

BIOLOGY

1. Assertion(A): Plasmids are extrachromosomal gentical material of bacteria.

Reason(R): These are genetic material present apart from the nucleoid.

- 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) are false.

2. Assertion(A): In order to link the alien DNA, the vector needs to have very few, preferably single, recognition site for the commoniy used restriction enzymes.

Reason(R): Presence of more than one recognition sites within the vector will generate several fragments, which will complicate the gene cloning.

- 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) are false.

3. Assertion(A): Restriction enzymes cut the strand of DNA to produce sticky ends.

Reason(R): Stickiness of the ends facilitates the action of the enzyme DNA polymerase.

- 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) are false.

4. Which type of restriction enzymes are used in recombinant DNA technology?

- a. Type-I
- b. Type-II
- c. Type-III
- d. All of the above

5. What does R indicate in EcoRI?

- a. Enzyme isolated from strain of bacteria
- b. Genus of bacteria
- c. Sequence of enzyme
- d. Species of bacteria

6. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs?

- a) 6.6×10^9 bp
- b) 3.3×10^6 bp
- c) 6.6×10^6 bp
- d) 3.3×10^9 bp

7. Read the following statements and choose the set of correct statements:

- (A) Euchromatin is loosely packed chromatin
- (B) Heterochromatin is transcriptionally active
- (C) Histone octomer is wrapped by negatively charged DNA in nucleosome

(D) Histones are rich in lysine and arginine

(E) A typical nucleosome contains 400 bp of DNA helix

Choose the correct answer from the options given below:

- (a) (A), (C), (D) Only (b) (B), (E) Only (c) (A), (C), (E) Only (d) (B), (D), (E) Only

8. Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.

Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.

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

- a) Both Statement I and Statement II are true. (b) Both Statement I and Statement II are false
c) Statement I is correct but Statement II is false d) Statement I is incorrect but Statement II is true.

9. What are the characteristics of rough *Streptococci* strain?

- a) noncapsulated and pathogenic b) noncapsulated and nonpathogenic
c) capsulated and pathogenic d) capsulated and nonpathogenic

10. In Griffith's experiment which of the following strains of pneumococci was isolated from dead mice?

- a) live rough cells b) dead rough cells c) live smooth cells d) dead smooth cells

11. Bacteria and fungi in a forest ecosystem are generally:

- a. Producers b. Decomposers c. Primary consumers. d. Secondary consumers

12. The three functional kingdoms of nature are -

- a. saprotrophs, phagotrophs and producers b. Autotroph, heterotroph and producers
c. Producers, phagotrophs and macroconsumers d. Macroconsumers and microconsumer

13. Biosphere is considered as.....

- a. Local ecosystem b. Natural ecosystem c. All the ecosystem d. Global ecosystem

14. What are the complex organic remains such as dead animal remains, dead plant remains, and fecal matter called?

- a) Humus b) Mucus c) Excreta d) Detritus

15. Biotic components of an ecosystem include?

- (a) Producers, consumers and decomposers (b) Producers and consumers
(c) Producers only (d) Consumers only

16. The opening of the infundibulum into the body cavity is called ____

- a. isthmus b. ampulla c. ostium d. thalamus

17. Outermost layer of ovary is made up of ____

- a. simple cuboidal cells b. stereocilia c. stroma d. cilia
18. Which of the following structures helps in collection of ovum after ovulation?
- a. Internal os b. Fimbriae c. Ampulla d. Isthmus
19. The Ligaments help ovaries to be in place
- a. To form connection with pelvic wall and uterine wall b. To form connection with pelvic wall
- c. To form connection with uterine wall d. To form connection with ovarian walls
20. Female reproductive system doesn't include
- a. Ovaries b. External Genitalia c. Mammary glands d. Bulbourethral glands
21. Which of the following is a part of the innate immune system?
- a. B lymphocytes b. T lymphocytes c. Natural killer cells d. Plasma cells
22. Which cells are primarily responsible for producing antibodies in the acquired immune response?
- a. T-helper cells b. B lymphocytes c. Macrophages d. Neutrophils
23. Which physical barrier is the first line of defense in the innate immune system?
- a. Skin b. Lymph nodes c. Spleen d. Bone marrow
24. Which of the following is NOT a characteristic of the innate immune response?
- a. Immediate response b. No immunological memory
- c. Specific to a particular pathogen d. Involves physical barriers such as skin
25. What is the primary function of cytotoxic T cells in the immune system?
- a. Produce antibodies b. Destroy infected host cells
- c. Activate B cells d. Act as antigen-presenting cells
26. Which one is wrongly matched ?
- a) *Streptomyces* – Antibiotics b) Coliforms - Vinegar
- c) Methanogens - Gobar gas d) Yeast - Ethanol.
27. In 1928, a scientist discovered the first effective antibiotic. Scientist and antibiotic are
- a) Fleming-Streptomycin b) Fleming-Penicillin
- c) Waksman-Penicillin d) Waksman-Streptomycin
28. Bacteria present in rumen of cattle digest cellulose to produce
- a) Polysaccharides b) Ethanol c) Sucrose d) Methane
29. Which is passed from primary settling tank to aeration tank?
- a) Liquid rich in organic matter b) Primary effluent
- c) Secondary effluent d) Both A and B

30. What is the function of aeration tank?

- a) To provide aerobic conditions
b) Form flocs and floccules
c) To digest organic matter
d) All the above

PHYSICS

Q1. The total energy of an electron in an atom in an orbit is -3.4 eV . Its kinetic and potential energies are, respectively

- (a) 3.4 eV , 3.4 eV (b) -3.4 eV , -3.4 eV (c) -3.4 eV , -6.8 eV (d) 3.4 eV , -6.8 eV

Q2. For which one of the following, Bohr model is not valid?

- (a) Hydrogen atom (b) Singly ionised helium atom (He)
(c) Deuteron atom (d) Singly ionised neon atom (Ne^+)

Q3. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1:T_2$ is:

- (a) 9:4 (b) 1:4 (c) 4:1 (d) 4:9

Q4. The wavelength of the first spectral line in the Balmer Series of hydrogen atom is 6561 \AA . The wavelength of the second spectral line in the Balmer series of singly ionized helium atom is

- (a) 1215 \AA (b) 1640 \AA (c) 2430 \AA (d) 4687 \AA

Q5. According to Bohr's theory, the time averaged magnetic field at the centre (i.e. nucleus) of a hydrogen atom due to motion of electrons in the n th orbit is proportional to [n = principal quantum number]

- (a) $1/n^2$ (b) $1/n^3$ (c) $1/n^4$ (d) $1/n^5$

Q6. For a concave mirror of focal length ' f ' the minimum distance between the object and its real image is

- (a) Zero (b) f (c) $2f$ (d) $4f$

Q7. If an object is placed at a distance of 10 cm in front of a concave mirror of focal length 20 cm , the image formed will be

- (a) real and 20 cm in front of the mirror. (b) real and 6.67 cm in front of the mirror.
(c) virtual and 20 cm behind the mirror. (d) virtual and 6.67 cm behind the mirror.

Q8. A concave mirror for face viewing has focal length of 0.4 m . The distance at which you hold the mirror from your face in order to see your image upright with a magnification of 5 is

- (a) 0.32 m (b) 0.24 m (c) 1.60 m (d) 0.16 m

Q9. You are asked to design a shaving mirror assuming that a person keeps it 10 cm from his face and views the magnified image of the face at the closest comfortable distance of 25 cm . The radius of curvature of the mirror would then be

- (a) 60 cm (b) 24 cm (c) 30 cm (d) -24 cm

$$f = -\frac{R}{2}$$

$$R = 2f$$

$$-13.6 \times \frac{1}{4} = \frac{13.6}{4}$$

$$-3.4$$

$$u = -10$$

$$f = -20$$

$$\frac{1}{-20} = \frac{1}{-10} + \frac{1}{v}$$

$$\frac{1}{10} - \frac{1}{20} = \frac{1}{v}$$

$$\frac{2-1}{20} = \frac{1}{v}$$

$$\frac{1}{20} = \frac{1}{v}$$

$$v = 20$$

$$f = -40\text{ cm}$$

$$\frac{v}{u} = 5$$

$$v = -5u$$

$$\frac{1}{-40} = \frac{1}{u} - \frac{1}{5u}$$

$$5u = 160$$

$$u = -32\text{ cm}$$

$$u = -10\text{ cm}$$

$$v = 15\text{ cm}$$

$$\frac{1}{f} = \frac{1}{-10} + \frac{1}{15} = \frac{-3+2}{30}$$

$$\frac{1}{f} = \frac{-1}{30} \Rightarrow f = -30$$

Q10. An observer moves towards a stationary plane mirror at a speed of 4 m/s. With what speed will his image move towards him?

- (a) 2m/s (b) 4m/s (c) 8m/s (d) the image will stay at rest.

CHEMISTRY

1. Which of the following units is useful in relating concentration of solution with its vapour pressure?

- (a) mole fraction (b) parts per million (c) mass percentage (d) molality

2. A beaker contains a solution of substance 'A'. Precipitation of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is _____.

- (a) saturated (b) supersaturated (c) unsaturated (d) concentrated

3. Which cell will measure standard electrode potential of copper electrode?

- (a) $\text{Pt(s)} | \text{H}_2(\text{g}, 0.1 \text{ bar}) | \text{H}^+(\text{aq}, 1 \text{ M}) || \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) | \text{Cu}$
 (b) $\text{Pt(s)} | \text{H}_2(\text{g}, 1 \text{ bar}) | \text{H}^+(\text{aq}, 1 \text{ M}) || \text{Cu}^{2+}(\text{aq}, 2 \text{ M}) | \text{Cu}$
 (c) $\text{Pt(s)} | \text{H}_2(\text{g}, 1 \text{ bar}) | \text{H}^+(\text{aq}, 1 \text{ M}) || \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) | \text{Cu}$
 (d) $\text{Pt(s)} | \text{H}_2(\text{g}, 1 \text{ bar}) | \text{H}^+(\text{aq}, 0.1 \text{ M}) || \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) | \text{Cu}$

4. The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called _____.

- (a) Cell potential (b) Cell emf (c) Potential difference (d) Cell voltage

5. The correct IUPAC name of $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is

- (a) Diamminedichloridoplatinum (II) (b) Diamminedichloridoplatinum (IV)
 (c) Diamminedichloridoplatinum (0) (d) Dichloridodiammineplatinum (IV)

6. Which of the following species is not expected to be a ligand?

- (a) NO (b) NH_4^+ (c) $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ (d) CO

7. Which of the following statements is not correct about order of a reaction.

- (a) The order of a reaction can be a fractional number.
 (b) Order of a reaction is experimentally determined quantity.
 (c) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.
 (d) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

8. Which of the following statements is correct?

- (a) The rate of a reaction decreases with passage of time as the concentration of reactants decreases.
 (b) The rate of a reaction is same at any time during the reaction.
 (c) The rate of a reaction is independent of temperature change.
 (d) The rate of a reaction decreases with increase in concentration of reactant(s).

9. The position of -Br in the compound in $\text{CH}_3\text{CH}=\text{CHC}(\text{Br})(\text{CH}_3)_2$ can be classified as _____.

- (a) Allyl (b) Aryl (c) Vinyl (d) Secondary

10. Ethylidene chloride is a/an _____.

- (a) vic-dihalide (b) gem-dihalide (c) allylic halide (d) vinylic halide

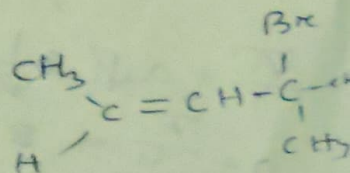
MATHEMATICS

1. Let $f(x) = \int \frac{\sqrt{x}}{(1+x)^2} dx (x \geq 0)$. Then $f(3) - f(1) =$

- (a) $\frac{\pi}{12} + \frac{1}{2} - \frac{\sqrt{3}}{4}$ (b) $\frac{\pi}{6} + \frac{1}{2} - \frac{\sqrt{3}}{4}$ (c) $-\frac{\pi}{6} + \frac{1}{2} + \frac{\sqrt{3}}{4}$ (d) None of these

$$x + 0 - 2 = 0$$

$$x = 2$$



$$2b + a - ab = \frac{\pi}{4} - \frac{\pi}{2\sqrt{2}}$$

$$3b = \frac{\pi}{4} - \frac{\pi}{2\sqrt{2}}$$

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2. The integral $\int (1+x - \frac{1}{x}) e^{x+\frac{1}{x}} dx$ is equal to

- (a) $(x+1)e^{x+\frac{1}{x}} + c$ (b) $xe^{x+\frac{1}{x}} + c$ (c) $(x-1)e^{x+\frac{1}{x}} + c$ (d) None of these

3. $\int \frac{\sin^2 x \cos^2 x}{(\sin^3 x + \cos^3 x)^2} dx =$

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

4. If $A = \frac{1}{2} \begin{bmatrix} 1 & \sqrt{3} \\ -\sqrt{3} & 1 \end{bmatrix}$, then:

- (a) $A^{30} + A^{25} + A = I$ (b) $A^{30} = A^{25}$ (c) $A^{30} + A^{25} - A = I$ (d) $A^{30} - A^{25} = 2I$

5. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & -1 \\ 0 & 12 & -3 \end{bmatrix}$. Then the sum of the diagonal elements of the matrix $(A+I)^{11}$ is equal to

- (a) 6144 (b) 4094 (c) 4097 (d) 2050

6. The number of square matrices of order 5 with entries from the set $\{0,1\}$, such that the sum of all elements in each row is 1 and the sum of all elements in each column is also 1, is

- (a) 225 (b) 120 (c) 150 (d) 125

7. If A and B are two events such that $P(A \text{ or } B) = P(A)$ then

- (a) A and B are mutually exclusive (b) A and B are independent
(c) B is subset of A (d) A is subset of B

8. From a set of 100 cards numbered 1 to 100, one card is drawn at random. The probability that the number obtained on the card is divisible by 6 or 8 but not by 24 is

- (a) $\frac{1}{5}$ (b) $\frac{6}{25}$ (c) $\frac{1}{4}$ (d) None of these

9. The value of k if $f(x)$ is continuous at $x = \frac{\pi}{2}$

$$f(x) = \begin{cases} \frac{k \cos x}{\pi - 2x}, & x \neq \frac{\pi}{2} \\ 3, & x = \frac{\pi}{2} \end{cases}$$

- (a) 2 (b) 6 (c) 4 (d) 0

10. The value of a and b for which the function $f(x)$ is continuous for $0 \leq x \leq \pi$ are

$$f(x) = \begin{cases} x + a\sqrt{2} \sin x, & 0 \leq x < \frac{\pi}{4} \\ 2x \cos x + b, & \frac{\pi}{4} \leq x \leq \frac{\pi}{2} \\ a \cos 2x - b \sin x, & \frac{\pi}{2} < x \leq \pi \end{cases}$$

- (a) $a = \frac{\pi}{3}, b = -\frac{\pi}{12}$ (b) $a = -\frac{\pi}{6}, b = \frac{\pi}{12}$ (c) $a = \frac{\pi}{6}, b = -\frac{\pi}{12}$ (d) None of these

$$0 = 2 \frac{\pi}{4} \cos \frac{\pi}{4} + b$$

$$0 = \frac{\pi}{2} \cos 45^\circ + b$$

$$b = -\frac{\pi}{2} \times \frac{1}{\sqrt{2}}$$

$$b = -a - b$$

$$2b + a = 0$$

$$k \cos x = 3\pi - 6x$$

$$k = \frac{3\pi - 6x}{\cos x}$$

$$\lim_{x \rightarrow \frac{\pi}{2}} k$$

$$f(\frac{\pi}{2}) = 3$$

$$k \cos \frac{\pi}{2} = 3$$

$$k \cdot 0 = 3$$

$$\frac{k \cos 90^\circ}{\pi - \pi} = 3$$

$$2 = 32$$

$$\frac{32}{64}$$

$$\frac{96}{1024}$$

$$\frac{16}{64} \cdot 2$$

$$\frac{16}{96}$$

$$\frac{12}{8}$$

$$2^{10}$$

$$\frac{26}{104}$$

$$\frac{4}{8}$$

$$\frac{12}{16}$$

- 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114, 120, 126, 132, 138, 144, 150, 156, 162, 168, 174, 180, 186, 192, 198, 204, 210, 216, 222, 228, 234, 240, 246, 252, 258, 264, 270, 276, 282, 288, 294, 300