

**2011**  
**CHEMISTRY**

*Full Marks : 70*

*Candidates are required to give their answers in their own words  
as far as practicable.*

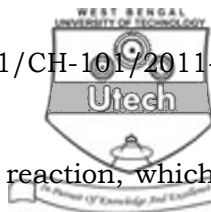
**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any ten of the following :  
 $10 \times 1 = 10$
- i) The unit in which wave number is measured is  
 a) hertz                                  b) sec<sup>-1</sup>  
 c) nanometre                         d) cm<sup>-1</sup>.
- ii) The Balmer series in the spectrum of hydrogen atom falls in  
 a) ultraviolet region              b) visible region  
 c) infrared region                  d) none of these.
- iii) The radius of first orbit in hydrogen atom is 0.529 Å.  
 The radius of second orbit is given by  
 a)  $\frac{1}{2} \times 0.529 \text{ Å}$                   b)  $2 \times 0.529 \text{ Å}$   
 c)  $4 \times 0.529 \text{ Å}$                     d)  $8 \times 0.529 \text{ Å}$ .

[ Turn over



- iv) The energy of an electron in Bohr's atom ..... as we move away from the nucleus.
- a) remains the same
  - b) decreases
  - c) increases
  - d) sometimes increases, sometimes decreases.
- v) According to de Broglie's equation, the momentum of a particle in motion is ..... proportional to wavelength.
- a) inversely
  - b) directly
  - c) not
  - d) none of these.
- vi) Number of phases at triple point is
- a) 0
  - b) 1
  - c) 2
  - d) 3.
- vii) In  $SN_2$  reaction,
- a) carbocation is produced
  - b) racemic mixture is produced
  - c) inversion of structure takes place
  - d) none of these.



viii) In electrophilic aromatic substitution reaction, which of the following is deactivating but o-/p- directing ?

- a)  $\text{NH}_2$                                       b)  $\text{OH}$   
c)  $\text{Cl}$     d)  $\text{NO}_2$ .

ix) Which molecule has non-zero dipole moment ?

- a)  $\text{Cl}_2$     b)  $\text{CO}_2$   
c)  $\text{CCl}_4$     d)  $\text{CHCl}_3$ .

x) The principal & azimuthal quantum number for 3rd orbital are

- a)  $N = 3, l = 0$                                       b)  $N = 3, l = 1$   
c)  $N = 3, l = 2$                                       d)  $N = 3, l = -1$ .

xi) The ( \* ) C atom in the compound  $\text{CH}_3\text{C}^*\text{H}(\text{Cl})(\text{Br})$

- a) Prochiral    b) Achiral  
c) Stereogenic    d) Chiral.

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.                       $3 \times 5 = 15$

2. Explain how degree of dissociation determined from conductance measurement. Calculate mobility of  $\text{H}^+$  ion in water where specific conductance of  $\text{H}^+$  is 350.                       $3 + 2$



3. a) What is ionic mobility ? Explain how ionic mobility vary with concentration.
- b) Calculate the shortest wavelength in the absorption spectrum of deuterium ( $R_H = 109737 \text{ cm}^{-1}$ ). The velocity of an electron is  $2 \times 10^8 \text{ cmsec}^{-1}$ . 2 + 3
4. How can the principle of radioisotopes be used in clinical assay ? Write down the hazardness of radioactivity. 3 + 2
5. Explain with example Pauli's exclusion principle. Write down correct set of quantum numbers for the outermost electron of chromium (Cr) atom. 3 + 2
6. Write down the Fischer projection of the following compounds : 2 + 1 + 2
- a) (2R, 3S) -2, 3- di hydroxy pentane
- b) L (-)- Glycine
- c) (Z)-2-bromo pent 2-ene.



**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Define : Phase, component and degree of freedom.
- b) Write in short on phase diagram of water.
- c) What are Nernst distribution law, azeotropic mixture and critical solution temperature ?  $3 + 6 + 6$
8. a) What are optical activity and specific rotation?
- b) What are elements of symmetry ? Explain each of them.
- c) Explain the terms 'enantiomers', 'diastereomers' and 'meso-compound'.  $(2 + 2) + (1 + 4) + (2 \times 3)$
9. a) Define Hybridization and describe three hybridized states of carbon.
- b) Illustrate the formation of sigma bond and pi bond.



c) Explain why :

i) The C-C bond length in alkanes is more than the C-C bond length in alkenes, which is again more than that in alkynes.

ii) The bond angle in a  $sp$  hybridized carbon is  $180^\circ$ .

$$7 + 3 + (2.5 \times 2)$$

10. a) Deduce the relation for radioactivity. The half-life of radium is 1590 years. How long will it take for 1 gm. of the element to lose 0.1 gm ?

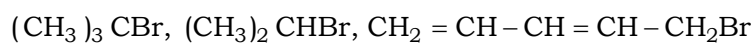
b) Write the nature of  $\alpha$ ,  $\beta$  positron decay and  $k$ -capture.

c) Briefly explain Meson theory for nuclear stability. What do you mean by mass defect and nuclear binding energy ?

$$5 + 5 + 5$$



11. Draw the orbital representation of acetylene with hybridization state. Define polarity and polarizability. Arrange the order of  $\text{SN}^1$  reactivity of following with proper explanation.



Define diastereomers.

5 + 4 + 5 + 1

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