

BIOLOGY

1. The association of histone H₁ with a nucleosome indicates

- a) transcription is occurring
- b) DNA replication is occurring
- c) the DNA is condensed into chromatin fibre
- d) the DNA double helix is exposed

2. Identify the correct order of organisation of genetic material from largest to smallest.

- a) Chromosome, gene, genome, nucleotide
- b) Genome, chromosome, nucleotide, gene
- c) Genome, chromosome, gene, nucleotide
- d) Chromosome, genome, nucleotide, gene

3. Transformation was discovered by

- a. Meselson and Stahl
- b. Hershey and Chase
- c. Griffith
- d. Watson and Crick

4. The net electric charge on DNA and histones is

- a) negative and positive, respectively
- b) both negative
- c) both positive
- d) zero

5. The fact that a purine base always paired through hydrogen bonds with a pyrimidine base leads to, in the DNA double helix

- a) uniform width throughout DNA
- b) uniform length in all DNA
- c) the semiconservative nature
- d) the antiparallel nature

6. How many statements given below are correct with respect to plasmids?

- A. They float freely in the cytoplasm of certain bacterial cells.
- B. They have the ability to replicate, independent of the genomic DNA.
- C. Herbert Boyer developed a method of removing and reinserting them in the cells.
- D. They are circular ssDNA molecules.

Select the correct option.

- a. Three
- b. Four
- c. Two
- d. One

7. Assertion (A): The restriction endonucleases can recognize palindromic sequences.

Reason(R): These sequences read the same in both directions of the two complementary DNA strands.

- a. Both (A) and (R) are true and (R) is the correct explanation of (A).
- b. Both (A) and (R) are true but (R) is not the correct explanation of (A).
- c. (A) is true but (R) is false.

d. Both (A) and (R) is false

8. Assertion (A): Restriction enzyme is a type of endonuclease

Reason (R): Restriction enzyme cuts the two stands of DNA at specific positions within the DNA

In the light of the above statements, choose the correct answer from the options given below:

a. (A) is correct but (R) is not correct.

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

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

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

9. The enzyme used to produce complementary DNA (cDNA) from an mRNA template is:

a. DNA polymerase b. Reverse transcriptase c. DNA ligase d. Restriction enzyme

10. Match the column-

Column I

Column II

A. Restriction endonuclease

i. HindII

B. First recombinant DNA

ii. Obtained from strain RY13

C. First restriction endonuclease

iii. Isolated in 1963

D. EcoRI

iv. Developed in 1972

a. a-iii, b-i, c-ii, d-iv b. a-i, b-ii, c-iii, d-iv c. a-iii, b-iv, c-i, d-ii d. a-iii, b-iv, c-ii, d-i

11. 1. What is the process of break down complex organic matter into inorganic substances called?

a) Organization b) Decomposition c) Production d) Consumption

12. The process of mineralisation by microorganisms helps in the release of

a. Inorganic nutrients from humus b. Both organic and inorganic nutrients from detritus

c. Inorganic nutrients from detritus and formation of humus d. Organic nutrients from humus

13. Which of the following is an ecosystem service provided by a natural ecosystem?

a. Cycling of nutrients b. Prevention of soil erosion

c. Pollutant absorption and reduction of the threat of global warming d. All of the above

14. Which one of the following aspects is not a component of functional unit of ecosystem?

a. Productivity b. Decomposition c. Energy flow d. Ecological pyramids

15. Vertical distribution of different species occupying different levels in dense vegetation is called...

a. Stratification b. Species composition c. Standing crop d. Trophic structure

16. Which of the following hormones is only secreted by human placenta?

a. hCG b. Estrogens c. Progesterone d. LH.

17. The vas deferens receives duct from the seminal vesicle and opens into urethra as

- a. Epididymis b. Ejaculatory duct c. Efferent ductule d. Ureter.

18. Urethral meatus refers to the

- a. Urinogenital duct b. Opening of vas deferens into urethra
c. External opening of the urinogenital duct d. Muscles surrounding the urinogenital duct.

19. In mammals, failure of testis to descend into the scrotum is known as

- a. Paedogenesis b. Castration c. Cryptorchidism d. Impotency

20. Secondary sexual characters in females develop in response to hormone

- a. Relaxin b. Progesterone c. Estrogen d. Gonadotropin

21. If BOD of sample water is very high, the sample is

- a) highly polluted c) normal b) less polluted d) none of these.

22. 'Flocs' is

- a) primary sludge produced in sewage treatment
b) a type of biofortified food
c) a mesh-like structure formed by association of bacteria and fungal filaments in sewage treatment
d) the effluent in primary treatment tank obtained during sewage treatment.

23. Read the following statements and select the correct option.

Statement 1: Besides curdling of milk, LAB also improve its nutritional quality by increasing vitamin B12

Statement 2: LAB, when present in human stomach, check disease causing microbes.

- (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.

24. The inoculum is added to the fresh milk in order to convert milk into curd, the term 'inoculum' here refers to

- a) a starter rich in vitamin B12 b) a starter rich in proteins
c) a starter containing millions of LAB d) an aerobic digester

25. Which enzyme helps in removing oil stains from clothes?

- a) Streptokinase b) Trypsin c) Lipase d) Amylase

26. Which of the following statements about the pathophysiology of pneumonia is incorrect?



- ~~Q~~ ~~for~~
 $L = 0.1 \text{ m}$
 $B = 0.1 \text{ T}$
 $v = 15 \text{ m/s}$
 $0.1 \times 0.1 \times 15$
 $0.15 \checkmark$

PHYSICS

- Q1. A metal rod moves at constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement (s) from the following:
- (a) the entire rod is at the same electric potential.
 - (b) there is an electric field in the rod.
 - (c) the electric potential is highest at the centre of the rod and decreases towards its ends.
 - (d) the electric potential is lowest at the centre of the rod and increases towards its ends.
- Q2. A straight conductor 0.1 m long moves in a uniform magnetic fields 0.1 T. The velocity of the conductor is 15 m /s and is directed perpendicular to the field. The e.m.f. induced between the two ends of conductor is
- (a) 0.10V (b) 0.15V (c) 1.50V (d) 15.00 V
- Q3. A charge moving with velocity v in X-direction is subjected to a field of magnetic induction in negative X-direction. As a result, the charge will
- (a) remain unaffected
 - (b) start moving in a circular path in Y-Z plane
 - (c) retard along X-axis
 - (d) moving along a helical path around X-axis.
- Q4. A proton and an alpha particle enter in a uniform magnetic field with the same velocity. The time period of rotation of the alpha particle will be

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

$$r = \frac{mv}{qB}$$

$$T = \frac{2\pi}{mv/r}$$

✓ (a) four times that of the proton

(b) two times that of the proton

(c) three times that of the proton

(d) same as that of the proton.

Q5. A uniform magnetic field acts at right angles to the direction of motion of electrons. As a result, the electron moves in a circular path of radius 2 cm. If the speed of the electrons is doubled, then the radius of the circular path will be

(a) 2.0 cm

(b) 0.5 cm

✓ (c) 4.0 cm

(d) 1.0 cm.

Q6. A magnetic field

(a) always exerts a force on charged particle

(b) never exerts a force on charged particle

✓ (c) exerts a force, if the charged particle is moving across the magnetic field line

(d) exerts a force, if the charged particle is moving along the magnetic field line.

Q7. A positive charge is moving upward in a magnetic field which is towards north. The particle will be deflected towards

(a) east

✓ (b) west

(c) north

(d) south

Q8. A and B are two identical spherical charged bodies which repel each other with force F, kept at a finite distance. A third uncharged sphere of the same size is brought in contact with sphere B and removed. It is then kept at the mid-point of A and B. Find the magnitude of force on C.

(a) F/2 (b) F/8 (c) F (d) zero

Q9. A comb runs through one's dry hair, attracts small bits of paper. This is due to:

(a) comb is a good conductor

(b) paper is a good conductor

✓ (c) the atoms in the paper get polarised by the charged comb

(d) The comb possesses magnetic properties.

Q10. A charge Q is divided in two parts q and Q-q. What is the value of q for maximum force between them?

(a) 3Q/4 (b) Q/3 (c) Q (d) Q/2

$$\frac{kq(Q-q)}{r^2} = \frac{k(Q-q)^2}{r^2}$$

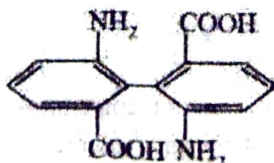
$$Q = 3q$$

CHEMISTRY

1. The replacement of chlorine of chlorobenzene to give phenol requires drastic conditions, but the chlorine of 2,4-dinitrochlorobenzene is readily replaced since,

- (a) nitro groups make the aromatic ring electron rich at ortho/para positions
- (b) nitro groups withdraw electrons from the meta position of the aromatic ring
- (c) nitro groups donate electrons at meta position
- (d) nitro groups withdraw electrons from ortho/para positions of the aromatic ring

2. The IUPAC name of

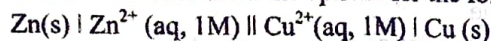


- (a) *o, o'* - diamino - *o, o'* - dicarboxy biphenyl
 (b) 6, 6' - diamino diphenyl - 2, 2' - dicarboxylic acid
 (c) diamino dicarboxy biphenyl
 (d) none of these

3. Chlorine in vinyl chloride is less reactive because

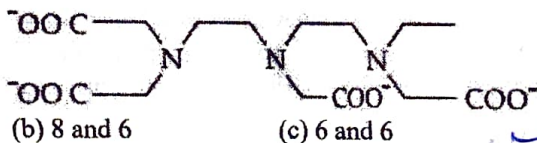
- (a) sp^2 - hybridised carbon has more acidic character than sp^3 - hybridised carbon
 (b) C - Cl bond develops partial double bond character
 (c) of resonance
 (d) All are correct

4. Identify the incorrect statement from the options for the following cell



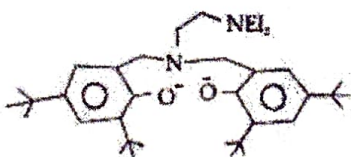
- (a) If $E_{\text{ext}} = 1.1\text{V}$, no flow of e^- or current occurs.
 (b) If $E_{\text{ext}} < 1.1\text{V}$, Zn dissolves at anode and Cu deposits at cathode.
 (c) If $E_{\text{ext}} > 1.1\text{V}$, e^- flows from Cu to Zn.
 (d) If $E_{\text{ext}} > 1.1\text{V}$, Zn dissolves at Zn electrode and Cu deposits at Cu electrode.

5. The maximum possible denticities of a ligand given below towards a common transition and inner transition metal ion,



- (a) 8 and 8 (b) 8 and 6 (c) 6 and 6 (d) 6 and 8

6. The following is



- (a) hexadentate (b) tetradentate (c) bidentate (d) tridentate

7. The rate of a first order reaction is $1.8 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$ when the initial concentration is 0.3 mol L^{-1} . The rate constant in the units of second is :

- (a) $1 \times 10^{-2} \text{ s}^{-1}$ (b) $1 \times 10^{-4} \text{ s}^{-1}$ (c) $6 \times 10^{-2} \text{ s}^{-1}$ (d) $6 \times 10^{-2} \text{ s}$

8. The volume of 80% sulphuric acid (H_2SO_4) by weight (density = 1.80 g mL^{-1}) required to prepare 1L of $0.2 \text{ M H}_2\text{SO}_4$ is

- (a) 14.7 mL (b) 29.4 mL (c) 6.8 mL (d) 13.60 mL

9. The energy of an electron in the ground state ($n=1$) for He^+ ion is $-x \text{ J}$, then that for an electron in $n=2$ state for Be^{3+} ion in J is:

- (a) $-4x$ (b) $-\frac{4}{9}x$ (c) $-x$ (d) $-\frac{x}{9}$

10. Match List-I with List-II.

List-I (Process)

- A. Isothermal process
 B. Isochoric process
 C. Isobaric process
 D. Adiabatic process

List-II (Conditions)

- I. No heat exchange
 II. Carried out at constant temperature
 III. Carried out at constant volume
 IV. Carried out at constant pressure

$$\int \frac{x^2+1}{\sqrt{x^2+1}} dx$$

$$\int \sqrt{x^2+1} dx$$

$$2x = x^2+1$$

$$dx = 2x dx$$

$$dx = \frac{2x}{3x^2}$$

$$\frac{\sqrt{x^2+1}}{3x}$$

$$\frac{19.6}{1.8} = 10.88$$

$$\frac{10.88}{35.28}$$

$$\frac{32}{64} = 0.5$$

$$\frac{x}{1.80} = 100$$

$$\frac{x}{98} = 0.2$$

$$\frac{6 \times 10^{-3}}{60} = 10^{-4}$$

$$\frac{1.8}{60} = 0.03 \times 10^{-3}$$

$$n = k \left[\frac{1}{A} \right]^{0.3}$$

$$1.8 \times 10^{-3} = k \left[\frac{1}{0.3} \right]$$

$$k = \frac{1.8 \times 10^{-3}}{0.3}$$

$$x = 19.6 \text{ g}$$

Choose the correct answer from the options given below:

(a) A-I, B-II, C-III, D-IV

(c) A-IV, B-III, C-II, D-I

(b) A-II, B-III, C-IV, D-I

(d) A-IV, B-II, C-III, D-I

MATHEMATICS

1. Two numbers are drawn at random from the integer 1 to 9. If the sum of the numbers is even, then the probability that both numbers are odd -

(a) $\frac{5}{8}$

(b) $\frac{3}{8}$

(c) $\frac{2}{3}$

(d) None of these

2. Two cards are drawn without replacement from a well shuffled pack of 52 cards. The probability that one is a red queen and the other is a king of black colour is

(a) $\frac{5}{663}$

(b) $\frac{2}{663}$

(c) $\frac{3}{663}$

(d) None of these

3. $\int \frac{\sin^6 x - \cos^6 x}{1 - 2\sin^2 x \cos^2 x} dx$

(a) $\frac{\sin 2x}{2} + c$

(b) $-\frac{\sin 2x}{2} + c$

(c) $\frac{\cos 2x}{2} + c$

(d) None of these

4. $\int \frac{8x+13}{\sqrt{4x+7}} dx$

(a) $\frac{1}{3}(4x+7)^{3/2} - \frac{1}{2}(4x+7)^{1/2} + c$ (b) $\frac{1}{2}(4x+7)^{3/2} + c$ (c) $-\frac{1}{2}(4x+7)^{1/2} + c$ (d) None of these

5. $\int \frac{dx}{\sqrt{x+1}-\sqrt{x}}$

(a) $\frac{2}{3}(x+1)^{3/2} + c$ (b) $\frac{2}{3}(x+1)^{3/2} - \frac{1}{2}(x+1)^{1/2} + c$ (c) $\frac{2}{3}(x+1)^{3/2} + \frac{2}{3}x^{3/2} + c$ (d) None of these

6. $\int \frac{d(x^2+1)}{\sqrt{x^2+1}} dx$

(a) $2\sqrt{x^2+2} + c$

(b) $(x^2+2)^{3/2} + c$

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

(d) None of these

7. $f(x) = x \sin\left(\frac{\pi}{x}\right)$ is continuous everywhere, then $f(0) =$

(a) -1

(b) 1

(c) 0

(d) None of these

8. If $f(x) = \begin{cases} \frac{\log x}{x-1}, & \text{if } x \neq 1 \\ k, & \text{if } x = 1 \end{cases}$

Is continuous at $x = 1$, then the value of k is

(a) 1

(b) 0

(c) e

(d) None of these

9. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x = 1$ is equal to

(a) 1

(b) 0

(c) $\frac{1}{2}$

(d) $\frac{1}{3}$

10. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$, then $A^5 =$

(a) $5A$

(b) $32A$

(c) $16A$

(d) None of these

$\log 1 = 0$

$f(1) = K$

$f(2) = \frac{\log 2}{2-1}$

$= \log 2 = 0.303$

$n(S) = 9$

$(1,3) (3,1) (1,5) (5,1) (1,7) (7,1)$

$\frac{52}{51} \times \frac{52}{51} = \frac{2704}{2601}$

$\frac{2C1}{52C2} \times \frac{2C1}{51C1}$

$\frac{2 \times 2}{52 \times 51}$

$\frac{4}{2652}$

$\frac{1376}{688}$

$4 \times 4 \times 2$

32

$\frac{dy}{dx} = \frac{d}{dx} x^{1/2} + \frac{d}{dx} x^{-1/2}$

$= \frac{1}{2} x^{-1/2} - \frac{1}{2} x^{-3/2}$

$= \frac{1}{2\sqrt{x}} - \frac{1}{2\sqrt{x^3}}$

$A^2 = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

$A^3 = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

$= \begin{bmatrix} 8 & 0 & 0 \\ 0 & 8 & 0 \\ 0 & 0 & 8 \end{bmatrix}$