

Inorganic Chemistry

Some of these with a * mark are original questions. The others have been taken from various sources.

Q1.* Facial MA_3B_3 coordination complex is optically inactive. It seems that it does not have a plane of symmetry. Then why is it inactive? Or is it that it does have a plane of symmetry? Which other symmetry elements does it possess?

Q2. The hybridization and structure of I in I_2Cl_6 is

- A) sp^3 tetrahedral
- B) dsp^2 square planar
- C) sp^3d^2 octahedral
- D) sp^3d^2 planar

Q3. The hybridization of P, N in phosphazene ($P_3N_3Cl_6$) is

- A) sp^2 sp^2
- B) sp^2 sp^3
- C) sp^3 sp^2
- D) none

Well, phosphazene is an aromatic compound. Note that this info will give u the wrong ans.

Q4. What is the hybridization and shape of paraperiodic acid H_5IO_6 ? Arrange the following in the increasing order of acidity (K_{a1})

HIO_4 , H_5IO_6 , HIO_3 , $HClO_4$.

Q5.* A white crystalline solid A on heating upto 300 Celsius gives only B & C (constituent elements). B is a colourless gas with dipole moment = 2.8 B.M.

C is a violet solid which turns starch iodide paper blue. A can be reduced to C by a poisonous gas D. D is used to purify nickel by the Mond's process. Identify A to D.

Q6.* Write the IUPAC name of $[\text{IrCl}(\text{CO})(\text{O}_2)(\text{PPh}_3)_2]$ complex.
Note – Generally coordination compounds have 4 or 6 coordination no.

Q7. It is a well known fact that ethanol and water form strong hydrogen bonds. Then why does a mixture of ethanol and water show positive deviations from the Raoult's law for ideal solutions?

Organic Chemistry

Q.1 *

A Whole Lotta Tests

This is the best organic chemistry problem I have made so far.

U need to have good knowledge about tests for identification of functional groups in order to solve this problem.

A preparatory question first

Qs. There are 4 beakers containing ethanol, phenol, acetic acid and 2-methyl 1-chloropropane and u r supposed to use only 1 reagent to *identify* both ethanol & phenol. Which of the following reagent would u use?

- a) aqueous FeCl_3
- b) Br_2 / water
- c) conc. H_2SO_4
- d) phenolphthalein

Now try this qs. (Only after u have successfully solved the above one)

A compound 'A' which does not have a chiral centre gives a compound 'B', which has a chiral centre, when treated with Tollen's reagent. A & B also give positive iodoform test.

B on treatment with I_2/NaOH gives C & a yellow ppt.

C decolourises KMnO_4/H^+ at 70 Celsius.

Further B on dehydration gives E which does not react with Na metal.

Note - A has less than 6 carbon atoms.

Identify A to E.

Anyone who gets the answer may verify the ans. by sending me the IUPAC name of A to

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Q.2

The Queenbee puzzle

This question is one of the many given in 30th Icho, Melbourne's preparatory problems. However the official solution is incomplete. Hence I have reproduced the slightly modified version.

The preparatory problems are available on my site

<http://www.chemolympiad.weebly.com> .

- Queenbee substance Q contains 65.2% carbon, 8.75% hydrogen & rest oxygen.
- 43.7 mg of Q required 23.7 ml of 0.0100 M NaOH to reach the end point.

- Molecular weight of Q < 200

Q reacts with H_2/Pt to give A. Further reduction of A with $NaBH_4/EtOH$ gives B. B was dehydrated upon warming with conc. H_2SO_4 to give alkene C. C^{13} NMR of C revealed a methyl group attached to a double bond. Ozonolysis of C (oxidative) gave ethanoic acid and a straight chain dicarboxylic acid D. Similar cleavage of Q yielded only oxalic acid and E which contained only one $-COOH$ group.

1. There are 2 possible structures of Q. Which are they?
2. If the NMR spectrum of Q in water shows two singlets at $\delta = 5$ & $\delta = 11$
OR
If IR spectrum shows an absorption band at $\nu = 3600\text{ cm}^{-1}$
OR
If it has a chiral centre,
Then identify the structure of Q.

Qs.3