Sl. No. of Q.P.: 1503

5/12/18

Unique Paper Code	:	217161
Name of the Course	:	B.Sc(Prog)
Name of the Paper	:	CHPT-101: Chemistry-I
Semester	:	I

Time : 3hrs

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **three** questions from **Section-A** and **Section-B** respectively

Section-A

1. (a) write all the possible orbitals when n=4 . Determine maximum number of electrons which can exist in a completely filled orbital with, n=4.
   (b) Give four possible quantum numbers for a 5f electron of an atom.
   (c) Define concept of exchange energy
   (d) Draw the shapes of 2s , 2p and $3z^2$ orbitals
   (e) states all the possible values for the quantum numbers n, l and m

   (3, 3, 2, 1 ½,3)

2. (a) Give the salient features of molecular orbital theory
   (b) PCl_5 has trigonal bipyramid shape while IF_5 has distorted square pyramid. Explain
   (c) Bond angle of OF_2 is less than that of OCl_2
   (d) Draw the molecular orbital energy level diagram for N_2^+ , discuss its bond order and magnetic behaviour. Why is the bond order in N_2^+ less then that in N_2 molecule.
   (e) Predict which of the following ions is planar,
   ClO^{3-} , ClO^{4-} , NO^{3-}

   (3, 3, 1 ½ , 3, 2)

3. (a) $ZnCl_2$ is soluble in organic solvents while $MgCl_2$ is insoluble
   (b) Melting points of NaCl is much higher than that of $AlCl_3$
   (c) Be_2 molecules doesn't exist, explain on the basis of molecular orbital theory
   (d) Which is more polar and why, CO_2 or NO_2
   (e) Gives postulates of VSEPR theory. (3,3,1 ½ , 3, 2)

4. Write short note on the following:
   (a) Bonding and anti bonding orbitals
   (b) Fazan's rule
   (c) Polarization power

(d) Quantum number

(e) Dual nature of electron

(3,3,1 ½ , 3, 2)

Section-B

1. Attempt any ***five*** of the following: (2½ x5=12½)

(a) Giving reasons arrange the following carbocations in increasing order of stability:
$(CH_3)_3C^+$, $CH_3CH_2^+$, $(CH_3)_2CH^+$, CH_3^+

(b) Classify the following as electrophiles and nucleophiles:
Br^+, H_2O, NH_2^-, NO_2^+, NH_4^+

(c) Benzyl radical is more stable than allyl radical. Explain

(d) Phenol is more acidic than alcohols but less acidic than carboxylic acids. Explain

(e) Why alkynes are less reactive than alkenes towards electrophilic addition reactions?

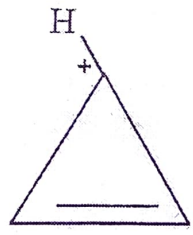
(f) What is Saytzeff's rule? Explain, giving suitable examples

2. (a) Write structure of 2-bromo-3-chlorobutane and indicate the number of stereoisomers possible for this compound 2

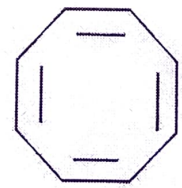
(b) Out of ethylamine and aniline, which one is more basic and why? 3

(c) The peroxide effect (or Kharasch effect) in alkene is observed only in the addition of HBr and not HCl and HI. Expalin. 3

(d) What is aromaticity? Giving suitable reason explain which of the following compound is/are aromatic 4½



(i)



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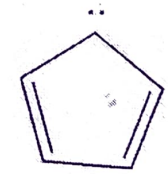


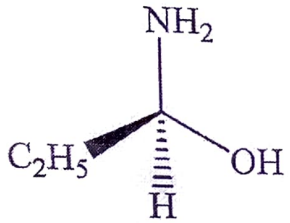
(iii)

3. (a) Arrange the following in increasing order of acidic strength with suiatable explanation 2

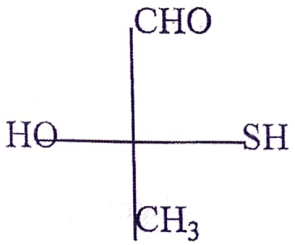
$ClCH_2COOH$, $HCOOH$, CH_3COOH, $Cl_2CHCOOH$

(b) Draw the Newman projection for different conformations possible for butane. Discuss their stability 3

(c) Assign R and S configuration of the following 3

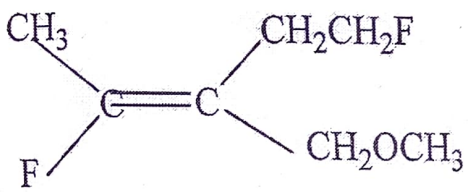


(a)

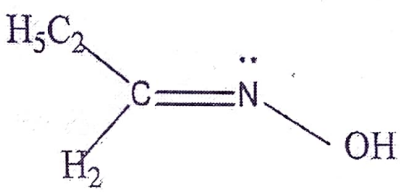


(b)

(d) Assign E/Z configuration of the following 4½



(a)



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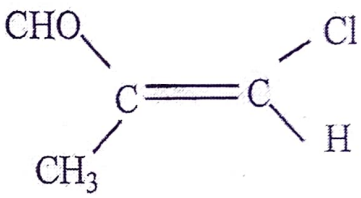

(c)

4. (a) How will you differentiate between 'configuration' and the 'conformation'. 2

(b) Giving mechanism involved write the structure of alcohol formed from $CH_3CH=CH_2$, under following conditions: 4½

i. Hydroboration- Oxidation

ii. Oxymercuration- demercuration

iii. Acid catalysed hydration

(c) Draw all possible conformations of cyclohexane. Which amongst these is most stable? Give reason for your answer 3

(d) Methane and chlorine react in the presence of light to give chloromethane. Give mechanism for this reaction 3

[This question paper contains ___ printed pages]

Your Roll No....2018.....

Sr. No. of Question Paper :1506 (23)

Unique Paper Code : 235166

Name of the Paper : MAPT-101 Calculus and Matrices

Name of the Course : **B.Sc (Mathematical Sciences)-I** / B.Sc. (Prog.) I

~~B. Sc. (Physical Sciences)-I~~

Semester : I

Duration : 3 Hours Maximum Marks: 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper
2. Attempt **any two** questions from each section.

SECTION-I

1. (a) Let $S = \{(1,3),(1,-1)\}$. Show that
   (i) S spans R^2
   (ii) S is linearly independent . (6)

   (b) Show that
   (i) $W_1 = \{(a, b, 1) : a, b \in R\}$ is not a subspace of R^3
   (ii) $W_2 = \{(a, b): a, b \geq 0 : a, b \in R\}$ is a subspace of R^2 (6)

2. (a) Find rank of the matrix by reducing it to triangular form using Elementary Row Operations

$$\begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 2 & 3 & 4 \\ 3 & 1 & 1 & 3 \end{bmatrix}.$$ (6)

   (b) Let $T : R^3 \rightarrow R^2$ be a Linear Transformation such that $T(1,0,1) = (2,-1)$, $T(0,1,1) = (1,1)$, $T(1,1,0) = (-1,4)$. Find $T(1, 2, 3)$ and $T(1,1,1)$ (6)

3. (a) Using Elementary Row Operations, solve the following system of equations

$$x + 2y + 3z = 14$$
$$3x + y + 2z = 11$$
$$2x + 3y + z = 11$$ (6)

(b) Find the eigen values and the corresponding eigen vectors of the matrix

$$\begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$ (6)

SECTION II

4. (a) Discuss the convergence of the sequences

(i) $<\frac{\cos n}{n}>$

(ii) $<(-1)^n>$ (6)

(b) If $y = \frac{1}{x^2+1}$, Show that $y_n = \frac{(-1)^{n+1} n! \sin(n+1)\theta}{r^{n+1}}$

where $r = \sqrt{1+x^2}$, $\theta = \tan^{-1}(\frac{1}{x})$. (6)

(c) If $y = a \cos(\ln x) + b \sin(\ln x)$, Show that

$x^2 y_{n+2} + (2n+1)\, x\, y_{n+1} + (n^2+1)\, y_n = 0$ (6)

5. (a) Draw the graph of $y = \frac{1}{2}x^2 - 3x + \frac{11}{2}$

Mention the transformations used at every step (6)

(b) If the population of a country doubles itself in 100 years, in how many years will it become four times under the assumption that the rate of increase is proportional to the number of inhabitants? (6)

(c) Find the Taylor Series expansion of e^x at the points $x = 0$ and $x = a$. (6)

6. (a) Draw the level curves of $f(x,y) = y^2 + x^2$ at heights $k = 1,2,5$ (6)

(b) Verify that $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$ where $z = \frac{xy}{\sqrt{1+x^2+y^2}}$ (6)

(c) Verify that the function

$z = \log(x^2 + y^2) + 2\tan^{-1}(y/x)$ satisfy the Laplace's Equation (6)

SECTION III

7. (a) Find an equation of a straight line joining the points whose affixes are $1 - i$ and $2-5i$ (4)

(b) Find an equation of the circle described on the join of the points $(1+i)$ and $(2 - i)$ as the extremities of one of its diameters $(3\frac{1}{2})$

8. (a) Let $Z_1 = 1 + i$, $Z_2 = 1 - \sqrt{3}i$. Find their polar representations and interpret $Z_1 - Z_2$ geometrically. (4)

(b) Form an equation in lowest degree with real coefficients which has $2 - 3i$ and $3 + 2i$ as two of its roots. $(3\frac{1}{2})$

9. (a) Solve the equation $Z^4 + 1 = 0$, where Z is a complex number (4)

(b) Find modulus and argument of the complex number

$$\left(\frac{1+\sin\phi+i\cos\phi}{1+\sin\phi-i\cos\phi}\right)^n$$ $(3\frac{1}{2})$

14/12/18

(This paper contains 2 printed pages)

Sr.No. of question paper © 1509 (24)

Your Roll No. .....

Unique paper code: 216/223/151

Name of the Course: B.Sc.(P)/ B.Sc. (H)

I

Name of the paper: Introduction to Biology LSPT-101

Semester-I / III

Time: 3 hours

Maximum Marks: 75

Instructions for candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper
2. Attempt five questions in all including Question No.1 which is compulsory.

1. (i) Define (any 5) 1X5=5 marks

a) Phylogeny
b) Codon
c) Atherosclerosis
d) Derived lipids
e) Saponification number
f) Central dogma

(ii) Give one word answer for the following 1X5 = 5 marks

a) Sugar present in milk.
b) Disease caused due to deposition of fat in blood vessels.
c) Bond between nucleotides in DNA.
d) Molecules that are mirror images of each other.
e) Tentative answer to a well-framed question.

(iii) Match the following 1X5=5marks

Nucleotide	Protein degradation
Sanger	Heredity
Collagen	DNA
Gene	Energy
ATP	Connective tissue

2. Differentiate between (any 5): 3X5=15 marks
   i. Fibrous and globular proteins
   ii. Saturated and Unsaturated fatty acids
   iii. Replication and Transcription
   iv. Starch and cellulose
   v. Primary and secondary structure of proteins
   vi. Macronutrients and Micronutrients

3. Write short notes on (any 5) 3X5=15 marks
   a. Phospholipids
   b. Speciation
   c. Enantiomers
   d. Mass extinction
   e. Ecosystem
   f. Fossils

4. (a) Briefly describe the key features of the Darwin's theory of Natural selection. 8marks
   (b) Describe the role of mass extinction and adaptive radiation in changing life on earth.7marks

5. (a) What are model organisms? Briefly explain any two model organisms widely used in biological research. 8marks
   (b) Discuss the main features of the domain Archaea. 7marks

6. (a) Mention different types of carbohydrates with suitable examples and the function of each. 10marks
   (b) What is the importance of weak bonds in biological macromolecules? 5marks

7. (a) Discuss the key events involved in the conversion of glucose to pyruvate in glycolytic pathway. Also mention the enzymes involved at each step. 10marks
   (b) Draw a well labeled diagram of a typical eukaryotic cell. 5marks

Sl. No of Question Paper : 1510 (25) 2018

Unique Paper Code : 222161 / 222163

Name of the Paper : Physics – I (Mechanics)

Name of the Course: : B. Sc. Prog

Semester : I

Unique Paper Code: 222161

Duration : 3hrs Maximum Marks: 75

Attempt any five questions in all. Question number one is Compulsory.

Attempt any Four Questions from rest of the paper.

Q1 Attempt any five questions :

a) The velocity of ais $6\hat{i} + 5\hat{j} + 4\hat{k}$ in a frame of reference S' moving with velocity 0.8 c along the x axis relative to a reference frame S at rest. What is the velocity of particle in latter frame?

b) State Keplers law.

c) A particle executes Simple harmonic motion of period 10 sec and amplitude 5 cm . Calculate the maximum amplitude of velocity.

d) State the law of gravitational attraction and hence define the gravitational constant G. Also write its dimensions.

e) Define Poisson's ratio. Also explain the term Resilience.

f) State Newtons Laws of motion. Show that Newtons first law of motion is a special case of second law.

g) What do you understand by inertial and gravitational mass?

h) The length of rocket ship is 100 m on the ground. When it is in flight its length observed on the ground is 99 metres, Calculate the speed.

(5 x 3 = 15)

Q2 a) Define inertial frame of reference. Show that all other frames of reference with constant velocity relative to it are also inertial frames of reference. What are characteristic properties and importance of such frames?

b) If centre of mass of three particles of masses 1, 2 and 3 kg be at the point 3,3,3. Where should the fourth mass of 4kg be placed so that the centre of mass of four particles be at the point 1,1,1? . 7

Q3 a) At what velocity will a 10,000 kg truck have i) same momentum, ii) the same kinetic energy as a 4,0000 kg car at 30 m/sec ? 3

b) Define Angular momentum. State and prove law of conservation of Angular Momentum. Show that the time rate of change of angular momentum of a particle is equal to torque acting on it 9

c) Show that the force $F = yz\,i + zx\,j + xy\,k$ is a conservative force. 3

Q4 a) What are central forces? Show that angular momentum of particle moving under the influence of central forces is always conserved. Also show that Areal velocity of radius vector remains constant under the influence of central force. 8

b) Why are gravitational and coulombs forces called central forces. 2

c) Find the mass of sun from the following data radius of earth orbit is $r = 1.5\times10^{8}$ km and $G = 6.66\times10^{-8}$ N m^2 kg^{-2}. 5

Q5 a) Define Simple Harmonic Motion. What are important properties of Simple Harmonic Oscillator. Why is S.H.M considered to be a fundamental periodic motion? Show that time period of a Simple Harmonic Oscillator is given by

$$T = 2\pi\sqrt{\text{Displacement}/\text{Acceleration}}$$ 8

b) Show with the help of a diagram the phase relation between displacement, velocity and acceleration for given displacement $y = A\sin(\omega t + \Phi)$ 6

c) What is the ratio of Kinetic energy at displacement one fourth to one third of amplitude in case of simple harmonic motion. 3

Q6 a) State basic postulates of relativity. 3

b) Show by means of Lorentz transformations equations that

$$x'^2 - C^2t'^2 = x^2 - C^2t^2$$ 5

c) Explain in detail the concept of twin paradox . 7

7 a) Prove the relation $Y = 2n(1 + \sigma)$; where Y is Youngs modulus, n is modulus of rigidity and σ is poisons ratio. 6

b) Show that in any type of strain the work done per unit volume is equal to ½ stress x strain. 6

c) A wire 5m long and 0.3mm in diameter is stretched by a force 800 gm weight. Calculate the energy stored in it. 3