# BIOLOGY

1. Select the correct statement related to allergic response:

A) Allergens stimulate formation of Ig E antibody.    B) Histamine is secreted from mast cells.

C) Treatment involves use of steroids and antihistamines.   D) Immune system becomes hyposensitive.

a. Only A, B, D          b. Only A, B, C          c. Only B, C, D                    d. All of these

2. Which of the following is an example of an autoimmune disease?

a) AIDS                b) Tuberculosis          c) Rheumatoid arthritis    d) Malaria

3. In which organ are T-lymphocytes matured?

a) Bone marrow  b) Spleen                c) Thymus                    d) Lymph nodes

4. Which of the following is not a characteristic of innate immunity?

a) Non-specific response   b) Immediate response     c) Memory formation        d) Physical barriers

5. Which of the following statements is true about autoimmunity?

a) The immune system attacks foreign pathogens

b) The immune system fails to recognize its own cells.

c) Autoimmunity only affects elderly individuals.

d) Vaccines are used to treat autoimmune diseases.

6. A gene, whose expression helps to identify transformed cells is known as

a. selectable marker              b. vector          c. plasmid                d. structural gene

7. A selectable marker is used to:

 a. help in eliminating the non-transformants so that the transformants can be regenerated.

b. identify the gene for the desired trait in an alien organism.

c. select a suitable vector for transformation in a specific crop.

d. mark a gene on a chromosome for isolation using a restriction enzyme.

8. Insertional inactivation of the lac Z gene forms-

a. Blue recombinant colonies                        b. Colourless recombinant colonies

c. Fluorescent green colonies        d. There is no relation between the lac Z gene and colour of the colony.

9. In the screening process during rDNA experiments, clones that metabolize B-gal turn:

a. Colorless                b. Blue                c. Yellow                d. Green

10. A cloning vector has two antibiotic resistance genes- for tetracycline and ampicillin. A foreign DNA was inserted into the tetracycline gene. Non- recombinants would survive on the medium containing:

a. ampicillin but not tetracycline

b. tetracycline but not ampicillin

c. both tetracycline and ampicillin

d. neither tetracycline nor ampicillin

11. Which one is the omnivorous -

a. Frog.                b. Consumer                c. Deer.                d. Man

12. The process of breakdown of detritus by detrivores is-

a. Mineralisation.        b. Fragmentation        c. Leaching .        d. Humification

13. The breakdown of detritus into small particles by earthworm is a process called -

a. Mineralisation.        b. Catabolism        c. Humification.        d.Fragmentation

14. Given below are two statements:

Statement 1: Decomposition is a process in which detritus is degraded into simpler substances by microbes

Statement 2: Decomposition is faster if the detritus is rich in lignin and chitin.

Choose the correct answer

a. Statement 1 is correct but Statement 2 is incorrect

b. Statement 1 is incorrect but statement 2 is correct.

c. Both Statement 1 and 2 are correct

d. Both Statement 1 and 2 are incorrect.

15. In relation to gross primary productivity and net primary productivity of an ecosystem, which one of the following is correct?

a. Gross primary productivity is always more than net primary productivity

b. Gross primary productivity and net primary productivity are one and same

c. There is no relationship between gross primary productivity and net primary productivity

d. Gross primary productivity is always less than net primary productivity

16.Sperms produce an enzymatic substance for dissolving egg, coverings. It is called

a.Hyaluronic acid        b. Hyaluronidase c. Androgamone  d. Diastase.

17. Oocyte is liberated from ovary under the influence of LH, after completing

a. Meiosis and before liberating polar bodies        b. Meiosis I and before liberating polar bodies

c. Meiosis        d. Meiosis I after release of polar body.

18.Antrum is cavity of

a. Ovary                b.Blastula                c. Graffian follicle        d. Gastrula

19.Hormone responsible for ovulation and  development of corpus luteum is

a. FSH                b.LH                c. LTH                d. ICSH

20. Hormone controlling human menstrual cycle is

a. Estrogen          b. FSH          c. LH          d. All the above

21. Which of the following best describes the Central Dogma of Biology?

a. DNA replication followed by protein synthesis          b. DNA to RNA to protein

c. RNA replication followed by DNA synthesis          d. Protein to RNA to DNA

22. The semi-conservative nature of DNA replication means that:

a. Each new DNA molecule consists of one old and one new strand.

b. Each new DNA molecule consists entirely of new strands.

c. Each old DNA molecule is replaced entirely by RNA.

d. DNA is replicated without any changes.

23. During transcription in the Central Dogma of Biology:

a. DNA is replicated to form new DNA molecules.     b. RNA is synthesized from a DNA template

c. Proteins are synthesized from RNA molecules          d. DNA is translated into protein sequences.

24. Which of the following statements is true regarding the reverse transcriptase enzyme?

a. It synthesizes RNA from a DNA template          b. It synthesizes DNA from an RNA template.

c. It synthesizes RNA from an RNA template.          d. It synthesizes DNA from a protein template.

25. Which of the following components is crucial for humoral immunity?

a) Cytotoxic T cells          b) Helper T cells          c) B cells          d) Natural killer cells

26. 1.Read the following statements and select the incorrect one.

a) Little decomposition occurs during the formation of primary sludge.

b) Formation of primary sludge requires aeration.

c) Activated sludge possess flocs of decomposer microbes.

d) Formation of activated sludge requires aeration.

27. Read the following statements and select the correct option. Statement 1: BOD represents the amount of dissolved oxygen that would be consumed if all the organic matter in one litre of water were oxidised by microorganisms.

Statement 2: High value of BOD indicates that water is highly polluted by organic matter.

(a) Both statements 1 and 2 are correct.

(b) Statement 1 is correct but statement 2 is incorrect.

(c) Statement 1 is incorrect but statement 2 is correct.

(d) Both statements 1 and 2 are incorrect
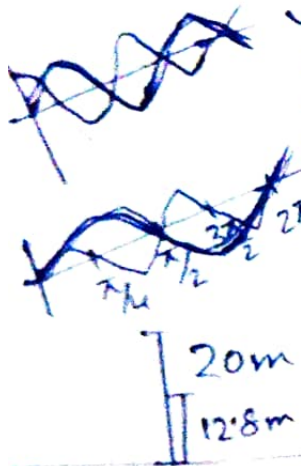
28. If BOD of water is higher, then dissolved oxygen content of water will be

a) higher        b) lower        c) medium        d) none of these.

29. Biogas is more useful than burning of dung cakes because

a) it is a non-pollutant        b) it can be easily generated, stored and transported

c) it is cheap, safe and renewable source of energy        d) all of these

30. The primary treatment fails to remove

a) sand, silt        b) small pebbles        c) pathogens or dissolved substances        d) both (a) and (c).

# PHYSICS

Q1. Lenz's law is consistent with conservation of

(a) energy        (b) mass        (c) charge        (d) momentum.

Q2. The magnetic flux linked with the coil varies with time as, $\phi=3t^2+4t+9$. The magnitude of the induced emf at t=2s is

(a) 9V        (b) 16V        (c) 3V        (d) 4V.

Q3. Two solenoids of equal number of turns having their length and radii in the same ratio 1:2. The ratio of their self inductance will be

(a) 1:4        (b) 1:1        (c) 2:1        (d) 1:2.

Q4. The phase difference between the flux linked with a coil rotating in a uniform magnetic field and emf produced in it is

(a) π/2        (b) π/3        (c) -π/6        (d) π

Q5. A beam of protons with speed 4x 10⁵ m/s enters a uniform magnetic field of 0.3T at an angle of 60° to the magnetic field. The pitch of the resulting helical path of protons is close to (Mass of the proton 1.67 x 10⁻²⁷ kg, charge of the proton = 1.69 x 10⁻¹⁹C)

(a) 2 cm        (b) 5 cm        (c) 12 cm        (d) 4 cm

Q6. Proton with kinetic energy of 1MeV moves from south to north. It gets an acceleration of 10¹²m/s² by an applied magnetic field (west to east). The value of magnetic field is : (Rest mass of proton is 1.6 x 10⁻²⁷ kg)

(a) 0.71 mT        (b) 7.1 Mt        (c) 0.071 mT        (d) 71 mT.

Q7. If a stationary charge is put inside magnetic field, then the charge will

(a) Move in helix        (b) move in circle        (c) move in stationary line        (d) remain stationary

Q8. Two charged sphere separated by distance d' exert same force on each other. If they are immersed in a liquid of dielectric constant 2, then what is the force exerted, if all other conditions are same

(a) F/2        (b) F        (c) 2F        (d) 4F

Q9. A ball is dropped from a height 20 m above the surface of water in a lake. The refractive index of water is 4/3. A fish inside the lake, in line of the ball, is looking at the ball. At the instant when the ball is 12.8 m above the water surface, the fish sees the speed of ball as

(a) 9 m/s        (b) 12 m/s        (c) 16 m/s        (d) 21.33 m/s

Q10. The lowest Bohr orbit in hydrogen atom has

(a) The maximum     (b) the least energy     (c) infinite energy     (d) Zero energy.

## MATHEMATICS

1. $\int \frac{dx}{x(x^n+1)}$ is equal to

(a) $\frac{1}{n}\log\left(\frac{x^n}{x^n+1}\right) + c$     (b) $\frac{1}{n}\log\left(\frac{x^n+1}{x^n}\right) + c$     (c) $\log\left(\frac{x^n}{x^n+1}\right) + c$ (d) None of these

2. For any square matrix A, $AA'$ is a

(a) Unit matrix     (b) Symmetric matrix     (c) Skew symmetric matrix (d) None of these

3. If $A = \begin{bmatrix} \cos2\theta & -\sin2\theta \\ \sin2\theta & \cos2\theta \end{bmatrix}$ and $A + A' = I$, then the value of $\theta$ is equal to

(a) $\frac{\pi}{6}$     (b) $\frac{\pi}{3}$     (c) $\frac{3\pi}{2}$     (d) $\frac{\pi}{2}$

4. $i.(j \times k) + j.(k \times i) + k.(i \times j) =$

(a) 1     (b) 0     (c) 3     (d) None of these

5. If x>1 for $(2x)^{2y} = 4e^{2x-2y}$, then $(1 + \log_e 2x)^2 \frac{dy}{dx}$ equals

(a) $\frac{x\log_e 2x - \log_e 2}{x}$     (b) $\log_e 2x$     (c) $\frac{x\log_e 2x + \log_e 2}{x}$     (d) none of these

6. $\lim_{x \to \frac{\pi}{4}} \frac{\cot^3 x - \tan x}{\cot\left(x+\frac{\pi}{4}\right)}$ is

(a) $4\sqrt{2}$     (b) $8\sqrt{2}$     (c) 4     (d) none of these

7. If $x = 3\tan t$ and $y = 3\sec t$ then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$ is

(a) $\frac{1}{6\sqrt{2}}$     (b) $\frac{3}{2\sqrt{2}}$     (c) $\frac{1}{3\sqrt{2}}$     (d) None of these

8. In a class of 60 students ,40 opted for NCC , 30 opted for NSS and 20 opted for both NCC and NSS. If one of these students is selected at random, then the probability that the student selected has opted neither for NCC nor for NSS is

(a) $\frac{1}{6}$     (b) $\frac{5}{6}$     (c) $\frac{1}{3}$     (d) None of these

9. Four persons can hit a target correctly with probabilities $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ and $\frac{1}{8}$ respectively. If all hit at the target independently, then the probability that the target would be hit, is :

(a) $\frac{1}{192}$     (b) $\frac{25}{32}$     (c) $\frac{25}{192}$     (d) 7/32

10. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$. If $u_1$ and $u_2$ are column matrices such that $Au_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $Au_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, then

$u_1 + u_2 =$

(a) $\begin{bmatrix} -1 \\ -1 \\ 0 \end{bmatrix}$     (b) $\begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$     (c) $\begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$     (d) none of these

# CHEMISTRY

**1.** 25.3 g of sodium carbonate, $Na_2CO_3$ is dissolved in enough water to make 250 ml of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, $Na^+$ and carbonate ions, $CO_3^{2-}$ are respectively (Molar mass of $Na_2CO_3 = 106$ g mol$^{-1}$):

(a) 1.90 M and 1.910 M
(b) 0.477 M and 0.0477 M
(c) 1.910 M and 0.955 M
(d) 0.955 M and 1.910 M

**2.** The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is

(a) 1.78 M
(b) 1.02 M
(c) 2.05 M
(d) 0.50 M

**3.** For a second order reaction rate at a particular time is $x$. If the initial concentration is tripled, the rate will become:

(a) 3x
(b) $9x^2$
(c) 9x
(d) 27x.

**4.** For a chemical reaction, A $\rightarrow$ B, it is observed that the rate of reaction doubles when the concentration of A is increased four times. The order of reaction in A is:

(a) Two
(b) One
(c) Half
(d) Zero

**5.** What pressure of $H_2$ would be required to make the e.m.f. of the hydrogen electrode zero in pure water at 25°C ?

(a) $10^{-7}$ atm
(b) 1 atm
(c) $10^{-14}$ atm
(d) Zero

**6.** In the electrochemical cell: $Zn|ZnSO_4(0.01$ M$)||CuSO_4(1.0$ M$)|Cu$, the emf of this Daniell cell is $E_1$. When the concentration of $ZnSO_4$ is changed to 1.0 M and that $CuSO_4$ changed to 0.01 M, the emf changes to $E_2$. From the following, which one is the relationship between $E_1$ and $E_2$? (Given, RT/F = 0.059)

(a) $E_1 < E_2$
(b) $E_2 = 0 \neq E_1$
(c) $E_1 > E_2$
(d) $E_1 = E_2$

**7.** The molecular formula of Wilkinson catalyst, used in hydrogenation of alkenes is:

(a) $Co(CO)_8$
(b) $[Pt(NH_3)_2Cl_2]$
(c) $(Ph_3P)_3$ RhCl
(d) $K[Ag(CN)_2]$.

**8.** The number of geometrical isomers that can exist for square planar $[Pt(Cl)$ (py) $(NH_3)$ $(NH_2OH)]^+$ is (py = pyridine)

(a) 4
(b) 6
(c) 3
(d) 2

**9.** The total number of contributing structures showing hyperconjugation (involving C—H bonds) for the following carbocation is

$H_3C \overset{+}{C} CH_2CH_3$

(a) six
(b) four
(c) eight
(d) three

**10.** Hyper conjugation is most useful for stabilizing which of the following carbocations?

(a) neo-Pentyl
(b) tert-Butyl
(c) iso-Propyl
(d) Ethyl