Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination (C)
January, 2018

Level : B. Tech.
Year : II
Course : BIOT 209
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date JAN. 09, 2018

SECTION "A"
[10 Q. × 1 = 10 marks)

Choose and tick the most appropriate answer.

1. A heavy and large particle
   [a] has a lower velocity for a given kinetic energy or temperature and interacts less with its environment which slows it down such that it diffuses slowly than light and small particle
   [b] has a higher velocity for a given kinetic energy or temperature and interacts less with its environment which slows it down such that it diffuses slowly than light and small particle
   [c] has a lower velocity for a given kinetic energy or temperature and interacts more with its environment which slows it down such that it diffuses slowly than light and small particle
   [d] has a higher velocity for a given kinetic energy or temperature and interacts more with its environment which slows it down such that it diffuses slowly than light and small particle

2. Solutions with identical osmotic pressure are called
   [a] osmotic solutions
   [b] isosmotic solutions
   [c] hyposmotic solutions
   [d] hyperosmotic solutions

3. In ionic solutions, the diffusion potential reduces to Nernst's potential when
   [a] both the ions have zero mobility
   [b] both the ions have equal mobility
   [c] one of the two ions have zero mobility
   [d] diffusion takes place through a membrane permeable to both of the ions with equal mobility

4. All of the following statements are correct except
   [a] Action potential is a mechanism by which the neurons send signals to other neurons or to muscle cells.
   [b] Action potential is a potential spike with an amplitude that depends upon the amplitude of the stimulus.
   [c] Action potential is a cycle of depolarization and repolarization caused by the opening of Na^+ and K^+ channels.
   [d] Action potential is a potential spike with a polarity which is opposite to that of the resting membrane potential.

5. For the outstanding achievement of voltage clamp technique in neurobiophysics, the 1963 Nobel prize in physiology or medicine was awarded to
   [a] Hodgkin – Katz
   [b] Guldberg – Waage
   [c] Hodgkin – Huxley
   [d] Goldman – Hodgkin

6. When an electron jumps from outer orbits to second orbit, then the spectrum of electromagnetic radiation is called
[a] Pfund series [b] Balmer series
[c] Lyman series [d] Bracket series

7. One Bohr's magnetron (with e and m electronic charge and mass) is given by
[a] $\frac{eh}{2m}$ [b] $\frac{eh}{4m}$ [c] $\frac{eh}{4\pi m}$ [d] $\frac{eh}{2\pi m}$

8. In dipole-dipole interaction, the potential energy is inversely proportional to the
[a] separation distance between the ion and dipole
[b] square of the separation distance between the ion and dipole
[c] fourth power of the separation distance between the ion and dipole
[d] sixth power of the separation distance between the ion and dipole

9. The operator $-\frac{\hbar^2}{2m}\nabla^2$ is called
[a] momentum operator [b] Hamiltonian operator
[c] kinetic energy operator [d] angular momentum operator

10. Spin-spin relaxation process in NMR technique causes
[a] chemical shift [b] line broadening
[c] high resolution imaging [d] thermal equilibrium

SECTION "B"
[10 Q. × 1 = 10 marks]

Fill in the blanks.

11. If R = 8.4 J/mol.K, then the osmotic pressure of a sugar solution with a sugar concentration of 0.6 mol/litre at 27°C is ..... N/m^2.

12. Flux of water ϕ_w is related to the hydrostatic pressure P and osmotic pressure π as .....

13. The movement of the particles against the concentration gradient using external energy sources and mechanisms is called .....

14. A nerve process (dendrite or axon) can be considered as a cylindrical membrane with an intracellular fluid, a conducting medium, called .....

15. Sensory detectors which keep the brain informed about the inside conditions of the body are called .....

16. In the intensity rule, the condition $\Delta L = -1$, $\Delta J = -1$ gives .....

17. Consider two atoms of wave functions ψ_A and ψ_B are taking part in bonding process. The probability density for the combination of these atoms according to LCAO model is $c_1^2\psi_A^2 \pm 2c_1c_2\psi_A\psi_B + c_2^2\psi_B^2$. The middle term of this expression is called .....

18. The frequency difference between any two successive rotational spectra of a diatomic molecule with moment of inertia I is .....

19. ..... can be used to visualize the surface of conductors as well as insulators.

20. The hologram does not contain a distinct image of the object but carries a record of both ..... of the light at each point.

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Time : 2 hrs. 30 mins.

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Semester: II
F.M. : 55

SECTION "C"
[5 Q. × 4 = 20 marks]

1. What do you mean by Brownian motion? Derive an expression for the average distance moved in a given time.

   OR

   Define the term active transport. Discuss the transport of Na^+ and K^+ across the cell membrane as an example of active transport.

2. Discuss the visual, chemical, somatic and visceral receptors.

3. Explain the effect of nuclear motion on atomic spectra.

   OR

   Explain the three basic postulates of wave mechanics (quantum mechanics).

4. A beam of electron enters in a uniform magnetic field of 1.2 T. Calculate the energy difference between the electron whose spins are parallel and anti-parallel to the field.

5. Explain the induced dipole-induced dipole interaction.

   OR

   Explain the working principle of STM with schematic diagram.

SECTION "D"
[5 Q. × 7 = 35 marks]

6. Define the terms osmosis and chemical potential. Derive Van't Hoff equation $\pi = RTC_A$.

7. Explain the water flux in and out of cells. Derive an expression for the osmotic pressure to estimate it by measuring the hydrostatic pressure difference.

   OR

   Discuss Guldberg-Waage's law. Derive an expression for Nernst equation.

8. Define the terms action potential and synapse. Write down the properties of action potential. Discuss the transport of information in the nervous system.

   OR

   Discuss the voltage clamp technique and hence obtain an expression for the externally applied current I_{ext}.

9. What is NMR technique? Explain two mode of operation of NMR instrument with schematic diagram.

10. What is Zeeman Effect? Explain the experimental setup to observe the Zeeman Effect with schematic diagram. Also give the theory of normal Zeeman Effect.

    OR

    Explain the theory fluorescence and phosphorescence with energy diagram.