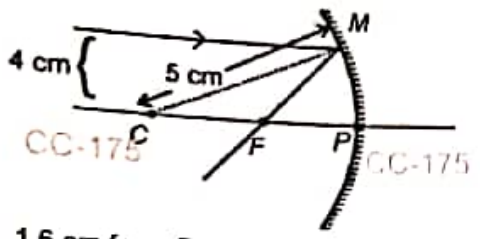
PHYSICS

Choose the correct answer:

SECTION-A

1. In the given ray diagram, a ray of light incident parallel to principal axis of a concave mirror of radius of curvature 5 cm will meet principal axis after reflection, at



(1) 1.6 cm from P (2) 0.4 cm from P
(3) 0.83 cm from P (4) 4.8 cm from P

2. The SI unit of power of lens is
(1) dioptre (2) meter
(3) $(\text{dioptre})^{-1}$ (4) centimetre

3. If the focal length of objective lens is increased, then magnifying power of
(1) Microscope will increase but that of telescope will decrease
(2) Microscope will decrease but that of telescope will increase
(3) Both microscope and telescope will increase
(4) Both microscope and telescope will decrease

4. Which of the following is true for a triangular prism kept in minimum deviation condition? (symbols have usual meanings)
(1) $i = \frac{\delta_m - 2A}{2}$ (2) $e = \frac{\delta_m + A}{2}$
(3) $i = \frac{\delta_m}{2} + A$ (4) $e = \frac{\delta_m}{2} - A$

5. A normal eye is not able to see objects closer than 25 cm because
(1) The focal length of the eye is 25 cm
(2) The distance of the retina from the eye-lens is 25 cm
(3) The eye is not able to decrease the distance between the eye-lens and the retina beyond a limit
(4) The eye is not able to decrease the focal length beyond a limit

6. The fundamental phenomena used in optical fibres to transmit signals is
(1) Total internal reflection
(2) Scattering
(3) Diffraction
(4) Dispersion

7. Match the column-I and column-II

	Column-I		Column-II
(A)	Mirage	(i)	Refraction of light
(B)	Apparent depth of object is lesser than the actual depth in water	(ii)	Scattering of sunlight
(C)	Blue colour of sky	(iii)	Total internal reflection
(D)	The formation of rainbow	(iv)	Dispersion of sunlight

(1) (A) → (ii); (B) → (iii); (C) → (iv); (D) → (i)
(2) (A) → (iii); (B) → (iv); (C) → (i); (D) → (ii)
(3) (A) → (iv); (B) → (i); (C) → (ii); (D) → (iii)
(4) (A) → (iii); (B) → (i); (C) → (ii); (D) → (iv)

8. In YDSE, if distance between slits is halved then
(1) Fringe width will be doubled
(2) Fringe width will be halved
(3) Fringe width will be quadrupled
(4) Fringe width will remain same

27. With reference to binding energy per nucleon versus mass number curve, consider the following statements and choose the correct option

I. Binding energy per nucleon increases with mass number for nuclei $30 < A < 170$.

II. Binding energy per nucleon is lower for both light nuclei ($A < 30$) and heavy nuclei ($A > 170$) with respect to nuclei $A = 56$.

III. Binding energy per nucleon is maximum of about 8.75 MeV for $A = 56$

IV. In region $1 < A < 80$, binding energy per nucleon increases with mass number.

(1) I, II, III and IV (2) II and III

(3) II, III and IV (4) I, II and III

28. An electron in an orbit of hydrogen atom moves in a way that it forms a standing wave. The wavelength of wave associated with this electron is

(1) Directly proportional to radius of orbit

(2) Directly proportional to principal quantum number

(3) Inversely proportional to radius of orbit

(4) Directly proportional to angular momentum of electron for that orbit

29. The masses of neutron and proton are 1.0087 a.m.u. and 1.0073 a.m.u. respectively. If the neutrons and protons constitute to form a helium nucleus (alpha particles) of mass 4.0015 a.m.u., then the binding energy of the helium nucleus will be nearly (1 a.m.u. = 931 MeV)

(1) 28.4 MeV (2) 20.8 MeV

(3) 17.3 MeV (4) 14.2 MeV

30. Barrier potential of a P-N junction diode depend on

(1) Doping density (2) Mode of biasing

(3) Temperature (4) All of these

31. When p-n junction diode is forward biased then

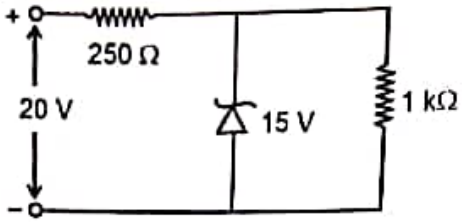
(1) Both the depletion region and barrier height are reduced

(2) The depletion region is widened while barrier height is reduced

(3) The depletion region is reduced while barrier height is increased

(4) Both the depletion region and barrier height are increased

32. A zener diode, having breakdown voltage equal to 15 V, is used in a voltage regulator circuit as shown in figure. The current through the diode is



(1) 10 mA (2) 15 mA

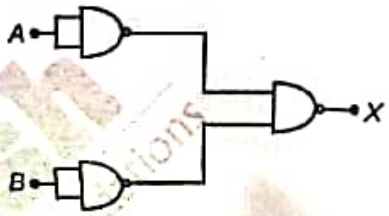
(3) 20 mA (4) 5 mA

33. When the forward bias voltage of a diode is changed from 0.6 V to 0.7 V, the current changes from 5 mA to 15 mA. Then its forward bias resistance is

(1) 0.01 Ω (2) 0.1 Ω

(3) 10 Ω (4) 100 Ω

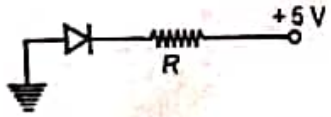
34. The combination of gates shown below yields

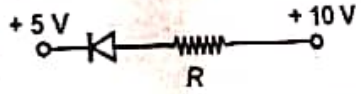


(1) OR gate (2) NOT gate

(3) NOR gate (4) NAND gate

35. Which of the following diode is not forward biased?

(1) 

(2) 

(3) 

(4) 

Space for Rough Work

9. Unpolarized light is incident on a plane glass surface. The angle of incidence (i) so adjusted that reflected and refracted rays are perpendicular to each other, then

(1) $\tan i = \frac{\mu}{2}$ (2) $\tan i = \mu$

(3) $\sin i = \mu$ (4) $\cos i = \mu$

10. Choose the incorrect statement about polaroids

(1) They reduce the intensity of light falling on them

(2) They consist of long chain molecules aligned in a particular direction

(3) They are used in sunglasses to remove glare

(4) They cannot polarise transverse waves

11. **Assertion (A):** In YDSE, if $I_1 = 9I_0$ and $I_2 = 4I_0$, then $\frac{I_{max}}{I_{min}} = 25$.

Reason (R): In YDSE, $I_{max} = (\sqrt{I_1} + \sqrt{I_2})^2$ and $I_{min} = (\sqrt{I_1} - \sqrt{I_2})^2$.

(1) (A) and (R) are true, (R) is the correct explanation of (A)

(2) (A) and (R) are true, (R) is not the correct explanation of (A)

(3) (A) is true, (R) is false

(4) Both (A) and (R) are false

12. Laser light of wavelength 540 nm incident on a pair of slits produce interference pattern on a screen in which the bright fringes are separated by 9.00 mm. A second laser light on the same setup produces an interference pattern in which the fringes are separated by 8.1 mm. The wavelength of the second light is

(1) 720 nm (2) 486 nm

(3) 630 nm (4) 450 nm

13. In a Young's double-slit experiment, let β be the fringe width and I_0 be the intensity at the central bright fringe. At a distance y from the central bright fringe, the intensity will be

(1) $I_0 \cos\left(\frac{y}{\beta}\right)$ (2) $I_0 \cos^2\left(\frac{y}{\beta}\right)$

(3) $I_0 \cos^2\left(\frac{\pi y}{\beta}\right)$ (4) $\left(\frac{I_0}{4}\right)\cos^2\left(\frac{\pi y}{\beta}\right)$

14. Einstein's photoelectric equation states that $h\nu = W_0 + E_k$. (W_0 is the work function)

In this equation, E_k refers to the

(1) Kinetic energy of all the emitted electrons

(2) Mean kinetic energy of the emitted electrons

(3) Maximum kinetic energy of the emitted electrons

(4) Minimum kinetic energy of the emitted electrons

15. A football of mass m is moving with a kinetic energy K. The de-Broglie wavelength associated with the ball is

(1) $\frac{h}{2mK}$ (2) $\sqrt{\frac{h}{2mK}}$

(3) $\frac{h}{\sqrt{2mK}}$ (4) $\sqrt{\frac{3h}{8mK}}$

16. The work function of a metal is independent of

(i) Nature of the metal

(ii) Dimensions of the metal

(iii) Quantity of the metal

(1) (i) only

(2) (i) and (iii)

(3) (ii) and (iii)

(4) All of these

17. Ultraviolet radiation of 4.2 eV falls on a metal surface having work function 2.2 eV. The kinetic energy (in joule) of the fastest electron emitted is

(1) 3.2×10^{-21}

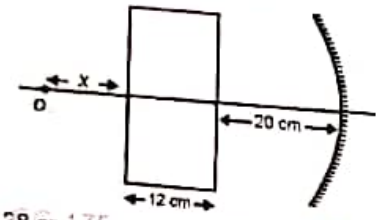
(2) 3.2×10^{-19}

(3) 3.2×10^{-17}

(4) 3.2×10^{-15}

SECTION - B

36. A refracting slab (μ = 1.5) of thickness 12 cm is kept in front of a concave mirror of radius 40 cm (as shown below). The value of x for which object and final image coincide will be



(1) 28 cm
(2) 40 cm
(3) 32 cm
(4) 12 cm

37. A telescope is normally adjusted to obtain a magnification of 20x. If focal length of objective is 40 cm then focal length of eyepiece should be

(1) 1 cm
(2) 2 cm
(3) 20 cm
(4) 800 cm

38. For a prism of refractive index $\sqrt{2}$, minimum deviation is obtained for angle of incidence 45°, the angle of prism is

(1) 30°
(2) 90°
(3) 45°
(4) 60°

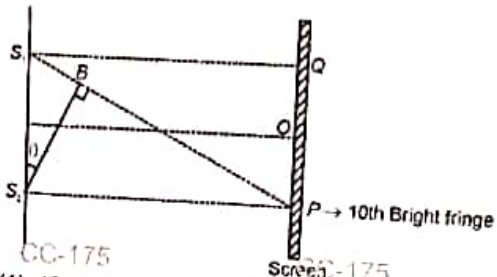
39. Two thin lenses of focal length 20 cm and 25 cm are placed in contact. The effective power of the combination is

(1) 7 D
(2) 9 D
(3) 4 D
(4) 5 D

40. In YDSE, angular fringe width of central fringe is found to be 0.30°. If the whole set-up is immersed in water $\left(\mu = \frac{4}{3}\right)$ then angular fringe width of central fringe becomes

(1) 0.40°
(2) 0.10°
(3) 0.225°
(4) 0.525°

41. Thomas Young in his famous double slit experiment took several observations and recorded one of them as shown below. If he used light of wavelength 6000 Å then path difference S_1B will be



(1) 10 μm
(2) 6 μm
(3) 4 μm
(4) 20 μm

42. Two coherent sources of wavelength 'λ' are placed at a distance 4.2λ from each other symmetric to the centre of a circular screen. Total number of bright fringes obtained on the screen are

(1) 8
(2) 20
(3) 16
(4) 18

43. Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. If power emitted is 2 mW and considering all photons to be emitting electrons from a metal surface, then the value of photocurrent will be nearly

(1) 0.8 mA
(2) 2.4 mA
(3) 0.006 mA
(4) 2.56 mA

44. The ratio of de-Broglie wavelength of hydrogen gas molecules to that of oxygen gas molecules at a common temperature T is

(1) 2 : 1
(2) 4 : 1
(3) 16 : 1
(4) 8 :1

Space for Rough Work

53. Consider the following statements

(a) Oxidation of phenol with chromic acid produces a conjugate diketone known as benzoquinone

(b) Sodium phenoxide on reaction with CO_2 followed by acidic hydrolysis gives salicylaldehyde

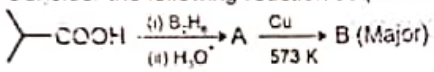
(c) Phenol liberates hydrogen gas on reaction with sodium metal

The **correct** statements are

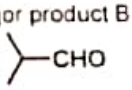
(1) (a) and (b) only (2) (b) and (c) only

(3) (a) and (c) only (4) (a), (b) and (c)

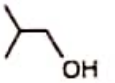
54. Consider the following reaction sequence



Major product B is

(1) 

(2) 

(3) 

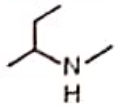
(4) 

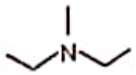
55. Glucose does not react with

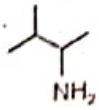
(1) HI (2) Br_2 water

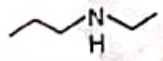
(3) HCN (4) $NaHSO_3$

56. An amine having molecular formula $C_5H_{13}N$ gives isocyanide test. The possible structure of the amine could be

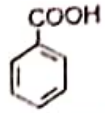
(1) 

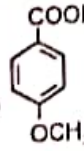
(2) 

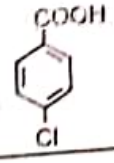
(3) 

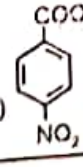
(4) 

57. The most acidic compound among the following is

(1) 

(2) 

(3) 

(4) 

58. Given below are the two statements

Statement I: Boiling point of 1-bromobutane is more than 2-bromobutane.

Statement II: The boiling points of isomeric haloalkanes decrease with increase in branching

In light of the above statements, choose the correct answer.

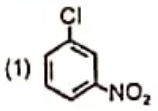
(1) Statement I is correct but statement II is incorrect

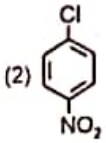
(2) Both statement I and statement II are correct

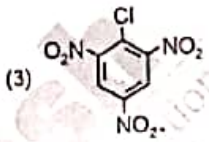
(3) Both statement I and statement II are incorrect

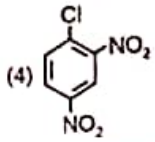
(4) Statement I is incorrect but statement II is correct.

59. Which among the following is least reactive towards nucleophilic substitution reaction?

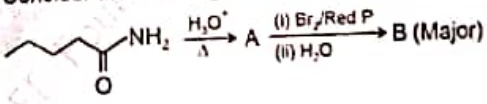
(1) 

(2) 

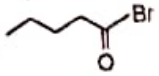
(3) 

(4) 

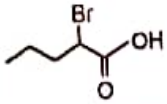
60. Consider the following reaction sequence

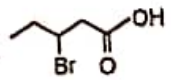


Major product B is

(1) 

(2) 

(3) 

(4) 

61. Which set contains only essential amino acids?

(1) Lysine, Glutamine and Alanine

(2) Methionine, Valine and Histidine

(3) Asparagine, Arginine and Glycine

(4) Proline, Tyrosine and Cysteine

62. The compound which give both positive Tollens' test and iodoform test is

(1) HCOOH (2) CH_3CHO

(3) HCHO (4) CH_3CH_2CHO

63. Total number of optically active isomers possible for 2,3-dibromopentane is

(1) 2 (2) 4

(3) Zero (4) 3

64. Polar protic solvent among the following is

(1) DMSO (2) Acetone

(3) Ethanol (4) DMF

65. Purine base among the following is

(1) Uracil (2) Cytosine

(3) Thymine (4) Adenine

66. Given below are the two statements

Statement I: Abnormally low level of thyroxine leads to hypothyroidism.

Statement II: Thyroxine is produced from thyroid gland.

In light of the above statements, choose the correct answer.

(1) Both statement I and statement II are correct

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct

(4) Both statement I and statement II are incorrect

67. Consider the following statements

a. Methanol is known as wood spirit.

b. Ethanol gives red colour in the Victor Meyer test.

c. Ethanol on reaction with PCC gives ethanoic acid as major product.

The correct statements are

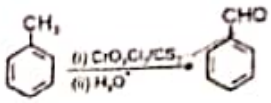
(1) a and b only

(2) b and c only

(3) a and c only

(4) a, b and c

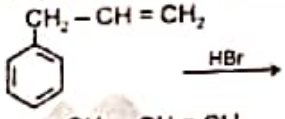
68. Match the reaction given in column I with name associated given in column II and choose the correct answer

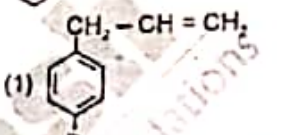
Column I	Column II
a. $CH_3-Br \xrightarrow{NaI} CH_3-I$	(i) Etard reaction
b. $CH_3-Br \xrightarrow{CH_3CH_2ONa} CH_3-O-CH_3$	(ii) Swarts reaction
c. 	(iii) Finkelstein reaction
d. $CH_3CH_2-Br \xrightarrow{AgF} CH_3CH_2-F$	(iv) Williamson synthesis

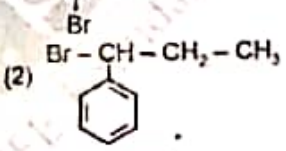
(1) a(iii), b(iv), c(ii), d(i) (2) a(iv), b(iii), c(ii), d(i)

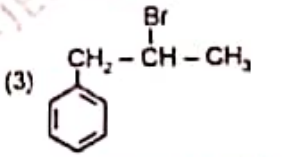
(3) a(iii), b(iv), c(i), d(ii) (4) a(iv), b(iii), c(i), d(ii)

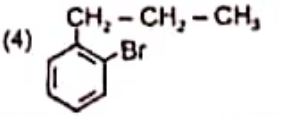
69. Major product of the given reaction is



(1) 

(2) 

(3) 

(4) 

70. The alkane that gives maximum number of mono-chloro products on reaction with Cl_2 in presence of sunlight is

(1) n-Hexane (2) 2-methylpentane

(3) 2,3-dimethylbutane (4) 2,2-dimethylpentane

62 The compound which give both positive Tollens' test and iodoform test is

(1) HCOOH (2) CH_3CHO

(3) HCHO (4) CH_3CH_2CHO

63 Total number of optically active isomers possible for 2,3-dibromopentane is

(1) 2 (2) 4

(3) Zero (4) 3

64 Polar protic solvent among the following is

(1) DMSO (2) Acetone

(3) Ethanol (4) DMF

65 Purine base among the following is

(1) Uracil (2) Cytosine

(3) Thymine (4) Adenine

66. Given below are the two statements

Statement I: Abnormally low level of thyroxine leads to hypothyroidism.

Statement II: Thyroxine is produced from thyroid gland.

In light of the above statements, choose the correct answer.

(1) Both statement I and statement II are correct

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct

(4) Both statement I and statement II are incorrect

67. Consider the following statements

a. Methanol is known as wood spirit.

b. Ethanol gives red colour in the Victor Meyer test.

c. Ethanol on reaction with PCC gives ethanoic acid as major product.

The correct statements are

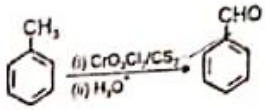
(1) a and b only

(2) b and c only

(3) a and c only

(4) a, b and c

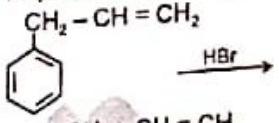
68. Match the reaction given in column I with name associated given in column II and choose the correct answer

Column I	Column II
a. $CH_3-Br \xrightarrow{NaI} CH_3-I$	(i) Etard reaction
b. $CH_3-Br \xrightarrow{CH_3ONa^+} CH_3-O-CH_3$	(ii) Swarts reaction
c. 	(iii) Finkelstein reaction
d. $CH_3CH_2-Br \xrightarrow{AgF} CH_3CH_2-F$	(iv) Williamson synthesis

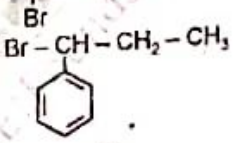
(1) a(iii), b(iv), c(ii), d(i) (2) a(iv), b(iii), c(ii), d(i)

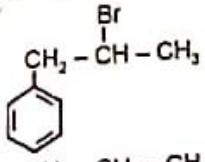
(3) a(iii), b(iv), c(i), d(ii) (4) a(iv), b(iii), c(i), d(ii)

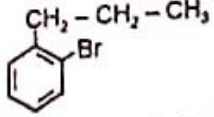
69. Major product of the given reaction is



(1) 

(2) 

(3) 

(4) 

70. The alkane that gives maximum number of mono-chloro products on reaction with Cl_2 in presence of sunlight is

(1) n-Hexane (2) 2-methylpentane

(3) 2,3-dimethylbutane (4) 2,2-dimethylpentane

Space for Rough Work

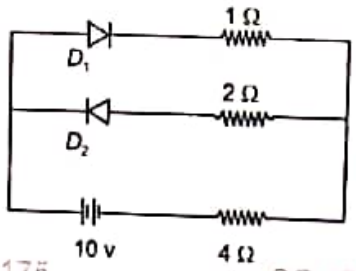
45. For production of X-rays in a roentgen tube the target metal used should have
(i) High thermal conductivity
(ii) Low specific heat capacity
(iii) High melting point
(1) (i) only (2) (i) and (ii) only
(3) (i) and (iii) only (4) (i), (ii) and (iii)

46. If the total binding energies of $^{2}_{1}H$, $^{4}_{2}He$, $^{56}_{26}Fe$ and $^{235}_{92}U$ nuclei are 2.22, 28.3, 492 and 1786 MeV respectively, then the most stable nucleus is
(1) $^{56}_{26}Fe$ (2) $^{2}_{1}H$
(3) $^{235}_{92}U$ (4) $^{4}_{2}He$

47. Two nuclei have their mass number in the ratio of 1 : 4. The ratio of their nuclear densities would be
(1) 1 : 4 (2) 1 : 2
(3) $1 : (4)^{1/3}$ (4) 1 : 1

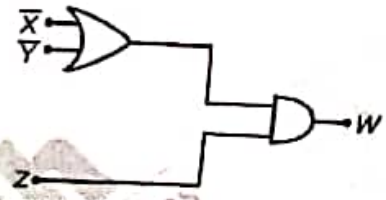
48. In radioactive decay process, the negatively charged emitted β-particles are
(1) The electrons present inside the nucleus
(2) The electrons produced as a result of decay of neutrons inside the nucleus
(3) The electrons produced as a result of collisions between atoms
(4) The electrons orbiting around the nucleus

49. In the given circuit, the current through 4 Ω resistor is (diodes are ideal)



(1) 1 A (2) 2 A
(3) 4 A (4) 5.5 A

50. For the given combination of logic gates the output W is

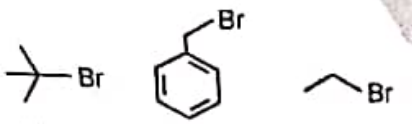


(1) $(X + Y) \cdot Z$ (2) $(X \cdot Y) \cdot Z$
(3) $(\bar{X}+\bar{Y}) \cdot Z$ (4) $(X + Y) + Z$

CHEMISTRY

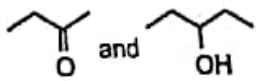
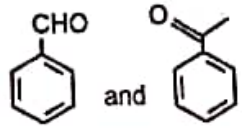
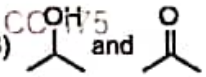
SECTION-A

51. Correct order of reactivity of the given compounds towards S_N1 reaction is



(i) (ii) (iii)

(1) (ii) > (i) > (iii)
(2) (i) > (ii) > (iii)
(3) (ii) > (iii) > (i)
(4) (iii) > (i) > (ii)

52. The pair of compounds which give positive iodoform test is
(1)  and
(2)  and
(3)  and
(4)  and HCHO

53. Consider the following statements

(a) Oxidation of phenol with chromic acid produces a conjugate diketone known as benzoquinone

(b) Sodium phenoxide on reaction with CO_2 followed by acidic hydrolysis gives salicylaldehyde

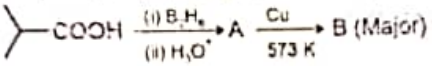
(c) Phenol liberates hydrogen gas on reaction with sodium metal

The **correct** statements are

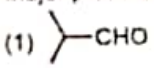
(1) (a) and (b) only (2) (b) and (c) only

(3) (a) and (c) only (4) (a), (b) and (c)

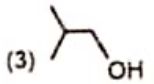
54. Consider the following reaction sequence



Major product B is

(1) 

(2) 

(3) 

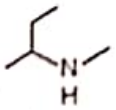
(4) 

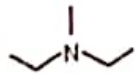
55. Glucose does not react with

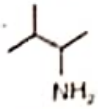
(1) HI (2) Br_2 water

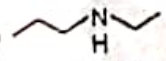
(3) HCN (4) $NaHSO_3$

56. An amine having molecular formula $C_5H_{13}N$ gives isocyanide test. The possible structure of the amine could be

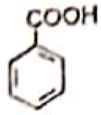
(1) 

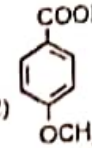
(2) 

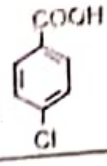
(3) 

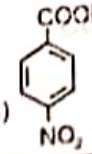
(4) 

57. The most acidic compound among the following is

(1) 

(2) 

(3) 

(4) 

58. Given below are the two statements

Statement I: Boiling point of 1-bromobutane is more than 2-bromobutane

Statement II: The boiling points of isomeric haloalkanes decrease with increase in branching

In light of the above statements, choose the correct answer.

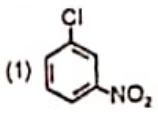
(1) Statement I is correct but statement II is incorrect

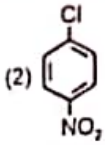
(2) Both statement I and statement II are correct

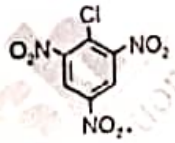
(3) Both statement I and statement II are incorrect

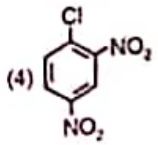
(4) Statement I is incorrect but statement II is correct.

59. Which among the following is least reactive towards nucleophilic substitution reaction?

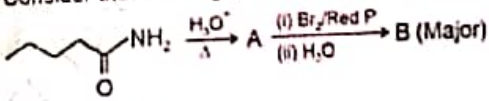
(1) 

(2) 

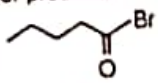
(3) 

(4) 

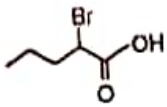
60. Consider the following reaction sequence

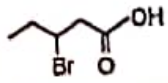


Major product B is

(1) 

(2) 

(3) 

(4) 

61. Which set contains only essential amino acids?

(1) Lysine, Glutamine and Alanine

(2) Methionine, Valine and Histidine

(3) Asparagine, Arginine and Glycine

(4) Proline, Tyrosine and Cysteine

191. Which of the following was used by S L. Miller in his experiment to produce amino acids?
(1) CH_3, H_2, NH_4 and water vapour at 900°C
(2) CH_4, N_2, NH_4 and water vapour at 600°C
(3) CH_3, H_2, NH_3 and water vapour at 600°C
(4) CH_4, H_2, NH_3 and water vapour at 800°C

192. Adaptive radiation is a phenomenon of evolution of
(1) A single species in an isolated geographical area from parent species
(2) Different species in a given geographical area starting from a point and spreading to other habitats
(3) Different species from different geographical area spreading to the same habitat
(4) A single species from different parent species in the same geographical area

193. A population is in Hardy- Weinberg equilibrium. 'N(AA)' and 'N(aa)' are the number of homozygous individuals and 'N(Aa)' is the number of heterozygous individuals. Choose the option that correctly represents the allelic frequency of 'A' and 'a' in a population with 'N(AA)' = 90, 'N(Aa)' = 40 and 'N(aa)' = 70.
(1) 'A' = 0.55 and 'a' = 0.45
(2) 'A' = 0.25 and 'a' = 0.75
(3) 'A' = 0.60 and 'a' = 0.40
(4) 'A' = 0.70 and 'a' = 0.30

194. Choose the odd one w.r.t. homology.
(1) Thorns of *Bougainvillea* and tendrils of *Cucurbita*
(2) Forelimbs of man and cheetah
(3) Vertebrate brains
(4) Flippers of penguins and dolphins

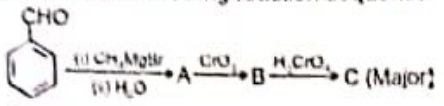
195. In which of the following techniques, recombinant DNA is directly injected into the nucleus of an animal cell?
(1) Biolistics
(2) Disarmed retrovirus mediated
(3) Micro-injection
(4) Gene gun

196. In recombinant DNA technology, same restriction enzyme is used for cutting both foreign DNA and vector DNA because
(1) The resultant DNA fragments have the same kind of sticky ends which can be joined (side-by-side) by using DNA polymerase.
(2) DNA has same palindromes which produce same sticky ends by DNA ligase.
(3) The resultant DNA fragments have different type of sticky ends that can be joined together (end-to-end) using DNA ligase.
(4) The resultant DNA fragments have same type of sticky ends that can be joined together (end-to-end) using DNA ligase.

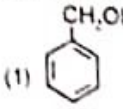
197. Read the following statements (A) and (B) and choose the correct option.
Statement (A): The most commonly used bioreactors are of stirring type.
Statement (B): Sterile air bubbles are sparged through simple stirred-tank bioreactors.
(1) Both statements (A) and (B) are correct
(2) Only statement (A) is correct
(3) Only statement (B) is correct
(4) Both statements (A) and (B) are incorrect

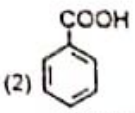
198. In RNAi, the source of complementary RNA could be from an infection by
(1) Viruses having DNA genomes that replicate *via* an RNA intermediate
(2) Transposons that replicate *via* a DNA intermediate
(3) Viruses having RNA genomes that replicate *via* DNA intermediate
(4) Viruses having RNA genomes or mobile genetic elements that replicate *via* an RNA intermediate

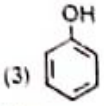
87. Consider the following reaction sequence

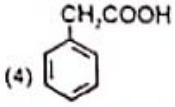


Major product C is

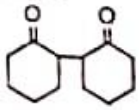
(1) 

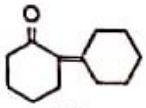
(2) 

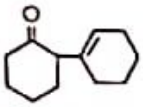
(3) 

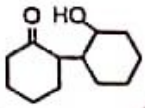
(4) 

88. Major product obtained on the reaction of cyclohexanone with dilute NaOH followed by heating is

(1) 

(2) 

(3) 

(4) 

89. Given below are the two statements

Statement I: Benzal chloride on reaction with water at 373 K gives benzaldehyde as major product.

Statement II: Benzaldehyde undergoes disproportionation reaction on heating with concentrated alkali.

In light of the above statements, choose the correct answer.

(1) Statement I is correct but statement II is incorrect

(2) Both statement I and statement II are correct

(3) Both statement I and statement II are incorrect

(4) Statement I is incorrect but statement II is correct

90. Lactose is composed of

(1) β-D-galactose and β-D-glucose

(2) α-D-glucose and β-D-glucose

(3) α-D-glucose and β-D-fructose

(4) β-D-galactose and α-D-glucose

91. Consider the following statements

a. Cellulose is a straight chain polysaccharide composed of only α-D-glucose units

b. Amylose constitutes about 15-20% of starch

c. Amylopectin is a branched chain polymer of α-D-glucose units

The correct statements are

(1) a and b only (2) b and c only

(3) a, b and c (4) a and c only

92. Number of chiral carbons present in sucrose is

(1) 8 (2) 9

(3) 10 (4) 6

93. Consider the following statements

a. Benzenediazonium fluoroborate is water insoluble and stable at room temperature.

b. Benzenediazonium fluoroborate on heating gives fluorobenzene.

c. Benzenediazonium chloride on reaction with ethanol gives phenetole as major product.

The correct statements are

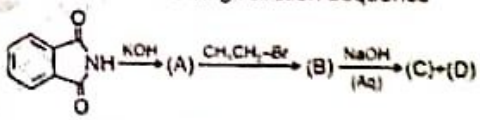
(1) a and b only

(2) b and c only

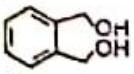
(3) a, b and c

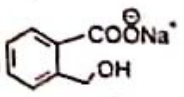
(4) a and c only

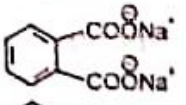
94. Consider the following reaction sequence

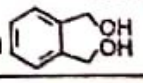


Products (C) and (D) are

(1) CH_3CH_2OH and 

(2) $CH_3 - NH - CH_3$ and 

(3) $CH_3CH_2 - NH_2$ and 

(4) $CH_3CH_2 - NH_2$ and 

Space for Rough Work

79. Consider the following statements

a. Ethanal is miscible with water in all proportions

b. Formaldehyde is a gas at room temperature

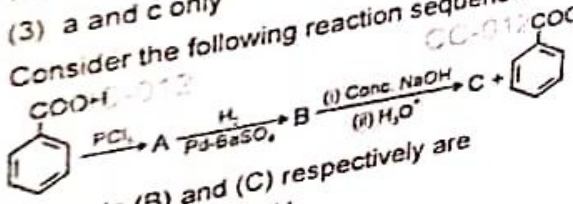
c. The boiling points of aldehydes and ketones are higher than ethers of comparable molecular masses.

The correct statements are

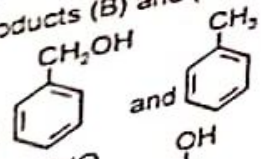
(1) a and b only (2) b and c only

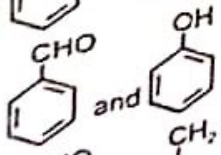
(3) a and c only (4) a, b and c

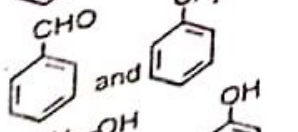
80. Consider the following reaction sequence

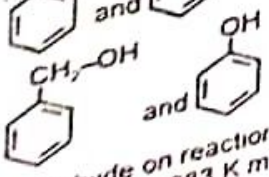


Products (B) and (C) respectively are

(1) 

(2) 

(3) 

(4) 

81. Benzaldehyde on reaction with HNO_3 in presence of H_2SO_4 at 273–283 K majorly gives

(1) o-Nitrobenzaldehyde

(2) Nitrobenzene

(3) m-Nitrobenzaldehyde

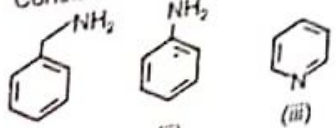
(4) p-Nitrobenzaldehyde

82. Propanamide on reaction with bromine in presence of aqueous KOH gives

(1) Ethyl amine (2) 1-Aminopropane

(3) Propan-1-ol (4) 1-Bromopropane

83. Consider the following compounds

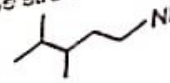


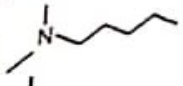
The correct order of basic strength of these compounds is

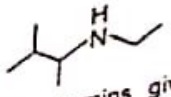
(1) (i) > (iii) > (ii) (2) (ii) > (i) > (iii)

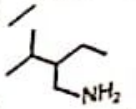
(3) (iii) > (ii) > (i) (4) (ii) > (iii) > (i)

84. Compound 'A' having molecular formula $C_7H_{17}N$ on reaction with Hinsberg's reagent gives compound B which is insoluble in aqueous alkali. The structure of 'A' could be

(1) 

(2) 

(3) 

(4) 

85. Match vitamins given in column I with their deficiency diseases given in column II

	Column I		Column II
a.	Vitamin B_1	(i)	Increased fragility of RBCs
b.	Vitamin B_6	(ii)	Ben beri
c.	Vitamin E	(iii)	Hardening of comea of eye
d.	Vitamin A	(iv)	Convulsions

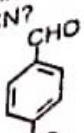
The correct match is

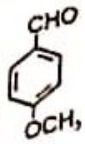
(1) a(iv), b(ii), c(i), d(iii) (2) a(ii), b(iv), c(iii), d(i)

(3) a(iii), b(iv), c(i), d(ii) (4) a(ii), b(iv), c(i), d(iii)

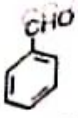
SECTION - B

86. Which among the following reacts fastest with HCN?

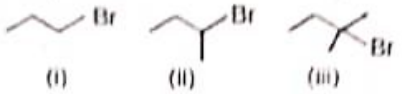
(1) 

(2) 

(3) 

(4) 

71 Correct order of S_N2 reactivity for the given compounds is



(i) (ii) (iii)

(1) (iii) > (ii) > (i) (2) (ii) > (i) > (iii)

(3) (i) > (ii) > (iii) (4) (ii) > (iii) > (i)

72 The incorrect statement among the following is

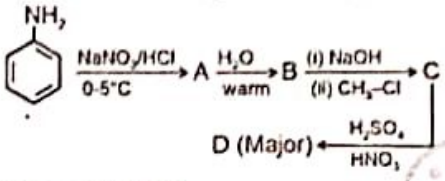
(1) Methyl magnesium bromide on reaction with methanol liberates ethane gas

(2) Ethyl bromide reacts with sodium in dry ether to give n-butane

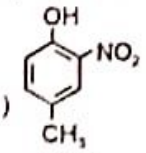
(3) 2-Bromopentane when heated with alcoholic KOH gives pent-2-ene as major product

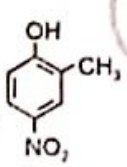
(4) NO_2^- is an ambident nucleophile

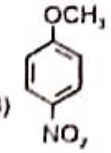
73. Consider the following reaction sequence

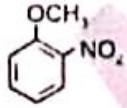


Major product D is

(1) 

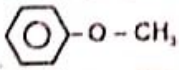
(2) 

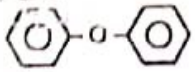
(3) 

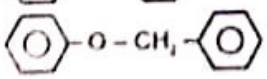
(4) 

74. The compound which is most difficult to cleave by HI is

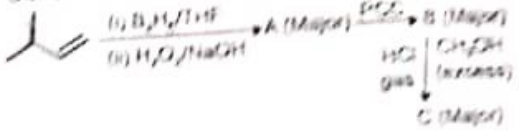
(1) $CH_3CH_2-O-CH_3$

(2) 

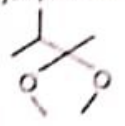
(3) 

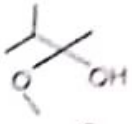
(4) 

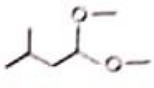
75. Consider the following reaction sequence

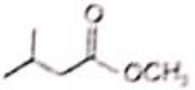


Major product C is

(1) 

(2) 

(3) 

(4) 

76 Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A): Acetic acid gives CO_2 on reaction with sodium bicarbonate

Reason (R): Acetic acid is a stronger acid than carbonic acid

In the light of the above statements, choose the most appropriate answer from the options given below.

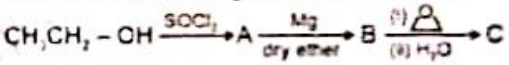
(1) (A) is true but (R) is false

(2) (A) is false but (R) is true

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

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

77. Consider the following reaction sequence



Product C is

(1) $CH_3CH_2CH_2CH_2-OH$

(2) $CH_3CH_2\underset{\underset{OH}{|}}{C}HCH_3$

(3) $CH_3CH_2CH_2CHO$

(4) $CH_3CH_2CH_2-O-CH_3$

78. Acrolein is obtained by the aldol condensation of

(1) Benzaldehyde and Acetaldehyde

(2) Formaldehyde and Acetaldehyde

(3) Formaldehyde and Acetone

(4) Benzaldehyde and Acetophenone

	a	b	c	d
(1)	T	T	T	T
(2)	F	T	T	F
(3)	F	T	T	T
(4)	F	F	F	T

124. Read the following statements and select the **correct** option.

Assertion (A): RNA is better for the transmission of genetic information.

Reason (R): DNA has evolved from RNA with chemical modifications that make it more stable.

(1) Both A and R are false
(2) A is true but R is false
(3) Both A and R are true but R is not the correct explanation of A
(4) Both A and R are true and R is the correct explanation of A

125. Choose the **correct** option w.r.t. human genome project.

(1) One approach was focused on identifying all the genes which expressed as RNA is referred to as sequence annotation.
(2) Humans were used as host for the cloning of DNA.
(3) One of the method took blind approach of simply sequencing the whole set of genome.
(4) The DNA fragments obtained from humans were sequenced using automated DNA sequencer that worked on the principle of method given by Marshal Nirenberg.

126. All of the following are limitations of ecological pyramid, **except**

(1) It takes into account the same species belonging to two or more trophic levels
(2) Saprophytes are not given any place
(3) It assumes simple food chain
(4) It does not accommodate food web

127. Which of the following can be the most appropriate sequence of stages during hydrarch succession?

(1) Submerged plant stage → phytoplankton → Marsh meadow stage → Reed swamp stage → Forest
(2) Phytoplankton → Submerged plant stage → Reed swamp stage → Forest → Marsh meadow stage
(3) Phytoplankton → Submerged plant stage → Reed swamp stage → Marsh meadow stage → Forest
(4) Marsh meadow stage → Submerged plant stage → phytoplankton → Reed swamp stage → Forest

128. What type of ecological pyramid would be obtained with the following data?

Tertiary consumer : 10 J
Secondary consumer : 100 J
Primary consumer : 1000 J
Primary producer : 10,000 J

(1) Upright pyramid of number
(2) Upright pyramid of biomass
(3) Upright pyramid of energy
(4) Inverted pyramid of energy

129. Which of the following options depicts the **correct** difference between carbon and phosphorus cycle?

(1) Atmospheric inputs of phosphorus through rainfall are much smaller than carbon inputs
(2) Gaseous exchange of phosphorus between organism and environment is enormous
(3) The natural reservoir of phosphorus is atmosphere
(4) Carbon cycle exemplifies sedimentary cycle

130. Select the **odd** one out w.r.t. the suspension strategies adopted by organisms to avoid stressful conditions

(1) Bear going into hibernation
(2) Some snails and fish go into aestivation
(3) Many zooplankton species in lakes enter diapause
(4) Migration of birds from Siberia to Keolado National Park

131. Select the **correct** statement.

(1) Pacific salmon fish breed only once in their lifetime.
(2) Usually, oysters produce small number of small-sized offspring
(3) Mammals from colder climates generally have shorter ears and longer limbs.
(4) Nearly all plants can maintain a constant internal environment.

114. Given below are the two statements:

Statement I: AUG has dual functions as it codes for methionine, and also acts as initiator codon.

Statement II: Polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as DNA fingerprinting.

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

(1) Only statement I is correct

(2) Only statement II is correct

(3) Both statements I and II are correct

(4) Both statements I and II are incorrect

115. If a dsDNA has 15% of the total bases as G then, what will be the percentage composition of A and C?

(1) A : 15%, C : 35% (2) A : 35%, C : 15%

(3) A : 25%, C : 25% (4) A : 35%, C : 35%

116. Which of the following statements is **correct**?

(1) Guanine pairs with cytosine through two hydrogen bonds

(2) Guanine does not pair with cytosine

(3) Guanine pairs with thymine through one H-bond

(4) Guanine pairs with cytosine through three H-bonds

117. Which of the following statements is **correct** w.r.t. experiment conducted by Hershey and Chase?

(1) They worked to discover whether it was protein or DNA from viruses that entered the bacteria

(2) They gave unequivocal proof that protein is the genetic material

(3) In the experiment it was found that viruses grown on radioactive sulphur contained radioactive DNA

(4) They discovered protein-digesting enzymes and RNA-digesting enzymes during the experiment

118. Mostly in eukaryotes, the structural genes in a transcription unit

a. Are monocistronic.

b. Have uninterrupted coding sequences.

c. Have split gene arrangement.

The **incorrect** one(s) is/are

(1) b and c only (2) a only

(3) b only (4) a and c only

119. Satellite DNA differs from genomic DNA as the former

(1) Forms a major peak during density gradient centrifugation

(2) Exemplifies non-repetitive DNA

(3) Normally do not code for any proteins

(4) Shows very less degree of polymorphism

120. The process of translation of mRNA to protein begins when

(1) A release factor binds to the stop codon

(2) The small subunit of ribosome encounters an mRNA

(3) Ribosomes move from codon to codon along mRNA

(4) Release of complete polypeptide from the ribosome occurs

121. The process which leads to accumulation of dark coloured amorphous substance that is highly resistant to microbial action is called

(1) Mineralisation (2) Humification

(3) Catabolism (4) Fragmentation

122. Each trophic level has a certain mass of living material at a particular time which is called

(1) Standing crop

(2) Standing state

(3) Net primary productivity

(4) Photosynthetic efficiency

123. State **true (T)** or **false (F)** to the given statements and choose the **correct** option.

a. In tailing during post-transcriptional process, adenylate residues are added at 3' end in a template dependent manner.

b. Process of splicing represents the dominance of RNA-world

c. RNA polymerase binds with Rho factor to terminate the transcription process.

d. rRNAs play structural and catalytic role during translation.

ZOOLOGY

SECTION-A

151. In humans, the male gonads produce sperms in highly coiled structures called

(1) Vasa efferentia

(2) Epididymis

(3) Seminiferous tubules

(4) Vas deferens

152. In human males, the urethra runs through the penis and opens to the outside at the tip of the penis and is considered as an outlet tube of

(1) The excretory system only

(2) The reproductive system only

(3) Both the excretory system and reproductive system

(4) The excretory system, reproductive system and digestive system

153. In humans, together with the wave-like contraction in the oviduct, the cilia convey the egg down the duct to the

(1) Fimbriae

(2) Vagina

(3) Clitoris

(4) Womb

154. In human females, the vaginal and urethral openings are located within a cavity bordered by a paired fold of tissue called _____ under labia majora.

Fill in the blank with a suitable option.

(1) Hymen

(2) Clitoris

(3) Labia minora

(4) Birth canal

155. Match the following columns w.r.t. humans and choose the **correct** option.

	Column I		Column II
a.	Parturition	(i)	Attachment of blastocyst to uterine wall
b.	Gestation	(ii)	Delivery of baby
c.	Ovulation	(iii)	Embryonic development
d.	Implantation	(iv)	Release of ovum

(1) a(i), b(ii), c(iii), d(iv) (2) a(iv), b(iii), c(ii), d(i)

(3) a(ii), b(iii), c(iv), d(i) (4) a(iii), b(i), c(ii), d(iv)

156. The Big Bang theory attempts to explain to us the origin of

(1) Species (2) Life

(3) Universe (4) Earth

157. Read the following statements (A) and (B) and choose the **correct** option.

Statement (A): The study of history of life forms on Earth is called evolutionary biology.

Statement (B): When we see stars, we apparently are peeping into the past.

(1) Both statements (A) and (B) are incorrect

(2) Only statement (A) is correct

(3) Only statement (B) is correct

(4) Both statements (A) and (B) are correct

158. Spontaneous generation theory was dismissed once and for all by careful experimentation demonstrated by

(1) Louis Pasteur (2) Oparin

(3) Haldane (4) Ernst Haeckel

159. Choose the **correct** option to complete the analogy.

Flying squirrel : Flying phalanger :: _____ : Numbat

(1) Mouse (2) Lemur

(3) Anteater (4) Bobcat

141. Heterochromatin is
(1) The only fragment that can translate proteins
(2) Transcriptionally inactive
(3) Loosely packed chromatin
(4) Lightly stained

142. The discontinuously synthesised fragments during DNA replication are later joined by
(1) DNA helicase (2) DNA ligase
(3) DNase (4) RNase

143. Lichens involved in the primary succession on rocks, help in weathering and soil formation. During succession, they are termed as
(1) Pioneer species (2) Seral species
(3) Climax species (4) Keystone species

144. Carbon constitutes "A" of dry weight of organisms.
Select the **correct** option to fill "A".
(1) 70% (2) 49%
(3) 80% (4) 100%

145. Which of the following statements is **incorrect**?
(1) Decomposition is largely an oxygen requiring process
(2) The pyramid of biomass in sea is generally inverted
(3) GFC is the major conduit for energy flow in an aquatic ecosystem
(4) Low temperature and anaerobiosis promote decomposition

146. Given below are two statements.
Statement I: The waste products and the dead organisms are not decomposed by phosphate-solubilising bacteria, and inhibit the release of phosphorus in soil.
Statement II: Phosphorus is a major constituent of biological membranes, nucleic acids and cellular energy transfer systems.
In the light of above statements choose the **correct** answer from the options given below.
(1) Only statement I is correct
(2) Both statements I and II are correct
(3) Only statement II is correct
(4) Both statements I and II are incorrect

147. Match list-I with list-II

	List-I		List-II
a.	Friedrich Miescher	(i)	Cell free system for protein synthesis
b.	Marshall Nirenberg	(ii)	Proposed DNA double helix model
c.	Watson and Crick	(iii)	Named nuclein
d.	Jacob and Monod	(iv)	*Lac* operon

Choose the **correct** answer from the options given below.
(1) a(iv), b(ii), c(iii), d(i) (2) a(iii), b(i), c(ii), d(iv)
(3) a(iii), b(iv), c(ii), d(i) (4) a(ii), b(iv), c(iii), d(i)

148. Identify the **correct** statement.
(1) DNA polymerases catalyse polymerisation only in one direction *i.e.*, 3′ → 5′.
(2) Inheritance of a character is also affected by promoter and regulatory sequences of a structural gene.
(3) In DNA, terminator region utilised during transcription is located towards 5′ end of the coding strand (downstream).
(4) In bacteria, DNA is scattered throughout the cell.

149. What will be the corresponding sequence of transcribed mRNA produced by the following stretch of coding strand of DNA?
5′–TTCCCTTGGCCC–3′
(1) 3′–UUCCCUUGGCCC–5′
(2) 3′–AAGGGAACCGGG–5′
(3) 5′–UUCCCUUGGCCC–3′
(4) 5′–UUGGGUUCCGGG–3′

150. Which one of the following statements about *lac* operon is **wrong**?
(1) Regulation of *lac* operon by repressor is referred to as negative regulation.
(2) All the three gene products in *lac* operon are required for metabolism of lactose.
(3) Repressor protein binds to the promoter region of the operon.
(4) It represents polycistronic structural gene regulated by common promoter and regulatory genes.

180. In restriction enzyme *Eco*RI, letter 'E' is derived from the name of
(1) Genus of the prokaryotic cell
(2) Species of the bacterial cell
(3) Strain of bacteria
(4) Order of enzyme isolation

181. If a recombinant DNA carrying amp^R gene is transferred in *E.coli* cell, the host cell is transformed into ampicillin-resistant cell. The ampicillin resistance gene in this case is called a
(1) Vector (2) Plasmid
(3) Selectable marker (4) Cloning site

182. Comprehend the given statements w.r.t. gel electrophoresis.
a. DNA fragments are negatively charged and move towards cathode.
b. DNA fragments separate according to their size through sieving effect provided by agarose gel.
c. Larger the fragment size, farther it moves from cathode.
d. Agarose is a natural polymer extracted from sea weeds.
Choose the option with only **correct** statements.
(1) a and b (2) b and c
(3) c and d (4) b and d

183. Genetic modification has
(1) Made crops less tolerant to abiotic stresses
(2) Reduced reliance on chemical pesticides
(3) Helped to increase post-harvest losses
(4) Decreased efficiency of mineral usage by plants

184. Critical research areas of biotechnology are
a. Providing the best catalyst in the form of improved organism usually a microbe or pure enzyme.
b. Creating optimal conditions through engineering for a catalyst to act.
c. Downstream processing technologies to purify the protein/organic compound.
Choose the most appropriate option.
(1) a only (2) a and b only
(3) b and c only (4) a, b and c

185. Transgenic animals are used in chemical safety testing of toxicity of drugs. These animals are made to carry genes which make them
(1) Less sensitive to toxic substances than non-transgenic animals
(2) More sensitive to toxic substances than non-transgenic animals
(3) Resistant to toxic effect of drugs
(4) More tolerant to large doses of drugs

SECTION - B

186. Which of the following structures is not a human female reproductive accessory duct?
(1) Oviducts (2) Uterus
(3) Clitoris (4) Vagina

187. In each breast of a human female, the total number of lactiferous ducts is equal to the total number of
(1) Alveoli (2) Mammary tubules
(3) Mammary ducts (4) Mammary ampulla

188. Foetal ejection reflex triggers the release of
(1) Oxytocin from foetal hypothalamus
(2) Oxytocin from foetal neurohypophysis
(3) Oxytocin from maternal pars nervosa
(4) Vasopressin from maternal neurohypophysis

189. In humans, parturition is induced by a complex neuroendocrine mechanism involving all of the following hormones, **except**
(1) Cortisol (2) Estrogens
(3) Oxytocin (4) FSH

190. Match Column I and Column II w.r.t. humans and choose the **correct** option.

	Column I		Column II
a.	Stem cells	(i)	Induces rupture of Graafian follicle
b.	Colostrum	(ii)	Present in inner cell mass
c.	LH surge	(iii)	Secretes a hormone which maintains endometrium
d.	Corpus luteum	(iv)	Contains several antibodies

(1) a(i), b(ii), c(iii), d(iv) (2) a(iv), b(iii), c(ii), d(i)
(3) a(ii), b(iv), c(i), d(iii) (4) a(iii), b(i), c(iv), d(ii)

Space for Rough Work

160. Read the following statements carefully
   a. Fitness is the end result of the ability to adapt and get selected by nature
   b. Homology in vertebrate hearts indicates divergent evolution
   c. Any population has built in variations in characteristics
   d. After industrialisation, the white winged moth did not survive due to health hazards caused by industrial smoke and soots

   Choose the option with only incorrect statements
   (1) a and b (2) b and c
   (3) b and d (4) a and d

161. Agarose gel electrophoresis is employed to check the
   (1) Formation of recombinant bacteria
   (2) Transformation of bacteria
   (3) Progression of a restriction enzyme digestion
   (4) Separation of bands of DNA on the basis of their charges

162. Stanley Cohen and Herbert Boyer accomplished the construction of first recombinant DNA by using the native plasmid of
   (1) *Escherichia coli*
   (2) *Bacillus thuringiensis*
   (3) *Salmonella typhi*
   (4) *Salmonella typhimurium*

163. **Assertion (A):** *Agrobacterium tumefaciens*, a pathogen of several dicot plants is able to transform normal plant cells into a tumor.
   Reason (R): It is able to deliver a piece of DNA known as 'T-DNA' in several dicot plant cells.
   In the light of above statements, choose the correct answer from the options given below
   (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
   (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
   (3) (A) is true, (R) is false
   (4) (A) is false, (R) is true

164. Arrange the following steps involved in the process of recombinant DNA technology in their chronological order
   (A) Extraction of the desired gene product
   (B) Amplification of the gene of interest
   (C) Isolation of desired DNA fragment
   (D) Ligation of DNA fragment into a vector
   (E) Insertion of recombinant DNA into the host
   Choose the correct option
   (1) (C) → (B) → (D) → (E) → (A)
   (2) (A) → (B) → (C) → (D) → (E)
   (3) (B) → (C) → (D) → (A) → (E)
   (4) (C) → (B) → (D) → (A) → (E)

165. Choose the correct statement w.r.t. C-peptide of human insulin
   (1) It is a part of mature insulin molecule
   (2) It participates in the formation of disulphide bridges with A chain
   (3) It is removed during maturation of proinsulin into insulin
   (4) The biological activities of insulin is due to the presence of peptide bonds between C-peptide and B chain

166. Bt toxin genes have been expressed in plants in order to provide resistance against
   a. Tobacco budworm and armyworm
   b. Beetles
   c. Flies and mosquitoes
   Choose the correct option
   (1) a and b only (2) b and c only
   (3) a, b and c (4) a and c only

167. *cry*IAb and *cry*IAc produce toxins that control
   (1) Cotton bollworms and corn borers respectively
   (2) Cotton bollworms
   (3) Corn borers
   (4) Corn borers and cotton bollworms respectively

168. Genetic modification has been used to create tailor-made plants to supply alternative resource to industries, in the form of
   a. Fuels
   b. Starches
   c. Pharmaceuticals
   Choose the correct option.
   (1) a only (2) b only
   (3) a and c only (4) a, b and c

CC-012

Space for Rough Work

132. All of the following are adaptations present in xerophytic plants, **except**
(1) Thick cuticle on the leaf surfaces
(2) Arrangement of stomata in deep pits
(3) Absence of special photosynthetic pathway like CAM
(4) Presence of spines

133. Kangaroo rat is capable of meeting all its water requirements through
(1) Increasing its body temperature
(2) Its internal fat oxidation
(3) Dilution of its urine
(4) Development of thick layer of blubber

134. Match the following and select the **correct** option.

	Column-I		Column-II
a.	Secondary consumer	(i)	Earthworm
b.	Detritivore	(ii)	Crop fields
c.	Man-made ecosystem	(iii)	Colloidal in nature
d.	Humus	(iv)	Wolf

(1) a(i), b(ii), c(iv), d(iii) (2) a(i), b(iv), c(ii), d(iii)
(3) a(iv), b(i), c(ii), d(iii) (4) a(iv), b(iii), c(ii), d(i)

135. Which of the following statements is **correct**?
(1) Sun is the only source of energy for all ecosystems on earth without any exception.
(2) Rate of primary succession is much faster than secondary succession.
(3) The annual net primary productivity of whole biosphere is approximately 50 million tons (dry weight) of organic matter.
(4) The function of the reservoir in nutrient cycling is to meet with the deficit which occurs due to imbalance in the rate of influx and efflux.

SECTION - B

136. Biogas is a mixture of which of the following gases?
(1) Methane and hydrogen sulphide only
(2) Methane, carbon dioxide and oxygen only
(3) Methane, carbon dioxide and hydrogen sulphide
(4) Hydrogen chloride, oxygen and carbon monoxide

137. Select the **incorrect** statement.
(1) Primary treatment of sewage involves physical removal of large and small particles through filtration and sedimentation.
(2) In paddy fields, cyanobacteria serves as an important biofertiliser
(3) Amount of vitamin B_{12} is more in curd, in comparison to milk
(4) *Bacillus thuringiensis* has no role in controlling butterfly caterpillars.

138. In the exponential growth equation $N_t = N_0e^{rt}$, 'r' represents
(1) Rate of metabolism
(2) Population density
(3) Intrinsic rate of natural increase
(4) The base of natural logarithms

139. **Assertion (A):** Resource partitioning is a mechanism to promote co-existence of two species rather than their exclusion.
Reason (R): If two species compete for same resource, they could avoid competition by predating on each other.
In the light of the above statements, choose the **correct** answer from the options given below.
(1) Both (A) and (R) are false
(2) Both (A) and (R) are true and (R) is the correct explanation of (A)
(3) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(4) (A) is true but (R) is false

140. Read the below given statements w.r.t. altitude sickness
a. It can lead to nausea, fatigue and heart palpitations.
b. It is experienced due to high atmospheric pressure at high altitude.
c. The body experiencing the effect compensates low oxygen availability by increasing RBC production.
The **correct** one(s) is/are
(1) a and b only (2) b and c only
(3) a and c only (4) c only

114. Given below are the two statements:

Statement I: AUG has dual functions as it codes for methionine, and also acts as initiator codon.

Statement II: Polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as DNA fingerprinting.

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

(1) Only statement I is correct

(2) Only statement II is correct

(3) Both statements I and II are correct

(4) Both statements I and II are incorrect

115. If a dsDNA has 15% of the total bases as G then, what will be the percentage composition of A and C?

(1) A : 15%, C : 35% (2) A : 35%, C : 15%

(3) A : 25%, C : 25% (4) A : 35%, C : 35%

116. Which of the following statements is **correct**?

(1) Guanine pairs with cytosine through two hydrogen bonds

(2) Guanine does not pair with cytosine

(3) Guanine pairs with thymine through one H-bond

(4) Guanine pairs with cytosine through three H-bonds

117. Which of the following statements is **correct** w.r.t. experiment conducted by Hershey and Chase?

(1) They worked to discover whether it was protein or DNA from viruses that entered the bacteria

(2) They gave unequivocal proof that protein is the genetic material

(3) In the experiment it was found that viruses grown on radioactive sulphur contained radioactive DNA

(4) They discovered protein-digesting enzymes and RNA-digesting enzymes during the experiment

118. Mostly in eukaryotes, the structural genes in a transcription unit

a. Are monocistronic.

b. Have uninterrupted coding sequences.

c. Have split gene arrangement.

The **incorrect** one(s) is/are

(1) b and c only (2) a only

(3) b only (4) a and c only

119. Satellite DNA differs from genomic DNA as the former

(1) Forms a major peak during density gradient centrifugation

(2) Exemplifies non-repetitive DNA

(3) Normally do not code for any proteins

(4) Shows very less degree of polymorphism

120. The process of translation of mRNA to protein begins when

(1) A release factor binds to the stop codon

(2) The small subunit of ribosome encounters an mRNA

(3) Ribosomes move from codon to codon along mRNA

(4) Release of complete polypeptide from the ribosome occurs

121. The process which leads to accumulation of dark coloured amorphous substance that is highly resistant to microbial action is called

(1) Mineralisation (2) Humification

(3) Catabolism (4) Fragmentation

122. Each trophic level has a certain mass of living material at a particular time which is called

(1) Standing crop

(2) Standing state

(3) Net primary productivity

(4) Photosynthetic efficiency

123. State **true (T)** or **false (F)** to the given statements and choose the **correct** option.

a. In tailing during post-transcriptional process, adenylate residues are added at 3' end in a template dependent manner.

b. Process of splicing represents the dominance of RNA-world

c. RNA polymerase binds with Rho factor to terminate the transcription process.

d. rRNAs play structural and catalytic role during translation.

169. Each primary oocyte gets surrounded by a single layer of granulosa cells when it is
(1) Present within secondary follicle
(2) Temporarily arrested in prophase-I
(3) Temporarily arrested in metaphase-II
(4) Present in follicle with a new theca layer

170. The cycle of events starting from one menstruation till the next one is called
(1) Menses
(2) Menstrual cycle
(3) Menopause
(4) Menarche

171. During fertilisation in humans, a sperm comes in contact with 'X' layer of the ovum and induces changes in the membrane that block the entry of additional sperms.
Choose the correct option for 'X'.
(1) Corona radiata
(2) Zona pellucida
(3) Membrana granulosa
(4) Vitelline membrane

172. Sertoli cells are regulated by a proteinaceous pituitary hormone called
(1) LH (2) FSH
(3) PRL (4) TSH

173. **Assertion (A):** In humans, the testes are situated outside the abdominal cavity within a pouch called scrotum
Reason (R): The scrotum helps in maintaining low temperature of the testes necessary for spermatogenesis.
In the light of above statements, choose the answer from the options given below.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(3) (A) is true, (R) is false
(4) Both (A) and (R) are false

174. Large difference arising suddenly in a population brought forth the idea of mutations, which are
(1) Large and directional
(2) Small and directional
(3) Random and directionless
(4) Small and continuous

175. Which of the following is not an example of evolution by anthropogenic action and natural selection?
(1) Herbicide resistant herbs
(2) Pesticide resistant pests
(3) Antibiotic resistant bacteria
(4) New breed of dogs by selective breeding

176. Zosterophyllum is the ancestor of
(1) Bryophytes
(2) Arborescent lycopods
(3) Psilophyton
(4) Seed ferns

177. Which of the following animals are considered as closest living relatives of birds?
(1) Dinosaurs (2) Mammals
(3) Tuataras (4) Crocodiles

178. Match Column I with Column II

	Column I		Column II
a.	Genetic drift	(i)	Influence phenotype
b.	Saltation	(ii)	Change in allele frequency by chance
c.	Gene flow	(iii)	Single step large mutation
d.	Inheritable factors	(iv)	Gene migration happens multiple times

Choose the correct option.
(1) a(i), b(ii), c(iii), d(iv) (2) a(ii), b(iii), c(iv), d(i)
(3) a(iv), b(iii), c(ii), d(i) (4) a(iii), b(ii), c(i), d(iv)

179. Choose the incorrect option w.r.t. *Homo erectus*.
(1) Fossils discovered in Java in 1891.
(2) They had a large brain around 900cc.
(3) They probably ate meal.
(4) They were more ape-like.

Space for Rough Work

SECTION-A

101. Which of the following bioactive molecules is used as an immunosuppressive agent in organ-transplant patients?
(1) Statin
(2) Cyclosporin A
(3) Streptokinase
(4) Pectinase

102. Select the **incorrectly** matched pair.
(1) *Trichoderma* – Very common in root ecosystems
(2) Dragonflies – Useful to get rid of mosquitoes
(3) Baculoviruses – Species specific, broad spectrum insecticidal applications
(4) *Glomus* – Members form mycorrhiza

103. A microbe used for the commercial production of butyric acid is
(1) *Acetobacter aceti*
(2) *Aspergillus niger*
(3) *Clostridium butylicum*
(4) *Lactobacillus*

104. Fermented products produced by *Saccharomyces cerevisiae* are
(1) Ethanol and Bread
(2) Swiss cheese and curd
(3) Curd and Bread
(4) Curd and Roquefort cheese

105. In which of the following population interactions, one species is harmed whereas the other is unaffected?
(1) Mutualism
(2) Amensalism
(3) Predation
(4) Commensalism

106. Desert lizards show (A) adaptation to manage their body temperature.
Select the **correct** option to fill A.
(1) Physiological
(2) Biochemical
(3) Behavioural
(4) Cytological

107. Commensalism is found in which of the following interactions?
(1) Orchid – Mango tree
(2) Mycorrhiza – Plants
(3) Fig – Fig wasp
(4) Lichens

108. Natality and immigration both result in
(1) Decrease in population density
(2) Increase in population density
(3) Constant population density for indefinite period of time
(4) Sudden decline and then abrupt increase in population density

109. Organisms which tolerate a wide range of salinities are called
(1) Euryhaline
(2) Stenohaline
(3) Eurythermal
(4) Stenothermal

110. In *lac* operon, *y* gene codes for
(1) β-galactosidase
(2) Permease
(3) Transacetylase
(4) Repressor protein

111. All of the following RNAs are transcribed by RNA polymerase III, **except**.
(1) 5S rRNA
(2) hnRNA
(3) tRNA
(4) snRNAs

112. Number of base pairs present in the haploid content of human DNA is
(1) 3.3×10^9 bp
(2) 6.6×10^9 bp
(3) 3.3×10^6 bp
(4) 6.6×10^6 bp

113. Which of the following is **not** a salient feature of genetic code?
(1) Stop codons have their own tRNA
(2) Degenerate
(3) Read in a contiguous fashion
(4) Nearly universal

132. All of the following are adaptations present in xerophytic plants, **except**
(1) Thick cuticle on the leaf surfaces
(2) Arrangement of stomata in deep pits
(3) Absence of special photosynthetic pathway like CAM
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133. Kangaroo rat is capable of meeting all its water requirements through
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(2) Its internal fat oxidation
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134. Match the following and select the **correct** option.

	Column-I		Column-II
a.	Secondary consumer	(i)	Earthworm
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c.	Man-made ecosystem	(iii)	Colloidal in nature
d.	Humus	(iv)	Wolf

(1) a(i), b(ii), c(iv), d(iii) (2) a(i), b(iv), c(ii), d(iii)
(3) a(iv), b(i), c(ii), d(iii) (4) a(iv), b(iii), c(ii), d(i)

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(1) Sun is the only source of energy for all ecosystems on earth without any exception.
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SECTION - B

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Reason (R): If two species compete for same resource, they could avoid competition by predating on each other.
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140. Read the below given statements w.r.t. altitude sickness
a. It can lead to nausea, fatigue and heart palpitations.
b. It is experienced due to high atmospheric pressure at high altitude.
c. The body experiencing the effect compensates low oxygen availability by increasing RBC production.
The **correct** one(s) is/are
(1) a and b only (2) b and c only
(3) a and c only (4) c only

	a	b	c	d
(1)	T	T	T	T
(2)	F	T	T	F
(3)	F	T	T	T
(4)	F	F	F	T

124. Read the following statements and select the **correct** option.

Assertion (A): RNA is better for the transmission of genetic information.

Reason (R): DNA has evolved from RNA with chemical modifications that make it more stable.

(1) Both A and R are false
(2) A is true but R is false
(3) Both A and R are true but R is not the correct explanation of A
(4) Both A and R are true and R is the correct explanation of A

125. Choose the **correct** option w.r.t. human genome project.

(1) One approach was focused on identifying all the genes which expressed as RNA is referred to as sequence annotation.
(2) Humans were used as host for the cloning of DNA.
(3) One of the method took blind approach of simply sequencing the whole set of genome.
(4) The DNA fragments obtained from humans were sequenced using automated DNA sequencer that worked on the principle of method given by Marshal Nirenberg.

126. All of the following are limitations of ecological pyramid, **except**

(1) It takes into account the same species belonging to two or more trophic levels
(2) Saprophytes are not given any place
(3) It assumes simple food chain
(4) It does not accommodate food web

127. Which of the following can be the most appropriate sequence of stages during hydrarch succession?

(1) Submerged plant stage → phytoplankton → Marsh meadow stage → Reed swamp stage → Forest
(2) Phytoplankton → Submerged plant stage → Reed swamp stage → Forest → Marsh meadow stage
(3) Phytoplankton → Submerged plant stage → Reed swamp stage → Marsh meadow stage → Forest
(4) Marsh meadow stage → Submerged plant stage → phytoplankton → Reed swamp stage → Forest

128. What type of ecological pyramid would be obtained with the following data?

Tertiary consumer : 10 J
Secondary consumer : 100 J
Primary consumer : 1000 J
Primary producer : 10,000 J

(1) Upright pyramid of number
(2) Upright pyramid of biomass
(3) Upright pyramid of energy
(4) Inverted pyramid of energy

129. Which of the following options depicts the **correct** difference between carbon and phosphorus cycle?

(1) Atmospheric inputs of phosphorus through rainfall are much smaller than carbon inputs
(2) Gaseous exchange of phosphorus between organism and environment is enormous
(3) The natural reservoir of phosphorus is atmosphere
(4) Carbon cycle exemplifies sedimentary cycle

130. Select the **odd** one out w.r.t. the suspension strategies adopted by organisms to avoid stressful conditions

(1) Bear going into hibernation
(2) Some snails and fish go into aestivation
(3) Many zooplankton species in lakes enter diapause
(4) Migration of birds from Siberia to Keolado National Park

131. Select the **correct** statement.

(1) Pacific salmon fish breed only once in their lifetime.
(2) Usually, oysters produce small number of small-sized offspring
(3) Mammals from colder climates generally have shorter ears and longer limbs.
(4) Nearly all plants can maintain a constant internal environment.

141. Heterochromatin is
(1) The only fragment that can translate proteins
(2) Transcriptionally inactive
(3) Loosely packed chromatin
(4) Lightly stained

142. The discontinuously synthesised fragments during DNA replication are later joined by
(1) DNA helicase (2) DNA ligase
(3) DNase (4) RNase

143. Lichens involved in the primary succession on rocks, help in weathering and soil formation. During succession, they are termed as
(1) Pioneer species (2) Seral species
(3) Climax species (4) Keystone species

144. Carbon constitutes "A" of dry weight of organisms.
Select the **correct** option to fill "A".
(1) 70% (2) 49%
(3) 80% (4) 100%

145. Which of the following statements is **incorrect**?
(1) Decomposition is largely an oxygen requiring process
(2) The pyramid of biomass in sea is generally inverted
(3) GFC is the major conduit for energy flow in an aquatic ecosystem
(4) Low temperature and anaerobiosis promote decomposition

146. Given below are two statements.
Statement I: The waste products and the dead organisms are not decomposed by phosphate-solubilising bacteria, and inhibit the release of phosphorus in soil.
Statement II: Phosphorus is a major constituent of biological membranes, nucleic acids and cellular energy transfer systems.
In the light of above statements choose the **correct** answer from the options given below.
(1) Only statement I is correct
(2) Both statements I and II are correct
(3) Only statement II is correct
(4) Both statements I and II are incorrect

147. Match list-I with list-II

	List-I		List-II
a.	Friedrich Miescher	(i)	Cell free system for protein synthesis
b.	Marshall Nirenberg	(ii)	Proposed DNA double helix model
c.	Watson and Crick	(iii)	Named nuclein
d.	Jacob and Monod	(iv)	*Lac* operon

Choose the **correct** answer from the options given below.
(1) a(iv), b(ii), c(iii), d(i) (2) a(iii), b(i), c(ii), d(iv)
(3) a(iii), b(iv), c(ii), d(i) (4) a(ii), b(iv), c(iii), d(i)

148. Identify the **correct** statement.
(1) DNA polymerases catalyse polymerisation only in one direction *i.e.*, 3′ → 5′.
(2) Inheritance of a character is also affected by promoter and regulatory sequences of a structural gene.
(3) In DNA, terminator region utilised during transcription is located towards 5′ end of the coding strand (downstream).
(4) In bacteria, DNA is scattered throughout the cell.

149. What will be the corresponding sequence of transcribed mRNA produced by the following stretch of coding strand of DNA?
5′–TTCCCTTGGCCC–3′
(1) 3′–UUCCCUUGGCCC–5′
(2) 3′–AAGGGAACCGGG–5′
(3) 5′–UUCCCUUGGCCC–3′
(4) 5′–UUGGGUUCCGGG–3′

150. Which one of the following statements about *lac* operon is **wrong**?
(1) Regulation of *lac* operon by repressor is referred to as negative regulation.
(2) All the three gene products in *lac* operon are required for metabolism of lactose.
(3) Repressor protein binds to the promoter region of the operon.
(4) It represents polycistronic structural gene regulated by common promoter and regulatory genes.

199. The year in which the first transgenic cow produced human protein-enriched milk is the same year in which

(1) An American company got patent rights on Basmati rice through the US Patent and Trademark Office

(2) First clinical gene therapy was given to a 4-year old girl

(3) The two enzymes responsible for restricting the growth of bacteriophage in *E.coli* were isolated

(4) Stanely Cohen and Herbert Boyer constructed first recombinant DNA

200. Match the column I with column II and choose the option with all **correct** matches.

	Column I		Column II
a.	Bt toxin	(i)	A single stranded DNA or RNA tagged with radioactive molecule
b.	Probe	(ii)	Insecticidal protein
c.	GEAC	(iii)	Conventional method of disease diagnosis
d.	Serum analysis	(iv)	Makes decisions regarding the validity of GM research

(1) a(i), b(ii), c(iii), d(iv) (2) a(iii), b(iv), c(ii), d(i)
(3) a(ii), b(i), c(iv), d(iii) (4) a(ii), b(i), c(iii), d(iv)

□ □ □