

RESEARCH ARTICLE

# Teaching organic nomenclature for pharmacy students: Adapting a course to online mode during COVID-19

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## Keywords

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## Abstract

**Introduction:** Due to the confinement of the COVID-19 pandemic, educational centres have remained closed, transferring the teaching process to online mode, thus adapting infrastructure, methodologies, and the university community. **Objectives:** This work aims to evaluate the effectiveness of strategies in learning organic nomenclature and seek student opinions about committing fraud in organic chemistry course assessments in the online mode in the pharmaceutical career. **Methods:** The methodologies used allowed the students to understand and apply the organic nomenclature rules, using online collaborative guides and crosswords worked in synchronous classes, previous reading, and the collaborative asynchronous creation of informative files for the recognition of heterocyclic compounds and formative assessment. All assessments were applied in three-people groups in the synchronous classes. Finally, an anonymous survey was administered to know the student perception of the possibility of fraud during the course. **Results:** A substantial improvement (from 47.7% to 80.5%) was observed in the application of IUPAC rules for organic compounds. Of the students who responded to the anonymous survey, 81% reported that the methodology used decreased the opportunity to commit fraud during assessments.

## Introduction

The year 2020 has marked the world as the year in which all educational establishments moved from the face-to-face to the online modality due to the lockdown caused by the COVID-19 pandemic. Chile was not the exception, and since March 2020, all education centres, including higher education, had to transfer classes to online platforms (Clark *et al.*, 2020; Crucho *et al.*, 2020; Hallal *et al.*, 2020; Tan *et al.*, 2020).

Along with this, in recent years, Chilean universities have adapted their way of building knowledge, based on skills and learning outcomes, centred on the student, where teachers have been trained and have had to implement new teaching methodologies in classrooms and design new strategies to develop their teaching practices, which represents a challenge in a pandemic.

During the spring term in 2020, the Pharmaceutical Chemistry students took the Organic Chemistry course online (e-learning). This course is theoretical-practical and ranges from organic nomenclature to the synthesis of organic compounds and their physicochemical properties. Online mode is a challenge for teachers, where they have to adapt all face-to-face activities, such as assessments, lessons, and laboratory experiences, to an online platform using technological tools that they have not used before (Singh & Thurman, 2019). They also have to deal with the anxiety of students generated by the confinement and understand how to use technological tools that allow the students to build knowledge (Angulo & Redon, 2011; Pizarro, 2014).

In general, some contents of the organic chemistry course are very abstract, which is concomitant with a lot of reading for the student involved (Austin *et al.*, 2015).

In face-to-face mode, teachers often use molecular models, also manipulated by students, to represent molecules three-dimensionally (Crucho *et al.*, 2020). However, this approach is not applicable in the online mode.

In the organic nomenclature, the skills of recognition and ranking of the different functional groups that organic molecules are worked on are essential. For this purpose, common-use drugs were used. Nomenclature of organic compounds must be revisited in greater depth, covering polyfunctional compounds and stereochemistry using IUPAC rules (Liotta, 1970; Traynham, 1987; Garrison & Cleveland-Innes, 2005; Skonieczny, 2006; Tu & Mclsaac, 2010). In this course, the recognition of heterocyclic compounds and their Hantzsch-Widman nomenclature was included due to their importance to pharmaceutical chemistry students because of the pharmacological properties that characterise them (Katritzky, 1965; McNaught, 1976; Favre & Powell, 2014; Pugh, 2020; Hellwich *et al.*, 2020). Organic chemistry is the course where students get acquainted with heterocyclic compounds for the first time. These compounds will be studied in the next term in the pharmacology course.

During the development of online classes, fragility in the evaluation and possible academic dishonesty have been a constant concern (Clark *et al.*, 2020). The growth of the online mode of education could lead to a dramatic increase in academic dishonesty, whether due to easy access to information, demotivation, or immaturity of students (King *et al.*, 2009). In the context of the COVID-19 pandemic, this increase may be exacerbated when online mode education is suddenly implemented, leaving no time for teachers to develop new assessment strategies to reduce fraud risk and plan teaching strategies that increase student motivation.

This work describes motivating strategies used in organic nomenclature in online pharmaceutical chemistry classes. It also surveys the students if the different methods applied increased motivation and decreased dishonest academic behaviour in an online organic chemistry course.

### **Course description**

The organic chemistry course belongs to the initial cycle of the study plan of the pharmaceutical chemistry curriculum; it belongs to the fourth term of the programme, corresponds to the area of theoretical-practical training, and is a prerequisite for pharmacology course imparted in the subsequent term. The requirement for the organic chemistry course is general chemistry taught in the first term. Organic chemistry aims to develop in students the necessary skills to explain the formation, composition,

structure, and chemical reactions of organic chemical compounds and their derivatives, using the basic concepts of organic chemistry.

Among the learning outcomes associated with this course, this research focuses on the part related to explaining the physicochemical properties and chemical functions of organic compounds and naming them according to the organic chemistry nomenclature.

The organic chemistry course provides knowledge of nomenclature and physicochemical properties of the different structures present in drugs, corresponding to the bases of knowledge of the mechanisms of action and functioning of drugs that are deepened in subsequent specific courses.

The organic chemistry course, being theoretical-practical, allows the synthesis of drugs in the laboratory; it is also the only organic chemistry course imparted to these students.

### **Methods**

According to the University Educational Model, the proposed work methodology for the development of the subject was based on an active-participatory method. It implies giving a leading role to students who become the axis and centre of the action and build their learning through active participation and guidelines the teacher gives (Anijovich & Mora, 2010; McGinn & Schiefelbein, 2015; Gutierrez, 2018). The strategies used were as follows:

#### **Online mode**

**1. During the first lesson:** The contents of the course were presented, and a diagnostic exam was applied (Supporting Information Appendix A). Then, classes via Microsoft Teams were held, considering scientific articles on organic nomenclature (Bodé *et al.*, 2016; Sedur & Toprak, 2013). The steps for naming an organic compound were worked, from linear monofunctional to polyfunctional and cyclic compounds, working the priorities of different functional groups. At the end of the nomenclature class, benzene derivatives, such as phenol, toluene, acetanilide, and heterocyclic compounds, were presented using the Hantzsch-Widman nomenclature. ChemSketch software was used for the 3D modelling of stereoisomer compounds. All meetings on Microsoft Teams were recorded for later viewing, and the pdf presentation was shared before the course so that students download it, take notes, and focus on what is discussed in classes. The duration of classes was between 40 to 60 minutes at

most to reduce the time spent in front of a computer and promote autonomous work.

**2. In the third class:** Crosswords (Supporting Information Appendix B) were used to activate prior knowledge, principally to recognise the main functional groups.

**3. Previous reading** (McGinn & Schiefelbein, 2015): A file was created to deepen knowledge in organic nomenclature using information from journals of chemistry education (Liotta, 1970; Skonieczny, 2006).

**4. Guides:** Two collaborative Microsoft Word documents were shared with the students on Microsoft Teams. Files were divided into two parts, one on structure-name and the other on name-structure. Exercises were reviewed with the possibility for students to edit synchronously (Supporting Information Appendix C) these documents during the class under the teacher's guidance in a meeting on Microsoft Teams.

**5. Complementary activity:** The activity was created for students to recognise heterocyclic compounds in medicines. Groups of three students had to fill out an informative file in which they must look for heterocyclic compounds contained in known drugs. They also briefly completed the use, International Nonproprietary Name (INN), and IUPAC nomenclature of these drugs (Supporting Information Appendix D).

### Assessments

**1. In the first class:** A voluntary diagnostic exam was performed (Supporting Information Appendix A), using the Microsoft Forms platform. In this exam, the nomenclature section included multiple-choice questions, where the student was asked to choose only one answer from four alternatives. Moreover, two types of short answer questions were asked in 15 questions, i.e., the recognition of functional groups and nomenclature for monofunctional compounds. This diagnostic exam was answered by 80% of the course (44 students). The diagnostic test was carried out to identify weaknesses, thus dedicating more time to work and focus on these issues in the teaching practice.

**2. Quiz:** Quiz 1 was designed to prepare the students to face midterm exam 1. A cooperative assessment was applied in groups of three students, using a file attached in Microsoft Teams. This 30-minute exam consisted of writing the names of three structures, different for each group. The correct answers of all groups were shared in pdf with all the students in the subsequent week (Supporting Information Appendix E).

**3. Formative assessment:** A model of the Midterm Assessment 1 was applied without qualification. The

feedback on Microsoft Teams was achieved and focused on learning outcomes not developed, and the resolution was shared in pdf format (Supporting Information Appendix F) before Midterm Assessment 1.

**4. Midterm Assessment 1:** It consisted of two parts. The first part was made up of 15 multiple-choice questions, answered individually through Microsoft Forms (weighing 30% of the total score). The second part corresponded to three alkanes synthesis questions (weighing 30% of the total score) and three nomenclature exercises with stereogenic centres, where students must indicate the name according to IUPAC rules with stereogenic descriptors (R and S) and whether the structure presented optical activity (weighing 40% of the total score). As for Quiz 1, different exercises were applied in Midterm Assessment 1 for each group, using cooperative working (Supporting Information Appendix F).

### Student's satisfaction survey

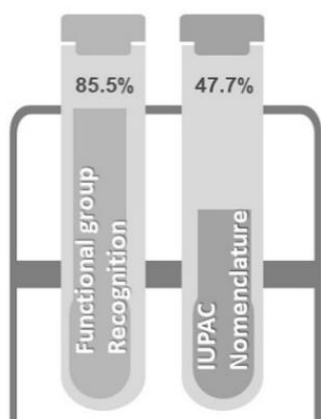
Once the course was finished, a survey based on a Likert scale was developed on Google Forms and sent to the students with an informed consent form for voluntary participation. The survey was not reviewed by an ethics committee because it only corresponded to an assessment of the strategies used in the course. The survey was anonymous to ensure the honesty of responses since this information would be used to improve online teaching, and participants signed informed consent to participate in the study.

The survey was explained before being applied. It consisted of seven questions, five rated on a Likert scale, one multiple-choice, and one open-ended question. The survey data were collected at the end of the course. The response rate was 56% (Supporting Information Appendix G).

### Results

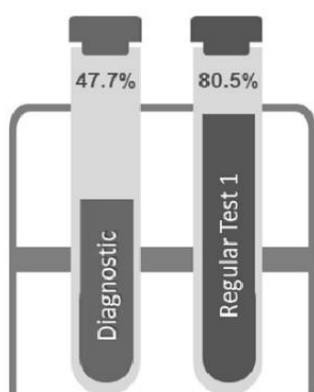
Figure 1 presents a summary of organic chemistry results of the diagnostic exam, considering only the questions related to organic nomenclature. As can be seen, the students, given their previous chemistry courses, could recognise most of the functional groups included in the test and achieve an average score of 85.5%. But when the IUPAC nomenclature rules were applied, the score fell drastically to 47.7%.

A comparison between the diagnostic exam and midterm exam was made, and no significant differences were found for the recognition of functional groups (85.5% and 86.6%, respectively).



**Figure 1: Organic chemistry diagnostic exam results for organic nomenclature questions**

Figure 2 presents the IUPAC nomenclature evaluation (Item 2) and shows a considerable improvement, from an initial achievement of 47.7% to 80.5%. This result was consistent with the result of Quiz 1, where the course average was 85%, indicating that the strategies used in classes allowed the students to acquire advanced skills. They developed the ability to identify compounds by applying the IUPAC nomenclature rules, surpassing the recognition level of functional groups.



**Figure 2: Comparison between diagnostic exam and midterm assessment 1 for IUPAC Nomenclature**

### Survey responses

The concern of the teachers was academic dishonesty due to the use of information technologies in the assessments; therefore, the students were asked to evaluate the following statement “Do you find that the evaluation methodologies used by the professor prevented or reduced fraud in the Organic Chemistry course (Quiz 1 and Midterm Assessment 1)”. Twenty-

five students (81%) answered by “strongly agree” or “agree”. Students were asked if the methodologies used helped them develop their learning outcomes, and 77% “strongly agreed” or “agreed” with that. When asked if the activities developed in the course promoted motivation, 77% of students “strongly agreed” or “agreed” with the methodologies applied, and 74% confirmed their engagement with the course.

### General opinions from students' section

Student opinions gathered through the open-ended question should be considered in the planning and methodologies of the online courses. Some students revealed that the online mode was complex due to a lack of technological skills, not having a computer for exclusive use or a special place dedicated to studying, connectivity issues, and difficulty concentrating at home. On the other hand, one opinion established that working in groups of three students in assessments was positive because it promoted discussion within the group.

### Discussion

Online education is not a new concept; this situation, where the student and the teacher are physically separated (Singh & Thurman, 2019), was suddenly imposed by local authorities due to the COVID-19 lockdown, but its application faced several problems. The main issues were the lack of motivation (King *et al.*, 2009) and academic dishonesty (Clark *et al.*, 2020) that must be addressed in the teaching practice. In this work, an improvement in the application of IUPAC rules (from 47.7 % to 80.5 %) was observed using active participation (Dallimore *et al.* 2004) through shared files that the students completed synchronously under the teacher's guidance, promoting the discussion between students and improving the motivation and participation in online classes. Collaborative work was used to prevent academic dishonesty in assessments, with groups of three students created and different chemical structures assigned. Some students reported that assessments in small groups were very positive, allowing them discuss and argue their answers.

### Conclusion

Methodologies that encourage participation and discussion can engage students in online learning. This work promotes scientific reasoning, critical thinking, development of leadership skills, communication, and teamwork among students, all of which are essential

characteristics for a scientific career, such as pharmaceutical chemistry.

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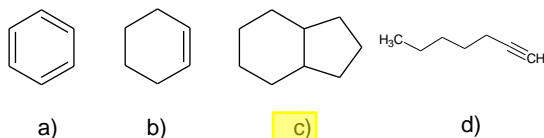
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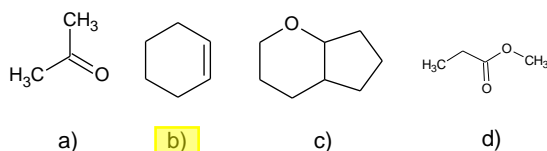
### Appendix A: Diagnostic exam

Multiple-choice section. Answer the following questions by marking with an oblique line only one alternative (Total score 30 points).

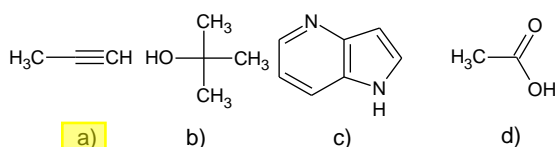
1. Check the alternative that corresponds to an alkane



2. Check the alternative that corresponds to an alkene



3. Check the alternative that corresponds to an alkyne



4. Check the alternative that corresponds to an alcohol

A) R-OH b) R-NH<sub>2</sub> c) R-COOH d) R-CHO

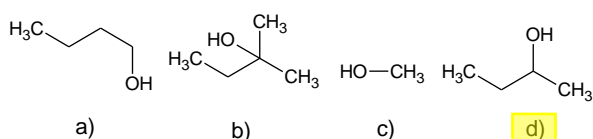
5. Check the alternative that corresponds to a carboxylic acid

A) R-OH b) R-O-R' c) R-NH<sub>2</sub> d) R-COOH

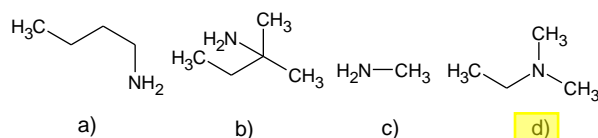
6. Check the alternative that corresponds to an ester

a) R-OH b) R-COOR' c) R-Cl d) R-SH

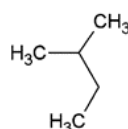
7. Check the alternative that corresponds to a secondary alcohol



8. Check the alternative that corresponds to a tertiary amine

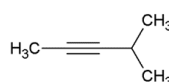


9. Select the alternative that corresponds to the name of the following chemical structure.



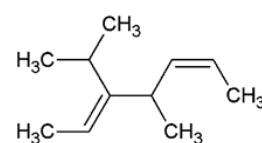
a) 2-methylbutane b) 3-methylbutane c) isopropylethane d) ethylpropane

10. Select the alternative that corresponds to the name of the following chemical structure.



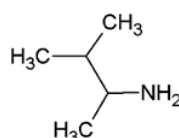
a) 2-methyl-3-pentyne b) 4-methyl-2-pentyne c) isopropylethane d) ethylpropane

11. Select the alternative that corresponds to the name of the following chemical structure.



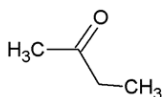
a) 4-isopropyl-3-methyl-2,5-heptadiene b) 3-dimethyl-4-methyl-2,5-heptadiene c) 3-isopropyl-4-methyl-2,5-heptadiene d) 5-isopropyl-4-methyl-2,5-heptadiene

12. Select the alternative that corresponds to the name of the following chemical structure.



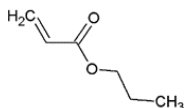
a) 3-amino-2-methylbutane b) 2-amino-3-methylbutane c) 2-methyl-3-butanamine d) 3-methyl-2-butanamine

13. Select the alternative that corresponds to the name of the following chemical structure.



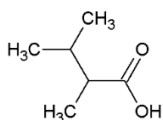
a) ethyl propanoate b) propyl ethanoate c) 3-butanone d) 2-butanone

14. Select the alternative that corresponds to the name of the following chemical structure.



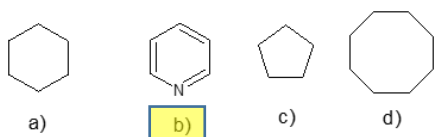
a) hexen-3-one b) propyl propanoate c) propyl propenoate d) propyl propenoic acid

15. Select the alternative that corresponds to the name of the following chemical structure.



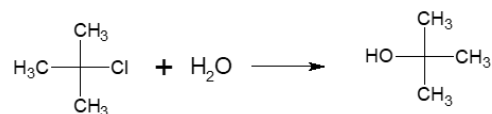
a) 2-isopropylpropanoic acid b) 2,3-dimethylbutanone c) 2,3-dimethyl butanoic acid d) 2,3-dimethyl-4-butanoic acid

16. Check the alternative that corresponds to an aromatic compound



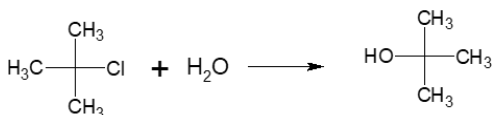
17. What is the mechanism of the next reaction?

a) SN1 b) SN2 c) E1 d) E2



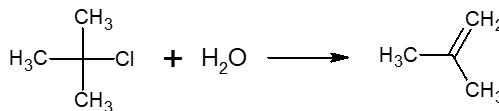
18. What is the mechanism of the next reaction?

a) SN1 b) SN2 c) E1 d) E2



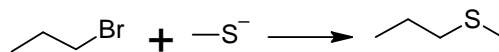
19. What is the mechanism of the next reaction?

a) SN1 b) SN2 c) E1 d) E2



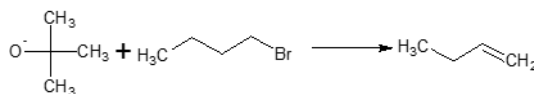
20. What is the mechanism of the next reaction?

a) SN1 b) SN2 c) E1 d) E2



21. What is the mechanism of the next reaction?

a) SN1 b) SN2 c) E1 d) E2



22. What is the product of reaction between an alcohol and a carboxylic acid in acidic media?

a) Aldehyde b) ketone c) Ester d) Amide

23. What reaction generates as a product an alcohol from an alkene?

a) Oximercuration-demercuration b) Esterification d) Nitration d) Saponification

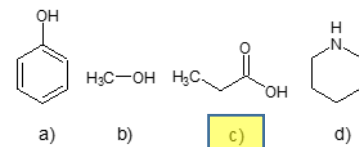
24. What is the angle expected for C-O-C of an epoxide?

a) 120° b) 104,5° c) 60° d) 180°

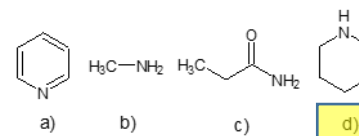
25. What is the product of reaction between an alkene and chloride acid?

a) Alkyne b) Aldehyde c) Alcohol d) Alkyl halide

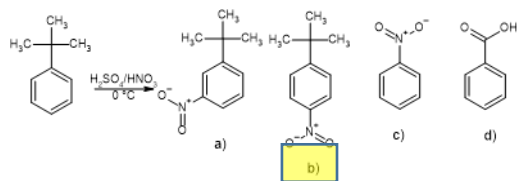
26. What compound is the most acidic?



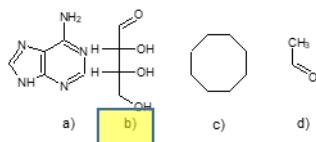
27. What compound is the most basic?



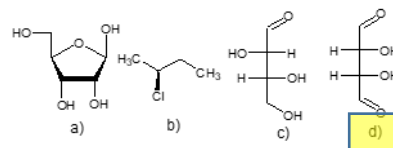
28. What is the product of the next reaction?



29. What compound shows chirality?



30. Which is a meso compound?





**Appendix B: Crosswords**

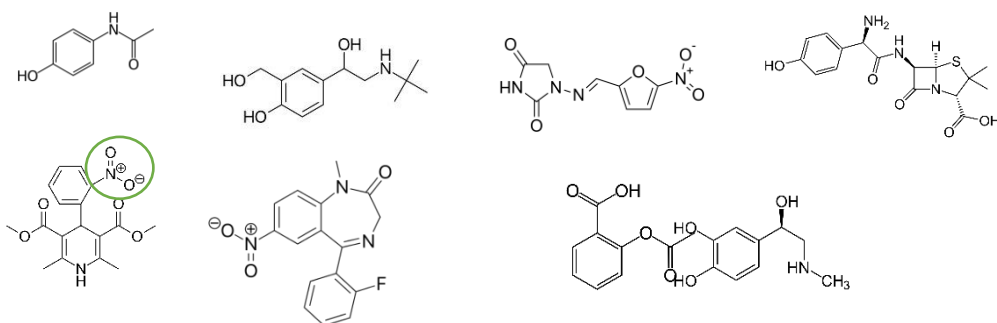
**Functional group recognition (complete the crossword with the functional groups)**

		CORRECT ☺
		WRONG ☹
<b>Across</b>		
1.- R-COOH	carboxylic acid	
2.- R-C≡N	nitrile	
3.- R-O-R'	ether	
4.- R-NH <sub>2</sub>	amine	
5.- R-C=C-R'	alkene	
<b>Down</b>		
1.- R-OH	alcohol	
2.- R-CO-R'	ketone	
3.- R-CHO	aldehyde	
4.- R-CO-NH <sub>2</sub>	amide	
5.- R-CO-O-R'	ester	

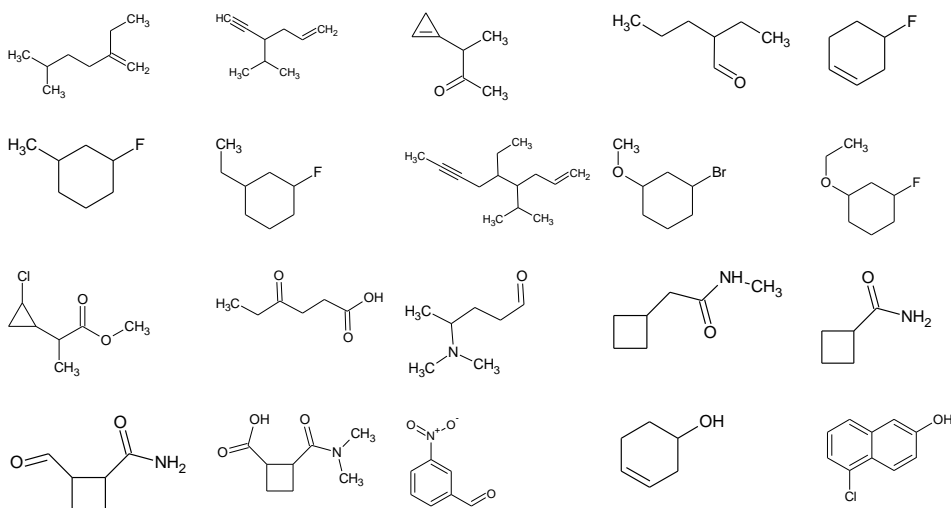
## Appendix C: Guides

## Guide 1. Organic nomenclature

I. Circle and write the functional group the following drugs.



II. Applying the IUPAC naming rules, name the following compounds:

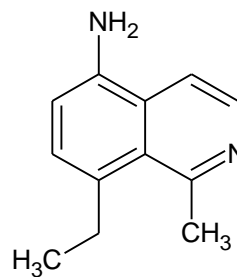
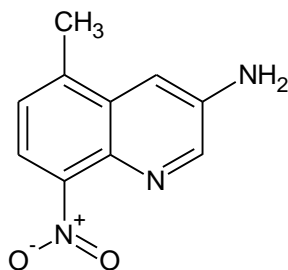
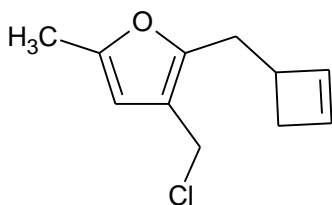
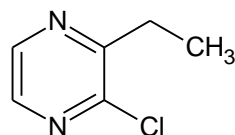
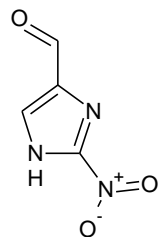
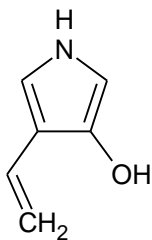
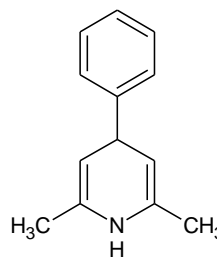
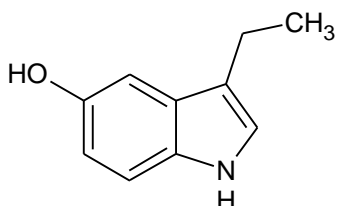
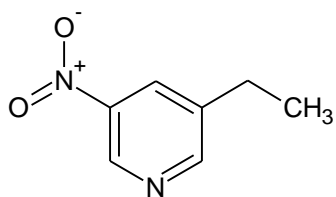


III. Draw the structures of the following compounds.

- 2-ethyl-5-methylhex-1-ene
- 4-(methylethyl)hex-1-en-5-yne
- 3-(cycloprop-1-en-1-yl)butan-2-one
- 2-ethylpentanal
- 4-fluorocyclohex-1-ene
- 1-fluoro-3-methylcyclohexane
- 1-ethyl-3-fluorocyclohexane
- 5-ethyl-4-(1-methylethyl)-1-en-7-yne
- 1-bromo-3-methoxycyclohexane
- 1-etoxy-3-fluorocyclohexane
- methyl 2-(2-chlorocycloprop-1-yl)propanoate.
- 4-oxohexanoic acid
- 4-(dimethylamino)pentanal
- 2-cyclobutyl-N-methylethanamide
- Cyclobutanecarboxamide
- 2-formylcyclobutane-1-carboxamide
- 2-(dimethylcarbamoyl)cyclobutane-1-carboxylic acid
- 3-nitrobenzaldehyde
- Cyclohex-3-en-1-ol
- 5-chloronaphthalen-2-ol

## Guide 2. Nomenclature of heterocyclic compounds

1. Write the name for the next compounds using Hantzsch nomenclature and IUPAC rules.

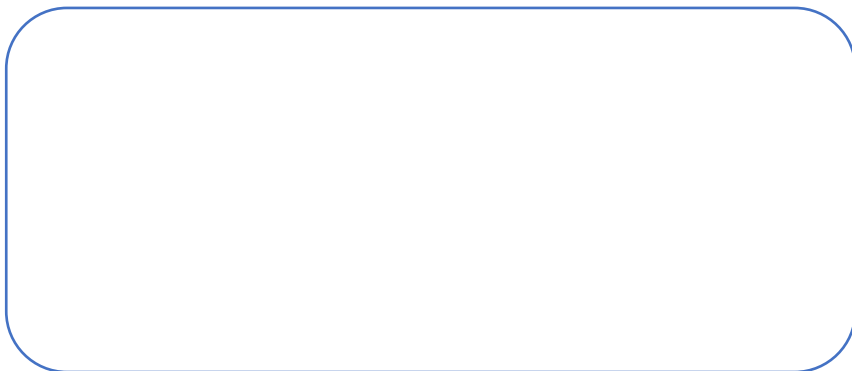


2. Draw the structures of the following compounds

- 3-ethyl-5-nitropyridine
- 3-ethyl-5-hydroxy-1H-indole
- 2,6-dimethyl-4-phenyl-1,4-dihydropyridine
- 4-ethenyl-3-hydroxy-1H-pyrrole
- 2-nitro-1H-imidazole-4-carbaldehyde
- 2-chloro-3-ethylpyrazine
- 3-(chloromethyl)-2-((cyclobut-2-en-1-yl)methyl)-5-methylfuran
- 5-methyl-8-nitroquinoline
- 5-amino-8-ethyl-1-methylisoquinoline

**Appendix D: Heterocycle recognition activity (Informative file)**

- Fill the file with one drug that contains a heterocycle previously showed in class.



- Commercial name:

---

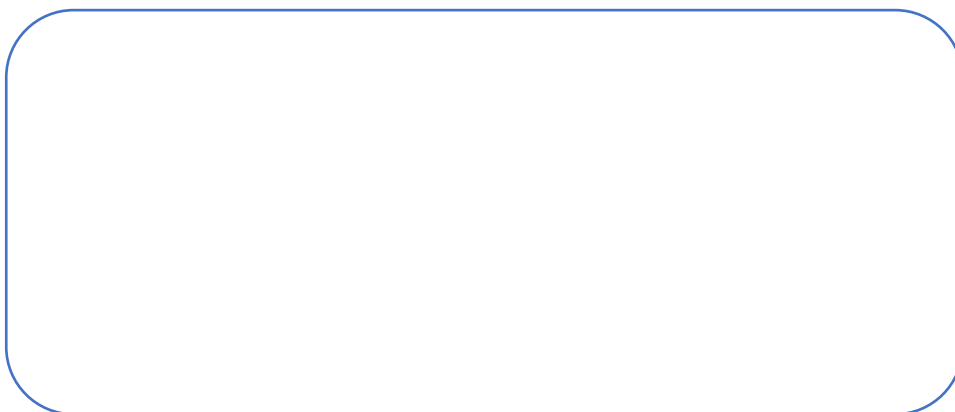
- IUPAC name:

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- Principal use:

---

- Draw and name the heterocycle on the selected drug.

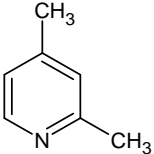
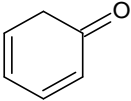
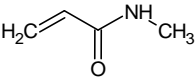


**Appendix E: Quiz 1**

Mini test in-group of three students, with 30 minutes to respond

Example

Names:

Exercise	Student's response	Feedback	Qualification
		2,3-dimethylpyridine	
		Cyclohex-2,4-dienone	
		N-methylpropenamide	

### Appendix F: Formative and Midterm Assessment 1 example

For formative and formal test, the same format and level of questions was used, but with different questions for each group students.

1. Check the alternative that corresponds to a carboxylic acid.

- a) R-CHO **b) R-COOH** c) R-OH d) R-COO-R'

2. Check the alternative that corresponds to an ester.

- a) R-CHO b) R-COOH c) R-OH **d) R-COO-R'**

3. Check the alternative that corresponds to an amide.

- a) R-NH<sub>2</sub> b) R-NH-R' **c) R-CONH<sub>2</sub>** d) R-COO-R'

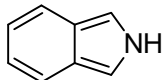
4. Check the alternative that corresponds to an alcohol

- a) R-OH** b) R-O-R' c) R-CO-R' d) R-COO-R'

5. Check the alternative that corresponds to an alcohol

- a) R-OH** b) R-O-R' c) R-CO-R' d) R-CHO

6. Check the alternative that corresponds to the figure.



- a) indole b) pyrrole c) pyrazole **d) isoindole**

7. Check the alternative that corresponds to the figure.



- a) pyrimidine b) pyridine c) pyrazole **d) pyrazine**

8. Check the alternative that corresponds to the figure.



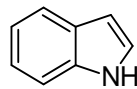
- a) pyridazine** b) pyrimidine c) pyridine d) pyrazole

9. Check the alternative that corresponds to the figure.



- a) pyrrole **b) furan** c) thiophene d) imidazole

10. Check the alternative that corresponds to the figure.



- a) indole** b) isoindole c) pyrrole d) furan

11. Check the alternative that corresponds to the figure.



- a) pyridine** b) imidazole c) pyrimidine d) indole

12. Check the alternative that corresponds to the figure.



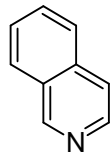
- a) pyridine b) imidazole c) pyrimidine **d) pyrrole**

13. Check the alternative that corresponds to the figure.



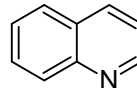
- a) pyridine b) imidazole **c) pyrazole** d) pyrimidine

14. Check the alternative that corresponds to the figure.



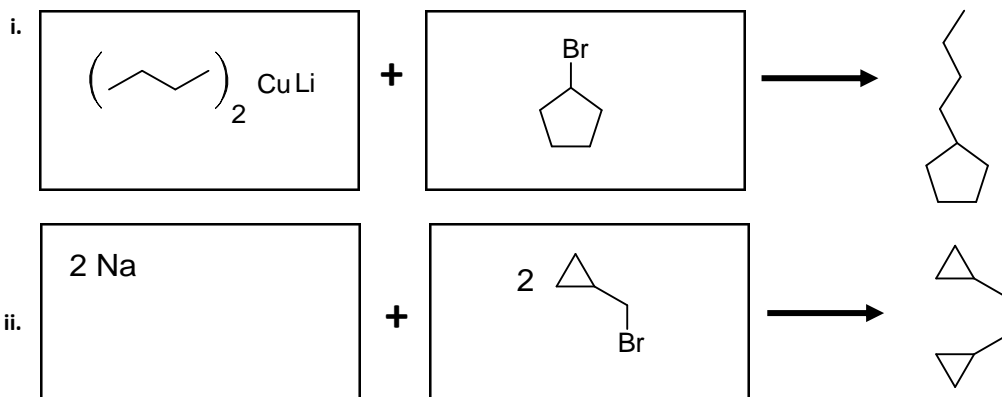
- a) quinoline **b) isoquinoline** c) pyrazine d) pyrazole

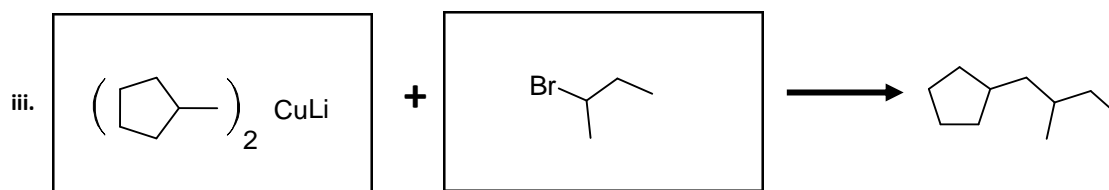
15. Check the alternative that corresponds to the figure.



- a) quinoline** b) pyrimidine c) pyrazine d) pyrazole

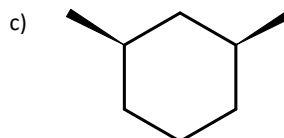
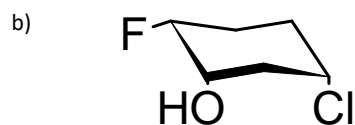
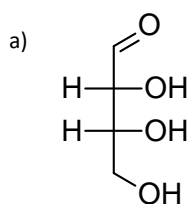
16. Fill in the boxes with the reactants of the reaction schemes for the formation of the following alkanes, using reagents with a maximum of 5 carbons.



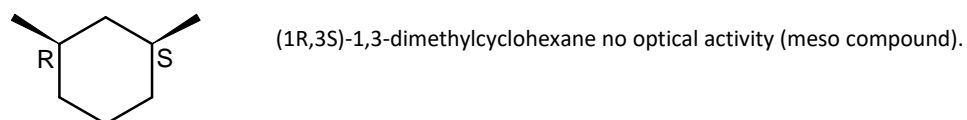
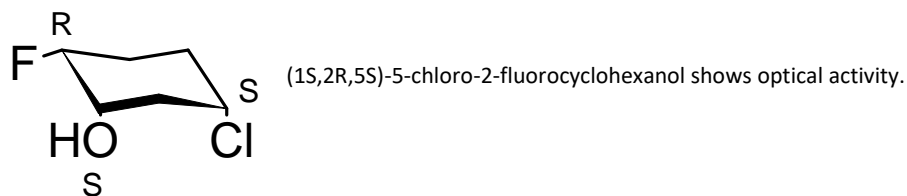
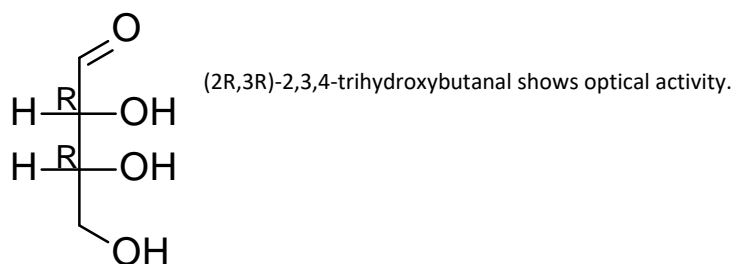


17. For the following compounds

- Assign the absolute settings for each stereogenic center.
- Indicate if the molecule will exhibit optical activity.
- Write the name according to IUPAC rules, indicating with R and S descriptors the stereogenic centers as appropriate.



Response.



**Appendix G: Student's satisfaction survey**

"Effects of online teaching on the achievement of learning outcomes in the Organic Chemistry course for students of the Chemistry and Pharmacy career at the Universidad Autónoma of Chile"

Dear students, to improve teaching practice, develop research in university teaching in online mode, and use new teaching methodologies, your collaboration is requested by answering the following questionnaire to evaluate the teaching methodologies used in the organic chemistry course.

I agree to participate voluntarily in the data collection process for the project mentioned above, carried out by the researchers: Dr. Claudio Barrientos Bastias and Dr. Silvana Moris López.

I agree to participate, and I agree to answer the questions that are asked of me in the most honest way possible, having full freedom to renounce this consent at any time, as well as order the discard of any unprocessed information that identifies me, the participation or not of this project will not affect your future grades. I authorise that the data obtained from this study be used for the purposes of systematising and publishing the result of the research.

I accept (Required)

1. Indicate what type (s) of device (s) you used for the online classes? (You can check more than one option)

- Cell phone       Computer  
 Tablet

2. Was the device (s) used shared with other people?

- Yes       No

3. Did you feel committed to the development of the course?

- 1 Totally disagree  
 2  
 3  
 4  
 5 totally agree

4. Do you find that the evaluation methodologies used by the professor prevented or reduced fraud in the Organic Chemistry course (Quiz 1 and midterm assessment 1)

- 1 Totally disagree  
 2  
 3  
 4  
 5 totally agree

5. Do you agree that the methodologies used by the teacher (puzzles, drug card, Kahoot, etc.) allowed him to achieve the learning outcomes stated for the course.

- 1 Totally disagree  
 2  
 3  
 4  
 5 totally agree

6. Do you consider that the activities carried out by the teacher for the first regular test were motivating.

- 1 Totally disagree  
 2  
 3  
 4  
 5 totally agree

7. Suggestions and comments regarding the development of the course in online mode.