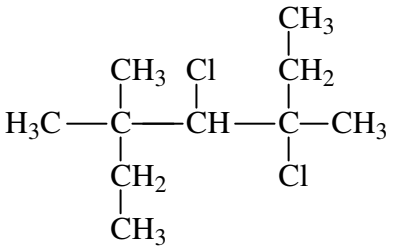
TEST 1: <u>Alkanes and cycloalkanes</u> **Version A**

Last name:_____ Group_____ Date_____

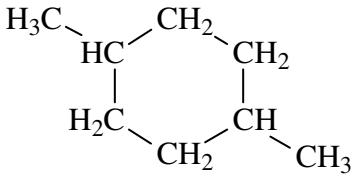
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

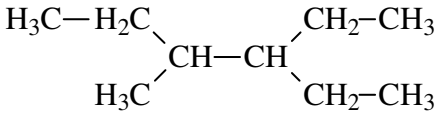
1.2

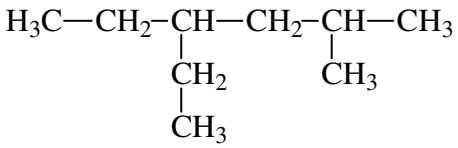
a) 2,2-dibromo-4-methylpentane
b) 2,4,4-trimethylhexane

a) **b)**

/ 4

2 **Do the formulas represent the same compound or constitutional isomers? Write the IUPAC names for these compounds.**





/ 2

3 **What kind of chemical bond cleavage (homolysis or heterolysis) occurs in the following processes?**

a) $2\ C_6H_5OH + 2\ Na \rightarrow 2\ C_6H_5O^-\ Na^+ + H_2$

b) $2\ CH_3CH_2Cl + 2\ Na \rightarrow CH_3–CH_2–CH_2–CH_3 + 2\ NaCl$

c) $CH_3CH_2COO^-\ K^+ \rightarrow K^+ + CH_3CH_2COO^-$ **/ 6**

4 **Write an equation for the reaction of propane with chlorine under UV irradiation or heating. What products of monochlorination are formed? Write structural formulas and the IUPAC names for these products.**

/ 8

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 1: Alkanes and cycloalkanes **Version A**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

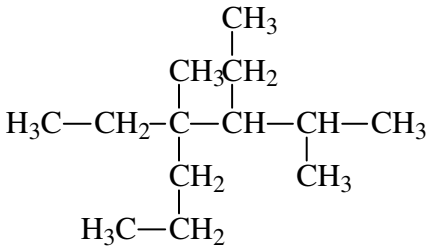
TEST 1: <u>Alkanes and cycloalkanes</u> **Version B**

Last name:_____ Group_____ Date_____

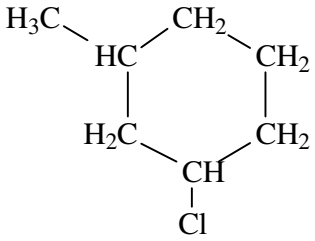
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

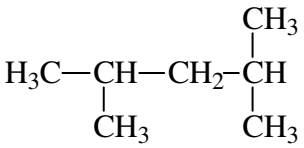
1.2

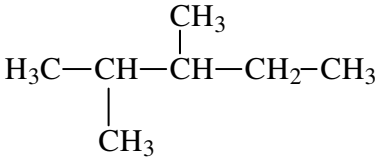
a) 3,3-dimethyl-6-ethylnonane
b) 2-bromo-2,3,3-trimethylhexane

a) **b)**

/ 4

2 **Do the formulas represent the same compound or constitutional isomers? Write the IUPAC names for these compounds.**





/ 2

3 **What kind of chemical bond cleavage (homolysis or heterolysis) occurs in the following processes?**

a) $C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$

b) $2\ C_2H_5OH + 2\ Na \rightarrow C_2H_5O^-Na^+ + H_2$

c) $2\ CH_3Cl + 2\ K \rightarrow CH_3\text{-}CH_3 + 2\ KCl$ **/ 6**

4 **The reaction of pentane with chlorine gives a mixture of three chloroalkanes, each with the molecular formula $C_5H_{11}Cl$. Write structural formulas and the IUPAC names for these chloroalkanes**.

/ 8

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 1: Alkanes and cycloalkanes **Version B**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

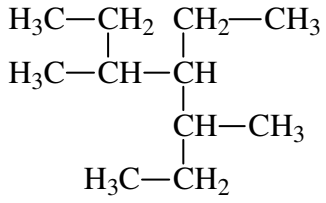
TEST 1: <u>Alkanes and cycloalkanes</u> **Version C**

Last name:_____ Group_____ Date_____

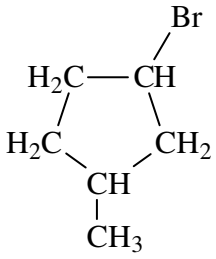
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

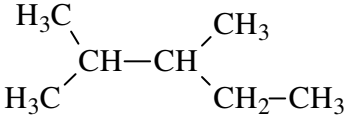
1.2

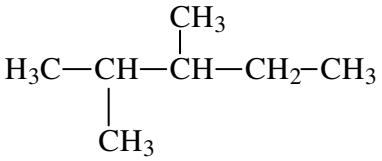
a) 2,5-dimethyl-5-ethylheptane
b) 2-bromo-3,3,4,4-tetramethylhexane

a) **b)**

/ 4

2 **Do the formulas represent the same compound or constitutional isomers? Write the IUPAC names for these compounds.**





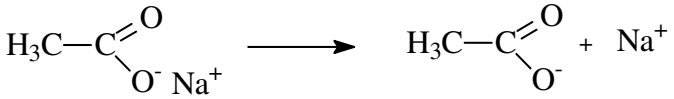
/ 2

3 **What kind of chemical bond cleavage (homolysis or heterolysis) occurs in the following processes?**

a) $2\,CH_3Br + 2\,Na \rightarrow CH_3\text{-}CH_3 + 2\,NaBr$

b) $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

c)



/ 6

4 **Write an equation for the reaction of butane with bromine under UV irradiation or heating. What products of monobromination are formed? Write structural formulas and the IUPAC names for these products.**

/ 8

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 1: Alkanes and cycloalkanes **Version C**

Question 2. Place for answers.

Question 3. Place for answers.

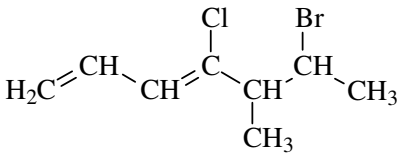
Question 4. Place for answers.

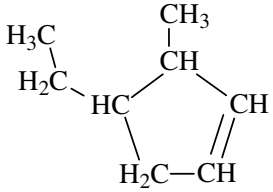
TEST 2: Alkenes and alkynes **Version A**

Name: _____ Group _____ Date _____

1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

a)

b)

1.2

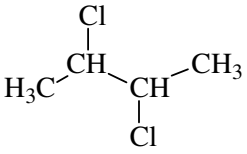
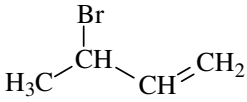
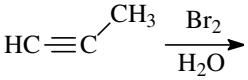
a) 4-bromo-2,3-dichloropent-2-ene
b) 2-chloro-3-methylcyclopentene

a) **b)**

/ 4

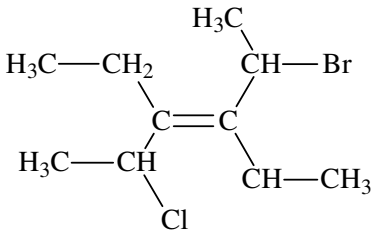
2 **Draw formulas for six structural (constitutional) isomers with the molecular formula C_5H_8. Structural formulas for at least one alkyne, one alkadiene and one cycloalkene have to be drawn.** **/ 6**

3 **Write structural formulas and names for products of the following reactions.**

a)  **b)**  **c)** 

/ 6

4 **Name this alkene and specify its configuration (E or Z).**



/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 2: Alkenes and alkynes **Version A**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

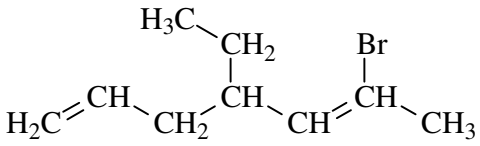
TEST 2: Alkenes and alkynes **Version B**

Name: _____ Group _____ Date _____

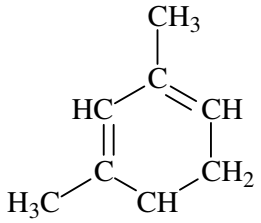
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

a) 1,6-dibromo-2-methylhex-3-ene
b) 1-ethylcyclohexa-1,4-diene

1.2

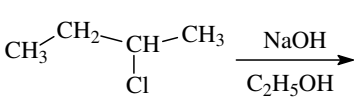
a) **b)**

/ 4

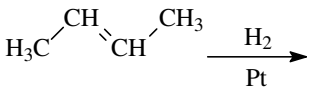
2 **Draw six structural (constitutional) isomers with the molecular formula C_6H_{10}. Structural formulas for at least one alkyne, one alkadiene and one cycloalkene have to be drawn.** **/ 6**

3 **Write structural formulas and names for products of the following reactions.**

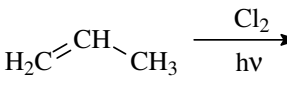
a)



b)

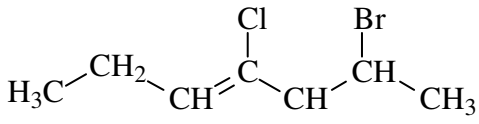


c)



/ 6

4 **Name this alkene and specify its configuration (E or Z).**



/4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 2: Alkenes and alkynes **Version B**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

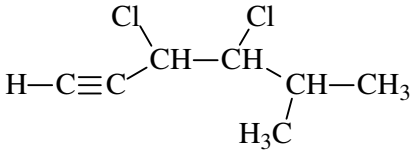
TEST 2: Alkenes and alkynes **Version C**

Name: _____ Group _____ Date _____

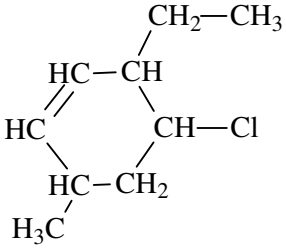
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

a) 2-methylbuta-1,3-diene
b) 3,3-dimethylcyclohexene

1.2

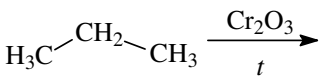
a) **b)**

/ 4

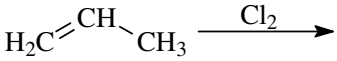
2 **Draw six structural (constitutional) isomers with the molecular formula C_6H_{12}. Structural formulas for at least two alkenes and two cycloalkanes have to be drawn.** **/ 6**

3 **Write structural formulas and names for products of the following reactions.**

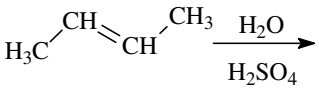
a)



b)

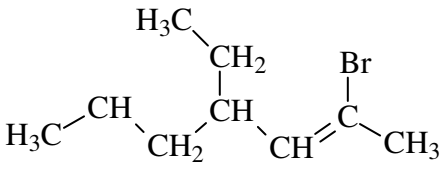


c)



/ 6

4 **Name this alkene and specify its configuration (E or Z).**



/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

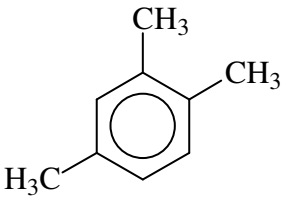
TEST 3: Arenes **Version A**

Name: _____ Group _____ Date _____

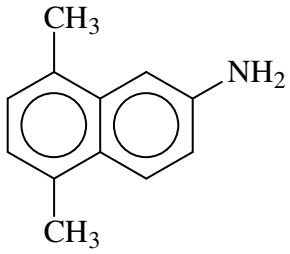
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

a) 1-bromo-3-nitrobenzene
b) 2-amino-3-methylnaphthalene

a) **b)**

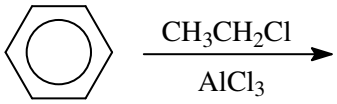
1.2

/ 4

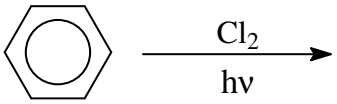
2 **Draw structural formulas for all possible isomers of dibromochlorobenzene.** **/ 6**

3 **Write structural formulas and names for products of the following reactions.**

a)



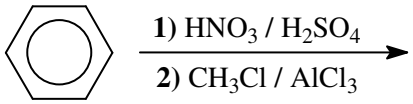
b)



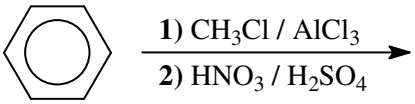
/ 4

4 **Write structural formulas and names for final products of the two-step reactions *a* and *b*.** Remember that each of these reactions has two consequent stages – (1) and (2). Products of the reaction (1) are reagents in the reaction (2).

a)



b)



/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

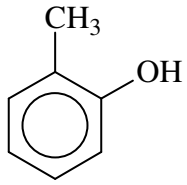
TEST 3: Arenes **Version B**

Name: _____ Group _____ Date _____

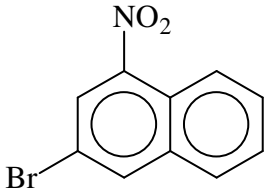
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

a) 1,3,5-trimethylbenzene
b) 1,8-dinitronaphthalene

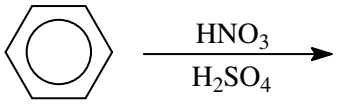
1.2

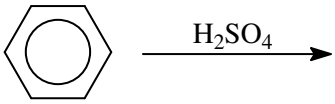
a) **b)**

/ 4

2 **Draw structural formulas for all possible isomers of bromodichlorobenzene.** **/ 6**

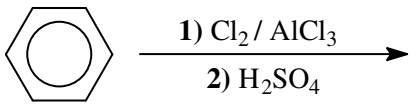
3 **Write structural formulas and names for products of the following reactions.**

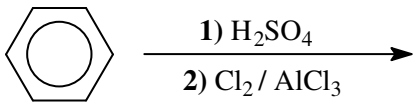
а) 

б) 

/ 4

4 **Write structural formulas and names for final products of the two-step reactions *a* and *b*.** Remember that each of these reactions has two consequent stages – (1) and (2). Products of the reaction (1) are reagents in the reaction (2).

а) 

б) 

/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 3: Arenes **Version B**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

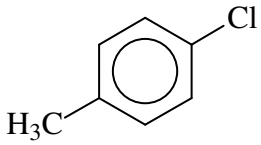
TEST 3: Arenes **Version C**

Name: _____ Group _____ Date _____

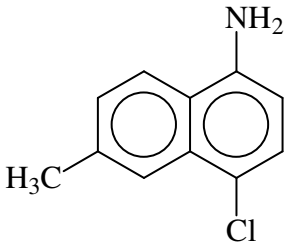
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

a) 1-hydroxy-2,4,6-trinitrobenzene
b) 2,3-dimethyl-6,7-dinitronaphthalene

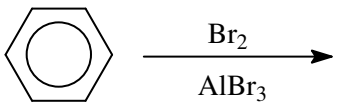
1.2

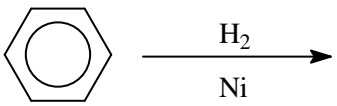
a) **b)**

/ 4

2 **Draw structural formulas for each of the six isomers of benzene derivative C_6H_4BrClF.** **/ 6**

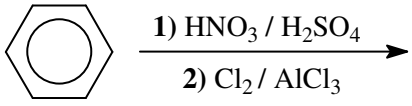
3 **Write structural formulas and names for products of the following reactions.**

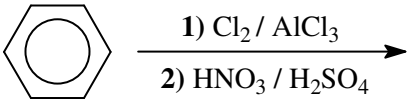
a) 

b) 

/ 4

4 **Write structural formulas and names for final products of the two-step reactions *a* and *b*.** Remember that each of these reactions has two consequent stages – (1) and (2). Products of the reaction (1) are reagents in the reaction (2).

a) 

b) 

/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

Question 2. Place for answers.

Question 3. Place for answers.

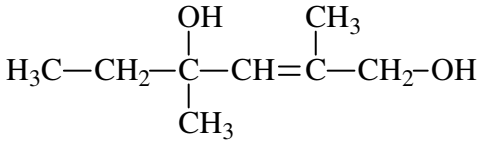
Question 4. Place for answers.

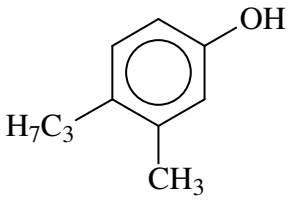
TEST 4: Alcohols and ethers **Version A**

Last name:_____ Group_____ Date_____

1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

a)

b)

1.2

a) 3-bromo-2-methyloctane-1,2,7-triol
b) methyl pentyl ether

a) **b)**

/ 4

2 **Draw structural formulas for four isomers of an oxygen-containing compound having the chemical formula $C_6H_{14}O$. First isomer has to be primary alcohol, the second one – should be secondary alcohol, the third one should be tertiary alcohol, and the last one has to be ether. Write names for all these isomers.** **/ 6**

3 **A mixture of methanol and propanol was boiled in the presence of concentrated sulfuric acid as a catalyst. Draw structural formulas for obtained ethers and write their names.**

/ 6

4 **When heating butan-1-ol with concentrated sulfuric acid, a gas is obtained. Then, this gas reacts with an aqueous solution of bromine. Write equations for the dehydratation and bromination reactions, write names for intermediate and final products.**

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 4: Alcohols and ethers **Version A**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

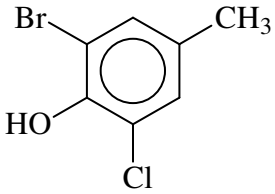
TEST 4: Alcohols and ethers **Version B**

Last name:_____ Group_____ Date_____

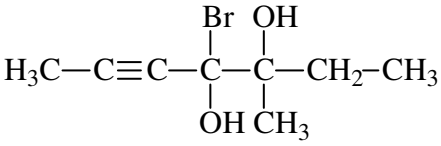
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

1.2

a) 3,3-diethylpentan-1,5-diol
b) butyl propyl ether

a) **b)**

/ 4

2 **Draw structural formulas for all isomers of a diatomic alcohol which molecule contains seven carbon atoms. Write names for all these isomers.** **/ 6**

3 **Write equations for reactions of cyclohexanol and phenol with metallic sodium and sodium hydroxide (if these reactions take place). Write names for products of all the reactions.**

/ 6

4 **Propan-2-ol was boiled in the presence of a mixture of concentrated hydrobromic and sulfuric acids. Obtained product was distilled and, then, added to metallic sodium. Write equations for bromination and Wurtz reactions, write names for all the intermediate and final products.**

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 4: Alcohols and ethers **Version B**

Question 2. Place for answers.

Question 3. Place for answers.

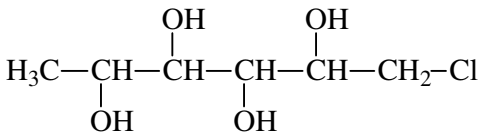
Question 4. Place for answers.

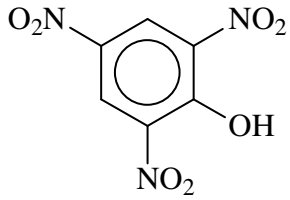
TEST 4: Alcohols and ethers **Version C**

Last name:_____ Group_____ Date_____

1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

a)

b)

a) 3-chlorocyclopentane-1,2-diol
b) dipropyl ether

1.2

a)

b)

/ 4

2 **Draw structural formulas for four isomers of an oxygen-containing compound having the chemical formula $C_4H_{10}O$. Two first isomers have to be ethers, the third one should be secondary alcohol, and the fourth one has to be tertiary alcohol. Write names for all these isomers.** **/ 6**

3 **2-chlorophenol is not soluble in water, but it completely dissolves when adding potassium hydroxide. If then one adds sulfuric acid to the obtained transparent solution, 2-chlorophenol precipitates again. Write equations for the occurring reactions. Write the name for a product of the reaction between 2-chlorophenol and the base.**

/ 6

4 **1-chlorobutane was boiled with aqueous NaOH solution up to complete dissolving a halogenoalkane in water. The obtained solution was mixed with several drops of concentrated sulfuric acid, and then, boiled up to formation on the water surface of a new liquid layer having pungent odor. Write equations for halogenalkane hydrolysis and susequent etherification reaction. Name reaction products.**

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 4: Alcohols and ethers **Version C**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

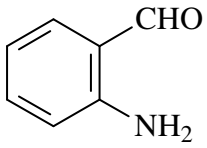
TEST 5: <u>Aldehydes and ketones. Carbohydrates</u> **Version A**

Last name:_____ Group_____ Date_____

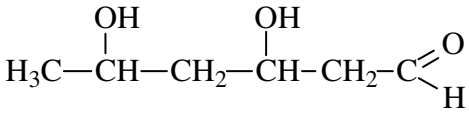
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

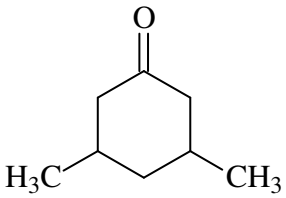
a)



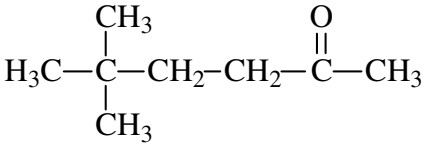
b)



c)



d)



a)

b)

c)

d)

1.2 a) 2-hydroxybutanedial; b) 3,5-dibromobenzaldehyde;
c) 3,4-dimethylcyclopentanone; d) 5-bromo-4-methylhexan-2-one;

a) **b)**

c) **d)**

/ 8

2 **What chemical test could you use to distinguish between propanal and acetone? Write equations for all reactions.**

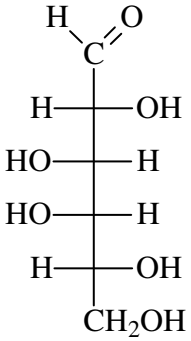
/ 4

3 **Write an equation for the reaction of 2-pentanone with ethanol to form a hemiacetal.**

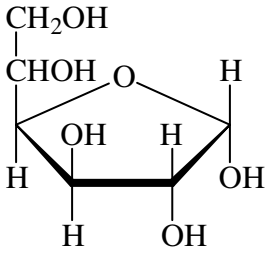
/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

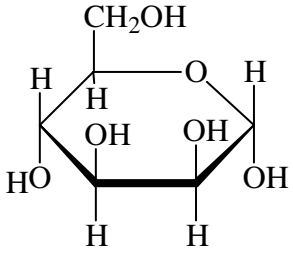
4 **D-Galactose forms cyclic hemiacetal D-Galactopyranose. Which of the following Haworth projections corresponds to D-Galactopyranose?**



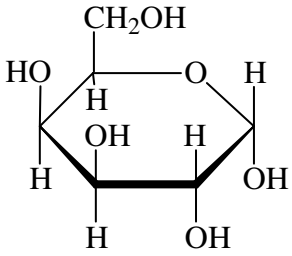
D-Galactose



a



b



c

/ 4

Question 2. Place for answers.

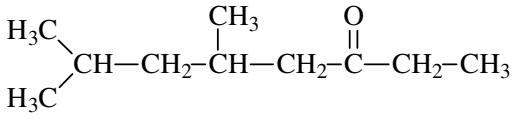
Question 3. Place for answers.

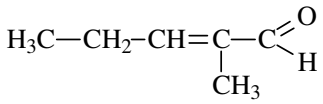
TEST 5: <u>Aldehydes and ketones. Carbohydrates</u> **Version B**

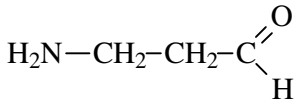
Last name:_____ Group_____ Date_____

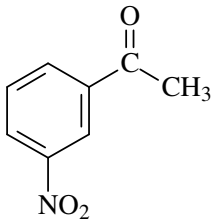
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

c) 

d) 

a)

b)

c)

d)

1.2 a) 3,5-dihydroxyhexanal; b) 4-methylbenzaldehyde;
c) 1,4-cyclohexanedione; d) 1,1-dibromopentan-3-one;

a) **b)**

c) **d)**

/ 8

2 **What chemical test could you use to distinguish between benzaldehyde and cyclopentanone? Write equations for all reactions.**

/ 4

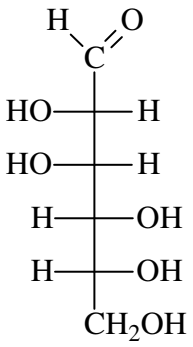
3 **Write an equation for the reaction of benzaldehyde with methanol to form a hemiacetal.**

/ 4

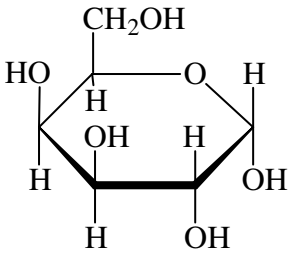
Result	**/ 20**	**Date**	**Teacher's signature**

(continuation)

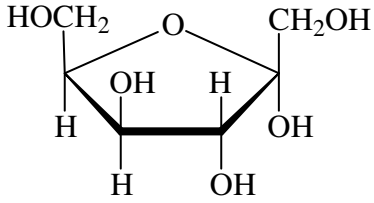
4 **D-Mannose forms cyclic hemiacetal D-Mannopyranose. Which of the following Haworth projections is D-Mannopyranose?**



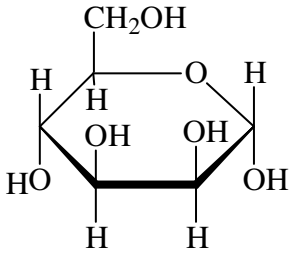
D-Mannose



a



b



c

/ 4

Question 2. Place for answers.

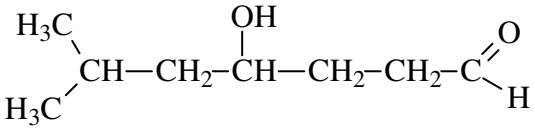
Question 3. Place for answers.

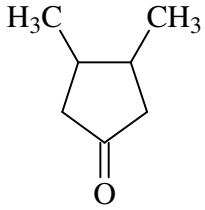
TEST 5: Aldehydes and ketones. Carbohydrates **Version C**

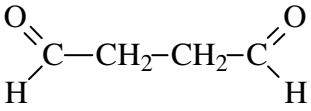
Last name:_____ Group_____ Date_____

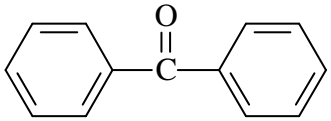
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

c) 

d) 

a)

b)

c)

d)

1.2

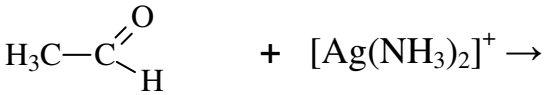
a) 3-methyl-3-phenylbutanal; b) 4-bromocyclohexanone;
c) 3,4-dihydroxyhexanedial; d) 1,7-dichloroheptane-3,5-dione;

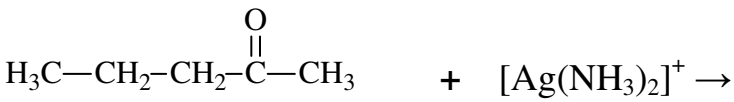
a) **b)**

c) **d)**

/ 8

2 **Complete equations for these oxidation reactions. If some reaction is not possible, write "no reaction".**





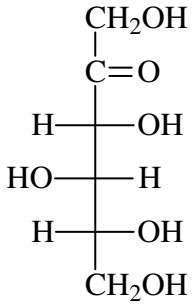
/ 4

3 **Write an equation for the reaction of butanal with ethanol to form a hemiacetal.**

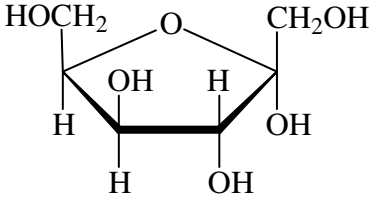
/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

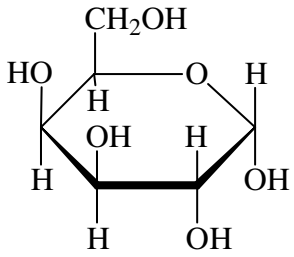
4 D-Sorbose forms cyclic hemiacetal D-Sorbofuranose. Which of the following Haworth projections is D-Sorbofuranose?



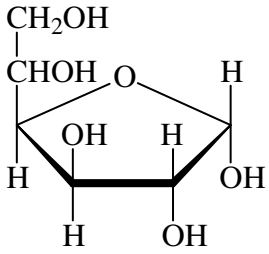
D-Sorbose



a



b



c

/ 4

Question 3. Place for answers.

Question 4. Place for answers.

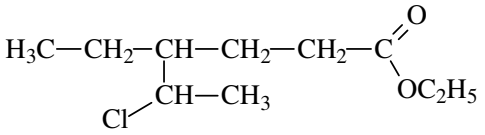
TEST 6: <u>Carboxylic acids and esters</u> **Version A**

Last name:_____ Group_____ Date_____

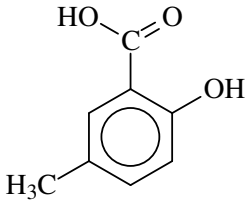
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

1.2

a) 3-bromo-4-chloro-5-methylpentanoic acid
b) ethyl 5-fluoro-2,3-dimethylbenzoate

a) **b)**

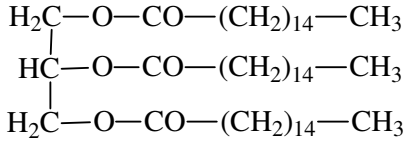
/ 4

2 **Write structural formulas for four isomers of an oxygen-containing compound having the chemical formula $C_4H_8O_2$. First two isomers have to be acids, other two isomers should be esters. Name all these isomers.** **/ 6**

3 **A mixture of ethanoic acid and butanol was boiled in the presence of concentrated sulfuric acid as a catalyst. Draw structural formulas for obtained esters, write their names.**

/ 4

4 **Write the saponification reaction for glycerol tripalmitate. Esterification of what fatty acid leads to the formation of this fat? Draw structural formula for this acid and write an equation for its neutralization reaction with sodium hydroxide. Name all the compounds.**



/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 6: Carboxylic acids and esters **Version A**

Question 2. Place for answers.

Question 3. Place for answers.

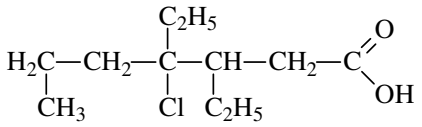
Question 4. Place for answers.

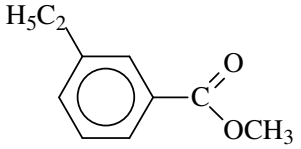
TEST 6: <u>Carboxylic acids and esters</u> **Version B**

Last name:_____ Group_____ Date_____

1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

a)

b)

1.2

a) 5-chloro-4-methyl-3-oxo-pentanoic acid
b) ethyl 3-chloro-2-methylbenzoate

a) **b)**

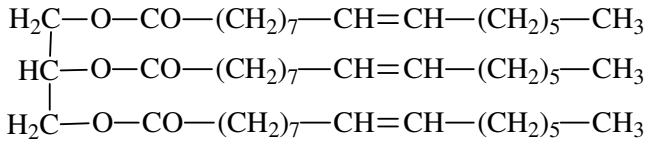
/ 4

2 **Write structural formulas for four isomers of an oxygen-containing compound having the chemical formula $C_5H_{10}O_2$. First two isomers have to be acids, other two isomers should be esters. Names all these isomers.** **/ 6**

3 **A mixture of butanoic acid and ethanol was boiled in the presence of concentrated sulfuric acid as a catalyst. Draw structural formulas of obtained esters, write their names.**

/ 4

4 **Write the saponification reaction for glycerol tripalmitate. Esterification of what fatty acid leads to the formation of this fat? Draw structural formula for this acid and write an equation for its neutralization reaction with sodium hydroxide. Name all the compounds.**



/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 6: Carboxylic acids and esters **Version B**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

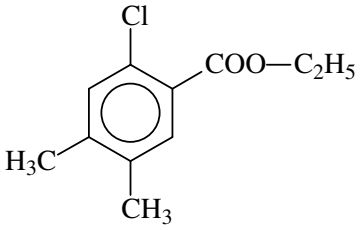
TEST 6: <u>Carboxylic acids and esters</u> **Version C**

Last name:_____ Group_____ Date_____

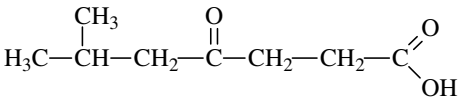
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

1.2

a) methyl 4-hydroxy-3-nitrobenzoate
b) 3-bromo-4-chlorocyclopentanoic acid

a) **b)**

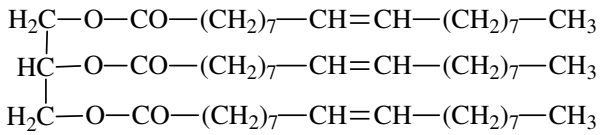
/ 4

2 **Write structural formulas for four isomers of an oxygen-containing compound having the chemical formula $C_6H_{12}O_2$. First two isomers have to be acids, other two isomers should be esters. Names all these isomers.** **/ 6**

3 **A mixture of methanoic acid and 2-methylpropanol was boiled in the presence of concentrated sulfuric acid as a catalyst. Draw structural formulas of obtained esters, write their names.**

/ 4

4 **Write the saponification reaction for glycerol trioleate. Esterification of what fatty acid leads to the formation of this fat? Draw structural formula for this acid and write an equation for its neutralization reaction with sodium hydroxide. Name all the compounds.**



/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

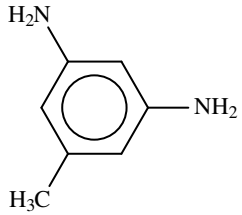
TEST 7: <u>Amines, aminoacids and peptides</u> **Version A**

Last name:_____ Group_____ Date_____

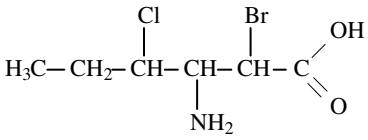
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

1.2

a) 2-amino-5-bromo-4-chloro-3-methyl-1-nitropentane
b) 3-amino-2-methyl-5-chlorooct-6-ynoic acid

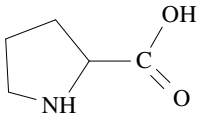
a) **b)**

/ 4

2 **Write structural formulas for four isomers of a nitrogen-containing compound having the chemical formula $C_4H_{11}N$. First isomer has to be primary amine, the second and third ones should be secondary amines, and the last one has to be tertiary amine. Names all these isomers.**

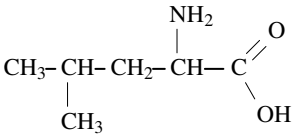
/ 6

3 **Proline, showed in figure, has amphoteric properties. What functional groups exhibit acidic and basic properties of this aminoacid? Write equations for reactions of proline with hydrochloric acid and potassium hydroxide.**

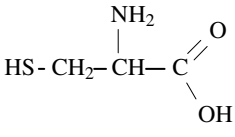


/ 6

4 **Draw structural formulas for all dipeptides, which can be obtained using the following aminoacids. Name all the dipeptides.**



- Leucine



- Cysteine

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 7: Amines, aminoacids and peptides **Version A**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

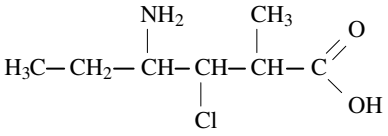
TEST 7: <u>Amines, aminoacids and peptides</u> **Version B**

Last name:_____ Group_____ Date_____

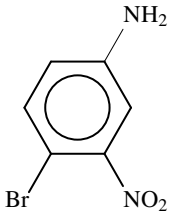
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

1.2

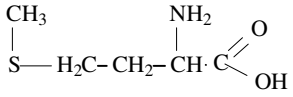
a) 6-amino-3-ethyl-5-methyl-hexanoic acid
b) 1-amino-3-methyl-5-nitrocyclohexane

a) **b)**

/ 4

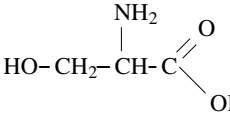
2 **Write structural formulas of four isomers of a nitrogen-containing compound having the chemical formula C_3H_9N. First and second isomers have to be primary amine, the third one should be secondary amine, the fourth one has to be tertiary amine. Names all of these isomers.** **/ 6**

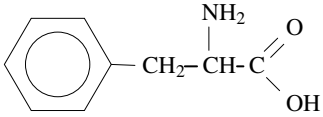
3 **Methionine, showed in figure, has amphoteric properties. What functional groups exhibit acidic and basic properties? Write equations for reactions of methionine with hydrobromic acid and sodium hydroxide.**



/ 6

4 **Draw structural formulas for all dipeptides, which can be obtained using the following aminoacids. Name all the dipeptides.**

 - Serine

 - Phenylalanine

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

Question 2. Place for answers.

Question 3. Place for answers.

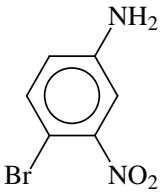
Question 4. Place for answers.

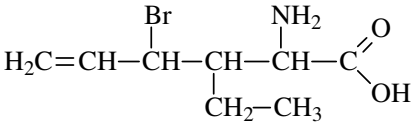
TEST 7: <u>Amines, aminoacids and peptides</u> **Version C**

Last name:_____ Group_____ Date_____

1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a) 

b) 

1.2

a)

b)

a) 1-amino-3-ethyl-3,4-dimethylcyclopentane
b) 2-amino-3-bromo-5-chlorohex-3-enoic acid

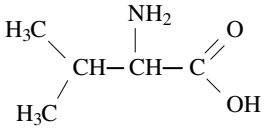
a) **b)**

/ 4

2 **Write structural formulas for four isomers of a nitrogen-containing compound having the chemical formula $C_5H_{13}N$. First and second isomers have to be primary amines, the third one should be secondary amine, the fourth one has to be tertiary amine. Names all these isomers.**

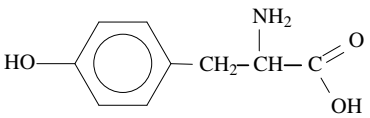
/ 6

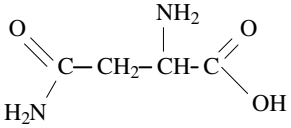
3 **Valine, showed in figure, has amphoteric properties. What functional groups exhibit acidic and basic properties? Write equations for reactions of valine with hydrochloric acid and sodium hydroxide.**



/ 6

4 **Draw structural formulas for all dipeptides, which can be obtained using the following aminoacids. Name all the dipeptides.**

 - Thyrosine

 - Asparagine

/ 4

Result	**/ 20**	**Date**	**Teacher's signature**

TEST 7: Amines, aminoacids and peptides **Version C**

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

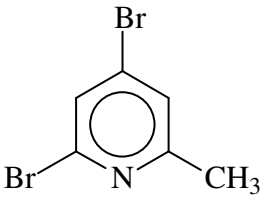
TEST 8: Heterocyclic compounds **Version A**

Last name:_____ Group_____ Date_____

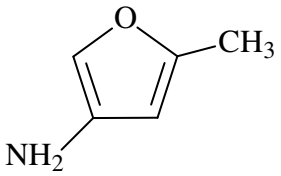
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

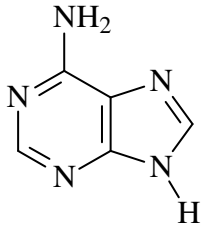
1.2

a) 2,4,6-trimethylpyrimidine
b) N-propylpyrrole

a) **b)**

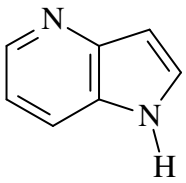
/ 4

2 **Draw formulas for four isomers of adenine (6-aminopurine) taking into account that this compound exhibits prototropic isomerism. Name these isomers.**



/ 6

3 **The compound showed in figure has amphoteric properties. Which nitrogen atom exhibits acidic properties? Which nitrogen atom exhibits basic properties? Write equations for reactions of this compound with hydrochloric acid and metallic potassium.**



/ 6

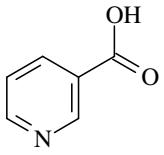
Result	**/ 20**	**Date**	**Teacher's signature**

(continuation)

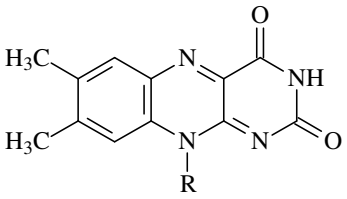
4 **Below, you can see structural formulas for some vitamins.**
Answer, which vitamins are:

- **heterocyclic compounds:**
- **alkaloids:**
- **acids:**
- **bases:**
- **alcohols:**

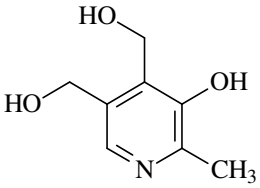
/ 4



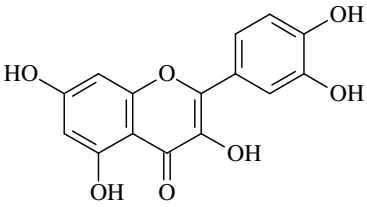
a
vitamin PP



b
vitamin B_2



c
vitamin B_6



d
vitamin P

Questions 2 and 3. Place for answers.

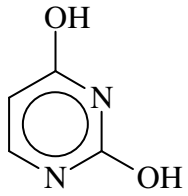
TEST 8: Heterocyclic compounds **Version B**

Last name:_____ Group_____ Date_____

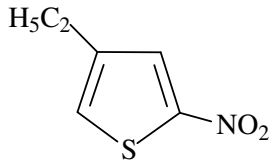
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

b)

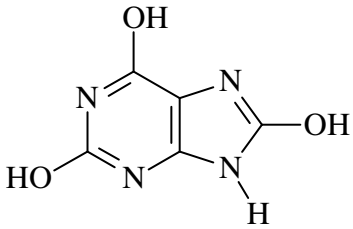
1.2

a) 2,5-dimethylfuran
b) 2,4-dibromo-6-ethylpyridine

a) **b)**

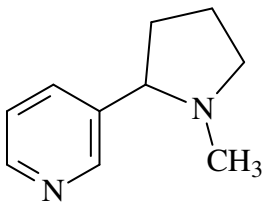
/ 4

2 **Draw structural formulas for five isomers of uric acid taking into account that this compound exhibits prototropic isomerism.**



/ 6

3 **Which acid-base properties are typical for alkaloid nicotine? Write examples of chemical reactions demonstrating acid or base properties of nitrogen atoms in this compound.**



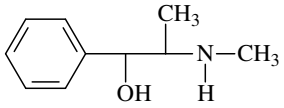
/ 6

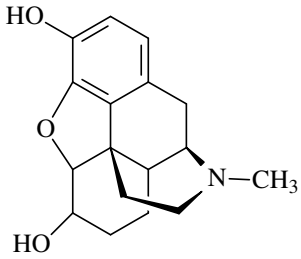
Result	**/ 20**	**Date**	**Teacher's signature**

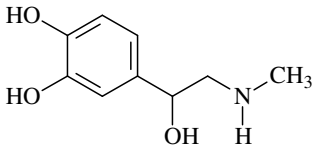
(continuation)

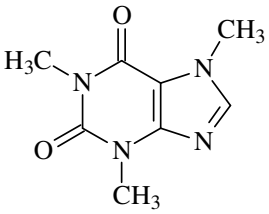
4 **Below, you can see structural formulas for biologically active substances called alkaloids. Answer, which alkaloids are:** **/ 4**

- **heterocyclic compounds:**
- **acids:**
- **ethers:**
- **arenes:**
- **alcohols:**









a ***b*** ***c*** ***d***

ephedrine **morphine** **adrenaline** **caffeine**

Questions 2 and 3. Place for answers

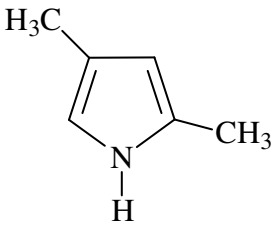
TEST 8: Heterocyclic compounds **Version C**

Last name:_____ Group_____ Date_____

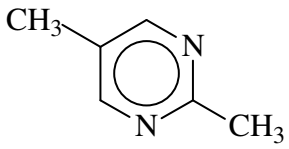
1 **1.1. Write the IUPAC names for each of the following compounds.**
1.2. Draw structural formulas for each of the following compounds.

1.1

a)



b)



a)

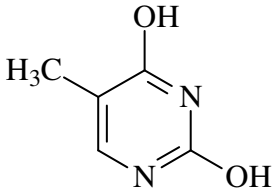
b)

a) N-ethylpyrimidine
b) 2,3-dimethylthiophene

1.2 **a)** **b)**

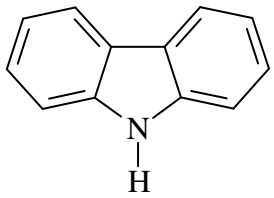
/ 4

2 **Draw structural formulas for four isomers of thymine taking into account that this compound exhibits prototropic isomerism.**



/ 6

3 **Carbazole reacts both with metallic sodium and with hydrobromic acid. Write equations for corresponding reactions. Which acid-base properties does carbazole demonstrate – acidic, basic or amphoteric?**



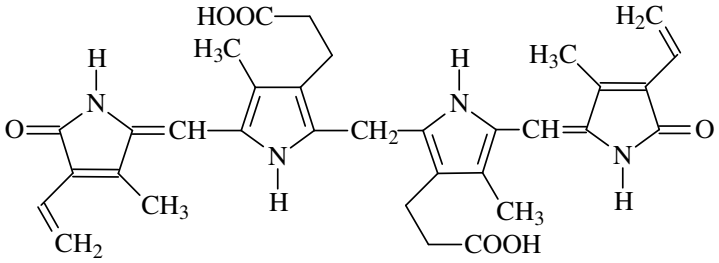
/ 6

Result	**/ 20**	**Date**	**Teacher's signature**

4 **Below, you can see structural formulas for animal and vegetal pigments. Answer, which pigments are:**

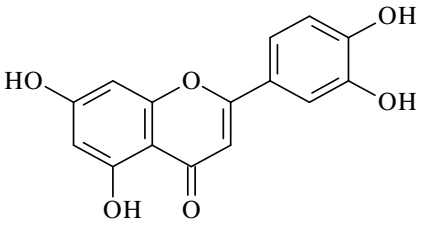
- **heterocyclic compounds:**
- **alkaloids:**
- **amphoteric compounds:**
- **arenes:**
- **alcohols:**

/ 4



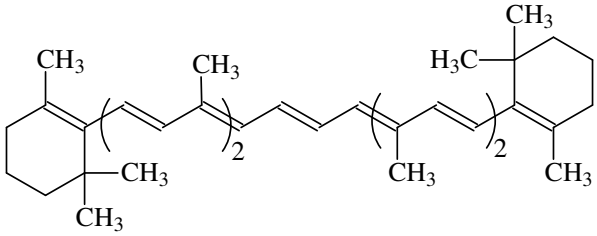
a

bilirubin



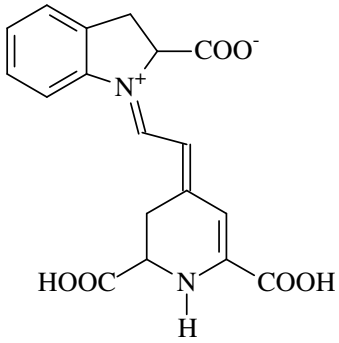
b

luteolin



c

***β*–carotene**



d

betanin

Questions 2 and 3. Place for answers:

PRACTICE 1. Hydrocarbons, halogen-containing compounds, alcohols

Experiment 1. The combustion of hydrocarbons

1. What is the mechanism of hydrocarbon combustion?

Radical reduction	Heterolytic oxidation	Homolytic oxydation
☐	☐	☐

2. What side products can be formed when toluene burning?

Nitrogen and carbon oxides	Carbon and its monooxide	Hydrogen sulfide and methane
☐	☐	☐

3. What flame color is observed when burning: 1 – toluene, 2 – methane, 3 – ethanol?

1 – bluish, 2 – bluish, 3 – yellow	1 – yellow, 2 – yellow, 3 – bluish	1 – yellow, 2 – bluish, 3 – bluish
☐	☐	☐

Experiment 2. Qualitative test for alkenes and alkynes with aqueous solution of bromine

1. What is the mechanism of the reaction between unsaturated hydrocarbons and bromine?

Radical substitution	Electrophilic addition	Nucleophilic addition
☐	☐	☐

2. What maximal quantity of bromine atoms can be added to propyne molecule?

One	Two	Four
☐	☐	☐

3. How does bromine solution change color in the presence of alkenes?

yellow → colorless	yellow → brownish	colorless → yellow
☐	☐	☐

Experiment 3. Qualitative test for alkenes and alkynes with aqueous $KMnO_4$ solution

1. Reaction of alkenes with potassium permanganate is:

reduction of alkenes	oxidation of alkenes	neutralization of alkenes
☐	☐	☐

2. Which precipitate forms in the result of alkyne – permanganate reaction?

$HMnO_4$	$C_2H_5–O–C_2H_5$	MnO_2
☐	☐	☐

3. How does color solution change when reacting potassium permanganate and ethyne?

pink → colorless	yellow → colorless	pink → yellow
☐	☐	☐

Experiment 4. Beilstein test

1. Beilstein test can be used for detecting atoms of:

sulfur	oxygen	chlorine
☐	☐	☐

2. What metal should be used in the reaction?

Iron	Copper	Chromium
☐	☐	☐

3. How does flame color change when making Beilstein test?

orange → green	bluish → orange	orange → colorless
☐	☐	☐

Experiment 5. Reaction of alcohols with metallic sodium

1. In the alcohol – sodium reaction, the alcohol demonstrates properties of :

base	acid	reducing agent
☐	☐	☐

2. Products of this reaction are:

salt and gaseous hydrogen	sodium hydroxide and gaseous alkane	aldehyde and carbon dioxide
☐	☐	☐

3. When growing the length of carbon chain, the rate of the reaction:

does not change	decreases	increases
☐	☐	☐

Experiment 6. Reaction of alcohols with sodium hydroxide

1. Which properties does phenol demonstrate in the reaction with sodium hydroxide?

No reaction	Basic properties	Acidic properties
☐	☐	☐

2. Which properties does ethanol demonstrate in the reaction with sodium hydroxide?

No reaction	Basic properties	Acidic properties
☐	☐	☐

3. One of products of phenol – sodium hydroxide reaction is:

carbon dioxide	salt	No reaction – no products
☐	☐	☐

Experiment 7. Reaction of alcohols with copper dioxide II

1. Copper dioxide II reacts with alcohols as:

oxidizing agent	reducing agent	catalyst
☐	☐	☐

2. During the reaction of copper oxide with alcohol, the latter one transforms to:

carboxylic acid	copper alcoholate	aldehyde
☐	☐	☐

3. During the reaction of copper oxide with alcohol, the former one transforms to:

Cu_2O	metallic copper	copper alcoholate
☐	☐	☐

Experiment 8. Test for polyatomic (polyhydric) alcohols

1. Molecules of polyhydric alcohols form with Cu^{2+} ions:

ionic bonds	hydrogen bonds	coordinative bonds
☐	☐	☐

2. Reaction of polyatomic alcohols with copper hydroxide proceeds in:

basic medium	acidic medium	neutral medium
☐	☐	☐

3. When proceeding this reaction, one can observe changes:

dark blue precipitate → colorless solution	blue precipitate → dark blue solution	dark blue precipitate → light blue precipitate
☐	☐	☐

PRACTICE 2 Oxygen- and nitrogen-containing compounds

Experiment 1. Reaction of «silver mirror»

1. The «silver mirror» reaction is a test for the presence of:

ketones	ketones and aldehydes	aldehydes
☐	☐	☐

2. One of the products of «silver mirror» reaction is:

secondary alcohol	ester	carboxylic acid
☐	☐	☐

3. Tollens' reagent is:

$[Ag(NH_3)_2]OH$	$AgOH$	$Na[Ag(OH)_2]$
☐	☐	☐

Experiment 2. Reaction of aldehydes with copper hydroxide II

1. In the presence of copper hydroxide II, aldehydes:

are reduced	form salts	are oxidized
☐	☐	☐

2. Reaction of aldehydes with copper hydroxide II proceeds in:

neutral medium	basic medium	acidic medium
☐	☐	☐

3. When proceeding this reaction, one can observe following changes:

blue precipitate → orange-brownish precipitate	blue solution → orange-brownish precipitate	blue precipitate → dark blue solution
☐	☐	☐

Experiment 3. Properties of carboxylic acids

1. What color has universal indicator paper in the presence of butanoic acid?

blue	orange	red
☐	☐	☐

2. When the carbon chain length increases, the acidity of carboxylic acids:

increases	does not change	decreases
☐	☐	☐

3. When the number of caboxyl groups increases, the acidity of carboxylic acids:

increases	does not change	decreases
☐	☐	☐

Experiment 4. Esterification

1. Reaction of propanol and butanoic acid gives:

butyl propanoate	propyl butanoate	propylbutanal
☐	☐	☐

2. What is the role of sulfuric acid in esterification reaction?

catalyst	sulfonating agent	buffer component
☐	☐	☐

3. The esterification is accompanied by:

precipitate formation	yellow coloring	changing odor of reaction mixture
☐	☐	☐

Experiment 5. Properties of amines

1. What color has universal indicator paper in the presence of ethylamine:

blue	greenish-yellow	pink
☐	☐	☐

2. On going from primary amine to tertiary amine, basic properties of these compounds:

increase	decrease	do not change
☐	☐	☐

3. On going from quarternary amine to tertiary amine solubility of these compounds in water:

increases	decreases	do not change
☐	☐	☐

Experiment 6. Reaction of amines, aminoacids and nitrogen-containing heterocycles with $Cu(OH)_2$

1. Reaction with $Cu(OH)_2$ results in appearance:

blue precipitate	dark blue solution	yellow solution
☐	☐	☐

2. Changing color in the presence of Cu^{2+} ion is due to formation of:

coordinative bond	hydrogen bond	**Cu^{+} ion**
☐	☐	☐

3. Reaction with $Cu(OH)_2$ proceeds in:

neutral medium	basic medium	acidic medium
☐	☐	☐

Experiment 7. Biuret test

1. What reagent is appropriate for making biuret test?

copper II chloride	copper I hydroxide	sodium sulfate
☐	☐	☐

2. One uses biuret test to detect in molecules the presence of:

hydrogen bonds	π-bonds with heteroatoms	peptide bonds
☐	☐	☐

3. If biuret test is positive, the color of solution becomes:

brownish-orange	purple	dark blue
☐	☐	☐

Experiment 8. Xanthoproteic test

1. Xanthoproteic reaction is:

nitration	hydration	dehydratation
☐	☐	☐

2. Xanthoproteic test for polypeptides is positive if peptide chain contains amino acid residues with:

hydroxy groups	aromatic rings	disulfide bridges
☐	☐	☐

3. If xanthoproteic test is positive, one can observe:

formation of white precipitate	dissolution of white precipitate	formation of yellow precipitate
☐	☐	☐