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SEAT No. _____

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Sardar Patel University Examination 2019
M.Sc. (Semester-III) Inorganic Chemistry, PS03CINC22
Nuclear Chemistry and Reaction Mechanism
20/11/2019 (Wednesday)
Time: 2:00 pm to 5:00 pm

Note: Numbers at the right show full marks.**Total Marks: 70****Q.1. Select the correct answer from the following:****[8]**

- 1) If $^{235}\text{U}_{92}$ decays only by emitting 2α & 1β particles, the possible product is _____.
 (a) $^{231}\text{Ac}_{89}$ (b) $^{235}\text{Ac}_{89}$ (c) $^{236}\text{Ac}_{89}$ (d) $^{227}\text{Ac}_{89}$
- 2) When $^{35}\text{Cl}_{17}$ undergo (n,p) reaction, the radioisotope formed is _____.
 (a) $^{32}\text{P}_{15}$ (b) $^{35}\text{S}_{16}$ (c) $^{34}\text{S}_{16}$ (d) $^{34}\text{P}_{15}$
- 3) The corrosion of brass is inhibited by CS_2 due to formation of _____.
 (a) CuS (b) ZnS (c) both a & b (d) none of these
- 4) The rate of exchange for Co/Co^{+2} is much faster with _____.
 (a) Cl^- (b) NO_3^- (c) CH_3COO^- (d) ClO_4^-
- 5) The chromium(III) species formed after electron transfer between IrCl_6^{-2} & $\text{Cr}(\text{H}_2\text{O})_6^{+2}$ is _____.
 (a) $[\text{Cr}(\text{H}_2\text{O})_6]^{+3}$ (b) $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]^{+2}$ (c) CrCl_6^{-1} (d) $\text{Cr}(\text{H}_2\text{O})_3\text{Cl}_3$
- 6) Electron transfer from $\text{Fe}(\text{H}_2\text{O})_6^{+2}$ to $\text{Fe}(\text{H}_2\text{O})_6^{+3}$ is likely to occur via _____.
 (a) d-d transition (b) inner sphere electron transfer (c) SN^1 (d) outer sphere electron transfer
- 7) In the first step of dissociative SN^1 mechanism, an octahedral complex (MX_5Y) may produce an intermediate (MX_5) having _____ structure(s).
 (a) trigonal bipyramidal (b) square pyramidal (c) both a & b (d) none of above
- 8) The complex $[\text{Co}(\text{en})_2(\text{Cl})_2]$ can have _____ optically active & _____ optically inactive isomer(s).
 (a) one, two (b) two, one (c) three, no (d) no, three

Q.2. Answer any seven of the following:**[14]**

- i. Calculate molar nuclear binding energy for ^4He . (Isotopic mass = 4.0017 amu, mass of proton = 1.00727 m_u , mass of electron = 0.000548 m_u , mass of neutron = 1.008665 m_u , Avogadro number = $6.02 \times 10^{23} \text{ mol}^{-1}$, speed of light = $2.998 \times 10^8 \text{ ms}^{-1}$)
- ii. Explain ^{19}F NMR for SF_4 at various temperatures.
- iii. Write the process for the separation of radioactive uranium and plutonium.
- iv. Explain the prevention of corrosion in brass by CS_2 .
- v. Write a short note on tracer studies using Tritium.
- vi. Write the optical isomers of $[\text{Co}(\text{en})(\text{NO}_2)_2(\text{NH}_3)_2]$.
- vii. Explain two electron transfer reaction with suitable examples.
- viii. Explain Complementary & Non-Complementary reactions with suitable examples.
- ix. Explain why hydrolysis of $\text{trans}-[\text{Co}(\text{en})_2\text{ClY}]^{+2}$ ion leads to mixtures of products?

[P.T.O.]

Q.3. Answer the following:

[A] Explain in detail how stable isotopes are separated.

[6]

[B] Write a note on nuclear stability and N/P ratio with suitable graph.

[6]

Or

[B] (i) What is nuclear binding energy. Explain with nuclear energy binding curve.

[3]

(ii) Write a short note on ortho- and para-hydrogen.

[3]

Q.4. Answer the following:

[A] Explain the isotopic exchange by electron transfer mechanism.

[6]

[B] What are the reasons for considerable effect of anion on the rate of exchange between metal and their ions?

[6]

Or

[B] (i) Write a short note on radiometric method for analysis.

[3]

(ii) Write a short note on electrochemical displacement for exchange reaction.

[3]

Q.5. Answer the following.

[A] Describe the dissociative (SN^1) & associative (SN^2) mechanisms with examples.

[6]

[B] Discuss the kinetics of anation reaction.

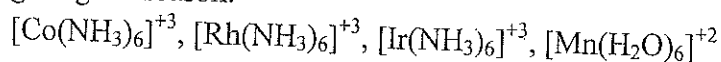
[6]

Or

[B] (i) A Pt(II) complex of tetramethyldiethylenetriamine is attacked by Cl^- ions 10^5 times less rapidly than the diethylenetriamine analogue. Explain this observation in terms of an associative rate determining step.

[3]

(ii) Write the increasing order of the rate of substitution by H_2O in the following complexes giving the reason.



[3]

Q.6. Answer the following.

[A] Write a short note on electron transfer by inner sphere mechanism.

[6]

[B] Discuss isomerization & racemization in octahedral complexes giving suitable examples.

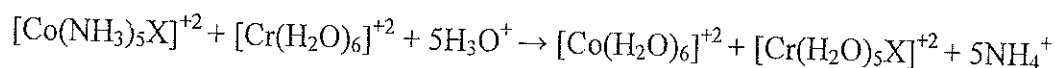
[6]

Or

[B] (i) When the pyridine is added to an aqueous solution of Na_3RhCl_6 , the reaction stop at $[Rh(py)_3Cl_3]$, but on adding a small amount of ethanol, quantitative formation of $[Rh(py)_4Cl_2]^+$ occurs. Explain this with suitable mechanism.

[3]

(ii) For the following general reaction, explain the effect of halides & discuss the mechanism of reaction.



[3]

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