PLAN FOR DAGEN

Kurstid: 12:00 – 14:00

- Introduksjon
- Kjemikurs med Lars (~45 min)
- Pause (15 min)
- Biologikurs med Amanda (~45 min)
- Oppsummering og spørsmål

"REGLER"

- Hold kamera og mikrofon avskrudd
- Har du spørsmål?
  - Spar de til pausen eller oppsummeringen ♡

OM MEG

- Lars Tande
- 27 år
- Fra innlandets perle Hamar
- Interesser
- Hobbyer

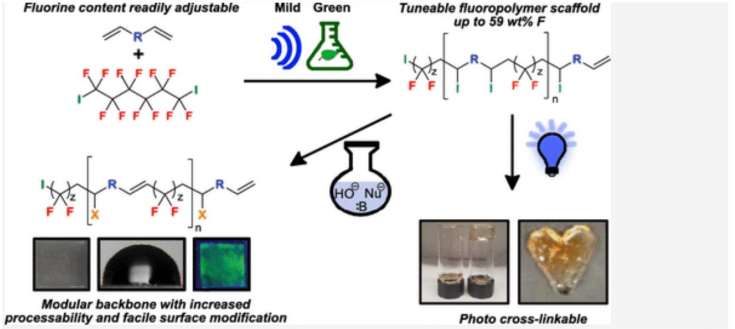

KJEMIKURS

TYPE OPPGAVER DERE VIL STØTE PÅ

- TENKEOPPGAVER
- TIOSBESPARENDE OPPGAVER
- SAMMENSATTE OPPGAVER
- REGNEOPPGAVER

TENKEOPPGAVER

Read the following text and answer the questions pertaining to it:



Fluoropolymers have infiltrated society as coatings and insulators. However, low processability, few opportunities for polymer functionalization, and explosive monomers hampering academic investigation of these materials have precluded the extension of the unique properties of perfluorocarbons to the cutting edge of material science. Here, we present semifluorinated iodo–ene polymers as a scaffold to overcome fluoropolymer limitations. A sodium dithionate initiated polymerization of perfluorodiiodides and dienes allows for high-molecular-weight polymers (>100 kDa) to be prepared in the presence of oxygen and water with up to 59 wt % fluorine content. These conditions are sufficiently mild to enable the polymerization of functional dienes, leading to biodegradable fluoropolymers. The iodo–ene polymerization results in the addition of polarizable iodine atoms, which improve polymer processability; yet, these atoms can be removed after processing for enhanced stability. Displacement of the iodine atoms with thiols or azides facilitates covalent surface modification and cross-linking. Finally, the low bond dissociation energy of the C–I bond allows allyl group addition as well as photo-cross-linking. Collectively, the simple synthesis and modular nature of the semifluorinated iodo–ene polymers will enable the convergence of perfluorocarbons and advanced materials. (Modular and Processable Fluoropolymers prepared via a Safe, Mild Iodo-Ene Polymerisation. J.A.Jaye, E.M.Sletten, *ACS Cent. Sci.* 2019, **5,** 982-991)

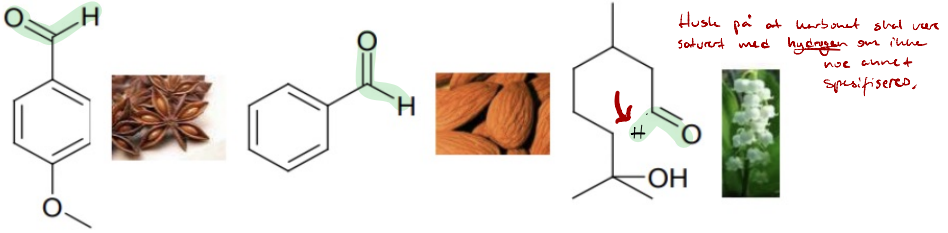
67. Why the synthesis of semifluorinated polymers is called green (see the scheme)?
    A. Because the products obtained are green-colored.
    B. Because the product obtained has the molecular weight > 100 kDa.
    C. Because the polymerization can be carried out in the presence of water and oxygen.
    D. Because it is a catalytic process (with sodium dithionate).
    E. Because the product obtained has a fluorine content up to 59 wt %.

67: Fenta logisk. Grønn = miljøvennlig.

68: Det er "tunable" fordi det kan justeres på to forskjellige måter for å lage enten modular backbone eller photo cross-linkable.

68. Which statement accurately describes the expression “tunable fluoropolymer scaffold”?
    A. It has a high molecular weight.
    B. It has the fluorine content up to 59 wt %.
    C. It can split off HI when treated by various bases.
    D. It can be cross-linked under influence of light.
    E. Answers C. and D. are correct.

65. Indicate the type of compound responsible for the fragrances presented below:



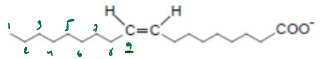
Hva er felles her?

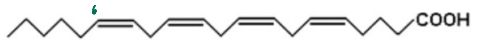
A. Ketones
B. Thiols
C. Carboxylic acids
D. Aldehydes
E. Esters

66. The omega-reference system of naming fatty acids (carboxylic acid characteristic for fats) indicates the number of carbons, the number of double bonds, and the position of the double bond closest to the omega carbon (the carbon in terminal methyl group), counting from the omega carbon. Omega−9 fatty acids are polyunsaturated fatty acids characterized by the presence of a double bond, nine atoms away from the terminal methyl group. (https://library.med.utah.edu/NetBiochem/FattyAcids/4_1c.html)

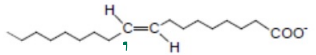
Omega-karbonet er første karbon alken-binding når man teller fra metyl-enden av fettsyren

Choose from the following the correct answer were all listed acids belong to the class of Omega−9:

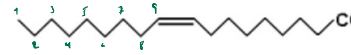
✓ 1 

2 

3 

✓ 4 

5 

✓ 6 

A. only 2

B. 1 and 6

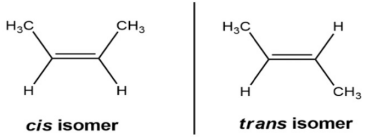
C. 3 and 5

D. 2,4 and 5

E. 1, 3 and 4

Her har vi 3 omega-9 fettsyrer, men av alternativene er det kun B som KUN inneholder omega-9 fettsyrer.

67. *Cis/trans* geometric isomers are molecules that are locked into their spatial positions with respect to one another by a double bond or a ring structure. They have the same structure but a different spatial arrangement of atoms as presented in the example.



The fatty acids no. 1 and 4 from the previous question represent the following geometry, respectively:

A. 1 – trans, 4 – cis

B. 1 – cis, 4 – trans

C. 1 and 4 – trans

D. 1 and 4 – cis

E. Neither cis nor trans for 1 and 4

Cis er samme side, trans er motsatt (latin)
↳ Etymologi: kjekt å vite utenlig mye innen bl.a. kjemi og medisin

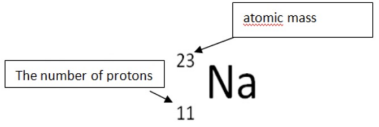
SAMMENSATTE OPPGAVER

Questions 46 – 47 refer to the following additional information:

The electrons in an atom are arranged in shells that surround the nucleus. Each shell has a different energy level, increasing the further it is from the nucleus. Each energy level is given a number-principal quantum number, n. Because *n* describes the most probable distance of the electrons from the nucleus, the larger the number *n* is, the farther the electron is from the nucleus, the larger the size of the orbital, and the larger the atom is.

Within the shells, electrons are further grouped into subshells (orbitals) of four different types, identified as s, p, d, and f in order of increasing energy.

There are n^2 subshells for each energy level. For n=1, there is 1^2 or one orbital. For n = 2, there are 2^2 or four orbitals. All orbitals that have the same value of n are said to be in the same shell (level). To calculate the maximum number of electrons in each shell, the formula $2n^2$ can be used (Dan Berger *Re: Why do electron shells have set limits ? madsci.org*, 17 March 1999). Each electron subshell can contain a certain amount of electrons, s = 2, p = 6, d = 10 and f = 14. Electrons fill the shell and subshell levels in a semi-regular process. After filling the first shell level (with only an *s* subshell), electrons move into the second-level *s* subshell and then into the *p* subshell before starting on another shell level. Because of its lower energy state, the 4*s* orbital fills before the 3*d* (*Encyclopaedia Brittanica*).



Electron configuration of Kr $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6$.

Atoms are composed of particles called protons, electrons, and neutrons. Protons carry a positive electrical charge, electrons carry a negative electrical charge, and neutrons carry no electrical charge. The atom is electrically neutral and the vast majority of its mass is concentrated in its nucleus (*Kaznowski and Pazdro "Chemistry"*).

46. Indicate the correct notation of the electron configuration of the Ag atom **in ascending order of orbital energies:**

A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^1$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^2 4d^9$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^9$

D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^9 5s^2$

E. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10}$

4s fylles før 3d
Vi får ikke oppgitt informasjon om 5s og 4d, men det er irrelevant ettersom alle alternativer starter C har 3d før 4s.

47. Indicate the correct number of neutrons in Ag atom:

A. 30

B. 47

C. 61

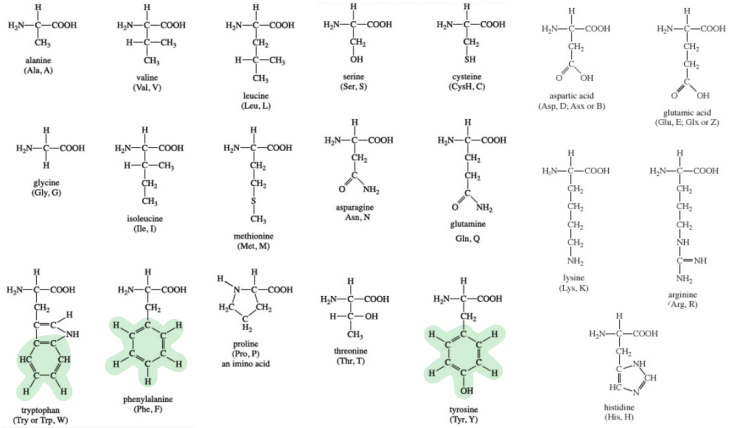
D. 107

E. 108

Antall protoner
Atommasse til Ag = 47
Atommasse for Ag = 107.868
Atommasse for protoner og nøytroner er cirka 1
107.868 - 47 = 60.868 ≈ 61

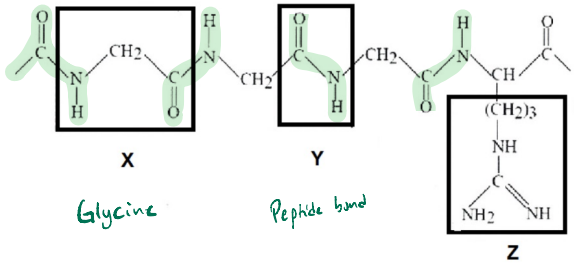
The following text and pictures 1 and 2 refer to questions 75 through 78

Picture 1 below shows the select formulas, names, and three-letter abbreviations of amino acids that can be present in human proteins. https://www.britannica.com/science/amino-acid



Picture 1. Amino acids formulas and names.

At the turn of the twentieth century, a German chemist Emil Fischer was the first to propose the linking together of amino acids, which he called the peptide bond. They can be linked by a condensation reaction in which an -OH is lost from the carboxyl group of one amino acid along with a hydrogen from the amino group of a second amino acid, forming a molecule with an amide bond: -COHN-. (https://www.britannica.com/science/amino-acid/Amino-acid-reactions#ref997074).



Picture 2. Polypeptide formula.

75. How many peptide bonds are present in the polypeptide fragment in Picture 2?

A. 1
B. 2
C. 3
D. 4
E. 5

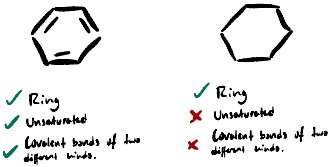
76. The **Z** frame from the Picture 2 is:

A. Alanine
B. Cysteine
C. Polypeptide bond
D. Glycine
E. Side chain of arginine

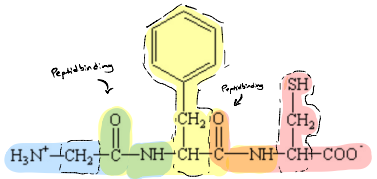
77. Indicate which of the following amino acids have an aromatic side chain

A. Tyrosine
B. Phenylalanine and Tryptophan
C. Valine and Leucine
D. Histidine
E. Both A and B

"... unsaturated chemical compounds characterized by one or more planar rings of atoms joined by covalent bonds of two different kinds"

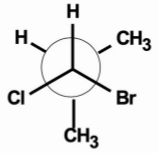


78. Choose the CORRECT tripeptide sequence:

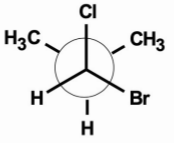


A. Gly -Phe -Cys
B. Glu – Tyr – Met
C. Cys – Phe – Gly
D. Ala – Tyr – Cys
E. Gly - Phe – Met

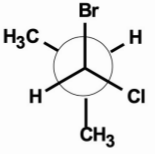
77. Below, various Newman projections along C^1-C^2 bond of 1-bromo-1-chloro-2-methylpropane are presented. Which of them depict the same stereoisomer?(Remember that in Newman projection 3 substituents at C^1 are shown in front of the circle, and 3 substituents at C^2 are shown behind the circle. The free rotation along C-C bond is possible and is well depicted by this projection).



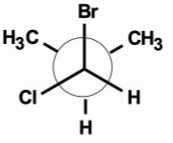
1.



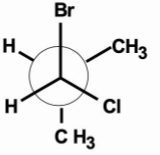
2.



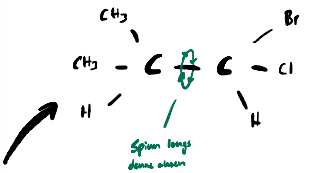
3.



4.



5.



77.

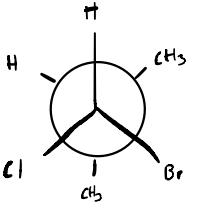
A. 1. and 3.
B. 1. and 2.
C. 2. and 4.
D. 1. and 5.
E. Answers A., C., and D. are correct.

Roterer de, og ser at 1 og 3, 2 og 4 og 1 og 5 er helt like, bare i annen konfigurasjon langs karbonkjeden.

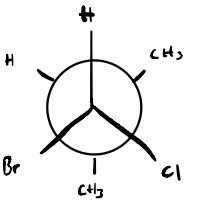
78. Which of them depict enantiomers?

A. 1. and 2.
B. 2. and 4.
C. 1. and 3.
D. 1. and 5.
E. None

"Roterer de" i hodet mitt. Br og Cl er speilbilder, altså er 1 og 2 enantiomerer.



1



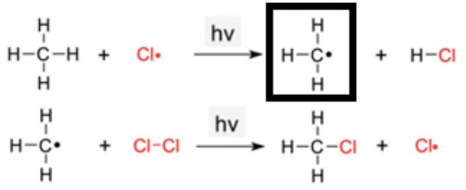
2

Types of organic reactions

SUBSTITUTION	ADDITION	ELIMINATION
nucleophilic electrophilic free radical	nucleophilic electrophilic	

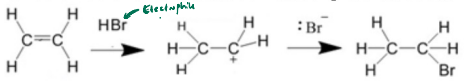
Carbocation is the characteristic chemical entity occurring during the reaction with electrophilic mechanism. It has the positive charge present on one of the carbons of the reacting compound. The characteristic chemical entity taking part in the reaction with nucleophilic mechanism is called nucleophile – a molecule or group in which there is an excess of electrons acting as a donor [e.g., OH^-, F^-, CH_3S^-, $(CH_3)_3N$:]. Free radicals created in the presence of light (hv) are characteristic for substitution with free radical mechanism (e.g., •Br, •CH_3-CH_3). The reaction type specific for the arenes is substitution (electrophilic), the one specific for the alkynes and alkenes is addition, while for the alkanes it is substitution (radical).

68. The chemical entity in the frame is a(n):



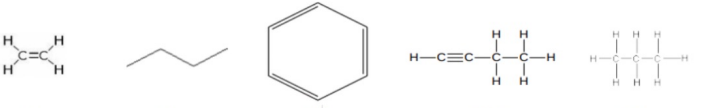
A. nucleophile — Udelt elektronpar med delvis negativ ladning
B. radical — Kun ett uparet elektron, ujevnmetning av •
C. carbocation — C^+
D. carbanion — C^-
E. electrophile — Elektron-mangelende molekyl med delvis positiv ladning

69. Name the mechanism of the addition reaction presented below:



A. electrophilic
B. nucleophilic
C. free radical
D. E1
E. E2

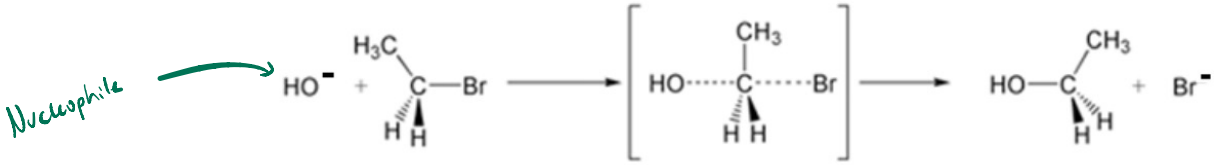
70. Which of the compounds will undergo the addition reaction?



I II III IV V

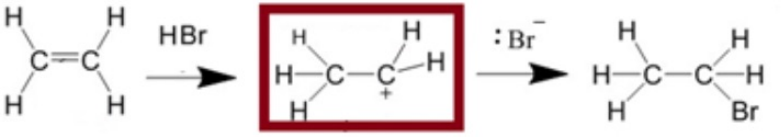
A. I and V
B. I and IV — Her dobbelt- eller trippelbindinger som kan angripes.
C. II and III
D. II and V
E. I, III and IV — Benzene gjør ikke det, fordi det er for stabilt.
↳ Substitusjonsreaksjoner er mulig, men ikke addisjon.

64. Name the mechanism of the substitution reaction presented below:



A. electrophilic
B. nucleophilic
C. free radical
D. E1
E. E2

65. The chemical entity in the frame is called:



A. nucleophile
B. radical
C. carbocation
D. carbanion
E. A and D correct

Et l'carbon sans er et l'cation.

The following information refers to questions 56 through 58

The bicarbonate buffer system is an acid-base mechanism that involves the balance of bicarbonate ions (HCO_3^-), carbon dioxide (CO_2) and carbonic acid (H_2CO_3) to maintain blood pH, homeostasis (the state of steady internal, physical, and chemical conditions maintained by living systems), and proper metabolic function (doi:10.1002/jps.24108, https://www.worldcat.org/title/anatomy-and-physiology/oclc/1001472383).

Reactions of bicarbonate buffer system catalyzed by carbonic anhydrase are:

$$CO_2 + H_2O = H_2CO_3 = H^+ + HCO_3^-$$

Simple acid-base disorders are divided into acidosis or alkalosis, as well as metabolic or respiratory disorders. They are classified as metabolic if the change in pH is primarily due to an alteration in serum bicarbonate (HCO_3-). They are classified as respiratory if the change is primarily due to a change in pCO_2 (increase or decrease in ventilation). The graph below presents the values of pH, (HCO_3-) and pCO_2 that allow to determine the appropriate type of simple acid-base disorder.

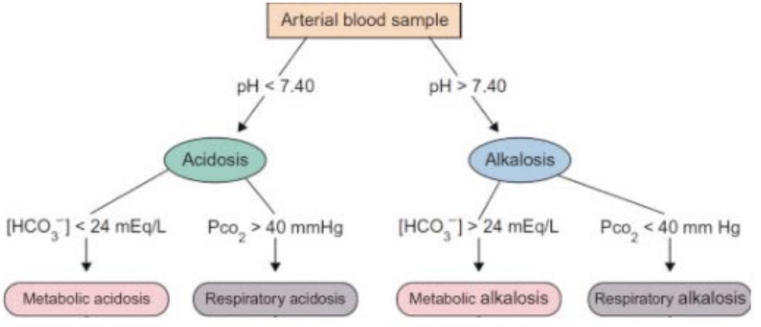


Figure 37.8. Classification, characteristics of simple acid–base disorders.

R. M. Berne, M. N. Levy, Principles of physiology, 3rd ed.

Water, Electrolytes, and Acid–Base Balance N.V. Bhagavan Chung-Eun Ha, in Essentials of Medical Biochemistry (Second Edition), 2015

56. Analyze the picture and decide which answer is true for acid base homeostasis in arterial blood sample (where pH is at physiological range and the components of bicarbonate buffer are in the proper concentrations)

A. pH 7.2; $[HCO_3^-] = 24$ mEq/L, $pCO_2 = 50$ mm Hg
B. pH 7.5; $[HCO_3^-] = 40$ mEq/L, $pCO_2 = 40$ mm Hg
C. pH 7.4; $[HCO_3^-] = 24$ mEq/L, $pCO_2 = 40$ mm Hg
D. pH 7.3 $[HCO_3^-] = 24$ mEq/L, $pCO_2 = 40$ mm Hg
E. pH 7.4; $[HCO_3^-] = 40$ mEq/L, $pCO_2 = 60$ mm Hg

57. Determine the metabolic disorder with the given set of parameters in arterial blood sample pH 7.55; $[HCO_3^-] = 24$ mEq/L, $pCO_2 = 28$ mm Hg

A. metabolic acidosis
B. metabolic alkalosis
C. respiratory acidosis
D. respiratory alkalosis
E. mixed disorder where all parameters are not within the range

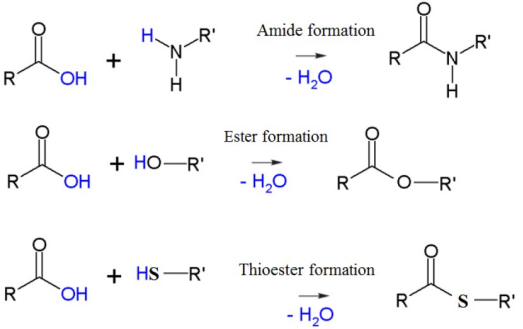
58. Brønsted-Lowry theory called a proton theory of acids and bases states that any compound that can transfer a proton to any other compound is an acid, and the compound that accepts the proton is a base. A proton is a nuclear particle with a unit positive electrical charge; it is represented by the symbol H^+ because it constitutes the nucleus of a hydrogen atom (https://www.britannica.com/science/Bronsted-Lowry-theory).

Determine the role of the bicarbonate buffer system components in terms of the Brønsted-Lowry theory.

A. H_2O is a base and H+ is an acid
B. CO_2 is a base and HCO_3^- is an acid
C. HCO_3^- is a base and H_2CO_3 is an acid
D. H_2O is a base, and CO_2 an acid.
E. All of the above are possible

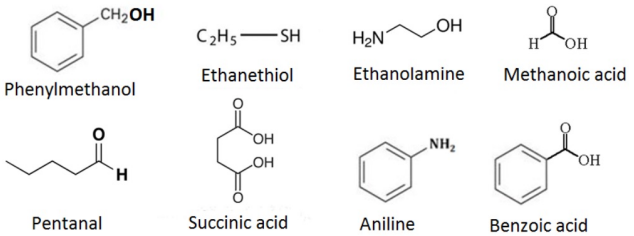
The following information refers to the questions no. 72 – 74

The reaction equations below present amide, ester, and thioester formation, where R and R' stand for the chosen aliphatic/aromatic side chain.



An amide and ester bond can be broken by addition of H_20. The process is called hydrolysis.

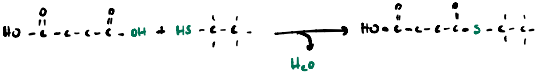
<u>The following compounds are given:</u>



72. Which pair of the compounds will theoretically create an amide bond?
A. There is no such pair of compounds that will create an amide bond.
B. pentanal and aniline
C. pentanal and ethanolamine
D. methanoic acid and aniline
E. B and D are correct

72: Det er kun D som gir mening, ettersom vi trenger både en –OH -gruppe OG en primær/sekundær amins lokalisert ved siden av et karbon med et O dobbeltbundet til seg.

73. Indicate the formula of the thioester created in the reaction of ethanethiol and succinic acid?
A. $C_3H_4CO\text{-}O\text{-}C_2H_5$
B. $HOOC\text{-}C_2H_4CO\text{-}S\text{-}C_2H_5$
C. $C_2H_5CO\text{-}S\text{-}C_4H_4$
D. $C_6O_4H_{12}S$
E. $HOOC\text{-}C_4H_6CO\text{-}SH$



74. In an ester formation process, the following compounds may theoretically create a product:
A. phenylmethanol and succinic acid
B. phenylmethanol and benzoic acid
C. ethanolamine and methanoic acid
D. B and C are correct
E. A, B and C are correct

74: Vi trenger en primæralkohol (-OH) og en karboksylsyre ($C^{=O}_{-OH}$) for å lage en ester.

↳ Alle de kombinasjonene foreslått kan teoretisk produsere en ester.

TIDSBESPARENDE OPPGAVER

49. *0.45% sodium chloride for injection contains 4.5 NaCl g/L; 1 g = 1000 mg and 1L = 1000 mL*
Choose the correct answer:

A. 0.5% sodium chloride injection contains 0.45 NaCl g/L

B. 1% sodium chloride injection contains 1 NaCl mg/L

C. 0.5% sodium chloride injection contains 0.45 NaCl g/L

D. 0.9% sodium chloride injection contains 9 NaCl mg/mL

E. 0.9% sodium chloride injection contains 0.9 NaCl g/L

$$0.45\ \%\ NaCl = \frac{4.5}{1000} \Longrightarrow 0.9\ \%\ NaCl = \frac{9}{1000}$$

* Det er ikke samme enhed, men forholdstallet på 1/1000 er det samme for både g/L og mg/mL

54. Mepivacaine is a local anesthetic used in medical treatment. The range of its action depends on the concentration of the solution used. Its solutions act as follows:

- 0.5% - anesthesia of small surface sensory nerves;
- 1% - blocking conduction in sensory and sympathetic nerves;
- 1.5% - complete anesthesia and partial tracheal block in nerve cell motions;
- 2% - complete block in nerve cell movements.

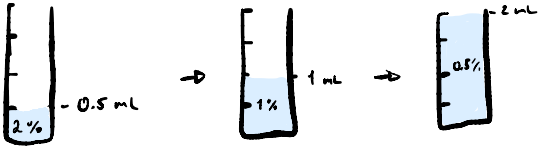
Source: https://bazalekow.mp.pl/leki/doctor_subst.html?id=541

You have 0.5 ml of Mepivacaine solution that completely blocks cell movements, but you need to anesthetize only the small surface sensory nerves. How many ml of sterile injectable water should be added to your Mepivacaine solution to obtain the proper concentration?

A. 0.25 ml
B. 0.5 ml
C. 1 ml
D. 1.5 ml
E. 2 ml

0.5 mL and 2% concentration.

Vi ønsker 0.5 % konsentrasjon.



2 mL - 0.5 mL = 1.5 mL

REGNEOPPGAVER

60. Balance the chemical equation and calculate how many grams of NaCl will be obtained if 40g of Na_2SO_4 had reacted.

$Na_2SO_4 + BaCl_2 \rightarrow 2NaCl + BaSO_4$

Ferdig balansert

$Na_2SO_4 + 2\,BaCl_2 \rightarrow 2\,NaCl + BaSO_4$

2	Na	2
1	S	1
4	O	4
1	Ba	1
2	Cl	2

A. 16.8g

B. 33g

C. 24g

D. 12g

E. 58.5g

$Mm_{Na_2SO_4} = 142.04\ g/mol$

$n_{Na_2SO_4} = \frac{40\ g}{142.04\ g/mol} = 0.282\ mol$

$Mm_{NaCl} = 58.44\ g/mol$

$m_{NaCl} = (0.282\ mol \cdot 58.44\ g/mol) \cdot 2 = 32.96\ g \approx 33\ g$

48. Every chemical equation adheres to the law of conservation of mass, which states that matter cannot be created or destroyed. Therefore, there must be the same number of atoms of each element on each side of a chemical equation (*Boundless Chemistry Steve Lower's Website*). Substances react with each other in a strictly defined quantitative ratio, thus to balance an equation, it is necessary that there are the same number of atoms on the left side of the equation as on the right. In a balanced reaction, both sides of the equation have the same number of elements. The stoichiometric coefficient is the number written in front of atoms, ions, and molecules in a chemical reaction to balance the number of each element on both the reactant and product sides of the equation (*Joseph Nijmeh, Mark Tye Chemistry LibreText*).
Balance the chemical equation and calculate how many grams of $Al(NO_2)_3$ will be obtained if 40g of Al_2O_3 had reacted:

$$Al_2O_3 + HNO_2 \rightarrow Al(NO_2)_3 + H_2O$$

A. 110.5g

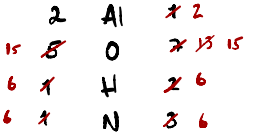
B. 64.73g

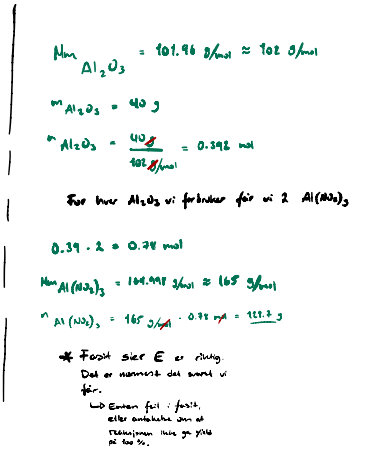
C. 188g

D. 40g

E. 121.67g

1: Balanser for Al
2: Balanser for N
3: Balanser for H og O på H_2O





BONUS : VENN-DIAGRAM

stones og pink må overlappe, ettersom steiner kan være både rosa eller ikke.

Which conclusions are true based on the statements below?

Statements:

- Some stones aren't pink.
- Some pink things are big.
- All big things aren't heavy.

Noen pink ting er big, og de kan derved overlappe men det sier ingenting om stones, så de kunn derfor ikke la de to overlappe.

Dette betyr at pink og big skal overlappe, ettersom det både finnes lunge rosa ting og lunge lunge rosa ting

95.	All pink things are heavy.	True	False
96.	Some stones might not be heavy.	True	False
97.	Some pink things are stones.	True	False
98.	All big things are stones.	True	False
99.	Some heavy things might be pink.	True	False *

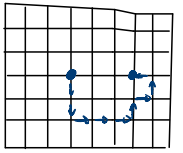
Systematiser informasjonen din før du går videre til spørsmålene

Trekk logiske slutninger ved å se hvilke populasjoner med ting som overlapper hverandre.

* Fasiten sier 99 er riktig, jeg er uenig 😕
→ Send gjerne inn et løsningsforslag om du finner den har et bedre svar!

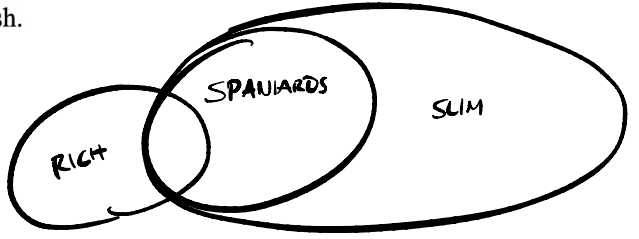
92. **Sally rides a bike from her apartment to the office, and every morning she visits her favourite café on the way. To get to the café, she rides two hundred meters to the south and then turns left and continues for 300 m. After a short coffee break, she rides 100 m to the north, turns right, and in 100 m she turns left. In 100 m, she turns left again and walks for 100 m. Her office is straight ahead. In which direction relative to Sally's apartment is her office located?**

A. East
B. West
C. South
D. South-East
E. South-West



93. **If all Spaniards are slim and some rich people are Spanish, then which of the statements is always true?**

A. There is no slim person who is not Spanish.
B. All Spaniards are rich.
C. Some rich people are slim.
D. All slim people are rich.
E. Some Spaniards are rich but not slim.



100. **Five years ago, Mark was five times older than his son. In one year from now, his age will be equal to three times that of his son. How old is Mark?**

A. 12
B. 28
C. 30
D. 35
E. 36

Felles nevner er 5
Lo Roskeste metode er bare å prøve deg

	5 år siden			1 dag			Om ett år		
Mark	25	20	30	30	25	35	31 ✗	26 ✗	36 ✓
Son	5	4	6	10	9	11	11 ✗	10 ✗	12 ✓

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