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Paper – II

Life Sciences

Booklet Code

A

TEST BOOKLET NO.

Subject Code : **0 3**

Roll No. :

(Figures as per admission card)

Roll No. (in words) : _____

_____

OMR Sheet No. :

Name and Signature of Invigilator/s

Signature : _____

Name : _____

Time : 2 Hours

Maximum Marks : 200

Number of Pages in this Booklet : 24

Number of Questions in this Booklet : 100

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of hundred (100) multiple-choice type of questions.
3. At the commencement of examination, the test booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below** :
   (i) To have access to the Test Booklet, tear off the paper seal on the edge of the cover page. Do not accept a booklet without sticker seal or open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Test Booklet will be replaced nor any extra time will be given.**
   (iii) After the verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the questions are to be indicated in the **OMR Sheet kept inside this Booklet**. If you mark at any place other than in the circles, the OMR Sheet will not be evaluated.
6. Read the instructions given in OMR Sheet carefully. Fill the Booklet Code of Paper – II in OMR Sheet **Compulsorily**.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space provided for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
10. You can take away test booklet and carbon copy of OMR Answer Sheet after the examination.
11. **Use only Blue/Black Ball point pen.**
12. **Use of any calculator, electronic gadgets or log table, etc. is prohibited.**
13. **There is no negative mark for incorrect answer.**

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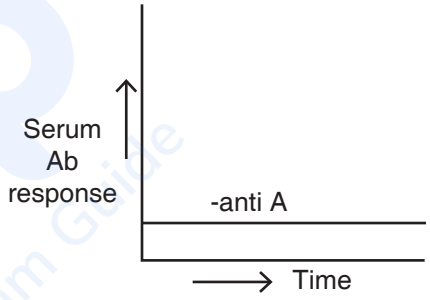
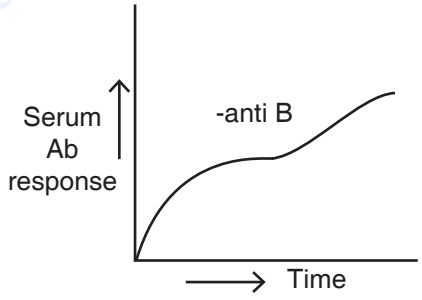
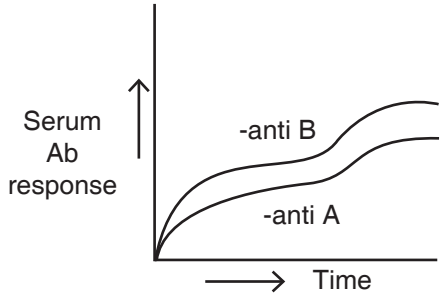
1. Identify the correct sequence of events in cytokinin signaling pathway.
(His = Histidine; AHP = Arabidopsis thaliana histidine phosphotransfer protein)
(A) Receptor binding → phosphorylation of AHP → phosphorylation of an aspartate residue → activation of His kinase
(B) Receptor binding → phosphorylation of AHP → activation of His kinase → phosphorylation of an aspartate residue
(C) Receptor binding → phosphorylation of an aspartate residue → activation of His kinase → phosphorylation of AHP
(D) Receptor binding → activation of His kinase → phosphorylation of an aspartate residue → phosphorylation of AHP

2. There are two common mutations that lead to uncontrolled cell proliferation and invasiveness that characterize cancer cells. The first is to make a proto-oncogene hyperactive and the second is to make a tumor suppressor gene inactive. Mutations of the APC (Adenomatous polyposis coli) gene occur in 80% of humans colon cancers. Normal APC increases the affinity of the degradation complex for β-Catenin, which in excess can enter the nucleus and promote transcription of target genes for cell proliferation. Based on this information, the APC gene belongs to
(A) Tumor-suppressor gene
(B) Proto-oncogenes
(C) Either proto-neo gene or tumor-suppressor gene
(D) Constitutively expressed gene

3. For raising an antibody the student was provided with three substances A, B and C. Figure given below represent the pattern of immunological response in mice when (i) A was administered along with C, (ii) B was administered along with C and (iii) A was conjugated with B and administered along with C.

i.


ii.


iii.


Select the option representing correct identifications of A, B and C.
(A) A-Protein, B-Hapten, C-Adjuvant
(B) A-Hapten, B-Protein, C-Adjuvant
(C) A-Protein, B-Adjuvant, C-Hapten
(D) A-Hapten, B-Adjuvant, C-Protein

4. Which one of the following shows holoblastic cleavage ?

(A) Mammal

(B) Fish

(C) Bird

(D) Insect

5. During sea urchin gastrulation the sheet of epithelial cells (future endoderm) infolds into the blastocoel. This type of cell movement during gastrulation is called as

(A) Invagination

(B) Involution

(C) Ingression

(D) Epiboly

6. Which of the following is a diversity index ?

(A) Upright index

(B) Inverted index

(C) Bell shaped index

(D) Simpson's index

7. In the terrestrial ecosystem the density of birds is greater in the ecotone zone between the forest and grassland. This is due to the

(A) Climax community

(B) Edge effect

(C) Ecad

(D) Ecocline

8. To prove connection between India and Seychelles in geological time, DNA from which taxon would be best ?

(A) Bats

(B) Frogs

(C) Birds

(D) Sharks

9. White eyes flies are caused by recessive allele at one locus, if in a Drosophila population in Hardy Weinberg equilibrium 9% of flies have white eyes. Find the expected frequency of wild type alleles.

(A) 70%

(B) 21%

(C) 49%

(D) 30%

10. Closely related endemic species are in higher proportion in isolated island such as Hawaiian and Galapagos, than in Mainland. Which one of the following statements is false ?

(A) Isolated island often have numerous unoccupied niches

(B) From mainland very few species coloize these islands

(C) Species that colonize these islands eventually radiate into multiple species

(D) These islands have higher rates of species extinction

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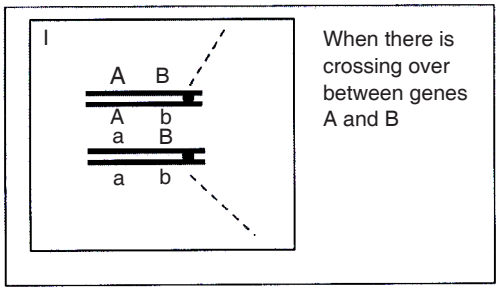
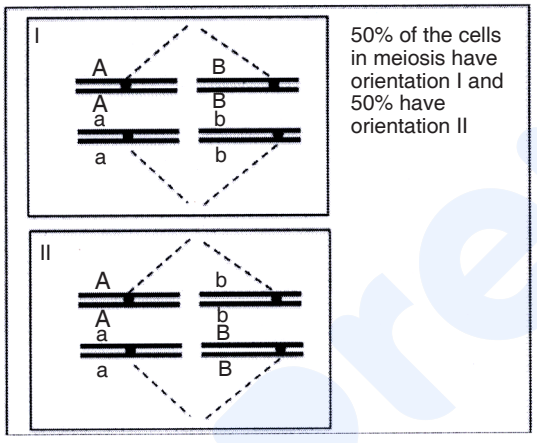
11. The following figures represent organizations of chromosomes at Metaphase stages of meiosis. Which one of the following will ensure independent assortment of the genes marked ?

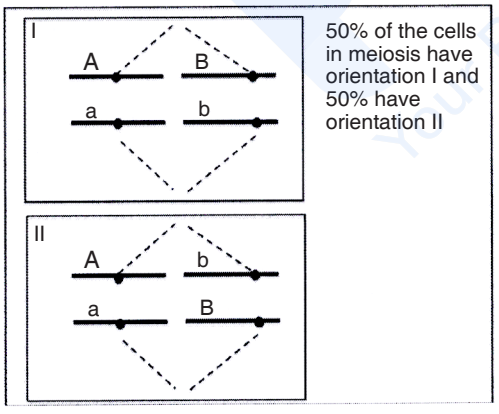
(A)



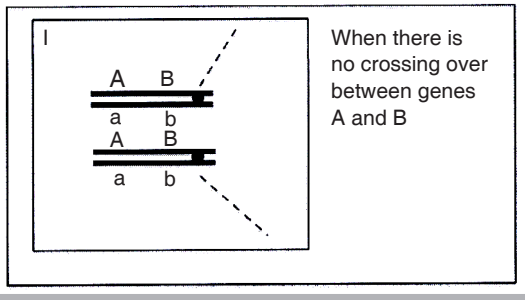
(B)



(C)



(D)



12. A child has 'O' blood group. There are four pairs of individuals who could be the likely parent of the child. The blood groups of the parents are listed below :

Parent	Blood group of	
	Mother	Father
1.	A	B
2.	AB	O
3.	O	A

Which of the above individuals can likely be parents of the child ?

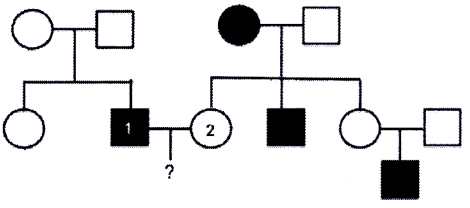
(A) Parent 1 only

(B) Parent 3 only

(C) Both parents 2 and 3

(D) Both parents 1 and 3

13. The following pedigree shows the inheritance pattern of a rare genetic disorder :



If the individuals marked 1 and 2 had a child, what is the probability that it is a girl showing the disorder ?

(A) 1

(B) 2/3

(C) 1/2

(D) 1/4

14. Which one of the following events can shift a group of genes from one linkage group to another ?

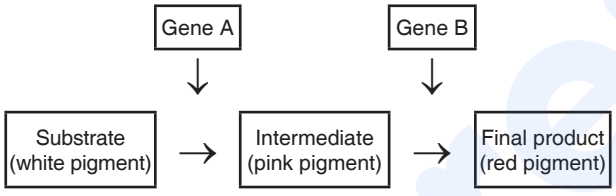
(A) Recombination

(B) Mutation

(C) Inversion

(D) Translocation

15. The following pathway depicts the formation of red pigments in a flower :



The step-wise conversion, is carried out by enzymes encoded by genes A and B. The genes A and B are located on chromosomes 2 and 3 respectively. Null alleles for the genes (a and b) are recessive to their respective wild type alleles. If a plant with the genotype AaBb is self-pollinated, what is the expected phenotypes of the progeny and the ratio in which they would occur ?

(A) Red : Pink : White; 1 : 2 : 1

(B) Red : Pink : White; 9 : 3 : 4

(C) Red : White; 3 : 1

(D) Red : White; 15 : 1

16. Which one of the following pairs of plant growth regulators and their function is mismatched ?

(A) Auxin – promote cell elongation

(B) Gibberellins – promote bud and seed dormancy

(C) Cytokinins – delay senescence

(D) Abscisic acid – stimulate closing of stomata

17. Which one is not true for the species possessing C4 Pathway ?

(A) They are able to minimize the photorespiration by using more efficient enzymes to fix CO_2

(B) Oxidative decarboxylation occurs in the chloroplasts of bundle sheath cells

(C) They have high compensation point for CO_2

(D) They have lower photosynthesis yield in comparison to C3 and CAM Plants

18. Monophyletic group

(A) Include all representatives of a clade but not most recent common ancestors

(B) Contain unrelated organisms

(C) Contain all representatives of clade and most recent common ancestors

(D) Include most recent ancestors (common) but not its decendents

19. Match the following :

Group – I	Group – II
1. Rhizobium	a. Free-living, anaerobic, chemotroph
2. Desulfovibrio	b. Free-living, aerobic, chemotroph
3. Azotobacter	c. Free-living, anaerobic, phototroph
4. Chromatium	d. Symbiotic, aerobic, chemotroph

Identify the correct one.

(A) 1 – d; 2 – c; 3 – b; 4 – a

(B) 1 – d; 2 – a; 3 – b; 4 – c

(C) 1 – c; 2 – b; 3 – d; 4 – a

(D) 1 – b; 2 – c; 3 – d; 4 – a

20. What is Diphtheria toxin ?

(A) Is cleaved on the surface of susceptible eukaryotic cells into two fragments, one of which enters the cytosol

(B) Binds to peptidyl transferase and inhibits protein synthesis

(C) Reacts with ATP to phosphorylate eIF2 and prevent the insertion of the Met RNAi into the P site

(D) Reacts with NAD+ to add ADP-ribose to eEF2 and prevents movement of the peptidyl-tRNA from A to P site in the ribosome

21. A cell passes through stages in its developmental history. The following are three stages of developmental history.

1. Determination
2. Differentiation
3. Specification

Which one of the following correctly reflects the progression in a cell's developmental history ?

(A) 3 → 1 → 2

(B) 1 → 2 → 3

(C) 1 → 3 → 2

(D) 2 → 1 → 3

22. Diapedesis is

(A) An increase in diameter of blood vessels

(B) An increase in capillary permeability

(C) Adherence of cells to the endothelial wall

(D) Emigration of phagocytes through the gap between endothelial cells to inflammation site

23. Which type of anemia is responsible for the disease thalassemia ?

(A) Aplastic anemia

(B) Hemolytic anemia

(C) Hemorrhagic anemia

(D) Iron deficiency anemia

24. Name the hormone, which is released by the posterior pituitary.

(A) Oxytocin

(B) Thyroid stimulating hormone

(C) Interstitial-cell stimulating hormone

(D) Prolactin

25. Diabetes insipidus is caused due to insufficient level of

(A) Insulin

(B) Anti-diuretic hormone

(C) Thyroxine

(D) Thyroid stimulating hormone

26. A researcher ligates a EcoRI digested DNA fragment to a plasmid DNA digested with EcoRI. On transformation the researcher observed that the percentage of clones with recombinant plasmids was low. Which one of the following strategies would improve the observed results ?

(A) Fill the staggered end of both the insert and the plasmid to create blunt ends

(B) Treat the digested plasmid with an enzyme, which removes the phosphate groups at the 5′ ends

(C) Reduce the amount of insert used in the ligation reaction

(D) Use of higher amount of ligation mixture for transformation

27. A researcher was asked to clone a 2 Kb fragment isolated following digestion with the restriction enzyme 'W'. He was given the choice of using a plasmid with a multiple cloning site with sites for enzymes 'X', 'Y' and 'Z'. The recognition sequence and the site of cleavage (marked with *) of the four enzymes are as follows :

Restriction site for W : 5′ G*TCGAC 3′

Restriction site for X : 5′ C*TCGAG 3′

Restriction site for Y : 5′ CTGCA*G 3′

Restriction site for Z : 5′ GTCGA*C 3′

The research scholar can clone the fragment in the RE site for

(A) X only

(B) Z only

(C) both X and Z

(D) both Y and Z

28. If the A_{260} of 1ml of DNA sample is 0.800, what will be the expected absorbance of 200μl of the same sample ?

(A) 0.160

(B) 0.320

(C) 0.400

(D) 0.800

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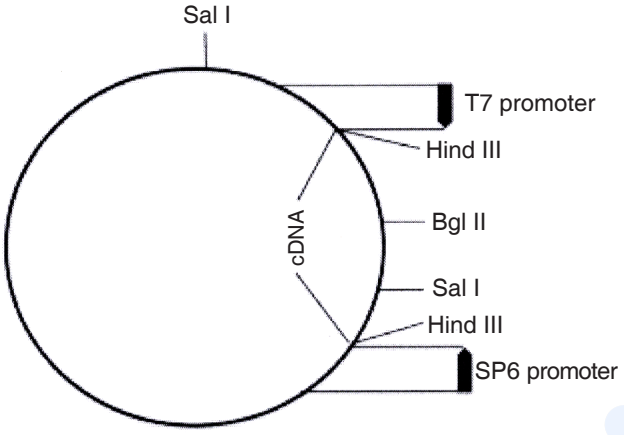
29. A cDNA fragment flanked by Hind III sites was cloned into a vector at the Hind III site, for its expression under T7 promoter as shown in the figure below.



Which one of the following digestions will help determine the correct orientation of the cDNA ?

(A) Digestion with Hind III

(B) Digestions with Bgl II

(C) Digestion with Sal I

(D) Double digestion with Hind III and Sal I

30. The size of DNA that can be cloned in Yeast Artificial Chromosome (YAC)

(A) Ranges on an average between 200 to 2000 kb

(B) Less than 200 kb

(C) Has no size restriction

(D) Ranges on an average between 100 to 270 kb

31. Which of the following are protozoans ?

(A) Diatoms, flagellates, amoebas and ciliates

(B) Apicomplexans, flagellates, amoeba and ciliates

(C) Amoeba, actinomycetes, ciliates and flagellates

(D) Flagellates, ciliates, cyanobacteria and apicomplexans

32. The table given below lists of organisms (Column A) and characteristic features (Column B).

Column A	Column B
a. Caulobacter	i. Multicellular fruiting body
b. Myxobacteria	ii. Endospore
c. Methylotroph	iii. Non-free living, Penicillin resistant
d. *Bacillus subtilis*	iv. Immortal stalk cells
e. *Mycoplasma*	v. Can use formate, cyanide and carbon monoxide as source of carbon

Choose the option that correctly matches organisms with their characteristic features.

(A) a – i; b – v; c – iv; d – ii; e – iii

(B) a – iv; b – i; c – v; d – ii; e – iii

(C) a – iv; b – v; c – i; d – iii; e – ii

(D) a – ii; b – i; c – v; d – iv; e – iii

33. Techoic acid a component of gram +ve bacteria's cell wall binds with which of the following to protect bacteria from thermal injury ?

(A) Mg^{+2}

(B) Fe^{+2}

(C) Phosphorus

(D) Sulphur

34. Pentaglycine chain bridges the lysine E-amino group and the D-alanine carboxylic group in the cell wall of

(A) Gram positive bacteria

(B) Gram negative bacteria

(C) Fungi

(D) Higher plants

35. Penicillin inhibits bacterial growth by irreversibly inactivating the enzyme

(A) Fatty acid synthase

(B) Cytochrome oxidase

(C) Glycopeptide transpeptidase

(D) Hexokinase

36. Column X lists different DNA polymerase and column Y some functions.

Column X	Column Y
i. DNA polymerase I	a. Mitochondrial DNA replication
ii. DNA polymerase α	b. Main Replicative enzyme
iii. DNA polymerase γ	c. Priming during replication
iv. DNA polymerase δ	d. DNA repair and gap filling

Select the option with all correct matches.

(A) i – c; ii – a; iii – d; iv – b

(B) i – b; ii – c; iii – d; iv – a

(C) i – b; ii – c; iii – a; iv – d

(D) i – d; ii – c; iii – a; iv – b

37. The table below lists inhibitors of protein synthesis (Column X) and their mode of action (Column Y).

Column X	Column Y
1. Puromycin	a. Blocking 'A' site on ribosome
2. Tetracycline	b. ADP ribosylation of eEF2
3. Diphtheria toxin	c. Premature termination of peptide
4. Ricin	d. Inactivates 60S submit of eukaryotic ribosomal 23S rRNA

Which one of the following represents a correct match between the two column ?

(A) 1 – c, 2 – d, 3 – b, 4 – a

(B) 1 – b, 2 – a, 3 – d, 4 – c

(C) 1 – d, 2 – c, 3 – b, 4 – a

(D) 1 – c, 2 – b, 3 – d, 4 – a

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38. Based on current knowledge, the concept of 'one gene – one peptide' does not hold true. Following is a list of processes in eukaryotic cell, involved in the encoding of a peptide from a gene.

1. Alternative splicing.
2. RNA editing.
3. Transport of mRNA from nucleus to the cytoplasm.
4. Post translational modification of peptides.

Which one of the following options represent processes that has falsified the 'one gene–one peptide' concept ?

(A) 1 only

(B) Both 1 and 2

(C) Both 2 and 3

(D) Both 1 and 4

39. Among the following list of sequences which one is characteristic of promoter region of genes transcribed at a low rate ?

(A) The TATA Box

(B) The Matrix Associated regions

(C) CpG island

(D) Insulators

40. Which of the following apply uniquely to secondary lymphoid organs ?

(A) presence of precursor B and T cells

(B) circulation of lymphocytes

(C) terminal differentiation

(D) cellular proliferation

41. In photosynthesis, the light-dependent reaction take place on the thylakoid membranes. The inside of the thylakoid membrane is called the lumen and outside the thylakoid membrane is the stroma, where the light-independent reaction takes place. Which of the following are the products of the light reaction of photosynthesis that are utilized in the Calvin cycle ?

(A) Electrons and H^+

(B) ATP and NADPH

(C) CO_2 and glucose

(D) RUBP and PGA

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42. Which one of the following statements is not correct ?

(A) Cytoskeleton is present in eukaryotic cell and absent in prokaryotic cell

(B) In biological membranes, integral proteins and lipids interact mainly by hydrophobic interactions

(C) All membrane processes, such as pumping and channeling of molecules are carried out by proteins

(D) Channel proteins can facilitate both active and passive transport

43. Which one of the following statements describes the functioning of Photosystem II ?

(A) The splitting of water yields molecular carbon dioxide as a byproduct

(B) The P680 chlorophyll donates a pair of protons to NADPH, which is + thus converted to NADP+

(C) The electron vacancies in P680 are filled by electron derived from water

(D) Light energy excites electrons in the electron transport chain in a photosynthetic unit

44. Which statement about the function of the casparian strip is correct ?

(A) Prevents excess transpiration from leaves

(B) Regulates ion movements into the root vascular cylinder

(C) Prevents horizontal water movement from vascular cylinder to cortex

(D) It is a pathway for nutrient transfer from xylem to phloem

45. The pigment molecules responsible for photosynthesis are located in the

(A) Cytoplasm

(B) Stroma of chloroplast

(C) Thylakoid membrane of the chloroplast

(D) Mitochondria

46. An ORF (Open Reading Frame) of 1200bp in *E. coli* encodes for a peptide. What will be the expected mass (kDa) of the peptide encoded by this ORF ?

(A) 11 (B) 22

(C) 44 (D) 132

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47. Given the percentages of different bases, which one of the following nucleic acid is likely to be double stranded DNA molecule ?

(A) A(35), T(15), G(35), C(15)

(B) A(35), T(35), G(15), C(15)

(C) A(35), U(35), G(15), C(15)

(D) A(35), T(15), G(15), C(35)

48. Triple stranded collagen helix is stabilized by

(A) Leucine and isoleucine

(B) Proline and hydroxyproline

(C) Phenylalanine and valine

(D) Methionine and cysteine

49. In presence of competitive inhibitor in enzyme catalysed reactions

(A) V_{max} increases

(B) V_{max} decreases

(C) K_m increases

(D) K_m decreases

50. Net charge on an amino acid at a pH less than pI will be

(A) Positive

(B) Negative

(C) Neutral

(D) Charge is not affected by pH

51. In a monohybrid cross involving a dominant and recessive character, the F_2 progeny showed the presence of 2500 individuals with dominant phenotype and 1500 with recessive phenotype. Which one of the following tests can be performed to test whether the F_2 fits the expected 3 : 1 ratio ?

(A) ANOVA

(B) Chi-square test

(C) Student's t-test

(D) Z-test

52. A cross was made between two parents with genotypes *aaBB* and *AAbb*. The F_1 progeny was test-crossed. If the genetic distance between the two genes is 10 cM, what percentage of the progeny from the test-cross will have the genotype *AABB* ?

(A) 90% (B) 45%

(C) 10% (D) 5%

53. If the recessive disease phenylketonuria (PKU) occurs in a genetically constant population at Hardy-Weinberg equilibrium with a frequency of 1 in 10000, the percentage of the population expected to be carriers is approximately

(A) 1% (B) 2%

(C) 10% (D) 20%

54. A biosensor can be most appropriately defined as

(A) A device that have silicon chips replaced by biomolecules

(B) Any device that can be used to take physiological measurements in medical diagnostics

(C) Any device that produces a measurable signal proportional to the concentration of the target biological or chemical analyte

(D) A device used for detection of chemical substances that connects biological components to a physiochemical device

55. Human immune-deficiency virus (HIV)-infected individuals are said to be diagnosed for AIDS when

(A) an individual found to be positive for HIV infection irrespective of any other parameters

(B) an HIV-infected individual has CD4 count lower than 200 cells/mm^3

(C) an HIV-infected individual has CD4 count between 500-1500 cells/mm^3

(D) an HIV-infected individual has CD4 count more than 1500 cells/mm^3

56. Triskelion structure is associated with

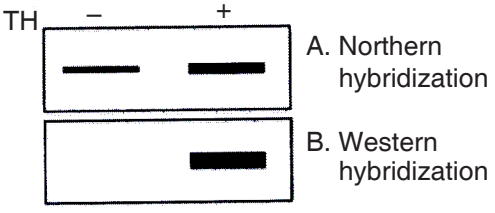
(A) Glycophorin A

(B) Clathrin

(C) Elastases

(D) Nucleosomes

57. The expression of gene 'A' in the presence (+) and absence (–) of thyroid hormone (TH) was analyzed in a cell line. The following is a representation of the observation made following northern hybridization (panel A) and western hybridization (panel B) of gene 'A' products.



Based on the above observations, it can be concluded that thyroid hormone regulates gene 'A'

(A) only at the transcriptional level

(B) only at the translational level

(C) both at transcriptional and translational level

(D) neither at transcriptional nor translational level

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58. DNA polyerase III lacks following activities :

(A) 5′ – 3′ polymerase

(B) 3′ – 5′ exonuclease

(C) 5′ – 3′ exonuclease

(D) Both 5′ – 3′ and 3′ – 5′ exonuclease activity

59. Splicing of GU-AG intron

(A) Involves transesterification reaction

(B) Form Y-shaped branch structure

(C) Occurs in prokaryotic messenger RNA

(D) Requires maturase activity

60. Which one of the following is recognized by the small subunit of *E. coli* ribosome ?

(A) Rho utilization site

(B) Leader sequence

(C) Kozak sequence

(D) Shine Dalgarno sequence

61. Poisson distribution is applied for

(A) Continuous random variable

(B) Discrete random variable

(C) Irregular random variable

(D) Uncertain random variable

62. In order to localise a known protein present at low concentrations in tissues one would use

(A) Electron microscopy

(B) Autoradiography

(C) Immuno-fluorescence microscopy

(D) Phase contrast microscopy

63. The long and elaborate horns of males as compared to females in deer are an example of

(A) Sexual selection

(B) Trait matching

(C) Stress physiology

(D) Adaptive radiation

64. Which of the following conditions is true ?

(A) In semelparous species, individuals reproduce repeatedly in their lifetime

(B) In semelparous species, individuals reproduce only once in their lifetime

(C) In iteroparous species, individuals reproduce only once in their lifetime

(D) In iteroparous species, individuals reproduce only exactly twice in their lifetime

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65. Match the following classes of terpenes and their ecological significance.

Group – I

1. Monoterpenes
2. Diterpenes
3. Triterpenes
4. Tetraterpenes

Group – II

a. β-Carotene
b. Pyrethroids
c. Dihydroleucodine
d. Sito sterol

Group – III

p. Membrane Component
q. Plant Pigment
r. Insecticidal activity
s. Antioxidant

Identify the correct one :

(A) 1-b-r; 2-c-s; 3-d-p; 4-a-q

(B) 1-d-p, 2-b-r; 3-c-s; 4-a-q

(C) 1-d-q; 2-c-p; 3-b-s; 4-a-r

(D) 1-a-q; 2-c-r; 3-b-s; 4-d-p

66. In chick, development of wing feathers, thigh feathers and claws depends on epithelial specificity conferred by induction from mesenchymal components from different sources of the dermis. This may be attributed to

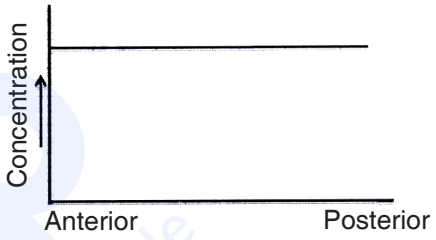
(A) Autocrine interaction

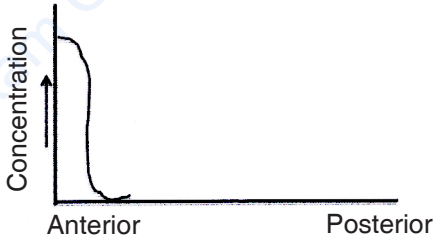
(B) Regional specificity of induction

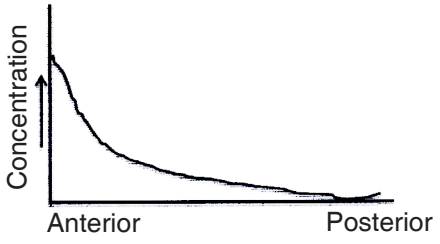
(C) Genetic specificity of interaction

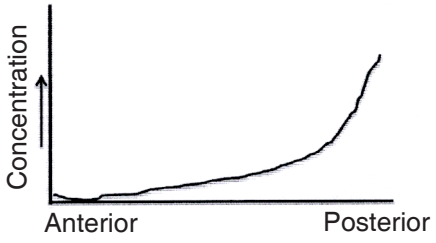
(D) Autonomous development

67. The level of bicoid protein was measured in early cleavage embryo of Drosophila. Which one of the following graphs is a correct representation of bicoid gradient along the anterior-posterior axis ?

(A)


(B)


(C)


(D)


68. Izumo, present in the acrosomal membrane and Juno, an oocyte membrane protein is involved in sperm-egg fusion in mammals. Which one of the following experiments and their outcomes unequivocally demonstrate that Izumo's interaction with Juno will lead to sperm-egg fusion ?

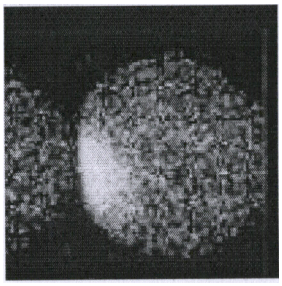
(A) Immunostaining of sperms and eggs with antibodies against Juno and Izumo demonstrating their specificity of expression

(B) Overexpression of Juno in the oocyte to demonstrate sperm binding

(C) Developing independent kidney cell lines expressing either Juno or Izumo and demonstrating that these cells adhere to each other

(D) Demonstrating interaction of Izumo and Juno by FRET (Fluorescence Resonance Energy Transfer)

69. When a sperm fuses with sea urchin egg, a wave of calcium release is seen starting from the point of sperm entry that propagates across the egg. The calcium wave can be viewed if the egg is stained with a dye that fluoresces on binding to calcium. Compounds like A23187 and EDTA are used to analyze the origin and outcome of these waves. A23187 is a calcium ionophore that allows the diffusion of Ca^{2+} across lipid membranes, permitting them to travel across otherwise impermeable barriers. EDTA chelates Ca^{2+}, by binding to and holding onto it. In order to find out if the observed wave is due to release of Ca^{2+} from within the cell or influx of Ca^{2+} from outside, different experiments were proposed. Which one of the following treatments will help in answering the question ?



(A) Placing sea urchin eggs in seawater containing A231872

(B) Inducing fertilization of sea urchin eggs in calcium free water

(C) Treating sea urchin eggs with EDTA before fertilization

(D) Treating sea urchin eggs with A231872 before fertilization

70. CLAVATA-WUSCHAL genes are expresses in

(A) Sieve elements

(B) Tracheasy elements

(C) Wood parenchyma

(D) Shoot apical meristem

71. Which one of the following metabolic pathways is common to both fermentation and cellular respiration of a glucose molecule ?

(A) Reduction of pyruvate to lactate

(B) The electron transport chain

(C) Synthesis of acetyl CoA from pyruvate

(D) Glycolysis

72. Name the two amino acids that are components of artificial sweetener, 'aspartame'.

(A) Aspartic acid and phenylalanine

(B) Arginine and tyrosine

(C) Aspartic acid and tryptophan

(D) Aspartic acid and glutamic acid

73. In humans, sulfur of cysteine does not participate in the

(A) donation of sulfur for methionine formation

(B) conversion of cyanide to less toxic thiocyanate

(C) formation of thiosulfate

(D) formation of taurine

74. The DNA content of cells in G1 phase is 2C. If these cells divide to form gametes, what will be the amount of DNA present in them ?

(A) 4C

(B) 2C

(C) C

(D) 1/2C

75. The following merodiploids were developed to study the induction of lac operon in *E. coli* :

Strain A. $I^+O^CZ^+Y^+/F'I^-O^+Z^-Y^-$

Strain B. $I^-O^+Z^+Y^+/F'I^-O^+Z^-Y^-$

Strain C. $I^-O^+Z^+Y^+/F'I^+O^+Z^-Y^-$

Strain D. $I^+O^CZ^-Y^-/F'I^+O^+Z^+Y^+$

Which one of the following options represents strains that will show constitutive expression of the lac operon ?

(A) Strains A and B

(B) Strains B and C

(C) Strains A and C

(D) Strains C and D

76. You have been given three tubes 1, 2 and 3, each having different combinations of the same antigen and its complementary antibody. In tube '1' antibody is in excess amount, in the tube '2' antigen is in excess amount while in tube '3', both are in equivalent amounts. In which tube will you observe maximum precipitation ?

(A) Tube 1

(B) Tube 2

(C) Tube 3

(D) Tubes 1, 2 and 3 will have same amount of precipitate

77. Aminopterin is used during hybridoma cell selection because

(A) It blocks the denovo pathway of DNA synthesis

(B) It prevents the growth of B cells

(C) It blocks the syntheses of IgG by hybridoma cells

(D) It blocks the salvage pathway of DNA synthesis

78. Independent plant transgenic lines developed with the same T-DNA construct can show wide variation in the expression of the transgene. The following reasons were put forth to explain this observation

1. The number of transgenes incorporated in different lines could vary
2. The position of integration of the transgene cassette may differ from plant to plant
3. The activity of the promoter may vary from plant to plant

Which of the above are the correct reasons for the observed variation in expression ?

(A) 1 only

(B) 2 only

(C) Both 1 and 2

(D) 1, 2 and 3

79. The following are some transgenic plants that have been developed

1. Bt. brinjal
2. Bt. cotton
3. Golden Rice
4. Flavr savr tomato

Which one of the following options represents transgenic plant(s) that has been commercialized in India ?

(A) Only 2

(B) Both 1 and 2

(C) Both 2 and 3

(D) Both 1 and 4

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80. The reporter gene β-*glucuronidase* (*gus*) from *E. Coli* is often used in plant transformation experiments to assess the efficiency of Agrobacterium-based transformation. Analyzing GUS activity at different stages of plant transformation and regeneration does this. However, as Agrobacterium may be also present during the process of regeneration there is a need to distinguish between activity of GUS in transformed plant cells and agrobacterial cells. This has been achieved by

(A) driving the expression of *gus* under CaMV35S promoter

(B) cloning an intron into the coding region of the *gus* gene

(C) washing the explants with bacteriocidal agents

(D) using appropriate quantities of selection markers like kanamycin and hygromycin

81. The amount of mineral nutrients in the soils of tropical rain forests are comparatively low because

(A) The population of microbes and fungi, which are responsible for decomposition are insufficient

(B) Decomposition of organic matter and re-assimilation of chemicals by the plant occur rapidly

(C) Nutrient cycling occurs at relatively slow rate

(D) Low diversity of herbs

82. Greatest loss of biodiversity in the last two centuries has resulted from the

(A) The physical alteration of habitats

(B) Introduction of alien species to new ecosystems

(C) Use of fossil fuels to support transportation and electrical production

(D) The use of rivers, lakes and oceans for transportation

83. Three of the following criteria have contributed to the recognition of Western Ghats-Sri Lanka and Indo-Burma regions as hotspots of biodiversity

1. High species diversity
2. High vegetation density
3. High rate of endemism
4. Ethno-botanical importance
5. Threat perception
6. Adaptation of flora and fauna to warm and humid conditions

Which three of the above are correct criteria in this context ?

(A) 1, 2 and 6

(B) 1, 3 and 5

(C) 2, 4 and 6

(D) 3, 4 and 6

84. In the biodiversity analysis, the importance of a species is its relative contribution to the whole community. The Importance Value Index (IVI) can be calculated by which of the following ?

(A) Density of all species × average basal area per individual

(B) Relative frequency × relative basal area

(C) Relative density + relative frequency + relative basal area

(D) Total number of species × relative density/100

85. What is the difference between a threatened species and an endangered species ?

(A) A threatened species means that the population is likely to become endangered and an endangered species has population numbers so low that it is likely to become extinct

(B) A threatened species is already extinct and an endangered species means that the population's numbers have increased greatly over the last 5 years

(C) A threatened species means that the population is likely to become endangered and an endangered species is already extinct

(D) A threatened species and an endangered species are considered same

86. If you had 50 V, 20 D and 6 J regions able to code for a heavy chain and 40 V and 5 J regions of genes able to code for a light chain, you could have a maximum immunoglobulin repertoire of

(A) 3420 specificities

(B) 6200 specificities

(C) 1,200,000 specificities

(D) more than 1,200,000 specificities

87. A panel of cell lines was created from human-mouse somatic-cell fusions. Each line was examined for the presence of human chromosomes and for the production of three enzymes. On the basis of the results shown in the table given below, give the chromosome location of enzyme 1, enzyme 2 and enzyme 3.

Cell	Enzyme			Human chromosomes								
line	1	2	3	4	8	9	12	15	16	17	22	X
A	+	–	+	–	–	+	–	+	+	–	–	+
B	+	–	–	–	–	+	–	–	+	+	–	–
C	–	+	+	+	–	–	–	–	–	+	–	+
D	–	+	+	+	+	–	–	–	+	–	–	+

Select the option with correct combination of enzyme (E) and chromosome (Ch).

(A) E1 – Ch9; E2 – Ch4; E3 – ChX

(B) E1 – Ch16; E2 – Ch17; E3 – ChX

(C) E1 – Ch9; E2 – Ch17; E3 – Ch1

(D) E1 – Ch16; E2 – Ch4; E3 – Ch1

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88. Which of the following events will not usually lead to transformation of a normal cell into a cancer cell ?

(A) Gain of function of oncogenes

(B) Loss of function of tumor suppressors

(C) Gain of function of genes involved in nucleotide excision repair

(D) Loss of function of pro-apoptosis related genes

89. Which one of the following is not a second messenger ?

(A) Cyclic GMP

(B) Diacylglycerol

(C) Inositol triphosphate

(D) Phosphatidyl inositol

90. Following are stages of tumor development.

1. Metastasis
2. Progression
3. Promotion
4. Initiation

Select the option representing the correct sequence of tumor development.

(A) 2, 3, 4, 1

(B) 4, 3, 2, 1

(C) 1, 2, 3, 4

(D) 1, 3, 4, 2

91. What important thermal balance objective is facilitated by counter-current circulation in mammals ?

(A) Hyperthermia

(B) Sweating

(C) Homeostasis for core of body or vital organs

(D) Homeostasis in extremities

92. Which one of the following statements is correct regarding melatonin in vertebrates ?

(A) Pineal organ and lateral eyes secrete melatonin

(B) Melatonin concentrates pigments in melanosomes

(C) Melatonin is secreted at night in all species

(D) Melatonin is not known to be produced by any peripheral cells

93. The force development by a skeletal muscle depends on

(A) its length

(B) its cross-sectional area

(C) number of sarcomeres

(D) length and number of sarcomeres

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94. Following statements describe motor neuron pathways in the somatic nervous system and autonomic nervous system (ANS).

1. Somatic motor neurons release only acetylcholine (ACh.)
2. Autonomic motor neurons release either ACh or norepinephrine (NE)
3. Somatic nervous system stimulation either excites or inhibits visceral effectors
4. Stimulation by the autonomic nervous system always excites its effectors (skeletal muscle fibers)

Which of the following options represents all incorrect statements ?

(A) 1 only (B) 2 and 3 only
(C) 3 and 4 only (D) 4 only

95. Given following are the statements regarding amine hormones.

1. Amine hormones are synthesized by decarboxylating (removing a molecule of CO_2) and otherwise modifying certain amino acids.
2. They are called amines because they lack an amino group ($-NH_3+$).
3. The dopamine is synthesized by modifying the amino acid tyrosine.
4. Histamine is synthesized from the amino acid histidine by mast cells and platelets.
5. Serotonin and melatonin are derived from methionine.

Select the option with all correct statements.

(A) 1, 2, 3, 4 only (B) 1, 2, 5 only
(C) 1, 3, 4 only (D) 2, 4, 5 only

96. An *E. coli* strain was developed where the operator of the lac operon was changed to that of the operator binding to the trp repressor. The following statements are made regarding the expected outcomes of this modification :

1. Expression of β-galactosidase will be observed when tryptophan is low in the medium.
2. While expression of β-galactosidase will be controlled by tryptophan levels, lactose permease expression will still be controlled by lactose levels.
3. The lac operon will be under attenuation control.

Which one of the following options represents all correct sentences ?

(A) 1 only
(B) 2 only
(C) Both 1 and 2
(D) Both 1 and 3

97. Nucleosome is a structural unit of chromosome consisting of

(A) 4 histone molecules and a specific length of DNA
(B) 8 histone molecules and a specific sequence of DNA
(C) 8 histone molecules and a specific length of DNA
(D) 4 histone molecules and specific sequence of DNA

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98. Name the protein that holds two sister chromatids together.

(A) Securin

(B) Separase

(C) Cohesin

(D) APC

99. The table below lists compound in Group I and targets in Group II.

Group I (Compounds)	**Group II (Target)**
P. Cyanide	1. K^+ionophore
Q. Antimycin A	2. Electron transfer from cyt-b to cyt-c
R. Valinomycin	3. Prevents electron transfer from Fe-S centre to ubiquinone
S. Rotenone	4. Cytochrome oxidase

Match the compounds in Group I with their correct targets in Group II.

(A) P – 3, Q – 2, R – 4, S – 1

(B) P – 4, Q – 3, R – 1, S – 2

(C) P – 4, Q – 2, R – 1, S – 3

(D) P – 3, Q – 4, R – 2, S – 1

100. Given below is names of scientists (Column X) and associated areas of recognition (Column Y).

Column X	**Column Y**
a. Z. Janseen	1. Proposed cell theory
b. R. Hooke	2. Discovered cell
c. R. Brown	3. Compound microscope
d. M. J. Schleiden and T. Sehwann	4. Discovery of nucleus

Which one of the following is a correct match between X and Y ?

(A) a – 1, b – 3, c – 2, d – 4

(B) a – 2, b – 1, c – 4, d – 3

(C) a – 3, b – 4, c – 2, d – 1

(D) a – 3, b – 2, c – 4, d – 1

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