



UNIVERSITY
OF SKÖVDE

Cover sheet with information
to the invigilator

School of Bioscience

Course Basic Chemistry

Examination Supervised Written Examination II

Course code Ke117G

Credits for written examination 5

Date 2024-01-08

Examination time 8.15-12.30

Available teacher Patric Nilsson

Available on phone number 070-2274574

Visiting the examination ☐ Yes, at
☒ No

Aids and other information for invigilators

Calculator. All answers must be given in the exam sheet. Additional and/or extra sheets will NOT be considered

Calculator ☒ Provided by the University
☒ Student's own calculator
☐ Not allowed

If you copy the exam papers yourself, provide the number of copies

Instructions to examinations responsible

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School of Bioscience

WRITTEN EXAMINATION

Course Basic Chemistry

Examination Supervised Written Examination II

Course code Ke117G

Credits for written examination 5

Date 2024-01-08

Examination time 8.15-12.30

Examination responsible Patric Nilsson/Magnus Fagerlind

Teachers concerned

Aid at the exam/appendices. Calculator

Other All answers must be given in the exam sheet. Answers in additional sheets will NOT be considered

Instructions

- ☐ Take a new sheet of paper for each teacher.
- ☐ Take a new sheet of paper when starting a new question.
- ☐ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☐ Use page numbering.
- ☐ Don't use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points. To pass the exam, all learning objective require the grade E or higher. To pass a learning objective, 50% correct answers are required

F < 35 ≤ E < 42 ≤ D < 49 ≤ C < 56 ≤ B < 63 ≤ A

Examination results should be made public within 18 working days

Good luck!

Total number of pages

Supervised Written examination II (organic chemistry)

Course: Basic Chemistry (Ke117G)

Important information regarding the exam: The supervised written exam II examines three learning objectives in total

- name organic chemical substances and draw their structural formula. To pass the learning objective, 50% correct answers are required (20p in total)
- present different classes of organic substances, their properties, structures, reactivity and biological functions. To pass the learning objective, 50% correct answers are required. (30p in total)
- describe the four classes of biological macromolecules, with focus on their structures and biochemical reactions and function. To pass the learning, 50% correct answers are required. (20p in total)

To pass the supervised written exam, all learning objectives require the grade E or higher. To pass a learning objective, at least 50 % correct answers are required. Important things to keep in mind while writing the exam: The teacher who corrects the exam is not a mind-reader. This means that you need to be specific in your answers otherwise it is very difficult or even impossible to follow your line of thinking. In the end, this will make a huge difference in the number of points you get on a question if you, by chance, make a simple mistake. All answers should be given in this exam sheet. No additional or extra sheets are allowed. Answers given on an extra sheet will not be considered. Most importantly, believe in yourself. There are no surprises in this exam. We have talked about all the things over and over again.

Good luck

Patric

Learning objective: name organic chemical substances and draw their structural formula. To pass the learning objective, 50% correct answers are required (10 out of 20p is required)

1	<p>Use the following condensed and line-angle formulas A to F to answer the TRUE and FALSE statement below</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center;"> $\text{A) } \text{CH}_3\text{-CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C-CH}_2\text{-CH}_3$ </div> <div style="text-align: center;"> $\text{D) } \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C-H}$ </div> <div style="text-align: center;"> $\text{B) } \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C-CH}_3$ </div> <div style="text-align: center;"> $\text{E) } \text{Cyclopentanone}$ </div> <div style="text-align: center;"> $\text{C) } \text{CH}_3\text{-}\overset{\text{O}}{\parallel}\text{C-CH}_2\text{-CH}_2\text{-CH}_3$ </div> <div style="text-align: center;"> $\text{F) } \text{Cyclobutylaldehyde}$ </div> </div> <p> a) A and B are structural isomers b) D and F are aldehydes c) B and C are the same compound d) C and D are structural isomers e) E and F are structural isomers f) A is chiral g) A and C are the same compound h) B and E are ketones </p>	<p>0.5p 0.5p 0.5p 0.5p 0.5p 0.5p 0.5p 0.5p</p>
2	<p>Identify each of the following pairs of Fischer projections as enantiomers or identical compounds</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center;"> $\text{A) } \begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_2\text{OH} \end{array} \text{ and } \begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{CH}_2\text{OH} \end{array}$ </div> <div style="text-align: center;"> $\text{C) } \begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_3 \end{array} \text{ and } \begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{CH}_3 \end{array}$ </div> <div style="text-align: center;"> $\text{B) } \begin{array}{c} \text{H} - \text{C} = \text{O} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_2\text{OH} \end{array} \text{ and } \begin{array}{c} \text{H} - \text{C} = \text{O} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{CH}_2\text{OH} \end{array}$ </div> <div style="text-align: center;"> $\text{D) } \begin{array}{c} \text{OH} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_3 \end{array} \text{ and } \begin{array}{c} \text{OH} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{CH}_3 \end{array}$ </div> </div>	<p>2p</p>

3	<p>Draw the condensed structural formula or line-angle formula for</p> <p>a) Methyl butanoate</p> <p>b) 4-Oxo-pentanoic acid</p> <p>c) 2,3-dichlorophenol</p> <p>d) 4,5-dimethyl-2-hexene</p> <p>e) Methoxy butane</p> <p>f) 3-Hydroxy-3-methyl-pentanal</p> <p>g) N,N-Dimethylmethanamine</p> <p>h) N-Methylpropanamide</p>	<p>1p</p> <p>1p</p> <p>1p</p> <p>1p</p> <p>1p</p> <p>1p</p> <p>1p</p> <p>1p</p>
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4	<p>Classify each of the following as primary (1), secondary (2), or tertiary alcohol and/or amine</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\text{A) } \text{H}_3\text{C}-\text{CH}(\text{OH})-\text{CH}_3$ </div> <div style="text-align: center;"> $\text{B) } \text{CH}_3-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{N}}}-\text{CH}_2-\text{CH}_3$ </div> <div style="text-align: center;"> $\text{C) } \text{H}_3\text{C}-\overset{\text{CH}_3}{\underset{ }{\text{C}}}-\underset{\text{OH}}{\underset{ }{\text{C}}}-\overset{\text{CH}_3}{\underset{ }{\text{C}}}-\text{CH}_3$ </div> </div>	3p
5	<p>In the figure below, identify the chiral carbons</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center; margin: 10px;"> </div> <div style="text-align: center; margin: 10px;"> $\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CH}_3$ </div> <div style="text-align: center; margin: 10px;"> $\text{HO}-\overset{\text{CH}_2\text{OH}}{\underset{\text{CH}_3}{\mid}}-\text{H}$ </div> <div style="text-align: center; margin: 10px;"> </div> <div style="text-align: center; margin: 10px;"> </div> </div>	3p

Learning objective: *present different classes of organic substances, their properties, structures, reactivity and biological functions. To pass the learning objective, 50% correct answers are required. (15 out of 30p is required)*

6	<p>Draw the condensed structural formulas for the products from</p> <p>a) Acid (HCl) hydrolysis, and</p> <p>b) base (NaOH) hydrolysis of <i>N</i>-ethylbutanamide</p>	<p>2p</p> <p>2p</p>
7	<p>Draw the structure and name the compound formed from the following reactions</p> <p>a) Methyl propanoate + NaOH (base hydrolysis of an ester)</p> <p>b) Methyl ethanoate + H₂O (Acid hydrolysis of an ester)</p> <p>c) Ethanoic acid + methanol (esterification)</p> <p>d) Butanoic acid + NaOH (neutralization of a carboxylic acid)</p> <p>e) Reduction of 2-methylpentanoic acid</p> <p>f) Oxidation of D-fructose (no need to draw the structure, just give the name)</p>	<p>2p</p> <p>2p</p> <p>2p</p> <p>2p</p> <p>2p</p> <p>2p</p>

	g) Reduction of 2-methyl-3-pentanone	2p
8	Draw the condensed structural or line-angle formula and give the IUPAC names for all the aldehydes and ketones that have the molecular formula C_4H_8O	6p
9	Why does the $C=O$ double have a dipole, whereas the $C=C$ double bond does not?	2p

10	Which compound in each of the following pairs would have the higher boiling point? a) Propane or ethanal b) Propanal or pentanal c) Butanal or 1-butanol d) Propanone or pentanone	0.5p 0.5p 0.5p 0.5p
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11	True or false a) Hexanal is soluble in water b) Butanone is soluble in water c) 2-Pentanone is slightly soluble in water d) Methoxy methane is insoluble in water	0.5p 0.5p 0.5p 0.5p
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Learning objective: describe the four classes of biological macromolecules, with focus on their structures and biochemical reactions and function. To pass the learning, 50% correct answers are required. (10 out of 20p is required)

12

Cellulose, amylose, amylopectin, and glycogen are all important polysaccharides in organisms. Complete the table below

	Cellulose	Amylose	Amylopectin	Glycogen
Organisms (Plants or animal)				
Monosaccharide (specify the monosaccharide and also if it is β or α)				
Types of bonds				
Branches (yes or no)				

1p

1p

1p

1p

13 Compare the structure and functional groups of arachidonic acid and prostaglandin PGE₁

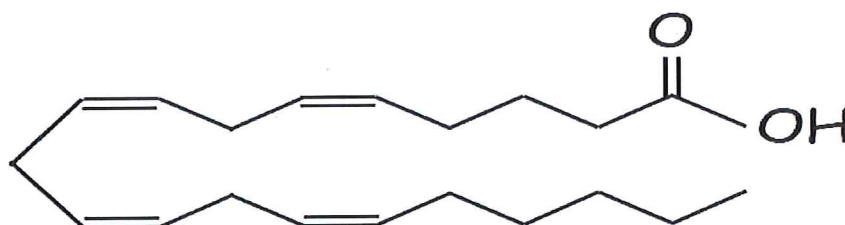
- a) With respect to functional groups
- b) With respect to cis-trans double bonds
- c) What type of molecules are they?
- d) Other differences

1p

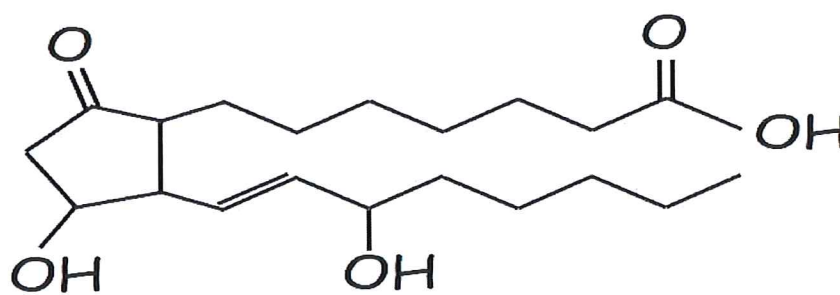
1p

1p

1p


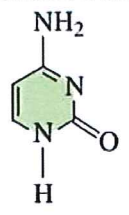
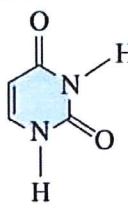
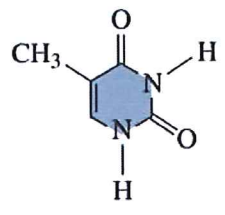
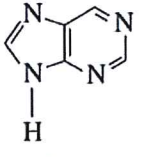
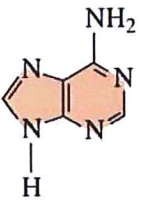
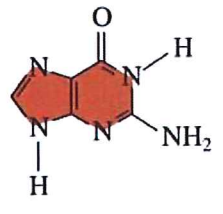


Arachidonic acid



Prostaglandin PGE₁

14	<p>Cholesterol is the most important and abundant steroid in the body.</p> <p>a) The cholesterol molecule contains α steroid nucleus: what is characteristic of α steroid nucleus?</p>	2p
	<p>b) Cholesterol is also the precursor for other molecules and cholesterol derivatives are found in other molecules, which ones?</p>	3p

15	<p>In the figure below, identify the purines and pyrimidines</p> <p>Pyrimidine Bases in Nucleic Acids</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Pyrimidine</p> </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>Purine Bases in Nucleic Acids</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Purine</p> </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>	2.5p
16	<p>TRUE or FALSE?</p> <p>a) An amino acid is acidic when the R group is an amine</p> <p>b) An amino acid has an α-carbon that is attached to $-\text{NH}_3^+$, $-\text{COO}^-$, $-\text{H}$ group, and an R group</p> <p>c) The amino acids differ by their R groups</p> <p>d) An amino acid is basic when the R-group is a carboxylate</p> <p>e) In peptides, amino acids are joined by ester bonds</p> <p>f) Amino acids have a central carbon atom called the β-carbon</p> <p>g) An amino acid is nonpolar when the R group is H, alkyl or aromatic</p>	<p>0.5p</p> <p>0.5p</p> <p>0.5p</p> <p>0.5p</p> <p>0.5p</p> <p>0.5p</p> <p>0.5p</p>

17	What are the differences between secondary and tertiary protein structures with respect to bonds?	1p
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Well done 😊

Periodic Table of the Elements

Periodic Table of the Elements

1 H Hydrogen 1.01																	2 He Helium 4.00
3 Li Lithium 6.94	4 Be Beryllium 9.01															10 Ne Neon 20.18	
11 Na Sodium 22.99	12 Mg Magnesium 24.31															18 Ar Argon 39.95	
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 84.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.29
55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.85	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.20	83 Bi Bismuth 208.98	84 Po Polonium [209]	85 At Astatine [209]	86 Rn Radon 222.02
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]
57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium [144]	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97	101 La Lanthanum 138.91	102 Ce Cerium 140.12	103 Pr Praseodymium 140.91
89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium [254]	100 Fm Fermium 257.10	101 Md Mendelevium 258.10	102 No Nobelium 259.10	103 Lr Lawrencium [262]	104 Th Thorium 232.04	105 Pa Protactinium 231.04	106 U Uranium 238.03

- Alkali Metal
- Alkaline Earth
- Transition Metal
- Basic Metal
- Metalloid
- Nonmetal
- Halogen
- Noble Gas
- Lanthanide
- Actinide

Priority rules

High Priority		Group	Prefix	Suffix
		Carboxylic acid	carboxy-	-oic acid
		Ester	oxycarbonyl-	-oate
		Amide	carbamoyl-	-amide
		Aldehyde	formyl-	-al
		Ketone	oxo-	-one
		Alcohol	hydroxy-	-ol
		Thiol	mercapto-	-thiol
		Amine	amino-	-amine
		Alkene	alkenyl-	-ene
		Alkyne	alkynyl-	-yne
		Alkane*	alkyl-	-ane
		Ether	alkoxy-	-ane
		Halo	halo-	-ane
Low priority		Nitro	nitro-	-ane