DU_GENETICE_2017

1. A decrease in the atomic number is not observed in case of :

   (a) electron capture (b) β -emission (c) α -emission (d) postron emission

2. Of the following, Coomasse day stains proteins by reacting with :

   (a) arginine residues (b) free C-termini (c) peptide bonds (d) aromatic ring

3. The colors of oil film seen on water near petrol station are due to which phenomenon of light?

   (a) Diffraction (b) Interference (c) Polarization (d) Refraction

4. In the 19th century, jeener vaccinated many people against smallpox. He vaccinated people with :

   (a) a dose of attenuated smallpox

   (b) smallpox antibodies taken from a rhesus monkey

   (c) a small dose of smallpox

   (d) a small dose of cowpox

5. Lichens are the best indicatior of :

   (a) water pollution in hills (b) air pollution in cities

   (c) deficiency of water in the soil (d) deficiency of CO_2 in air

6. Tu You you was awarded the Nobel prize in medicine in 2015 for her contribution to the discovery and used of :

   (a) Ephedrine to fight asthma (b) Artemisin to combat malaria

   (c) Averctin against filariasis (d) Ginseng for enhacing immunity

7. Bright light in various shapes and size are observed after we press our eyesshut with our palms to block all visible light. Currently, the most likely explanation for this is :

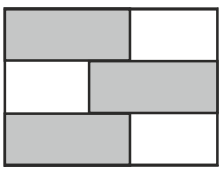
   (a) Visual memory (b) Defects in retina

   (c) Mechanical stimulation of retinal cells (d) Floating particles in the eye

8. If one gram of a radioactive substacne was reduced to 0.0312 gm in a time of 100 hrs, the $t_{1/2}$ of the substance is :

   (a) 10 hrs (b) 20 days (c) 20 hrs (d) 31 hrs

9. A square pattern of white and grey paving stones, as shown below, is used for paving a rectangular path of 3 m × 0.9 m. In this pattern, the white sequares have sides of 10 cm each, and two white sequares exactly cover one grey rectangle. How many grey rectangles are needed to pave the path?



   (a) 30 (b) 60 (c) 90 (d) 120

10. In the Calvin cycle of C_3 plants what molecule is the acceptor of CO_2 ?

(a) Erythrose-4-phosphate (b) Ribulose-1, 5-diphosphate

(c) Ribose-5-phosphate (d) Glucose

11. In an experimental set-up to measure rate of photosynthesis, what would be the result of stomatal closure?

(a) The rate of photosynthesis will begin to show and then stop.

(b) There will be essentially no effect on photosynthesis.

(c) Water conservation will cause the rate of photosynthesis to increase.

(d) O_2 release will stop and dramatic increase in O_2 uptake will begin.

12. When we are in a supine position for a long time and then suddenly stand upright, we often experience momentary dizzines. In a normal individual, free from disease, the most likely reason for this is :

(a) Inner ear fluid disbalance

(b) Effect of gravity on the cardiovascular system

(c) Sudden pressure at the base of the skull

(d) Compression in the lung

13. Energy is stored in the ATP molecule in its :

(a) sugar portion (b) adenine portion

(c) third phosphate bond (d) sugar-adenine bond

14. During glycolysis, electrons removed from glucose are passed onto :

(a) FAD (b) NAD^+ (c) acetyl CoA (d) pyruvic acid

15. You have a mixture of four proteins (P_1 -P_4) in a Tris - Cl, pH 7.5 solution. The isoelectric point (pI) of each protein is P_1 : 4.5, P_2 : 9.6, P_3 : 10.7 and P_4: 5.6. You separate them on a cation exchange column. Which best represents the distribution of protein(s) in the flow through and eluate fractions ?

(a) Flow through : P1, P2, P3 and eluate P4 (b) Flow through : P1, P2 and eluate P3, P4

(c) Flow through : P1, P2, P3, P4 and eluate none (d) Flow through : P2, P3 and eluate P1, P4

16. Which of the following may have catalytic activity?

(a) DNA (b) Phospholipids (c) Glycogen (d) RNA

17. An enzyme has a V_{max} of 50 μmol prodcut fromed (minute x mg protein)$^{-1}$ and a K_m of 10 μM for the substrate. When a reacion mixtrue contains the enzyme and 5 μM substrate, which of the following percentatges of the maximum velocity will be coloset to the initial reaction rate ?

(a) 25.2% (b) 16.6% (c) 33.2% (d) 66.4%

18. Insulin's ability to enhance glucose transport is primarily due to :

(a) phosphorylation of glucose

(b) a change in the affinity of the transporters to glucose

(c) a decrease in the activity of $Na^+ - K^+$ pump

(d) an increase in the number of glucose transporters in the plasma membrane

19. Which of the following techniques can be reliably used to study direct protein : protein interaction?

(a) Fluorescence resonacne energy transfer (FRET)

(b) Fluorescence recovery after photobleaching (FRAP)

(c) Yeast three hybrid system

(d) Serial analysis of gene expression (SAGE)

20. Equllibrium density ultracentrifugation will be ineffective for fractionation of :

(a) nucleic acids (b) viruses (c) ribosomes (d) proteins

21. During DNA replication, the sequence 5'TAGA3' will produce the following complementary sequence :

(a) 5'ATCT3' (b) 5'AUCU3' (c) 5'TCTA3' (d) 5'UCTA3'

22. The chromosome of a certain bacterium is a circular, dsDNA molecule of 5.2×10^6 base-pairs. If the rate of replication-fork movement is 1000 nucleotides per second, what will be approximate time required to replicate the chromosome?

(a) 87 minutes (b) 44 minutes (c) 22 minutes (d) 11 minutes

23. The base in the wobble position of a codon

(i) is the 5' (first) base

(ii) is the 3' (third) base

(iii) may form non-standard base-pair with an anti-codone

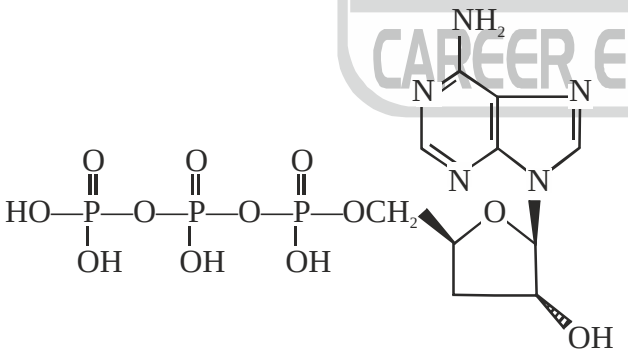
(iv) often contains inosine

Which of the statements are correct?

(a) (i), (iii) and (iv) (b) (ii), (iii) and (iv)

(c) (i) and (iii) (d) (ii) and (iii)

24. Cordycepin 5 triphosphate is an anglog of ATP with the following chemical structure



What is the most likely mechanism of its action on transcription?

(a) By binding and sequestration of RNA polymerase

(b) By inhibiting elongation of mRNA

(c) By interfering with the energy requirements

(d) By not allowing A : T base - pairing

25. Among the following molecular process-biological effect pairs, identify the mismatched pari.

(a) Histone deacetylation - activation of gene expression

(b) Protein phosphorylation - signal transduction

(c) DNA methylation - sex - specific control of gene expression

(d) Proteolytic cleavage - activation of signaling by peptide hormones

26. A single molecule of DNA is amplified by PCR for 25 cycles. Theoretically, how many molecules of amplicon will be produced?

(a) 25 (b) 1^{25} (c) 2^{25} (d) 25^2

27. Which one of the following techniques is used for genome editing?

(a) Targeting Induced Local Lesions in Genomes (TILLING)

(b) RNA interference (RNAi)

(c) Clustered regularly interspaced short palindromic repeates (CRISPR)/Cas

(d) Antisense RNA

28. Which of the following techniques uses days that specifically stain the centromeric region of a chromosome?

(a) C banding (b) G banding (c) R banding (d) Q banding

29. Due to inturning of the cell sheet during gastrulation in frog embryo a cavity is formed, which grows in size as gastrulation progresses. The cavity thus formed is known as :

(a) Blastocoel (b) Enterocoel (c) Archenteron (d) Pseudocoel

30. Which of the following is often referred to as the 'natural genetic engineer' ?

(a) *Azotobacter* (b) *Aspergillus* (c) *Agrobacterium* (d) *Azospirullum*

31. Which of the following is true for both prokaryotic and eukaryotic gene expression?

(a) After transcription a 3' poly-A tail and a 5' cap is added to the mRNA

(b) Translation of mRNA may begin before transcription is complete

(c) RNA polymerase may recognize a promoteer region upstream from teh gene

(d) The mRNA transcript is alway co-linera to the gene from which it was transcribed

32. During replication, DNA polymerase utilizes :

(a) bases as precursors

(b) nucleosides as precursors

(c) deoxynucleotide monophosphates as precursors

(d) deoxynucleotide triphosphates as precursors

33. The Z form of DNA :

(a) is inhibited by methylation of bases (b) is a permanent conformation of DNA

(c) tends to be found at the 3' end of genes (d) is favoured by alternating GC sequence

34. The Michaelis - Menton constant, K_m of an enzyme is :

(a) substrate concentration at maximal activity

(b) substrate concentration at half initial reaction rate

(c) normal substrate concentration that occurs under physiological conditions

(d) substrate concentration at half maximal velocity

35. Which one of the following is used by the mismatch repair system to distinguish parental strand from daugher strand?

(a) methylated adenines in GATC sequence on the parental strand

(b) methylated adenines in GATC sequence on the daughter strand

(c) methylated cytosine on the parental strand

(d) methylated cytosine on the daughter strand

36. A culture of bacteria was grown for many generations in a medium in which only N^{15} was available as source of nitrogen. The culture was then switched back to N^{14}. After one generation, DNA was isolated and analyzed by CsCl density gradient. How many bands do you expect ?

(a) One (b) Two (c) Three (d) Four

37. Ubiquitination is a proccess that involves protein degradation. Which of the following is correct in the context of ubiquitination?

(a) Ubiquitin is a heterocyclic compound and is attached to the target protein by enzyme ubiquitinasee

(b) Ubiquitin is a polypeptide and is attached to the target protein by ubiquitin ligase

(c) Ubiquitin is a quinine compound and is attached to the target by ubiquitin ligase

(d) Ubiquitin is a derivative of CTP and is attached to the target protein by ubiquitin ligase

38. In the fairy-tale 'Jack and the Bean stalk', the bean plants grew very tall. Treatment with which one of the following is most likely to result in such a phenotype ?

(a) Auxin (b) Gibberellin (c) Cytokinin (d) Ethylene

39. A bacteriophage is unlikely to infect a mammalian cell becuase :

(a) bacteriophage needs bacterial cells before invading mammalian cell

(b) animal cells are normally lysed in presence of bacteriophage

(c) bacteriophage are normally lysed in presence of animal cells

(d) the structrue and regulatory machinery of aminal cells are not compatible with bacteriophage

40. Which of the following is not a polymer of Glucose?

(a) Maltose (b) Inulin (c) Amylopectin (d) Cellulose

41. The conversion of alanine to carbohydrate is best described as a process of :

(a) ketogenesis (b) gluconeogenesis (c) glycogenesis (d) glycolysis

42. Which one of the following represents a cluster of genes that control development in *Arabidopsis, Drosophila* and mice ?

(a) Homolgous (b) Heterologous (c) Homeotic (d) Clusterd

43. A hybridoma cell secreting mouse monoclonal antibodies can be generated by :
(a) fusing spleen cells from immune mice with any cell from that mice
(b) culturing B cells in the presence of B cell grwoth factors
(c) transforming splenic B cells from an immune response with Epstein Barr virus
(d) fusing spleen cells from an immune mice with an appropriate plasmacytoma cell-line

44. the number of haploid chromosomes in a cell is referred to as 'n' and the equivalent quantity of DNA is represented by 'c'. A diploid cell at metaphase has :
(a) n : c (b) 2n : 2c (c) 2n : 4c (d) 4n : 4c

45. A study was designed to test the effect of a novel drug 'X' on mammalian cells. The drug 'X' was incubated with the mammalian cells at 37°C for 2 hours following which changes in transcriptome of the cells were analyzed. Which among the following is the most appropriate control of the experimen?
(a) Mammalian cells incubated with 'X' at 24°C for 2 hours
(b) Mammalian cells incubated with 'X' at 37°C for 5 minutes
(c) Mammalian cells incubated without 'X' at 37°C for 2 hours
(d) Mammalian cells incubated with 'X' along with an inhibitor of 'X' at 37°C for 2 hours

46. Which of the following is an INCORRECT match of the excretory system to its organism?
(a) Annelids - Nephridia (b) Molluscs - Siphons
(c) Arthropods - Coxal glands (d) Insects - Malphigian tubes

47. In biological sciences, the null hypothesis is usually rejected if the value of p is
(a) greater than 0.5 (b) equal to 1 (c) less than 0.05 (d) less than 0.95

48. Tryptophan is a precursor in the biosynthesis of :
(a) Insulin (b) Melationin (c) Calcitonin (d) Prolactin

49. In hybridization experiments, high stringency washing means washing in the presence of :
(a) low salt concentratin and high temperature
(b) high salt concentration and high temperature
(c) high salt concentration and low temperature
(d) only water

50. Membrane-bound and free ribosomes are structurally identical, but differ only at a given time in terms of association with :
(a) Acetylated proteins (b) Glycosylated proteins
(c) Phospholipids (d) Nascent proteins

51. A plasmid may have the following characteristics :
(i) an origin of replication
(ii) a regulatable promoter
(iii) a gene conferring antibiotic resistance
(iv) the ability to alternate in the cell between linear and circular form
(v) multiple cloning site

To be useful in the preparation of recombinant DNA, a plasmid must have which of the above ?
(a) ii, iii, iv, v (b) i, iii, iv, v
(c) i, iii, v (d) i, ii, v

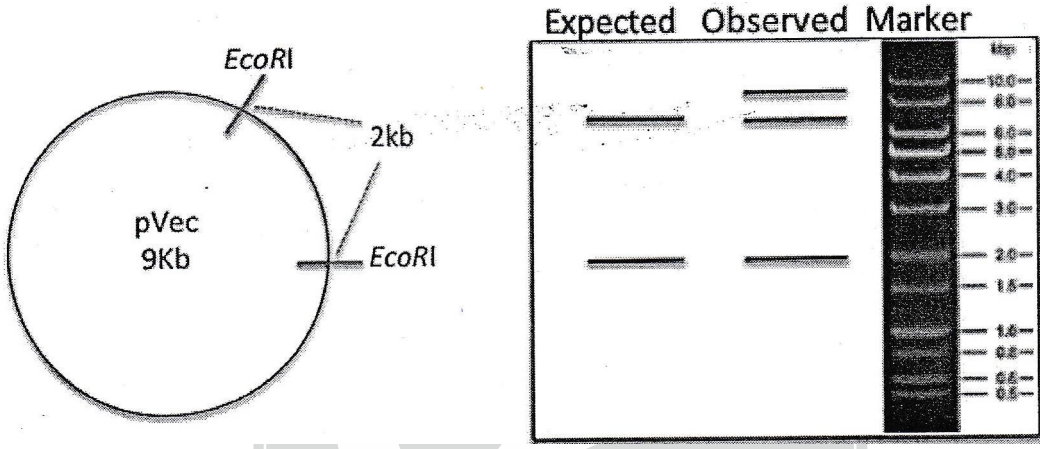
52. Jonita was asked to ligate an*EcoRI* digested 1 kb fragment of a gene into an *EcoRI* site of a pUC19 vector. However, after the ligation reaction and screening, she failed to observe and ligated products. Which one of the following is she likely to have added by mistake in her ligation mixutre along with the DNA ligase?

(a) Polynucleotide kinase
(b) T4 DNA Polymerase
(c) Alkaline phosphatase
(d) Ribonucleotide reductase

53. Which one of the following CANNOT be used to simultaneously screen for both transformed and untransformed *E.coli* cells ?

(a) Green Fluorsescent Protein (GFP)
(b) β -galactosidase
(c) Ampicillin
(d) Luciferase

54. A student was asked to digest a vector (pVec, size 9 kb) with restriction enzyme, *EcoRI*.



Since there are two sites for *EcoRI* present on the vector the result on Agarose gel was expected to be of two fragments (as shown in the hypothetical illustration). However, three bands were observed of size, 9kb, 7kb and 2kb.

What is the most likely reason for this observation ?

(a) Incomplete digestion
(b) Contamination with another vector
(c) Mutation
(d) Endonuclease activity

55. *Naja naja, Gorilla gorilla, Rita rita* are scientific names with same generic and species names. Such pattern of nomenclature is known as :

(a) Synonym (b) Homonym (c) Tautonym (d) Montypic species

56. Differentiation of most somatic cells generally does not appear to involve the loss of genes or recombination of DNA segments. The most striking exception to this rule is found in :

(a) immunoglobulin genes
(b) mitochondrial genes
(c) histone genes
(d) ribosomal RNA genes

57. When an Arabidopsis plant was shifted from a long day photoperiod to a short day photoperiod, an increase in the transcription of five genes involved in circadian rhythm was reported. Whcih one of the following would be the most appropriate technique to demonstrate increased transcription of these gene

(a) Southern hybridization
(b) Northern hybridization
(c) Western hybridization
(d) Fluorescence *in situ* hybridization

58. The sticky 3' overhangs produced by *Pst*I : CTGCA/G can be converted into blunt ends by :

(a) filling in using terminal transferase

(b) filling in using Klenow fragment of DNA polymerase

(c) removal of the over hang with Endonuclease V

(d) removal of the over hang with Klenow fragment

59. Auxanometer is used for measuring :

(a) respiratory activity in plants (b) rate of growth in plants

(c) photosynthetic activity (d) osmotic pressure

60. Following are a set of events in *E. coli* that can be regulated during transcription and translation:

(i) rate of coupling of transcription and translation

(ii) Ribosome pausing during translation

(iii) Rate of translation initiation

(iv) Level of aminoacylated tRNAs

(v) Formation of rho-independent terminator

(vi) Formation of rho-dependent terminator

(vii) Level of amino acid

With reference to tryptophan operon, which of the above play a role in the phenomenon of attenuation?

(a) (i), (iii), (iv), (vii) (b) (i), (ii), (iv), (v), (vii)

(c) (i), (ii), (iii), (iv), (vi) (d) (i), (ii), (vi), (vii)

QUESTION FROM 61 TO 80 ARE COMPULSORY

61. As per Hardy-Weinberg equilibrium, if the frequency of the two alleles is 0.6 and 0.4, the genotype frequencey of heterozygotes in the population will be :

(a) 0.80 (b) 0.64 (c) 0.48 (d) 0.32

62. Evolution of multi-gene family occurs by :

(a) random mutations (b) only gen duplication

(c) only unequal crossing - over (d) both duplication and unequal crossing over

63. Which of the foetus with following karyotypes will not survive at birth?

(a) 47, XY, + 13 (b) 47, XX, + 18 (c) 47, XY, + 21 (d) 45, Y

64. What is an auxotrophic mutant ?

(a) A mutant that can grow on minimal medium on which a wild type cannot grow

(b) A mutant that requires an antibiotic for its growth

(c) A mutant that requires nutrients that are not required by wild type

(d) A mutant that can grow on restrictive temperatures

65. For the Ab Bb cc Dd X Aa bb CC Dd, what is the chance of obtaining a progeny which shows all the dominant traits ?

(a) 0 (b) 9/32 (c) 9/64 (d) 16/64

66. For a given gene (AA), a diploid cell at metaphase will have :

(a) 2 copies of the allele on 2 chromosomes (b) 2 copies of the allele on 4 chromosomes

(c) 4 copies of the allele on 2 chromosomes (d) 4 copies of the allele on 4 chromosmes

67. The defective protein causing sickle cell anemia is due to the substitution of one nucleotide in the gene *HBB* on chromosome number 11, resulting in the change of the codon GAG (which encodes for glutamic acid) to a codon GTG (which encodes for valine). This mutation represents:

(a) transition (b) transversion

(c) transposition (d) paramutation

68. Two genes A and B are located at a distacne of 60cM on a linkage group. Based on this statement which of the following comments is correct?

(a) There is 60% recombination between A and B

(b) The distance between A and B was derived using a third maker

(c) There is 30% recombination between A and B

(d) The observation is wrong; the genes A and B are actually unlinked

69. A mechanism that can cause a gene to move from one linkage group to another is :

(a) Translocation (b) Inversion (c) Crossing-over (d) Duplication

70. F_1 progeny resulting from a parental cross involving two linked genes were test-crossed. The progeny obtained were :

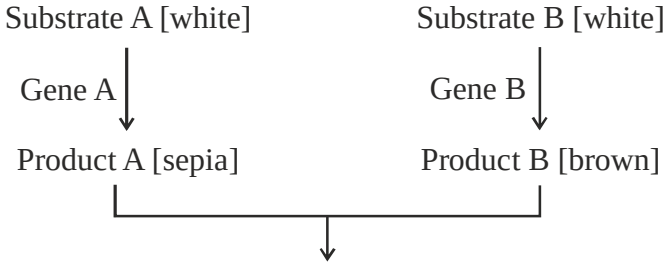
Cenotype	Precentage
AaBb	45
aabb	45
Aabb	5
aaBb	5

Based on the above result, what was the genotype of the individuals in the parental corss?

(a) AABB X aabb (b) AAbb X aaBB

(c) AaBb X aabb (d) AbBb X AABB

71. In a hypothetical example, while allele A and B control the pathway regulating the brick-red flower color as shown below, mutant allele a and b code for a non-funtional enzyme.



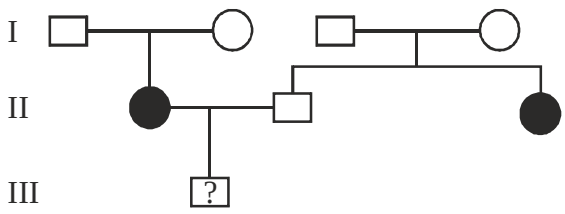
If a plant heterozygous for genes A and B is selfed, what percentage of the progeny will have sepia colored flowers?

(a) 9/16 (b) 3/16 (c) 2/4 (d) 1/4

72. A cross between a hybrid and its recessive parent is known as :

(a) Back cross (b) Test croos (c) Dihybrid cross (d) Monohybrid cross

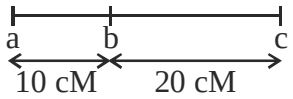
73. The following pedigree represents the inheritance of an autosomal recessive trait



What is the probability that the child (marked as ?) in the generation III is showing the trait?

(a) 1/3 (b) 1/6 (c) 1/4 (d) 1/8

74. The following represents a genetic map for three genes a, b and c in *Drosophila.*



If a female heterozygous for the three genes are test-corssed, what percentage of the progeny will result from double cross over events, assuming there is no interference ?

(a) 1.0 (b) 1.5 (c) 2.0 (d) 3.0

75. A female from a pure-breeding strain of *Drosophila* with vermillion-coloured eyes is corssed with a male from a pure-breeding wild type, red-eyed, strain. All the F_1 males males have vermillion eyes while all the females have wild type red eyes. Which of the following conclusions may be drawn from this observation with respect to the inheriatance of the vermillion eye colour?

(a) the vermillion eye colour trait is sex-limited recessive

(b) the vermillion eye colour trait is sex-linked dominant

(c) the vermillion eye color trait is sex-limited dominant

(d) the vermillion eye color trait is sex-linked recessive

76. The most common cause of pleiotropic effect of a gene is due to :

(a) the same product of the given gene being involved in different metabolic pathways

(b) the gene making very different products in different cell types

(c) the DNA sequence of the gene getting changed in cell-specific manner

(d) the gene not functioning in some cells

77. Which of the following is correctly matched ?

(a) Monosmic : 2n + 1 (b) Nullisomic : 2n – 1

(c) Trisomic : 2n + 3 (d) Double monosmic : 2n – 1 – 1

78. The phenotypic effect in the inherited disease phenylketonuria in humans is due to :

(a) Accumulation of phenylketones in the blood (b) Deficiency of phenylketones in the blood

(c) Accumulation of lactose in the blood (d) Deficiency of phenylketones in the diet

79. A series of cell lines were created by fusing mouse and human somatic cells. In mouse human somatic cell hybrids, human chromosomes tend to get lost before becoming a stable cell-line. Some hybrid cell lines may carry human chromosome deletions. Each cell-line was examined for the presence of chromosomes and for the production of an enzyme. The following result were obtained :

Cell line	Gene product	Chromosomal segments									
		1*p*	1*q*	2*p*	2*q*	3*p*	3*q*	4*p*	4*q*	5*p*	5*q*
A	+	+	+	−	−	+	+	−	−	+	+
B	+	−	−	+	+	−	−	+	+	+	+
C	−	+	+	−	−	+	+	−	+	−	+
D	+	−	+	+	−	−	+	−	−	+	−
E	−	−	+	+	+	−	+	−	−	−	−

Which segment of the chromosome has the gene encoding for the enzyme ?

(a) 1p (b) 5p (c) 5q (d) 4p

80. A black Labrador homozygous for dominant alleles (BBEE) is crossed with a yellow Labrador homozygous for the recessive alleles (bbee). On inter-crossing the F_1, the F_2 progeny was obtained in the following ratio : 9 Black : 3 Brown : 4 Yellow

This pattern of inheritance is an example of :

(a) Recessive epistasis were allele *e* is epistatic to B and *b*

(b) Dominant eistasis where allele E is epistatic to B and *b*

(c) Recessive epistasis where allele *e* is episatic to E

(d) Complementary epistasis where allele *b* is epistatic