ПРИВАТНИЙ ВИЩИЙ НАВЧАЛЬНИЙ ЗАКЛАД
«ХАРКІВСЬКИЙ МІЖНАРОДНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ»
Кафедра фундаментальних загальнонаукових дисциплін

МЕТОДИЧНІ МАТЕРІАЛИ ДО САМОСТІЙНОЇ РОБОТИ

освітньої компоненти

MEDICAL AND BIOLOGICAL PHYSICS

(«Медична і біологічна фізика» для студентів з англійською мовою навчання)

(назва освітньої компоненти)

підготовки другого (магістерського) рівня вищої освіти
галузь знань 22 ОХОРОНА ЗДОРОВ'Я
спеціальність 222 МЕДИЦИНА
освітньо-професійної програми МЕДИЦИНА

Курс 1 Семестр 2

Методичні матеріали до самостійної роботи розглянуто та затверджено на засіданні кафедри фундаментальних загальнонаукових дисциплін
Протокол від «23» вересня 2022 року № 2

Зав. кафедри _____ Тетяна КУДРЯВЦЕВА
(підпис)

Затверджено на засіданні навчально-методичної комісії
Протокол від «28» лютого 2023 року № 2 (наказ № 23 від 28.02.2023)

Голова _____ Жанна ДАВИДОВА
(підпис)

РОЗРОБНИК : НЕССОНОВА Марина, доцент кафедри, к.т.н., доцент

(вказати ПРІЗВИЩЕ, ім'я авторів, їхні посади, наукові ступені та вчені звання)

Методичні матеріали до самостійної роботи з освітньої компоненти «Медична та біологічна фізика» для студентів з англійською мовою навчання містять методичні рекомендації з тем, передбачених навчальною програмою освітньої компоненти, затвердженої на засіданні кафедри фундаментальних загальнонаукових дисциплін (Протокол від «30» серпня 2022 року № 1), що стосуються розділу 2 «Mathematical Models of Medical and Biological Physics» і викладаються у другому семестрі вивчення дисципліни. Вони охоплюють дві теми відповідно до тематичного плану практичних занять і самостійної роботи за зазначеним розділом, а саме Тема 4 «One-compartment pharmacokinetics model» і Тема 5 «Multi-compartment models of kinetics of drugs».

Методичні розробки містять такі складові: ключові терміни та поняття теми, методичні рекомендації та рекомендовані ресурси для підготовки, перелік практичних і тестових завдань для самостійного виконання, критерії оцінювання.

Методичні розробки призначено для використання викладачами при організації самостійної роботи студентів 1 курсу спеціальності 222 Медицина другого (магістерського) рівня вищої освіти, що навчаються англійською мовою, з дисципліни «Медична і біологічна фізика» за розділом 2 «Mathematical Models of Medical and Biological Physics».

МЕТОДИЧНА КАРТКА ОРГАНІЗАЦІЇ САМОСТІЙНОЇ РОБОТИ

Тема: Mathematical models of medical and biological physics : One-compartment pharmacokinetics model

Ключові терміни та поняття теми: one-compartment pharmacokinetics model, drug amount (concentration) in plasma serum, pharmacokinetic curves, elimination rate constant, half-life of the drug

Методичні рекомендації до виконання самостійної роботи:

Самостійна робота з даної теми передбачає виконання студентами практичних завдань (розв'язок задач) за темою.

Рекомендовано користуватися конспектом, зробленим під час розв'язку типових завдань з теми на практичних заняттях, конспектом і слайдами лекції з поточної теми.

Інші джерела, рекомендовані для використання під час самостійної роботи з теми:

1. Shargel L. Chapter 3. One-compartment open model: intravenous bolus administration [Electronic resource] / L. Shargel, S. Wu-Pong, A.C. Yu // Applied Biopharmaceutics & Pharmacokinetics. – 6th ed. – McGraw Hill, 2012. – Mode of access: https://accesspharmacy.mhmedical.com/content.aspx?bookid=513&sectionid=41488021. – Title from screen.
2. Knigavko V.G. Medical and biological physics: textbook for students studying the subject in English / V.G. Knigavko, O.V. Zaytseva, M.A. Bondarenko. – Kharkiv : KhNMU, 2016. – 556 p.
3. Knigavko V.G. Glossary of terms on Medical and Biological Physics / V.G. Knigavko, O.V. Zaytseva, M.A. Bondarenko. – Kharkiv : KhNMU, 2017. – 110 p.
4. Nelson P. Biological Physics / Philip Nelson. – [S. l.] : Freeman & Company, W.H., 2013. – 600 p.
5. Physical Biology of the Cell / R. Phillips [et al.]. – New York : Garland Science, 2013. – 1057 p.
6. Schellart Nico A.M. Compendium of medical physics, medical technology and biophysics for students, physicians and researchers / Nico A.M. Schellart. – Amsterdam : Dept. of Biomedical Engineering and Physics of Academic Medical Center University of Amsterdam, 2009. – 434 p.

Практичні завдання виконуються студентами за варіантами, для оцінювання кожним студентом надається власний варіант завдання.

Нижче наведено перелік варіантів завдань для самостійної роботи з теми.

Завдання для самостійної (домашньої) роботи:

Варіант 1.

Task 1.

2 hours and 10 minutes after intravenous administrating of 68 mg of the drug, 22 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 1.5 days. Find the amount of drug in plasma serum

6.5 hours after intravenous administration of 50 mg.

Task 3.

Half-life of the drug is 12 hours How long does it take to get 7.5 mg of drug in plasma serum after intravenous administration of 120 mg?

Task 4.

Half-life of the drug is 27 minutes. How long does it take for an intravenously administrated drug to decrease to 33% of the initial dose?

Task 5.

A patient was intravenously administrated 25 mg of **I n s u l i n** .

A. What amount of the drug can be detected in plasma serum 1.5 hours after injection?
B. How long does it take to have 15 mg of Insulin in plasma serum?
C. How long does it take for concentration of Insulin in plasma serum to decrease to 65% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 2.

Task 1.

10 minutes after intravenous administrating of 225 mg of the drug, 150 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 8 hours. Find the amount of drug in plasma serum 14 hours after intravenous administration of 200 ml.

Task 3.

Half-life of the drug is a half of a week. How long does it take to get 75 mg of drug in plasma serum after intravenous administration of 600 mg?

Task 4.

Half-life of the drug is 3.75 hours. How long does it take for an intravenously administrated drug to decrease by 45% of the initial dose?

Task 5.

A patient was intravenously administrated 15 mg of **K e t o r o l a c** .

A. What amount of the drug can be detected in plasma serum 2.5 hours after injection?
B. How long does it take to have 2.1 mg of Ketorolac in plasma serum?
C. How long does it take for concentration of Ketorolac in plasma serum to decrease to 70% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 3.

Task 1.

19 hours after intravenous administrating of 525 mg of the drug, 0.7 mg of it remains in

plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 4.5 weeks. Find the amount of drug in plasma serum 11 days after intravenous administration of 875 mg.

Task 3.

Half-life of the drug is 3 hours and 20 minutes. How long does it take to get 30 mg of drug in plasma serum after intravenous administration of 160 mg?

Task 4.

Half-life of the drug is 24 minutes. How long does it take for an intravenously administrated drug to decrease to 68% of the initial dose?

Task 5.

A patient was intravenously administrated 39 mg of **P a r e c o x i b** .

A. What amount of the drug can be detected in plasma serum 4.5 hours after injection?
B. How long does it take to have 10 mg of Parecoxib in plasma serum?
C. How long does it take for concentration of Parecoxib in plasma serum to decrease to 15% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 4.

Task 1.

A week after intravenous administrating of 820 mg of the drug, 17.5 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 3.25 hours. Find the amount of drug in plasma serum 9.5 hours after intravenous administration of 250 mg.

Task 3.

Half-life of the drug is 15 hours and 5 minutes. How long does it take to get 0.1 mg of drug in plasma serum after intravenous administration of 67 mg?

Task 4.

Half-life of the drug is 3 hours. How long does it take for an intravenously administrated drug to decrease by 75% of the initial dose?

Task 5.

A patient was intravenously administrated 35 mg of **R a n i t i d i n e** .

A. What amount of the drug can be detected in plasma serum 6 hours after injection?
B. How long does it take to have 15 mg of Ranitidine in plasma serum?
C. How long does it take for concentration of Ranitidine in plasma serum to decrease by 90% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 5.

Task 1.

15 minutes after intravenous administrating of 125 mg of the drug, 90 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 8.25 hours. Find the amount of drug in plasma serum 14 hours after intravenous administration of 75 mg.

Task 3.

Half-life of the drug is 11 hours and 20 minutes. How long does it take to get 25 mg of drug in plasma serum after intravenous administration of 150 mg?

Task 4.

Half-life of the drug is 1.5 weeks. How long does it take for an intravenously administrated drug to decrease to 40% of the initial dose?

Task 5.

A patient was intravenously administrated 10 mg of **D r o p e r i d o l** .

A. What amount of the drug can be detected in plasma serum 90 minutes after injection?

B. How long does it take to have 8.25 mg of Droperidol in plasma serum?

C. How long does it take for concentration of Droperidol in plasma serum to decrease by 30% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 6.

Task 1.

3 days after intravenous administrating of 14 g of the drug, 150 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 5 hours and 40 minutes. Find the amount of drug in plasma serum 8 hours after intravenous administration of 60 mg.

Task 3.

Half-life of the drug is 35 minutes. How long does it take to get 26 ml of drug in plasma serum after intravenous administration of 115 ml?

Task 4.

Half-life of the drug is 9 hours and 12 minutes. How long does it take for an intravenously administrated drug to decrease by 80% of the initial dose?

Task 5.

A patient was intravenously administrated 275 mg of **V e d o l i z u m a b** .

A. What amount of the drug can be detected in plasma serum 15 days after injection?

B. How long does it take to have 50 mg of Vedolizumab in plasma serum?

C. How long does it take for concentration of Vedolizumab in plasma serum to decrease by 25% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 7.

Task 1.

4.5 hours after intravenous administrating of 1.25 g of the drug, 850 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 40 minutes. Find the amount of drug in plasma serum 2.5 hours after intravenous administration of 210 mg.

Task 3.

Half-life of the drug is 7 hours and 15 minutes. How long does it take to get 3 ml of drug in plasma serum after intravenous administration of 85 ml?

Task 4.

Half-life of the drug is 55 minutes. How long does it take for an intravenously administrated drug to decrease to 64% of the initial dose?

Task 5.

A patient was intravenously administrated 450 mg of **A c e t a z o l a m i d e** .

A. What amount of the drug can be detected in plasma serum 15 minutes after injection?

B. How long does it take to have 100 mg of Acetazolamide in plasma serum?

C. How long does it take for concentration of Acetazolamide in plasma serum to decrease to 85% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 8.

Task 1.

35 minutes after intravenous administrating of 100 mg of the drug, 34 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 9.25 hours. Find the amount of drug in plasma serum half of a day after intravenous administration of 73 mg.

Task 3.

Half-life of the drug is 3 hours and 7 minutes. How long does it take to get 8 mg of drug in plasma serum after intravenous administration of 60 mg?

Task 4.

Half-life of the drug is 18 days. How long does it take for an intravenously administrated drug to decrease by 23% of the initial dose?

Task 5.

A patient was intravenously administrated 4.5 mg of **C h l o r p r o m a z i n e** .

A. What amount of the drug can be detected in plasma serum 20 hours after injection?

B. How long does it take to have 0.5 mg of Chlorpromazine in plasma serum?

C. How long does it take for concentration of Chlorpromazine in plasma serum to decrease to 10% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 9.

Task 1.

1.5 weeks after intravenous administrating of 955 ml of the drug, 70 ml of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 8.25 hours. Find the amount of drug in plasma serum 13 hours after intravenous administration of 205 ml.

Task 3.

Half-life of the drug is 2 days and 8 hours. How long does it take to get 0.2 mg of drug in plasma serum after intravenous administration of 150 mg?

Task 4.

Half-life of the drug is 6.5 hours. How long does it take for an intravenously administrated drug to decrease to 60% of the initial dose?

Task 5.

A patient was intravenously administrated 40 mg of **C y c l i z i n e** .

A. What amount of the drug can be detected in plasma serum 1.5 days after injection?

B. How long does it take to have 2.5 mg of Cyclizine in plasma serum?

C. How long does it take for concentration of Cyclizine in plasma serum to decrease by 20% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 10.

Task 1.

25 minutes after intravenous administrating of 50 mg of the drug, 43 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 6 days. Find the amount of drug in plasma serum 31 hours after intravenous administration of 200 mg.

Task 3.

Half-life of the drug is 3 hours and 40 minutes. How long does it take to get 7 mg of drug in plasma serum after intravenous administration of 100 mg?

Task 4.

Half-life of the drug is 23 hours. How long does it take for an intravenously administrated drug to decrease by 7% of the initial dose?

Task 5.

A patient was intravenously administrated 11 mg of **C h l o r p r o m a z i n e** .

A. What amount of the drug can be detected in plasma serum 12 hours after injection?

B. How long does it take to have 3 mg of Chlorpromazine in plasma serum?

C. How long does it take for concentration of Chlorpromazine in plasma serum to decrease by 40% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 11.

Task 1.

11 hours after intravenous administrating of 100 mg of the drug, 49 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 33.5 minutes. Find the amount of drug in plasma serum 4 hours after intravenous administration of 810 ml.

Task 3.

Half-life of the drug is 1.5 months. How long does it take to get 57 mg of drug in plasma serum after intravenous administration of 200 mg?

Task 4.

Half-life of the drug is 6 hours and 35 minutes. How long does it take for an intravenously administrated drug to decrease to 65% of the initial dose?

Task 5.

A patient was intravenously administrated 1.25 mg of **N a l o x o n e** .

A. What amount of the drug can be detected in plasma serum 4 hours and 20 minutes after injection?

B. How long does it take to have 0.5 mg of Naloxone in plasma serum?

C. How long does it take for concentration of Naloxone in plasma serum to decrease by 25% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 12.

Task 1.

35 minutes after intravenous administrating of 550 mg of the drug, 95 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 9 days. Find the amount of drug in plasma serum 27 hours after intravenous administration of 375 mg.

Task 3.

Half-life of the drug is 5 hours and 15 minutes. How long does it take to get 9 mg of drug in plasma serum after intravenous administration of 170 mg?

Task 4.

Half-life of the drug is 13 hours. How long does it take for an intravenously administrated drug to decrease by 20% of the initial dose?

Task 5.

A patient was intravenously administrated 500 mg of **A c e t a z o l a m i d e** .

A. What amount of the drug can be detected in plasma serum 5 hours after injection?

B. How long does it take to have 30 mg of Acetazolamide in plasma serum?

C. How long does it take for concentration of Acetazolamide in plasma serum to decrease by 10% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 13.

Task 1.

2 hours after intravenous administrating of 120 mg of the drug, 45 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 5.5 days. Find the amount of drug in plasma serum 13 hours after intravenous administration of 675 ml.

Task 3.

Half-life of the drug is 3 hours and 25 minutes. How long does it take to get 1.3 mg of drug in plasma serum after intravenous administration of 15.2 mg?

Task 4.

Half-life of the drug is 8 days and 3 hours. How long does it take for an intravenously administrated drug to decrease by 15% of the initial dose?

Task 5.

A patient was intravenously administrated 1.9 mg of **N a l o x o n e** .

A. What amount of the drug can be detected in plasma serum 1.5 hours after injection?

B. How long does it take to have 1 mg of Naloxone in plasma serum?

C. How long does it take for concentration of Naloxone in plasma serum to decrease to 80% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 14.

Task 1.

7 hours and 15 minutes after intravenous administrating of 350 mg of the drug, 105 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.
Half-life of the drug is 4.5 hours. Find the amount of drug in plasma serum 5 hours after intravenous administration of 42 mg.

Task 3.
Half-life of the drug is 43 minutes. How long does it take to get 0.6 mg of drug in plasma serum after intravenous administration of 60 mg?

Task 4.
Half-life of the drug is 90 minutes. How long does it take for an intravenously administrated drug to decrease to 17% of the initial dose?

Task 5.
A patient was intravenously administrated 290 mg of **V e d o l i z u m a b** .
A. What amount of the drug can be detected in plasma serum 3 weeks after injection?
B. How long does it take to have 20 mg of Vedolizumab in plasma serum?
C. How long does it take for concentration of Vedolizumab in plasma serum to decrease to 80% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 15.

Task 1.
1 hour and 35 minutes after intravenous administrating of 540 mg of the drug, 190 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.
Half-life of the drug is 22 hours. Find the amount of drug in plasma serum 1.5 days after intravenous administration of 575 mg.

Task 3.
Half-life of the drug is 9 hours and 10 minutes. How long does it take to get 1.25 mg of drug in plasma serum after intravenous administration of 8 g?

Task 4.
Half-life of the drug is 25 minutes. How long does it take for an intravenously administrated drug to decrease by 65% of the initial dose?

Task 5.
A patient was intravenously administrated 6.75 mg of **D r o p e r i d o l** .
A. What amount of the drug can be detected in plasma serum 5.5 hours after injection?
B. How long does it take to have 3 mg of Droperidol in plasma serum?
C. How long does it take for concentration of Droperidol in plasma serum to decrease to 75% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 16.

Task 1.

25 minutes after intravenous administrating of 25 g of the drug, 200 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 14 hours. Find the amount of drug in plasma serum 15 hours after intravenous administration of 235 ml.

Task 3.

Half-life of the drug is 6.5 days. How long does it take to get 1 g of drug in plasma serum after intravenous administration of 7 000 mg?

Task 4.

Half-life of the drug is one week. How long does it take for an intravenously administrated drug to decrease to 20% of the initial dose?

Task 5.

A patient was intravenously administrated 50 mg of **R a n i t i d i n e** .

A. What amount of the drug can be detected in plasma serum 50 minutes after injection?

B. How long does it take to have 1 mg of Ranitidine in plasma serum?

C. How long does it take for concentration of Ranitidine in plasma serum to decrease to 85% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 17.

Task 1.

1 day and 3 hours after intravenous administrating of 19 g of the drug, 200 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 2 hours. Find the amount of drug in plasma serum 7.5 hours after intravenous administration of 66 mg.

Task 3.

Half-life of the drug is 3 hours and 20 minutes. How long does it take to get 30 mg of drug in plasma serum after intravenous administration of 800 ml?

Task 4.

Half-life of the drug is 2 months. How long does it take for an intravenously administrated drug to decrease by 70% of the initial dose?

Task 5.

A patient was intravenously administrated 37.5 mg of **P a r e c o x i b** .

A. What amount of the drug can be detected in plasma serum 10 minutes after injection?

B. How long does it take to have 25 mg of Parecoxib in plasma serum?

C. How long does it take for concentration of Parecoxib in plasma serum to decrease

by 65% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 18.

Task 1.

2 hours and 35 minutes after intravenous administrating of 750 ml of the drug, 325 ml of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 11 hours. Find the amount of drug in plasma serum 7 hours after intravenous administration of 23 mg.

Task 3.

Half-life of the drug is 8 days. How long does it take to get 7.5 mg of drug in plasma serum after intravenous administration of 110 mg?

Task 4.

Half-life of the drug is 12 hours and 25 minutes. How long does it take for an intravenously administrated drug to decrease by 25% of the initial dose?

Task 5.

A patient was intravenously administrated 20 mg of **I n s u l i n** .

A. What amount of the drug can be detected in plasma serum 10 minutes after injection?

B. How long does it take to have 4 mg of Insulin in plasma serum?

C. How long does it take for concentration of Insulin in plasma serum to decrease by 35% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 19.

Task 1.

3 days after intravenous administrating of 550 mg of the drug, 120 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 5 hours and 15 minutes. Find the amount of drug in plasma serum 1 day after intravenous administration of 20 g.

Task 3.

Half-life of the drug is 7.5 days. How long does it take to get 55 mg of drug in plasma serum after intravenous administration of 400 mg?

Task 4.

Half-life of the drug is 5.25 hours. How long does it take for an intravenously administrated drug to decrease to 15% of the initial dose?

Task 5.

A patient was intravenously administrated 12.5 mg of **K e t o r o l a c** .

A. What amount of the drug can be detected in plasma serum 20 minutes after injection?

B. How long does it take to have 0.75 mg of Ketorolac in plasma serum?

C. How long does it take for concentration of Ketorolac in plasma serum to decrease by 33% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 20.

Task 1.

2 hours and 20 minutes after intravenous administrating of 620 mg of the drug, 410 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 1.75 hours. Find the amount of drug in plasma serum 45 minutes after intravenous administration of 250 mg.

Task 3.

Half-life of the drug is 11 hours and 20 minutes. How long does it take to get 48 ml of drug in plasma serum after intravenous administration of 800 ml?

Task 4.

Half-life of the drug is 8.5 days. How long does it take for an intravenously administrated drug to decrease by 69% of the initial dose?

Task 5.

A patient was intravenously administrated 15 mg of **K e t o r o l a c** .

A. What amount of the drug can be detected in plasma serum 2 hours and 45 minutes after injection?

B. How long does it take to have 8 mg of Ketorolac in plasma serum?

C. How long does it take for concentration of Ketorolac in plasma serum to decrease by 80% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 21.

Task 1.

60 hours after intravenous administrating of 475 mg of the drug, 95 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 45 minutes. Find the amount of drug in plasma serum 3 hours after intravenous administration of 2 ml.

Task 3.

Half-life of the drug is 19 days. How long does it take to get 45 mg of drug in plasma

serum after intravenous administration of 180 mg?

Task 4.

Half-life of the drug is 3 hours and 10 minutes. How long does it take for an intravenously administrated drug to decrease to 72% of the initial dose?

Task 5.

A patient was intravenously administrated 23 mg of **I n s u l i n** .

A. What amount of the drug can be detected in plasma serum 5 minutes after injection?
B. How long does it take to have 0.5 mg of Insulin in plasma serum?
C. How long does it take for concentration of Insulin in plasma serum to decrease to 40% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 22.

Task 1.

10 minutes after intravenous administrating of 5 mg of the drug, 4.75 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 2 days. Find the amount of drug in plasma serum 9 hours after intravenous administration of 650 mg.

Task 3.

Half-life of the drug is 6 hours and 40 minutes. How long does it take to get 25 mg of drug in plasma serum after intravenous administration of 110 mg?

Task 4.

Half-life of the drug is 65 minutes. How long does it take for an intravenously administrated drug to decrease by 55% of the initial dose?

Task 5.

A patient was intravenously administrated 50 mg of **C y c l i z i n e** .

A. What amount of the drug can be detected in plasma serum 3.5 hours after injection?
B. How long does it take to have 30 mg of Cyclizine in plasma serum?
C. How long does it take for concentration of Cyclizine in plasma serum to decrease by 85% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 23.

Task 1.

8 minutes after intravenous administrating of 300 mg of the drug, 250 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 14 hours. Find the amount of drug in plasma serum 2 hours and

50 minutes after intravenous administration of 70 mg.

Task 3.
Half-life of the drug is 2 hours and 25 minutes. How long does it take to get 35 mg of drug in plasma serum after intravenous administration of 600 mg?

Task 4.
Half-life of the drug is 3.3 hours. How long does it take for an intravenously administrated drug to decrease to 21% of the initial dose?

Task 5.
A patient was intravenously administrated 40 mg of **R a n i t i d i n e** .
A. What amount of the drug can be detected in plasma serum 10 hours after injection?
B. How long does it take to have 25 mg of Ranitidine in plasma serum?
C. How long does it take for concentration of Ranitidine in plasma serum to decrease by 15% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 24.

Task 1.
5 hours and 40 minutes after intravenous administrating of 330 ml of the drug, 70 ml of it remains in plasma serum. Find the half-life of the drug.

Task 2.
Half-life of the drug is 40 hours. Find the amount of drug in plasma serum 4 days after intravenous administration of 325 mg.

Task 3.
Half-life of the drug is 2 weeks. How long does it take to get 65 mg of drug in plasma serum after intravenous administration of 230 mg?

Task 4.
Half-life of the drug is 10 days. How long does it take for an intravenously administrated drug to decrease by 17% of the initial dose?

Task 5.
A patient was intravenously administrated 40 mg of **P a r e c o x i b** .
A. What amount of the drug can be detected in plasma serum an hour after injection?
B. How long does it take to have 15 mg of Parecoxib in plasma serum?
C. How long does it take for concentration of Parecoxib in plasma serum to decrease to 90% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 25.

Task 1.
5 days after intravenous administrating of 0.75 g of the drug, 100 mg of it remains in plasma

serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 3.25 hours. Find the amount of drug in plasma serum 6 hours and 10 minutes after intravenous administration of 200 ml.

Task 3.

Half-life of the drug is 1 month. How long does it take to get 75 mg of drug in plasma serum after intravenous administration of 60 g?

Task 4.

Half-life of the drug is 7.5 hours. How long does it take for an intravenously administrated drug to decrease to 15% of the initial dose?

Task 5.

A patient was intravenously administrated 12 mg of **D r o p e r i d o l** .

A. What amount of the drug can be detected in plasma serum 45 minutes after injection?

B. How long does it take to have 0.1 mg of Droperidol in plasma serum?

C. How long does it take for concentration of Droperidol in plasma serum to decrease by 35% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 26.

Task 1.

6 hours and 40 minutes after intravenous administrating of 340 mg of the drug, 90 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 1.5 weeks. Find the amount of drug in plasma serum 13 days after intravenous administration of 650 mg.

Task 3.

Half-life of the drug is 30 minutes. How long does it take to get 45 mg of drug in plasma serum after intravenous administration of 200 mg?

Task 4.

Half-life of the drug is 12 days. How long does it take for an intravenously administrated drug to decrease by 10% of the initial dose?

Task 5.

A patient was intravenously administrated 20 mg of **D e s o x y n** .

A. What amount of the drug can be detected in plasma serum 7.5 hours after injection?

B. How long does it take to have 3 mg of Desoxyn in plasma serum?

C. How long does it take for concentration of Desoxyn in plasma serum to decrease to 40% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not

mentioned in the task.

Варіант 27.

Task 1.

15 minutes after intravenous administrating of 750 mg of the drug, 200 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 1.5 hours. Find the amount of drug in plasma serum 8.5 hours after intravenous administration of 4 mg.

Task 3.

Half-life of the drug is 3 hours and 40 minutes. How long does it take to get 10 mg of drug in plasma serum after intravenous administration of 120 mg?

Task 4.

Half-life of the drug is 40 minutes. How long does it take for an intravenously administrated drug to decrease to 36% of the initial dose?

Task 5.

A patient was intravenously administrated 300 mg of **V e d o l i z u m a b** .

A. What amount of the drug can be detected in plasma serum a month after injection?
B. How long does it take to have 120 mg of Vedolizumab in plasma serum?
C. How long does it take for concentration of Vedolizumab in plasma serum to decrease to 30% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 28.

Task 1.

55 minutes after intravenous administrating of 425 mg of the drug, 110 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 6 hours and 20 minutes. Find the amount of drug in plasma serum 10 hours after intravenous administration of 66 mg.

Task 3.

Half-life of the drug is 9 hours. How long does it take to get 42 mg of drug in plasma serum after intravenous administration of 150 mg?

Task 4.

Half-life of the drug is 18 hours. How long does it take for an intravenously administrated drug to decrease by 55% of the initial dose?

Task 5.

A patient was intravenously administrated 400 mg of **A c e t a z o l a m i d e** .

A. What amount of the drug can be detected in plasma serum a day after injection?
B. How long does it take to have 125 mg of Acetazolamide in plasma serum?

C. How long does it take for concentration of Acetazolamide in plasma serum to decrease to 30% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 29.

Task 1.

1.5 days after intravenous administrating of 250 mg of the drug, 75 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 8 hours. Find the amount of drug in plasma serum 17 hours after intravenous administration of 60 mg.

Task 3.

Half-life of the drug is 9 hours and 35 minutes. How long does it take to get 2 mg of drug in plasma serum after intravenous administration of 15 mg?

Task 4.

Half-life of the drug is 25 minutes. How long does it take for an intravenously administrated drug to decrease by 60% of the initial dose?

Task 5.

A patient was intravenously administrated 0.475 mg of **N a l o x o n e** .

A. What amount of the drug can be detected in plasma serum 35 minutes after injection?

B. How long does it take to have 0.01 mg of Naloxone in plasma serum?

C. How long does it take for concentration of Naloxone in plasma serum to decrease to 5% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 30.

Task 1.

8.5 hours after intravenous administrating of 550 mg of the drug, 120 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 55 minutes. Find the amount of drug in plasma serum 3 hours after intravenous administration of 35 mg.

Task 3.

Half-life of the drug is 12 days. How long does it take to get 30 mg of drug in plasma serum after intravenous administration of 140 mg?

Task 4.

Half-life of the drug is 4 hours and 20 minutes. How long does it take for an intravenously administrated drug to decrease to 60% of the initial dose?

Task 5.

A patient was intravenously administrated 2.5 mg of **C h l o r p r o m a z i n e** .

A. What amount of the drug can be detected in plasma serum 1.5 days after injection?

B. How long does it take to have 0.1 mg of Chlorpromazine in plasma serum?

C. How long does it take for concentration of Chlorpromazine in plasma serum to decrease to 40% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Варіант 31.

Task 1.

4 hours after intravenous administrating of 65 mg of the drug, 52.3 mg of it remains in plasma serum. Find the half-life of the drug.

Task 2.

Half-life of the drug is 25 minutes. Find the amount of drug in plasma serum 1.5 hours after intravenous administration of 250 mg.

Task 3.

Half-life of the drug is 2 hours and 45 minutes. How long does it take to get 5 mg of drug in plasma serum after intravenous administration of 30 mg?

Task 4.

Half-life of the drug is 8.5 hours. How long does it take for an intravenously administrated drug to decrease to 90% of the initial dose?

Task 5.

A patient was intravenously administrated 300 mg of **P a c e r o n e** .

A. What amount of the drug can be detected in plasma serum a week after injection?

B. How long does it take to have 70 mg of Pacerone in plasma serum?

C. How long does it take for concentration of Pacerone in plasma serum to decrease by 75% of the initial dose?

Note: for task #5 in addition to your solutions and answers provide a reference (link) to the source you use to find parameters (characteristics of the medicine) that are not mentioned in the task.

Форми контролю самостійної роботи:

Контроль правильності виконання практичних завдань з теми.

Вид навчальних занять, під час яких проводиться контроль самостійної роботи:

Самостійна робота виконується студентами і перевіряється викладачем у позааудиторний час. У разі виникнення суперечливих питань щодо виконання завдань або оцінювання самостійної роботи, ці питання вирішуються під час консультацій.

Критерії оцінювання самостійної роботи:

Розв'язок кожного завдання оцінюється виходячи із максимальної оцінки 5 балів. Кожна помилка знижує максимальну оцінку на 10% (0.5 бали). Відсутність посилань на джерела інформації при виконанні завдання 5 знижує оцінку на 1 бал. Таким чином, максимальна оцінка за самостійну роботу з даної теми складає 35 балів, мінімальний бал, необхідний для зарахування роботи становить 21 бали.

МЕТОДИЧНА КАРТКА ОРГАНІЗАЦІЇ САМОСТІЙНОЇ РОБОТИ

Тема: Mathematical models of medical and biological physics : Multi-compartment models of kinetics of drugs

Ключові терміни та поняття теми: multi-compartment pharmacokinetics model, drug amount (concentration) in plasma serum, differential equations, derivative of drug amount as elimination rate.

Методичні рекомендації до виконання самостійної роботи:

Самостійна робота з даної теми передбачає:

a. виконання студентами практичних завдань (розв'язок задач) за темою;
b. тестування за темами розділу.

Рекомендовано користуватися конспектом, зробленим під час розв'язку типових завдань з теми на практичних заняттях, конспектом і слайдами лекції з поточної теми.

Інші джерела, рекомендовані для використання під час самостійної роботи з теми:

1. Shargel L. Chapter 4. Multicompartment models: intravenous bolus administration [Electronic resource] / L. Shargel, S. Wu-Pong, A.C. Yu // Applied Biopharmaceutics & Pharmacokinetics. – 6th ed. – McGraw Hill, 2012. – Mode of access: https://accesspharmacy.mhmedical.com/content.aspx?bookid=513&sectionid=41488022. – Title from screen.
2. Knigavko V.G. Medical and biological physics: textbook for students studying the subject in English / V.G. Knigavko, O.V. Zaytseva, M.A. Bondarenko. – Kharkiv : KhNMU, 2016. – 556 p.
3. Knigavko V.G. Glossary of terms on Medical and Biological Physics / V.G. Knigavko, O.V. Zaytseva, M.A. Bondarenko. – Kharkiv : KhNMU, 2017. – 110 p.
4. Nelson P. Biological Physics / Philip Nelson. – [S. l.] : Freeman & Company, W.H., 2013. – 600 p.
5. Physical Biology of the Cell / R. Phillips [et al.]. – New York : Garland Science, 2013. – 1057 p.
6. Schellart Nico A.M. Compendium of medical physics, medical technology and biophysics for students, physicians and researchers / Nico A.M. Schellart. – Amsterdam : Dept. of Biomedical Engineering and Physics of Academic Medical Center University of Amsterdam, 2009. – 434 p.

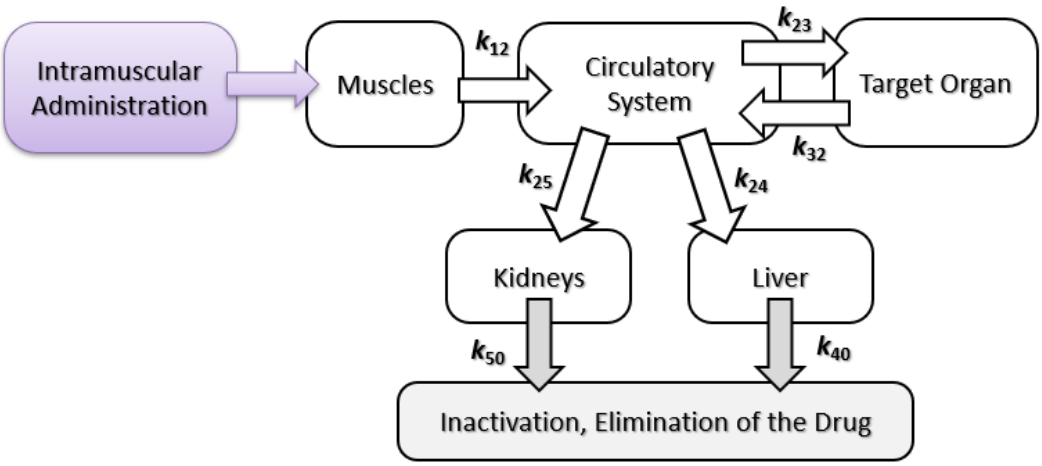
a. Практичні завдання виконуються студентами за варіантами, для оцінювання кожним студентом надається власний варіант завдання.

Нижче наведено перелік варіантів завдань для самостійної роботи з теми.

Завдання для самостійної (домашньої) роботи:

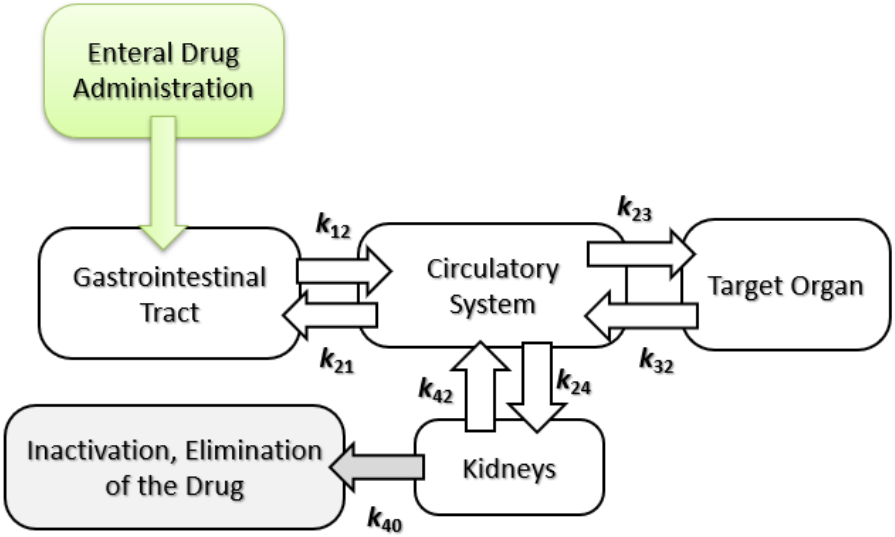
Варіант 1.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



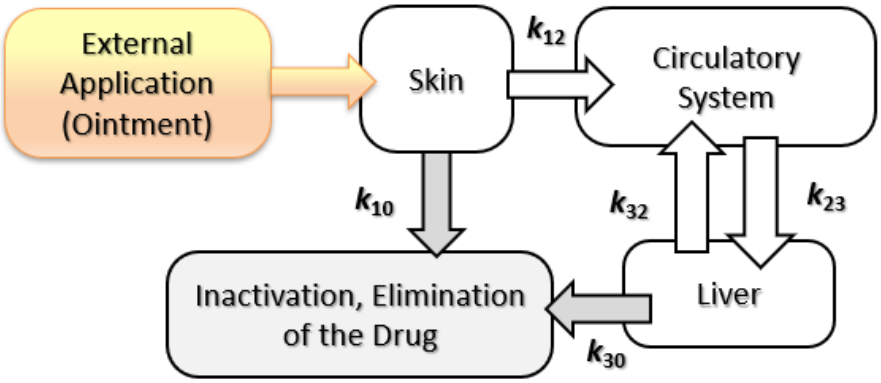
Варіант 2.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



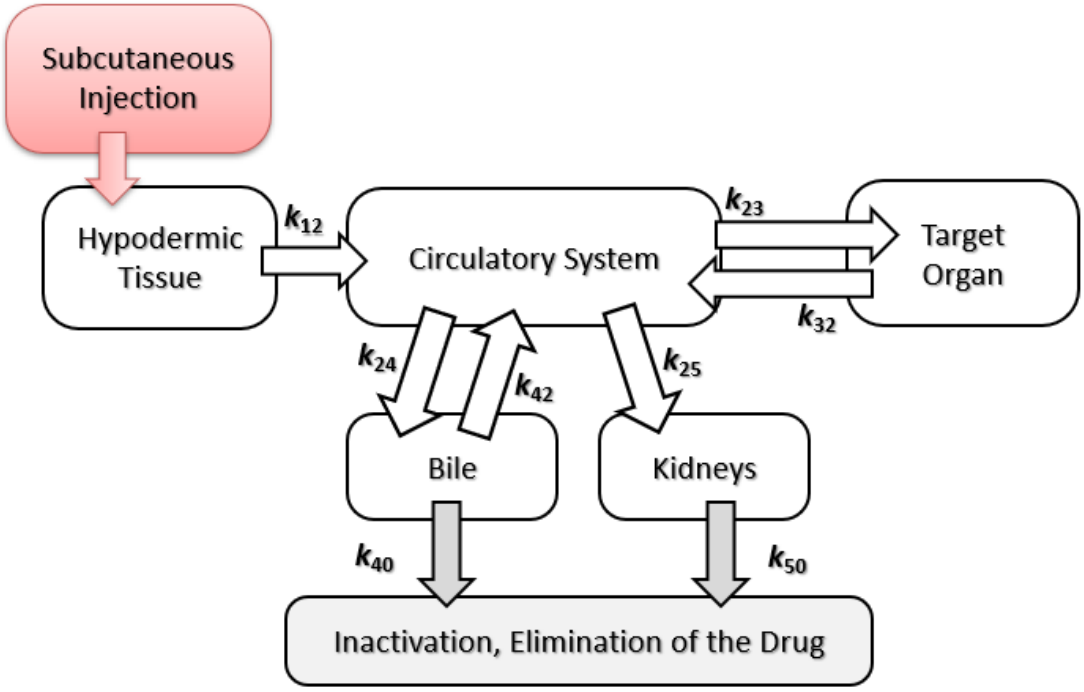
Варіант 3.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



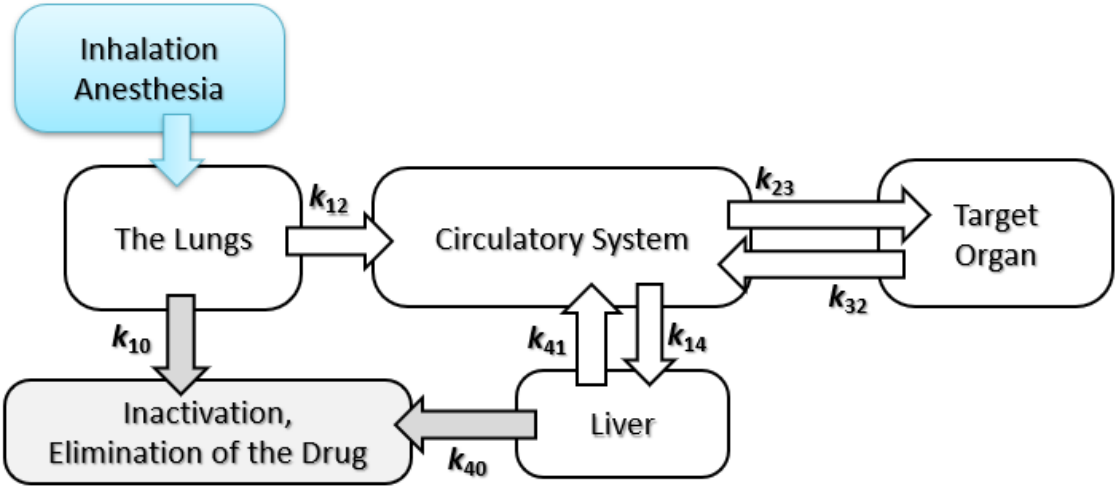
Варіант 4.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



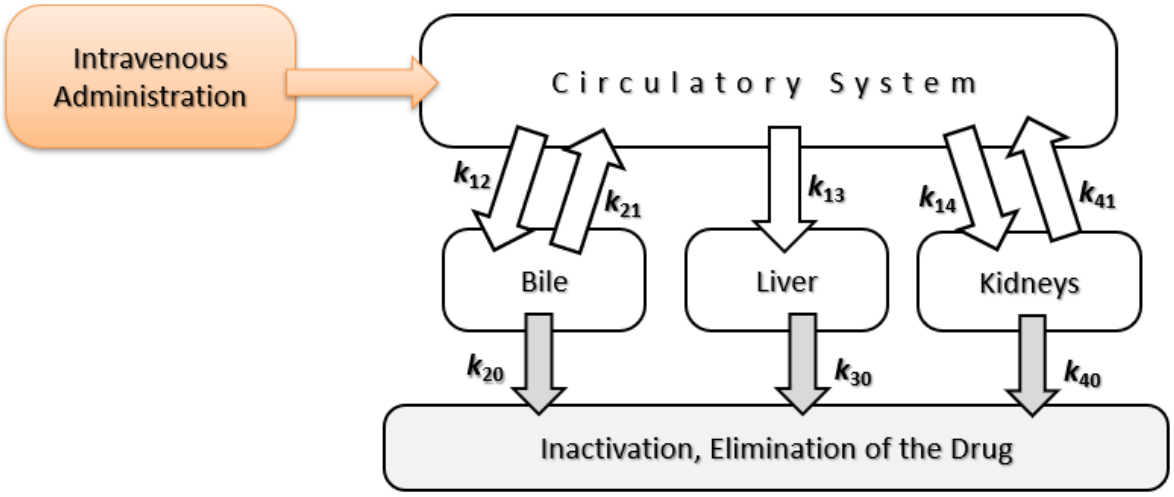
Варіант 5.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



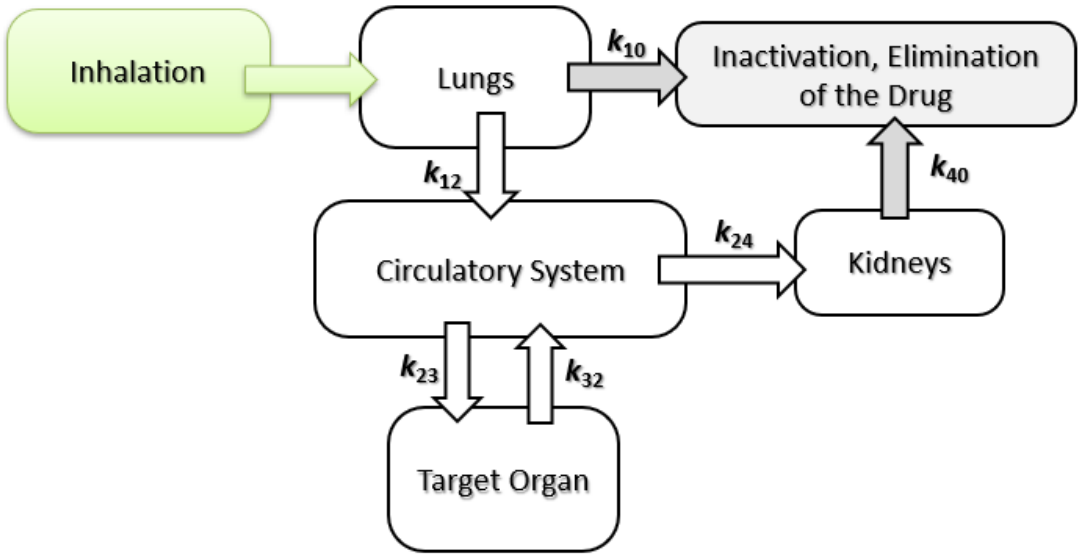
Варіант 6.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



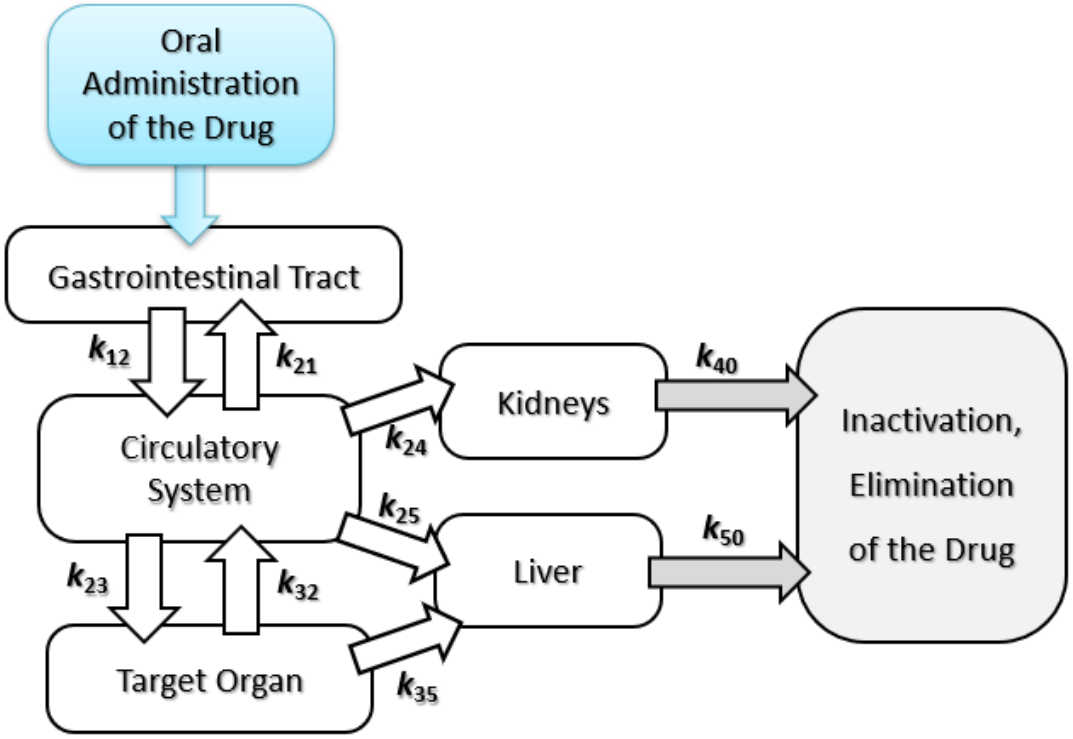
Варіант 7.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



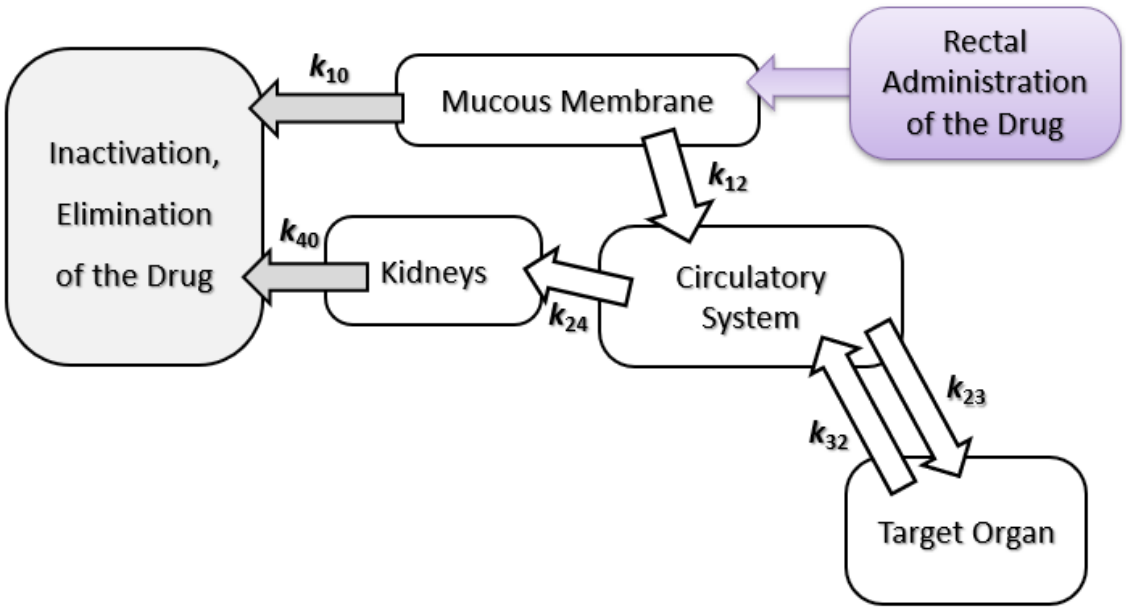
Варіант 8.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



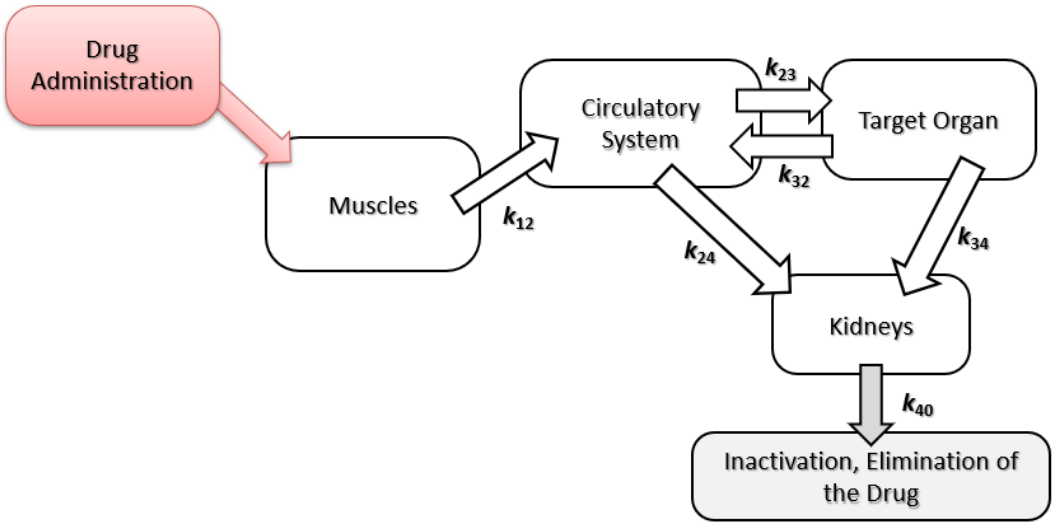
Варіант 9.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



Варіант 10.

Write down the system of differential equations that describe the multicompartment pharmacokinetics model:



b. **Тестові завдання за розділом** (посилання на проходження тестування: https://onlinetestpad.com/piqkaeaybkhve).

   Кожен тест містить 10 питань, що охоплюють теми розділу 2 освітньої компоненти (теми, що викладаються у другому семестрі).
   Налаштування тесту дозволяють проходити тест у тренувальному режимі з перевіркою правильності наданих відповідей.

Повний перелік тестових питань наведено нижче:

$$\delta(t) = \delta_0 \cdot e^{-k_{el} \cdot t}$$

In this formula for one-compartment pharmacokinetics model, t means...

- ○ the time needed for complete elimination of the drug
- ○ the time remaining until the drug is completely eliminated
- ○ the half-life of the drug
- ○ the time passed from the beginning of illness to the administration of the drug
- ○ the time passed after administration of the drug

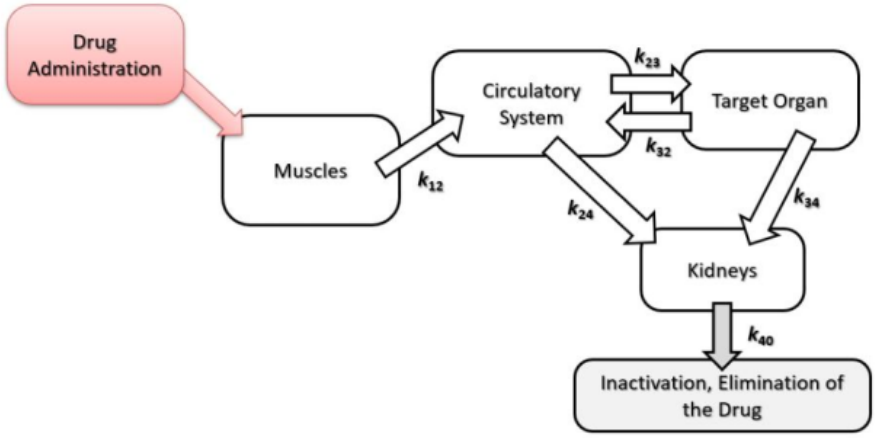
In the one-compartment pharmacokinetics model, it is assumed that...

- the rate of change in the amount of drug at a given time t is directly proportional to the amount of drug at that time
- the rate of change in the amount of drug at a given time t is inversely proportional to the amount of drug at that time
- the rate of change in the amount of drug at a given time t can be found as an exponent of the amount of drug at that time
- the rate of change in the amount of drug at a given time t does not depend on the amount of drug at that time

$$\delta(t) = \delta_0 \cdot e^{-k_{el} \cdot t}$$

In this formula for one-compartment pharmacokinetics model, the Greek letter "delta" indexed 0, stands for...

- the amount of the drug that was initially administrated
- the amount of the drug that is already eliminated
- the minimum possible level for the amount of the drug
- the maximum safe dose of the drug that can be administrated
- the amount of the drug that remains in blood serum at the time t



In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the target organ.

(***designations used in the answers:***

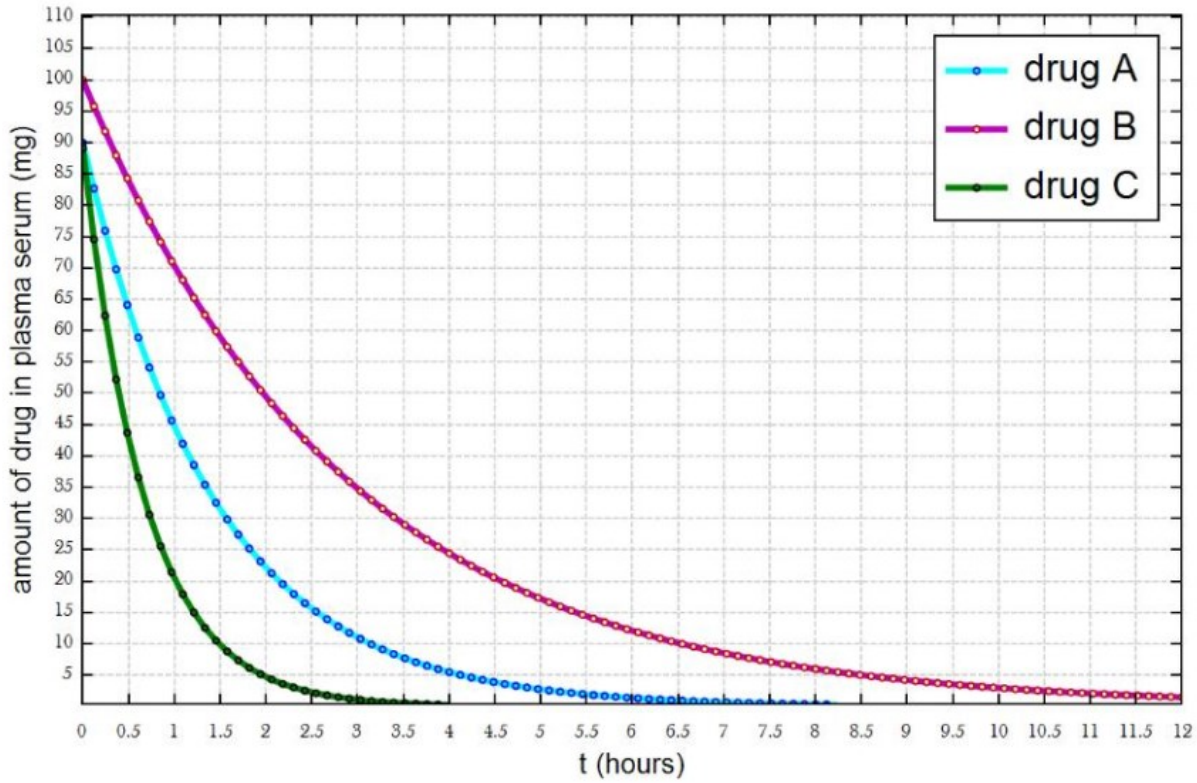
C -- concentration of drug;

mscl -- muscles; CS -- circulatory system; TO -- target organ; kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_{TO}}{dt} = -k_{34} \cdot C_{TO} - k_{32} \cdot C_{TO} + k_{23} \cdot C_{CS}$
- $\frac{dC_{TO}}{dt} = k_{23} \cdot C_{CS} - k_{34} \cdot C_{kdn} - k_{32} \cdot C_{TO}$
- $\frac{dC_{TO}}{dt} = k_{23} \cdot C_{CS} - k_{34} \cdot C_{kdn} - k_{32} \cdot C_{CS}$
- $\frac{dC_{TO}}{dt} = k_{12} \cdot C_{mscl} + k_{23} \cdot C_{CS} - k_{32} \cdot C_{TO} - k_{34} \cdot C_{kdn}$
- none of the enlisted

In the one-compartment pharmacokinetics model, it is assumed that...

- ○ the amount of drug at a given time t is directly proportional to the initial amount of drug and the time passed after administration
- ○ the amount of drug at a given time t is inversely proportional to the initial amount of drug and the time passed after administration
- ○ the amount of drug at a given time t can be found as an exponent of the initial amount of drug
- ○ the amount of drug at a given time t depends neither on the initial amount of drug nor on the time passed after administration
- ○ the amount of drug at a given time t can be found as an exponent of the time passed after administration



What was the initial dose of drug A?

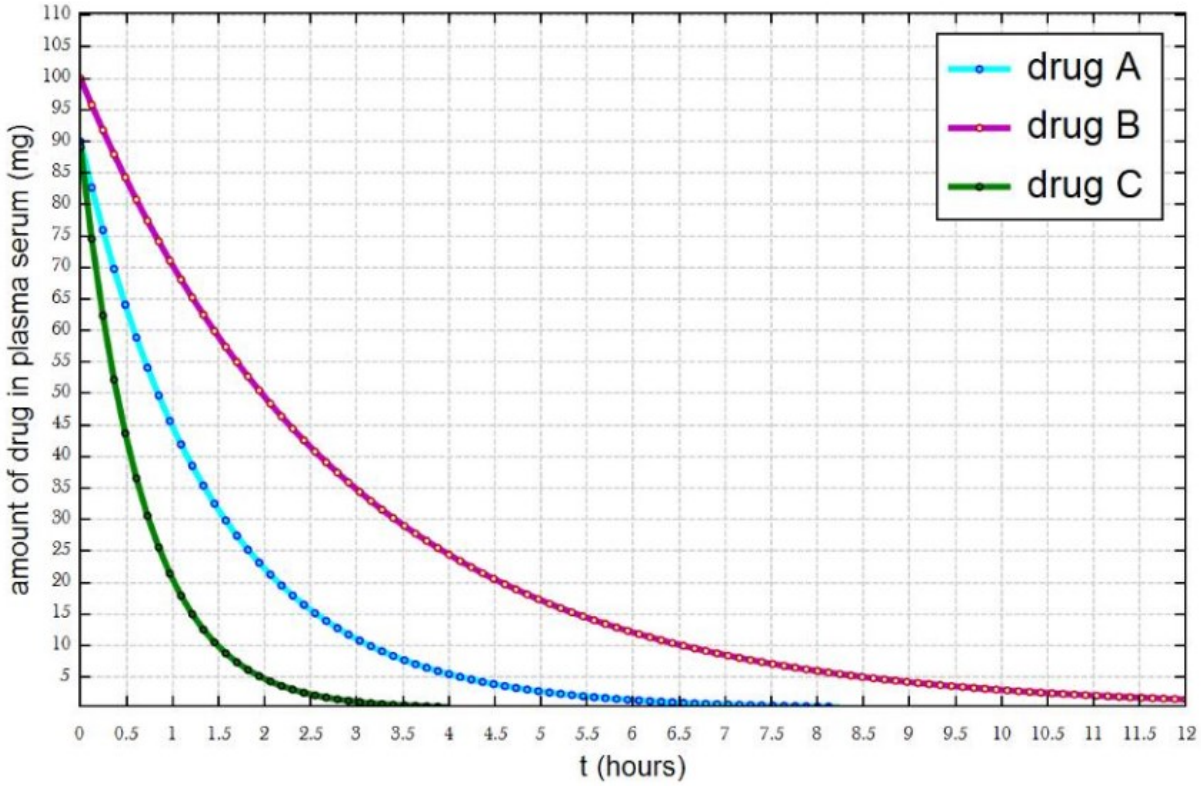
(write answer in mg, rounded to the nearest integer number)

One-compartment pharmacokinetics model...

- ○ assumes that the amount of the administered drug comes to the blood plasma serum directly, without passing through other tissues, organs or systems
- ○ assumes that the amount of the administered drug in the blood plasma serum does not depend on time passed after the administration
- ○ works for any type of drug administration

One-compartment pharmacokinetics model describes the change of the amount of the drug in the blood plasma serum in a case of ...

- ○ intravenous administration only
- ○ two forms of drug administration: intravenous and intramuscular
- ○ any type of drug administration
- ○ three forms of drug administration: intravenous, intramuscular and subcutaneous
- ○ any type of drug administration, except oral



What is the half-life of drug C?

(write answer in minutes, rounded to the nearest integer number)

$$\delta(t) = \delta_0 \cdot e^{-k_{el} \cdot t}$$

In this formula for one-compartment pharmacokinetics model, the coefficient k indexed el, is named...

- ○ elaboration constant
- ○ coefficient of elasticity
- ○ quantity of elements (in the model)
- ○ elementary coefficient
- ○ elimination rate constant

In the one-compartment pharmacokinetics model, the elimination rate constant...

- ○ is the same for all the drugs
- ○ is different for different drugs
- ○ depends on the initial amount of drug administrated

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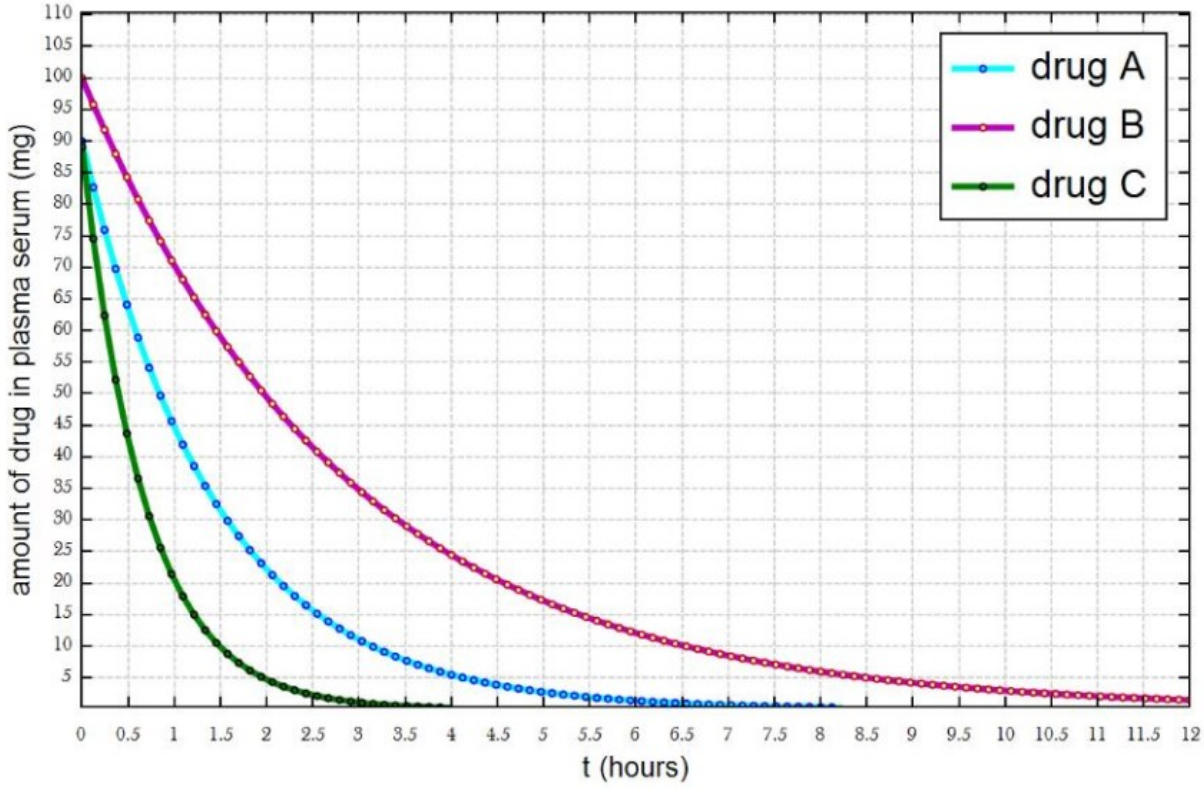
In the one-compartment pharmacokinetics model, the elimination rate constant...

- ○ depends on the time passed after the drug administration
- ○ does not depend on the time passed after the drug administration
- ○ depends on the initial amount of drug administrated



What was the initial dose of drug B?

(write answer in mg, rounded to the nearest integer number)

$$\delta(t) = \delta_0 \cdot e^{-k_{el} \cdot t}$$

In this formula for one-compartment pharmacokinetics model, the Greek letter "delta" as function of time (at the left part of equality), stands for...

- the amount of the drug that was initially administrated
- the amount of the drug that is already eliminated
- the minimum possible level for the amount of the drug
- the maximum safe dose of the drug that can be administrated
- the amount of the drug that remains in blood serum at the time t

The half-life of the drug....

- is directly proportional to the elimination rate constant in the one-compartment pharmacokinetics model
- is inversely proportional to the elimination rate constant in the one-compartment pharmacokinetics model
- is logarithm of the elimination rate constant in the one-compartment pharmacokinetics model
- does not depend on the elimination rate constant in the one-compartment pharmacokinetics model

$$\delta(t) = \delta_0 \cdot e^{-k_{el} \cdot t}$$

In this formula for one-compartment pharmacokinetics model, t means...

- the time needed for complete elimination of the drug
- the time remaining until the drug is completely eliminated
- the half-life of the drug
- the time passed from the beginning of illness to the administration of the drug
- the time passed after administration of the drug

The half-life of the drug....

- is longer for the greater initial doses of the drug
- is shorter for the greater initial doses of the drug
- does not depend on the initial amount of drug administrated

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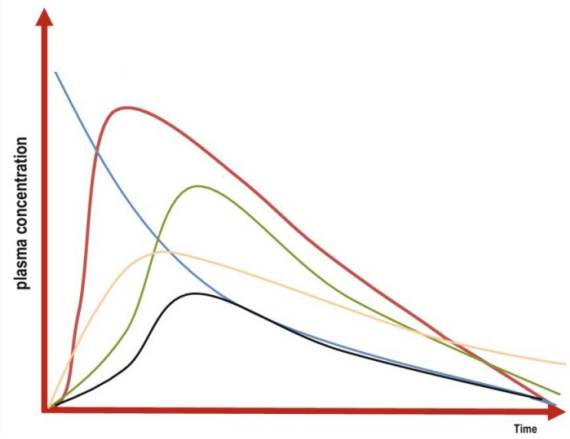
The half-life of the drug....

- is the time needed to reduce the initial dose of the administrated drug by half
- is the half of the time left to the expiration date of the drug
- is the half of the time passed after the administration of the drug
- is the half of the time required for the complete elimination of the administrated drug
- none of the enlisted



Which of the pharmacokinetic curves shown in the picture correspond to a one-compartment pharmacokinetics model?

- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line

Which of the pharmacokinetic curves shown in the picture describe the change in the concentration of drug after intravenous administration?

- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line

Which of the pharmacokinetic curves shown in the picture describe the change in the concentration of drug after intramuscular administration?

- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line

Which of the pharmacokinetic curves shown in the picture describe the change in the concentration of drug after oral administration?

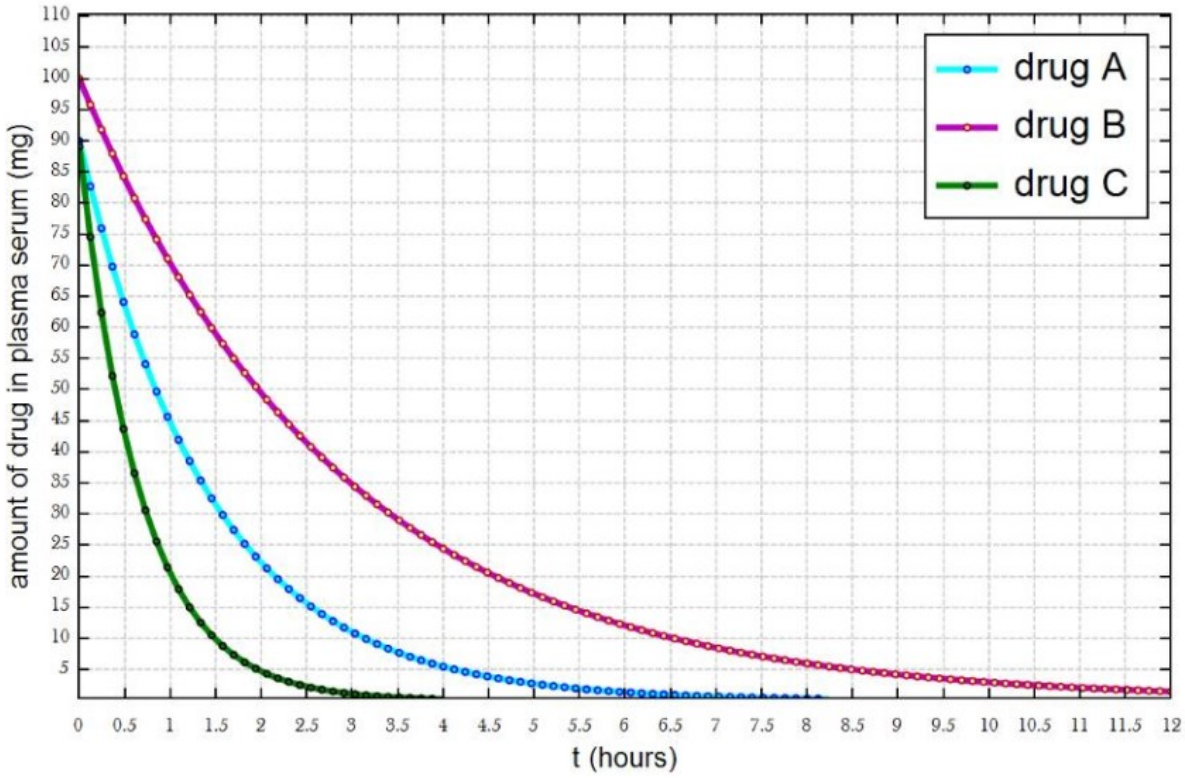
- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line

Which of the pharmacokinetic curves shown in the picture describe the change in the concentration of drug after rectal administration?

- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line

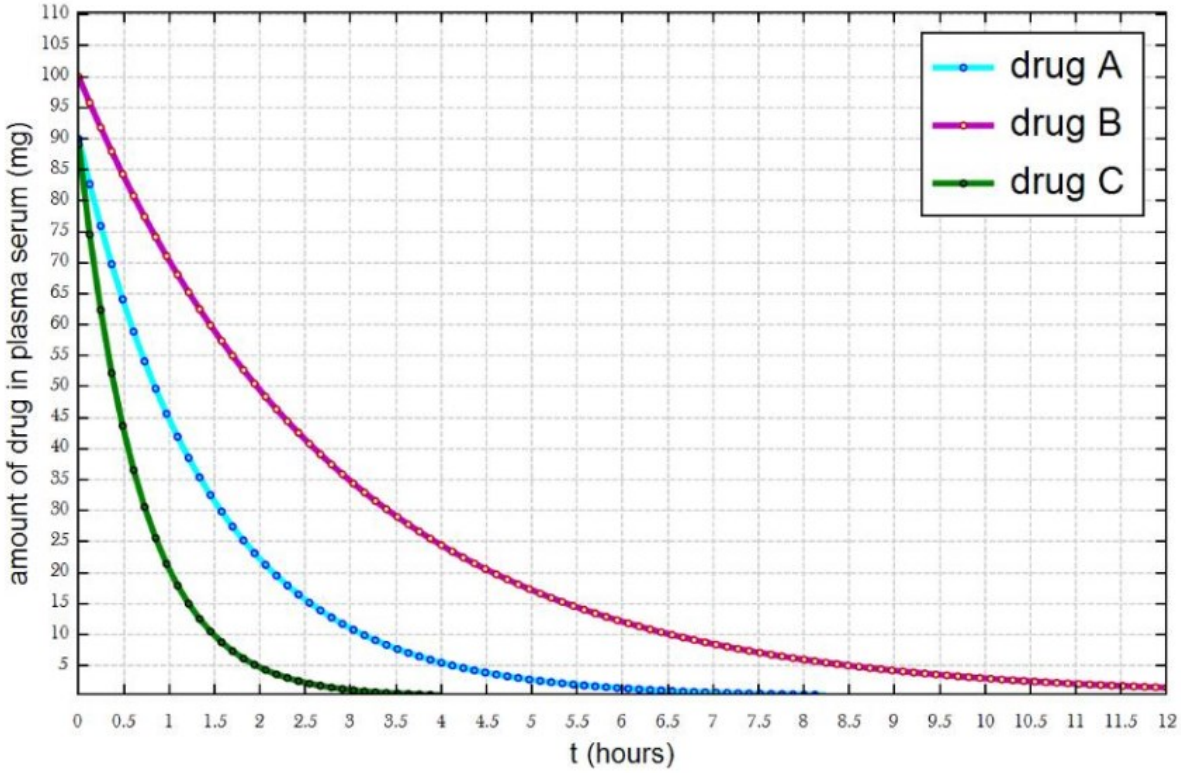
Which of the pharmacokinetic curves shown in the picture describe the change in the concentration of drug after subcutaneous administration?

- ☐ black line
- ☐ red line
- ☐ yellow line
- ☐ blue line
- ☐ green line



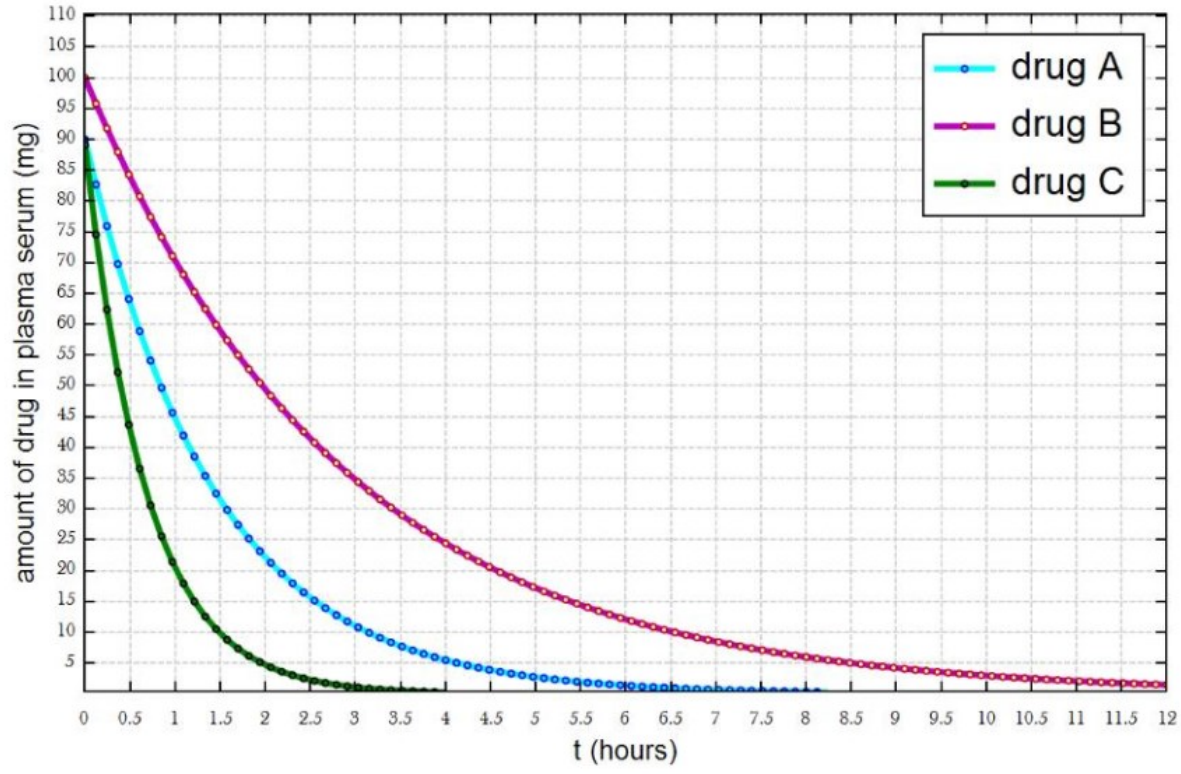
What was the initial dose of drug C?

(write answer in mg, rounded to the nearest integer number)



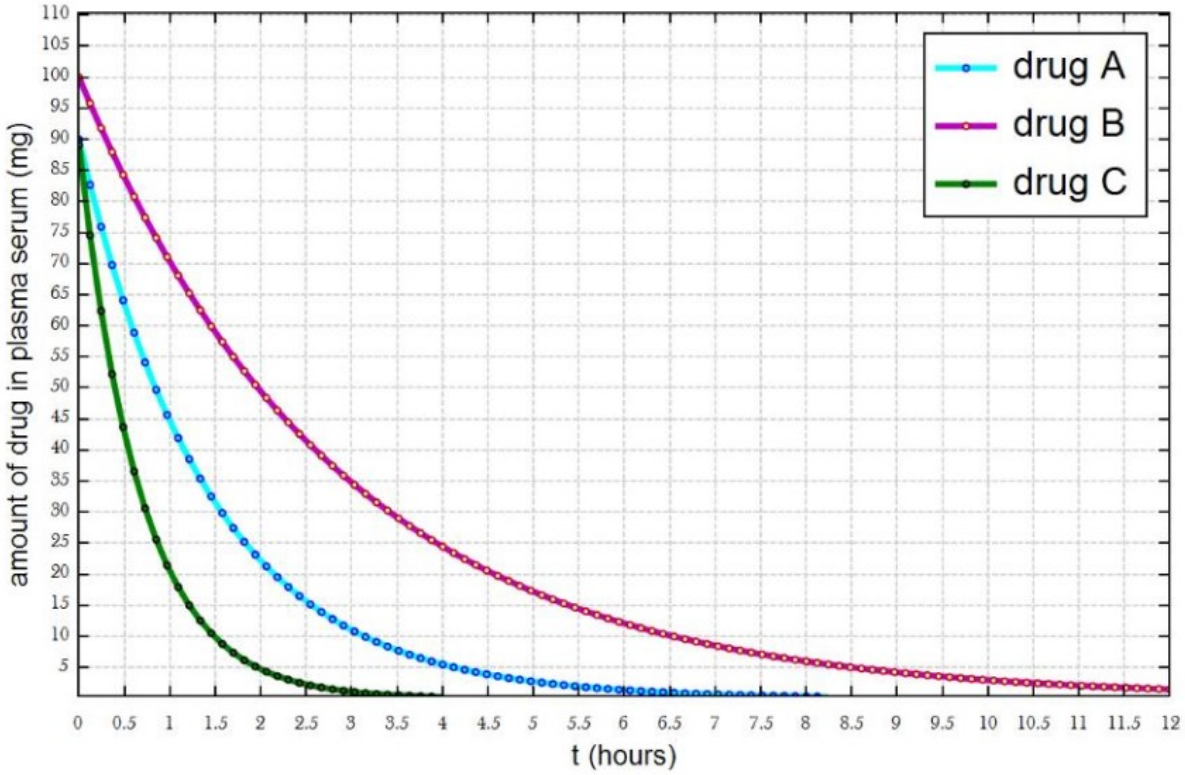
What is the half-life of drug A?

(write answer in minutes, rounded to the nearest integer number)



What is the half-life of drug B?

(write answer in minutes, rounded to the nearest integer number)



Compare the elimination rate constants for the drugs B and C.

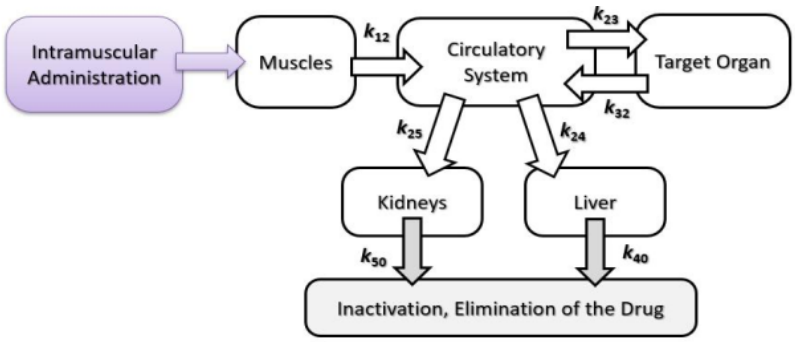
- they are incomparable
- they are equal
- elimination rate constant for the drug B is greater than elimination rate constant for the drug C
- elimination rate constant for the drug C is greater than elimination rate constant for the drug B
- the given graph does not provide enough information to answer the question

Compare the elimination rate constants for the drugs A and C.

- they are incomparable
- they are equal
- elimination rate constant for the drug A is greater than elimination rate constant for the drug C
- elimination rate constant for the drug C is greater than elimination rate constant for the drug A
- the given graph does not provide enough information to answer the question

Compare the elimination rate constants for the drugs A and B.

- they are incomparable
- they are equal
- elimination rate constant for the drug A is greater than elimination rate constant for the drug B
- elimination rate constant for the drug B is greater than elimination rate constant for the drug A
- the given graph does not provide enough information to answer the question



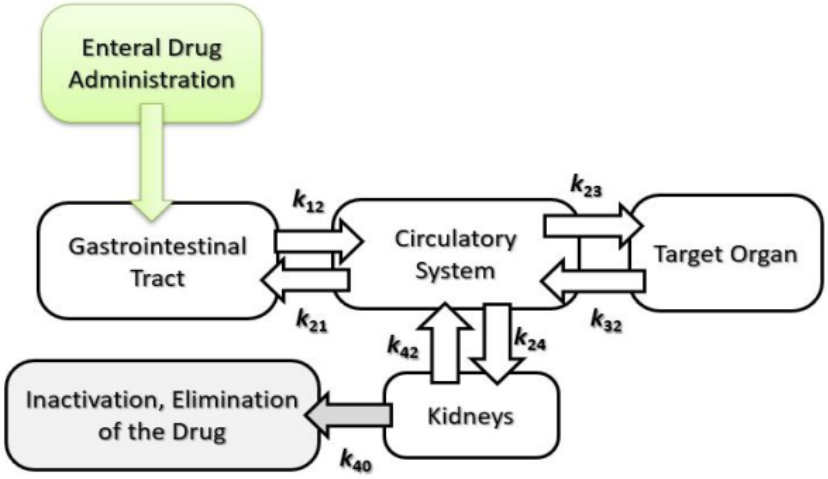
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the kidneys.

(designations used in the answers:

C -- concentration of drug;

mscl -- muscules; CS -- circulatory system; TO -- target organ; kdn -- kidneys; lvr - liver; out -- eliminated, inactivated)

- $\frac{dC_{kdn}}{dt} = k_{25} \cdot C_{CS} - k_{50} \cdot C_{kdn}$
- $\frac{dC_{kdn}}{dt} = -k_{25} \cdot C_{CS} + k_{50} \cdot C_{kdn}$
- $\frac{dC_{kdn}}{dt} = k_{12} \cdot C_{mscl} + k_{25} \cdot C_{CS} + k_{32} \cdot C_{TO} - k_{50} \cdot C_{kdn}$
- $\frac{dC_{kdn}}{dt} = k_{25} \cdot C_{CS} + k_{50} \cdot C_{out}$
- none of the enlisted



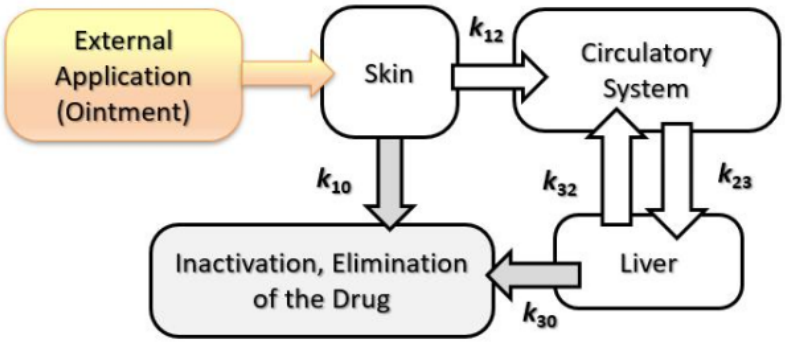
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the kidneys.

(designations used in the answers:

C -- concentration of drug;

GIT -- gastrointestinal tract; CS -- circulatory system; TO -- target organ; kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_{kdn}}{dt} = -(k_{42} + k_{40}) \cdot C_{kdn} + k_{24} \cdot C_{CS}$
- $\frac{dC_{kdn}}{dt} = k_{12} \cdot C_{GIT} + k_{24} \cdot C_{CS} + k_{32} \cdot C_{TO} - k_{42} \cdot C_{kdn}$
- $\frac{dC_{kdn}}{dt} = -k_{40} \cdot C_{out} - k_{42} \cdot C_{CS} + k_{24} \cdot C_{kdn}$
- $\frac{dC_{kdn}}{dt} = k_{24} \cdot (C_{GIT} + C_{CS} + C_{TO}) - k_{42} \cdot C_{kdn} - k_{40} \cdot C_{out}$
- none of the enlisted



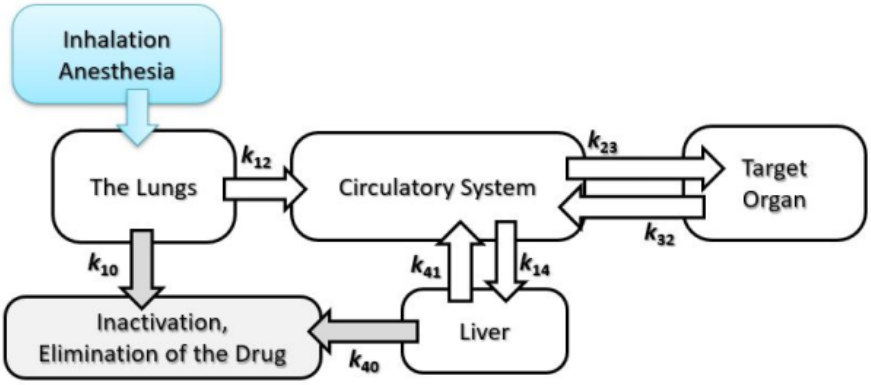
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the circulatory system.

(designations used in the answers:

C -- concentration of drug;

skn -- skin; CS -- circulatory system; lvr -- liver; out -- eliminated, inactivated)

- $\frac{dC_{CS}}{dt} = k_{32} \cdot C_{lvr} - k_{23} \cdot C_{CS} + k_{12} \cdot C_{skn}$
- $\frac{dC_{CS}}{dt} = (k_{32} - k_{23}) \cdot C_{lvr} + k_{12} \cdot C_{skn}$
- $\frac{dC_{CS}}{dt} = (k_{32} - k_{30}) \cdot C_{lvr} - k_{23} \cdot C_{CS} + (k_{12} - k_{10}) \cdot C_{skn}$
- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_{skn} - k_{23} \cdot C_{CS} + k_{32} \cdot C_{lvr} - k_{30} \cdot C_{lvr} - k_{10} \cdot C_{skn}$
- none of the enlisted



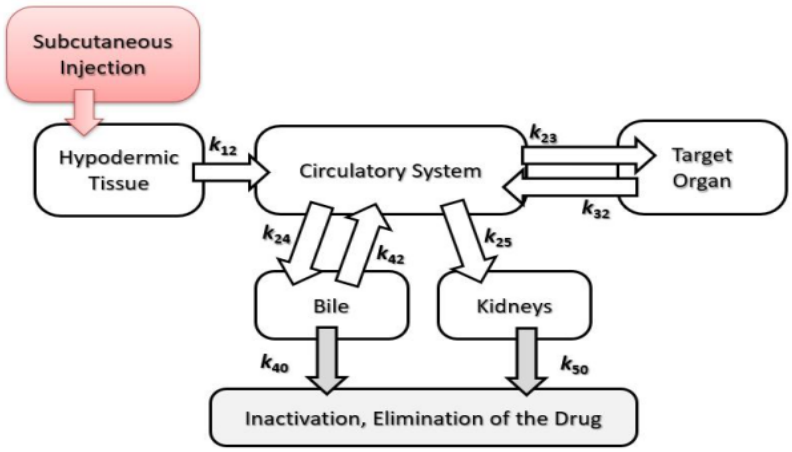
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the circulatory system.

(designations used in the answers:

C -- concentration of drug;

L -- lungs; CS -- circulatory system; TO -- target organ; lvr -- liver ; out -- eliminated, inactivated)

- $\frac{dC_{CS}}{dt} = k_{41} \cdot C_{lvr} - k_{14} \cdot C_{CS} + k_{12} \cdot C_L - k_{23} \cdot C_{CS} + k_{32} \cdot C_{TO}$
- $\frac{dC_{CS}}{dt} = (k_{12} - k_{30}) \cdot C_L + (k_{41} - k_{14}) \cdot C_{lvr} + (k_{32} - k_{23}) \cdot C_{TO}$
- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_L + k_{32} \cdot C_{TO} + (k_{41} - k_{14}) \cdot C_{lvr}$
- $\frac{dC_{CS}}{dt} = -k_{12} \cdot C_L + k_{23} \cdot C_{CS} - k_{32} \cdot C_{TO} - k_{41} \cdot C_{lvr} + k_{14} \cdot C_{CS}$
- none of the enlisted



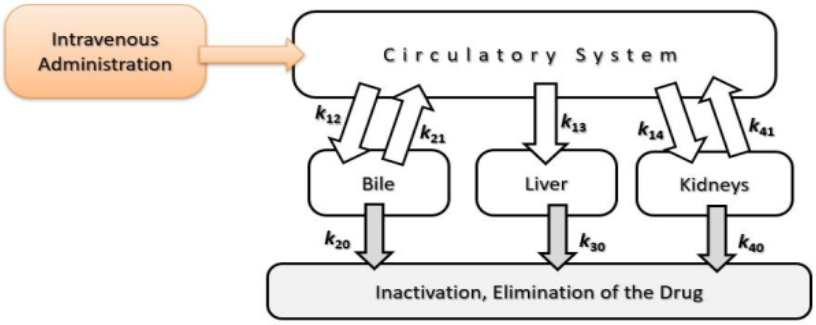
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the biliary system.

(designations used in the answers:

C -- concentration of drug;

HT -- hypodermic tissue; CS -- circulatory system; TO -- target organ; b -- bile (biliary system); kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_b}{dt} = -k_{40} \cdot C_b + k_{24} \cdot C_{CS} - k_{42} \cdot C_b$
- $\frac{dC_b}{dt} = -k_{40} \cdot C_{out} + k_{24} \cdot C_{CS} - k_{42} \cdot C_b$
- $\frac{dC_b}{dt} = k_{12} \cdot C_{HT} + k_{24} \cdot C_{CS} - k_{42} \cdot C_b - k_{40} \cdot C_b$
- $\frac{dC_b}{dt} = k_{12} \cdot C_{HT} + k_{32} \cdot C_{TO} + k_{24} \cdot C_{CS} - k_{42} \cdot C_b - k_{40} \cdot C_b$
- none of the enlisted



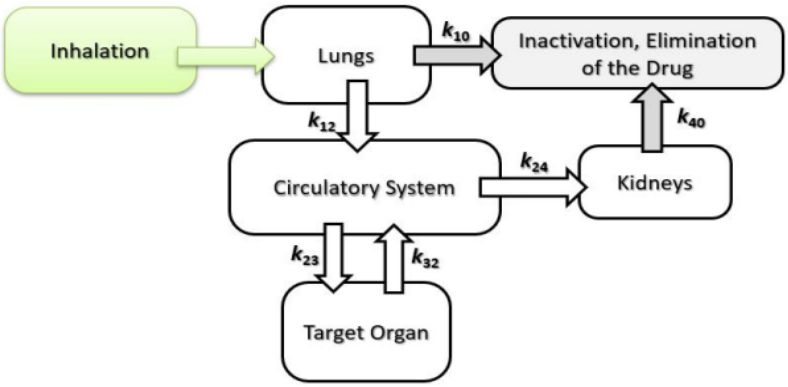
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the biliary system.

(designations used in the answers:

C -- concentration of drug;

CS -- circulatory system; b -- biliary system (bile); lvr -- liver ; kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_b}{dt} = k_{12} \cdot C_{CS} - (k_{20} + k_{21}) \cdot C_b$
- $\frac{dC_b}{dt} = k_{12} \cdot C_{CS} - k_{20} \cdot C_{out} - k_{21} \cdot C_b$
- $\frac{dC_b}{dt} = (k_{12} + k_{13} + k_{14}) \cdot C_{CS} - k_{20} \cdot C_b$
- $\frac{dC_b}{dt} = -k_{20} \cdot C_{out} + k_{12} \cdot C_{CS} - k_{21} \cdot C_{CS}$
- none of the enlisted



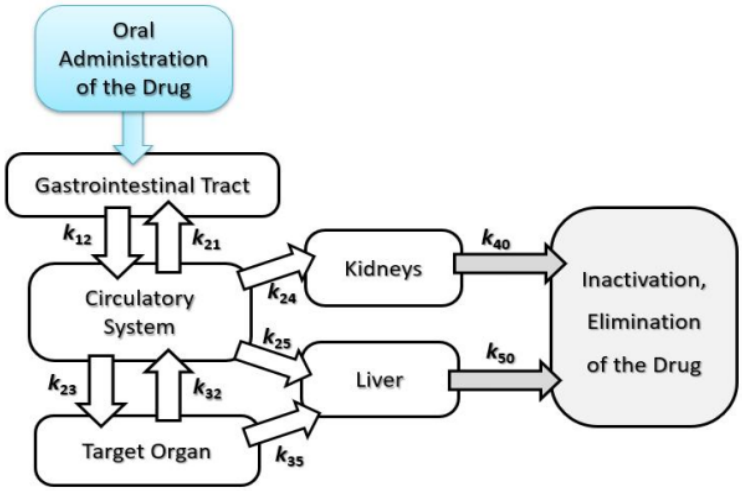
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the circulatory system.

(designations used in the answers:

C -- concentration of drug;

L -- lungs; CS -- circulatory system; TO -- target organ; kdn -- kidneys ; out -- eliminated, inactivated)

- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_L - k_{23} \cdot C_{CS} + k_{32} \cdot C_{TO} - k_{24} \cdot C_{CS}$
- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_L - (k_{23} + k_{32}) \cdot C_{TO} - k_{24} \cdot C_{kdn}$
- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_L - k_{24} \cdot C_{kdn} - k_{23} \cdot C_{TO} + k_{32} \cdot C_{TO}$
- $\frac{dC_{CS}}{dt} = (k_{12} - k_{10}) \cdot C_L - (k_{23} + k_{24}) \cdot C_{CS} + k_{32} \cdot C_{TO}$
- none of the enlisted



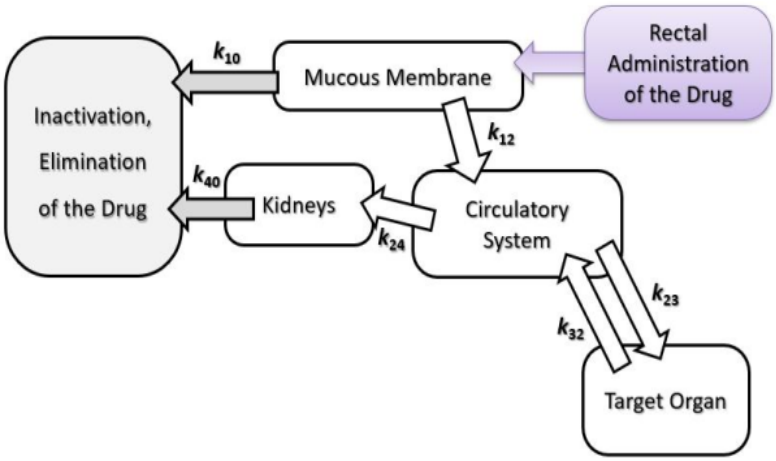
In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the target organ.

(designations used in the answers:

C -- concentration of drug;

GIT -- gastrointestinal tract; CS -- circulatory system; TO -- target organ; lvr -- liver ; kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_{TO}}{dt} = k_{23} \cdot C_{CS} - k_{32} \cdot C_{TO} - k_{35} \cdot C_{TO}$
- $\frac{dC_{TO}}{dt} = k_{12} \cdot C_{GIT} + k_{23} \cdot C_{CS} - k_{32} \cdot C_{CS} - k_{35} \cdot C_{lvr}$
- $\frac{dC_{TO}}{dt} = -k_{23} \cdot C_{CS} + k_{32} \cdot C_{TO} + k_{35} \cdot C_{TO} - (k_{50} + k_{40}) \cdot C_{out}$
- $\frac{dC_{TO}}{dt} = k_{32} \cdot C_{TO} - k_{35} \cdot C_{TO} - k_{23} \cdot C_{CS}$
- none of the enlisted



In the scheme of the multi-compartment pharmacokinetics model shown in the picture, select the equation that describes the change in drug concentration in the circulatory system.

(designations used in the answers:

C -- concentration of drug;

mm -- mucous membrane; CS -- circulatory system; TO -- target organ; kdn -- kidneys; out -- eliminated, inactivated)

- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_{mm} - (k_{24} + k_{23}) \cdot C_{CS} + k_{32} \cdot C_{TO}$
- $\frac{dC_{CS}}{dt} = (k_{12} - k_{10}) \cdot C_{mm} - k_{23} \cdot C_{TO} + k_{32} \cdot C_{TO} - (k_{24} + k_{40}) \cdot C_{kdn}$
- $\frac{dC_{CS}}{dt} = -k_{12} \cdot C_{mm} + k_{24} \cdot C_{kdn} + k_{32} \cdot C_{TO} - k_{23} \cdot C_{CS}$
- $\frac{dC_{CS}}{dt} = k_{12} \cdot C_{mm} - k_{24} \cdot C_{CS} - (k_{40} + k_{10}) \cdot C_{out} + (k_{32} - k_{23}) \cdot C_{TO}$
- none of the enlisted

Форми контролю самостійної роботи:

1. Контроль правильності виконання практичних завдань з теми.
2. Контроль правильності відповідей на тестові запитання

Вид навчальних занять, під час яких проводиться контроль самостійної роботи:

Самостійна робота виконується студентами і перевіряється викладачем у позааудиторний час. У разі виникнення суперечливих питань щодо виконання завдань або оцінювання самостійної роботи, ці питання вирішуються під час консультацій.

Критерії оцінювання самостійної роботи:

a. Розв'язок кожного практичного завдання оцінюється виходячи із максимальної оцінки 10 балів. Кожна помилка знижує максимальну оцінку на 10% (1 бал). Таким чином, максимальна оцінка за практичну частину самостійної роботи з даної теми складає 10 балів, мінімальний бал, необхідний для зарахування роботи становить 6 балів.
b. Проходження тесту оцінюється виходячи з максимальної оцінки 1 бал. Для зарахування тесту необхідно отримання не менше 60% правильних відповідей. Тест є тренувальним і кількість спроб проходження тесту необмежена. Зараховується результат найкращої спроби.