(\text{O}) = 16.0 \quad A_r(\text{C}) = 12.0 \quad A_r(\text{Cl}) = 35.5$$