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CSIR-UGC (NET)

Life Sciences

Model Question Paper

Based on Exam Pattern

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CSIR-UGC (NET) Life Sciences

Model Question Paper-1

Duration : 180 minutes

Maximum Marks : 200

Read the following instructions carefully.

The question paper is divided in three parts :

Part 'A' : The candidates shall be required to answer 15 questions. Each question shall be of two marks. The total marks allocated to this section shall be 30 out of 200.

Part 'B' : A candidate shall be required to answer 35 questions. Each question shall be of two marks. The total marks allocated to this section shall be 70 out of 200.

Part 'C' : A candidate shall be required to answer 25 questions. Each question shall be of four marks. The total marks allocated to this section shall be 100 out of 200.

» There will be negative marking @ 25% for each wrong answer.

PART 'A'

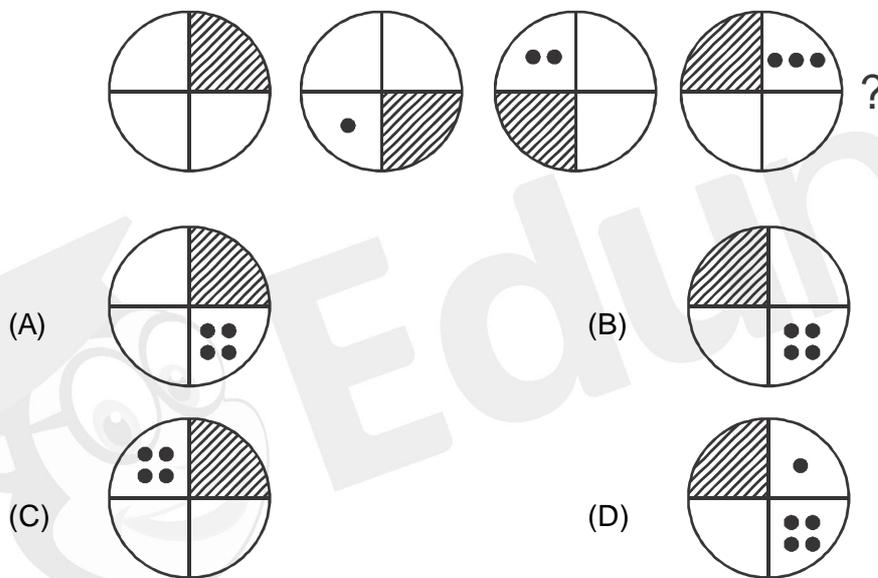
1. Two boys A and B are at two diametrically opposite points on a circle. At one instant the two start running on the circle; A anticlockwise with constant speed v and B clockwise with constant speed $2v$. In 2 minutes, they pass each other for the first time. How much later will they pass each other for the second time ?

- (A) 1 minute (B) 2 minutes
(C) 3 minutes (D) 4 minutes

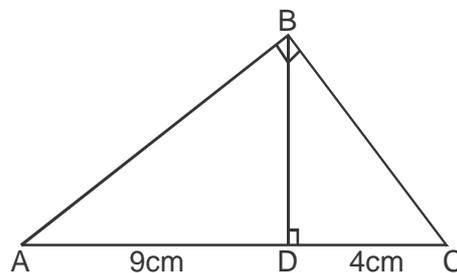
2. A coin is tossed six times. The probability that head will occur at least once is

- (A) $\frac{63}{64}$ (B) $\frac{1}{3}$
(C) $\frac{1}{64}$ (D) $\frac{3}{2}$

3. Identify the figure that comes next in the sequence.



4. In triangle ABC, shown in the figure, AB is perpendicular to BC. Further, BD is perpendicular to AC. If AD = 9 cm and DC = 4 cm, the length BD is



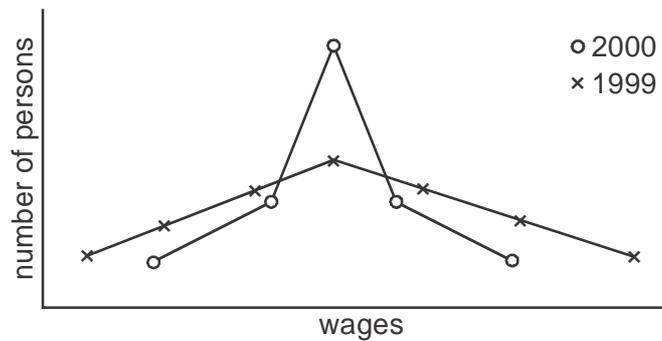
- (A) 6 cm (B) 6.5 cm
(C) $\frac{36}{13}$ cm (D) $\frac{13}{36}$ cm

5. Select the number from the given options for completing the given series.

9, 8, 8, 8, 7, 8, 6,

- | | |
|-------|-------|
| (A) 5 | (B) 6 |
| (C) 8 | (D) 4 |

6. The distribution of wages in a population is shown below for 2 years.



The average wage(s)

- (A) in 1999 is greater than that in 2000
 (B) in 1999 is less than that in 2000
 (C) in the two years are equal, but the variances are unequal
 (D) in the two years are unequal, but the variances are equal

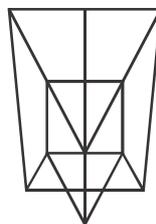
7. The gross income of a person is ₹ 20000. 10% of his income is exempted from income tax and his net income is ₹ 19100. The rate of income tax is :

- | | |
|--------|--------|
| (A) 3% | (B) 2% |
| (C) 4% | (D) 5% |

8. If TOUR is written as 1234, CLEAR is written as 56784 and SPARE is written as 90847, find the code for CARE :

- | | |
|----------|----------|
| (A) 1247 | (B) 4847 |
| (C) 5247 | (D) 5847 |

9. The number of triangles in this figure are :



- | | |
|--------|--------|
| (A) 19 | (B) 16 |
| (C) 21 | (D) 15 |

10. A six centimetre cube is painted green on all sides. It is cut into two centimetre cubes. How many cubes will be there with two sides painted ?

- | | |
|--------|-------|
| (A) 12 | (B) 8 |
| (C) 24 | (D) 4 |

11. Study the following table and determine whose overall performance is best among the three.

Subject	A's Marks	B's Marks	C's Marks
Maths	30	40	35
English	60	50	45
Science	20	40	40
Soc. Sc.	40	55	40
G.K.	60	35	39
Hindi	30	20	41

- (A) A (B) B
(C) C (D) Cannot be determined
12. The letters in the first set have a certain relationship. On the basis of this relationship mark the right choice for the second set :
AST : BRU :: NQV : ?
(A) ORW (B) MPU
(C) MRW (D) OPW
13. The sum of the length, breadth and depth of a cuboid is 19 cm and its diagonal is $5\sqrt{5}$ cm. Its surface area is :
(A) 361 cm^2 (B) 125 cm^2
(C) 236 cm^2 (D) 486 cm^2
14. A swimming pool 9 m wide and 12 m long is 1 m deep on the shallow side and 4 m deep on the deeper side. Find its volume.
(A) 270 m^3 (B) 300 m^3
(C) 360 m^3 (D) 420 m^3
15. A sum of money amounts to ₹ 1150 in 3 years and to ₹ 1250 in 5 years at a certain rate per cent p.a. simple interest. The rate per cent p.a. will be :
(A) 5% (B) 8%
(C) 7% (D) 6%

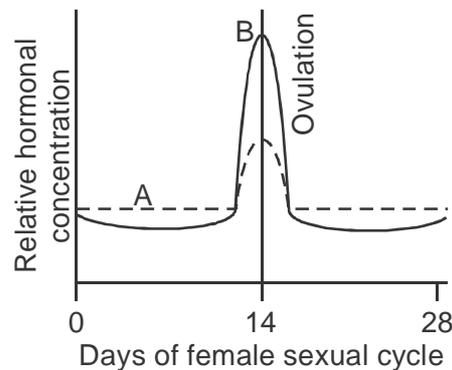
PART 'B'

16. In glycolysis, the conversion of 1 mol of fructose 1,6-bisphosphate to 2 mol of pyruvate results in the formation of :
(A) 1 mol NAD^+ and 2 mol of ATP (B) 1 mol NADH and 1 mol of ATP
(C) 2 mol NAD^+ and 4 mol of ATP (D) 2 mol NADH and 4 mol of ATP
17. Which one of the following areas in India, is a hotspot of biodiversity ?
(A) Sunderbans (B) Western Ghats
(C) Eastern Ghats (D) Gangetic Plain

18. What is the function of ATP, adenosine triphosphate ?
- (A) message carrier (B) store and transport energy
(C) make proteins (D) breakdown sugars
19. Which of the following statements about Michaelis-Menten kinetics is correct ?
- (A) K_m , the Michaelis constant, is defined as the concentration of substrate required for the reaction to reach maximum velocity.
(B) K_m , the Michaelis constant, is defined as the dissociation constant of the enzyme-substrate complex.
(C) K_m , the Michaelis constant, is expressed in terms of the reaction velocity.
(D) K_m , the Michaelis constant, is a measure of the affinity the enzyme has for its substrate.
20. In a dihybrid cross, $AaBb \times AaBb$, what fraction of the offspring will be homozygous for both recessive traits are _____
- (A) 0.0625 (B) 625
(C) 0.625 (D) 6.25
21. In human, the black colour hair (B) allele is dominant to the brown- hair allele(b). If two heterozygous mate, brown hair percentage is _____
- (A) 50 (B) 75
(C) 100 (D) 25
22. A dwarf plant can be induced to reach normal height by the application of :
- (A) auxins (B) cytokinins
(C) gibberellins (D) ethylene
23. Cellular totipotency is demonstrated by
- (A) Only Gymnosperm cells (B) Only bacterial cell
(C) All eukaryotic cells (D) Plant cell
24. Which of the following plant cell will show totipotency ?
- (A) Xylem vessels (B) Sieve tube
(C) Meristem (D) Cork cells
25. Recombinant proteins are
- (A) proteins synthesized in animals
(B) proteins synthesized by transgene in host cell by rDNA technology
(C) proteins synthesised in cells that are produced by protoplast fusion
(D) proteins synthesized in mutated cell lines
26. The first successfully cloned animal was
- (A) monkey (B) gibbon
(C) sheep (D) rabbit

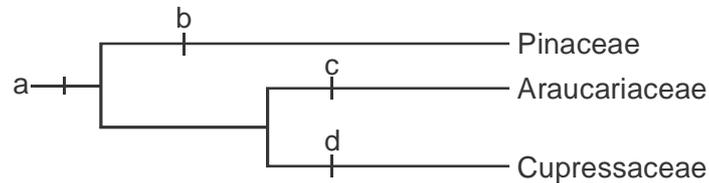
27. Most commonly used method for transformation of plants is-
- Protoplast method
 - Agrobacterium mediated transformation
 - Microinjection
 - none of these
28. Which of the following bonds will be most difficult to break ?
- | | |
|---------|---------|
| (A) C–O | (B) C–C |
| (C) C–N | (D) C–S |
29. Which of the following proteins acts as an energy transducer ?
- | | |
|-----------------|------------------------|
| (A) G-protein | (B) Bacteriorhodopsin |
| (C) Haemoglobin | (D) Heat shock protein |
30. Many cancers carry mutant p53 genes, while some cancers have normal p53 genes. p53 activates p21 (Waf1) which inhibits G1/S-Cdks and phosphorylation of the retinoblastoma protein (Rb). Cancers with normal p53 genes could
- express non-phosphorylatable form of Rb
 - express high levels of p53-deubiquitinases
 - express inactive forms of G1/S-cdks
 - express inactive forms of G1/S cyclins
31. A fixed smear of a bacterial culture is subjected to the following solutions in the order listed below and appeared red
- Carbolfuchsin (heated)
 - Acid-alcohol
 - Methylene blue
- Bacteria stained by this method can be identified as
- non-acid fast *E. coli*
 - acid-fast *Mycobacterium* sp.
 - Gram positive *E. coli*
 - Gram negative *Mycobacterium* sp.
32. Insulin and other growth factors stimulate a pathway involving a protein kinase mTOR, which in its turn augments protein synthesis. mTOR essentially modifies protein(s) which in their unmodified form act as inhibitors of protein synthesis. The following proteins are possible candidates
- eEF-1
 - eIF-4E-BP1
 - eIF-4E
 - PHAS-1
- Which of the following sets is correct ?
- | | |
|-------------------|--------------------|
| (A) (i) and (ii) | (B) (ii) and (iv) |
| (C) (i) and (iii) | (D) (ii) and (iii) |

33. The graph represents relative plasma concentration of hormones (A and B) during reproductive cycle in a normal female. Which one of the following combinations is correct ?



- (A) (A) is FSH and (B) is oestrogen
 (B) (A) is oestrogen and (B) is LH
 (C) (A) is FSH and (B) is LH
 (D) (A) is LH and (B) is FSH
34. The ABO blood type in human is under the control of autosomal multiple alleles. Colour blindness is recessive X-linked trait. A male with a blood type A and normal vision marries a female who also has blood type A and normal vision. The couple's first child is a male who is colour blind and has O blood group. What is the probability that their next female child has normal vision and O blood group ?
- (A) $\frac{1}{4}$ (B) $\frac{3}{4}$
 (C) $\frac{1}{8}$ (D) 1
35. Chlorophyll pigment composition and carbohydrate food reserves of some algal groups are given below.
 Pigments : (i) Chlorophyll a and b (ii) Chlorophyll a and c.
 Carbohydrate food reserve; (a) Paramylon; (b) Starch; (c) Laminarin; (d) Leucosin.
 Identify the correct combination of the characters for the given groups.
- (A) Euglenophyta – (i and a); Bacillariophyta – (ii and d); Phaeophyta – (ii and c); Chlorophyta – (i and b)
 (B) Euglenophyta – (ii and a); Bacillariophyta – (ii and d); Phaeophyta – (i and c); Chlorophyta – (i and b)
 (C) Euglenophyta – (i and a); Bacillariophyta – (ii and b); Phaeophyta – (i and c); Chlorophyta – (i and d)
 (D) Euglenophyta – (i and d); Bacillariophyta – (ii and a); Phaeophyta – (ii and c); Chlorophyta – (i and b)

36. Identify the synapomorphies in the following cladogram



- (A) (A) seeds with long terminal wing; (B) ovules 1-20 per scale; (C) resin canals; (D) 1 ovule per scale
- (B) (A) resin canals; (B) seeds with long terminal wing; (C) 1 ovule per scale; (D) ovules 1 20 per scale
- (C) (A) resin canals; (B) ovules 1-20 per scale; (C) seeds with long terminal wing; (D) 1 ovule per scale
- (D) (A) seeds with long terminal wing; (B) ovules 1-20 per scale; (C) 1 ovule per scale; (D) resin canals

37. Symbiotic biological nitrogen fixation takes place with the association between a plant and a nitrogen fixing prokaryote as shown in the following table.

List of Plant	Nitrogen Fixing
(a) Soyabean	(i) Frankia
(b) Casuarina	(ii) Bradyrhizobium
(c) Gunnera	(iii) Anabaena
(d) Azolla	(iv) Nostoc

The correct combination is

- | | (a) | (b) | (c) | (d) |
|-----|-------|-------|-------|-------|
| (A) | (i) | (ii) | (iii) | (iv) |
| (B) | (ii) | (i) | (iv) | (iii) |
| (C) | (iii) | (ii) | (i) | (iv) |
| (D) | (iv) | (iii) | (ii) | (i) |

38. Among the following events in the history of life

- | | |
|--------------------------------|------------------------|
| (i) prokaryotic cell | (ii) eukaryotic cell |
| (iii) natural selection | (iv) organic molecules |
| (v) self-replicating molecules | |

Which is the correct chronological order ?

- | | |
|------------------------------------|------------------------------------|
| (A) (iv), (v), (iii), (i) and (ii) | (B) (iv), (v), (i), (ii) and (iii) |
| (C) (v), (iv), (i), (iii) and (ii) | (D) (iv), (v), (i), (iii) and (ii) |

39. The Hardy-Weinberg principle comes from considering what happens when Mendelian genes act in a population. The model predicts that there will be no change in allele frequencies when

- (A) migration into the population occurs at a steady rate
- (B) the population suffers a bottleneck
- (C) a rare new mutation is associated with a sharp increase in fitness
- (D) no evolutionary process is at work

- (iv) Tight junctions are occluding junctions, which seal gap between two cells.
- (v) Hemidesmosomes are cell-matrix anchoring junctions connecting intermediate filament in one cell to extracellular matrix.

Which of the following combination of statements is not correct ?

- (A) (i) and (ii)
- (B) (i) and (iii)
- (C) (iii) and (iv)
- (D) (iv) and (v)

45. A mouse was primed with trinitrophenyl-lipopolysaccharide (TNP-LPS), whereas another mouse was primed with TNP-Keyhole limpet haemocyanin (TNP-KLH). After three weeks, these mice were sacrificed and splenic cells were fractionated to B-cells and T-cells. B-cells from TNP-LPS primed mice were co-cultured with T-cells from TNP-LPS or TNP-KLH-primed mice. Similarly, B-cells from TNP-KLH-primed mice were co-cultured with the T-cells from TNP-LPS or TNP-KLH-primed mice. So, we have four co-cultures

- (A) $B^{TNP-LPS} \times T^{TNP-LPS}$
- (B) $B^{TNP-LPS} \times T^{TNP-KLH}$
- (C) $B^{TNP-KLH} \times T^{TNP-LPS}$
- (D) $B^{TNP-KLH} \times T^{TNP-KLH}$

46. Which among the following statements about ATP-binding cassette (ABC) proteins is not correct?

- (A) ATP-binding cassette (ABC) proteins have ATP-binding transmembrane domains
- (B) A number of genetic diseases are associated with deficiencies in ATP-binding cassette (ABC) proteins
- (C) ATP-binding cassette (ABC) proteins have ATP-binding cytoplasmic domains
- (D) The multidrug resistance protein (MDR protein) is an ATP-binding cassette (ABC) protein

47. A bacterial culture undergoing balanced growth requires a first-order reaction. In other words, the rate of increase in bacteria at any particular time is proportional to the number or mass of bacteria present at that time. If 'N' is the number of cells at any given time 't' and 'μ' is 'growth rate constant' this process can be expressed mathematically as

- (A) $dN/dt = \mu N$
- (B) $dt/dN = \mu N$
- (C) $d\mu/dt = N$
- (D) $(dN/dt) \times N = \mu$

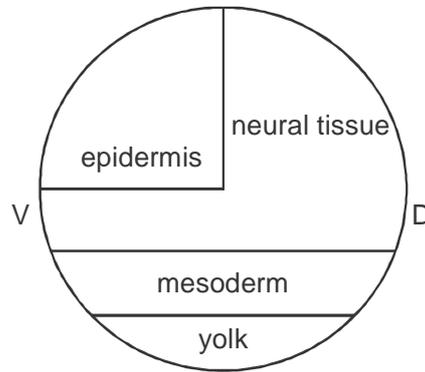
48. Tumor cells were isolated from a breast cancer patient. These cells were injected in nude mice and divided into 4 groups. The groups received following combinations of drugs.

- Group 1** – EGF receptor-conjugated with methotrexate
- Group 2** – Transferrin receptor-conjugated with methotrexate
- Group 3** – Mannose receptor-conjugated with methotrexate
- Group 4** – Free drug

In which of the following, the tumorigenic index would be minimum ?

- (A) Free drug
- (B) EGF receptor-conjugated drug
- (C) Transferrin receptor-conjugated drug
- (D) Mannose receptor-conjugated drug

49. The figure below represents the late zebrafish gastrul(a)



Following developments can be proposed for a further development of a late zebrafish gastrula

- The concentration of FGF decreases from the yolk towards the epidermis, along with the increase of BMP activity from the dorsal to the ventral axis
- Increase in FGF activity in the epidermis with the concomitant decrease in BMP activity towards the ventral axis
- Neural induction in zebrafish is independent of the organizer and depends upon the activation of the BMP signaling
- On comparison, both *Xenopus* and chick embryos require activation of FGF for neural induction to occur in addition to BMP inhibition.

Which of the above statements are true ?

- | | |
|-----------------|-----------------|
| (A) (a) and (c) | (B) (b) and (c) |
| (C) (a) and (d) | (D) (c) and (d) |
50. Which among the following statements about the ATP generation in the electron transport chains is true ?
- The F_1 subunit of the ATP synthase contains the catalytic centre which synthesis occurs
 - The F_0 subunit of the ATP synthase binds ADP and P_i tightly before the ATP synthesis occurs
 - The F_1 subunit of the ATP synthase contains the motor that is driven to rotate by the proton flow
 - The F_0 subunit of the ATP synthase contains the catalytic centre which synthesizes ATP

PART 'C'

51. During development and differentiation, there is a dynamic programme of differential expression of sets of genes. In bacteria, phage infections are among the simplest examples of developmental process. Typically, only a subset of the phage genome, offer referred to as immediate early genes, are expressed in the host immediately after phage infection. As time passes, early genes start to be expressed, and the immediate early genes and bacterial genes are turned off. In the final stage of phage infection, the early genes give way to late genes. One of the simplest way it is achieved is through expression of

- | | |
|---------------------------------|--------------------------------------|
| (i) cascade of σ factors | (ii) new RNA polymerases |
| (iii) different holoenzymes | (iv) different transcription factors |

The correct reasons are

- | | |
|------------------------|-------------------------|
| (A) (i) and (iv) | (B) (i), (iii) and (iv) |
| (C) (i), (ii) and (iv) | (D) (i), (ii) and (iii) |

52. In which molecule would the radiolabel appear the earliest when wheat and sugar cane leaves are fed with $^{14}\text{CO}_2$?
- (A) Wheat — malate, sugarcane — 3 phosphoglycerate
 (B) Wheat — aspartate, sugarcane — malate
 (C) Wheat — 3 phosphoglycerate, sugarcane — 3 phosphoglycerate
 (D) Wheat — 3 phosphoglycerate, sugarcane — malate
53. A young dicot seedling (e.g., soyabean) is subjected to gravity stimulus by laying it horizontally on a surface the shoot bends upwards and root bends downward. Indicate the reason
- (A) Redistribution of auxin throughout the seedlings is responsible for stimulatory unequal growth in shoots and roots
 (B) Redistribution of auxin in shoots while cytokinine in roots is responsible for stimulatory unequal growth
 (C) Redistribution of auxin in roots while cytokinine in shoots is responsible for stimulatory unequal growth
 (D) Redistribution of cytokinine throughout the seedlings is responsible for stimulatory unequal growth in shoots and roots
54. Which of the following is mismatched ?
- (A) Photosystem I - uses the P700 molecule in its photocenter
 (B) PGA - α 3-carbon compound
 (C) antenna complex - contains hundreds of pigment molecules
 (D) CAM plants - open their stomata during the day and close them at night to avoid photorespiration
55. Which one of the following sequences shows the correct hierarchy of classification, going from the most inclusive to the least inclusive ?
- (A) Kingdom, Domain, Phylum, Order, Class, Family, Genus, Species
 (B) Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species
 (C) Genus, Species, Kingdom, Phylum, Order, Class, Family
 (D) Species, Genus, Family, Class, Order, Phylum, Kingdom
56. What reagent is quantified when performing an indirect ELISA ?
- (A) Antibodies in patient's serum (B) Fluorescent antibody
 (C) Chromagen (D) Complement
57. The vector for T-DNA is :
- (A) *Thermus aquaticus* (B) *Agrobacterium tumefaciens*
 (C) *Bacillus thuringiensis* (D) *Salmonella typhimurium*
58. The mutation which will not affect the length of a protein is,
- (A) nonsense mutation (B) missense mutation
 (C) frameshift mutation (D) All of these

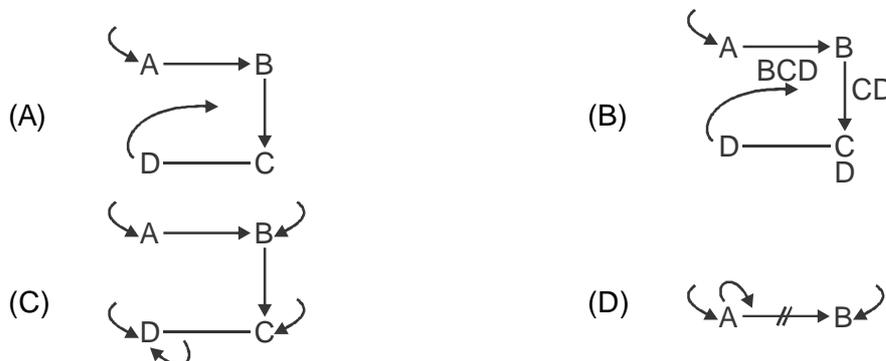
59. The relation between algae and fungi in lichen is
 (A) symbiosis (B) parasitism
 (C) commensalism (D) protocoooperation.
60. Which gene transfer technique involves the use of a fatty bubble to carry a gene into a somatic cell ?
 (A) electroporation (B) liposome transfer
 (C) microinjection (D) particle bombardment
61. Binding of myoglobin to the antimyoglobin antibody with an affinity constant of K_o is $1.43 \times 10^{-5} M^{-1}$ if $r = 1$ and $n = 3$ calculate the value of ligand concentration $\text{---} 10^5 M$
 (A) 349 (B) 3.49
 (C) 0.349 (D) 0.0349
62. Which of the following statements is not true for transposable element system ?
 (A) It consists of autonomous and non-autonomous elements
 (B) Dissociation elements are autonomous in nature
 (C) Transposase is transcribed by the central region of autonomous elements
 (D) Certain repeats in the genome remain fixed even after the element transposes out

63. A conjugation experiment is carried out between $F^+ \text{ his}^+ \text{ leu}^+ \text{ thr}^+ \text{ pro}^+$ bacteria and $F^- \text{ his}^- \text{ leu}^- \text{ thr}^- \text{ pro}^-$ bacteria for a period of 25 min. At this time the mating is stopped, and the genotypes of the recipient F^- bacteria are determined. The results are shown below :

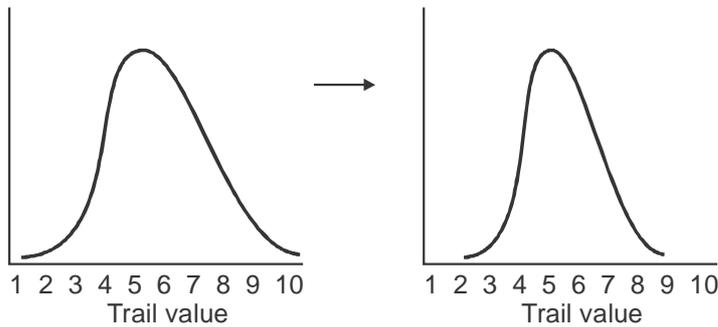
Genotype	Number of colonies
his^+	0
leu^+	13
thr^+	26
pro^+	6

What is the probable order of these genes on the bacterial chromosome ?

- (A) thr, leu, pro, his
 (B) pro, leu, pro, and the position of his cannot be determined
 (C) thr, leu, pro and the position of his cannot be determined
 (D) his, pro, leu, thr
64. Which of the following species replacement sequence depicts tolerance model of community succession ?



65.

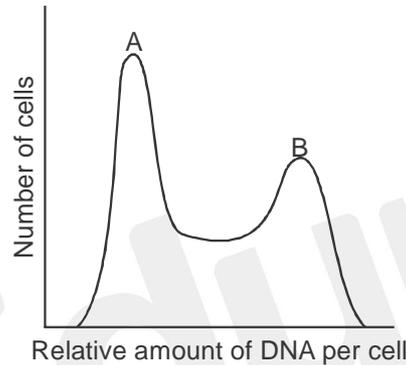


The change in a trait with time as a result of natural selection is shown above. This type of natural selection is

- (A) directional
- (B) disruptive
- (C) stabilizing
- (D) random

66.

A population of proliferating cells is stained with a DNA binding fluorescence dye so that the amount of fluorescence is directly proportional to the quantity of DNA. Amount of DNA in each cell is measured by flow cytometry. The number of cells with a given DNA content is plotted and following statements were made



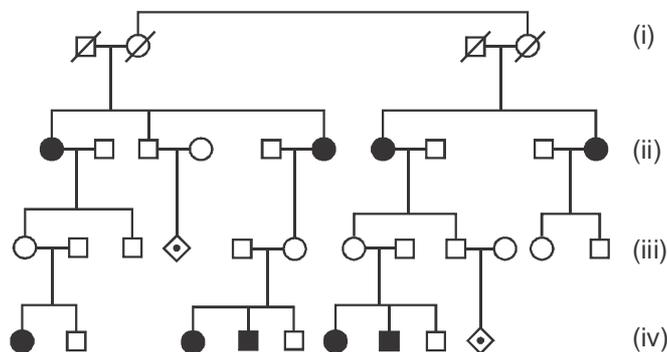
- (i) Peak A contains the cells of G₁-phase
- (ii) Peak B contains the cells of G₂-phase
- (iii) Peak A contains the cells of G₂-phase
- (iv) Peak B contains the cells of G₁-phase

Which of the above mentioned statement is correct ?

- (A) (i) and (ii)
- (B) (iii) and (iv)
- (C) (ii) and (iv)
- (D) (i) and (iii)

67.

Find the pattern of inheritance of the trait showing incomplete penetrance from the figure shown

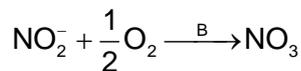
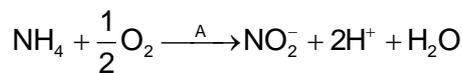


- (A) autosomal dominant
- (B) autosomal recessive
- (C) mitochondrial inheritance
- (D) X-linked recessive

68. Which of the following illustrations explain the correct pairing preceding recombination between a chromosome (ABC•DEFG/ABC•DEFG) and its inverted homologue (ABC•DGFE/ABC•DGFE). The dot in genotype represent the centromere.



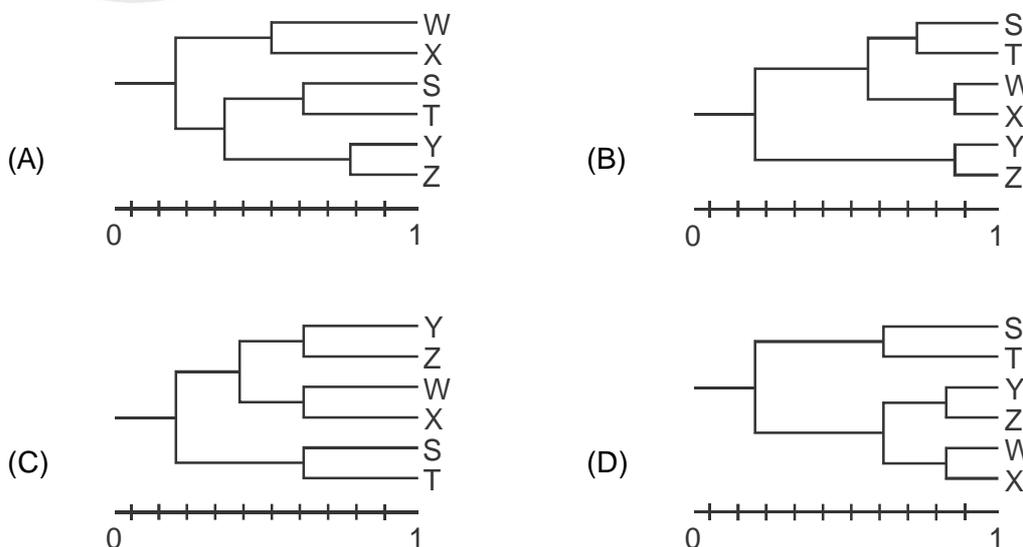
69. In the process of nitrification by organisms, the respective bacteria A and B in the following reaction are :



- (A) Azotobacter and Nitrobacter (B) Nitrobacter and Azotobacter
 (C) Nitrosomonas and Nitrobacter (D) Nitrobacter and Nitrosomonas

70. Based on Coefficient of Association table given below, which of the following taxonomic phenogram of relationship is correct ?

	S	T	W	X	Y	Z
S	1.0					
T	0.8	1.0				
W	0.5	0.7	1.0			
X	0.6	0.6	0.9	1.0		
Y	0.3	0.1	0.2	0.2	1.0	
Z	0.2	0.0	0.3	0.4	0.9	1.0



71. Which one of the following indicate steps involved in DNA foot-printing to monitor interaction of DNA with a protein ?
- (A) DNA + protein → treat with restriction enzymes → run agarose gel → stain with ethidium bromide and view under UV light
 - (B) Label one of the DNA strands with a radiolabel → treat one portion of labelled DNA with the protein of interest followed by reaction with DNase → treat second portion of DNA with only DNase. Run both the treated DNA samples on a sequencing gel
 - (C) Analyze fragments obtained from the experiments described in (2) by MALDI mass spectrometry
 - (D) DNA + protein → treat with DNase followed by restriction enzymes. Run the sample on SDS page and visualize by commassie blue staining
72. Site-specific recombination results in precise DNA rearrangements, which is limited to specific sequences. The enzymes that are important to carry out the process are
- (A) restriction endonuclease and DNA polymerase
 - (B) nuclease and ligase
 - (C) DNA polymerase and ligase
 - (D) DNA polymerase and DNA gyrase
73. *Mycobacterium tuberculosis* is an intra-cellular bacterium. It prefers to infect
- (A) macrophages
 - (B) B-cells
 - (C) T-cells
 - (D) neutrophils
74. CD19 is a marker for
- (A) B-cells
 - (B) T-cells
 - (C) macrophages
 - (D) NK cells
75. Which one of the following statement describes the process of phloem loading ?
- (A) Triose phosphate is transported from the chloroplast to cytosol
 - (B) Sugars are transported into the sieve elements and companion cells
 - (C) Sugars are transported from producing cells in the mesophyll to cells in the vicinity of the sieve elements
 - (D) Solutes are transported from roots to the shoots

ANSWER KEY

PART 'A'

1	2	3	4	5	6	7	8	9	10
D	A	A	A	C	B	D	D	B	A
11	12	13	14	15					
C	D	C	A	A					

PART 'B'

16	17	18	19	20	21	22	23	24	25
D	B	B	D	A	D	C	D	C	B
26	27	28	29	30	31	32	33	34	35
C	B	A	B	B	B	B	C	C	A
36	37	38	39	40	41	42	43	44	45
B	B	A	D	D	C	A	C	A	D
46	47	48	49	50					
A	A	C	B	A					

PART 'C'

51	52	53	54	55	56	57	58	59	60
B	D	A	D	B	A	B	B	A	B
61	62	63	64	65	66	67	68	69	70
C	B	C	B	C	A	A	C	C	B
71	72	73	74	75					
B	B	A	A	B					

SOLUTION

PART 'A'

1. (D) Let A and B meet at point 'C' after running 2 minutes.

So, distance ACB = $\frac{1}{2} \times$ (Perimeter of circular path)

Distance travelled by 'A' in 2 minutes

$$AC = 2v$$

Distance travelled by 'B' in 2 minutes

$$BC = 2(2v) = 4v = \frac{1}{2} \times (\text{Perimeter of circle})$$

$$= AC + BC = 2v + 4v = 6v$$

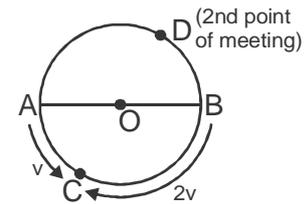
Perimeter of circle = $12v$

Now, from formula,

Perimeter of circle = $2\pi r$

$$2\pi r = 12v$$

$$r = \frac{6v}{\pi}$$



{where r = radius}

...(i)

Again, let them meet 2nd time at point D after time 't' minutes.

So, distance travelled by 'B' in t minutes

$$CAD = 2vt$$

Distance travelled by 'A' in t minutes

$$CAD = v \cdot t$$

From figure,

$$CAD + CBD = 2\pi \cdot (r)$$

$$2vt + vt = 2\pi \cdot r$$

From equation (i),

$$r = \frac{6v}{\pi}$$

$$3vt = 2\pi \cdot \frac{6v}{\pi}$$

$$3vt = 12v$$

$$t = \frac{12v}{3v}$$

$$t = 4 \text{ minutes.}$$

{Perimeter of circle}

2. (A) The probability that head occurs = $\frac{1}{2}$

$$\text{Probability that head does not occur} = 1 - \frac{1}{2} = \frac{1}{2}$$

The probability that head does not occur in any of the 6 trials = $\left(\frac{1}{2}\right)^6 = \frac{1}{64}$

So, the probability for head to occur at least once = $1 - \frac{1}{64} = \frac{63}{64}$.

3. (A) Because number of dots is increasing and dot is ahead and net is at back.

4. (A) In $\triangle BDC$,

$$BD^2 = BC^2 - 16$$

$$BC^2 = 16 + BD^2$$

In $\triangle ABC$,

$$AB^2 = (13)^2 - BC^2 = 169 - 16 - BD^2$$

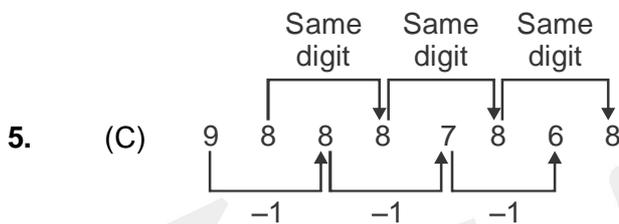
Again in $\triangle ABD$, $BD^2 = AB^2 - 81$

$$BD^2 = 169 - 16 - BD^2 - 81$$

$$2BD^2 = 169 - 197 = 72$$

$$BD^2 = 36$$

\therefore $BD = 6$ cm.



6. (B) From the graph, number wages in 1999 is 7 whereas number of wages in 2000 is 9. From the graph, we can estimate that average wages in 2000 is greater than 1999.

7. (D) Gross income = ₹ 20000

Income exempted from income tax = 10% of gross income

\therefore Income on which income tax is chargeable = $(100 - 10\%) = 90\%$ of gross income

$$= 20000 \times \frac{90}{100} = ₹ 18000$$

\therefore Total income tax paid on

$$= ₹ 20000 - ₹ 19100 = ₹ 900$$

\therefore Rate per cent of income tax

$$= \frac{900}{18000} \times 100 = 5\%.$$

8. (D) R is in every group of letter and 4 is in every group of numbers so R = 4

$$C L E A R = 5 6 7 8 4 \quad \dots(i)$$

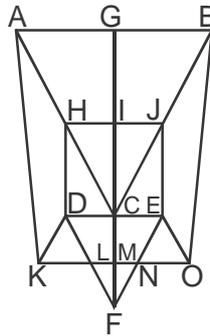
$$S P A R E = 9 0 8 4 7 \quad \dots(ii)$$

Here 847 are common

So $CL = 56$ and $SP = 90$

Thus C A R E = 5 8 4 7.

9. (B)



The main triangles are : ABC, DEF, LNF, and HJC i.e. 4 triangles

The simplest triangles are HIC, IJC, HDC, JCE, DKL, LMF, MFN and NOE i.e. – 8 triangles

Other triangles are : AGC, GBC, DCF and CEF – i.e. 4 triangles

So, the total number of triangles is $4 + 8 + 4 = 16$.

10. (A) The smaller 27 pieces of the cube will be cut in the manner that :

1. 8 pieces will be painted on 3 sides,
2. 12 pieces on 2 sides,
3. 6 pieces on 1 side, and
4. 1 piece will not have paint at all.

Diagrammatically, the explanation taking one side of the cube will be :

a	b	a
b	c	b
a	b	a

1. 'a' are the corner pieces [$4 \times 2 = 8$]
2. 'b' are the centre pieces of the cornered sides [$4 \times 3 = 12$]
3. 'c' is the centred piece [$1 \times 6 = 6$]
4. The interior blank piece will be only 1.

11. (C) A, B and C's mean marks are equal but

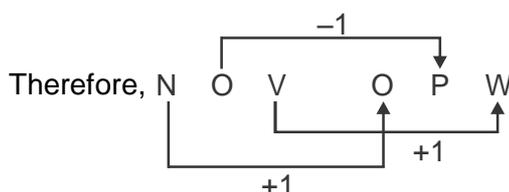
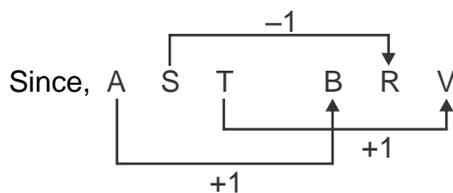
A's range is $60 - 20 = 40$

B's range is $55 - 20 = 35$

C's range is $45 - 35 = 10$

Standard deviation will be maximum in case of A then comes B and least SD will be there in case of C.

12. (D)



13. (C) $(l + b + h) = 19$ and $\sqrt{l^2 + b^2 + h^2} = 5\sqrt{5}$.
 and so $(l^2 + b^2 + h^2) = 125$
 Given $(l + b + h)^2 = 19^2$
 Now $(l^2 + b^2 + h^2) + 2(lb + bh + lh) = 361$
 $\Rightarrow 2(lb + bh + lh) = (361 - 125) = 236$
 So, surface area = 236 cm².
14. (A) Volume of the swimming pool = $12 \times 9 \times \left(\frac{4+1}{2}\right) = 12 \times 9 \times \frac{5}{2} = 270 \text{ m}^3$.
15. (A) Here, simple interest for 2 years
 $= ₹ 1250 - ₹ 1150 = ₹ 100$
 \therefore Simple interest for 3 years
 $= \frac{100 \times 3}{2} = ₹ 150$
 Hence, P = ₹ 1150 - ₹ 150 = ₹ 1000
 \therefore Rate = $\frac{50 \times 100}{1000 \times 1} = 5\%$.

PART 'B'

16. (D) Glyceraldehyde-3-phosphate is converted to pyruvate. Four ATP and two NADH molecules are produced. Because two ATP were consumed in stage 1, the net production of ATP per glucose molecule is 2.
17. (B) The **Western Ghats** are a mountain range that runs almost parallel to the western coast of the Indian peninsula, located entirely in India. It is a UNESCO World Heritage Site and is one of the eight "hottest hotspots" of biological diversity in the world.
18. (B) An adenosine triphosphate molecule stores energy that is released and used by energy-consuming reactions, such as muscle contraction, transmission of nerve impulses and formation of other molecules. ATP is found in cells and is made from the breakdown of food. It is composed of oxygen, hydrogen, phosphorus and carbon atoms. The energy in an ATP molecule is locked within phosphate bonds, which hold its phosphate groups together.
19. (D) An enzyme that displays hyperbolic kinetics (single substrate enzyme) is referred to as a Michaelis-Menten enzyme. For such an enzyme, the plot of velocity of the reaction against substrate concentration is hyperbolic. The Michaelis-Menten equation describes the kinetics of such an enzyme at initial rates before any product is formed. The Michaelis-Menten equation can be used to calculate the Michaelis constant (K_m). This is defined as that concentration of substrate at which the enzyme is working at half maximum velocity. K_m is expressed in units of molar concentration and is independent of the enzyme concentration. K_m is also a measure of the affinity that the enzyme has for its substrate. The higher the K_m , the lower the affinity of the enzyme for its substrate.
20. (A) 0.0625
 Both parents produce 25% each of AB, Ab, aB, and ab.
 There is only one of 16 possible combinations with this genotype. The predicted fraction is therefore 1/16. 1/4 of the gametes of each parent will be ab. The fraction of the offspring homozygous for both recessive traits will be 1/4 times 1/4, or 1/16 or 0.0625

21. (D) 25 (Bb × Bb)
BB, Bb, Bb, bb: B denoted black hair 75% and bb 25 % brown hair (b)
22. (C) Gibberellins (GAs) are plant hormones that regulate growth and influence various developmental processes, including stem elongation, germination, dormancy, flowering, sex expression, enzyme induction, and leaf and fruit senescence.
23. (D) Many somatic plant cells, including some fully differentiated types (e.g. leaf mesophyll), provided they contain intact nuclear, plastid and mitochondrial genomes, have the capacity to regenerate into whole plants called totipotency.
24. (C) totipotent cells serve the same role in plants that stem cells do in animals. They are found in shoot and root growing tips as meristems.
25. (B) Recombinant proteins are proteins synthesized by transgene in host cell by rDNA technology. Recombinant protein is a protein that whose code is carried by a recombinant DNA. The term recombinant DNA means that two segments of DNA in a plasmid. Plasmids are those which generally occur in bacteria.
26. (C) Dolly (5 July 1996 – 14 February 2003) was a female domestic sheep, and the first mammal to be cloned from an adult somatic cell, using the process of nuclear transfer.
27. (B) Agrobacterium mediated transformation most commonly used method for transformation of plants. This natural ability to alter the plant's genetic makeup was the foundation of plant transformation using Agrobacterium. Currently, Agrobacterium-mediated transformation is the most commonly used method for plant genetic engineering because of relatively high efficiency.
28. (A) The interaction of atoms in biological molecules are primarily covalent in nature. The energy required to rupture the bonds are
 C–C → 82 kcal/mole
 C–N → 80 kcal/mole
 C–O → 84 kcal/mole
 C–S → 45 kcal/mole
29. (B) An energy transducer transforms one mode of energy to another. For example, for most sensory modalities sensory cells act as energy transducers, transforming the energy of the environmental stimulus into a change in the electrical potential difference across a biological membrane. Bacteriorhodopsin (bR) is an integral protein in the plasma membrane of a bacterium. Upon light absorption, bR transports protons across the membrane, converting the photon energy into the energy of a proton electrochemical gradient. bR is a single small protein and is the simplest known active ion pump and biological light energy transducer. Energy transduction is thus, the fundamental physical basis of the sensory response of most biological systems to their environment.
30. (B) The tumor suppressor gene product that the viral proteins serve to inactivate is called p⁵³ and plays a part in development of cancer. The p⁵³ gene encodes a transcription factor. The activity of p⁵³ is highly regulated by post translational mechanisms including protein-protein interaction, acetylation, phosphorylation and ubiquitination. One of the transcriptional targets of p⁵³, MDM₂ can regulate both the transcriptional activity and half life of p⁵³ in negative feedback loop. MDM₂ is a ubiquitin ligase that targets p⁵³ for ubiquitin mediated proteolysis. Ubiquitin mediated degradation entails linking of ubiquitin by a thioester linkage to ubiquitine activating enzyme before the ubiquitin is transferred to carrier.
31. (B) Acid fast stain (also called Ziehl Neelsen stain) is a special bacteriological stain used to identify Mycobacteria. Acid fast staining is helpful in diagnosing Mycobacterium tuberculosis since its lipid rich cell wall makes it resistant to gram stain. It can also be used to stain

some other bacteria like *Nocardia*. The reagents used in acid fast stain are carbolfuchsin acid alcohol and methylene blue.

32. (B) The mTOR (Mammalian Target of Rapamycin) pathway involves the regulation of a protein kinase variously known as FKBP₁₂-rapamycin associated protein (FRAP), or rapamycin and FKBP₁₂ target 1 (RAFT₁). Activated mTOR phosphorylates protein phosphatase 2A (pp2A), S₆K₁ and eIF₄E-BP (PHAS₁). This phosphorylation of pp₂A prevents diphosphorylation of eIF₄E-BP. Phosphorylation of eIF₄E-BP release eIF₄E which then participate in formation of protein translation complex involving capped mRNAs.
33. (C) Menstruation is bleeding from the uterus of adult female at interval of one lunar month (28 days) on an average. The menstrual cycle consists of proliferative phase (14 days), secretory phase (10 days) and menstrual phase (4 days). The follicle stimulating hormone (FSH) secreted by anterior pituitary stimulates ovarian follicle to secrete oestrogen. Oestrogen stimulates the proliferation of endometrium of the uterine wall. The luteinizing hormone (LH) secreted by anterior pituitary causes ovulation. The initial FSH level should be higher than LH for menstrual cycle.
34. (C) The ABO blood type in human has three common alleles. I^A, I^B and I^O. The men with blood group A may have I^A, I^B and I^AI^O genotype thus producing two types of gametes I^A and I^O (Similarly female).

♂	♀	X ^c O	XO	X ^c A	XA
XA	X ^c XAO	XXAO	X ^c XAA	XXAA	
YA	X ^c YAO	XYAO	X ^c YAA	XYAO	
XO	X ^c XOO	XXOO	X ^c XAO	XXAO	
YO	X ^c YOO	XYOO	X ^c YAO	XYAO	

Out of 16, the female with normal vision and O blood group are $\frac{2}{16} = \frac{1}{8}$.

35. (A)
- | Algal group | Chlorophyll pigment | Reserve food |
|-----------------|---------------------|---------------------|
| Euglenophyta | a, b | Paramylon |
| Bacillariophyta | a, c | Chrysoleminarion |
| Phaeophyta | a, c | Laminarian, manitol |
| Chlorophyta | a, b | Starch and oil |
36. (B) Cladograms depict a sequence in the origin of derived characters. A cladogram is interpreted as a family tree depicting a hypothesis regarding monophyletic lineages.
37. (B)
- | List of Plant | Nitrogen Fixing Organism |
|---------------|--------------------------|
| Soyabean | – Bradyrhizobium |
| Casuarina | – Frankia |
| Gunnera | – Nostoc |
| Azolla | – Anabaena |
38. (A) Modern hypothesis of origin of life states biochemical origin of life. It leads first chemogeny followed by biogeny. During chemogeny organic molecules were formed. From these

organic molecules proto cell type self replicating molecules evolved. These are followed by prokaryotic heterotrophs then prokaryotic autotrophs and finally eukaryotes. Natural selection plays a major role during entire evolutionary process.

39. (D) According to Hardy-Weinberg principle the gene and genotype frequencies of each allele in a large, randomly mating population remain at an equilibrium generation after generation if that population exhibit biparental mode of reproduction, and absence of evolutionary forces like mutation, migration, selection etc.
40. (D) Correlation coefficient lies between +1 and -1. It is not affected by the change in scale of origin. When there is perfect correlation (i.e., ± 1) the two regression lines become only one line.
41. (C) Cystic fibrosis disease is caused by a mutation in gene encoding an ABC transporter that functions as a Cl^- channel in the plasma membrane of epithelial cells. The channel is unusual in that it requires both ATP hydrolysis and cAMP dependent phosphorylation.
42. (A) The repetitive AU sequence in mRNA coded for only two type of amino acids. As



But in absence of initiation codon individual amino acids are coded for each peptide.

43. (C) Follicle Stimulating Hormone (FSH) stimulates growth of ovarian follicles and secretion of oestrogens in female and spermatogenesis in males. Interstitial Cell Stimulating Hormone (ICSH) activates the leydig's cells of testis to secrete androgen. In females (here called LH) it stimulates the corpus luteum of the ovary to secrete progesterone, i.e., the comparison in cAMP production will clarify this paradox in both age groups.
44. (A) The light junctions sometimes called terminal bar are sheet-like junctions which connect one cell to other without any communication between the cells and containing sealing strands.
Gap junctions permit controlled passage of small molecules or ions between the cells. Desmosomes are mechanical junctions which attaches cytoskeleton of one cell to the cytoskeleton of other cell or to extracellular matrix.
45. (D) Ig G is the major immunoglobulin in normal human serum accounting for 70-50% of total immunoglobulin pool.
Trinitrophenylated lipopolysaccharide (TNP-LPS) is thymus-independent immunogen. Spleen cells from mice preinjected with high doses of bacterial lipopolysaccharide did not generate anti-trinitrophenyl (TNP) plaque-forming cells in vitro to the T-dependent antigen, TNP-sheep erythrocytes but did generate fully plaque-forming cells to the T-independent antigens, TNP-Ficoll and TNP-Brucella abortus.
46. (A) ATP-binding cassette (ABC) proteins do not have ATP-binding transmembrane domains rather these transport proteins have two transmembrane domains and two cytoplasmic domains. It is the cytoplasmic domains (this unit is called a cassette) that are the ATP-binding domains. At the expense of ATP breakdown small molecules such as drugs are transported across the membrane.
Cystic fibrosis is an important genetic disease due to deficiency in ATP-binding cassette (ABC) proteins. The gene responsible for this is CFTR gene, which encodes an ABC transporter protein known as the cystic fibrosis transmembrane conductance regulator (CFTR) protein. In eukaryotes a protein known as the multidrug resistance protein (MDR protein) has been discovered that is an ATP-binding cassette (ABC) protein.
47. (A) It's the formula.

48. (C) Fe^{2+} is toxic to cancer cells. Its uptake by the cell along with methotrexate will not allow tumor to develop as it blocks ONd synthesis.
49. (B) Fibroblast growth factor (FGF) in epidermis suppress the activity of Bone Morphogenetic Protein (BMP) towards the ventral axis. Neural induction in zebra fish is independent of organizer and dependson the activity of BMP.
50. (A) ATP is synthesized in mitochondria as a result of the chemiosmotic mechanism. The energy released by the electron flow is channeled to translocate protons across the inner mitochondrial membrane and establish a proton gradient. This proton gradient drives the proton flow back into the mitochondrial matrix via. ATP synthase. The energy of this is harnessed to rotating the F_0 subunit, a circular structure in the membrane. This then drives a shaft to rotate in the F_1 subunit, the enzyme catalytic centre on which ATP is generated. Each of the F_0 and F_1 subunits are made up of multiple subunits. It is not exactly understood how the energy of the rotating shaft is utilized for the ATP synthesis. The synthesis at ATP from ADP and P_i tightly bound to the ATP synthase involves very little free energy change. It is the release of ATP that requires the energy supplied by the rotating shaft.

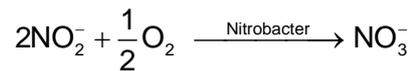
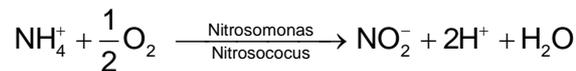
PART 'C'

51. (B) The sigma (σ) subunit of *E. coli* polymerase has a specific role in initiation of transcription. It enables the enzyme to find promotor sequences to which it binds.
A number of transcription factors (initiation, elongation and termination) are required for the expression of gene. The initiation of transcription is an important control point where the cell can regulate the expression of gene.
52. (D) Maize, sugarcane, sorghum are C_4 plants while wheat is a C_3 plant. In C_4 plants initial CO_2 fixation takes place in mesophyll cells. The primary acceptor of CO_2 is phosphoenol pyruvate which is converted to oxaloacetate and then to malate. While in C_3 plants the CO_2 is first combined with RuBP to form 3-phosphoglyceric acid.
53. (A) Auxin is synthesized in shoot apices, leaf primordia and developing seeds. Its movement is polar. It is basipetal in stem but acropetal in root. It helps in elongation of both root and shoot. Differential distribution of auxin produce plant responses like phototropism and geotropism.
54. (D) The CAM cycle, all the reactions occur in the same cell but at different times of the day. It is immediately obvious that CAM plants will be slow-growing. They do photosynthesis in the daytime (remember the light reactions and Calvin cycle can only operate in the light). Much of this gain is lost the next night by use of the starch.
55. (B) The classification system that we use today was established by Carolus Linnaeus, a Swedish biologist, in the 18th century. It provides a hierarchy of categories used to classify each living organism. From the largest (most inclusive) to the smallest (least inclusive), these categories include.
56. (A) The ELISA can be performed to evaluate either the presence of antigen or the presence of antibody in a sample, it is a useful tool for determining serum antibody concentrations (such as with the HIV test or West Nile virus).
57. (B) The numerous vectors used in plant transformation, the Ti plasmid of *Agrobacterium tumefaciens* has been widely used. These bacteria have a natural ability to transfer T-DNA of their plasmids into plant genome upon infection of cells at the wound site.
58. (B) A change in DNA sequence that changes the codon to a different amino acid. Not all missense mutations are deleterious, some changes can have no effect. Because of the

ambiguity of missense mutations, it is often difficult to interpret the consequences of these mutations in causing disease.

59. (A) Algae and fungi in a lichen show symbiotic relationship. Fungi give support to the algae, give protection and help in absorption of water while algae provide food to fungi which is a chlorophyllous. No one is harmed but both are benefitted by each other.
60. (B) A fatty bubble called a liposome carries a gene into a somatic cell. Here, the delivered gene may replace an abnormal one.
61. (C) $0.349 \quad K_a = \frac{[Ag - Ab]}{[Ab][Ag]} = \frac{r}{c(n-r)}$
 $K_o = 1/(3-1) \quad c$
 $1.43 \times 10^{-5} M^{-1} = 1/ (2) \quad c$
 $c = 1/(2) \times 1.43 \times 10^{-5} M^{-1} = 0.349 \times 10^5 M$
62. (B) The maize hAT family members Activator/Dissociation (Ac/Ds) are composed of the autonomous Ac and nonautonomous Ds transposable elements. Ac is 4565 bp and encodes a 3.5 kb open reading frame (ORFs) that directs the synthesis of an 807 amino acid transposase (TPase) protein. The TPase transcript initiates at several sites within a 100-bp interval at the 5' end of the element and spans most of Ac. The lack of canonical CAAT and TATA boxes in the promoter region may account for the multiple transcriptional initiation sites with Ac and the low levels of Ac transcript. Ac contains ~ 240 bp subterminal repeats and 11 bp terminal inverted repeats at each end. The subterminal repeat regions at both Ac ends contain TPase binding sites that are essential for TPase recognition and subsequent transposition of both Ac and Ds.
63. (C) Bacterial conjugation is a plasmid encoded mechanism of transfer of genetic material that involves cell to cell contact. The process involve a donor cell which contain a particular type of conjugative plasmid and a recipient cell which does not. Different conjugative plasmids may have slightly different *tra* regions. In the given conjugation experiment the order of genes cannot be determined.
64. (B) The occurrence of relatively definite sequence of communities over a period of time in the same area is known as ecological succession. The species may increase their capacity of tolerance towards changing environment by developing ecads, ecotypes and serel community.
65. (C) Stabilizing selection occurs when the environment does not change. Natural selection has to produce change and if environment does not change there is no pressure for well adapted species to change.
66. (A) Synthesis of DNA takes place during S-phase of cell cycle thus cell in G_2 phase has double the DNA content as G_1 .
67. (A) Many genes do not produce the concerned phenotype in all the individuals, which carry them in appropriate genotype, such a situation is called incomplete penetrance. For example a recessive gene producing partial chlorophyll deficiency in the cotyledonary leaves of lima beans shows incomplete penetrance. In the given figure if the penetrance is complete and allele individual but in reality do not appear due to incomplete penetrance.
68. (C) When a segment of chromosome is oriented in the reverse direction; such a phenomenon is called inversion. It may be classified into two class on the basis of presence or absence of centromere within the inverted segment, i.e., paracentric (centromers located outside the inverted segments) and pericentric (centromers located within the inverted segment).

69. (C) Nitrification is the phenomenon of conversion of ammonium nitrogen to nitrite and then to nitrate.



70. (B) Coefficient of association is an important measure of interrelation between two variables (attributes). In phenetic method, a phenogram is formed. Higher the coefficient of association (i.e., as the value approached to 1.0) the more closely related are the species. For example the coefficient between S and T is 8 character and between T and W is 7 character.
71. (B) Foot printing enables identification of the site on a DNA molecule to which a protein such as RNA polymerase, binds since binding of protein to a region of DNA protect the phosphodiester bonds of that region for cleavage by DNase I.

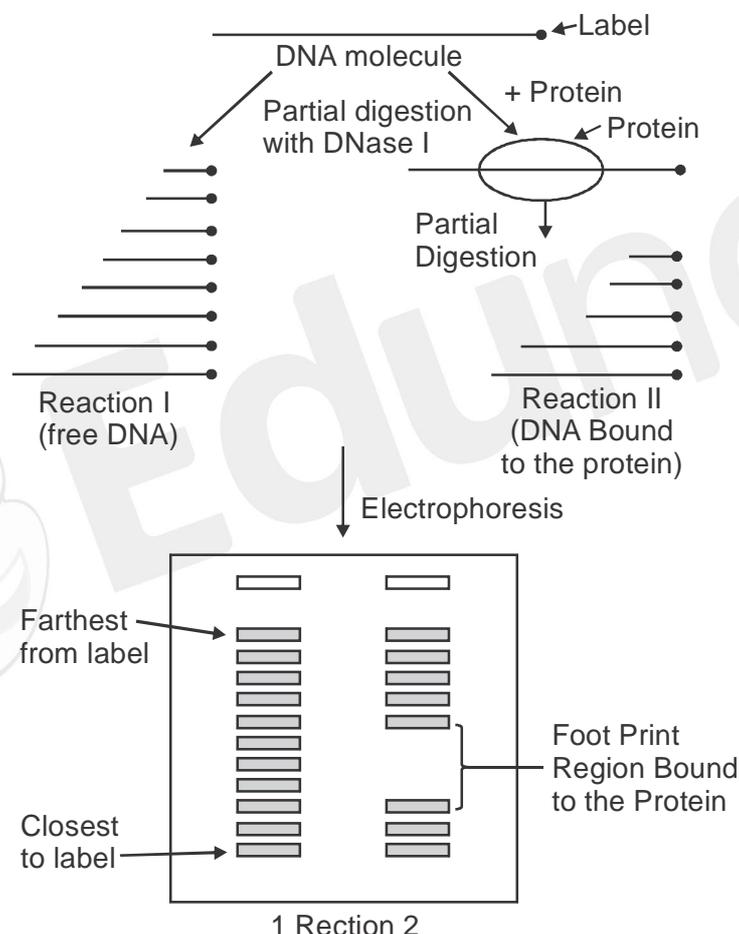


Figure. Footprinting using DNase I. In reaction I, protein-free DNA molecules are partially digested with DNase I, while in reaction II the DNA molecules are bound to the concerned protein during partial digestion with DNase I.

72. (B) Site specific recombination is guided by a recombination enzyme that recognizes specific nucleotide sequences present on one or both of the recombining DNA molecules. By separating and joining double stranded DNA molecules at specific sites, this type of recombination enables various types of mobile DNA sequences to move about within and between chromosome. In bacteriophage lambda the enzyme lambda integrase catalyze

the recombination process. The integrase resembles a DNA topoisomerase in that it forms a reversible covalent linkage to DNA wherever it breaks a DNA chain.

73. (A) *Mycobacterium tuberculosis* is rod-shaped and acid fast bacterium. It infects the respiratory tract and gets established in lung tissues. After being phagocytosed by macrophages the bacteria are enclosed into small and hard tubercle. Against infection by *M. tuberculosis* patients develop a cell mediated immunity which involves the sensitised T-cells. Macrophages are derived from monocytes. They have receptors for antibodies and complement.
74. (A) The majority of B-cells carry MHC class II antigens, which are important for cooperative (cognate) interactions with T-cells. Complement receptors for C_3b (CD35) and C_3d (CD21) are commonly found on B-cells and are associated with activation and possibly homing of the cells. CD19/CD21 interacts with complement associated with antigen plays a antigen binding antibody receptor.
75. (B) Sucrose moves from the mesophyll of leaves to phloem, probably phloem parenchyma cells and may continue through symplasm (plasmodesmata) to sieve element companion cell (Se-CC) complex. From here it can be taken up across the membrane of Se-CC complex.



Eduncle