K21P 4178

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.)
Examination, October 2021
(2018 Admission Onwards)
CHEMISTRY
CHE 1C.04 : Physical Chemistry – 1

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one word** or **sentence**. **Each** question carries **1** mark.

1. State Nernst heat theorem.
2. What is meant by chemical potential ?
3. Define thermomolecular pressure difference.
4. Give an example for a ternary system with one pair of partially miscible liquids.
5. Give one example each for polarisable and non-polarisable electrode.
6. What do you understand by the term polarization ?
7. Define corrosion.
8. How is IR drop related to current density ? **(8×1=8)**

SECTION – B

Answer **any eight** questions. Answer in **one** or **two** sentences. **Each** question carries **2** marks.

9. What is meant by residual entropy ? Explain with any one example.
10. State and explain Onsager's reciprocal relation.

P.T.O.

11. Draw the general phase diagram of a ternary system with three pairs of partially miscible liquids.
12. Why H^+ ions show abnormal ionic mobility in aqueous solution ?
13. Define hydrogen overvoltage and oxygen overvoltage.
14. What is meant by transfer coefficient or symmetry factor ?
15. Draw polarographic cell assembly.
16. Calculate the mean ionic activity coefficient of 0.01 molal $CaCl_2$ in water at 25°C. A = 0.509.
17. What do you mean by exchange current density ?
18. Explain passivation of metals.
19. Draw the polarization diagram for corroding metal when anode area equals one-half of cathode area.
20. Write any two limitations of Pourbaix diagrams. **(8×2=16)**

SECTION – C

Answer **any four** questions. **Each** question carries **3** marks.

21. Derive an expression for the rate of entropy production for a system with matter and heat transport.
22. Write a note on liquid junction potential.
23. Write Butler-Volmer equation and explain the terms.
24. Draw electrode-electrolyte interface and show inner and outer Helmholtz plane.
25. Write the equation for thickness of ionic atmosphere and explain the terms.
26. What are the advantages of dropping mercury electrode ?
27. How will you establish polarization diagram of corroding metals ?
28. Write a note on Pilling – Bedworth ratio. **(4×3=12)**

SECTION – D

Answer '**a**' or '**b**' of **each** question. **Each** question carries **6** marks.

29. a) State third law of thermodynamics. How can you determine the absolute entropy of a gas using third law of thermodynamics ?

OR

b) Discuss phase rule for three component system. Draw and discuss the general phase diagram of a 3-component system with two pairs of partially miscible liquids.

30. a) Explain the principle and working of polarography.

OR

b) Derive Debye Huckel limiting law and write Debye-Huckel equation for appreciable concentration.

31. a) Derive Debye Huckel Onsager equation.

OR

b) Derive Tafel equation. Explain the significance of slope and intercept.

32. a) Write an essay on various types of damages due to corrosion.

OR

b) Write notes on :

i) Electrochemical impedance spectroscopy

ii) Cathodic protection. **(4×6=24)**

K21P 4177

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.)
Examination, October 2021
(2018 Admission Onwards)
CHEMISTRY
CHE1C.03 : Organic Chemistry – 1

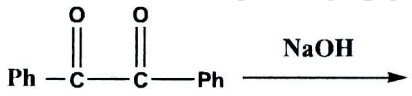
Time : 3 Hours Max. Marks : 60

SECTION – A

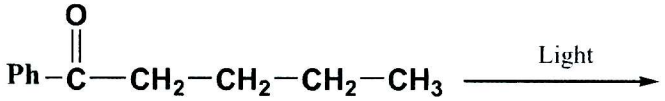
Answer **all** questions in **one** word or **one** sentence. **Each** question carries **one** mark.

1. Triplet carbene is more stable than singlet carbene. Why ?
2. Which of the following is more stable ?

3. Draw the most stable conformation of ethylene glycol.
4. Give the product



5. Illustrate Hoffmann Elimination.
6. What is the order of nucleophilicity of halide ion in a polar protic solvent like water ?
7. Predict the product



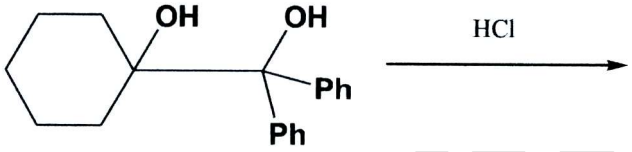
8. Give any one criteria that should be fulfilled by the compound to become photosensitizer.

P.T.O.

SECTION – B

Answer **any eight** questions. Answer in **two** or **three** sentences. **Each** question carries **2** marks.

9. Draw the possible canonical structures of vinyl chloride and arrange them in the order of stability.
10. For a halo hydrocarbon, 7-chlorocyclo-1, 3, 5 heptatriene is unusual in its ionization to give chloride ion in water. Why ?
11. Neomenthyl Chloride undergoes HCl elimination more easily than menthyl chloride. Why ?
12. What is meant by prostereoisomerism ?
13. Give the product.

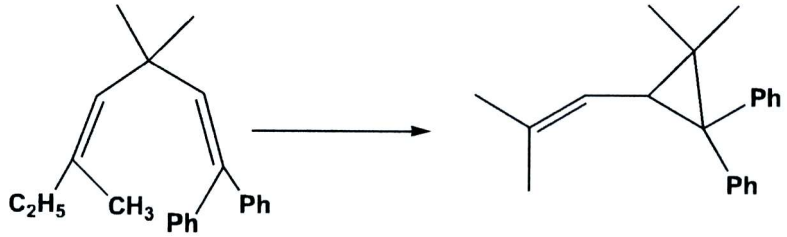


14. Explain the effect of nature of nucleophile on SN reactions.
15. Give the product of the following reactions. Which reaction is faster ? Why ?

1) $CH_3 - CH_2 - I \xrightarrow{Alc.NaOH}$

2) $CD_3 - CH_2 - I \xrightarrow{Alc.NaOH}$

16. Give different possible stereoisomers formed during the dehalogenation of 2, 3-dibromobutane.
17. Why Guanidine is considered as the strongest organic N-base ?
18. Illustrate the product formed when Naphthalene undergoes Photo cyclic addition with alkene.
19. Suggest the mechanism for the following photo rearrangement.

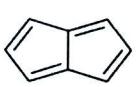


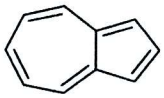
20. What are the characteristics of photoreaction ?

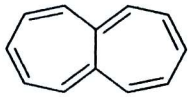
SECTION – C

Short paragraph questions. Answer **four** questions. **Each** question carries **three** marks.

21. One of the following compounds is more stable than the other two. Classify each as aromatic, anti-aromatic and non-aromatic.


Pentalene


Azulene


Heptalene

22. Write a short note on Nitrene.

23. Illustrate Damjanove rearrangement with mechanism.

24. Draw Cis and Trans decalin and explain which is more stable.

25. Give two reactions that involves the formation of benzyne intermediate. Also explain the bonding in Benzyne.

26. How the substrate structure influences E_1, E_2 and E_1c B mechanism ?

27. Illustrate the Photo Fries Rearrangement.

28. Gas phase irradiation of 2-pentanone produces acetone, ethylene in about 88% yield along with 12% methyl cyclobutanol. Account for the formation of these products.

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries **six** marks.

29. A) Discuss aromaticity of annulenes and heteroannulenes.

OR

B) Illustrate one addition and one insertion reaction each involving carbene and nitrene.

30. A) Illustrate the esterification of menthol, isomenthol, neomenthol and isoneomenthol.

OR

B) Write a short note on :

i) Benzil- Benzilic acid rearrangement.

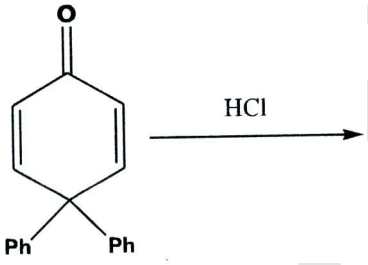
ii) Favorski Rearrangement.

31. A) What are the factors which determines the competition between substitution and elimination reaction ?

OR

B) i) Write a short note on neighbouring group participation in S_N reaction.

ii) Give the Product.



32. A) Discuss the Photochemistry of vision.

OR

B) Explain the following :

i) Singlet and Triplet state.

ii) Photochemistry of Vitamin D.

iii) Barton Reaction.

K22P 1568

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS – Reg./Sup./Imp.) Examination, October 2022
(2019 Admission Onwards)
CHEMISTRY
CHE 1C.02 : Inorganic Chemistry – I

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **1** mark.

1. Give any two examples for metallochromic indicator.
2. Which organic precipitant is used for the gravimetric estimation of Fe (III) ?
3. What is relative standard deviation ?
4. Give the auto-ionisation reaction of H_2SO_4.
5. How is nuclear radius related to mass number of the nucleus ?
6. What do you mean by a breeder reactor ?
7. What are closo boranes ?
8. Which phosphorus sulphide is used for making matches ? **(8×1=8)**

SECTION – B

Answer **any eight** questions. Answer in **two** or **three** sentences. **Each** question carries **2** marks.

9. Explain the terms :
   a) Students t-test and
   b) F-test.

10. Calculate the standard deviation for an element whose percentage in a sample has been found to be 20.8, 21.6, 22.1, 22.0, 23.3, 21.9 and 22.8.

11. Explain selective masking and demasking techniques in EDTA titration with suitable examples.

12. What is the order of basicity of alkylamines in solution phase ? Explain the reason.

13. What is meant by levelling effect ? Give an example.

14. What is symbiosis ?

15. Write a nuclear equation for
    a) α-decay of $_{91}Pa^{231}$
    b) β-decay of $_{90}Th^{227}$.

16. Why nuclei with nucleon number 2, 8, 20, 50, 82 or 126 shows exceptional behaviour ?

17. What are the similarities between a nucleus and a liquid drop ?

18. Derive 'STYX' code for B_5H_{11} and draw its structure.

19. Starting from S_4N_4, how will you prepare S_2N_2 and $(SN)_X$.

20. How will you prepare P_4S_7 ? Give its structure. **(8×2=16)**

SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **3** marks.

21. Discuss briefly the application of oxine in gravimetric estimation of metal ions.

22. What are the essential requirements for a substance to be used as a metallochromic indicator ?

23. With equations and words, explain what happens :
    a) When metallic potassium is dissolved in NH_3 to form a dilute solution.
    b) When more potassium is added to form concentrated solution.
    c) When (a) is treated with Fe_2O_3.

24. Discuss the properties of sulphuric acid as a non-aqueous solvent.

25. Explain transient and secular radioactive equilibrium.

26. Write a short note on collective model of nucleus.

27. Give an account of the structure and bonding in $[NPCl_2]_3$.

28. What is Wade's rule ? Discuss. **(4×3=12)**

SECTION – D

Essay type questions. Answer either '**a**' or '**b**' of **each** question. **Each** question carries **6** marks.

29. a) Explain the terms distribution coefficient and distribution ratio in solvent extraction. Discuss the principle involved in counter current extraction and its applications.

OR

b) What are chelometric indicators ? Explain the function of chelometric indicators with special reference to EDTA titration. Briefly discuss the feasibility of EDTA titration.

30. a) Write a generalised acid base concept. Use acid base concept to correlate the following observations :

Basicity of metal oxides, acidity of metal oxides, hydration and hydrolysis reactions, acidity of oxyacids and basicity of substituted amines.

OR

b) Acids and bases are classified into hard and soft. What is its theoretical basis ? What are its applications ?

31. a) Explain the various methods used for the detection and measurements of radiation.

OR

b) What is reaction cross section ? Explain different types of nuclear reactions.

32. a) Write briefly on the preparation, properties and structure of phosphorus-sulphur cages.

OR

b) How is diborane prepared ? Discuss its important properties, structure and bonding ? **(4×6=24)**

K21P 4176

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS – Reg./Supple./Imp.)
Examination, October 2021
(2018 Admission Onwards)
CHEMISTRY
CHE1C.02 : Inorganic Chemistry – I

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **1** mark.

1. What do you mean by standard deviation ?
2. Name an organic precipitant used for the gravimetric estimation of Nickel (II).
3. Why is pH 10 buffer used in EDTA titration ?
4. Classify the following on Lewis acid or Lewis base giving reason :
   i) CO_2
   ii) Mg^{2+}.
5. What is Dosimetry ?
6. What are magic numbers ?
7. Complete the following equation :
   $B_2H_6 + 2NaH \xrightarrow{\text{diglyme}}$
8. What are phosphazines ? **(8×1=8)**

SECTION – B

Answer **any eight** questions. Answer in **two** or **three** sentences. **Each** question carries **2** marks.

9. What is distribution law ? What are the limitations of distribution law ?
10. How do you assess the reliability of results ?

P.T.O.

11. What do you mean by precipitation from homogeneous solution ? Explain.

12. Is OH^- or S^{2-} more likely to form insoluble salts with 3+ transition metal ions ? Which is more likely to form insoluble salts with 2+ transition metal ions ?

13. What are room temperature molten salts ?

14. What is hydrometallurgy ?

15. Explain the Bethe's notation of nuclear process with example.

16. What do you mean by neutron capture cross section ?

17. Explain spontaneous fission.

18. How is S_4N_4 prepared ? S_4N_4 is associated with thermochromic property. Why ?

19. The 'STYX' number of B_5H_9 is 4120. Explain.

20. Give an account of the structure and bonding in $(PNCl_2)_3$. **(8×2=16)**

SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **3** marks.

21. What are the essential requirements for a substance to be used as a metallochromic indicator ?

22. Write a short note on organic precipitants used in gravimetric analysis.

23. Explain symbiosis.

24. Discuss the acid base properties of different substances in sulphuric acid solvent.

25. Explain the principle and working of GM counter.

26. Write a short note on radiolysis of water.

27. By taking a suitable example explain the Jemmis 'mno' rule.

28. Give one method each for the preparation of P_4S_3, P_4S_5 and P_4S_{10}. What are their uses ? **(4×3=12)**

SECTION – D

Essay type questions. Answer either '**a**' or '**b**' of each question. **Each** question carries **6** marks.

29. a) Explain the terms distribution coefficient and distribution ratio in solvent extraction. Discuss the principle involved in counter current extraction and its applications.

OR

b) What are Chelometric titrations ? Explain selective masking and demasking techniques in EDTA titration with suitable examples. Discuss the industrial applicaiton of masking.

30. a) Write about the merits and demerits of liquid ammonia as a nonaqueous solvent. Explain the properties of alkali metal – liquid ammonia solution.

OR

b) Explain the theoretical basis of hardness and softness of acids and bases.

31. a) Write the salient features of liquid drop model. How does it explain the nuclear fission reaction ?

OR

b) Explain different types of nuclear reactions. How is reaction rate and reaction cross section related ?

32. a) Discuss the importance of icosohedral frame work in understanding the structure of higher boranes and carboranes.

OR

b) Explain the preparation, structure and properties of S_2N_2 and polythiazyl.

(4×6=24)

K22P 1567

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS – Reg./Sup./Imp.) Examination, October 2022
(2019 Admission Onwards)
CHEMISTRY
CHE1C.01 : Theoretical Chemistry – I

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or sentence. **Each** question carries **1** mark. **(8×1=8)**

1. Write down the expression for Fock operator.
2. Define free valence.
3. Express the energy equation of a Harmonic oscillator.
4. Define minimal basis set.
5. What are Lagendre polynomial ?
6. Write down the Hamiltonian for He atom in atomic unit.
7. Write down the perturbation term for H_2 molecule.
8. Draw the angular distribution diagram of 2pz orbital.

SECTION – B

Answer **eight** questions in **two** or **three** sentences. **Each** question carries **2** marks. **(8×2=16)**

9. State variation theorem.
10. Define STO and GTO.
11. Discuss the hybridization of water molecule.
12. What are commutators ?

P.T.O.

13. State Pauli's antisymmetry principle.

14. What are Coulomb integrals ?

15. Write down the molecular term symbol for O_2 molecule.

16. Give any two assumptions of Huckel's theory.

17. What is meant by semi empirical methods ?

18. Explain Born-Oppenheimer approximation.

19. Write down the minimum energy at which degeneracy exist for particle in one dimensional box.

20. How dual character of electron is confirmed ?

SECTION – C

Answer **four** questions in short paragraph. **Each** question carries **3** marks. **(4×3=12)**

21. What is an eigen function ? Explain with example.

22. Define spherical harmonics.

23. Draw the molecular orbital diagram of LiH molecule.

24. Briefly give the assumptions of VBT.

25. Find the commutators of d/dx and d^2/dx^2 for the function e^{-ikx}.

26. What is meant by complex conjugate ?

27. What is a Laplacian operator ?

28. Find the first order correction in energy of a particle in a box model.

SECTION – D

Answer either **a** or **b** of **each** question. **Each** question carries **6** marks. **(4×6=24)**

29. a) Explain Huckel's theory of molecular orbital using suitable example.

OR

b) Discuss the complete quantum mechanical treatment of a rigid rotator.

30. a) Compare and contrast VBT and MOT.

OR

b) Explain Hartree-Fock-self-consistent field method.

31. a) Give a brief account of approximation method used in quantum mechanics.

OR

b) Discuss the operator postulates in quantum mechanics.

32. a) How MOT is successful in explaining the bonding in H_2^+ ion ?

OR

b) Discuss valence bond theory applied to H_2 molecule.

K21P 4175

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.)
Examination, October 2021
(2018 Admission Onwards)
CHEMISTRY
CHE1C.01 : Theoretical Chemistry – I

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or sentence. **Each** question carries **1** mark : **(8×1=8)**

1. Which of the following functions is acceptable ?
   a) $\psi = x$ b) $\psi = x^2$ c) $\psi = \sin x$ d) $\psi = e^{-x}$
2. What are eigenfunctions ?
3. The energy of a particle in a box is found to be $9\ h^2/8\ ma^2$. Find out the value of principle quantum number.
4. Write the equation for energy of a rigid rotor.
5. Write down the perturbation term for helium atom.
6. What is associate Legendre polynomial ?
7. What are Slater type orbitals ?
8. Define basis set.

SECTION – B

Answer **any eight** questions in **two** or **three** sentences. **Each** question carries **2** marks : **(8×2=16)**

9. Explain Hermitian operator.
10. Evaluate the commutator $[d/dx, d^2/dx^2]$.

P.T.O.

11. State and explain expectation value postulate of quantum mechanics.

12. What is a well behaved wave function ?

13. Write down the wave function corresponding to the energy $6h^2/8ma^2$.

14. Verify that ψ = Asinkx + Bcoskx is a general solution for a particle in a one dimensional box of infinite potential wall.

15. What are Hermite polynomials ? Find out the values of first two Hermite polynomials.

16. Discuss the significance of quantum numbers n, l and m.

17. Using atomic units write the complete Hamiltonian for electronic motion in hydrogen atom in spherical polar coordinates.

18. Mention the problem facing by many electron system. How it can be solved ?

19. What is a spin orbital ?

20. Give the determinantal wave functions of a 3 electron system.

SECTION – C

Answer **any four** questions in short paragraph. **Each** question carries **3** marks : **(4×3=12)**

21. Explain black body radiation.

22. Consider the wave function ψ = A sin kx. Find the eigenvalue of this function for the operator d^2/dx^2.

23. Draw the molecular orbital diagram of CO molecule.

24. How do you apply Huckel theory to allyl system ?

25. What do you mean by self-consistent field method ?

26. Calculate the ground state energy of butadiene molecule using particle in a box model. (C-C single and double bond lengths are 1.54 Å and 1.34 Å respectively)

27. What are Laguerre polynomials ?

28. Draw the radial plot of Px orbital.

SECTION – D

Answer either **a** or **b** of **each** question. **Each** question carries **6** marks : **(4×6=24)**

29. a) Discuss the postulates of quantum mechanics.

OR

b) Explain the method of variation applied to Helium atom.

30. a) What are antisymmetric wave functions ? Construct the slater determinant of a system with four electrons.

OR

b) What is VBT ? Apply VBT to hydrogen molecule.

31. a) Discuss semi empirical and abinitio method used in computational chemistry.

OR

b) What are operators ? Explain different operators used in quantum mechanics.

32. a) Discuss the quantum mechanics of simple harmonic oscillator.

OR

b) Discuss the importance of angular momentum in quantum mechanics. What are ladder operators ?