

/4

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

- **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) $CH_3CH_2COO^-K^+ \rightarrow K^+ + CH_3CH_2COO^-$
- **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
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Question 3. Place for answers.

TEST 1: Alkanes and cycloalkanes

Last name:____ Group_____ Date_____ 1.1. Write the IUPAC names for each of the following compounds. 1 1.2. Draw structural formulas for each of the following compounds. CH₃ HC CH_2 CH₃CH₂ H₃C-CH₂-C-CH-CH-CH₃ a) b) H₂C ĊH₂ ĊH₃ 1.1 H_3C-CH_2 Cl a) b) a) 3,3-dimethyl-6-ethylnonane b) 2-bromo-2,3,3-trimethylhexane a) b) 1.2

- /4
- 2 Do the formulas represent the same compound or constitutional isomers? Write the IUPAC names for these compounds.

$$H_{3}C-CH-CH_{2}-CH \\ \downarrow \\ CH_{3} \\ CH$$

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) $2 CH_3Cl + 2 K \rightarrow CH_3-CH_3 + 2 KCl$
- 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
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Question 3. Place for answers.

TEST 1: Alkanes and cycloalkanes

Version C

Last name:		Group_	Date				
1	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) $H_{3}C-CH_{2} CH_{2}-CH_{3}$ $H_{3}C-CH-CH$ $H_{3}C-CH-CH_{3}$ $H_{3}C-CH_{2}$ (H-CH_{3}) $H_{3}C-CH_{2}$ (a) b)	b)	$\begin{array}{c} & & Br \\ H_2C - CH \\ H_2C \\ CH \\ CH_3 \end{array}$				
	a) 2,5-dimethyl-5-ethylheptane b) 2-bromo-3,3,4,4-tetramethylhexane						
1.2	a)	b)					
			/ 4				

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

$$\begin{array}{c} H_{3}C \\ H_{3}C \\ H_{3}C \end{array} \begin{array}{c} CH-CH \\ H_{3}C \\ CH_{2}-CH_{3} \end{array} \begin{array}{c} CH_{3} \\ H_{3}C-CH-CH-CH_{2}-CH_{3} \\ H_{3}C \\ CH_{3} \end{array} / 2$$

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

a)
$$2 CH_3Br + 2 Na \rightarrow CH_3-CH_3 + 2 NaBr$$

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

c)
$$H_3C - C \stackrel{\neq O}{\searrow} Na^+ \longrightarrow H_3C - C \stackrel{\neq O}{\searrow} Na^+$$

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	
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Question 3. Place for answers.

TEST 2: <u>Alkenes and alkynes</u>

Version A

	Name:		Group	Date	
1		C names for each of the fe formulas for each of the	following comp	oounds.	
1.1	a) _{H2} C ^{≠CH} ⊂C	$H \stackrel{Cl}{\succ} C \stackrel{Br}{\underset{CH}{\overset{H}{\sim}} C} CH \stackrel{CH}{\underset{CH_{3}}{\overset{CH}{\sim}} CH_{3}}$	H ₃ C \ H ₂ C	$\begin{array}{c} CH_{3} \\ CH \\ CH \\ HC \\ H_{2}C \\ -CH \end{array}$	
_	a) b)				
	a) 4-bromo-2,3-dichlo b) 2-chloro-3-methylo	-			
1.2	a)		b)		
					/ 4
2		ix structural (constitutior tural formulas for at leas be drawn.			/ 6
3	Write structural form	nulas and names for prod	lucts of the follo	owing reactions.	
a)	$H_{3C} \xrightarrow{Cl} CH \xrightarrow{CH} CH_{3} \xrightarrow{C} CH_{3}$	$\stackrel{\text{Zn}}{\longrightarrow} \mathbf{b}) \stackrel{\text{Br}}{\underset{\text{H}_{3}\text{C}}{\overset{\text{CH}}{\overset{CH}}}{\overset{CH}}{\overset{CH}}{\overset{CH}}}{\overset{CH}}{\overset{CH}}{\overset{CH}}}}}}}}}}$	$_{\sim}$ CH ₂ $\xrightarrow{\text{HBr}}$	c) $HC \equiv C \xrightarrow{CH_3} \frac{Br_2}{H_2O}$	
					/ 6
-	Name this alkene and (E or Z).	specify its configuration	Н ₃ С— Н ₃ С—	$-CH_{2} CH - Br$ $C = C$ $-CH CH - CH_{3}$	/ 4
					/ 4
Res	ult / 20	Date	Teac	her's signature	

Question 3. Place for answers.

TEST 2: <u>Alkenes and alkynes</u>

Version B

	Name:		Group	Date	
1	1.1. Write the IUPAC names for 1.2. Draw structural formulas for			•	
1.1	$\begin{array}{c} H_{3}C \\ H_{2}C \\ H_{2}$	Br CH CH ₃	b)	$HC \xrightarrow{CH_3} HC \xrightarrow{C} CH \\ H_3C \xrightarrow{C} CH_2 \\ H_3C \xrightarrow{C} CH_2$	
	a) b)				
	a) 1,6-dibromo-2-methylhex-3-en b) 1-ethylcyclohexa-1,4-diene	e			
1.2	a)		b)		
					/ 4
2	Draw six structural (constitution Structural formulas for at least have to be drawn.				/ 6
3	Write structural formulas and n	ames for produ	cts of the fo	llowing reactions.	
-	$CH_{3} \xrightarrow{CH_{2} CH - CH_{3}}_{C1} \xrightarrow{NaOH}_{C_{2}H_{5}OH} b)$	_		-	$\frac{\text{Cl}_2}{\text{hv}}$
					/ 6
4	Name this alkene and specify its configuration (E or Z).	Н	₃ C ^{CH₂} C	$Cl Br \\ CH = CH CH CH_{CH_{3}}$	/4
Res	sult / 20	Date	Tea	icher's signature	

Question 3. 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) $H-C\equiv C$ $CH-C$ a) b)	Cl H CH—CH ₃ H ₃ C	b)	CH ₂ —CH ₃ HC—CH HC—CH—Cl HC—CH ₂ H ₃ C			
	a) 2-methylbuta-1,3-dieneb) 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	/ 6
	drawn.	

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

a)	H ₃ C ^{CH₂} CH ₃	$r_2O_3 \rightarrow b$	H ₂ C ^{×CH} CH ₃ -	$Cl_2 \rightarrow c)$	H ₃ C ^{CH} CH ^{CH}	H_2O H_2SO_4
						/ 6
-	Name this alkene a (E or Z).	and specify i	ts configuration	H ₃ C ^{CH} C	$_{3}C$ $_{1}CH_{2}$ Br $_{1}CH_{2}CH_{$	CH ₃
						/ 4
Res	ult / 20)	Date	Теас	cher's signature	

Question 3. Place for answers.

TEST 3: <u>Arenes</u>

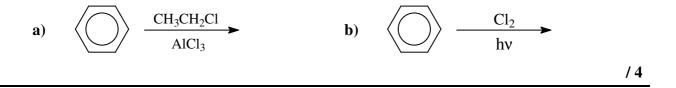
V	ersion	Α

	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) CH ₃ H ₃ C	b) CH_3 NH_2 CH_3					
	a) b)						
	a) 1-bromo-3-nitrobenzene b) 2-amino-3-methylnaphthalene						
	a)	b)					
1.2							

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2 Draw structural formulas for all possible isomers of dibromochlorobenzene. / 6
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3 Write structural formulas and names for products of the following reactions.



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).

Result/ 20DateTeacher's signature	
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Version A

Question 2. Place for answers.

Question 3. Place for answers.

TEST 3: Arenes

Version I	3
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	Name:	Group	Date		
1	1.1. Write the IUPAC names for each of 1.2. Draw structural formulas for each o		-		
1.1	a)	b)	Br NO ₂		
	a) b)				
	a) 1,3,5-trimethylbenzeneb) 1,8-dinitronaphthalene				
1.2	a)	b)			
				/ 4	
2	Draw structural formulas for all possible	e isomers of bromo	dichlorobenzene.	/ 6	
3	Write structural formulas and names for	• products of the fo	llowing reactions.		
	a) (HNO_3) H_2SO_4	б)	$\rightarrow H_2 SO_4 \rightarrow$	/4	
4	Write structural formulas and names for Remember that each of these reactions has to reaction (1) are reagents in the reaction (2).				
	a) $(1) \operatorname{Cl}_2 / \operatorname{AlCl}_3 \rightarrow 2) \operatorname{H}_2 \operatorname{SO}_4 \rightarrow $	б)	$\begin{array}{c} 1) H_2 SO_4 \\ \hline 2) Cl_2 / AlCl_3 \end{array}$		

				/ 6
Result	/ 20	Date	Teacher's signature	

Question 3. Place for answers.

TEST 3: <u>Arenes</u>

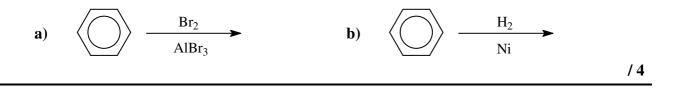
X 7	ersion	С
v	el sion	U

	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) H_3C Cl H ₃ C	b) H_3C Cl		
	a) 1-hydroxy-2,4,6-trinitrobenzene b) 2,3-dimethyl-6,7-dinitronaphthalene			
1.2	a)	b)		

/4

,	Draw structural formulas for each of the six isomers of benzene derivative	
4	C ₆ H ₄ BrClF.	/ 6

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



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)
$$(1) \text{HNO}_3 / \text{H}_2\text{SO}_4$$

2) Cl₂ / AlCl₃
b) $(2) \text{HNO}_3 / \text{H}_2\text{SO}_4$
/ 6

Question 3. 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) $H_3C-CH_2-CH_2-CH=C-CH_2-OH$ CH_3 a)	b)	H ₇ C ₃ OH CH ₃		
	b)a) 3-bromo-2-methyloctane-1,2,7-triolb) methyl pentyl ether				
1.2	a)	b)			

/4

/6

- 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.
- **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.

Question 3. Place for answers.

TEST 4: Alcohols and ethers

Version **B**

]	Last name:	_ Group	Date		
	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) Br CH ₃ HO Cl	b) H ₃ C−C≡C	Br OH $C - C - C - CH_2 - CH_3$ OH CH ₃		
	a) b)				
	a) 3,3-diethylpentan-1,5-diolb) butyl propyl ether				
1.2	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.	/0		

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.

/4

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.

Result/ 20DateTeacher's signature

Question 3. 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 1.2. Draw structural formulas for each of th	• •	5.	
1.1	a) H_3C -CH-CH-CH-CH-CH-CH ₂ -Cl OH OH	b)	NO ₂ OH NO ₂	
	a) b)			
	a) 3-chlorocyclopentane-1,2-diolb) dipropyl ether			
1.2	a)	b)		

/4

/6

- 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.
- **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.

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

Question 3. Place for answers.

-		ne:		Froup	Date
1		rite the IUPAC names for each of aw structural formulas for each of			
	a)	CHO NH ₂	b)	OH H ₃ C—CH—	OH └ CH2-CH-CH2-C ^O _H
1.1	c)	H ₃ C CH ₃	d)	CH H ₃ C—C— CH CH	$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ CH_2 - CH_2 - CH_2 - CH_3 \end{array} $
	a)				
	b)				
	c)				
	d)				
		a) 2-hydroxybutanedial; c) 3,4-dimethylcyclopentanone;		-dibromobenzald romo-4-methylh	
1.2	a)		b)		
	c)		d)		
					/ 8
2		hemical test could you use to dist equations for all reactions.	inguish be	etween propana	l and acetone?

Version A

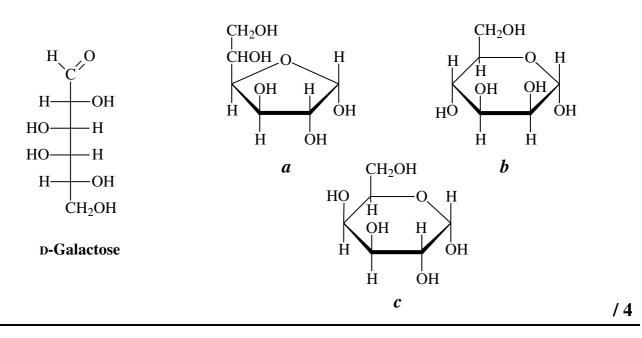
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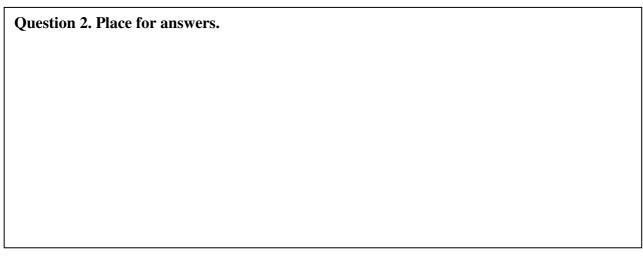
3 Write an equation for the reaction of 2-pentanone with ethanol to form a hemiacetal.

Result	/ 20	Date	Teacher's signature

(continuation)

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





L	ast nan	ne:		Date
1		Write the IUPAC names for eac Draw structural formulas for ea	•	-
	a)	$H_{3}C$ CH_{3} $H_{3}C$ $CH-CH_{2}-CH-CH_{2}-CH$ $H_{3}C$ $H_{3}C$ $H_{3}C$ $CH-CH_{2}-CH$ $H_{3}C$ $H_{3}C$ $CH-CH_{2}-CH$ $H_{3}C$	CH ₂ -CH ₃ b)	$H_{3}C-CH_{2}-CH=C-C < H_{H_{3}}O$
1.1	c)	H ₂ N-CH ₂ -CH ₂ -C ['] _H	d)	O II C CH ₃
	a)			
	b)			
	c)			
	d)			
		a) 3,5-dihydroxyhexanal;c) 1,4-cyclohexanedione;	b) 4-methylbe d) 1,1-dibrom	enzaldehyde; opentan-3-one;
1.2	a)		b)	
	c)		d)	
				/ 8

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

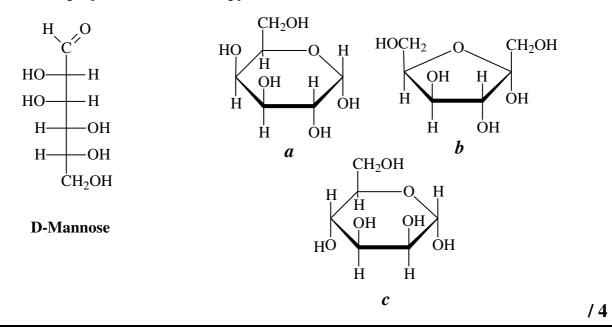
Version **B**

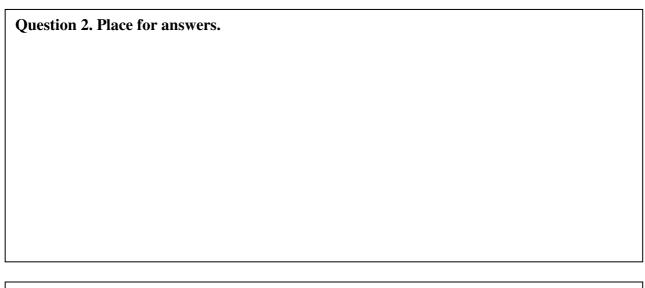
3 Write an equation for the reaction of benzaldehyde with methanol to form a hemiacetal.

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

(continuation)

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





Last	name:	Group Date
1		Write the IUPAC names for each of the following compounds. Draw structural formulas for each of the following compounds.
	a)	$\begin{array}{cccc} H_{3}C & OH & H_{3}C & CH_{3}\\ H_{3}C & H_{3}C & H & H_{3}C & H_{$
1.1	c)	$ \begin{array}{c} O \\ C \\ H \end{array} \begin{array}{c} O \\ C \\ H \end{array} \begin{array}{c} O \\ C \\ H \end{array} \end{array} \begin{array}{c} O \\ C \\ H \end{array} \end{array} \begin{array}{c} O \\ C \\ H \end{array} \end{array} \begin{array}{c} O \\ C \\ C \\ C \\ C \end{array} \end{array} \begin{array}{c} O \\ C \\ C \\ C \\ C \end{array} \end{array} $
	a)	
	b)	
	c)	
	d)	
		a) 3-methyl-3-phenylbutanal;b) 4-bromocyclohexanone;c) 3,4-dihydroxyhexanedial;d) 1,7-dichloroheptane-3,5-dione;
1.2	a)	b)
	c)	d)
		/ 8

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

Version C

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.

Result	/ 20	Date	Teacher's signature
			<u> </u>

Version C

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

Haworth projections is D-Sorbofuranose?

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CH₂OH CH₂OH HOCH₂ CH₂OH HO .0 O H H Ċ=O QН Η OH Η H--OH ÓН Ĥ ÓН Η но—н ÓН Ĥ Ĥ ÓН b H--OH a CH₂OH CHOH_O ĊH₂OH Ĥ **D-Sorbose** OН Η ÓН Ĥ Ĥ ĠН С

Question 3. Place for answers.

Question 4. Place for answers.

(continuation)

D-Sorbose forms cyclic hemiacetal D-Sorbofuranose. Which of the following

Last name: Group_____ Date____ 1.1. Write the IUPAC names for each of the following compounds. 1 1.2. Draw structural formulas for each of the following compounds. HO H₃C-CH₂-CH-CH₂-CH OH a) b) 1.1 H₃C a) b) a) 3-bromo-4-chloro-5-methylpentanoic acid b) ethyl 5-fluoro-2,3-dimethylbenzoate b) a) 1.2

- 2 Write structural formulas for four isomers of an oxygen-containing compound having the chemical formula C₄H₈O₂. First two isomers have to be acids, other two isomers should be esters. Name all these isomers. /6
- A mixture of ethanoic acid and butanol was boiled in the presence of 3 concentrated sulfuric acid as a catalyst. Draw structural formulas for obtained esters, write their names.

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Write the saponification reaction for glycerol tripalmitate. Esterification of what 4 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.

 $H_2C-O-CO-(CH_2)_{14}-CH_3$ HC-O-CO-(CH₂)₁₄-CH₃ H₂Ċ-O-CO-(CH₂)₁₄-CH₃

/ 6

Result	/ 20	Date	Teacher's signature	
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TEST 6: Carboxylic acids and esters

Version A

Question 3. Place for answers.

]		1e:				
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)	$\begin{array}{c} C_2H_5\\ H_2C-CH_2-C-CH-CH_2-C\\ H_3\\ CH_3\\ CH_5\\ \end{array} \\ \begin{array}{c} CH_2-C\\ CH_2-C$	b)	H ₅ C ₂ OCH ₃		
	a) b)					
		chloro-4-methyl-3-oxo-pentanoic acid nyl 3-chloro-2-methylbenzoate				
1.2	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.
- **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.

/6

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.

 $H_2C-O-CO-(CH_2)_7-CH=CH-(CH_2)_5-CH_3$ $HC-O-CO-(CH_2)_7-CH=CH-(CH_2)_5-CH_3$ $H_2C-O-CO-(CH_2)_7-CH=CH-(CH_2)_5-CH_3$

/ 6

Result	/ 20	Date	Teacher's signature	
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TEST 6: <u>Carboxylic acids and esters</u>

Version B

Question 3. Place for answers.

TEST 6: Carboxylic acids and esters

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) H ₃ C	$COO-C_2H_5$	b)	CH ₃ H ₃ C—CH—CI	\mathbf{H}_{2} \mathbf{C} \mathbf{C} \mathbf{H}_{2} \mathbf{C} \mathbf{H}_{2} \mathbf{C} \mathbf{C} \mathbf{H}_{2} \mathbf{C} \mathbf{C}	О ОН		
	a) b)							
	a) methyl 4-hydroxy b) 3-bromo-4-chloro							
1.2	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.

$$\begin{array}{c} H_{2}C - O - CO - (CH_{2})_{7} - CH = CH - (CH_{2})_{7} - CH_{3} \\ H - O - CO - (CH_{2})_{7} - CH = CH - (CH_{2})_{7} - CH_{3} \\ H_{2}C - O - CO - (CH_{2})_{7} - CH = CH - (CH_{2})_{7} - CH_{3} \end{array}$$

Result	/ 20	Date	Teacher's signature
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Question 3. Place for answers.

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

Version A

]	Last name:		Group	Date	
1	1.1. Write the IUPAC 1.2. Draw structural f				
1.1	a)	NH ₂	b) H ₃ C—C	$ \begin{array}{cccc} Cl & Br & OH \\ H_2 - CH - CH - CH - CH - C & O \\ & & & \\ NH_2 & O \\ \end{array} $	
	a) b)				
	a) 2-amino-5-bromo- b) 3-amino-2-methyl	•	-		
1.2	a)		b)		
					/4
2	Write structural form having the chemical for second and third ones tertiary amine. Names	rmula C ₄ H ₁₁ N. Fi should be second	rst isomer has to be p	rimary amine, the	/ 6
3	Proline, showed in functional groups ex aminoacid? Write e hydrochloric acid and	hibit acidic and quations for rea	basic properties of t actions of proline w	this OH	
					/ 6
4	Draw structural form following aminoacids.			obtained using the	
	$CH_{3}-CH-CH_{2}-CH-C$	- Leucine	$HS-CH_2-CH-C$	о - Cysteine н	
					/4
Resu	llt / 20	Date	Teach	er's signature	

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

Version A

Group____ Last name:____ Date_____ 1.1. Write the IUPAC names for each of the following compounds. 1 1.2. Draw structural formulas for each of the following compounds. NH_2 b) a) 1.1 B NO₂ a) b) a) 6-amino-3-ethyl-5-methyl-hexanoic acid b) 1-amino-3-methyl-5-nitrocyclohexane b) a) 1.2 /4 Write structural formulas of four isomers of a nitrogen-containing compound 2 having the chemical formula C₃H₉N. 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 Methionine, showed in figure, has amphoteric properties. 3 Methionine, showed in figure, has amplitude properties. What functional groups exhibit acidic and basic properties? $H_3 = H_2C - CH_2 - CH_2$ 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. $\sim CH_2 - CH_2$ HO-CH₂-CH-C O - Serine /4

TEST 7: Amines, aminoacids and peptides

Version **B**

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				following compou following compo		
1.1	a)	Br NO	-	b) H ₂ C=CH	$\begin{array}{c} \text{Br} & \text{NH}_2 \\ \text{I-CH-CH-CH-CH-CH-C} \\ \text{I-CH}_2 - \text{CH}_3 \end{array} OH$	
	a) b)					
	b)	4 1 2 4 1				
		•	ethylcyclopentan rohex-3-enoic act			
1.2	a)			b)		
2	having the che	emical formul	a C ₅ H ₁₃ N. Firs	t and second iso	aining compound mers have to be	/ 4
2	having the che primary amine be tertiary amin Valine, showed	emical formul s, the third on ne. Names all in figure, has	a C ₅ H ₁₃ N. Firs e should be seco these isomers.	t and second iso ndary amine, the operties. What	aining compound mers have to be fourth one has to	/ 4 / 6
3	having the che primary amine be tertiary amin	emical formul s, the third on ne. Names all in figure, has os exhibit acid actions of vali	a C ₅ H ₁₃ N. Firs e should be seco these isomers. amphoteric pr lic and basic pro	t and second ison ndary amine, the operties. What perties? Write nloric acid and	aining compound mers have to be fourth one has to	
3	having the che primary amines be tertiary amin Valine, showed functional group equations for re	emical formul s, the third on ne. Names all in figure, has os exhibit acid actions of vali	a C ₅ H ₁₃ N. Firs e should be seco these isomers. amphoteric pr lic and basic pro	t and second ison ndary amine, the operties. What perties? Write nloric acid and	aining compound mers have to be fourth one has to // H ₃ C NH ₂ O H ₃ C O H	
3	having the che primary amine be tertiary amin Valine, showed functional group equations for re sodium hydroxid	emical formul s, the third on ne. Names all t in figure, has os exhibit acid actions of vali de.	a C ₅ H ₁₃ N. Firs e should be seco these isomers. a amphoteric pr lic and basic pro ine with hydroc	t and second iso ndary amine, the operties. What perties? Write nloric acid and	aining compound mers have to be fourth one has to // H ₃ C NH ₂ O H ₃ C O H	/ 6
3	having the che primary amines be tertiary amin Valine, showed functional group equations for re sodium hydroxid	emical formul s, the third on ne. Names all in figure, has os exhibit acid actions of vali de.	a C ₅ H ₁₃ N. Firs e should be seco these isomers. amphoteric pr lic and basic pro- ine with hydroc or all dipeptide	t and second iso ndary amine, the operties. What perties? Write nloric acid and s, which can be	aining compound mers have to be fourth one has to $H_{3}C$ $CH-CH-C$ OH $H_{3}C$ OH $H_{3}C$ $H_{$	/ 6
3	having the che primary amines be tertiary amin Valine, showed functional group equations for re sodium hydroxid	emical formul s, the third on ne. Names all in figure, has os exhibit acid actions of vali de.	a C ₅ H ₁₃ N. Firs e should be seco these isomers. amphoteric pr lic and basic pro- ine with hydroc or all dipeptide	t and second iso ndary amine, the operties. What perties? Write nloric acid and s, which can be	aining compound mers have to be fourth one has to // H ₃ C O H ₃ C O H ₃ C O H ₃ C O H ₃ C O H O H O H O H	/ 6

Question 2. Place for answers.

Question 3. Place for answers.

Question 4. Place for answers.

Version C

TEST 8: Heterocyclic compounds

Version A

]	Last name:		Group	D Date
1		he IUPAC names for each of tructural formulas for each o		-
1.1	a)	Br Br N CH ₃	b)	O CH ₃ NH ₂
	a) b)			
	a) 2,4,6-ti b) N-prop	rimethylpyrimidine bylpyrrole		
1.2	a)		b)	

/4

 NH_2

N

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

Ĥ

TEST 8: <u>Heterocyclic compounds</u>

Below, you can see structural formulas for some vitamins. 4 Answer, which vitamins are: heterocyclic compounds: • • alkaloids: acids: • bases: • /4 alcohols: • OH 0 HO ŌН H₃C HO. NH .OH ОН O HO H₃C `N' | R O ОН 0 CH₃ N ÓН b d С a vitamin B₂ vitamin B₆ vitamin PP vitamin P

Questions 2 and 3. Place for answers.

(continuation)

Version A

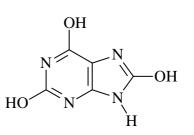
TEST 8: <u>Heterocyclic compounds</u>

Version B

	Last name:		Group_	Date
1		IUPAC names for each ctural formulas for eacl		-
1.1	a)	OH N OH	b)	H ₅ C ₂ NO ₂
	a) b)			
	a) 2,5-dimeth b) 2,4-dibror	nylfuran no-6-ethylpyridine		
1.2	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

ĊH₃

TEST 8: <u>Heterocyclic compounds</u>

4

Version B

called alkaloids. Answer, which alkaloids are: /4 • heterocyclic compounds: • acids: • ethers: • arenes: • alcohols: HO. CH₃ HO. H₃C CH₃ N-CH₃ Ó CH₃ HO N | H 0 Ĥ N-CH₃ óн | CH₃ HO b d С a ephedrine morphine adrenaline caffeine

Questions 2 and 3. Place for answers

(continuation)

Below, you can see structural formulas for biologically active substances

TEST 8: Heterocyclic compounds

Version C

]	Last name:	Group	Date
1	1.1. Write the IUPAC names for each of 1.2. Draw structural formulas for each o		
1.1	a) H_3C H_3C CH_3 H	b)	CH ₃ N CH ₃
	a) b)		
	a) N-ethylpyrimidineb) 2,3-dimethylthiophene		
1.2	a)	b)	

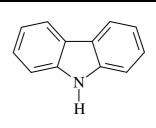
/4

2	Draw structural formulas for four isomers of thymine taking					mine taking		
	into	account	that	this	compound	exhibits	prototropic	
	isom	erism.						H ₃ C

/6

OH

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?

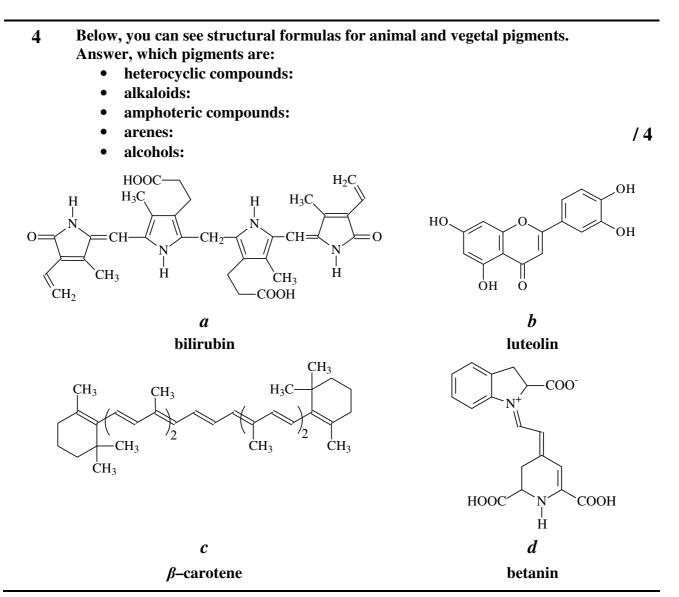


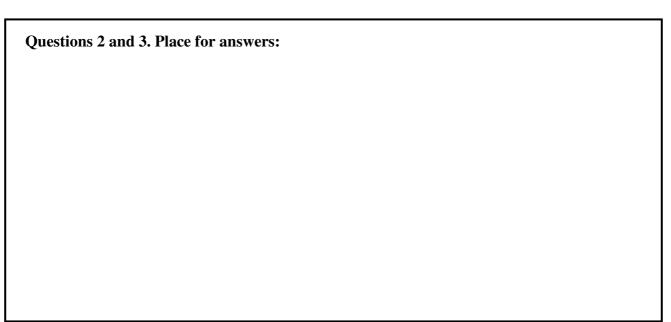
OH

/6

TEST 8: Heterocyclic compounds

Version C





(continuation)

PRACTICE 1. Hydrocarbons, halogen-containing compounds, alcohols

Experiment 1. The combustion of hydrocarbons						
1. What is the mechanism of hy	drocarbon combustion?					
Radical reduction	Heterolytic oxidation	Homolytic oxydation				
2. What side products can be fo	ormed 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,	1 – yellow,	1 – yellow,				
2 - bluish,	2 – yellow,	2 - bluish,				
3 - yellow	3 - bluish	3 - bluish				
Experiment 2. Qualitative test f	or alkenes and alkynes with a	equeous solution of bromine				
1. What is the mechanism of the	e reaction between unsaturate	ed hydrocarbons and bromine?				
Radical substitution	Electrophilic addition	Nucleophilic addition				
2. What maximal quantity of b	romine atoms can be added to	propyne molecule?				
One	Two	Four				
3. How does bromine solution c	hange color in the presence of	f alkenes?				
yellow \rightarrow colorless	yellow \rightarrow brownish	colorless \rightarrow yellow				
Experiment 3. Qualitative test f	for alkenes and alkynes with a	queous 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	ne result of alkyne – permang	anate reaction?				
HMnO ₄	$C_2H_5-O-C_2H_5$	MnO_2				

3. How does color solution char	nge when reacting potassium	permanganate and ethyne?
pink \rightarrow colorless	yellow \rightarrow colorless	pink \rightarrow 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	n the reaction?	
Iron	Copper	Chromium
3. How does flame color change	e when making Beilstein test?	
orange \rightarrow green	bluish \rightarrow orange	orange \rightarrow colorless
Experiment 5. Reaction of alcol	hols with metallic sodium	
1. In the alcohol – sodium react	ion, the alcohol demonstrates	s properties of :
base	acid	reducing agent
2. Products of this reaction area	:	
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 alco	hols with sodium hydroxide	
1. Which properties does pheno	ol demonstrate in the reaction	with sodium hydroxide?
No reaction	Basic properties	Acidic properties
2. Which properties does ethan	ol demonstrate in the reaction	n 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 wi	ith alcohols as:							
oxidizing agent	reducing agent	catalyst						
2. During the reaction of copp	per oxide with alcohol, the latter	one transforms to:						
carboxylic acid	copper alcoholate	aldehyde						
3. During the reaction of copp	per oxide with alcohol, the forme	er one transforms to:						
Cu ₂ O	metallic copper	copper alcoholate						
Experiment 8. Test for polyat	comic (polyhydric) alcohols							
1. Molecules of polyhydric alo	cohols form with Cu ²⁺ ions:							
ionic bonds	hydrogen bonds	coordinative bonds						
2. Reaction of polyatomic alco	bhols with copper hydroxide pro	ceeds in:						
basic medium	acidic medium	neutral medium						
3. When proceeding this reac	tion, one can observe changes:							
dark blue precipitate \rightarrow colorless solution	blue precipitate \rightarrow dark blue solution	dark blue precipitate → light blue precipitate						

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 \rightarrow orange-	blue solution \rightarrow orange-	blue precipitate \rightarrow dark blue		
brownish precipitate	brownish precipitate	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 acidit	ty of carboxylic acids:		
increases	does not change	decreases		
Experiment 4. Esterification				
1. Reaction of propanol and but	anoic 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 am	ines			
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:	,	1 4 1		
	decreases	do not change		
Experiment 6. Reaction of amines, aminoacids and nitrogen-containing heterocycles with Cu(OH) ₂				
1. Reaction with Cu(OH) ₂ result	ts 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	dissolution of white	formation of yellow		
precipitate	precipitate	precipitate		