Solutions

Problems

1. Analytical chemistry

IChO Veszprém - Budapest 1987

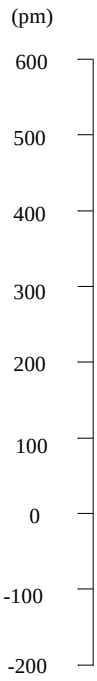
a) Write the balanced equations of the reactions mentioned above.
b) The gravimetric determination yielded a precipitate of which 12% by mass was decomposed by light. Determine the

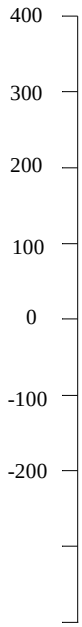
$FeSCN^{2+}$ complex that forms when

by reaction with hydrogen carbonate ions. This will be illustrated by the following calculations:

Lactic acid, written HL, is monoprotic, and the acid dissociation constant is $K_{HL} = l.4 \times l0^{-4}$.
The acid dissociation constants for carbonic acid are: $K_{a1} = 4.5 \times 10^{-7}$ and $K_{a2} = 4.7 \times 10$

Y-direction




400
300
200
100
0
-100
-200

b) Calculate the initial concentration of Cu^{2+}

mol/l sulphuric acid. The mixture is completely dehydrated by heating up to 70 °C. Toxic gases are emitted thereby. m_1 g of dry residue is obtained. In these conditions, only phosphate $Ca(H_2PO_4)_2$ is formed, silica and silicate do not react.

a blue whale in its first five years of life.

b) Be. xe.1

b)

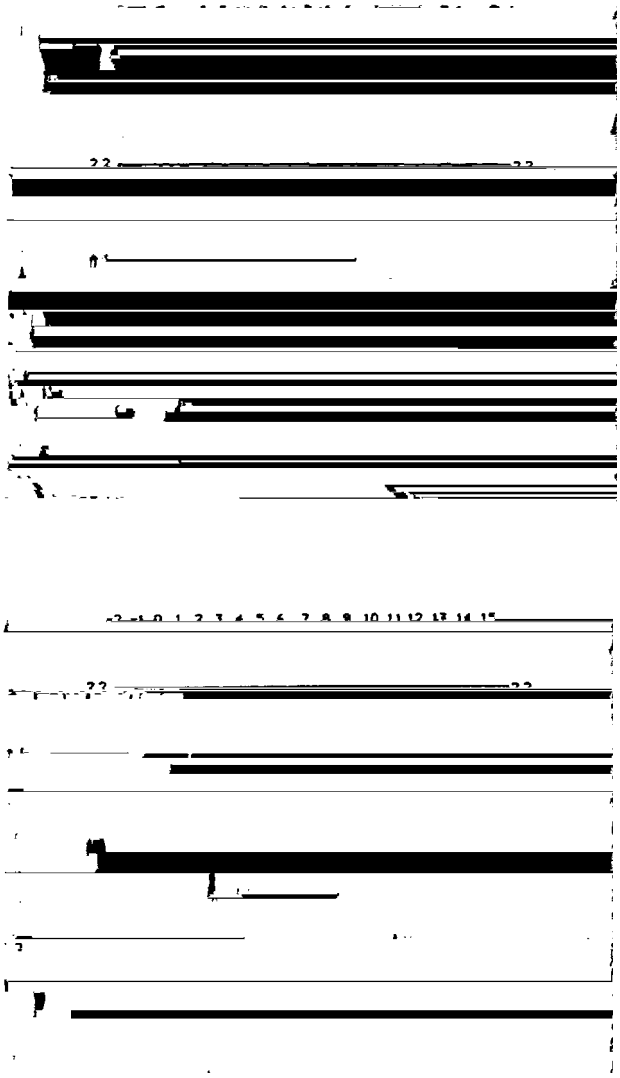


Fig. 3 Pourbaix diagrams of H_2O, N and Mn

IChO

IChO Lodz 1991

The energy of stable states of the hydrogen atom is given by: E_n

IChO Peruggia 93

Poisoning by carbon monoxide produced by ill-adjusted heating systems is a serious problem. In a methane burner the following reactions occur:

	CH_4	O_2	Co_2	CO	H_2O	
ΔH^o_f (kJmol^{-1})			-74.9	0	-393.5	-110.5 -241.8
S^o (JK^{-1}mol^{-1})			186.2	205.0	213.6	197.6 188.7

a) Calculate the equilibrium constants of both reactions at T = 1500 K, assuming that the values of ΔH^o and ΔS^o are independant of temperature.

b)

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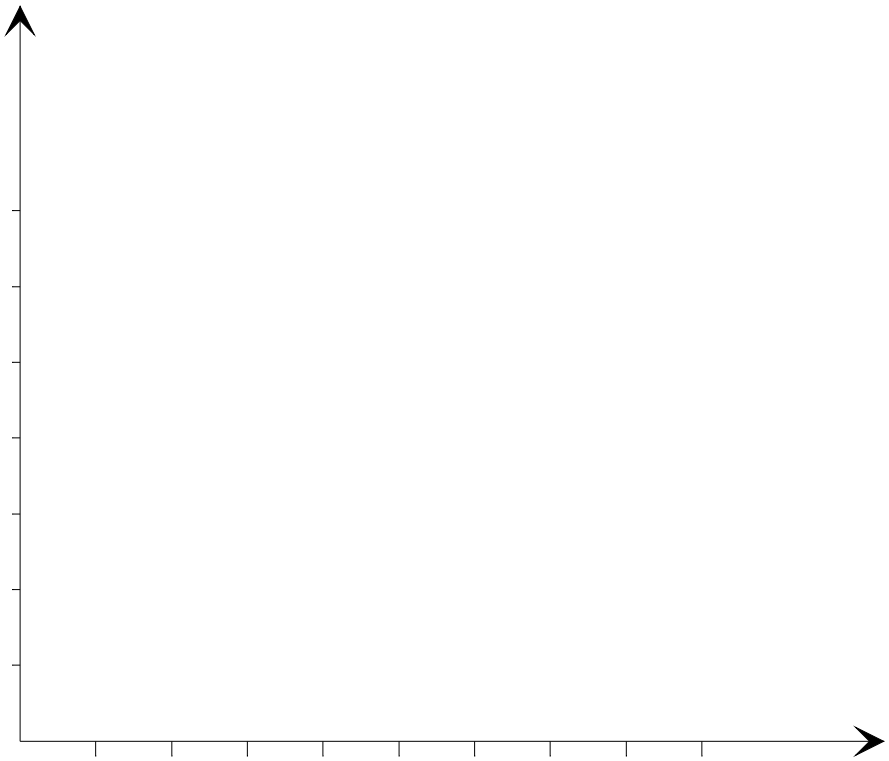
temperature.

From diammonium hexachloroplatinate(IV) we can prepare Pt(NH

Two different types of reactors are examined: continuous plug flow reactor and continuous stirred reactor (Fig. 6): In the continuous plug flow reactor



5. Organic chemistry

IChO Leiden 1986

The high efficiency of catalysis by enzymes is mainly due to an enzyme-reactant complex in which the reacting group is placed in a favourable position for the reaction with respect to the catalyzing groups of the enzyme. Studies are carried

Further observations

Addition of water to the iso-imide C gives a rapid reaction, which initially yields A. Subsequently, hydrolysis of A occurs.

IChO Veszprem - Budapest 1987

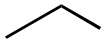
a) What ratio of primary / secondary / tertiary products can statistically be expected in the high temperature chlorina-

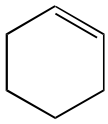
e)

titrated wited wited wited wited wited wueous KOH.0 RG16 g of C neu wilized 0 01 mol KOH.

IChO Pittsburgh 1992

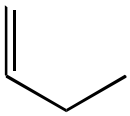
Rose oil is obtained from steam distillation of roses. It contains a number of terpenes, one of which is geraniol, $C_{10}H_{18}O$
(A). Upon oxidation, geraniol can either give a ten-carbon aldehyde or a ten-carbon carboxylic acid. Reaction with twomoles of 8 Tf 7.0





b) How many isomers, including stereoisomers, containing only saturated carbon atoms, are there for C_5H_{10}?

c) Which one of the following compounds has a dipole moment significantly different from zero?



4. a > c > b
5. b > a > c

f) What is the correct stereochemical descriptor of the optically active compound drawn below?

g) All the molecules drawn below are neutral compounds. Which one d1cnotal ntain > formtraposiactiveharge aouna(H)Tj -00439045

2,3 dideuterosuccinate	% of dideuterated fumarate
syn dehydrogenation	% of dideterated fumarate
anti dehydrogenation	
	isomer I
	isomer II
	...

Assume that the percentages of dideuterated fumarate are 0 or 50% respectively.

d) Show the stereochemistry of the enzymatic dehydrogenation.
e) The 2,3 - dideuterofumarate reacts with fumarase to (2S, 3S)-2,3-dideuteromalate (through addition of water). Show the stereochemical pathway of the reaction.
f) The acetylcoenzyme A, $CH_3COSCoA$ reacts with glyoxylate $OHC\text{-}CO_2^-$ in the presence of malate synthease enzyme to (S)-malate.

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A similar reaction can proceed between an ester CH