P. P. SAVANI UNIVERSITY

Fifth Semester of B.Sc. Examination
December-2021 SSCH3010–
Chemical crystallography

07.12.2021, Tuesday **Time: 09:00 a.m. to 11:30 a.m. Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

Section-I (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a Which of the following is an acid solvent?

A HF
B H_2SO_4
C HCl
D All

1.1b Reaction of AgCl and $Ba(NO_3)_2$ gives

A No reaction
B $AgNO_3$
C $BaCl_2$
D Both $BaCl_2$ and $AgNO_3$

1.1c Water is an example of_____ solvent.

A Protic
B Aprotic
C Both
D None

1.1d Which of the following molecules contains a C_4 axis and a σ_h plane

A $[PtCl_4]^{2-}$
B CH_4
C NH_3
D None

1.1e The solubility of I_2 is increased in the presence of KCl and Liq. SO_2 because of_____ complex formation.

A KI_3
B I_3
C KI_4
D KCl

1.1f Which of the following molecules contains a center of inversion (i).

A H_2O
B CH_4
C $[PtCl_4]^{2-}$
D None

1.1g _____ symmetry elements present in NH_3 molecule

A C_3V
B C_4V
C C_2V
D None

1.1h BF_3 possess_____point group.

A D_{4d}
B C_{2v}
C C_{3v}
D D_3h

1.1i In group theory, point group is a _____

A Collection of all symmetry elements
B Collection of any two symmetry elements
C Both
D None

1.1j To get the original structure in H_2O how many symmetry operations is required?

A C_2
B C_3
C C_4
D None

1.2 Answer the Following: **[05]**

1.2a In group theory what is meant by symbol E?
1.2b cyclopentane contains a_____principal rotation axis. (6-fold/5-fold)
1.2c What is the point group of H_2O?
1.2d Give any two examples of protic solvents.
1.2e The dielectric constant of water is higher than liquid ammonia. (True/False)

Q.2 Short Notes (Attempt any two) **[06]**

A Draw the character table for C_2V point group.
B Determine the point group of C_6H_6.
C Write a note on precipitation reactions of Liq. ammonia.

Q.3 Explain in detail (Attempt any two) **[14]**

A What is plane of symmetry? Explain the types of plane of symmetry with examples?
B Explain Acid-Base reactions in Liq. ammonia.
C Give details note on Liq. SO_2 and discuss any two reactions shown by them

Section-II (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a Due to lanthanide contraction covalent character between Ln^{3+} ion and OH^- ions _____ from $La(OH)_3$ to $Lu(OH)_3$.

A Decreases
B Increases
C Do not change
D Shows mixed trend

1.1b Which of the following is artificial lanthanide

A Promethium
B Neodymium
C Europium
D All of the above

1.1c Actinides are _____ basic than lanthanides.

A less
B high
C few radioactive
D None of the above

1.1d Which of the following oxidation state is not shown by Thorium

A +3
B +2
C +4
D None

1.1e Oxocations formation is a property of _____.

A Lanthanides
B Actinides
C Both
D None

1.1f Which of the following is not the isotope of Uranium

A ^{234}U
B ^{235}U
C ^{237}U
D ^{238}U

1.1g The atomic number of Thorium is

A 90
B 91
C 92
D 93

1.1h The color of lanthanides is associated with _____
- A f-f transition
- B d-d transition
- C Both
- D None

1.1i The group of fourteen elements from thorium (Th, Z = 90) to lawrencium (Lr, Z=103) are called
- A actinides
- B actinoids
- C actinons
- D All of the above

1.1j The atomic radius _____from Ce to Lu.
- A increases
- B decreases
- C Shows mixed trend
- D Do not change

1.2 Answer the Following: (MCQ/Short Question/Fill in the Blanks) **[05]**

1.2a Sm^{+2} is a good_____agent. (oxidizing/ reducing).

1.2b What are the oxidation states shown by Gadolinium?

1.2c Ability of actinides to form a complex compound is_____than lanthanides. (Higher/Lower)

1.2d Write the electronic configuration of Plutonium (Z=94).

1.2e In Lanthanides, basic character of the hydroxides_____with increasing atomic number. (decreases/increases)

Q.2 Short Notes (Attempt any two) **[06]**

A Describe the color properties of lanthanides.

B Write a short note about the oxidation states shown by Lanthanides.

C Explain the similarity between Lanthanides and Actinides.

Q.3 Explain in detail (Attempt any two) **[14]**

A Describe about the lanthanide contractions.

B Explain the general and physical properties of lanthanides

C Write a detail note on the methods for the purification and extraction of Uranium