

2020

## CHEMISTRY (Honours)

Paper Code : II - A & B

[New Syllabus]

### Important Instructions for Multiple Choice Question (MCQ)

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

**Example** : Such as for Paper III-A (MCQ) and III-B (Descriptive).

Subject Code : 

III	A	&	B
-----	---	---	---

Subject Name :

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

**Example** — If alternative A of 1 is correct, then write :

1. — A

- There is no negative marking for wrong answer.

### মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

- উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

Subject Code : 

III	A	&	B
-----	---	---	---

Subject Name :

- পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A)/(B)/(C)/(D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

উদাহরণ — যদি 1 নম্বর প্রশ্নের সঠিক উত্তর A হয় তবে লিখতে হবে :

1. – A

- ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

**Paper Code : II - A**

Full Marks : 10

Time : Twenty Minutes

Answer *all* the Questions.

Choose the Correct Answer.

Each Question Carries 1 Mark.

1. The radii of F, F<sup>-</sup>, O, O<sup>2-</sup> are in the order of —
  - (a) O<sup>2-</sup> > F<sup>-</sup> > F > O
  - (b) F<sup>-</sup> > O<sup>2-</sup> > O > F
  - (c) O<sup>2-</sup> > O > F<sup>-</sup> > F
  - (d) O<sup>2-</sup> > F<sup>-</sup> > O > F
2. Which of the following represents correct order of electron affinity —
  - (a) Cl > F > S > O
  - (b) F > O > S > Cl
  - (c) F > Cl > S > O
  - (d) Cl > S > O > F
3. Which of the following halide is inert towards hydrolysis at room temperature —
  - (a) SiCl<sub>4</sub>
  - (b) PCl<sub>3</sub>
  - (c) NCl<sub>3</sub>
  - (d) NF<sub>3</sub>

4. Which of the following substance has the highest melting point —
- (a) BaO
  - (b) MgO
  - (c) KCl
  - (d) NaCl
5. The molecular geometry of  $\text{BF}_3$  is —
- (a) Tetrahedral
  - (b) Pyramidal
  - (c) Square Planar
  - (d) Trigonal Planar
6. In the structure of  $\text{ClF}_3$  the number of lone pairs of electrons on central atom Cl is —
- (a) One
  - (b) Two
  - (c) Four
  - (d) Three
7. The lattice energies of KF, KCl, KBr and KI are in the order —
- (a)  $\text{KI} > \text{KCl} > \text{KBr} > \text{KI}$
  - (b)  $\text{KI} > \text{KBr} > \text{KCl} > \text{KF}$
  - (c)  $\text{KF} > \text{KCl} > \text{KI} > \text{KBr}$
  - (d)  $\text{KI} > \text{KBr} > \text{KF} > \text{KCl}$

8. Which of the following orbital combination cannot form  $\pi$  bond?
- (a)  $p_x + p_x$  sideways overlapping
  - (b)  $d_{x^2-y^2} + p_y$  sideways overlapping
  - (c)  $d_{xy} + d_{xy}$  sideways overlapping
  - (d)  $d_{yz} + p_y$  sideways overlapping
9. Which is the strongest acid in the following?
- (a)  $\text{HClO}_3$
  - (b)  $\text{HClO}_4$
  - (c)  $\text{H}_2\text{SO}_3$
  - (d)  $\text{H}_2\text{SO}_4$
10. The electronic transition from  $n = 2$  to  $n = 1$  will produce shortest wavelength in —
- (a)  $\text{Li}^{+2}$
  - (b)  $\text{He}^+$
  - (c)  $\text{H}$
  - (d)  $\text{H}^+$
-

2020

## CHEMISTRY (Honours)

Paper Code : II - B

[New Syllabus]

Full Marks : 40

Time : One Hour Fourty Minutes

*The figures in the margin indicate full marks.*

Answer any *four* questions taking *two* from each group.

### Group - A

1. (a) Discuss physical significance of magnetic quantum number. 2
- (b) Determine the ground state term for  $V^{+2}$ . 2
- (c) What optical transition in  $He^+$  spectrum would have the same wavelength as the first Lyman transition of hydrogen (Neglect the effect of reduced mass) 4
- (d) Out of the following configuration which will be more stable. Justify.  
(i)  $(n-1)d^4ns^2$ , (ii)  $(n-1)d^5ns^{-1}$  2
2. (a) By using Slater's rule calculate the effective nuclear charge for one 3d and one 4s electron of Fe. 3
- (b) The first ionization potential of the coinage metals follows the order  $Cu > Ag < Au$ . Explain. 2
- (c) Group 3 elements show regular trend in their atomic radii but group 4 elements show irregular trend. Explain. 2
- (d) Discuss the position of noble gases in the modern periodic table. 3

3. (a) Calculate the electronegativity of bromine (Atomic no-35) in Allred Rochow scale.  $E_{\text{covalent}} = 114 \text{ pm}$ . 3
- (b) Fluorine is more electronegative than chlorine but electron affinity of chlorine is more than that of fluorine. Explain. 2
- (c) What are superacids? How the acidity of such solution is measured? Explain citing examples. 3
- (d) In an atom the angular momentum of an electron is  $\sqrt{6} h/2\pi$ . What is the minimum value of the principal quantum number of the electron? 2
4. (a) Define electron affinity of an element. Electron affinity of nitrogen is negative. Explain. 1+2
- (b) How is hardness of a base evaluated? Why is methyl mercury cation chosen as the standard for this purpose? 4
- (c) What is HSAB principle? Explain with example characteristics of soft and hard acids and bases. 3

#### Group - B

5. (a) Calculate the limiting radius ratio ( $r^-/r^+$ ) of CsCl structure (CN = 8). 3
- (b) Using VSEPR theory, predict the shape and indicate the state of hybridization of the central atom of the following.
- (i)  $\text{IO}_2\text{F}_2^+$ , (ii)  $\text{XeF}_5^-$ , (iii)  $\text{ClF}_3$  3
- (c) Write down the Born Lande expression of Lattice energy for NaCl type of crystal and hence explain the term involved therein. 3
- Write down the name and formula of a paramagnetic halogen oxide. 1
6. (a) Calculate the formal charge on the constituent atoms in the molecule  $\text{N}_t = \text{N}_c - \text{O}$ . 3
- (b) The thermal stability of isomorphous sulphates of Ca, Sr and Ba with respect of decomposition into metal oxides (MO) and  $\text{SO}_3$  increases in the sequence  $\text{CaSO}_4 < \text{SrSO}_4 < \text{BaSO}_4$ . Explain. 3

- (c) Explain why  $\text{SF}_4$  readily hydrolyses but  $\text{SF}_6$  does not. 2
- (d) What is Bent's rule? Explain with example. 2
7. (a) Draw the most likely structure of  $\text{PCl}_2\text{Br}_3$  and give reasons to support it. 3
- (b) Sulphuric acid and telluric acid are differentially formulated. Comment. 2
- (c) Explain the order of acid strength of HF, HCl, HBr and HI in aqueous solution. 3
- (d)  $\text{P}_4$ ,  $\text{P}_4\text{O}_6$  and  $\text{P}_4\text{O}_{10}$  are related structurally. Explain. 2
8. (a) Give a comparative account of the chemistry of C, Si, Ge, Sn and Pb with special reference to their oxidation states and hydrides. 4
- (b) Discuss the structure and bonding in  $\text{B}_2\text{H}_6$ . 3
- (c) Write a short note on chlorofluorocarbon. 3
-