Sikkim Public Service Commission

Main Written Examination for the Post of Sub Inspector

PAPER - II GENETIC ENGINEERING

Time allowed: 3.00 Hrs | Maximum Marks: 250

INSTRUCTION TO CANDIDATES

Read the instructions carefully before answering the questions: -

1. **IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.**
2. **Use only Black Ball Point Pen to fill the OMR Sheet.**
3. Do not write anything else on the OMR Answer Sheet except the required information.
4. **This Test Booklet contains 50 questions in MCQ Mode in Part I to be marked in OMR Sheet. Part II and Part III are Subjective Questions which have to be written on separate answer sheet provided to you.**
5. Before you proceed to mark in the Answer Sheet (OMR), you have to fill in some particulars in the Answer Sheet (OMR) as per given instructions.
6. After you have completed filling in all your responses on the Answer Sheet (OMR) and the examination has concluded, you should hand over the Answer Sheet (OMR) and separate answer sheet to the Invigilator only. You are permitted to take with you the Test Booklet.
7. **Marking Scheme**

   THERE WIL BE NEGATIVE MARKING FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBECTVE TYPE QUESTIONS

   i. There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, one-third of the marks assigned to the question will be deducted as penalty.
   ii. If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to the question.
   iii. If a question is left blank. i.e., no answer is given by the candidate; there will be no penalty for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

PART - I

Choose the correct answer for the following questions: **(3x50=150)**

1. **Which of the following organelle is surrounded by a single membrane?**
   A. Chloroplast
   B. Mitochondria
   C. Peroxisomes
   D. Nucleus

2. **Sister chromatids are separated during which stage of meiosis?**
   A. Metaphase I
   B. Metaphase II
   C. Anaphase I
   D. Anaphase II

3. **The nature of membrane lipids is ?**
   A. Zwitter ion
   B. Hydrophobic
   C. Amphipathic
   D. Uncharged

4. **Apoptosis cannot kill which of the following?**
   A. Cell infected with virus
   B. Cell with DNA damage
   C. Cancer cells
   D. Immune cells

5. **Colchicine arrest which of the following stages of cell division?**
   A. Anaphase
   B. Telophase
   C. interphase
   D. metaphase

6. **Amitosis is shown by ?**
   A. euglena
   B. syllis
   C. hydra
   D. bacteria

7. **DNA replication is?**
   A. Conservative
   B. Non- conservative
   C. Semi conservative
   D. None

8. **DNA unwinding is done by?**
   A. Ligase
   B. Helicase
   C. Topoisomerase
   D. Hexonuclease

9. **ABO blood group is not an example of?**
   A. Co dominance
   B. Multiple allele
   C. Epistasis
   D. Mendelian relations

10. **Erythroblastosis foetalis is caused by the following combinations?**
   A. Rh + male with Rh + female
   B. Rh + male with Rh - female
   C. Rh - male with Rh - female
   D. Rh + male with ABO female

11. **Which among the following helps us in getting a three- dimensional picture of the specimen?**
   A. TEM
   B. SEM
   C. Compound microscope
   D. Simple microscope

12. **Minimum distance for the eye to focus on any object is?**
   A. 11cm
   B. 25cm
   C. 32cm
   D. 42cm

13. **In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?**
   A. Exciter filter
   B. Barrier filter
   C. Dichroic mirror
   D. Mercury arc lamp

14. **Which of the following is true for the RNA polymerase activity?**
   A. DNA dependent DNA synthesis
   B. Direct repair
   C. DNA dependent RNA synthesis
   D. RNA dependent RNA synthesis

15. **Name the sigma factor which is used for promoter recognition?**
A. Sigma 32
B. Sigma 70
C. Sigma 60
D. Sigma 40

16. **Translation occurs in the ?**
A. Nucleus
B. Cytoplasm
C. Nucleolus
D. Lysosome

17. **Which is the energy rich molecule required for initiation of translation?**
A. ATP
B. GTP
C. CTP
D. AMP

18. **hsp 60 and 70 proteins are involved in?**
A. initiation of translation
B. elongation of translation
C. termination of translation
D. protein folding

19. **Point mutation involves?**
A. Deletion
B. Insertion
C. Duplication
D. Change in single base pair

20. **Which of these operons is anabolic?**
A. Lac
B. Ara
C. Trp
D. Phe

21. **We know that lactose has a positive impact on the activity of the lac operon. Tryptophan's presence has a?**
A. Positive feedback
B. Negative feedback
C. No difference
D. Highly positive impact

23. **Which of the following two traits is characteristic of a single gene?**
A. Seed colour and shape
B. lower colour and position
C. Colour of flower and seed coat
D. Height and colour of seed

24. **Which of Mendel's law is against the theory of Blending inheritance?**
A. Law of segregation
B. Law of dominance
C. Law of recessive
D. Law of independent assortment

25. **Which of Mendel's laws will be violated by linkage?**
A. Panspermia
B. Diminance
C. Segregation
D. Independent assortment

26. **If proteins are separated according to their electrophoretic mobility then the type of electrophoresis is?**
A. SDS PAGE
B.. Affinity Electrophoresis
C. Electro focusing
D. Free flow electrophoresis

27. **When is electrophoresis not used?**
A. Separation of proteins
B. Separation of amino acids
C. Separation of Lipids
D. Separation of nucleic acids

28. **During translation, proteins are synthesized?**
A. by ribosomes using the information on DNA
B. by lysosome using the information on DNA
C. by ribosomes using the information on RNA
D. by lysosomes using the information on RNA

29. **Tetracycline blocks protein synthesis by?**
A. inhibiting binding of aminoacylt RNA to ribosome
B. inhibiting initiation of translation
C. inhibiting peptidyl transferase
D. inhibiting translocase enzyme

30. **Which term represents a pair of contrasting characters?**
A. Heterozygous
B. Homozygous
C. Codominant genes
D. Allelomorphs

31. **9:7 ratio in the F2 generation represents?**
A. Incomplete dominance
B. Co-dominance
C. Epistasis
D. Complementary interaction

32. **Bolivar and Rodriguez constructed which vector?**
   A. Yip7
   B. R6-5
   C. pUC8
   D. Pbr322

33. **Size of Pbr322 is _____**
   A. 100 kb
   B. 10 kb
   C. 4.3 kb
   D. 1 kb

34. **Northern blotting is performed for _____**
   A. Determining the size of DNA
   B. Determining the size of RNA
   C. Quantification of RNA
   D. Sequencing of RNA

35. **The process by which a probe is used to screen a library is known as _____**
   A. Hybridization
   B. Southern blotting
   C. Colony hybridization
   D. Western blotting

36. **Which of the following is a mismatch?**
   A. Polymerase – Taq polymerase
   B. Template – double stranded DNA
   C. Primer – oligonucleotide
   D. Synthesis – 5' to 3' direction

37. **What is the capsid (protective coat) of the bacteriophage made up of?**
   A. DNA
   B. RNA
   C. Protein
   D. Organic acids

38. **The cycle which is completed quickly in the infection by a phage is _____**
   A. Lysogenic
   B. Lytic
   C. Replication
   D. Capsid formation

39. **Which infection cycle is characterized by retention of the phage DNA molecule in the host bacterium for many thousands of cell division?**
   A. Lysogenic cycle
   B. Lytic cycle
   C. Integrative Phase
   D. Protein synthesis

40. Which of the following viruses possess an envelope?

A. Herpesvirus
B. Reovirus
C. Tobacco mosaic virus
D. Papillomavirus

41. Which of the following is true for a plasmid?

A. Contains an origin of replication
B. Imparts a useful characteristic to the host bacterium
C. Possesses one or more genes
D. Replicates only when the host genome is undergoing replication

42. What does an E.Coli genomic library contain?

A. Recombinant clones of genes
B. Genes in E.coli genome
C. Expressed genes
D. Protein products

43. Euploidy is a chromosomal variation in _____

A. Size
B. Position of genes
C. Number
D. Structure

44. Which of the following case of duplication involves more than one chromosome?

A. Tandem duplication
B. Reverse tandem duplication
C. Displaced
D. Transposed

45. Plant cell wall is made up of?

A. Cellulose, hemicelluloses and pectin
B. Cellulose and chitin
C. Cellulose, hemicelluloses and chitin
D. Cellulose only

46. The light stained and diffused region of chromatin is known as?

A. Heterochromatin
B. Euchromatin
C. chromatin
D. none of these

47. **The expected phenotypic ratio obtained by crossing the F1 generation in dihybrid cross would be?**
   A. 3:1
   B. 1:2:1
   C. 9:3:3:1
   D. 1:2:1:2:4:2:1:2:1

48. **In case of incomplete dominance monohybrid F1 _____ is 1:2:1**
   A. Genotype
   B. Phenotype
   C. Bothe genotype and phenotype
   D. The ratio is wrong

49. **Which of the following is untrue about the genome mapping?**
   A. It doesn't lead to the understanding a genome structure
   B. It involves identifying relative locations of genes
   C. It involves identifying traits
   D. It involves identifying mutations

50. **Linkage _____ as the distance between two genes _____**
   A. Decreases, decreases
   B. Unaffected, Decreases
   C. Decreases, Increases
   D. Increases, Increases

PART - II

Attempt <u>ANY TWO</u> questions. **(25X2=50)**

1. Discuss the ultrastructure of mitochondria?
2. Describe the different forms of RNA's with their functions?
3. What is the molecular basis of crossing over?
4. Write in detail about mechanism of cell death and its significance?
5. What are the effects of autopolyploidy and allopolyploidy?

Write short notes on <u>ANY FIVE</u> of the following: **(10X5=50)**

1. Give a detailed account of the mechanism of cell cycle?
2. What is the chromosomal basis of sex determination in Drosophila?
3. Write short note on Hardy Weinberg Law?
4. What is the difference between Reo- dominant and Incomplete dominance?
5. Write note on the following
   a. Molecular basis of gene mutation
   b. Modern concept of sex determination
6. Describe various types of vectors with help of suitable examples?
7. How can we analyze polygenic traits?
8. Differentiate phase contrast and fluorescence microscopy?