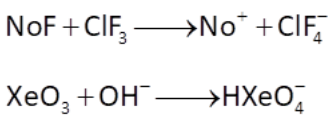
BYJU'S EXAM PREP

Important Questions on Acid and Base Chemistry

https://byjusexamprep.com

Important Questions on Acid and Base Chemistry

1. Identify the acids in the following two reactions



A. ClF_3 and XeO_3 B. ClF_3 and OH^-

C. NOF and OH^- D. NOF and XeO_3

2. The softest acid amongst the following is

A. Al^{3+} B. Li^+ C. Ca^{2+} D. Ag^+

3. Select the statement which satisfies correctly for CoF_6^{-3}, CoI_6^{-3}, AgI_2^-, AgF_2^-.

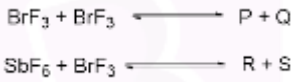
A. CoF_6^{-3} and AgF_2^- are stable butCoI_6^{-3} and AgI_2^- do not exist.

B. CoF_6^{-3} and AgI_2^- are stable but CoI_6^{-3} and AgF_2^- do not exist.

C. CoI_6^{-3} and AgF_2^- are stable but CoF_6^{-3} and AgI_2^- do not exist.

D. CoI_6^{-3} and AgI_2^- are stable but CoF_6^{-3} and AgF_2^- do not exist.

4. Identify the products for the following reactions:



A. P= BrF_2^+ Q= BrF_4^- R= BrF_2^+ S= SbF_6 B. P= BrF_2^+ Q= BrF_5 R= BrF_2^+ S= SbF_4^-

C. P= BrF_4^+ Q= BrF_6^- R= BrF_4^- S= SbF_6^+ D. P= BrF_4^+ Q= BrF_2^- R= BrF_2^+ S= SbF_6^-

5. What is the order of stability for the following compound:

I. $[Cr(NH_3)_5F]^{2+}$

II. $[Cr(NH3)_5I]^{2+}$

III. $[Cr(NH_3)_5Br]^{2+}$

A. I>II>III B. III>I>II

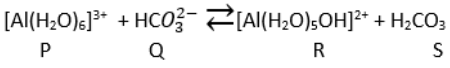
C. II>I>III D. I>III>II

6. Among the options given below, which one of the following is the correct sequence of increasing acid strength?

A. $Me_3B < BH_3 < BF_3$ B. $BF_3 < BH_3 < Me_3B$

C. $Me_3B < BF_3 < BH_3$ D. $BF_3 < Me_3B < BH_3$

7. In the following:



Species behaving as Bronsted- Lowry acids are

A. P, S B. P, R C. Q, R D. Q, S

8. According to HSAB principle, which of the following stable complexes are formed by Co^{2+} & Pd^{2+} ions?

   A. $[Pd(SCN)_4]^{-2}$ and $[Co(NCS)_4]^{-2}$
   B. $[Pd(SCN)_4]^{-2}$ and $[Co(SCN)_4]^{-2}$
   C. $[Pd(NCS)_4]^{-2}$ and $[Co(NCS)_4]^{-2}$
   D. $[Pd(NCS)_4]^{-2}$ and $[Co(SCN)_4]^{-2}$

9. When it comes to the bonding of the ligands Me_3N and Me_3P with the metal ions Be^{2+} and Pd^{2+}, the accurate statement is,

   A. The ligands bind equally strong with both the metal ions as they are dicationic.
   B. The ligands bind equally strong with both the metal ions as both the ligands are pyramidal.
   C. The binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+}.
   D. The binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+}.

10. Which of the following is not true regarding $H[B(HSO_4)_4]$?

   A. It is a stronger acid than HSO_3F.
   B. It acts as a strong acid in H_2SO_4.
   C. It can be prepared by dissolving boric acid in oleum.
   D. It cannot be titrated against $KHSO_4$.

Answer Key

1. A	**2. D**	**3. B**	**4. A**	**5. D**
6. C	**7. A**	**8. A**	**9. C**	**10. D**

Solutions

Solution 1:

Anion acceptors are acidic and anion donors are bases.

Solution 2: Soft acids are larger and more polarizable, Hence Ag^+ is the softest acid among Al^{3+}, Li^{3+} and Ca^{2+}.

Solution 3. AgI_2^- is stable but AgF_2^- does not exist. Since Ag^+ is a soft acid, F^- is a hard base, and I- is a soft base. Hence, AgI_2 (soft acid + soft base) is a stable complex and AgF_2^- (soft acid + hard base) does not exist.

Similarly, it is found that CoF_6^{-3} (hard acid + hard base) is more stable than CoI_6^{-3} (hard acid + soft base).

Solution 4. A high specific conductance of liquid BrF_3 indicates that it ionises as:

$$BrF_3 + BrF_3 \longleftrightarrow BrF_2^+ + BrF_4^-$$

SbF_5 acts as an acid in liquid BrF_3 because it increases the concentration of BrF_2^+ ions as shown-

$$SbF_5 + BrF_3 \longleftrightarrow BrF_2^+ + SbF_6^-$$

Solution 5.

$[Cr(NH_3)_5F]^{2+}$	$[Cr(NH_3)_5I]^{2+}$	$[Cr(NH_3)_5\ Br]^{2+}$
Cr^{3+} → hard acid	Cr^{3+} → hard acid	Cr^{3+} → hard acid
NH_3 → hard base	NH_3 → hard base	NH_3 → hard base
F^- → hard base	I^- → soft base	Br^- → borderline base

According to the HSAB principle, hard acid interacts with hard base to form a stable complex, so in complex I, all ligands are hard base, and metal is also hard, so, it will form a stable complex than others. In II, the hard metal ion interacts with hard base NH_3 and soft base I^- so, it forms less stable complex than I and III while in III, the hard metal ion interacts with hard base NH_3 and Br^- which is border line base, so, it is stable than II.

So, the stability order will be as follows:

I>III>II

Solution 6. Lewis acids are electron deficient species. If species contain more deficient central atoms then its Lewis acidic strength is very high. F is an electron withdrawing group due to which it will make B more deficient but on the other hand, it decreases the deficiency by back bonding. While H is unable to do such a back bonding due to absence of lone pair. Me is an electron releasing group, thus making the boron least electron deficient.

Solution 7.

$$\underset{P}{[Al(H_2O)_6]^{3+}} + \underset{Q}{HCO_3^{2-}} \rightleftharpoons \underset{R}{[Al(H_2O)OH]^{2+}} + \underset{S}{H_2CO_3}$$

Bronsted – Lowry acid: A species that can donate a proton to another molecule.

$$[Al(H_2O)_6]^{3+} \longrightarrow [Al(H_2O)_5(H)(OH)]^{3+} \longrightarrow [Al(H_2O)OH]^{2+} + H^+$$

$$H_2CO_3 \longrightarrow H^+ + HCO_3^{2-}$$

∴ P and S are Bronsted Lowry acid.

Solution 8. According to the HSAB principle, soft acid prefers to bind with a soft base, and hard acid prefers to bind with a hard base. $[SCN]^-$ is an ambidentate ligand. It coordinates through S-atoms to form complex $[Pd(SCN)_4]^{-2}$ because Pd^{2+} is a soft acid that prefers to bind with soft S atoms. Whereas with Co^{2+}, a hard acid prefers to bind with a hard N-atom to form complex $[Co(NCS)_4]^{-2}$.

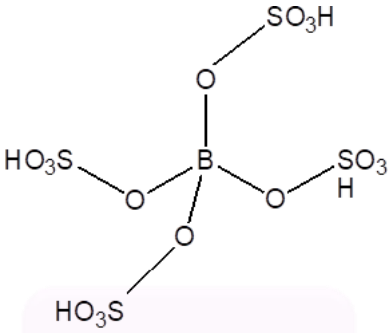
Solution 9. According to Pearson's HSAB principle, hard acids prefer binding to the hard bases to give ionic complexes, whereas the soft acids prefer binding to soft bases to give covalent complexes. NMe_3 is a hard ligand while PMe_3 is a soft ligand. Therefore, NMe_3 binds with hard acid (metal ion) Be^{++} and PMe_3 binds with soft acid (metal ion) Pd^{++}.

Solution 10. It is a superacid stronger than HSO_3F and H_2SO_4.It can be prepared with the help of reaction:

$H_3BO_3 + 2H_2SO_4 + 3SO_3 \longrightarrow [H_3SO_4]^+ + [B(HSO_4)_4]^-$

Conductometric titration against Strong base $KHSO_4$:

$H[B(HSO_4)_4] + KHSO_4 \longrightarrow K[B(HSO_4)_4] + H_2SO_4$



BYJU'S EXAM PREP

CRASH COURSES

Enrol for Ongoing CSIR NET Crash Courses

CSIR NET General Aptitude Course 2021

Complete Study Plan to Boost the CSIR NET Score

What to Expect?

- Live Classes
- Quizzes
- Doubt Sessions
- PYQ Discussion
- Mock Tests
- Chapter-wise Tests
- Revision Tests
- Expert faculty

Course Language

- Bilingual

This Course Includes

- 80+ Live Classes
- 1000+ Practice Questions
- Study Notes & Formula Sheets
- 10+ Mock Tests

CSIR NET Life Science 2021 Crash Course

Revision Plan to clear the exam

What to Expect?

- Live Classes
- Quizzes
- Doubt Sessions
- PYQ Discussion

Course Language

- English

This Course Includes

- 200+ Live Classes
- 3000+ Practice Questions
- 200+ Study PDFs
- 10+ Mock Tests

CSIR NET Chemical Science 2021 Crash Course

Complete Revision Plan to ACE the Exam

What to Expect?

- Live Classes
- Quizzes
- Doubt Sessions
- PYQ Discussion
- Mock Tests
- Chapter-wise Tests
- Revision Tests
- Expert faculty

Course Language

- English

This Course Includes

- 180+ Live Classes
- 3000+ Practice Questions
- 200+ Study PDFs
- 10+ Mock Tests

GET IT ON Google Play

https://byjusexamprep.com/