



‘সমানো মনঃ সন্নিহিতঃ সমানী’

UNIVERSITY OF NORTH BENGAL

B.Sc. Minor 4th Semester Examination, 2025

UCHEMIN20002-CHEMISTRY

CHEMISTRY-II

Time Allotted: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

1. Answer any **five** questions from the following:

2×5 = 10

নিম্নলিখিত যে-কোন পাঁচটি প্রশ্নের উত্তর দাও:

নিম্নলিখিত কুনে পাঁচ প্রশ্নহরুকে উত্তর লেখুহোস্ :

- (a) How surface tension varies with temperature?
পৃষ্ঠটান উষ্ণতার সাথে কীভাবে পরিবর্তিত হয় ?
কসরী সতহ তনাবকো তাপমান সিত পরিবর্তন হুন্ত ?
- (b) What are the differences between crystalline and amorphous solids?
কেলাসাকার এবং অনিয়তাকার কঠিন পদার্থের মধ্যে পার্থক্যগুলি কী ?
Crystalline অনি amorphous তোস পদার্থহরু बीच के भिन्नताहरू छन् ?
- (c) Why small drops of liquids are spherical in shape?
তরলের ক্ষুদ্রবিন্দুগুলি গোলাকার হয় কেন ?
পানীকো সানো থোপা কিন আকারমা গোলাকার হুন্ত ?
- (d) Ethylene can participate in addition reaction but ethane can not — Explain.
ইথিলিন যুতবিক্রিয়ায় অংশগ্রহণ করে কিন্তু ইথেন করে না। — ব্যাখ্যা কর।
Ethylene লে থপ প্রতিক্রিয়ামা ভাগ লিন সক্ত তর ethane লে সক্তদৈন — ব্যাখ্যা গর্নুহোস্।
- (e) What is Markovnikov rule?
মারকনিকভের সূত্র কী ?
Markovnikov কো নিয়ম কে হো ?
- (f) Why $-\text{NO}_2$ group is meta directing?
 NO_2 -গ্রুপ মেটানির্দেশক কেন ?
কিন $-\text{NO}_2$ সমূহ লে meta নির্দেশান গর্দত ?
- (g) Which element has more ionization potential among Mg and Al and why?
ম্যাগনেশিয়াম ও অ্যালুমিনিয়ামের মধ্যে কার আয়নায়ন বিভব বেশী এবং কেন ?
Mg অনি Al बीच কসকো ionization potential অধিক হুন্ত অনি কিন ?
- (h) What do you mean by transition elements?
সন্ধিগত মৌল বলতে কী বোঝ ?
Transition elements ভন্নালে কে বুজিন্ত ?

2. Answer any *four* questions from the following:

5×4 = 20

निम्नलिखित ये-कौन *चार* प्रश्नों के उत्तर दीजिए:

निम्नलिखित कुनै *चार* प्रश्नहरूको उत्तर लेख्नुहोस्:

- (a) (i) Explain the cleansing action of soap and detergent. 3
साबान एवं डिটারजेंटहरूको पदार्थहरूको प्रक्रिया व्याख्या कर।
साबुन र डिटरजेंटको सफा गर्ने कार्य व्याख्या गर्नुहोस्।
- (ii) What is surface energy? 2
पृष्ठशक्ति की ?
सतही ऊर्जा के हो ?
- (b) (i) Derive Bragg's equation. 3
Bragg-एर समीकरण उपपादन कर।
Bragg को समीकरण निकाल्नुहोस्।
- (ii) Find the Miller indices of the plane that has intercepts in the crystallographic axes in the ratio of 1 : 2 : ∞. 2
क्रिस्टालोग्राफिक अक्षहरूको 1 : 2 : ∞ अनुपाते छेदनकारी तलहरूको सूचकहरू बेर कर।
1 : 2 : ∞ को अनुपातमा crystallographic अक्षहरूमा अवरोधहरू भए Miller को सूचकांकहरू निर्णय गर्नुहोस्।
- (c) (i) Why is the second ionization potential is too large in comparison to the first ionization potential of Li atom? 3
Li-परमाणुको द्वितीय आयनायन विभव तल प्रथम आयनायन विभवको तुलनाय खूब बेशी केन ?
Li परमाणुको दोस्रो आयनीकरण क्षमता पहिलो आयनीकरण क्षमताभन्दा धेरै ठूलो किन हुन्छ ?
- (ii) Why the electron affinity of fluorine is lower than that of chlorine? 2
फ्लोरिनको इलेक्ट्रॉन आसक्ति क्लोरिनको अपेक्षा कम केन ?
किन फ्लोरिनको electron affinity क्लोरिनको भन्दा कम हुन्छ ?
- (d) Explain Mulliken and Pauling scales of electronegativity. 5
तुलनात्मकताको मूलिकेन एवं पाउलिंग स्केल व्याख्या कर।
Mulliken अनि Pauling को electronegativity scale हरू व्याख्या गर्नुहोस्।
- (e) (i) Acetylene is more acidic than ethylene — Explain. 2
असिटिलिन, इथिलिन अपेक्षा अधिक आम्लिक — व्याख्या कर।
Acetylene ethylene भन्दा बढी अम्लीय हुन्छ — व्याख्या गर्नुहोस्।
- (ii) Identify [A], [B] and [C] in the following: 3
निम्नलिखित श्रृंखला [A], [B], [C] शनाक्त कर।
निम्न मध्ये [A], [B] अनि [C] पहिचान गर्नुहोस्।
- $$\text{CH}_3 - \text{CH} = \text{CH}_2 \xrightarrow{\text{Br}_2} [\text{A}] \xrightarrow{\text{KOH}} [\text{B}] \xrightarrow[\text{H}_2\text{SO}_4]{\text{Hg}^{2+}} [\text{C}]$$
- (f) Define Saytzeff rule of elimination and explain with suitable example. 5
अपनयन विक्रियाय Saytzeff-सूत्रको संज्ञा दाउ एवं उपयुक्त उदाहरणसह व्याख्या कर।
एलिमिनेशनको Saytzeff नियमलाई परिभाषित गर्नुहोस् अनि उपयुक्त उदाहरणको साथ व्याख्या गर्नुहोस्।

3. Answer any *one* question from the following:

10×1 = 10

নিম্নলিখিত যে-কোন একটি প্রশ্নের উত্তর দাও:

নিম্নলিখিত কুনৈ এক প্রশ্নকো उत्तर लेख्नुहोस्:

(a) Write short notes on:

5×2 = 10

संक्षीप्त टिका लेख:

छोटो टिप्पणीहरू लेख्नुहोस्।

(i) Crystal structure of NaCl

NaCl-এর কেলাস গঠন

NaCl को क्रिस्टल संरचना।

(ii) Inert pair effect.

Inert pair প্রভাব।

Inert pair प्रभाव।

(b) (i) What is peroxide effect? Explain it briefly with suitable examples.

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পারঅক্সাইড প্রভাব বলতে কি বোঝ ? উপযুক্ত উদাহরণসহ ব্যাখ্যা কর।

पेरोक्साइड प्रभाव के हो ? उपयुक्त उदाहरणहरू दिएर संक्षिप्तमा व्याख्या गर्नुहोस्।

(ii) What you understand by ozonolysis? Discuss its mechanism and possible application.

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ওজোনোলিসিস বলতে কি বোঝ ? বিক্রিয়ার কৌশলটি এবং এর সম্ভাব্য প্রয়োগ বর্ণনা কর।

Ozonolysis भन्नाले के बुझ्नुहुन्छ ? यसको संयन्त्र र सम्भावित प्रयोग बारे छलफल गर्नुहोस्।

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‘সমান্য যন্ত্র: সমিতি: সমানী’

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 4th Semester Examination, 2025

GE2-P2-CHEMISTRY

NEW AND OLD SYLLABUS

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
All symbols are of usual significance.*

Use separate Answer scripts for Section-A (Inorganic) and Section-B (Physical)

SECTION-A

INORGANIC CHEMISTRY

Marks: 20

GROUP-A

1. Answer any **five** questions from the following: 1×5 = 5
- How many unpaired e-s are there in strong-field Fe(II) octahedral complex?
 - Which one of violet-coloured $[\text{Cr}(\text{OH}_2)_6]\text{Cl}_3$ and yellow-coloured $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ has higher C.F.S.E.?
 - Write down the relationship between the C.F.S.E. of the octahedral and tetrahedral complex.
 - Calculate the spin-only magnetic moment of Co^{2+} ions.
 - Which one of the $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ has larger C.F.S.E.?
 - What is the number of unpaired electron(s) present on the metal ion showing magnetic dipole moment 5.92 B.M.?
 - Give one suitable example of linkage isomerism.
 - Write down the electronic configuration of Ce.

GROUP-B

2. Answer any **one** question from the following: 5×1 = 5
- $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$ is a salt but $\text{K}_4[\text{Fe}(\text{CN})_6]$ is a complex. — Explain. 2
 - $[\text{Cu}(\text{OH}_2)_6]^{2+}$ is (A) diamagnetic (B) octahedral (C) outer orbital complex (D) d^2sp^3 hybridized (E) a complex with co-ordination no. 6. Which of the above options are false? 3
 - Mention the use of Latimer diagram. 2
 - Why the second ionization energy is very high for Cr? 2
 - Which of the following metal ions is coloured: 1
 Zn^{2+} , Cu^{2+} , Sc^{3+} , or Ti^{4+}

GROUP-C

3. Answer any **one** question from the following: 10×1 = 10
- Draw the *cis*- and *trans*- isomer of square planar $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ complex. 2
 - Define inner-metallic complex with suitable example. 2

- (iii) The standard reduction potential for $\text{Cu}^{2+}/\text{Cu}^+$ and Cu^+/Cu^0 are 0.158 V and 0.522 V, respectively. Will Cu^+ undergo disproportionation in an aqueous medium? 2
- (iv) Discuss the splitting of d-orbitals in square planar ligand field. 3
- (v) Calculate the spin magnetic moment of Sm^{+3} ion. 1
- (b) (i) $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$ exhibits different axial and equatorial bond length — Justify. 2
- (ii) Why we cannot expect an oxidation state other than +3 for Gd and Lu? 2
- (iii) Define inner orbital complex with suitable example. 2
- (iv) Comment on the need of Ligand Field Theory. 4

SECTION-B

PHYSICAL CHEMISTRY

Marks: 20

4. Answer any **five** questions from the following: $1 \times 5 = 5$
- (a) Define Boyle's temperature.
- (b) Write down Van der Waals equation for n moles of a real gas.
- (c) What is surface tension?
- (d) Define unit cell of a crystal.
- (e) Define order of a reaction.
- (f) Give S.I. unit of viscosity.
- (g) Give S.I. unit of surface tension.
- (h) Define the root mean square velocity of a gas at a given temperature.
5. Answer any **one** question from the following: $5 \times 1 = 5$
- (a) (i) What are crystalline and amorphous solids? Give one example of each. 2
- (ii) Derive the integrated rate equation for the rate constant (k) of a second order reaction of type, $2A \rightarrow \text{Products}$ at a given temperature. How its half life period ($t_{1/2}$) vary with initial concentration of the reactant? $2+1$
- (b) (i) Mention the postulates / assumptions of kinetic theory of gases. 2
- (ii) Derive the kinetic gas equation. 3
6. Answer any **one** question from the following: $10 \times 1 = 10$
- (a) (i) Derive Boyle's law and Avogadro's law from the kinetic gas equation. $2\frac{1}{2} + 2\frac{1}{2}$
- (ii) What is compressibility factor? How its value vary in ideal gases and real gases including H_2 and He? $1+2$
- (iii) How surface tension of a liquid vary with temperature? 2
- (b) Write short notes on any **four**: $2\frac{1}{2} \times 4 = 10$
- (i) Bragg's equation
- (ii) Law of constancy of Interfacial Angles
- (iii) Miller indices
- (iv) Variation of viscosity with temperature
- (v) Maxwell-Boltzmann distribution of Molecular Velocities
- (vi) Significance of Van der Waals constants
- (vii) Critical constants (T_C , P_C and V_C) of real gases and significance of critical temperature (T_C).

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