MINISTRY OF HEALTH OF UKRAINE
BOGOMOLOLETS NATIONAL MEDICAL UNIVERSITY

HANDBOOK ON EDUCATIONAL PRACTICE IN PHARMACOGNOSY for auditory and independent students work Laboratory handbook

Discipline: Educational practice in Pharmacognosy
Direction: second (master's) level of higher education
Specialty: 226 "Pharmacy, industrial pharmacy"
Department: Pharmacognosy and botany

Name _____
Course _____
Group _____

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The diary is intended for recording the results of research on educational practice in pharmacognosy in accordance with the working curriculum and the calendar-thematic plan.

The publication envisages its use for studying the basic discipline - educational practice in pharmacognosy and the development of separate sections of professionally oriented disciplines with the aim of students acquiring knowledge about the procurement of medicinal plant raw materials, raw materials of animal origin, the necessary outlook on the rational use of natural plant resources, their protection and reproduction.

The diary is supplemented with topics for extracurricular study for the self-training of students

Introduction. Educational practice in pharmacognosy is an important stage of training pharmacists and an integral part of the educational process. The study program of the educational discipline "Educational practice in pharmacognosy" is compiled in accordance with the Standard of Higher Education of Ukraine of the second (master's) level of the field of knowledge 22 "Health care" specialty 226 "Pharmacy, industrial pharmacy" specialization 226.01 "Pharmacy", approved and implemented by order of the Ministry of Education and Science of Ukraine dated November 4, 2022 No. 981. According to the curriculum for the training of specialists of the educational and qualification level, it takes place in the 6th semester. Educational practice is based on the knowledge obtained in the course of pharmacognosy and is integrated with the courses of botany and resource science of medicinal plants; deepens the knowledge of pharmacognosy, gives practical skills of being in nature, harvesting, primary processing of medicinal plant raw materials, lays the foundations of rational nature management.

The educational process is organized according to the credit-module system in accordance with the requirements of the Bologna process. Educational practice in pharmacognosy is one of the profile disciplines in the professional training of a pharmacy specialist. It provides the future specialist with comprehensive knowledge of medicinal plants (MP), medicinal plant materials (MPM), contributes to the formation of the necessary outlook on the rational use of natural plant resources, their protection and reproduction. The increase in demand for herbal medicinals, homeopathic remedies and special food products, which include medicinal plant raw materials, leads to the expansion of pharmaceutical production, increased procurement of plant raw materials and increased requirements for its quality. Pharmacognostic training involves theoretical and practical training of a pharmacy specialist in the main types of professional activity in the field of medicinal products of herbal origin. For this, a pharmacy specialist must be able to identify the MP in nature, timely harvest and dry the MP, and bring it to a standard state.

Purpose: consolidation knowledge of pharmacognosy; acquisition of practical skills of identification of MP and morphologically similar species in nature; harvesting, storage and processing of MPM; basics of MP cultivation; identification of thickets of wild MP, studying of MPM reserves and providing recommendations on the rational use of natural resources; determination of authenticity and benignity of crushed MPM.

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Safety instructions during educational practice in pharmacognosy

During the educational practice in pharmacognosy, each student undergoes a briefing on safety techniques, signs in the journal on safety techniques about familiarization with the briefing; strictly adheres to all sanitary and hygienic requirements.

1. It is forbidden to taste unfamiliar plants, as there are poisonous ones among them.
2. It is not allowed to drink water from random sources.
3. After working with plants, you must wash your hands thoroughly.
4. Prepared medicinal plants from the list of poisonous and potent should be stored with labels in a room with limited access.
5. Observe all safety rules when working with sharp, cutting and stabbing tools (scissors, knives, shovels) and their transportation.
6. Be careful with fire in the experimental area.
7. Do not touch unfamiliar things; if suspicious objects are discovered, notify the teacher (Emergency Service, police).
8. It is strictly forbidden to touch, stop, rest next to poles and towers, be under power lines.
9. It is forbidden to go to the edge of precipitous slopes, to go out and move on landslide-hazardous areas and slopes.
10. It is forbidden to trample and damage lawns, green areas, practice base equipment, etc.
11. The student, who is in practice, is responsible for the implementation of safety rules, for himself and for his teammates.
12. Every student should be able to provide first aid if necessary. In case of illness or injuries, you should report them to the head of the practice or consult a doctor.
13. Taking into account the peculiarities of one's own body, existing chronic diseases and other deviations in the state of health, which in general do not constitute an obstacle to the completion of practice, each student must take care of his own first-aid kit of medical drugs, "usual" for use in case of a certain deterioration of the state of health I (headache, stomach disorders, etc.).
14. It is necessary to have light clothes that cover all parts of the body, a main outfit, and a supply of drinking water. During rain and thunderstorms, it is forbidden to work in the field or in an open area, to hide under trees, and to swim in water bodies. It is not allowed to lie down and sit on wet ground.
15. Each student must comply with the requirements of practice managers regarding discipline and safety rules. In the case of violations, the manager has the right to apply preventive measures up to suspension from practice and early return of the student to the educational institution without crediting the practice.

Student’s surname and signature _____

CONTENT

CLASS WORK

TOPIC 1: Acquaintance with the program, calendar, tasks and practice base. Excursion into nature. Morphological description and definition of medicinal plants of various phytocenoses. Acquaintance with the organization of procurement of MPM. Mastering the methods of harvesting, drying, bringing MPM to a standard state, packing and labeling of MPM

Task 1. Describe the herbarium sample of MP according to the given scheme:

Sample 1.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 2.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 3.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 4.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 5.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 6.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 7.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 8.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 9.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Sample 10.

A place for a herbarium sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Chemical composition of MPM:

Use in medicine and pharmacy:

Task 2. Describe the MPM sample according to the scheme:

Sample 1.

A place for MPM sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

Sample 2.

A place for MPM sample

MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

Sample 3.

A place for MPM sample

MP and MPM (Latin and English)

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Morphological characteristics of MP and MPM

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Place of growth (cultivation conditions)

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Harvesting, drying, storage conditions

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Possible admixtures

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Chemical composition of MPM:

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Application in medicine and pharmacy:

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Teacher's signature _____

TOPIC 2: Mastering the express method of phytochemical analysis. Commodity analysis of a sample of MPM prepared individually. Completion of the practice diary and MPM samples, issued according to the requirements of the QCM.

Task 1. Carry out histochemical and microchemical reactions to confirm the presence of different groups of BAS:

The name of the reagent	Conditions	The result of the reaction
Reaction on cellulose (fiber)		
with chlorine-zinc-iodine	Chlorine-zinc-iodine is applied to the cut of the root and the color is observed	
with iodine and sulfuric acid	Iodine with sulfuric acid is applied to the root section and the color is observed	
with an ammonia solution of copper oxide	An ammonia solution of copper oxide is applied to the cut of the root and the color is observed	
with Lugol's solution	Lugol's solution is applied to the root section and the color is observed	
Reaction on mucus		
with methylene blue solution	A section of the altea root is placed for a few minutes in a solution of methylene blue in alcohol (1:5000), then transferred to glycerin	
with copper sulfate and alkali	A section of the altea root is placed for 5-10 minutes in a saturated solution of copper sulfate, washed with water and transferred to a 50% solution of potassium hydroxide	
with mascara solution (1:10)	Flax seed powder is placed on a glass slide in a drop of freshly prepared carcass solution (1:10) and mixed with a needle, covered with a cover glass and observed under a microscope	
with 3-5% sodium hydroxide solution	Flaxseed powder is placed in 1-2 drops of 3-5% sodium hydroxide solution, covered with a cover glass and examined under a microscope.	
Reaction on inulin		
Molish's reaction	A cross-section of the root of a dandelion or elecampane is placed in 1-2 drops of an alcoholic solution of α-naphthol (or thymol) and a drop of concentrated sulfuric acid is added	
Reaction on starch		
with Lugol's solution	1-2 drops of Lugol's solution are applied to a section of the altea root, covered with a cover glass and observed under a microscope	
Reaction on lignified cell membranes		
with 1% alcohol solution of phloroglucin	A section of althea root is placed on a slide in a 1% alcohol solution of phloroglucin and a drop of concentrated hydrochloric acid is applied to the section and a drop of glycerin is added after 1-2 minutes; cover with a cover glass and study under a microscope	

Reaction on essential oil		
with a solution of Sudan III	A section of the root is placed for several minutes in a solution of Sudan III and a drop of water or glycerin is added. Cover with a cover glass and observe under a microscope	
Reaction on fatty oils		
with a solution of Sudan III	A slice of castor seed is placed for a few minutes in Sudan III solution and washed with 50% alcohol and glycerol is added, covered with a cover glass and observed under a microscope	
Reaction on anthracene derivatives		
with a 5% solution of sodium hydroxide or ammonium hydroxide	A slice of castor seed is placed for a few minutes in Sudan III solution and washed with 50% alcohol and glycerol is added, covered with a cover glass and observed under a microscope	
Reaction on tannins		
with 1% ferric chloride or 1% aqueous solution of iron-ammonium alums	A slice of oak bark is placed in a drop of a 1% solution of ferric chloride or a 1% solution of iron-ammonium alum, covered with a cover glass, and the staining of the drug is observed under a microscope.	

Task 2. Carry out chemical reactions to confirm the presence of different groups of BAS:

The name of the reagent	**Conditions**	**The result of the reaction**
CARBOHYDRATES. GLYCOSIDES		
Reactions on starch		
preparation of paste	Place 1 g of starch in a 100 ml flask and add 50 ml of water. The mixture is heated for 5 minutes constantly stirring	
with iodine solution	1 drop of Lugol's solution is added to 2 ml of cooled starch paste	
with Fehling's reagent	To 2 ml of starch paste, add 2 drops of an aqueous solution of CuSO4 (solution A) and 2 drops of an alkaline solution of ferric salt (solution B) and heat in a water bath	
Reactions on cellulose		
with iodine solution	A drop of iodine solution is added to the cellulose powder	
with iodine in a solution of zinc chloride and potassium iodide	Appropriate reagents are added to the cellulose powder	
Reaction on inulin		
with α-naphthol (Molish reaction)	A drop of α-naphthol and a drop of concentrated sulfuric acid are applied to a cross-section of the raw material (chicory root, dandelion, echinacea, amaranth)	

Reactions on mucus		
with a solution of alkali	2 drops of sodium hydroxide solution are applied to a cross section of the altea root	
with concentrated hydrochloric acid	1 ml of 10% infusion of althea root and 2 drops of concentrated hydrochloric acid are added to the test tube	
with a solution of lead acetate	Add 2 ml of a solution of lead acetate to 2 ml of a 10% infusion of althea root	
FATS AND FATTY SUBSTANCES		
Reaction on seed oils (Bellier reaction)		
with nitric acid and 0.15% resorcinol solution	2 ml of the tested oil is poured into the test tube, 1 ml of nitric acid and 0.15% solution of resorcinol in benzene are carefully layered. The contents are vigorously stirred	
Reaction on seed oils (Bieber reaction)		
with water and concentrated sulfuric and nitric acids	Place 2.5 ml of oil in a test tube, carefully add 1 ml of a cooled mixture of equal volumes of water and concentrated sulfuric and nitric acids	
Reaction on fish oil		
with chloroform	0.1 g of fat is dissolved in 1 ml of chloroform and 5 ml of a solution of stibium (III) chloride is added	
Reaction on lanolin		
with concentrated sulfuric acid	0.1 g of fat is dissolved in 5 ml of chloroform and carefully layered in a test tube with 5 ml of concentrated sulfuric acid	
TERPENOIDS. IRIDOIDS. BITTERS		
with Stahl's reagent	0.5 ml of Stahl's reagent is added to 1 ml of the extract, the mixture is heated in a water bath for 2 minutes.	
with Trim-Hill's reagent	0.5 ml of Trim-Hill's reagent is added to 1 ml of the extract, the mixture is heated in a water bath for 2 minutes.	
ESSENTIAL OILS		
Reactions on aldehydes and ketones		
obtaining oximes	3 drops of an alcoholic solution of hydroxylamine chloride (15 g of hydroxylamine chloride in 100 ml of 80% alcohol) and a few drops of methylene orange are added to 2 drops of essential oil	
nitroprusside reaction	5-10 drops of essential oil are mixed with the same number of drops of sodium nitroprusside solution and 3 drops of 5% alkali solution	
Reactions on phenols		
reaction with iron III chloride	3-4 drops of iron III chloride solution are added to 1 ml of concentrated alcohol solution of essential oil	
reaction of the formation of azo dyes	3-4 ml of 25% sodium hydroxide solution and 1-2 drops of diazotized sulfanilic acid are added to 1 ml of essential oil	

Reactions on azulenogens		
Ehrlich-Muller reaction	5 drops of essential oil are mixed in a test tube with 1 ml of reagent and heated in a water bath	
Sabetay's reaction	Dissolve 5-10 drops of essential oil in 1-2 ml of chloroform and add 0.1-1 ml of a 5% solution of bromine in chloroform drop by drop.	
TRITERPENOIDS. STEROIDS. SAPONINS		
foaming test	2-3 ml of the aqueous extract of the raw material is vigorously shaken for 1 minute.	
Precipitation Reactions		
with barite water	3-4 drops of barite water are added to 1 ml of aqueous extract in a test tube	
with lead acetate	3-4 drops of 10% lead acetate solution are added to 1 ml of aqueous extract in a test tube	
with cholesterol solution	1 ml of 1% alcohol solution of cholesterol is added to 1 ml of alcohol-water extract in a test tube	
Color reactions		
the Lafon reaction	1 drop of a 10% solution of copper sulfate, 1 ml of concentrated sulfuric acid is added to 2 ml of the alcohol-water extract in a test tube and heated carefully	
Salkovsky's reaction	1 ml of chloroform and 5-6 drops of concentrated sulfuric acid are added to 2 ml of the alcohol-water extract in a test tube	
reaction with a solution of stibium (V) chloride	0.5 ml of a saturated solution of stibium (V) chloride in chloroform is added to 1 ml of the alcohol-water extract in a test tube	
Vanillin-sulfuric acid assay	1 ml of 0.5% alcohol solution of vanillin, 3-4 drops of concentrated sulfuric acid are added to 2 ml of alcohol-water extract in a test tube and heated in a water bath at a temperature of 60 °C.	
Determination on the chemical nature of saponins		
foaming reaction	Take 2 measuring tubes of the same diameter with ground stoppers. 5 ml of 0.1 M hydrochloric acid is poured into one of them, and 5 ml of 0.1 M sodium hydroxide solution is poured into the other. Add 0.5 ml of aqueous extract to both test tubes and shake both test tubes with the same intensity for 1 min.	
CARDIOGLYCOSIDES		
Reactions on the steroid part of cardioglycosides		
Lieberman-Burchard reaction	The dry residue is dissolved in 1 ml of acetic anhydride, transferred to a dry test tube, and 2 drops of concentrated sulfuric acid are carefully added along the wall	

Rosenheim reaction	1 ml of trichloroacetic acid in ethanol is added to 1 ml of chloroform extract	
Reactions on the lactone ring		
the Kedde reaction	The dry residue is dissolved in 2 ml of a 3% solution of 3,5-dinitrobenzoic acid and 1 ml of a 1M sodium hydroxide solution is added	
Raymond's reaction	The dry residue is dissolved in 1 ml of a 3% solution of m-dinitrobenzene in benzene and 2 drops of an alcoholic solution of potassium hydroxide are added	
Legal's reaction	The dry residue is dissolved in 1 ml of 5% sodium nitroprusside solution and 2 drops of 10% sodium hydroxide solution are added	
Reactions on the carbohydrate part of the molecule		
the Keller-Kiliani reaction	The dry residue is dissolved in 1 ml of acetic acid with traces of ferric sulfate (III), and 1 ml of concentrated sulfuric acid is poured over the walls of the test tube. Do not shake the contents of the test tube!	
with Fehling's reagent	0.5 ml of a 1% solution of hydrochloric acid is added to 2 ml of the obtained extract and heated on a water heater for 1 hour. After that, a few drops of a 10% solution of sodium hydrogen chloride are added to the test tube, and then 1 ml of Fehling's reagent and heated in a boiling water bath	
PHENOLIC COMPOUNDS		
Reactions on arbutin		
with iron (II) sulfate	A few crystals of iron (II) sulfate are added to 1 ml of extract	
with sodium phosphoric molybdenum solution	4 ml of ammonia solution and 1 ml of a 10% solution of sodium phosphoric-molybdic acid in hydrochloric acid are added to 1 ml of the extract	
Reaction on salidroside		
with 10% lead acetate solution	2-3 drops of a 10% solution of lead acetate are added to 1 ml of aqueous infusion of raw materials, the precipitate is filtered, 2 drops of a 1% alcoholic solution of 1-nitroso-2-naphthol and 3 drops of concentrated nitric acid are added to the filtrate	
COUMARINS AND CHROMONES		
lactone test	1 ml of alkalized extract is diluted with four times the amount of water, the mixture is neutralized with a 20% solution of sulfuric acid.	
azo dye formation reaction	3-5 drops of freshly prepared solution of diazotized sulfanilic acid are added to 1 ml of alkalized extract	

reaction with potassium hydroxide (on chromones)	Add 15 ml of purified water to 1.0 g of crushed raw material and boil in a water bath for 15 minutes. The resulting extract is filtered through cotton wool into a porcelain cup and evaporated. A crystal of potassium hydroxide is added to the dry residue	
FLAVONOIDS		
cyanidine reaction	2-3 drops of concentrated hydrochloric acid and 1-2 shavings of magnesium metal are added to 1 ml of the extract	
with alkali	1-2 drops of 10% alcohol-water solution of potassium or sodium hydroxide are added to 1 ml of the extract	
with iron (III) chloride	2-3 drops of 10% iron (III) chloride solution are added to 1 ml of extract	
with lead acetate	3-5 drops of a 10% solution of basic lead acetate are added to 1 ml of the extract	
QUINONES		
Borntraeger reaction	Place 1.0 g of crushed raw material in a flask, pour 10 ml of 10% alcoholic NaOH solution, boil for several minutes and filter. After cooling, the filtrate is acidified with 10% HCl to a slightly acidic reaction (according to the universal indicator), transferred to a separatory funnel and extracted with 10 ml of chloroform. After settling, the chloroform layer turns yellow (anthraquinone derivatives). 5 ml of chloroform extract is shaken in a test tube with 5 ml of 5% alcohol solution of NH4OH. Note the color of the ammonia layer.	
TANNINS		
with gelatin solution	A 1% gelatin solution is added dropwise to 2 ml of the extract under study, avoiding its excess	
with alkaloid solution	1% alkaloid solution (quinine hydrochloride, cytisine) is added drop by drop to 2 ml of the tested extract	
with iron-ammonium alums	4-5 drops of iron-ammonium alum solution are added to 2 ml of the tested hood	
with lead acetate solution	4 ml of a 10% solution of acetic acid and 2 ml of a 10% solution of lead acetate are added to 2 ml of the tested hood. The precipitate formed is filtered. Add a few drops of 1% iron-ammonium alum solution to the filtrate	
with bromine water	***The reaction is carried out under a hood!*** A 2% solution of bromine water is added dropwise to 5 ml of the tested extract until the smell of bromine appears.	
ALKALOIDS		
General-precipitation reactions		

with the Wagner-Bouschard reagent	a solution of iodine in a solution of potassium iodide	
with Mayer's reagent	a mixture of solutions of mercury dichloride and potassium iodide	
with Dragendorff's reagent	a solution of basic bismuth nitrate, potassium iodide and acetic acid	
with Bertrand's reagent	1% aqueous solution of silicon-tungstenic acid	
with Sonnenstein's reagent	1% aqueous solution of phosphoric-molybdic acid	
with picric acid	1% aqueous solution of picric acid	
with tannins	0.1% aqueous solution of tannin	

Task 3. Carry out MPM acceptance and sampling for batch analysis, determine the identity, purity and quality of the researched MPM batch that has arrived for analysis.

CERTIFICATE OF ANALYSIS

_____

(MPM name (eng., lat.)

Series (batch) number_____ Provider _____

Date of receipt _____

Quantity (kg, units, etc.) in series (batch)_____

The mass of the gross batch _____, net batch _____, packing _____

Упаковка _____

Sampling volume _____

Results of external review _____

_____

The average sample is selected by SPhU mass _____.

Analytical samples are selected from the average sample:

1) mass _____ to establish the identity, the degree of grinding and the content of impurities,
2) mass _____ to determine the loss on drying,
3) mass _____ to determine the content of ash and active substances.

Date of sampling _____ I took the sample _____
(Name)

The analysis of the analytical sample for identity, the degree of grinding and the content of impurities was carried out in accordance with the SPhU according to_____
(QCM name and №)

Macroscopic characteristics of MPM

_____
_____
_____
_____

_____

_____

Microscopic characteristics of MPM

_____

_____

_____

_____

_____

№ п/п	Indicators that are analyzed	Indicators according to regulatory documentation	Actual indicators
1	Loss on drying	%	%
2	Active substances, or the content of extractive substances	%	%
3	Total ash	%	%
4	Ash, insoluble in 10% HCl	%	%
5	Determination of crushed particles	%	%
6	Determination of extraneous impurities	%	%
7	Organic impurities	%	%
8	Mineral impurities	%	%
9	Determination of the degree of contamination of MPM by collared pests	%	%

The analysis is done _____ _____
(date, position, surname, initials) (signature)

Conclusions of the OKC _____

Head of OKK _____ _____ _____
(signature) (decryption of the signature) (date)

Group leader of
input control _____ _____ _____
(signature) (decryption of the signature) (date)

Note. In case of non-compliance of the raw material with the requirements of the QCM, give recommendations on bringing it to a standard state and indicate the possibility of using the raw material.

Teacher's signature _____

TOPIC 3: Introduction of medicinal plants. Care of cultivated medicinal plants. Acquaintance with the main cultivated medicinal plants and methods of their cultivation. Acquaintance with the wild flora of various phytocenoses. Geobotanical description of phytocenoses.

Task 1. Describe, according to the given scheme, MP, which are introduced and cultivated on the territory of Ukraine.

Sample 1.
MP and MPM (Latin and English)

_____
_____
_____
_____

Morphological characteristics of MP and MPM

_____
_____
_____
_____
_____

Place of growth (cultivation conditions)

_____

Harvesting, drying, storage conditions

_____
_____

Possible admixtures

_____
_____

Chemical composition of MPM:

_____
_____
_____
_____

Application in medicine and pharmacy:

_____
_____
_____
_____
_____
_____
_____

Sample 2.
MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

Sample 3.
MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

Sample 4.
MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

Sample 5.
MP and MPM (Latin and English)

Morphological characteristics of MP and MPM

Place of growth (cultivation conditions)

Harvesting, drying, storage conditions

Possible admixtures

Chemical composition of MPM:

Application in medicine and pharmacy:

_____
_____
_____
_____
_____
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_____

Teacher's signature _____

TOPIC 4: Getting to know the basics of studying stocks of wild medicinal plants for the purpose of rational use of natural resources of the Republic of Belarus and their protection. Determination of LRS productivity in the diary.

Task 1. Determine the biological, exploitative reserve of the raw matrerials and the amount of acceptable annual usage of the herb of the specified medicinal plant on the massif. The yield of dry raw materials for the selected type of MP, see appendix 1. The duty period, see appendix 2.

Density of the reserve of raw materials:

_____

_____

Biological reserve of the raw:

_____

_____

Exploitative reserve of the raw:

_____

_____

The amount acceptable annual usage:

_____

_____

Task 2. Determine the biological, exploitative reserve of the raw matrerials and the amount of acceptable annual usage of the herb of the specified medicinal plant on the massif. The yield of dry raw materials for the selected type of MP, see appendix 1. The duty period, see appendix 2.

Density of the reserve of raw materials:

_____

_____

Biological reserve of the raw:

_____

_____

Exploitative reserve of the raw:

_____

_____

The amount acceptable annual usage:

_____

_____

Teacher's signature _____

TOPIC 5: Acceptance of packaged products and sampling methods for analysis. Determining the authenticity and quality of crushed medicinal plant raw materials "leaves", "herbs", "rhizomes and roots" and "bark", "fruits", "seeds", "flowers". Drawing up a practice diary.

Task 1. Do a macroscopic analysis of MPM of different morphological groups (leaves, flowers, herbs, fruits, seeds, bark, roots, rhizomes) using Appendix 1 as a reference. Compare the established morphological signs of the observed MPM with descriptions in the pharmacopoeia monographs SPhU and make a conclusion based on identifying and analyzing the features.

Sample 1. For this analysis you have this MPM: leaves
Macroscopic analysis of MPM:

general appearance	
shape of leaf	
division of the blade	
attachment of leaf to stem; presence of petiole	
leaf base	
leaf apex	
leaf edge	
type of venation	
leaf pubescence	
size of a leaf blade and petiole	
colour of upper and of lower side of leaf blade	
odour	
taste	

Determination of the identity of this MPM:
_____
_____

Conclusion:_____
_____

	Latin name	**English name**
MPM		
MP		
Family		

Sample 2. For this analysis you have this MPM: flowers

Macroscopic analysis of MPM:

general appearance	
type of inflorescence	
pedicel, cm	
bract, cm	
shape and size of the receptacle	
type of perianth	
symmetry	
shape and colour of calyx	
shape and colour of corolla	
dimensions	
odour	
taste	

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

_____

	Latin name	**English name**
MPM		
MP		
Family		

Sample 3. For this analysis you have this MPM: fruits

Macroscopic analysis of MPM:

general appearance	
type of fruit	
shape	
type of surface	
number, shape, and size of seeds	
dimensions	
colour	
odour	
taste	

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

	Latin name	English name
MPM		
MP		
Family		

Sample 4. For this analysis you have this MPM: seeds
Macroscopic analysis of MPM:

general appearance	
shape	
type of surface	
colour	
dimensions	
odour	
taste	

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

_____

	Latin name	English name
MPM		
MP		
Family		

Sample 5. For this analysis you have this MPM: underground organs
Macroscopic analysis of MPM:

general appearance	
type of underground organs	
shape	
characteristics of surface	
characteristic of fracture	
dimensions	
colour of external surface	

colour of fracture surface	
odour	
taste	

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

_____

	Latin name	English name
MPM		
MP		
Family		

Sample 6. For this analysis you have this MPM: herb

Macroscopic analysis of MPM:

general appearance	
form of stem in cross section	
size of stem	
colour of stem	
shape of leaf	
attachment of leaf to stem, presence of petiole	
leaf base	
leaf apex	
leaf edge	
type of venation	
leaf pubescence	
size of leaf blade and petiole	
color of upper and of lower side of leaf blade	
location of flowers on stem, type of inflorescence	
pedicel, cm	
bract, cm	
shape and size of receptacle	
type of perianth	
symmetry	
shape and colour of calyx	
shape and colour of corolla	
dimensions	
flower pubescence	
odour	
taste	

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

	Latin name	English name
MPM		
MP		
Family		

Task 2. Carry out a microscopic analysis of MPM (leaves, flowers, grass, fruits, seeds, bark, roots, rhizomes). Compare the established anatomical features of the MPM under study with the description in the pharmacopoeial article of the SPhU and draw a conclusion regarding the appropriateness of the name under which it was submitted for analysis. Draw, label and describe the established microscopic features.

Method of manufacturing micropreparations: dry raw materials are softened and clarified by boiling in a 5% NaOH solution. When studying the anatomical features of the leaves, surface micropreparations are prepared separately from the upper and lower epidermis. When studying the anatomical features of the bark, roots and rhizomes, cross-sections of softened raw materials are prepared. A fragment of raw material is additionally illuminated on a slide by heating it in a solution of chloral hydrate. Temporary preparations are examined under a light microscope at low and high magnifications.

Sample 1. For this analysis you have this MPM: leaves
Microscopic analysis of MPM:

Upper epidermis	1. Cells of upper epidermis_____ _____ 2. Cells of lower epidermis _____ _____ 3. Type of stomatal complex _____ 4. Simple trichomes_____ _____

Lower epidermis	5. Glandular hairs_____ 6. Glandules_____ 7. Inclusions: type_____ _____ shape_____ _____ 8. Secretory structures_____

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

	Latin name	**English name**
MPM		
MP		
Family		

Sample 2. For this analysis you have this MPM: herb

Microscopic analysis of MPM:

Upper epidermis	1. Cells of upper epidermis_____ _____ 2. Cells of lower epidermis _____ _____ 3. Type of stomatal complex _____ 4. Simple trichomes_____ _____
Lower epidermis	5. Glandular hairs_____ 6. Glandules_____ 7. Inclusions: type_____ _____ shape_____ _____ 8. Secretory structures_____

Determination of the identity of this MPM:

_____

_____

Conclusion:_____

	Latin name	English name
MPM		
MP		
Family		

Sample 4. For this analysis you have this MPM: bark
Microscopic analysis of MPM:

Fragment of a cross-section of a cortex	1.Cork: colour_____ number of layers _____ 2. Characteristics of parenchyma form of cells _____ _____ 3. Medullary rays _____ 4. Mechanical elements: type:_____ arrangement: _____ _____ 5. Crystalline inclusions:_____

Determination of the identity of this MPM:

_____

_____

Conclusion: _____

	Latin name	English name
MPM		
MP		
Family		

Sample 4. For this analysis you have this MPM: roots or rhizome
Microscopic analysis of MPM:

A fragment of a cross-section of a root or a rhizome	1. Covering tissue_____ 2. Vascular tissues_____ 3. Medullary rays _____ 4. Main parenchyma _____ 5. Secretory structures_____ 6. Crystalline inclusions _____ 7. Stored substances_____

Determination of the identity of this MPM:

_____

Conclusion: _____

	Latin name	English name
MPM		
MP		
Family		

Teacher's signature _____

INDEPENDENT STUDETS WORK

Topic 1: Determination in nature by the determinant of medicinal plants and impurities familiar from the course of pharmacognosy and unknown.

Informational reference:

Impurities enter MPM during its harvesting, drying, processing and storage. They are divided into organic and mineral, acceptable and unacceptable. Acceptable organics include:

• parts of raw materials that have lost the color characteristic of this type of raw material (browned, blackened, faded, etc.). On average, 1–5% of such impurities are allowed;

• these are parts of medicinal plants that are not raw materials and do not correspond to the established description of raw materials. In general, from 2 to 5% of impurities are allowed;

• these are parts of other non-poisonous plants that could get into the raw materials during harvesting, drying and storage (twigs, hay, straw). Their content should not exceed 1–5%.

Inadmissible organic impurities include excrement of rodents and birds and poisonous plants. In the presence of impurities in the form of poisonous plants, the batch of raw materials is missing and not subject to analysis.

Mineral impurities most often get into plant raw materials during harvesting and processing (sand, earth, pebbles, dust). For different types of raw materials, their content can vary from 0.5 to 2%.

Inadmissible mineral impurities include metal items (wire, nails and glass).

Since MPM is stored by groups (bark, roots and rhizomes, fruits, etc.), some similar types of raw materials belonging to the same group can be a mutual admixture. For some types of raw materials, plants that can be mistakenly harvested instead of the derived plant are listed in the QCM, instructions and guides for their harvesting. This is due to their common places of growth, the proximity of morphological features of plants of the same family, the peculiarities of popular and scientific names of plants.

After determining the pulverization in the sieve and the residue on the sieve, impurities are selected. Every type of impurity. weighed separately with an error of ±0.1 g when the mass of the analytical sample is more than 100.0 g and with an error of +0.05 g when the mass of the analytical sample is up to 100.0 g. The content of each type of impurity is determined as a percentage.

Task on the topic: Determination of impurities in official MP

Latin name of the plant:

_____

Ukrainian name of the plant:

_____

Family name (Latin and Ukrainian):

_____

_____

An admixture to MPM (Latin and Ukrainian):

_____

_____

_____

Place of plant growth: _____

Morphological features of MPM	Morphological features of the admixture

Topic 2: Carrying out an express analysis of the chemical composition of BAS in various types of MPM.

Informational reference:

Any plant contains hundreds and thousands of substances of primary synthesis (proteins, carbohydrates, vitamins, lipids, enzymes, etc.) and BARs of secondary biosynthesis (phenolic compounds: coumarins, furocoumarins, chromones, xanthones, anthracene derivatives, flavonoids, lignans, tannins; terpenoids : components of essential oils, iridoids, cardiosteroids, sapogenins, steroids; cyanogenic and thioglycasides, alkaloids, etc.).

Medicinal plants supply MPM, as well as drugs and raw products that are naturally or forcibly secreted by plants: latex (opium, rubber), juices, waxes, gums (gum arabic, tragacanth), essential oils, resins, balsams (resin), gum-resins (asafetida); products of primary MPM processing (e.g. menthol and anethole from the corresponding essential oils, fatty oils and such solid vegetable fats as cocoa butter, coconut fat); individual BAS (cardiac glycosides, cyanogenic glycosides and thioglycosides, saponins, coumarins and furocoumarins, flavonoids, alkaloids, vitamins, etc.), galenic and new galenic preparations. Depending on the chemical composition and dominance of certain groups of substances, medicinal plants and MPM are divided into groups that contain a significant amount of certain

pharmacologically active compounds (carbohydrates, lipids, glycosides, phenolic compounds, essential oils, cardiosteroids, alkaloids, vitamins, etc.).

Tasks on the topic:

Task on the topic: Describe histochemical reactions for the determination of biologically active substances in medicinal plant raw materials:

1. Reaction to mucus on a cross section of the altea root:
   - with methylene blue solution.

Methodology: The section is placed for several minutes in a solution of methylene blue in alcohol (1:5000), then transferred to glycerin.

Result: the mucus turns _____color.

   - with copper sulfate and alkali.

Methodology: The section is placed for 5-10 minutes in a saturated solution of copper sulfate, washed with water and transferred to a 50% solution of potassium hydroxide

Result: the mucus turns _____color

2. Describe the histochemical reaction to the essential oil on a cross-section of the rhizome of the plantain:

Technique: the section is placed for a few minutes in a solution of sudan III, and then in glycerin.

Result: The essential oil turns _____color.

3. Describe the histochemical reaction to anthracene derivatives on the inner side of the alder buckthorn bark.

Methodology: the bark is placed on a glass slide in a drop of 5% sodium hydroxide or ammonium hydroxide solution, a drop of glycerin is added, covered with a cover glass and observed under a microscope

Result: _____ staining of tissues in which anthracene derivatives are localized.

4. Describe the histochemical reaction to tannins on the inner side of the bark of common oak.

Methodology: the bark is placed in a drop of ferric chloride or a 1% aqueous solution of ferric ammonium alum, covered with a cover glass and the color of the drug is observed under a microscope.

Result: fabrics containing tannins are dyed in _____ color.

5. Describe the histochemical reaction to starch.

Methodology: Lugol's solution is applied to a section of flax seeds, covered with a cover glass and observed under a microscope.

Result: Starch grains acquire _____color.

6. Describe the histochemical reaction to fiber.

Methodology: a section of a dandelion root is placed on a glass slide, a solution of phloroglucin in alcohol is added, a drop of concentrated hydrochloric acid is applied, and a drop of glycerin is added after 1-2 minutes; cover with a cover glass and study under a microscope at low magnification.

Result: Cell membranes acquire _____color.

Topic 3: Laying out herbarium samples of MPM and MP according to an individual task.

Informational reference:

Rules for collecting plants for the herbarium

1. Herbarium should be collected during flowering and fruiting of plants.
2. Along with the above-ground part, each herbized plant must also have an underground part (except for trees and bushes).
3. Harvesting of plants should be carried out in clear weather, after the dew has subsided. Collected after rain or in the morning (with dew), they do not dry well or turn black during drying.
4. In excavated specimens, the underground part should be well cleaned from the ground.
5. Plants for the herbarium are taken typical in size for this species: small ones should be taken in the amount of 3-5, large ones should be folded once or twice when placed in drying paper. In cases where the plant is very large and it is impractical to bend it, only characteristic parts are taken - segments of shoots with leaves (upper, middle and lower parts), flowering shoots with inflorescences, flowers, etc.
6. In order to identify some plants, it is necessary to have, in addition to flowers, fruits (for example, plants from the sedge, aster, bean, celery families, etc.).
7. Collected plants are placed in a folder with drying paper in a fresh, unshriveled state, while they must be carefully straightened and put on a working label, which indicates the place of collection, growing conditions, date, and the name of the collector. The overlapping parts are folded with strips of drying (filter) paper.
8. Before drying, specimens with thick underground parts, as well as juicy parts, are cut and dried only in halves, in some cases fleshy, juicy organs (or the plant as a whole) should first be immersed for a short time in boiling water, this speeds up drying them and ensures the preservation of the natural color.
9. The color of flowers is better preserved when laying parts of the perianth with pieces of cotton wool or filter paper.
10. So that the plants do not shrivel during drying, they are stacked up to 20–30 pieces in a bundle, and the bundles, in turn, are pressed with metal or wooden nets (herbar presses).

Task on the topic: Describe the rules of registration of the herbarium of the MP appointed by the teacher

_____

_____

_____

Topic 4: Selection of MPM drying mode, setting for drying and process control.

Informational reference: The collected raw materials contain 70-90% moisture, and dry - 10-15%. Several methods of MPM drying are used. Without artificial heating: air-shade, outdoors, in the shade, under a tent, in attics. Air-shade drying is used for leaves, grass and flowers. Air dryers are equipped with racks with frames on which a liquid canvas or metal mesh is stretched. Drying in air dryers, drying racks and in the attic is slower, but ensures better quality of raw materials. With artificial heating: dryers are heated by water, steam or heating gas. Mandatory ventilation to remove moisture. Raw materials containing essential oils should be dried at a temperature of 30–35 °C with a layer of 10–15 cm to prevent the evaporation of essential oil (peppermint leaves, sage, rhizomes with valerian roots, chamomile inflorescences, etc.). Raw materials containing glycosides are dried quickly at a temperature of 50–60 °C to prevent enzymatic hydrolysis. Raw materials containing ascorbic acid are dried at a temperature of 80–90 °C (rosehip fruits). Weight loss during drying is: buds - 65-70%, flowers - 70-80%, leaves - 55-90%, grass - 65-90%, roots, rhizomes - 60-80%, bark - 50-70 %, fruits — 30–60%, seeds — 20–40%. Drying is considered complete if the roots, rhizomes, bark, stems break from bending, leaves and flowers are ground into powder, fruits do not stick together in a lump and fall apart when pressed.

Tasks on the topic: describe the features of MPM drying indicated by the teacher.

Topic 5: Designing a practice diary with microherbar samples. Preparation for a practical class on standardization of packaged raw materials.

Informational reference: The main document for recording the student's work, the possession of skills and practical skills and the implementation of the thematic practice plan is a diary, in which the student must clearly record and describe all types of work performed provided by the educational practice program in pharmacognosy. The diary is checked and signed by the head of practice
every day and is a reporting document on the completion of practice. The prepared and signed diary is handed over to the teacher-head of practice on the last day of practice.
Tasks on the topic: fill in and submit the diary according to the approved algorithm and regulatory methodological documentation.

Student _____
_____
Head of practice _____
_____
Date_____

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4. **https://www.myphysicslab.com/**

APPENDIX 1

Table 1. Yield of dry medicinal raw materials from freshly collected ones, terms of its storage and harvesting

	Plant species	Type of raw material	Yield of dry raw materials, %	Maximum storage period, years	Months of raw material collection
1	**2**	3	4	5	6
1.	*Acorus calamus L.*	rhizomes	30	3	9-10
2.	*Althaea officinalis L.*	roots	22	3	4-5, 8-11
3.	*Ledum palustre L.*	herb (shoots)	32-36	2	6-9
4.	*Vinca minor L.*	herb	50	2	5-6
5.	*Atropa bella-donna L.*	leaves, herb, roots	14-16	2	6-8
6.	*Betula*	buds	40	2	1-3
7.	*Menyanthes trifoliata*	leaves	17	2	6-7
8.	*Vaccinium vitis-idaea L.*	- » -	45	3	3-7
9.	*Sambucus nigra L.*	flowers	18-20	3	5-6
		fruits	15	2	7-8
10.	*Melilotus officinalis* (L.) Rall.	herb	25	2	6-8
11.	*Valeriana*	rhizomes and roots	25	3	4-5, 8-10
12.	*Alnus*	fruits (cones)	38-40	3	8-9
13.	*Ononis arvensis L.*	roots	30-32	3	9-10
14.	Centaurea cyanus L.	flowers	20	1	6-8
15.	Crataegus	flowers	18-20	1	5-6
		fruits	25	2	9-10
16.	Polygonum hydropiper L=Persicaria hydropiper (L.) Delab.	herb	20-22	2	6-8
17.	Polygonum bistorta L.=Bistorta officinalis Delabre	rhizomes	25	6	8-9
18.	Polygonum persicaria L.=Persicaria maculosa S.F.Gray	herb	20-22	2	6-8
19.	Polygonum aviculare L.	herb	20	3	6-8
20.	Nuphar lutea (L.) Smith	rhizomes	8-10	2	7-8

21.	Sorbus aucuparia L.	fruits	-	2	9-12
22.	Capsella bursa-pastoris (L.) Medik	herb	26-28	3	5-8
23.	Achillea	herb, flowers	22	2	6-8
24.	Verbascum	flowers	16-18	1	7-8
25.	Quercus robur L.	bark	40	5	4-5
26.	Angelica sylvestris L.	rhizomes and roots	20	2	9-10
27.	Datura stramonium L.	leaves	16-18	2	6-8
28.	Rhamnus cathartica L.	fruits	17	4	8-10
29.	Hypericum perforatum L.	herb	30	3	6-7
30.	Centaurium erythraea Rafn	herb	25	2	6-8
31.	Viburnum opulus L.	bark	40	4	3-5
32.	Convallaria majalis L.	herb, leaves	20	1	5-6
		flowers	14	1	5
33.	Urtica dioica L.	leaves	22	2	6-8
34.	Frangula alnus Mill.	bark	40	5	4-5
35.	Taraxacum officinale Webb ex Wigg	roots	33-35	5	9-10
36.	Zea majus L.	stamens	25	3	6-9
37.	Tilia cordata Mill.	flowers	25	2	6-7
38.	Arctium lappa L.	roots	26-28	-	3-4, 9-10
39.	Origanum vulgare L.	herb	25	1	6-8
40.	Rubus idaeus L.	fruits	16-18	2	6-7
41.	Tussilago farfara L.	leaves	15	2	5-7
		inflorescences	15	1	3-4
42.	Saponaria officinalis L.	rhizomes	30-32	-	6-8
43.	Arctostaphylos uva-ursi (L.) Spreng.	leaves	50	5	5,6,9,10
44.	Digitalis grandiflora Mill.	leaves	19-20	1	6-8

45.	Inula helenium L.	rhizomes and roots	30	2	8-9
46.	Viscum album L.	shoots	Fresh MPM	1	7-12
47.	Herniaria glabra L.	herb	22-25	2	5-8
48.	Primula veris L.	rhizomes and roots	28-30	2	8-9
		leaves	22-23	2	4-5
49.	Potentilla erecta (L.) Rausch	rhizomes	28-32	6	4-5, 9-10
50.	Tanacetum vulgare L.	inflorescences	25	3	8-9
51.	Lycopodium clavatum L.	spores	6-7	10	5-9
52.	Plantago major L.	leaves	25-30	2	5-9
53.	Artemisia absinthium L.	herb, leaves	22	2	6-8
54.	Sanguisorba officinalis L.	rhizomes and roots	25	5	8-9
55.	Polemonium coeruleum L.	rhizomes and roots	30-32	-	8-9
56.	Leonurus villosus Desf. ex D'Urv. (L. quinquelobatus); L. .cardiaca L.	herb	25	3	6-9
57.	Glycyrrhiza glabra L.	rhizomes and roots	-	10	с-в
58.	Pinus sylvestris L.	buds	40	2	12-2
59.	Fragaria vesca L.	leaves	20	1	5-6
60.	Gnaphalium uliginosum L.	herb	23-25	3	7-8
61.	Viola tricolor L.	herb	20	2	5-8
62.	Matricaria recutita L.	flowers (inflorescences)	20	1	5-9
63.	*Equisetum arvense L.*	herb	25	4	6-7
64.	*Helichrysum arenarium (L.) Moench*	flowers (inflorescences)	25-30	3	6-8
65.	*Hierochloe odorata (L.) Beauv.*	herb	50	2	6-8
66.	*Thymus*	herb (shoots)	25-28	1	6-8
67	*Veratrum lobelianum Bernh.*	rhizomes and roots	25	3	9-10
68.	*Bidens tripartita L.*	herb	15	2	6-8

69.	*Chelidonium majus l.*	herb	23-25	3	5-7
70.	*Vaccinium myrtillus L.*	fruits	13	2	6-8
71.	(*Salvia officinalis L.*)	leaves	25-30	1	6-8
72.	(*Rosa majalis Herrm.*)	fruits	32-35	2	8-9
73.	(*Rumex confertus Willd.*)	roots	-	3	9-10
74.	(*Juniperus communis L.*)	cones	30	3	9-10

Table 2. Period of priority for harvesting medicinal plant raw materials

№ п/п	Вид лікарських рослин	Період черговості		Всього
		експлуатації (років)	популяцій (років)	
1	**2**	3	4	5
1.	Аїр, лепеха звичайна	1	5-8	6-9
2.	Алтея лікарська	1	5-6	6-7
3.	Багно	1	2	3
4.	Барвінок малий	1	5-7	6-8
5.	Бобівник трилистий	1	3-5	4-6
6.	Брусниця	1	3-4	4-5
7.	Бузина чорна	щорічно		
8.	Буркун лікарський	1	1	2
9.	Валеріана (ряд видів)	1	5	6
10.	Вовчуг польовий	1	6-7	7-8
11.	Волошка синя	щорічно		
12.	Глід (ряд видів)	- » -		
13.	Гірчак перцевий	1	1	2
14.	Гірчак зміїний (змійовик)	1	5	6
15.	Гірчак звичайний, спориш звичайний	щорічно		
16.	Глечики жовті	1	7-10	8-11
17.	Грицики звичайні	щорічно		
18.	Деревій (ряд видів)	щорічно		
19.	Жостір проносний	щорічно		
20.	Звіробій звичайний	1	2-3	3-4
21.	Золототисячник звичайний	1	2	3
22.	Калина звичайна	1	10	11
23.	Конвалія звичайна	1	3-4	4-5
24.	Коров`як (ряд видів)	щорічно		
25.	Кропива дводомна	щорічно		
26.	Крушина ламка	1	3-5	4-6
27.	Кульбаба лікарська	щорічно		
28.	Липа серцелиста	щорічно		
29.	Материнка звичайна	1	3-4	4-5
30.	Мати-й-мачуха звичайна (підбіл)	1	1	2

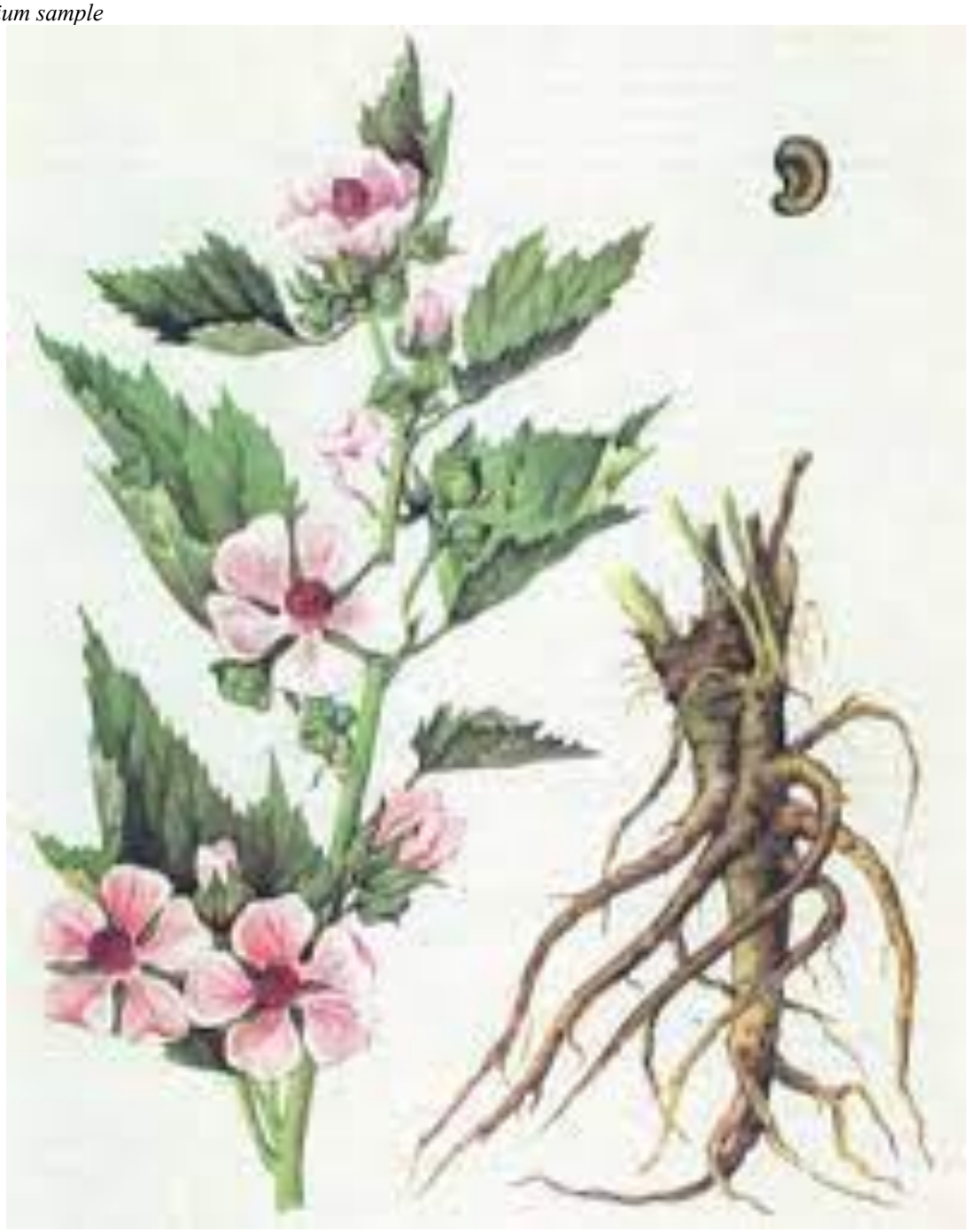
31.	Мильнянка лікарська	1	1	2
32.	Мучниця	1	3-4	4-5
33.	Наперстянка великоквіткова	1	1	2
34.	Омела біла	щорічно		
35	Остудник голий	1	2	3
36.	Первоцвіт весняний	1	3	4
37.	2	3	4	5
38.	Перстач прямостоячий (калган)	1	4	5
39.	Пижмо звичайне	1	1	2
40.	Плаун булавовидний	1	1	2
41.	Подорожник великий	1	1	2
42.	Полин гіркий	1	1	2
43.	Родовик лікарський	1	5	6
44.	Синюха голуба	1	5	6
45.	Собача кропива п`ятилопатева	1	1	2
46.	Солодка гола	1	3-4	4-5
47.	Суниці лісові	1	1	2
48.	Сухоцвіт багновий	1	2	3
49.	Фіалка триколірна	щорічно		
50.	Хамоміла лікарська (ромашка лікарська)	щорічно		
51.	Хвощ польовий	щорічно		
52.	Цмин пісковий	1	1-2	2-3
53.	Чебрець (ряд видів)	1	2-3	3-4
54.	Чемериця Лобелієва	1	3-4	4-5
55.	Череда трироздільна	щорічно		
56.	Чистотіл великий	1	1	2
57.	Шавлія лікарська	1	2-3	3-4
58.	Шипшина (ряд видів)	щорічно		
59.	Яловець звичайний	щорічно		

A sample of tasks filling

Task. Describe the herbarium sample of MP according to the given scheme:

Sample 1.

herbarium sample



MP and MPM (Latin and English)

Althaeae herba; Althaeae radices; Althaea officinalis L.; Malvaceae
Marshmallow herb; Marshmallow root; Marshmallow

Morphological characteristics of MP and MPM

MP description: A perennial, downy, hairy herbaceous plant with a strong, short, thick, branched rhizome and fleshy, long roots. Stems are erect, branched in the upper part. The leaves are alternate, petiolate, serrated at the edge. The flowers are bisexual, five-petalled, regular, in panicle-like inflorescences, located in the axils of the upper and middle stem leaves. The corolla is pale pink. The fruit is a disk-shaped curl.

MPM description: Roots: roots are unrefined whole raw materials. The roots are cylindrical, slightly twisted up to 2 cm thick. With deep longitudinal grooves and numerous scars from the roots. Fracture is fibrous on the outside, rough and granular on the inside, white or yellowish-white. The cleaned raw material has a grayish-white fine-fibrous outer surface. The taste is slimy and sweet.

Herb: Non-woody shoots with intact or broken leaves; flowers, buds and fruits of various degrees of development. Stems are rounded, with intermittent grooves, grayish-green, pubescent. Alternate five-lobed leaves. Leaf blade with ridged-dentate edge, downy-pubescent on both sides. Several flowers are located in the axils of the upper leaves. Calyx non-falling, with 5 sepals. The corolla is pale pink with 5 inverted egg-shaped petals.

Chemical composition of MPM:

Roots and herb contain polysaccharides (mucilage, starch, pectin substances, sugars), fatty oil, tannins, steroids, betaine, mineral salts. The herb also contains ascorbic acid, carotenoids, and flavonoids.

Uses in medicine and pharmacy:

Expectorant, enveloping, anti-inflammatory action in acute and chronic respiratory diseases; diseases of the gastrointestinal tract.

Task. Do a macroscopic analysis of MPM of different morphological groups (leaves, flowers, herbs, fruits, seeds, bark, roots, rhizomes) using Appendix 1 as a reference. Compare the established morphological signs of the observed MPM with descriptions in the pharmacopoeia monographs SPhU and make a conclusion based on identifying and analyzing the features.

Sample 5. For this analysis you have this MPM: underground organs
Macroscopic analysis of MPM:

whole, cut, ground, or pulverized	Unrefined whole raw material
shape	Cylindrical, somewhat twisted
surface	With deep longitudinal grooves and numerous scars from the roots
characteristic of fracture	Fracture is fibrous on the outside, rough and granular on the inside
presence of core	-
colour of fracture surface	Fracture is white or yellowish-white
colour of external surface	The cleaned raw material has a grayish-white fine-fibrous outer surface
odour	Not specific
taste	Mucilaginous, sweet

Determination of the identity of this MPM:
_____1, 2+_____
_____
Conclusion:_____ Althaeae radices_____

	Latin name	**English name**
MPM	**Althaeae radices**	**Marshmallow root**
MP	**Althaea officinalis L.**	**Marshmallow**
Family	**Malvaceae**	