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**1 SEM FYUGP MINCHM1**

**2 0 2 3**

( December )

**CHEMISTRY**

( Minor )

Paper : MINCHM1

**( Fundamentals of Chemistry—I )**

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

**UNIT—I**

**( Inorganic Chemistry )**

( Marks : 20 )

1. শুদ্ধ উত্তৰটো বাছি উলিওৱা : 1×2=2

Choose the correct answer :

(a) হাইজেনবাৰ্গৰ অনিশ্চয়তাৰ সূত্রটো হ'ল

Heisenberg's uncertainty principle is

(i)  $\Delta x \cdot \Delta P = \frac{h}{4\pi m}$

(ii)  $\Delta x \cdot \Delta P = \frac{h}{m v}$

(iii)  $\Delta x \cdot \Delta P \geq \frac{h}{4\pi}$

(iv)  $\Delta x \cdot \Delta P \leq \frac{h}{4\pi}$

NaF, NaI, NaBr, NaCl

What do you mean by polarizing power of a cation? Among the following compounds which is most covalent?

କୋଣଟି ଯୌଗ ପରି ଅଧିକାଳୀ ?

(b) ଶୁଣ କଟିମାନଙ୍କ ସମ୍ବନ୍ଧ ଅର୍ଥାତ୍ କି ? ତରଳ ଯୌଗମାନଙ୍କର

associated in the equation.

Write Schrödinger wave equation and mention the significance of terms

କରା ।

(a) ଉପରୋକ୍ତ ଉପରୋକ୍ତ ଯୁକ୍ତିକରଣଗୁଡ଼ିକ ଲିଖା ଏବଂ ଏହି ଯୁକ୍ତିକରଣର ଯେତେ ସମ୍ପର୍କ ସୂଚାଏ ସେତେ ସମ୍ପର୍କ ସୂଚାଏ

Answer the following questions (any two) :

2. ତରଳ ଅମ୍ଳମାନଙ୍କର ଉତ୍ତର ଲିଖା (କୌଣସି ଦୁଇଟି) :  $2 \times 2 = 4$

(i)  $H_2O$

(ii)  $NH_3$

(iii)  $PCl_5$

(iv)  $CCl_4$

zero dipole moment?

Which of the following compounds has

(b) ତରଳ କୋଣଟି ଯୌଗର ଦ୍ୱିଧ୍ରୁବକ ସମ୍ପର୍କ ଅର୍ଥାତ୍ ?

3 କରା ।  
 $n+1 = 4$  ଉପକରଣ ଥିବା ଉପକରଣର ସଂଖ୍ୟା ଉପକରଣ

ଉପକରଣର ସଂଖ୍ୟା ଉପକରଣ କରା । ଉପକରଣ

(i)  $Fe^{3+}$  ଉପକରଣର ସଂଖ୍ୟା ଲିଖା । ଉପକରଣ କରା ।

electronegativity.

Write briefly about Allred-Rochow scale of

What is electronegativity? Write

3 ଉପକରଣର ସଂଖ୍ୟା ଲିଖା ।

(ii) ଉପକରଣର ସଂଖ୍ୟା ଲିଖା କି ସଂଖ୍ୟା ? ଉପକରଣର ସଂଖ୍ୟା ଲିଖା ।

ionization energy?

element higher than that of first

the second ionization energy of an

What is ionization energy? Why is

2 କରା କି ?

(i) ଉପକରଣର ସଂଖ୍ୟା ଲିଖା କି ? ଉପକରଣର ସଂଖ୍ୟା ଲିଖା ।

(a) ଉପକରଣର ସଂଖ୍ୟା ଲିଖା କି ? ଉପକରଣର ସଂଖ୍ୟା ଲିଖା ।

Answer the following questions (any two) :

3. ତରଳ ଅମ୍ଳମାନଙ୍କର ଉତ୍ତର ଲିଖା (କୌଣସି ଦୁଇଟି) :  $5 \times 2 = 10$

a velocity of  $20 \text{ ms}^{-1}$ .

a body of mass 1 kg moving with

Calculate the de Broglie wavelength of

କରା ?

କରା କି ଉପକରଣର (de Broglie) ଉପକରଣର ସଂଖ୍ୟା ଲିଖା

(c) 1 kg ତରଳ ଅମ୍ଳ ଉପକରଣର  $20 \text{ ms}^{-1}$  ଉପକରଣର ସଂଖ୍ୟା ଲିଖା

- (b) (i)  $n+1 = 4$  ଉପକକ୍ଷତ ଧାରା ଦିଶାଇବା ସମୟରେ ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।  
 (ii)  $n+3$  ଉପକକ୍ଷତ ଧାରା ଦିଶାଇବା ସମୟରେ ଧାରା ଗଣନା କରାଯାଏ ।

Write the electron configuration of the element having atomic number 19. Also write the number of unpaired electrons in the ground state.

- (ii) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

What is ionization energy? Why is the second ionization energy of an element higher than that of first ionization energy?

- (a) (i) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।  
 (ii) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

Answer the following questions (any two):  
 3. ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।  
 5x2=10

Calculate the de Broglie wavelength of a body of mass 1 kg moving with a velocity of  $20 \text{ ms}^{-1}$ .

- (c) 1 kg ବସ ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।  
 ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

What do you mean by polarizing power of a cation? Among the following compounds which is most covalent?  
 $\text{NaF, NaI, NaBr, NaCl}$

Write Schrödinger wave equation and mention the significance of terms associated in the equation.  
 (b) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

- (a) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

Answer the following questions (any two):  
 2. ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।  
 2x2=4

- (i)  $\text{CCl}_4$   
 (ii)  $\text{PCl}_5$   
 (iii)  $\text{NH}_3$   
 (iv)  $\text{H}_2\text{O}$

Which of the following compounds has zero dipole moment?

- (b) ଧାରା ଗଣନା କରାଯାଏ । ଧାରା ଗଣନା କରାଯାଏ ।

( 4 )

Write the electronic configuration of  $Fe^{3+}$  ion. Find the number of unpaired electrons present in it and also mention the number of electrons present in  $n+l=4$  subshells.

(ii) হাইড্র'জেন বন্ধনি বুলিলে কি বুজা? কিয়  $o$ -হাইড্র'জি বেনজেলডিহাইড তবল কিয়  $p$ -হাইড্র'জি বেনজেলডিহাইড কঠিন, ব্যাখ্যা কবা। 2

What do you mean by hydrogen bond? Explain, why  $o$ -hydroxy benzaldehyde is liquid but  $p$ -hydroxy benzaldehyde is a solid.

(c) (i) দ্রবণ শক্তি বুলিলে কি বুজা?  $BaSO_4$  পানীত আংশিকভাৱে দ্রবণীয় কিন্তু  $Ba(OH)_2$  অধিক পৰিমাণে দ্রবীভূত হয়। কিয়? উপযুক্ত উদাহৰণসহ ব্যাখ্যা কবা। 3

What do you mean by solvation energy?  $BaSO_4$  is sparingly soluble in water but  $Ba(OH)_2$  has high solubility in water. Why? Explain with proper reason.

(ii)  $p$ - আৰু  $f$ -অৰবিটেলৰ কিমান সংখ্যক orientation সম্ভব? 2

How many orientations are possible for  $p$ - and  $f$ -orbitals?

24P/396

(Continued)

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4. চমু টোকা লিখা : 2×2=4

Write short notes on :

(a) ফাজানৰ নিয়ম

Fajan's rule

(b) লেটিছ শক্তি

Lattice energy

UNIT—II

( Physical Chemistry )

( Marks : 20 )

5. শুদ্ধ উত্তৰটো বাছি উলিওৱা : 1×2=2

Select the correct answer :

(a) তলৰ কোনটো গেছৰ অণুৰ ম'লাৰ গতিশক্তিৰ প্ৰকাশবাণী?

Which of the following is the expression for molar kinetic energy of gas molecules?

(i)  $\sqrt{\frac{3RT}{M}}$

(ii)  $\frac{3}{2}nRT$

(iii)  $\frac{3}{2}RT$

(iv)  $\frac{3}{2}KT$

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( Turn Over )

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- (b) এটা নিৰ্দিষ্ট উষ্ণতাত মিথেনৰ ব্যাপনৰ হাৰ এটা অজ্ঞাত গেছতকৈ দুগুণ। অজ্ঞাত গেছটোৰ ম'লাৰ ভৰ হ'ল

The rate of diffusion of methane at a given temperature is twice than that of an unknown gas. The molar mass of unknown gas is

- (i) 32  
(ii) 64  
(iii) 4  
(iv) 8

6. তলৰ যি কোনো দুটা প্ৰশ্নৰ উত্তৰ লিখা :  $2 \times 2 = 4$

Answer any two questions from the following :

- (a) স্বাধীনতাৰ মাত্ৰা বুলিলে কি বুজা? শক্তিৰ সমবিভাজনৰ নীতিটো লিখা।

What is meant by degree of freedom?  
Write the law of equipartition of energy.

- (b) বাস্তৱ গেছ এটাই আদৰ্শ গেছৰ আচৰণৰ পৰা বিচ্যুতি দেখুওৱাৰ কাৰণ কি?

What are the causes of deviation of real gases from its ideal behaviour?

- (c) এটা গেছৰ ক্ৰান্তীয় উষ্ণতা আৰু সংকোচিত চাপৰ সংজ্ঞা দিয়া।

Define critical temperature and reduced pressure of a gas.

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7. তলৰ প্ৰশ্নসমূহৰ উত্তৰ লিখা (যি কোনো দুটা) :  $5 \times 2 = 10$

Answer the following questions (any two) :

- (a) (i) হাইড্ৰ'জেন গেছৰ কাৰণে  $0^\circ\text{C}$  উষ্ণতাত (1) মূল গড় বৰ্গবেগ, ( $C_{r.m.s.}$ ) আৰু (2) সৰ্বোচ্চ সম্ভাৱ্য বেগ, ( $C_{m.p.}$ ) গণনা কৰা। 3

For hydrogen gas, calculate (1) the root-mean-square velocity, ( $C_{r.m.s.}$ ) and (2) the most probable velocity, ( $C_{m.p.}$ ) at  $0^\circ\text{C}$ .

- (ii) গেছৰ অণুৰ সংঘৰ্ষণ কম্পনাংকৰ সংজ্ঞা দিয়া। ইয়াৰ ওপৰত উষ্ণতা আৰু চাপৰ প্ৰভাৱৰ বিষয়ে লিখা। 2

Define collision frequency of gas molecules. Discuss the effect of temperature and pressure on it.

- (b) (i) গেছৰ গতিজ সমীকৰণ ব্যৱহাৰ কৰি দেখুওৱা যে এটা আদৰ্শ গেছৰ বাবে  $C_p - C_v = R$ . 3

Using kinetic gas equation, show that for an ideal gas  $C_p - C_v = R$ .

- (ii) পেৰাচ'ৰৰ সংজ্ঞা দিয়া। ইয়াৰ এটা প্ৰয়োগ উল্লেখ কৰা। 2

Define parachor. Mention one use of it.

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- (c) তৰলৰ পৃষ্ঠটান বুলিলে কি বুজা? উষ্ণতাৰ লগত ই কেনেদৰে সলনি হয়? পৰীক্ষাগাৰত তৰলৰ পৃষ্ঠটান উলিওৱাৰ এটা পদ্ধতি বৰ্ণনা কৰা।  $1+1+3=5$

What do you mean by surface tension of a liquid? How does the surface tension of a liquid vary with temperature? Describe one method of determining the surface tension of a liquid in the laboratory.

8. এটা গেছৰ গড় মুক্ত পথ আৰু সান্দ্ৰতা গুণাংকৰ মাজৰ সহস্বাটো নিৰ্ণয় কৰা। 4

Derive the relationship between mean free path and coefficient of viscosity of a gas.

নহিবা / Or

ক্ৰান্তীয় ধ্ৰুৱকবোৰক জান ডাব ৱালৰ ধ্ৰুৱক  $a$  আৰু  $b$ ৰ সহায়ত প্ৰকাশ কৰা।  $\text{CO}_2$  গেছৰ ক্ৰান্তীয় উষ্ণতা  $31.1^\circ\text{C}$  আৰু ইয়াৰ ক্ৰান্তীয় আয়তন  $0.0967$  lit. গেছটোৰ  $a$ ,  $b$  আৰু ক্ৰান্তীয় চাপ ( $P_c$ )ৰ মান নিৰ্ণয় কৰা।

Express critical constants in terms of van der Waals' constants  $a$  and  $b$ . The critical temperature of  $\text{CO}_2$  gas is  $31.1^\circ\text{C}$  and its critical volume is  $0.0967$  lit. Calculate the values of  $a$  and  $b$  and its critical pressure ( $P_c$ ) for the gas.

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UNIT—III

( Organic Chemistry )

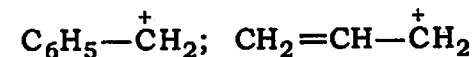
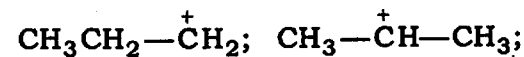
( Marks : 20 )

9. তলত দিয়াবিলাক উল্লেখ কৰা ধৰণেৰে সজোৱা :  $1 \times 2 = 2$

Arrange the following as mentioned :

- (a) সুস্থিৰতাৰ উৰ্দ্ধক্রমত

Increasing order of stability



- (b) অম্লতাৰ অধঃক্রমত

In decreasing order of acidity

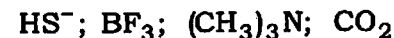


10. তলৰ যি কোনো দুটা প্ৰশ্নৰ উত্তৰ লিখা :  $2 \times 2 = 4$

Answer any two questions of the following :

- (a) ইলেক্ট্ৰ'ফাইল আৰু নিউক্লিয়'ফাইল বুলিলে কি বুজা? তলৰ যৌগসমূহৰ বা আয়নসমূহৰ পৰা ইয়াক বাছি উলিওৱা :

What are electrophiles and nucleophiles? Select electrophiles and nucleophiles from the following molecules/ions :



(b) কাৰ্বিনৰ সংজ্ঞা দিয়া আৰু ইয়াৰ শ্ৰেণীবিভাগ কৰা।  
What are carbenes and how are they classified?

(c) 1-বিউটিনকৈ 2-বিউটিন বেছি স্থিৰ। অতিসংযোজনৰ দ্বাৰা ইয়াক ব্যাখ্যা কৰা।  
2-butene is more stable than 1-butene. Explain it with the help of hyper-conjugation.

11. তলৰ প্ৰশ্নসমূহৰ উত্তৰ লিখা (যি কোনো দুটা) :  $5 \times 2 = 10$

Answer the following questions (any two) :

(a) (i) ক'ৰে-হাউচ সংশ্লেষণৰ দ্বাৰা 2-মিথাইল পেণ্টেনৰ প্ৰস্তুত-প্ৰণালী লিখা। 2

Prepare 2-methyl pentane with the help of Corey-House method.

(ii) ছ'ডিয়াম এছিটেটৰ গাঢ় জলীয় দ্ৰৱণেৰে তড়িৎ বিশ্লেষণ কৰিলে কি উৎপন্ন হয়? 1

What is produced when concentrated solution of sodium acetate is electrolyzed?

(iii) সংকৰণৰ সহায়ত ইথিলিন অণুৰ গঠন ব্যাখ্যা কৰা। 2  
Explain the formation of ethylene molecule with the help of hybridization.

(b) (i) আগমণিক প্ৰভাৱ আৰু ইলেক্ট্ৰ'মেৰিক প্ৰভাৱৰ মাজৰ পাৰ্থক্য লিখা। 2

Differentiate between inductive effect and electromeric effect.

(ii) তলত দিয়াটো সংস্পন্দন প্ৰভাৱৰ দ্বাৰা কেনেকৈ ব্যাখ্যা কৰিব? 2

How will you explain the following on the basis of resonance effect?

এৰাইল এমাইন এলকিন এমাইনতকৈ দুৰ্বল ক্ষাৰক।

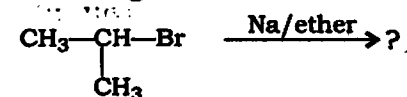
Aryl amine is a weaker base than alkyl amine.

(iii) লুইচ এছিড আৰু ক্ষাৰক বুলিলে কি বুজা? 1  
What are Lewis acid and bases?

(c) (i) মুক্তমূলক প্ৰতিস্থাপন বিক্ৰিয়া কি? মিথেনৰ ক্ল'ৰিনেচন বিক্ৰিয়াৰ ক্ৰিয়াবিধি উল্লেখ কৰা।  $1+2=3$   
What are free radical substitution reactions? Discuss the mechanism of chlorination of methane.

(ii) তলৰ বিক্ৰিয়াটো সম্পূৰ্ণ কৰা আৰু উৎপন্ন হোৱা যৌগটোৰ IUPAC নাম লিখা : 2

Complete the following reaction and give the IUPAC names of the following :



( 12 )

12. চমু টোকা লিখা :

2×2=4

Write short notes on :

(a) সংস্পন্দন

Resonance

(b) অম্ল আৰু ক্ষাৰকৰ তীব্ৰতা

Strength of acids and bases

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