



PREVIOUS QUESTIONS PAPERS DU MSC GENETICS (2018)

1. Which of the following statements about G proteins is FALSE?
 - (a) They must be activated before the cell can make needed cAMP.
 - (b) They become activated when bound to GDP.
 - (c) They are involved in signal cascades.
 - (d) They bind to and are regulated by guanine nucleotides.
2. Which one of the following statement about nitrogen fixation is correct?
 - (a) Plants convert atmospheric nitrogen to ammonia
 - (b) Mutant strains of rhizobium are able to secrete excess protein into the soil
 - (c) The enzyme nitrogenase reduces N₂ to form ammonia
 - (d) Ammonia is converted to N₂, which is the form of nitrogen most easily absorbed by plants
3. Which one of the following combination of scientist(s) and the experiment generated first conclusive evidence that DNA is the genetic material?
 - (a) Watson and Crick who gave a model for the structure of DNA
 - (b) Garrod, who postulated that Alkaptonuria, or black urine disease, is due to a mutation in the gene coding for important enzyme.
 - (c) Beadle and Tatum, who used a mutational and biochemical analysis of the bread mold Neurospora to establish a direct link between genes and enzymes
 - (d) Avery, MacLeod, and McCarty who repeated the transformation experiments and chemically characterized the transforming principle.
4. Which one of the following is the main contributor of the ascent of sap in the xylem vessels ?
 - (a) Root pressure
 - (b) Transpiration and cohesive forces
 - (c) Capillary action
 - (d) Atmospheric pressure
5. Which one of the following, studies the transcripts and proteins expressed by a genome?
 - (a) Structural genomics
 - (b) Comparative genomics
 - (c) Proteo genomics
 - (d) Functional genomics
6. Red hair is a recessive trait in humans. In a random mating population in Hardy-Weinberg equilibrium, approximately 9% of individuals are red-haired. What is the frequency of heterozygotes?
 - (a) 49%
 - (b) 18%
 - (c) 42%
 - (d) 81%
7. GTPase domain made up of alpha-helix and Beta pleated sheets in a certain relative orientation is an example of
 - (a) secondary structure
 - (b) primary structure
 - (c) quaternary structure
 - (d) tertiary structure
8. The migration of a protein on an SDS polyacrylamide gel is best described as inversely proportional to the
 - (a) isoelectric point
 - (b) log of carbohydrate content
 - (c) log of molecular weight
 - (d) negative charge





19. In a typical gene cloning experiment, by mistake a researcher introduced the DNA of interest within ampicillin resistant gene instead of lac z gene. The competent cells were allowed to take up the plasmid and then plated in the media containing ampicillin, X-gal and IPTG and subjected to blue-white screening. Considering all plasmids were recombinant which one of the following statements correctly describes the outcome of the experiment?
- All of the bacteria would grow and give white colonies.
 - The bacteria which took up the plasmids would grow and give blue colonies.
 - The bacteria which took up the plasmids would not grow.
 - The bacteria which took up the plasmids would form white colonies.
20. In a four-point (ABCD) cross between Hfr and F- strains of *E. coli*, the pair-wise frequencies of recombination fell in the following order :

$$AB > AC > AD$$

The most probable order of these genes on the bacterial chromosome would be:

- ABDC
 - ABCD
 - ADCB
 - ACDB
21. The RNA components of ribosomes are synthesized in the _____. [Question ID = 52116]
- nucleolus
 - endoplasmic reticulum
 - nucleus
 - Cytoplasm
22. Within the aqueous environment of an animal cell, sugars are stored as polymers rather than as monomers. If the sugars were stored as monomers instead of polymers, which of the following properties would be LEAST affected?
- pH
 - Freezing point
 - Boiling point
 - Viscosity
23. The key difference between dominance and epistasis is:
- dominance deals with two alleles; epistasis deals with two genes
 - dominance fits with Mendel's laws; epistasis is an exception to independent assortment
 - epistasis is a case of incomplete dominance
 - dominance expresses a relationship between two alleles; epistasis involves three or more
24. The end product of glycolysis of a glucose molecule is:
- 2 Pyruvate, NADH₂ and 2ATP
 - Pyruvate, NADH₂ and ADP
 - 2 Pyruvate, 2NADH₂ and ATP
 - Pyruvate, 2H⁺, 2e⁻ and 4 ATP
25. During eukaryotic cell division, metaphase to anaphase transition is regulated by degradation of
- Cyclin B1
 - Aurora A kinase
 - CDK1
 - Polo-like kinase
26. Fluorescence recovery after photobleaching in live cells is used to determine
- Co-localization of proteins
 - Diffusion of proteins
 - Distance between two organelles
 - Nucleic acid compactness
27. Monozygotic twin studies in humans are useful because:
- twins have a greater likelihood of being heterozygous for a given trait
 - more refined estimates can be made regarding location of the genes on chromosomes
 - they allow a true estimate of the environmental influences on phenotypic variation
 - they allow a true estimate of the genetic influence on phenotypic variation



28. Plasmid vectors used in cloning experiments often contain a fragment encoding the N-terminal 146 amino acids of β -galactosidase gene because:
- It enables the plasmid vector to replicate in *E. coli* host cells
 - It facilitates the ligation of the insert into the vector
 - It allows selection of *E. coli* host cells that contain plasmid in which the insert has been ligated
 - It allows selection of *E. coli* host cells that contain the plasmid
29. Calvin cycle represents one of the following phenomenon:
- Oxidative carboxylation
 - Dark respiration
 - Reductive carboxylation
 - Dark phosphorylation
30. When water is sprinkled on a red-hot iron plate, the drops become spherical and do not vaporize at once because:
- A layer of water vapour is formed between the plate and the drops which prevent heat conduction
 - At this place the temperature of the hot plate falls
 - Water molecules aggregate into drops
 - Boiling point of water rises
31. The initial mechanism for repairing nucleotide errors in DNA during replication is _____.
 (a) thymine dimers
 (b) nucleotide excision repair
 (c) DNA polymerase proofreading
 (d) mismatch repair
32. Why is it that inhaling nitric oxide reduces blood pressure only in lung tissue and not elsewhere in the body?
 Because
 (a) nitric oxide cannot cross plasma membranes
 (b) nitric oxide cannot enter the bloodstream
 (c) other body tissues use a different signalling molecule
 (d) nitric oxide breaks down quickly and thus cannot travel far
33. A non-competitive inhibitor of an enzyme-catalyzed reaction:
 (a) reduces K_m and increases V_{max}
 (b) no effect on K_m and reduces V_{max}
 (c) reduces K_m and reduces V_{max}
 (d) increases K_m and increases V_{max}
34. Removal of gene activity of A from a linear pathway results in higher than normal levels of transcripts from gene B. A reasonable hypothesis would be that:
- Gene B must act upstream to gene A
 - Increase in transcript B abundance is an experimental error
 - Gene A has no relation to transcript of gene B
 - Gene B acts downstream to gene A and is regulated by A directly or indirectly
35. A condition where the genotypic ratio obeys Mendelian laws while the phenotypic ratio does not is referred as:
 (a) test cross
 (b) back cross
 (c) epistasis
 (d) incomplete dominance
36. In human, cell cycle is regulated by all of the following EXCEPT:
 (a) Ubiquitinylation of proteins
 (b) Synthesis of cyclin proteins
 (c) Proteolysis of Cdks
 (d) Proteolysis of cyclin proteins





46. G-banding of metaphase chromosomes are
(a) Phyla specific (b) Species specific (c) Family specific (d) Genus specific

47. What is the anticodon sequence of tRNA used to translate the codon 5' AUU 3' present in the sequence of DNA template strand?
(a) 52 UAA-32 (b) 52 AUU-32 (c) 52 UUA-32 (d) 52 AAU-32

48. Substrate-level phosphorylation is catalyzed by which of the following enzymes?
(a) Pyruvate kinase (b) Hexokinase (c) Glycerol kinase (d) Galactokinase

49. During generation of a knockout mouse using homologous recombination, a viral thymidine kinase gene is often included in the vector outside of the region of homology between the vector and targeted chromosome. Which one of the following statement could best explanation of the purpose of this?
(a) To allow negative selection of cells in which integration of the targeting sequence has occurred by homologous recombination
(b) To allow positive selection of cells in which integration of the targeting sequence has occurred by homologous recombination
(c) To allow positive selection of cells in which integration of the targeting sequence has occurred by random insertion into the genome
(d) To allow negative selection of cells in which integration of the targeting sequence has occurred by random insertion into the genome

50. Following are some statements related to concepts of genetics:
(i) Segregation of alleles can occur at Anaphase II of meiosis
(ii) The alignment of chromosomes at Metaphase I leads to independent assortment
(iii) Independent assortment can lead to variation
Which of the above statements are correct?
(a) Only (i) (b) Only (ii)
(c) All (i), (ii) and (iii) (d) Both (i) and (ii)

51. If there were a gene for intelligence and the effect of that gene was altered by the inheritance of another gene, the latter gene would be referred to as a:
(a) Regulator gene (b) Sex controlled gene (c) Modifier gene (d) Pleiotropic gene

52. The number of introns in cDNA having 7 exons are
(a) 0 (b) 6 (c) 8 (d) 7

53. The primary effect of selection is to reduce the variability. The reduction in the frequency of extreme phenotypes by selection is called:
(a) Stabilizing selection (b) Cyclical selection
(c) Disruptive selection (d) Directional selection

54. The watery graveyard on earth for titanium fuel tanks and other high-tech space debris is better known as
(a) Final destination point (b) Point Zero
(c) Point Nemo (d) Doomsday point

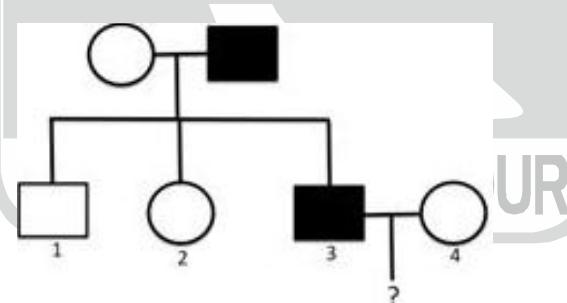
55. An auxotrophic mutant arises spontaneously in a wild type E. coli culture growing in a nutrient rich medium. Which one of the following techniques should be used to ensure the isolation of the auxotrophic mutant?
(a) Replica plating (b) Direct microscopic observation
(c) Antibiotic selection (d) Streaking for single colonies



56. Which of the following receptors is NOT present on cell surface?
- (a) Steroid hormone receptors
 - (b) Enzyme linked receptors
 - (c) Ion-channel linked receptors
 - (d) G protein coupled receptors
57. Which of the following processes is an example of allosteric regulation of protein activity?
- (a) Enzyme inhibition due to ATP binding
 - (b) Chaperonin-mediated protein folding
 - (c) Enzyme activation by a protein kinase
 - (d) Transit of the nuclear pore by RNA polymerase
58. Which one of the following statements about chromatin is NOT true?
- (a) DNA winds approximately 1.65 times around the nucleosomes
 - (b) H2A-H2B bind to both the entry and exit ends of DNA in nucleosomes
 - (c) Non-histone proteins are part of mitotic chromosomes
 - (d) Covalent modification of histones influence chromatin compaction
59. Which one of the following DNA polymerase is essential for both replication and repair of DNA in prokaryote?
- (a) DNA polymerase I
 - (b) DNA polymerase delta
 - (c) DNA polymerase II
 - (d) DNA polymerase III
60. X-rays passing through a strong uniform magnetic field:
- (a) Do not get deflected at all
 - (b) Get deflected in the opposite direction of the field
 - (c) Get deflected in the direction of the field
 - (d) Get deflected in the direction perpendicular to that of the field
61. In which one of the following microscopy techniques the specimen interfere with the wavelength of light to produce a high contrast image without the need of dyes or any damage to the sample?
- (a) Atomic force microscopy
 - (b) Fluorescence microscopy
 - (c) Phase contrast microscopy
 - (d) Bright field light microscopy
62. The value of which of the following parameters is zero when the cell is fully turgid?
- (a) Osmotic pressure
 - (b) Diffusion pressure deficit/water potential
 - (c) Turgor pressure/potential pressure
 - (d) Wall pressure
63. Organism with multiple sets of chromosomes from different species is called:
- (a) Allopolyploid
 - (b) Gametopolyploid
 - (c) Autopolyploid
 - (d) Heteropolyploid
64. Non-pigmented bacterial suspensions also show optical density in visible light, because of
- (a) non-specific refraction of light
 - (b) scattering of light
 - (c) absorption of light of specific wavelength
 - (d) refraction of specific wavelengths of light
65. A mixture of soluble proteins containing proteins X and Y is immunoprecipitated using anti-protein X antibody. Both protein X and protein Y are immunoprecipitated. Which of the following does NOT explain this observation?
- (a) Protein X and protein Y are present in the same organelle
 - (b) Protein X and protein Y are covalently bound.
 - (c) Protein Y is a truncated version of protein X.
 - (d) Protein X and protein Y are part of the same multimeric complex.



66. A breeder identified a variegation mutant in the leaf colour in a normal green population of maize. To study the genetics of this mutant he made a cross between variegated and green plants using variegated as the female parent. All the F₁ and F₂ progeny were variegated. The leaf variegation in maize could be due to:
- (a) Maternal inheritance
 - (b) Maternal effect
 - (c) Mendelian inheritance
 - (d) Mendelian inheritance, with variegated being dominant over green
67. Which one of the following changes will not alter the sequence of the encoded protein?
- (i) Codon optimization
 - (ii) Gene methylation
 - (iii) Synonymous mutation
 - (iv) Missense mutation
- | | | | |
|-------------|--------------|------------|------------------|
| (a) i & iii | (b) ii & iii | (c) i & iv | (d) i, ii, & iii |
|-------------|--------------|------------|------------------|
68. The genotype of F₁ individuals in a tetrahybrid cross is AaBbCcDd. Assuming that genes are independently assorting, what is the probability that the F₂ progeny will have the genotype AABccDd?
- (a) 2/256
 - (b) 1/256
 - (c) 1/64
 - (d) 2/64
69. How should a student prepare 100 mL of 1.0 M H₂SO₄ solution from a 10 M H₂SO₄ solution?
- (a) Adding 10 mL of 10M H₂SO₄ to 90 mL of H₂O
 - (b) Adding 10 mL of 10M H₂SO₄ to 80 mL H₂O, stirring and diluting to 100 mL after allowing to cool
 - (c) Adding 80 mL of H₂O to 10 mL of 10M H₂SO₄, stirring and diluting to 100 mL after allowing to cool
 - (d) Adding 90 mL of H₂O to 10 mL of 10M H₂SO₄
70. The following is a pedigree of a family from a marriage between first cousins. The family shows a rare X-linked trait whose inheritance pattern is shown below. The son (individual-3) showing the trait marries outside the family?



The following statements were made regarding the above trait.

- (i) The trait is recessive.
- (ii) The trait is dominant.
- (iii) The probability that the daughter (individual 2) is a carrier is 0.
- (iv) The probability that the daughter (individual 2) is a carrier is (a)
- (v) The probability that a son (?) born to individual 3 and 4 will show the trait is 0.
- (vi) The probability that a son (?) born to individual 3 and 4 will show that trait is 1/(b)

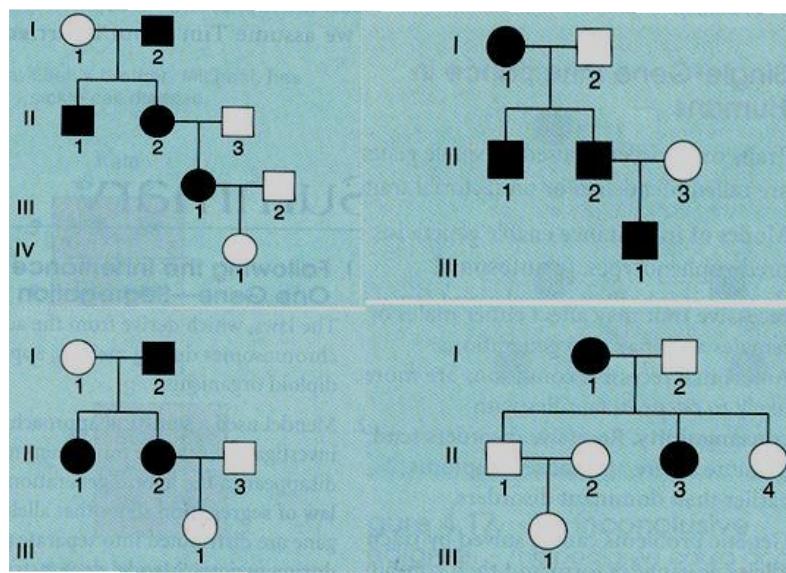
Which of the above statements are correct?

- | | |
|------------------------|--------------------------|
| (a) (i), (iv) and (v) | (b) (ii), (iii) and (vi) |
| (c) (ii), (iv) and (v) | (d) (i), (iii) and (vi) |

71. The basic unit of radioactive decay is Curie (Ci), 1Ci is equivalent to 2.22×10^{12} dpm (disintegrations per minute). The disintegrations actually detected by an instrument are referred to as counts per minute (cpm), cpm = dpm \times detection efficiency. For example if an instrument has 25% efficiency, 100 cpm = 400 dpm. (Use this information for answering the question below)

The radioactivity in a material was measured to be 5.55×10^{10} cpm using an instrument with 50% efficiency. How many Curies does this correspond to ?

72. Below are four pedigrees depicting families with achondroplasia, a common form of hereditary dwarfism. What is the most likely mode of inheritance ?



- (a) X-linked dominant
 - (c) Autosomal dominant

- (b) Autosomal recessive
 - (d) X-linked recessive

73. You have a mixture of three proteins in a Tris-Cl, pH 7.5 solution with the following molecular weight (mw) and isoelectric point (pi) : P1 (mw 40 kDa, pi 7.4), P2 (mw 150kDa, pi 7.2) and P3 (mw 250kDa, pi 7.3) respectively. What would be the most appropriate technique to separate them in an active form ?

74. 0.1 ml of a bacterial culture is diluted into 9.9 ml of buffer; 0.1 of this dilution is again diluted in 9.9 ml of fresh buffer. Plating 0.1 ml from the second dilution tube yield 72 colonies on a petri plate. What is the cell density of the original culture ?

75. The genotypes of a husband and wife are $I^A I^B \times I^A i$. Among the blood types of their children, how many different genotypes and phenotypes are possible?

76. It was important that Mendel examined not just the F_1 generation in this breeding experiments, but the F_2 generation as well, because
- many of the F_1 progeny died
 - parental traits not observed in the F_1 generation reappeared in F_2 generation
 - he obtained very few F_1 progeny, making statistical analysis was difficult
 - the dominant phenotypes were visible in the F_2 generation, but not the F_1 generation
77. The level of a pigment in an organism, is controlled by a single gene with many alleles. Two individuals with varying levels of pigment are crossed to obtain F_1 progeny. The level of pigments in the parents and the F_1 is as follows :

Parent A = 100, Parent B = 10, F_1 = 60

Based on this observation which one of the following best explains the relationship between the pair of alleles governing pigment levels in parents A and B ?

- Over-dominance
 - Incomplete dominance
 - Polygenic
 - Co-dominance
78. The following statements were made about polytene chromosomes in *Drosophila*:
- Polytene chromosomes are arrested in the metaphase stage of the division without dissolving the synaptonemal complex.
 - A pair of homologous are synapsed to make the arms of a polytene chromosome.
 - The chromocentre of the polytene chromosome is formed by the fusion of the centromeres.
 - Polytene chromosomes are transcriptionally active.

Which of the above statements are CORRET ?

- Statements (i), (ii) and (iii)
 - Statements (iii) and (iv) only
 - Statements (i), (ii) and (iv)
 - Statements (ii), (iii) and (iv)
79. The quantity of DNA can be measured by taking absorbance of a sample at 260 nm. Consider that 1OD corresponds to 50 μ g DNA/mL. A 2 mL sample of DNA showed an OD of 0.5. What is the amount of DNA (in ng) in 200 μ L of the DNA sample ?
- 250
 - 1000
 - 2500
 - 5000

80. A phenotypic ratio of 9:3:3:1 was obtained in the F_2 progeny of the dihybrid cross in the experiment of Grego Mendel.

The following statements refer to the above finding :

- The two alleles of a gene have a dominant -recessive relationship.
- The two alleles are co-dominant.
- The alleles of a gene segregate from each other.
- The genes assort independently.

Which of the above statements are correct ?

- Only iv.
- i, ii, iii and iv
- i, iii and iv
- Only i and iv



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81. In humans a gene can be mapped to a chromosome by somatic cell hybridization. In this technique, human and mouse somatic cells are fused. In the human-mouse cell hybrids, the human chromosomes are gradually lost in a random fashion. Thus different cell lines derived from the hybrid contain fewer sets of the human chromosomes. The human chromosomes in the hybrid cells can be identified by banding techniques and the presence of the gene under study can be identified in the different cell lines by studying the protein encoded by it. A gene mapping experiment was carried out to identify the location of gene 'X' using the above strategy, results of which is summarized below :

Cell Line	A	B	C	D	E	F	G
Protein X	+	-	+	+	-	-	-
Chromosome 3	+	+	+	-	-	+	-
Chromosome 5	-	-	+	+	+	-	+
Chromosome 6	+	-	+	+	-	-	-
Chromosome 8	+	+	-	-	-	+	+
Chromosome 9	-	+	-	-	+	+	-

Based on the above data identify the chromosome on which gene 'X' is located.



86. A mutant *E.coli* strain synthesizes the enzymes permease and β -galactosidase irrespective of the presence of the inducer (allolactose). This can result from
 (i) mutations in the operator region.
 (ii) mutations in the repressor gene.
 (iii) mutations in the structural genes.
 (iv) mutations in the promoter region.
- Which of the above options are correct ?
- (a) Both (i) and (iv) (b) Both (ii) and (iii) (c) Both (i) and (ii) (d) Both (ii) and (iv)
87. Rifampicin, an inhibitor of RNA polymerase, is added to a bacterial culture. The culture is immediately divided into three fractions, to which radioactive thymine or uracil or methionine are added, respectively. Five minutes later the cells are lysed and the radioactive label in all macromolecules is monitored. What will you observe?
 (a) The labels will be equally incorporated
 (b) Thymine and methionine incorporation will be greater than uracil
 (c) Uracil incorporated is similar to methionine but less than thymine
 (d) Uracil incorporated will be greater than methionine but less than thymine
88. Unequal contribution to heredity by males and females can be detected by
 (a) Dihybrid cross (b) Reciprocal cross (c) Test cross (d) Back cross
89. Dosage compensation in humans is brought about by
 (a) hypoactivity of both X-chromosomes in females (b) hyperactivity of autosomes in females
 (c) hyperactivity of single X-chromosome in males (d) inactivity of one X-chromosome in females
90. If non-disjunction occurs in meiosis I, which of the following scenario is most likely to occur
 (a) One gamete will be $n+1$, two will be n and one will be $n-1$
 (b) Two gametes will be normal and two will be $n-1$
 (c) Two gametes will be normal and two will be $n+1$
 (d) Two gametes will be $n+1$ and two will be $n-1$
91. Which of the following parameters are NOT USED to describe the DNA topology
 (a) The arrangement of the DNA in the nuclear matrix
 (b) The path of the DNA backbone in space due to torsional stress
 (c) The frequency of the helical turns
 (d) The number of times within certain boundaries that the two strand makes a 360 degree turn
92. Zebrafish exhibit horizontal stripes of pigment cells in the skin. A small fraction of a zebrafish population grown in a pond that is contaminated with a mutagen exhibits blue spots in addition to the horizontal stripes. DNA sequence analysis confirms that cells within the blue spots possess a mutation in a gene that controls pigmentation. However, when these blue spotted fish are crossed to the normal (wild type) fish these spots do not appear either in F1 or F2 generation. This can be explained by the fact that the mutation leading to blue colouration
 (a) gets corrected in the subsequent generations (b) is a somatic mutation
 (c) is a recessive mutation (d) is a dominant mutation
93. In glycoproteins, the carbohydrate moiety always gets attached through which of the following amino acids?
 (a) Glutamine or arginine (b) Tryptophan or phenylalanine
 (c) Aspartate or glutamate (d) Asparagine, serine, or threonine



94. Compound tissue could be best defined as:
- Similar types of cells at different locations performing many functions
 - Similar types of cells held together by connective tissue
 - Different types of cells with varying structure and function
 - Different types of cells performing one function
95. A test cross is generally carried out to :
- identify homozygous recessive individuals in the F_2
 - determine which allele is dominant and which is recessive
 - determine if two genes assort independently
 - identify heterozygous individuals with the dominant phenotype
96. Hershey and Chase's experiment to demonstrate that DNA is the genetic material used radioactivity to label proteins and DNA. For this, the bacteriophage was allowed to grow in media containing radioactive phosphorus or radioactive sulphur. It is expected that
- radioactive sulphur will label proteins and radioactive phosphorus will label DNA
 - radioactive sulphur will label DNA and radioactive phosphorus will label proteins
 - both the labels will be found in DNA and proteins to the same extent
 - radioactive sulphur will label both DNA and protein
97. Fill in the missing words to the quote: "Statistical methods may be described as methods for drawing conclusions about _____ based on _____ computed from the _____".
- | | |
|--------------------------------------|--------------------------------------|
| (a) Populations, Statistics, Samples | (b) Parameters, Samples, Statistics |
| (c) Samples, Statistics, Parameters | (d) Statistics, Samples, Populations |
98. According to the classical taxonomical system, order the following from the most general taxonomic group to the most specific group is:
- Phylum, Kingdom, Order, Family, Class, Genus, Species
 - Phylum, Kingdom, Class, Family, Order, Genus, Species
 - Kingdom, Phylum, Class, Order, Family, Genus, Species
 - Kingdom, Order, Class, Phylum, Family, Genus, Species,
99. The technique used for demonstrating semi-conservative mode of replication by Meselson and Stahl in *E. coli* was:
- | | |
|-------------------------|----------------------------|
| (a) Autoradiography | (b) Spectroscopy |
| (c) Gel Electrophoresis | (d) Density Centrifugation |
100. Assume that blue flower of a plant is dominant character over white. When a blue flowered plant is crossed with white flowered plant, the progeny showed 50% of plants with blue flowers and 50% of plants with white flowers. The genotypes of blue and white parents respectively are
- | | | | |
|-----------|-----------|-----------|-----------|
| (a) BB,Bb | (b) BB,bb | (c) Bb,bb | (d) bb,bb |
|-----------|-----------|-----------|-----------|

