

**BIOLOGY**

1. Which of the following cells are primarily responsible for the production of antibodies?  
a) T cells                      b) B cells                      c) Natural killer cells                      d) Macrophages
2. Which of the following is NOT a part of the innate immune system?  
a) Skin                      b) Mucous membranes                      c) Antibodies                      d) Phagocytic cells
3. Which of the following statements about vaccines is TRUE?  
a) They provide immediate protection against diseases.  
b) They always require multiple doses to be effective.  
c) They can contain weakened or inactivated forms of pathogens.  
d) They work by directly killing pathogens in the body.
4. Which type of immunity is provided by an injection of antibodies from another person or animal?  
a) Active immunity                      b) Passive immunity                      c) Innate immunity                      d) Adaptive immunity
5. The primary function of helper T cells (CD4+ T cells) is to:  
a) Directly kill infected cells.                      b) Produce antibodies.                      c) Activate other immune cells.  
d) Suppress the immune response
6. What enzyme is responsible for the removal of nucleotides from DNA's ends?  
a. Endonuclease                      b. Exonuclease                      c. DNA ligase                      d. Hind II
7. Which of the following component(s) does biotechnology include?  
(1) the creation of a gene    (2) in vitro fertilization                      (3) fixing a gene that is incorrect  
(4) creating a DNA vaccine  
a. (1) and (2)                      b. (2) and (3)                      c. (3) and (4)                      d. (1), (2), (3), and (4)
8. Which among the following is a commercial product made from genetically altered bacteria?  
a. Thyroxine                      b. Human insulin                      c. Testosterone                      d. Penicillin
9. The first restriction endonuclease was isolated from  
a) *Escherichia*                      b) *Bacillus*                      c) *Salmonella*                      d) *Haemophilus*
10. It is now possible to breed plants and animals of desired characters through  
a. tissue culture    b. genetic engineering    c. ikebana technique                      d. chromosome engineering
11. The process of formation of mature sperm cells is called:

a. Oogenesis

b. Ovulation

c. Spermatogenesis

d. Menstruation

12. Fertilisation in humans occurs in the:

a. Uterus

b. Vagina

c. Ovary

d. Fallopian tube

13. The release of a mature egg from the ovary is known as:

a. Menstruation

b. Fertilisation

c. Ovulation

d. Implantation

14. The hormone responsible for milk production in mammary glands is:

a. Estrogen

b. Progesterone

c. Prolactin

d. Oxytocin

15. The maximum number of spermatozoa are stored in the:

a. Epididymis

b. Seminal vesicles

c. Vas deferens

d. Prostate gland

16. Which one of the following is not a correct match of the term and its description?

a. Ecosystem - functional unit of nature

b. Global ecosystem - entire biosphere

c. Aquatic ecosystems - wetland

d. Natural ecosystem - crop field

17. The rate of conversion of light energy into chemical energy of organic molecules in an ecosystem is-

a. Net primary productivity

b. Gross primary productivity

c. Secondary productivity

d. Gross secondary productivity

18. Read the given statements and select the correct option :

Statement 1 : Net primary productivity is less than the gross primary productivity

Statement 2: Net primary productivity is equal to the gross primary productivity minus the respiration loss

a. Both the statement 1 and 2 are correct b. Statement 1 is correct but the statement 2 is incorrect

c. Statement 1 is incorrect but the statement 2 is correct d. Both the statement 1 and 2 are incorrect

19. Primary productivity depends upon-

a. Light and temperature b. Water and nutrients c. Photosynthetic capacity of producers d. All of these

20. Decomposers are also called as

a. Transducers.

b. Reducers c. Micro consumers

d. Both b and c

21. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?

a) super-coiling in nucleosomes

b) DNase digestion

c) through elimination of repetitive DNA

d) deletion of non-essential genes

22. Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?

a) Thymine, Uracil-----Pyrimidines

b) Uracil, Cytosine-----Pyrimidines

c) Guanine, Adenine-----Purines

d) Adenine, Thymine-----Purines

23. Variable part of DNA molecule is

$$2UB = \frac{mvx}{r}$$

$$r = \frac{mv}{2B}$$

2UB



$$\frac{2UB}{m} = 2E$$

a) phosphate b) sugar

c) nitrogen base d) all of these

24. Uracil, present only in RNA is a

a) Pyrimidine

b) Nucleotide

c) Nucleoside

d) Purine

25. Read the following statements and choose the incorrect statements.

i) Nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage.

ii) Phosphate group is linked to 5'-OH of a nucleoside through phosphoester linkage.

iii) Two nucleosides are linked through 3'-5'N-glycosidic linkage.

iv) Negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome.

v) The distance between a bp in a helix is approximately 0.34 nm.

(a) (i) only

(b) (iii) only

(c) (iv) and (v)

(d) (i), (ii), (iii) and (v)

26. Assertion: Statins produced by yeast *Trichoderma*.

Reason: It inhibit the enzyme responsible for synthesis of cholesterol

(a) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(b) (A) is correct but (R) is not correct

(c) (A) is not correct but (R) is correct

(d) Both (A) and (R) are correct and (R) is the correct explanation of

27. Assertion: Biogas is used as fuel for cooking and lighting.

Reason: It is considered as ecofriendly and pollution free source of energy

(a) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(b) (A) is correct but (R) is not correct

(c) (A) is not correct but (R) is correct

(d) Both (A) and (R) are correct and (R) is the correct explanation of

28. Select the correct group of biocontrol agents

(a) *Bacillus thuringiensis*, Tobacco mosaic virus, aphids (b) *Trichoderma*, *Baculovirus*, *Bacillus thuringiensis*

(c) *Oscillatoria*, *Rhizobium*, *Trichiderma*

(d) Nostoc, Azospirillum, Nucleopolyhedroviruses

29. Which of the following is not a biofertilizer

(a) Nostoc

(b) Mycorrhiza

(c) Agrobacterium

(d) Rhizobium

30. An organism used as a biofertilizer for raising soyabean crop is

a) Rhizobium

b) Nostoc

c) Azotobacter

d) Azospirillum

## PHYSICS

Q1. The focal length of a concave mirror is 50 cm. Where an object be placed, so that its image is two times and inverted

(a) 75 cm

(b) 60 cm

(c) 125 cm

(d) 50 cm

Q2. An object of size 7.5 cm is placed in front of a convex mirror of radius of curvature 25 cm at a distance of 40 cm. The size of the image should be

$$\frac{1}{-40} + \frac{1}{v} = \frac{1}{12.5} \quad u = -40 \quad f = 12.5$$

$$m = \frac{u}{v} = \frac{7.5}{12.5}$$

$$\frac{525}{4725} \times 2$$

$$\frac{12.5}{4} \times 2$$

$$\frac{1}{v} = \frac{40 + 12.5}{500}$$

$$500 = v \times 52.5$$

$$v = \frac{500}{52.5}$$

$$v = \frac{5000}{525}$$

$$v = 9 \quad 1^-$$

$$\frac{1}{u} - \frac{1}{2u} = \frac{1}{50}$$

$$u' = \frac{9 \times 7.5}{40}$$

$$= \frac{67.5}{40} = \frac{6.7}{4}$$

$$\frac{-2-1}{2u} = -\frac{1}{50}$$

$$-150 = 2u$$

$$u = -25$$

$$\frac{1}{v} = \frac{1}{12.5} + \frac{1}{40}$$

$$f = -50$$

$$f = -50$$

$$m = -2$$

$$\frac{v}{u} = -2$$

$$v = -2u$$

$$\frac{7.5}{40} \times \frac{12.5}{25}$$



$$\frac{1}{4v} + \frac{1}{v} = \frac{1}{30}$$

(a) 2.3 cm

(b) 1.78 cm

(c) 1 cm

(d) 0.8 cm

Q3. The image formed by a convex mirror of focal length 30 cm is a quarter of the size of the object. The distance of the object from the mirror is

(a) 30 cm

(b) 90 cm (c) 120 cm

(d) 60 cm

Q4. An object is placed 40 cm from a concave mirror of focal length 20 cm. The image formed is

(a) real, inverted and same in size (b) real, inverted and smaller in size

(c) virtual, erect and larger in size (d) virtual, erect smaller in size

Q5. The first line of the Lyman series in a hydrogen spectrum has a wavelength of 1210 Å. The corresponding line of a hydrogen atom of Z=11 is equal to

(a) 4000 Å

(b) 100 Å

(c) 40 Å

(d) 10 Å

Q6. Electron in H-atom first jumps from third excited state to second excited state and then from second excited state to first excited state. The ratio of the wavelength emitted in the two cases will be-

(a) 7/5

(b) 27/20

(c) 27/5

(d) 20/7

Q7. An electron of a stationary H-atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be-

(a) 24hR/25m

(b) 25hR/24m

(c) 25m/24hR

(d) 24m/25hR

Q8. If  $n_1$  is the frequency of the series limit of Lyman series,  $n_2$  is the frequency of the first line of Lyman series and  $n_3$  is the frequency of the series limit of Balmer series then-

(a)  $n_1 - n_2 = n_3$

(b)  $n_1 = n_2 - n_3$

(c)  $1/n_2 = 1/n_1 + 1/n_3$  (d)  $1/n_1 = 1/n_2 + 1/n_3$

Q9. A beam of protons with speed  $4 \times 10^5$  m/s enters a uniform magnetic field of 0.3 T at an angle of  $60^\circ$  to the magnetic field. The pitch of the resulting helical path of protons is close to : (Mass of the proton =  $1.67 \times 10^{-27}$  kg, charge of the proton =  $1.69 \times 10^{-19}$  C)

(a) 2 cm

(b) 5 cm

(c) 12 cm

(d) 4 cm

Q10. A particle having the same charge as of electron moves in a circular path of radius 0.5 cm under the influence of a magnetic field of 0.5 T. If an electric field of 100 V/m makes it to move in a straight path then the mass of the particle is (Given charge of electron =  $1.6 \times 10^{-19}$  C)

(a)  $9.1 \times 10^{-31}$  Kg

(b)  $1.6 \times 10^{-27}$  kg (c)  $1.6 \times 10^{-19}$  kg (d)  $2.0 \times 10^{-24}$  kg

## MATHEMATICS

1. If  $AB = O$ , then for the matrices  $A = \begin{bmatrix} \cos^2 \theta & \cos \theta \sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta \end{bmatrix}$  and  $B = \begin{bmatrix} \cos^2 \phi & \cos \phi \sin \phi \\ \cos \phi \sin \phi & \sin^2 \phi \end{bmatrix}$ ,  $\theta - \phi$  is

(a) an odd multiple of  $\frac{\pi}{2}$  (b) odd multiple of  $\pi$  (c) an even multiple of  $\frac{\pi}{2}$  (d) 0

2. If  $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$  and  $I$  is the unit matrix of order 2, then  $A^2$  equals

(a)  $4A - 3I$

(b)  $3A - AI$

(c)  $A - I$  (d) None of these

3. Find  $\frac{dy}{dx}$  if  $y = \sin(e^{x^2})$

(a)  $\sin(e^{x^2}) \cdot e^{x^2} \cdot 2x$

(b)  $\cos(e^{x^2}) \cdot e^{x^2} \cdot 2x$

(c)  $\sin(e^{x^2}) \cdot e^{x^2} \cdot x$

(d)  $\cos(e^{x^2}) \cdot e^{x^2} \cdot x$

$$\int \frac{\sqrt{x}}{14(5x)^2} dx$$

$$2x e^{x^2} \cos e^{x^2}$$

$$\begin{bmatrix} 6 & -3 \\ -3 & 6 \end{bmatrix} \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$

13  
4  
52

4. If  $y^x = x^y$ , then  $\frac{dy}{dx} =$

(a)  $\frac{y}{x} \left[ \frac{x \log x - y}{y \log x - x} \right]$

(b)  $\frac{x}{y} \left[ \frac{x \log x - y}{y \log x - x} \right]$

(c)  $\frac{y}{x} \left[ \frac{x \log y - y}{y \log x - x} \right]$

(d)  $\frac{x}{y} \left[ \frac{x \log y - y}{y \log x - x} \right]$

5. Find the value of  $k$ , for which

$$f(x) = \begin{cases} \frac{x^2-9}{x-3}, & x \neq 3 \\ 2x+k & \text{otherwise} \end{cases}$$

$(AB)(AD) = AB$

continuous at  $x = 3$

(a) 3

(b) 0

(c) -6

(d) 1/6

6. Let  $A = \begin{bmatrix} 1 & \frac{-1-i\sqrt{3}}{2} \\ \frac{-1+i\sqrt{3}}{2} & 1 \end{bmatrix}$ . Then  $A^{100} =$

$\frac{(x-3)(x+3)}{3+3} = 6+k$

$\frac{14}{8} = 1.75$

(a)  $2^{100}A$

(b)  $2^{99}A$

(c)  $2^{98}A$

(d) None of these

7. If  $A$  and  $B$  are two matrices such that  $AB = B$  and  $BA = A$ , then  $A^2 + B^2 =$

(a)  $2AB$

(b)  $2BA$

(c)  $AB$

(d)  $A+B$

$14 \sqrt{90}$

$n = \frac{18}{18}$

8. If  $x^m \cdot y^n = (x+y)^{m+n}$ , then  $\frac{dy}{dx}$  is

(a)  $\frac{y}{x}$

(b)  $\frac{x+y}{xy}$

(c)  $xy$

(d)  $\frac{x}{y}$

$\frac{16-9}{16-3} = 8+k$

$= 8+k$

$k = \frac{5-104}{13}$

$18 = m$

$\frac{2}{20} \times 100$

9.  $\int \frac{\sqrt{x}}{1+x} dx$  equals

(a)  $\log \left( \frac{1+\sqrt{x}}{\sqrt{x}} \right) + c$

(b)  $\log \left( \frac{\sqrt{x}}{1+x} \right)$

(c)  $2\sqrt{x} - 2 \tan^{-1} \sqrt{x} + c$

(d) None of these

$\frac{1000}{18} = 55.55$

10. If  $S_1, S_2, S_3$  denote the sum of first  $n_1, n_2$  and  $n_3$  terms respectively of an A.P, then :

$\frac{S_1}{n_1}(n_2 - n_3) + \frac{S_2}{n_2}(n_3 - n_1) + \frac{S_3}{n_3}(n_1 - n_2)$  is equal to :

(a) 1

(b)  $S_1 S_2 S_3$

(c)  $n_1 n_2 n_3$

(d) None of these

$3+x-6=0$   
 $x=3$

## CHEMISTRY

$\frac{1009}{13}$

1. The IUPAC name of  $K_3[Co(C_2O_4)_3]$  is

(a) Potassium trioxalatocobaltate(III)

(c) Potassium tris(oxalato)cobaltate(III)

(b) Potassium tris(oxalato)cobalt(III)

(d) Potassium trioxalatocobalt(III)

$\frac{n}{1 \text{ kg solvent}}$

2. A solution is prepared by adding 2 g of 'X' in 1 mole of water. Mass percent of 'X' in the solution is

(a) 10%

(b) 5%

(c) 2%

(d) 20%

$\frac{100}{1 \text{ kg}}$

3. What is the mole fraction of a solute in a 100 molal aqueous solution?

(a) 0.64

(b) 6.4

(c) 3.2

(d) 64

$\frac{100}{155.55}$

4. For the reaction  $2A + B_2 \rightarrow 2AB$  is an elementary reaction. For a certain quantity of reactants, if the volume of the reaction vessel is reduced by a factor of 3, then the rate of the reaction increases by a factor of.....

(a) 27

(b) 9

(c) 3

(d) 1/3

$\frac{1300}{14} = 92.85$

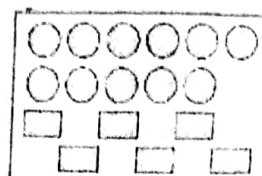
$\frac{100}{1000+1000} = 0.05$

$\frac{100}{18} + 100$

[A] 6

5. Reactant A represented by a square is in equilibrium with product B represented by circles. Then the value of equilibrium constant is

- (a) 1 (b) 2 (c) 3 (d) 4



6. Which of the following combination of statements is true regarding the interpretation of the atomic orbitals?

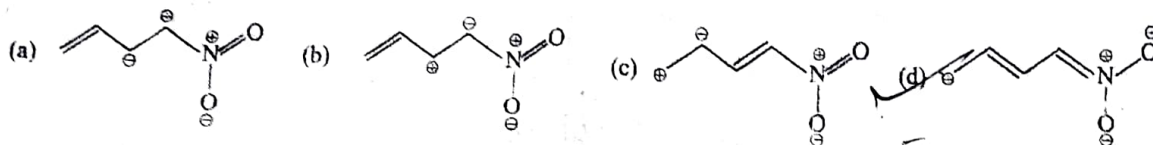
- ✓ I. An electron in an orbital of high angular momentum stays away from the nucleus than an electron in the orbital of lower angular momentum.  
 ✗ II. For a given value of the principal quantum number, the size of the orbit is inversely proportional to the azimuthal quantum number.  
 ✓ III. According to wave mechanics, the ground state angular momentum is equal to  $h/2\pi$ .  
 ✓ IV. The plot of  $\psi$  vs  $r$  for various azimuthal quantum numbers shows peak shifting towards higher  $r$  value.

- (a) I, III (b) II, III (c) I, II (d) I, IV

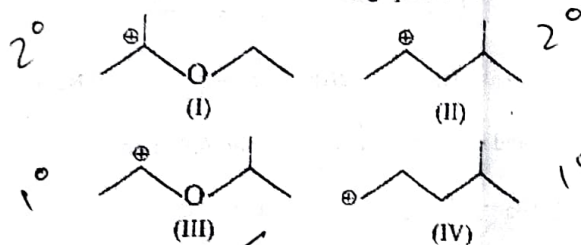
7. In the electrolytic cell, flow of electrons is from

- (a) cathode to anode in solution (b) cathode to anode through external supply  
 ✓ (c) cathode to anode through internal supply (d) anode to cathode through internal supply

8. Among the following, the least stable resonance structure is

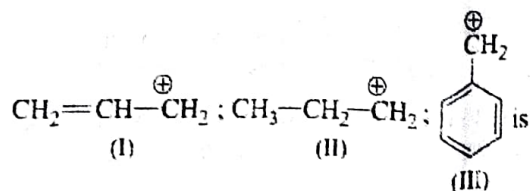


9. The correct stability order for the following species is



- (a) (II) > (IV) > (I) > (III) ✓ (b) (I) > (II) > (III) > (IV) (c) (II) > (I) > (IV) > (III) (d) (I) > (III) > (II) > (IV)

10. The order of stability of the following carbocations



- (a) III > II > I (b) II > III > I (c) I > II > III ✓ (d) III > I > II