PLAN FOR DAGEN

Kurstid: 18:00 - 20:00

- 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

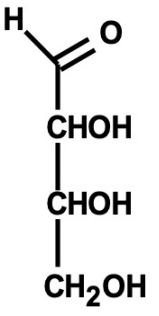
TYPE OPPGAVER DERE VIL STØTE PÅ

- TENKEOPPGAVER
- TIOSBESPARENDE OPPGAVER
- SAMMENSATTE OPPGAVER
- REGNEOPPGAVER

TENKEOPPGAVER

23. How many stereoisomers (enantiomers and diastereoisomers) are possible for this aldotetrose:

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



Formul for diastereoisomer $2^n - 2$

↖ Disse fjernes fordi de er enantiomer

↳ Derfor $2^n = 2^2 = 4$

50. At 40 °C, compound X is a liquid, compound Y is a gas, and compound Z is a solid. The single set of melting points (in kelvins) of these compounds could be:

	X	Y	Z
A.	303	323	373
B.	323	298	273
C.	273	298	323
D.	313	323	473
E.	303	198	298

Her skal du regne om Kelvin til celsius.

↳ Celsius = kelvin − 273,15

Ser på svaret først, og leter etter ting som ikke passer.

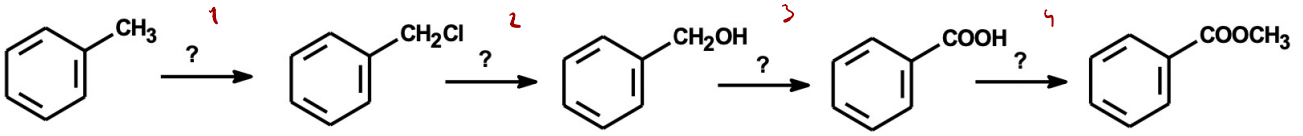
↳ X skal være flytende ved 40°C (313°K), kan stryke B ettersom det ville vært fast.

↳ Y skal være gass ved 313°K, kan stryke A og D ettersom de er fast stoff frem til 323°K.

↳ Z skal være fast stoff ved 313°K, kan stryke E ettersom det ville vært smeltet/fordampet ved 313°K.

↳ Sitter igjen med C, hvor alt passer.

24. Indicate the sequence of reagents that should be used to synthesize the final compound in the scheme below:



A. HCl; H_2O; $K_2Cr_2O_7$; CH_3OH/H_3O^+
B. Cl_2/hv; NaOH aq; $KMnO_4$ aq; CH_3OH/H_3O^+
C. HCl; H_2O; $K_2Cr_2O_7$; CH_3OH/H_3O^+
D. NaCl; H_2SO_4; $KMnO_4$ aq; CH_3COOH
E. Cl_2/hv; H_2O; H_2O_2; CH_3COCH_3

Tenk logisk, hvilke reaktanter og enioner kan reagere sammen?

1: Cl_2 brukes, og det dannes HCl + riste molekyl

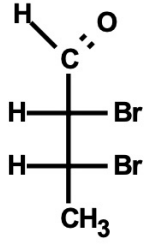
↳ kan umiddelbart stryke A, C og D ettersom de i tillegg til Cl^- har kationer (Na+ og H+) som ikke kan reagere med H+ fra molekyl 1.

2: NaOH kan danne benzyl alcohol fra benzyl chloride ved nucleophilic substitution.

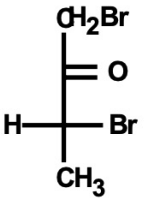
↳ H_2O kan ikke, ettersom den ikke er en kraftig nok nucleophile.

3: Trenger ikke mer, riktig svar er B

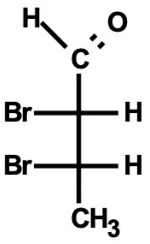
33. Presented below are 5 isomers of the compound $C_4H_6Br_2O$:



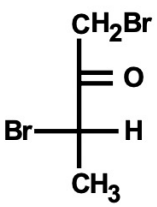
a



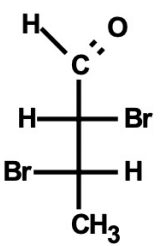
b



c



d



e

Which of the following statements concerning their isomerism is INCORRECT?

A. **a** and **b** are constitutional isomers → isomer med samma "constituents", samma numrer av de funktionella atomen.
B. **a** and **c** are enantiomers → spegelbilder
C. **a** and **e** are diastereoisomers → ikke spegelbilder, men ikke identiske.
D. **b** and **d** are enantiomers → spegelbilder
E. **c** and **e** are *E/Z* isomers → dobbeltbundet isomer med högsta prioritet enten på samma sida (Z, cis) eller motsatt sida (E, trans)
   → Z = Zusammen
   → E = entgegen

SAMMENSATTE OPPGAVER

The following information refers to questions no. 48 – 50

The four quantum numbers *n*, *l*, *m*, and *s* specify the complete and unique quantum state of a single electron in an atom, called its wave function or orbital.
The principal quantum number *n* designates the principal electron shell. 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. *N* can be any positive integer starting at 1, as *n* = 1 designates the first principal shell (the innermost shell). The first principal shell is also called the ground state, or lowest energy state. As the energy of the electron increases, so does the principal quantum number, e.g., *n* = 3 indicates the third principal shell, *n* = 4 indicates the fourth principal shell, and so on. The orbital angular momentum quantum number *l* determines the shape of an orbital, and therefore the angular distribution. The number of angular nodes is equal to the value of the angular momentum quantum number *l*. Each value of *l* indicates a specific s, p, d, f subshell. The value of *l* is dependent on the principal quantum number *n*. It takes the values from 0 to *n*-1 e.g. for *n* = 2, the values of *l* are 0 and 1. The number of values of the orbital angular number *l* can also be used to identify the number of subshells in a principal electron shell:

To identify what type of possible subshells *n* has, these subshells have been assigned letter names. The value of *l* determines the name of the subshell:

Name of Subshell	Value of *l*
s subshell	0
p subshell	1
d subshell	2
f subshell	3

We can designate a principal quantum number, *n*, and a certain subshell by combining the value of *n* and the name of the subshell (which can be found using *l*). For example, 3p refers to the third principal quantum number (*n* = 3) and the p subshell (*l* = 1) (Anastasiya Kamenko, Tamara Enriquez , Mandy Lam, Craig Fisher *Chemistry LibreText*).

48. If *l* = 5, how many angular nodes does the atom have?
A. 4
B. 6
C. 5
D. 1
E. 3

49. What is the name of the orbital with quantum numbers *n* = 5 and *l* = 1?
A. 4f
B. 5p
C. 3f
D. 2d
E. 4d

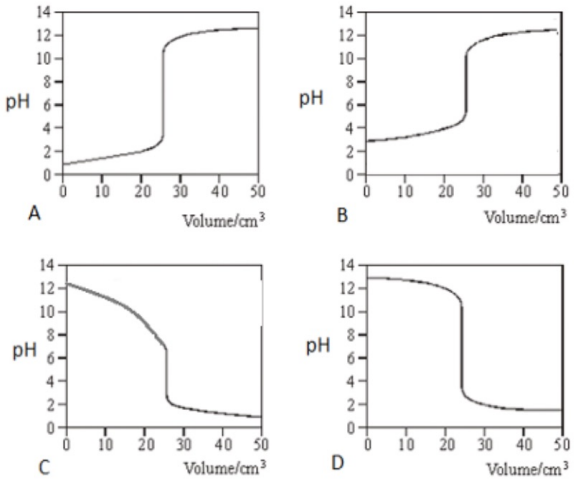
Ernste av alternativene som har p, som tilsvarer *l* = 1

50. What is the name of the orbital(s) with quantum number *n* = 2?
A. s, p
B. s
C. p
D. d
E. s, p, d

n = 2
l = fra 0 til *n*-1, altså 0 og 1
0 = s
1 = p

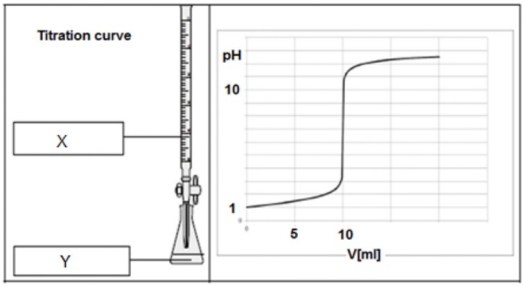
The following information refers to questions 59 through 61

Titration is a technique used to determine the concentration of an unknown solution. A titrant, which is a solution of known concentration, is used to determine the concentration of an unknown solution - analyte. A **titration curve** is a graphical representation of the pH of a solution during a titration. The titration curves below present the changes of pH vs. the volume of added solution for combinations of different acids and bases, among others: for strong acids, which we can name: HCl, HBr or HNO_3; for strong bases: NaOH, KOH, or LiOH; for weak acids: CH_3COOH, HCOOH or HNO_2; and for weak bases: $NH_3 \cdot H_2O$.



Graph A represents the titration of a strong acid with a strong base, graph B a weak acid with a strong base, graph C represents the titration of weak base with a strong acid graph D a strong base with strong acid.

59. Choose the appropriate set of acid and base for X and Y;$1cm^3$=1ml.



A. X - $NH_3 \cdot H_2O$; Y – HBr
B. X - NaOH; Y – HCl
C. X – HBr; Y – CH_3COOH
D. X – HNO_3; Y – KOH
E. X – LiOH; Y – HCOOH

Grafen ligger på A, altså titrering av stark syre med stark base.

60. Taking into consideration task no. 59, the pH of the analyte solution at the beginning of the titration equaled:

A. 1
B. 3
C. 10
D. 12.5
E. 7

Base i vilken på grafen ☺

61. Taking into consideration task no. 59 and knowing that the formula to calculate the pH of a strong acid is pH = - log[H+], when pOH for strong base is pOH = - log [OH-] and pH + pOH = 14, calculate the analyte ion from task 59 concentration before titration (when V=0ml). Assume complete dissociation of the strong base and acid used in the experiment as follows: $HX = H^+ + X^-$ and $BOH = B^+ + OH^-$ where HX – strong acid, BOH – strong base; as well as the unit M (mole/L)

A. 0.005 M
B. 1 M
C. 0.1 M
D. 0.01 M
E. It cannot be determined from the picture

$[H^+] = x$

$pH = -\log x$

$1.0 = -\log x$

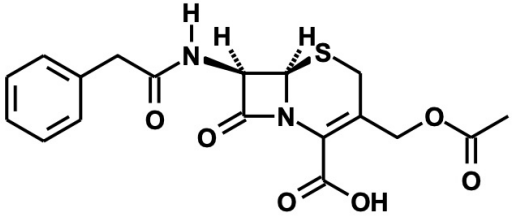
$10^{1.0} = 10^{-\log x}$

$10 = \frac{1}{x}$

$10x = 1$

$x = 0.1$

56. The Cefaloram, the first generation Cephalosporin antibiotic, still raises interest despite having been known relatively long (O. Soren et al, Journal of Antimicrobal Chemotherapy, **74** (1), 117-125 **2020)**



This is a line-angle (skeleton) formula. Choose the correct molecular formula of Cefaloram assuming that in this mode of presentation carbon atoms appear at the end of each segment, and all carbon atoms are connected with the number of hidden hydrogen atoms corresponding to their valence*:

*Valence is the property of an element that determines the number of other atoms with which an atom of the element can combine; hydrogen and halogens are usually monovalent, oxygen and sulphur divalent, nitrogen and phosphorus trivalent, and carbon tetravalent.

A. $C_{18}H_{16}N_2O_6S$
B. $C_{18}H_{18}N_2O_6S$
C. $C_{16}H_{16}N_2O_6S$
D. $C_{18}H_{18}NO_6S$
E. $C_{18}H_{18}N_2O_5S$

① starter med dem som er lett å telle, oksygen, stryker E
② Fortsetter til N, stryker D
③ Går til C, stryker C
④ Sitter igjen med hydrogen, her må man bare telle riktig

57. What is the number of atoms with certain valence in Cefaloram?

A. 14 monovalent, 6 divalent, 2 trivalent and 18 of tetravalent atoms
B. 16 monovalent, 7 divalent, 2 trivalent and 18 of tetravalent atoms
C. 16 monovalent, 7 divalent, 1 trivalent and 16 of tetravalent atoms
D. 18 monovalent, 7 divalent, 2 trivalent and 18 of tetravalent atoms
E. 18 monovalent, 6 divalent, 2 trivalent and 18 of tetravalent atoms

Bruker svaret fra forrige oppgave, veldig enkelt poeng å få med seg!
↳ OBS! Både oksygen og svovel er divalente!

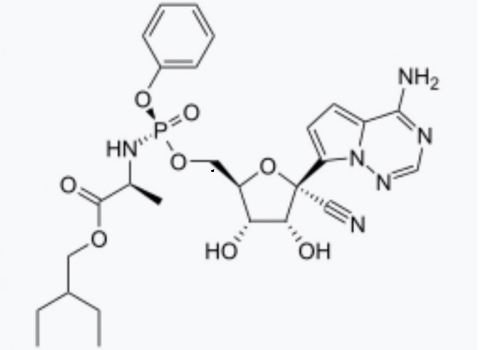
TIDSBESPARENDE OPPGAVER

73. **Remdesivir** is an antiviral medication. During the COVID-19 pandemic, remdesivir was approved or authorized for emergency use to treat COVID-19 in around 50 countries. Updated guidelines from the World Health Organization from November 2020 include a conditional recommendation against the use of remdesivir for the treatment of COVID-19 (https://www.gilead.com/news-and-press/press-room/press-releases/2020/10/us-food-and-drug-administration-approves-gileads-antiviral-veklury-remdesivir-for-treatment-of-covid19)

What is the chemical formula of the drug?

TOTALT UNYTTIG

Spørsmålet står her ☺ Les det først!



A. $C_{17}H_{35}N_6OP$

B. $C_{27}H_{35}N_6O_8P$

C. $C_{27}H_{15}N_6O_8P$

D. $C_{27}H_{35}N_6O_8$

E. $C_{17}H_{35}O_8P$

① P: skal være én, stryker D

② N: er tilstede, stryker E

③ O: er åpenbart mer enn kun én, stryker A

④ C: er lik på begge.

⑤ H: man kan telle hvis man har tid, men et trent øye ser at det åpenbart er nærmere 35 enn 15, stryker C

60. Evaporation is a chemical process by which an element or compound transitions from its liquid state to its gaseous state below the temperature at which it boils; such a process can be carried out by heating a suitable liquid in a ceramic vessel over a gas burner. Decantation is a process of pouring off the liquid from above the sediment that lies beneath the liquid in the vessel. Sedimentation uses gravity or a centrifuge to separate the mixture components according to density. Gravity filtration is a method of filtering impurities from solutions by using gravity to pull liquid through a filter (https://www.britannica.com/science/evaporation https://sciencenotes.org/what-is-decantation-definition-and-examples-chemistry/)https://orgchemboulder.com/Technique/Procedures/Filtration/Filtration.shtml)

Choose the correct name for the process.

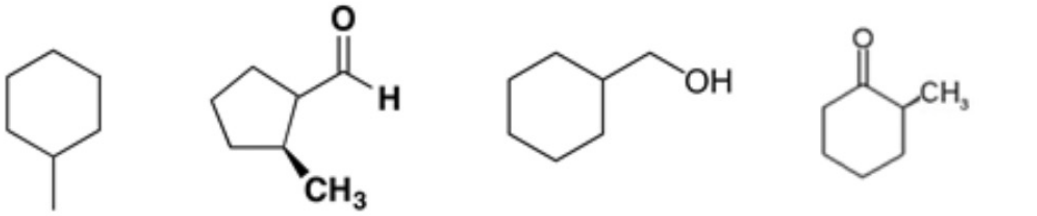
A. 1- gravity filtration, 2 – sedimentation, 3 - decantation
B. 1- sedimentation, 2 – evaporation, 3 – gravity filtration
C. 1- decantation, 2 – evaporation, 3 - sedimentation
D. 1- gravity filtration, 2 – evaporation, 3 - decantation
E. 1- decantation, 2 – sedimentation, 3 - decantation

Med mindre du kunn dette fra før, er dette en oppgave det faktisk er lurt å lese på.

Egentlig i prinsippet bare multiple choice liste, og dersom jeg ser en av disse prosessene som jeg kjenner igjen på bildene, men hvor rekkefølgen ikke stemmer med et alternativ, så kan jeg stryke det.

Eksempel: decantation ser jeg er nr 3. Kan derfor stryke B og C, ettersom de ikke stemmer overens.

64. Choose the correct types of compounds for the following formulas (1-4)

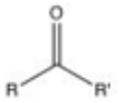
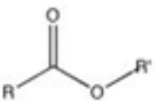
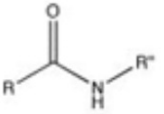


1 2 3 4

A. cycloalkene, alcohol, cycloketone, phenol
B. cycloalkane, aldehyde, cycloalcohol, cycloketone
C. phenol, cycloketone, cycloalkene, cycloaldehyde
D. cycloalkene, cycloketone, cycloaldehyde, cycloalkane,
E. cycloalkyne, aldehyde, phenol, cycloketone

Har du kontroll så tar denne max 10 sekunder!

65. The possible compounds for general formula I, II, and III are:

I  II  III 

A. I - aldehyde; II – ether or carboxylic acid; III – amine or amide
B. I - ketone; II – ether or acyl chloride; III – amino acid
C. I - ketone; II – ester or carboxylic acid; III –amide
D. I - ketone or aldehyde; II – ester or acyl chloride; III – amino acid
E. I - aldehyde; II – ester or carboxylic acid; III –amine

1. **In an aqueous solution, molar concentration of OH^- anions is 100 times higher than the concentration of H^+. pH of this solution equals:**

A. 6
B. 8
C. 9
D. 10
E. 12

[H+]	[OH-]	pH
1.0	1.0×10^{-14}	0.00
1.0×10^{-1}	1.0×10^{-13}	1.00
1.0×10^{-2}	1.0×10^{-12}	2.00
1.0×10^{-3}	1.0×10^{-11}	3.00
1.0×10^{-4}	1.0×10^{-10}	4.00
1.0×10^{-5}	1.0×10^{-9}	5.00
1.0×10^{-6}	1.0×10^{-8}	6.00
1.0×10^{-7}	1.0×10^{-7}	7.00
1.0×10^{-8}	1.0×10^{-6}	8.00
1.0×10^{-9}	1.0×10^{-5}	9.00
1.0×10^{-10}	1.0×10^{-4}	10.00
1.0×10^{-11}	1.0×10^{-3}	11.00
1.0×10^{-12}	1.0×10^{-2}	12.00
1.0×10^{-13}	1.0×10^{-1}	13.00
1.0×10^{-14}	1.0	14.00

Ved pH 7 : 1 : 1 forhold mellom H^+ / OH^-

Ved pH 8 har vi 10 ganger flere OH^-, men også 10 ganger færre H^+.

Så 0.1 : 10

pH 8

REGNEOPPGAVER

54. Assume that you are a physician administering a drug in a solution containing 5.0 mg of drug/L of a solution. If the recommended dosage of the drug is 3.5×10^{6} g per kilogram of body weight, what volume of the solution would you prescribe daily for a 70 kg patient?

A. 33 mL
B. 98 mL
C. 54 mL
D. 25 mL
E. 49 mL

SKRIVEFEIL!
LO $3.5 \cdot 10^{-6}$ er riktig

Gjør først om til samme enheter:

$3.5 \cdot 10^{-6}\ g = 3.5 \cdot 10^{-9}\ kg$

Pasienten veier 70 kg

$3.5 \cdot 10^{-9} \cdot 70 = 2.45 \cdot 10^{-7}\ kg$ ← Ønsket totaldose

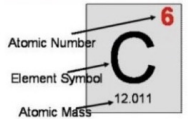
Gjør om til mg

$2.45 \cdot 10^{-7}\ kg \cdot 10^{6} = 0.245\ mg$

Finner riktig volum ut ifra konsentrasjonen

$\frac{0.245\ mg}{0.005\ mg/mL} = 49\ mL$

52. The mass of an atom, expressed in grams, is called the atomic mass. The mass of a chemical compound is equal to the sum of the masses of its individual components expressed in grams. The law of constant composition (also known as the law of definite proportions) of a chemical compound states that the mass ratio of elements in a chemical compound is a constant and characteristic value for a given compound. The percentage composition of a chemical compound is determined by the percentage of masses of individual elements in this compound (Kaznowski and Pazdro *Chemistry*).



Calculate the percentage composition of sulphur oxide in which weight ratio of sulphur to oxygen is 2 to 3. Indicate the proper chemical formula of this oxide.

A. SO_2
B. SO_3
C. S_2O_3
D. SO
E. S_2O_5

(1) Giver en antakelse på 100 g av molekylet

(2) For hvert 2 g med svovel er det 3 g oksygen

↳ $100 \cdot \frac{2}{5} = 40$ g svovel

↳ $100 \cdot \frac{3}{5} = 60$ g oksygen

(3) Konverterer til mol

↳ $M_{m_S} = 32$ g/mol ⇒ $\frac{40\ g}{32\ g/mol} = 1.25$ mol

↳ $M_{m_O} = 16$ g/mol ⇒ $\frac{60\ g}{16\ g/mol} = 3.75$ mol

(4) Forholdet er altså $\frac{1.25}{3.75}$

(5) Forkorter brøken ved å dele begge sider av nevneren med det minste tallet

↳ $\frac{1.25}{3.75} \mid : 1.25 \Rightarrow \frac{1}{3}$ ← Svovel, ← Oksygen

(6) SO_3

56. Calculate the number of moles of CaO in the sample containing $5 \cdot 10^{23}$ CaO molecules:

A. 0.83
B. 1.21
C. 0.415
D. 0.4
E. 5

Avogadros tall = $6.022 \cdot 10^{23}$ ← Tallet 'mol'

$\frac{5 \cdot 10^{23}}{6.022 \cdot 10^{23}} = 0.83$ mol

57. Calculate the mass of CaO in the sample from the task no. 56

FEILSKRIVING: g, ikke u

A. 6.76u
B. 46.48u
C. 22.4u
D. 23.24
E. 36u

$M_{m\,CaO} = 40 + 16 = 56$ g/mol

56 g/mol $\cdot$ 0.83 mol $= 46.48$ g

58. Molar concentration (Cm) is a measure of the concentration of a chemical species, in particular of a solute in a solution, in terms of the amount of substance per unit volume of solution. In chemistry, the most commonly used unit for molarity is the number of moles per litre, having the unit symbol mol/L or mol·dm^{-3} in SI unit ("Typography of unit symbols for Molar and Liter in siunitx". *TeX - LaTeX Stack Exchange*).

Husk på enheter!
1 L = 1 dm^3 = 1000 cm^3

Calculate the molar concentration of the solution obtained by dissolving 60g of sodium hydroxide NaOH in 240g of water (the density of the obtained solution was 1.2 g/cm^3). Use the additional information provided for the questions 56 and 57:

A. 2.5 mol·dm^{-3}
B. 3 mol·dm^{-3}
C. 1.5 mol·dm^{-3}
D. 6 mol·dm^{-3}
E. 4 mol·dm^{-3}

① $M_{m\,NaOH} = 40$ g/mol

② $n_{NaOH} = \frac{60\ g}{40\ g/mol} = 1.5$ mol

③ $v = \frac{m}{d} \Rightarrow V = \frac{(60 + 240)}{1.2\ g/cm^3} = 250$ cm^3

④ $\frac{1.5\ mol}{0.25\ dm^3} = 6$ mol/L

45. Fig. 9 presents a plot of change in KNO_3 solubility in water with increasing temperature. This plot shows the concentration of the saturated solution expressed in g of KNO_3 per 100 g of H_2O. Calculate the molarity of this solution at 30ºC knowing that the density at this temperature equals 1.25 g/cm^3.

Irrelevant: vi trenger kun massetransjonen, massetettheten er irrelevant for oppgaven vår.

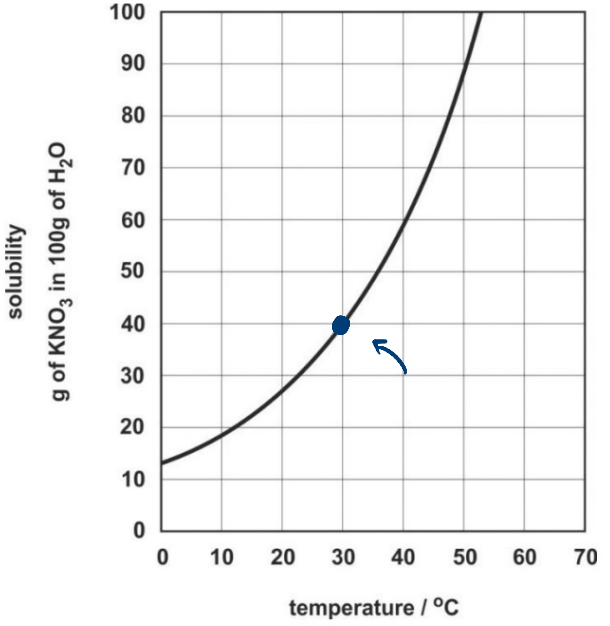


Fig. 9, Change in KNO_3 solubility in water with increasing temperature

A. 12.4 mol/dm^3
B. 5.0 mol/dm^3
C. 4.0 mol/dm^3
D. 3.6 mol//dm^3
E. 1.8 mol/dm^3

① 40 g KNO_3 per 100 g vann ved 30 °C

↓

② $M_m KNO_3 = 101{,}1$ g/mol

③ $n\ KNO_3 = \frac{40\ g}{101{,}1\ g/mol} = 0.396$ mol

④ $\frac{0.396\ mol}{0.1\ L}$

3.96 mol/L ≈ 4 mol/L

Bonus: Logikk

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

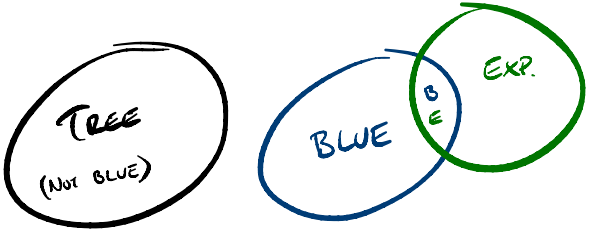
Felles nevner er 5

Lo Rasheste metode er bare å prøve tall

	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

94. **If no tree is blue and some blue things are expensive, then which of the statements is always true?**

A. There is a tree which is expensive.
B. Some trees are neither blue nor expensive.
C. Some blue things are not trees.
D. All expensive things are not blue.
E. None of the above statements is always true.



Ingen av de er absolutte sannheter!

93. **Two goats eat 80 kg of food in four days. How much food do 6 goats eat in two days?**

A. 80 kg
B. 100 kg
C. 120 kg
D. 160 kg
E. 240 kg

$\frac{80 \text{ kg}}{2} = 40 \text{ kg}$

$\frac{40 \text{ kg}}{4} = 10 \text{ kg}$ ← Dagsbehov per geit

$6 \cdot 2 \cdot 10 = 120 \text{ kg}$

92. **Which number completes the following sequence?**

128, 126, 123, 116, 114, 111, 104, 102, 99, ...

A. 87
B. 88
C. 90
D. 92
E. 97

Tenk enkelt, disse pleier ikke å være kompliserte!

→ Minus 2, minus 3, minus 7, minus 2, minus 3, minus 7 ...

$99 - 7 = 92$

TAKK FOR MEG!

bit.ly/3UHscbR

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