Physical TYBSc

QP Code : **14567**

(2 ½ Hours) [Total Marks :75

N.B. : (1) **All** questions are **compulsory.**
(2) **Figures** to the **right** indicate **full** marks.
(3) Use of logarithmic tables/ Non programmable calculator is allowed
(4) Answers to the two sections must be written in two separate answer books and tied together.

Physical Constants
N= 6.022×10^{23}
k = 1.38×10^{-23} J/K
F = 96500 C
R = 8.314J/mol/K
h= 6.626×10^{-34} J/s
c = 3.0×10^{8} m/s
π = 3.142
1a.mu = 1.66×10^{-27} kg = 931 MeV

$$\frac{2.303\,RT}{F} = 0.0592 \text{ at } 298K$$

Section -I

1. Attempt any **three** of the following :-
   (a) Explain the effect of presence of isotopes on the rotational spectra. 5
   (b) Define dipole moment and induced dipole moment. How does dipole moment study help in differentiating between linear and non-linear molecules? 5
   (c) What is Raman shift? Explain the origin of stokes and anti-stokes lines in Raman spectra. 5
   (d) Define force constant. The vibrational frequency of a diatomic molecule is 3.33×10^{5} m^{-1}. Calculate the force constant of the bond, if the reduced mass of the molecule is 1.2×10^{-27} kg. 5
   (e) Show that the frequency separation of successive lines in rotational spectrum of a diatomic molecule is given by 2B, where B is rotational constant. 5
   (f) Derive expression for P and R branch lines in vibrational -rotational spectra. 5

2. Attempt any **three** of the following :-
   (a) With respect to Lithium ion cell, explain cathode, anode and electrolytes used in the cell. 5
   (b) With respect to NMR, explain following terms. 5
      (1) Spin-spin relaxation
      (2) Spin-lattice relaxation.

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(c) Distinguish between low resolution spectra of ethyl alcohol and methyl alcohol. 5
(d) Explain the construction, working and electrode reactions of Bacon's H_2-O_2 fuel cell. 5
(e) Explain Lindemann's theory of unimolecular reactions. 5
(f) On the basis of rate of reactions, classify chemical reactions. State suitable example for each class. 5

3. Attempt any **seven** from the following :- 7

(1) _____molecule shows rotational spectra.
(a) HCl (b) O_2 (c) H_2

(2) The number of modes of vibration for a non-linear molecule are given by formula _____
(a) 3n-5 (b) 3n-6 (c) 3n-4

(3) Dipole moment is zero if the same substituents are at_____position in a molecule
(a) meta (b) para (c) ortho

(4) When for a molecule_____, the molecule is said to obey selection rule for rotational spectra.
(a) $\Delta J = \pm 2$ (b) $\Delta J = 0$ (c) $\Delta J = \pm 1$

(5) The energy required for stretching vibrations is _____ that for bending vibrations.
(a) more than (b) less than (c) equal to.

(6) Zero point energy is the energy molecule possesses at _____K.
(a) 306 (b) 298 (c) 273

(7) Solar cells work on the basis of _____
(a) Photoelectric effect
(b) Photovoltaic effect
(c) Compton effect.

(8) Hydrogen is considered as the promising fuel of future because of its _____resource.
(a) diminishing (b) renewable (c) polluting

(9) Tetramethyl silane has _____ equivalent protons in it and is used as reference in NMR.
(a) 10 (b) 12 (c) 8

(10) The unit for chemical shift in NMR is _____
(a) $mol^{-1} dm^{3}$ (b) $mol.dm^{-3}$ (c) ppm

(11) Effective collisions are collisions which take place between _____ molecules
(a) disoriented (b) oriented (c) deactivated

(12) Ultra-fast reactions can be studied using _____ method
(a) continuous -flow (b) stop-flow (c) non-flow.

Section -II

4. Answer **any three** of the following :-
(a) Explain the effect of crystal field splitting on lattice energy. 5
(b) Explain Russel Saunder's coupling schems. 5
(c) Draw a labelled molecular orbital energy level diagram for hexa fluoro ferrate (II) ion comment on its magneticproperties. 5
(d) Write any three merits and two demerits of crystal field theory. 5
(e) Explain crystal field splitting in square planar comlexes. 5
(f) Explain the effect of Π - bonding on the value of 10 Dq in case of cyano complexes. 5

5. Answer **any three** of the following :-
(a) Explain the principles involved in aerobic and anaerobic processes. 5
(b) Write notes on the following :- 5
(i) Coagulation (ii) TOC
(c) Write notes on 5
(i) Calamine and its uses
(ii) $KMnO_4$ and its uses.
(d) Discuss the structure and bonding involved in borazine. 5
(e) What are nanomaterials? Discuss the two dimentional nanoparticles. 5
(f) Describe in detail the colloidal route method for preparation of nanomaterials. 5

6. Write the most appropriate answer from those given for the following 8
(Answer any **Eight**)
(1) d-d electron repulsions are _____ in a complexes metal ion than in a free metal ion.
(a) more (b) less (c) twice

(2) The ground term has the _____spin multiplicity
(a) highest (b) lowest (c) zero

(3) ^2D is the ground state term for _____ configuration.
(a) d^1 (b) d^4 (c) d^8

(4) 10 Dq value for tetrahedral complexes is_____ of that for octahedral complexes.
(a) $\frac{6}{9}$ (b) $\frac{-4}{9}$ (c) $\frac{-3}{8}$

(5) The number of microstates in P^2 configuration is _____
(a) 10 (b) 20 (c) 15

(6) The terms for d^1 configuration are the same as that for _____ configuration.
(a) d^4 (b) d^2 (c) d^9

(7) Oxygen demanding waste in water leads to_____ of dissolved O_2
(a) depletion (b) increase (c) no change

(8) Removal of inoganic salts from the effluents can be done by _____ process.
(a) osmosis (b) precipitation (c) electrodialysis

(9) 'BOD' is often expressed in _____of O_2 required per litre of waste.
(a) nano grams (b) milligrams (c) grams

(10) The most widely used flocculent in effluent treatment is _____
(a) Alum (b) Boric acid (c) Na_2CO_3

(11) The B-N bond in borazine is _____
(a) polar (b) non polar (c) metallic

(12) The polymers that have atoms of only one element in their backbone are called_____
(a) homo atomic (b) subatomic (c) hetero atomic.
