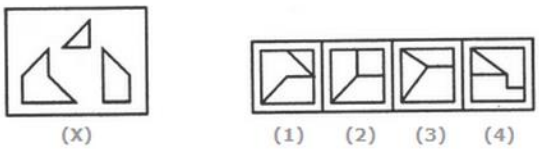
## Part A

1. **Three wheels can complete respectively 60, 36, 24 revolutions per minute. There is a red spot on each wheel that touches the ground at time zero. After how much time, all these spots will simultaneously touch the ground again?**
   a. 5/2 second
   b. 5/3 seconds
   c. 5 second
   d. 7.5 seconds

2. **Find out which of the figures (1), (2), (3) and (4) can be formed from the pieces given in figure (X).**




   a. 1
   b. 2
   c. 3
   d. 4

3. **The probability that a man will be alive for 25 years is 3/5 and the probability that his wife will be alive for 25 years is 2/3. Find the probability that only the man will be alive for 25 years.**
   a. 2/5
   b. 1/5
   c. 3/5
   d. 4/5

4. **If the value of x lies between 0 & 1 which of the following is the largest?**
   a. x
   b. x2
   c. -x
   d. 1/x

5. **2 litres of water evaporated from 6 litres of sugar solution containing 5% sugar, what will be the percentage of sugar in the remaining solution.**

   a. 7.0
   b. 70
   c. 7.5
   d. 75

6. **A can walk 3 km while B walks 5 kms. C can walk 6 km while A walks 3.5 km What start can C give B in a 3 km work?**

a. 12 km
b. ½ of a km
c. 2 km
d. 1/12 of a km.

**7. Today is 3rd November. The day of the week is Monday. This is a leap year. What will be the day of the week on this day after 3 years?**

a. Wednesday
b. Monday
c. Thursday
d. Sunday

**8. A train 300 m. long passes a pole in 15 sec. Find the speed.**

a. 10 sec/m
b. 20 sec/m
c. 30 sec/m
d. 25 sec/m

**9. The price of paint is Rs.100 per kg. A kilogram of paint covers 25sq.m. How much will it cost to paint the inner walls and the ceiling of a room having 6 meters each side?**

a. Rs.720
b. Rs.780
c. Rs.700
d. Rs.740

10. If $\log_2 x + \log_4 x + \log_{16} x = \frac{21}{4}$ find the value of 'x'.

a. 8
b. 4
c. 0.9
d. 10

**11. The angle of elevation of the sun, when the length of the shadow of a tree $\sqrt{3}$ times the height of the tree, is:**

a. 30º
b. 45º
c. 60º
d. 90º

**12. Rohan walked 20 m towards north. Then he turned right and walked 15 m. Then later he turned right and walked 40 m. Then he turns left and walks 30 m. Finally he turns left and walks 15 m. in which direction and how many meters away from the starting point is he now?**

a. 45 m west
b. 45 m East
c. 30 m west
d. 15 m West

**13. Two stations A and B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels towards B at 20 kmph. Another train starts from B at 8 a.m. and travels towards A at a speed of 25 kmph. At what time will they meet?**

a. 9 a.m.
b. 10 a.m.
c. 10.30 a.m.
d. 11 a.m.

**14. The height and weight of a chimpanzee varies proportionally. If a chimpanzee with 100 cm height has 20 Kg weight. What is the height of a chimpanzee with 30 kg weight?**

a. 100 cm
b. 150 cm
c. 200 cm
d. 15 cm

**15. If 40% of a number is equal to two-third of another number, what is the ratio of first number to the second number?**

a. 2 : 5
b. 3 : 7
c. 5 : 3
d. 7 : 3

**16. February 1, 1984 was a Wednesday just like February 29, 1984. When will the calendar show another February with a similar situation?**

a. 2000
b.1996
c. 2012
d. 2004

**17. At what time after 4.00 p.m. is the minutes hand of a clock exactly aligned with the hour hand?**

a. 4:21:49.5
b. 4:27:49.5
c. 3:21:49.5
d. 4:21:44.5

**18. A clock is set right at 8 a.m. The clock gains 10 minutes in 24 hours. What will be the true time when the clock indicates 1 p.m. on the following day?**

a..48 min. past 12
b.38 min. past 12
c.3. 28 min. past 12
d. 25 min. past 12

**19. How many days are there from 2nd January 1993 to 15th march 1993?**

a. 72
b. 73
c. 74
d. 71

**20. What was the day of week on 17th June 1998?**

a. Monday
b. Tuesday
c. Wednesday
d. Thursday

## Part B

**21. A certain mammalian organism has a diploid number of chromosomes equal to 42. This organism has one pair of sex chromosomes. How many autosomes does a gamete from this organism have?**

a. 42
b. 40
c. 21
d. 20

**22. A genetics class has 20 male students and 40 female students. If a student's name is picked at random from the class roll, what is the probability that the name will belong to a male student?**

a. 20%
b. 33.3%
c. 40%
d. 50%

**23. A tall, violet plant is crossed with a dwarf, white plant and all of the F1 offspring are tall, violet. The F1 plants are selfed to produce the F2 generation. What fraction of the F2 generation would you expect to be tall, white? (Assume independent assortment.)**

a. 1/4
b. 9/16
c. 3/16
d. 1/16

**24. Red-green color blindness is X-linked recessive. A woman with normal color vision has a father who is color-blind. The woman has a child with a man with normal color vision. Which phenotype is NOT expected for the child?**

a. color-blind female
b. color-blind male
c. noncolor-blind female
d. noncolor-blind male

**25. For double-stranded DNA, consider the following base ratios:**

**A. A/G**
**B. C/T**
**C. C/G**
**D. (A+C)/(G+T)**
**E. (A+G)/(C+T)**
**F. (A+T)/(G+C)**

**Which of those ratios always equals 1?**

a. A and B

b. D and F
c. C, D, and E
d. A, D, an

**26. If, during protein starvation, the osmotic pressure on the venous side of capillary beds drops below the hydrostatic pressure, then**

a. hemoglobin will not release oxygen.
b. fluids will tend to accumulate in tissues.
c. the pH of the interstitial fluids will increase.
d. most carbon dioxide will be bound to hemoglobin and carried away from tissues.

**27. Vasoconstriction in the gut is a likely response when an individual is**

a. lying down after standing up.
b. standing up after lying down.
c. stressed and secreting stress hormones.
d. responding to increased blood pressure.

**28. During a tidal expiration,**

a. the diaphragm contracts
b. the scalenes contract
c. the internal intercostals contract
d. there is no muscle contraction

**29. Even after air has been in our lungs for a while, it never becomes fully deoxygenated. In fact, the oxygen pressure doesn't drop much below 100mmHg. How come the blood cannot extract all the oxygen. Why?**

a. The structural change in the hemoglobin do not allow the complete extraction of oxygen
b. Alveoli of the lungs use some amount of oxygen.
c. The plasma oxygen tension reaches equilibrium with the oxygen tension of air.
d. Oxygen is used for cellular respiration by the lungs, so blood plasma cannot utilize the oxygen.

**30. Aminoacids, di and tripeptides enter the intestinal brush border via**

**a.** facilitated diffusion
**b.** $Na^+$-cotransport
**c.** $H^+$-cotransport
**d.** Both (b) and (c)

**31. After a fatty meal, most of the fat would be**

a. Absorbed in the portal circulation & transported to the liver
b. Absorbed in the portal vein & transported in the hepatic artery
c. Absorbed into chylomicrons in the lymphatics

d. Absorbed as triglycerides into the portal vein & bypass the liver

**32. Cyanide poisons mitochondria by blocking the final step in the electron transport chain. Human red blood cells placed in an isotonic solution containing cyanide are likely to**

a. lyse as the cyanide concentration increases inside the cell.
b. switch to anaerobic metabolism.
c. become unable to carry oxygen.
d. be unaffected.

**33. A person with a tidal volume of 450 mL, a vital capacity of 4,000 mL, and a residual volume of 1,000 mL would have a potential total lung capacity of**

a. 1,450 mL.
b. 4,450 mL.
c. 5,000 mL.
d. 5,450 mL.

**34. Which of the following statements is not true concerning glycolysis in anaerobic muscle?**

a. Fructose 1,6-bisphosphatase is one of the enzymes of the pathway.
b. It is an endergonic process.
c. It results in net synthesis of ATP.
d. It results in synthesis of NADH.

**35. In humans, gluconeogenesis:**

a. can result in the conversion of protein into blood glucose.
b. helps to reduce blood glucose after a carbohydrate-rich meal.
c. is activated by the hormone insulin
d. is essential in the conversion of fatty acids to glucose.

**36. Which of the following statements about the pentose phosphate pathway is correct?**

a. It generates 38 mol of ATP per mole of glucose consumed
b. It generates 6 moles of C02 for each mole of glucose consumed
c. It is a reductive pathway; it consumes NADH
d. It provides precursors for the synthesis of nucleotides

**37. Glycogen is converted to monosaccharide units by:**

a. glucokinase.
b. glucose-6-phosphatase
c. glycogen phosphorylase.
d. glycogen synthase.

**38. Which of the following is not true of the reaction catalyzed by the pyruvate Dehydrogenase complex?**

a. Biotin participates in the decarboxylation.
b. Both NAD+ and a flavin nucleotide act as electron carriers.
c. The reaction occurs in the mitochondrial matrix.
d. The substrate is held by the lipoyl-lysine "swinging arm."

**39. Which of the following is not true of the citric acid cycle?**

a. All enzymes of the cycle are located in the cytoplasm, except succinate dehydrogenase, which is bound to the inner mitochondrial membrane.
b. In the presence of malonate, one would expect succinate to accumulate.
c. Oxaloacetate is used as a substrate but is not consumed in the cycle.
d. Succinate dehydrogenase channels electrons directly into the electron transfer chain.

**40. During seed germination, the glyoxylate pathway is important to plants because it enables them to:**

a. Carry out the net synthesis of glucose from acetyl-CoA.
b. Form acetyl-CoA from malate.
c. Get rid of isocitrate formed from the aconitase reaction.
d. Obtain glyoxylate for cholesterol biosynthesis.

**41. The percentage of light absorbed by chlorophyll from total absorption is**

a. 12%
b. 83%
c. 96%
d. 4%

**42. Which among the following conditions are favorable for cyclic photophosphorylation:**

a. Aerobic condition only
b. Aerobic and low light intensity
c. Aerobic and optimum light
d. Anaerobic and low light intensity

**43. Carbon becomes available to crop plants in the form of**

a. Amino acids
b. Carbonates
c. $CO_2$
d. Elemental C

**44. Which among the following sentence is TRUE about C3 plants?**

a. Photosynthetically more efficient
b. More efficient in $CO_2$ fixation than C4 plants
c. PEPCO is present in mesophyll
d. First stable product is 3 phosphoglyceric acid

**45. The molecular formula of chlorophyll -b is**

a. $C_{55}H_{72}O_5N_4Mg$
b. $C_{55}H_{70}O_6N_4Mg$
c. $C_{50}H_{70}O_5N_4Mg$
d. $C_{50}H_{72}O_6N_4Mg$

**46. The scientist who discovered that the site of photosynthesis is chloroplast**

a. Arnon
b. Joseph Priestly
c. Julius Sachs
d. Robert Mayer

**47. P 700 is a special form of the following pigment**

a. Chlorophyll -a
b. Carotene
c. Xanthophylls
d. Chlorophyll-b

**48. In the following photosynthesizing organisms chlorophyll - a is absent**

a. Bacteria
b. Flowering plants
c. Cryptogams
d. Ferns

**49. Where the light reaction of photosynthesis does takes place?**

a. Quantasomes in Thylakoid
b. Outer membrane of chloroplast
c. Inner membrane of chloroplast
**d.** Stroma

**50. During photorespiration reaction between oxygen and substrate is happening within**

a. Mitochondria
b. Chloroplast
c. Peroxisome
d. Nuclues

**51. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that**

A) plant cells are capable of having a much higher surface-to-volume ratio than animal cells.
B) plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.
C) plant cells contain a large vacuole that reduces the volume of the cytoplasm.
D) animal cells are more spherical, whereas plant cells are elongated.

**52. One of the key innovations in the evolution of eukaryotes from a prokaryotic ancestor is the endomembrane system. What eukaryotic organelles or features might have evolved as a part of, or as an elaboration of, the endomembrane system?**

A) plasma membrane
B) chloroplasts
C) mitochondria
D) nuclear envelope

**53. Which of the following contain the 9 + 2 arrangement of microtubules, consisting of nine doublets of microtubules surrounding a pair of single microtubules?**

A) both motile cilia and primary (nonmotile) cilia
B) centrioles only
C) both flagella and motile cilia
D) both basal bodies and primary (nonmotile) cilia

**54. When a membrane is freeze-fractured, the bilayer splits down the middle between the two layers of phospholipids. In an electron micrograph of a freeze-fractured membrane, the bumps seen on the fractured surface of the membrane are**

A) peripheral proteins.
B) phospholipids.
C) carbohydrates.
D) integral proteins.

**55. Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?**

A) $CO_2$
B) an amino acid
C) glucose
D) $K^+$

**56. Finches in the Galapagoes Islands tend to eat different foods if they coexist on an island. What is this called?**

a. Competitive exclusion
b. Character displacement
c. Niche segregation
d. Exponential growth

**57. Density of a population (D) is**

a. D = S(size) / W(weight)
b. D = S(space) / N(number)
c. D = N(number) / S(space)
d. None of the above

**58. Autotrophs in the aquatic ecosystem unlike their counterparts in the terrestrial ecosystem are mostly microscopic and very low in indigestible (to the herbivores) matter. This explains the fact that compared to the terrestrial ecosystem, in the aquatic ecosystems**

a. Productivity/Biomass ratios are higher and energy transfer rates to higher trophic levels are faster
b. Productivity/Biomass ratios are lower and energy transfer rates to higher trophic levels are slower
c. Productivity/Biomass ratios are lower and energy transfer rates to higher trophic levels are faster
d. Productivity/Biomass ratios are higher and energy transfer rates to higher trophic levels are slower

**59. Imagine some cosmic catastrophe jolts Earth so that its axis is perpendicular to the orbital plane between Earth and the sun. The most obvious effect of this change would be**

a. the elimination of tides.
b. an increase in the length of night.
c. a decrease in temperature at the equator.
d. the elimination of seasonal variation.

**60. Which variables define the ecological life history of a species?**

a. the age at which reproduction begins, frequency of reproduction, and the number of offspring for each reproductive episode
b. the ratio of females to males, the length of the breeding season, and the number of offspring for each reproductive episode
c. the number of offspring produced over a lifetime by a breeding pair and the survivability of the offspring
d. timing breeding sessions with optimal environmental conditions and the number of offspring produced during each breeding session

**61. Since 1600 A.D., the most recorded extinctions have occurred among**

a. flowering plants
b. mammals
c. birds

d. amphibians

**62. Shannon index is measure of-**

a. Biodiversity evenness
b. Population
c. Pollution
d. Speciation

**63. Which term do ecologists use to describe the ability of a community either to resist change or to recover to its original state after change?**

a. stability
b. succession
c. productivity
d. competitive exclusion

**64. Which of the following is an example of aposematic coloration?**

a) stripes of a skunk
b) eye color in humans
c) colors of an insect-pollinated flower
d) a katydid whose wings look like a dead leaf

**65. In a particular case of secondary succession, three species of wild grass all invaded a field. By the second season, a single species dominated the field. A possible factor in this secondary succession was**

a. equilibrium.
b. facilitation.
c. immigration.
d. inhibition.

**66. Glycogen phosphorylase *a* can be inhibited at an allosteric site by:**

a. AMP.
b. calcium.
c. glucagon.
d. glucose

**67. Which of the following is not a significant biological oxidizing agent?**

a. Fe3+
b. NAD+
c. FAD
d. Ubiquinone (a.k.a. CoQ)
e. O2

**68. According to the Nernst equation,**

a. a negative redox potential indicates a spontaneous reaction.
b. a positive redox potential indicates a spontaneous reaction.
c. there is no relation between redox potential and ΔG.
d. only half-reactions can actually be measured.

**69. During electron transport, protons are pumped out of the mitochondrion at each of the major sites except for:**

a. Complex I.
b. Complex II.
c. Complex III.
d. Complex IV.
e. Complex MIM (a.k.a. MCMXCIX)

**70. Malate-asparatate shuttle operates in**

a. lungs and liver
b. heart and liver
c. pancreas and liver
d. none of these

## Part C

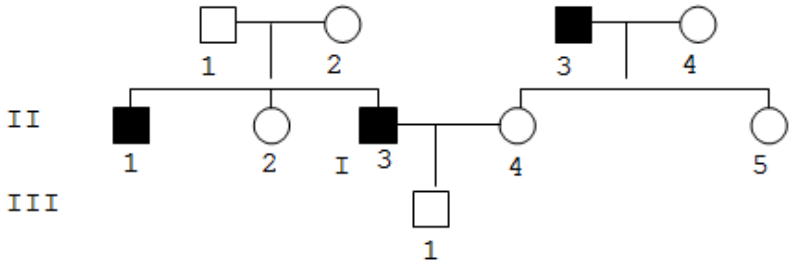
**71. Could the characteristic followed in the pedigree be caused by an autosomal dominant disease? Why or why not?**

a. Yes, all individuals fit the autosomal dominant inheritance pattern.

b. No, the offspring of I-1 and I-2 contradict an autosomal dominant inheritance.

c. No, the offspring of I-3 and I-4 contradict an autosomal dominant inheritance.

d. No, the offspring of II-3 and II-4 contradict an autosomal dominant inheritance




**72. A variety of opium poppy (*Papaver somniferum* L.) having lacerate leaves was crossed with a variety that has normal leaves. All the $F_1$ had lacerate leaves. Two $F_1$ plants were interbred to produce the $F_2$. Of the $F_2$, 249 had lacerate leaves and 16 had normal leaves. How lacerate leaves are determined in the opium poppy.**

a. A dominant allele at either gene A or gene B, or both, results in lacerate leaves

b. A dominant allele at both gene A or gene B, results in lacerate leaves

c. A recessive allele at either gene A or gene B, or both, results in lacerate leaves

d. A dominant allele at gene A and a recessive allele at gene B, results in lacerate leaves

**73. Pattern baldness in humans is a sex-influenced trait that is autosomal dominant in males and recessive in females. Jack has a full head of hair. Joann also has a full head of hair, but her mother is bald. (In women, pattern baldness is usually expressed as a thinning of the hair.) If Jack and Joann marry, what proportion of their children is expected to be bald?**

a. ¼ of their children will be bald

b. ½ of their children will be bald.

c. 1/8 of their children will be bald.

d. All of their children will be bald.

**74. In the snail Limnaea peregra, shell coiling results from a genetic maternal effect. An autosomal allele for a right-handed shell (s+), called dextral, is dominant over the allele for a left-handed shell (s), called sinistral. A pet snail called Martha is sinistral and reproduces only as a female (the snails are hermaphroditic). Indicate which of the following statements are true and which are false.**

**A. Martha's genotype must be ss.**

**B. Martha's genotype cannot be s+s+.**

**C. All the offspring produced by Martha must be sinistral.**

**D. At least some of the offspring produced by Martha must be sinistral.**

a. A-False; B –true; -C-False; D- False

b. A-true; B –true; -C-False; D- False
c. A-False; B –False; -C-False; D- False
d. A-False; B –true; -C-True; D- False

**75. Sydney Brenner isolated Salmonella typhimurium mutants that were implicated in the biosynthesis of tryptophan and would not grow on minimal medium. When these mutants were tested on minimal medium to which one of four compounds (indole glycerol phosphate, indole, anthranilic acid, and tryptophan) had been added, the growth responses shown in the table were obtained. Give the order of indole glycerol phosphate, indole, anthranilic acid, and tryptophan in a biochemical pathway leading to the synthesis of tryptophan.**

| Mutant | Minimal medium | Anthranilic acid | Indole glycerol phosphate | Indole | Tryptophan |
|---|---|---|---|---|---|
| *trp*-1 | – | – | – | – | + |
| *trp*-2 | – | – | + | + | + |
| *trp*-3 | – | – | – | + | + |
| *trp*-4 | – | – | + | + | + |
| *trp*-6 | – | – | – | – | + |
| *trp*-7 | – | – | – | – | + |
| *trp*-8 | - | + | + | + | + |
| *trp*-9 | – | – | – | – | + |
| *trp*-10 | – | – | – | – | + |
| *trp*-11 | – | – | – | – | + |

a. Precursor -> Indole -> Anthranilic Acid -> Indole glycerol phosphate -> Tryptophan
b. Precursor -> Anthranilic Acid -> Indole -> Indole glycerol phosphate -> Tryptophan
c. Precursor -> Anthranilic Acid -> Indole glycerol phosphate -> Indole -> Tryptophan
d. Precursor -> Indole -> Indole glycerol phosphate -> Anthranilic Acid -> Tryptophan

**76. A circular molecule of DNA contains 1 million base pairs. If DNA synthesis at a replication fork occurs at a rate of 100,000 nucleotides per minute, how long will theta replication require to completely replicate the molecule, assuming that theta replication is bidirectional?**

a. 5 min
b. 10 min
c. 15 min

d. 20 min

**77. A bacterium synthesizes DNA at each replication fork at a rate of 1000 nucleotides per second. If this bacterium completely replicates its circular chromosome by theta replication in 30 minutes, how many base pairs of DNA will its chromosome contain?**

a. 3,60,000
b. 36,000
c. 36,00,000
d. 3600

**78. Conditional mutations express their mutant phenotype only under certain conditions (the restrictive conditions) and express the normal phenotype under other conditions (the permissive conditions). One type of conditional mutation is a temperature-sensitive mutation, which expresses the mutant phenotype only at certain temperatures. Strains of E. coli have been isolated that contain temperature-sensitive mutations in the genes encoding different components of the replication machinery. In each of these strains, the protein produced by the mutated gene is nonfunctional under the restrictive conditions. These strains are grown under permissive conditions and then abruptly switched to the restrictive condition. After one round of replication under the restrictive condition, the DNA from each strain is isolated and analyzed. What would you predict to see in the DNA isolated from a strain having a Temperature-sensitive mutation in gene encoding DNA ligase?**

a. DNA replication takes place
b. DNA replication halts
c. DNA replication does not start
d. DNA replication does not stop

**79. A student mixes some heat-killed type IIS Streptococcus pneumonia bacteria with live type IIR bacteria and injects the mixture into a mouse. The mouse develops pneumonia and dies. The student recovers some type IIS bacteria from the dead mouse. It is the only experiment conducted by the student. Has the student demonstrated that transformation has taken place?**

a. No, the student has not demonstrated that transformation has taken place
b. Yes, the student has demonstrated that transformation has taken place
c. May be , need more information
d. Yes, the student has demonstrated that transformation and transfusion both have taken place

**80. The *blob* operon produces enzymes that convert compound A into compound B. The operon is controlled by a regulatory gene *S*. Normally the enzymes are synthesized only in the absence of compound B. If gene *S* is mutated, the enzymes are synthesized in the presence *and* in the absence of compound B. Does gene *S* produce a repressor or an activator?**

a. Gene S most likely codes for a repressor protein
b. Gene S most likely codes for a activator protein
c. Gene S definitely codes for a repressor protein

d. Gene S definitely codes for a activator protein

**81. For each of the following types of transcriptional control, indicate whether the protein produced by the regulator gene will be synthesized initially as an active repressor, inactive repressor, active activator, or inactive activator.**

**A. Negative control in a repressible operon**
**B. Positive control in a repressible operon**
**C. Negative control in an inducible operon**
**D. Positive control in an inducible operon**

a. A - inactive repressor; B -active activator; C- active repressor; D – inactive activator
b. A - active repressor; B -inactive activator; C- inactive repressor; D – active activator
c. A - active repressor; B -active activator; C- inactive repressor; D – inactive activator
d. A - Inactive repressor; B -inactive activator; C- active repressor; D – active activator

**82. The *mmm* operon, which has sequences A, B, C, and D, encodes enzymes 1 and 2. Mutations in sequences A, B, C, and D have the following effects, where a plus sign (+) = enzyme synthesized, and a minus sign (–) = enzyme not synthesized**

| | *mmm* absent | | *mmm* present | |
|---|---|---|---|---|
| Mutation in sequence | Enzyme 1 | Enzyme 2 | Enzyme 1 | Enzyme 2 |
| No mutation | + | + | – | – |
| A | – | + | – | – |
| B | + | + | + | + |
| C | + | – | – | – |
| D | – | – | – | – |

**Is the *mmm* operon inducible or repressible?**

a. Repressible
b. Inducible
c. Both
d. Can ‘t say from given information

**83. Other features of the reading of mRNA into proteins being the same as they are now (i.e., codons must exist for 20 different amino acids), what would the possible codon combinations be if the number of different bases in the mRNA were three , instead of four?**

a. 3
b. 9
c. 27
d. 15

**84. When bacteriophage lambda infects a sensitive bacterium, one of the first messenger RNA species synthesized is very short, beginning at a site PL and extending just through an adjacent gene N. After the appearance of the gene N protein, messages become much longer, still beginning at PL, but extending far beyond gene N. the N gene encodes**

a. An antiterminator acting just beyond gene N
b. A new sigma factor acting on a promoter beyond gene N
c. An activator for a promoter beyond gene N
d. An antirepressor that removes a protein repressor bound at gene N

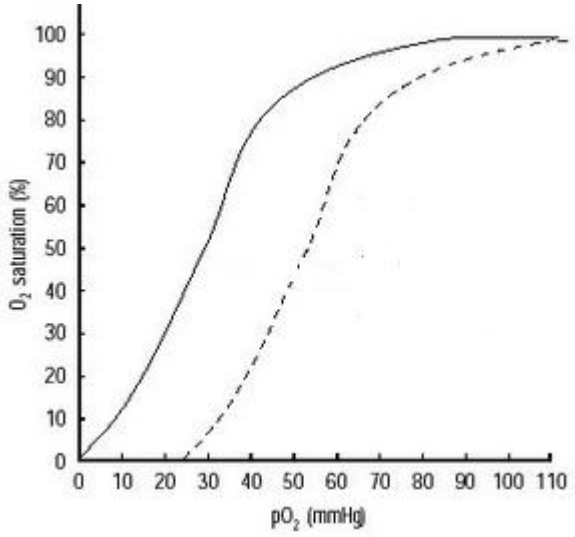
**85. For continuation of protein synthesis in bacteria, ribosomes need to be released from the mRNA as well as to dissociate into subunits. These processes do not occur spontaneously. They need the following possible conditions:**
**A. RRF and EF-G aid in this process.**
**B. An intrinsic activity of ribosomes and an uncharged tRNA are required.**
**C. IF-1 promotes dissociation of ribosomes.**
**D. IF-3 and IF-1 promote dissociation of ribosomes.**
**Which of the following sets is correct?**
a. A and D
b. A and B
c. A and C
d. B and D

**86. During strenuous exercise, the NADH formed in the glyceraldehyde 3-phosphate dehydrogenase reaction in skeletal muscle must be reoxidized to NAD+ if glycolysis is to continue. The most important reaction involved in the reoxidation of NADH is:**
a. dihydroxyacetone phosphate → glycerol 3-phosphate
b. glucose 6-phosphate → fructose 6-phosphate
c. isocitrate → α-ketoglutarate
d. pyruvate → lactate

**87. Glycolysis is the name given to a metabolic pathway occurring in many different cell types. It consists of 11 enzymatic steps that convert glucose to lactic acid. Glycolysis is an example of**:
a. Aerobic metabolism.
b. Anabolic metabolism.
c. A net reductive process.
d. Fermentation.

**88. A person who was recently been on broad spectrum antibiotics for a recurrent urinary bladder infection. While slicing vegetables, he cuts himself and had difficulty stopping the bleeding. How could the antibiotics have played a role in her bleeding?**
a) Antibiotics have removed the normal flora of large intestine which were producing vitamin K.
b) Antibiotics do not allow the absorption of vitamin K.
c) Antibiotics form a complex with Vitamin K therefore unavailable for clotting.
d) Antibiotics are directly inhibiting the clotting factor.

**89.. Which of the following causes is resulted in this shift of hemoglobin-oxygen curve?**




**A. Increase 2,3-BPG**
**B. Increase $CO_2$**
**C. Increase pH**
**D. Increased temperature**

a. Only A
b. Only C
c. A, B and D
d. B and D only

***90.*** **Which of the following statements are *correct?***

**(1) Normal exhalation during quiet breathing is an active process involving intensive muscle contraction.**

**(2) Passive exhalation results from elastic recoil of the chest wall and lungs.**

**(3) Air flow during breathing is due to a pressure gradient between the lungs and the atmospheric air.**

**(4) During normal breathing, the pressure between the two pleural layers (intrapleural pressure) is always sub atmospheric.**

**(5) Surface tension of alveolar fluid facilitates inhalation.**

**a.** 1,2 and 3

b. 3, and 4

c. 3, 4, and 5

d. 1, 3, and 5

**91. Which of the following statements regarding the regulation of gastric secretion and motility are *true*?**

**(1) The sight, smell, taste, or thought of food can initiate the cephalic phase of gastric activity.**

**(2) The gastric phase begins when food enters the small intestine.**

**(3) Once activated, stretch receptors and chemoreceptor in the stomach trigger the flow of gastric juice and peristalsis.**

**(4) The intestinal phase reflexes inhibit gastric activity.**

**(5) The enterogastric reflex stimulates gastric emptying**.

a. 1, 3, and 4

b. 2, 4, and 5

c. 1, 3, 4, and 5

d. 1, 2, and 5

**92. Which respiratory-associated muscles would contract if you were to blow up a balloon?**

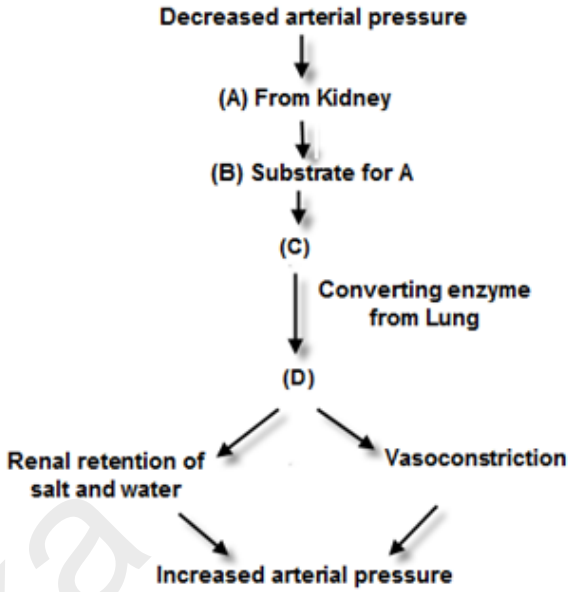
a. Diaphragm would contract, external intercostals would relax.

b. Internal intercostals and abdominal muscles would contract

c. External intercostals would contract and diaphragm would relax

d. Diaphragm contracts, internal intercostals would relax.

**93. In this flow diagram name the chemicals A, B, C, D in proper sequence**




a. Renin, Angiotensin II, Angiotensin I, Angiotensinogen
b. Angiotensin I, Angiotensinogen, Angiotensin II, Renin
c. Renin, Angiotensin I, Angiotensin II, Angiotensinogen
d. Renin, Angiotensinogen, Angiotensin I, Angiotensin II

**94. Taxol is an anticancer drug extracted from the Pacific yew tree. In animal cells, Taxol disrupts microtubule formation by binding to microtubules and accelerating their assembly from the protein precursor, tubulin. Surprisingly, this stops cell division phase. Specifically, Taxol must affect**

A) the formation of the mitotic spindle.
B) anaphase.
C) formation of the centrioles.
D) chromatid assembly.
E) the S phase of the cell cycle.

**95. At t- 3 hours, the cell density was determined to be 2.6 x 10 8 cells/mL. If 3.5 mL of culture are withdrawn at that time, the aliquot is centrifuged to pellet the cells, and the pellet is then resuspended in 7 mL of tryptone broth, what is the new cell concentration?**

a) $2.67x10^8$ cells/ml
b) $1.3x10^8$ cells/ml
c) $2.4x\ 10^9$ cells/ml
d) $1.299x10^9$cells/ml

**96. In the global nitrogen cycle, the following microbial organisms are involved in three important process-denitrification, nitrification and nitrogen fixation.**

**a. Rhizobium**
**b. Nitrosomonas**
**c. Nitrobacter**
**d. Pseudomonas**
**e. Azotobacter**

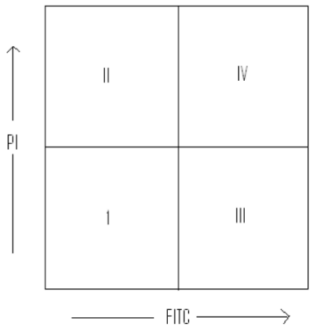
**Which of the following is the correctly matched pair of process and its causative species?**

a. Denitrification – (b); nitrogen fixation – (c) and (e); nitrification – (d)
b. Denitrification – (d); nitrogen fixation – (a) and (e); nitrification – (c)
c. Denitrification – (c); nitrogen fixation – (a) and (d); nitrification – (d)
d. Denitrification – (b); nitrogen fixation – (a) and (d); nitrification – (c)

**97. An experiment is designed to study the mechanism of sucrose uptake by plant cells. Cells are immersed in a sucrose solution, and the pH of the solution is monitored with a pH meter. Samples of the cells are taken at intervals, and the sucrose in the sampled cells is measured. The measurements show that sucrose uptake by the cells correlates with a rise in the pH of the surrounding solution. The magnitude of the pH change is proportional to the starting concentration of sucrose in the extracellular solution. A metabolic poison known to block the ability of cells to regenerate ATP is found to inhibit the pH changes in the extracellular solution. Based on this information which of the following statements would you predict is correct?**

a. Hydrogen ion movement is the result of facilitated diffusion.
b. Sucrose moving through the membrane forces hydrogen ions in to the cell
c. Sucrose and Hydrogen ions are transported in opposite directions across the membrane
d. Sucrose transport is the result of a hydrogen ion contransporter

**98. PS is concentrated in the inner leaflet of the cell membrane and is transported to the outer membrane when the cell is undergoing apoptosis. To differentiate between cells undergoing apoptosis and normal cells, late necrotic apoptotic cells were tagged with fluorescent protein Propidium Iodide (PI). PS was tagged with marker protein Annexin V coupled with FITC. FACS analysis was carried out and data was obtained in form of plot. In which quadrant would you expect the count of early apoptotic cells very high?**




A. Quadrant I
B. Quadrant II
C. Quadrant III
D. Quadrant IV

**99. ATP-driven pumps hydrolyze ATP to ADP and phosphate and use the energy released to pump ions or solutes across a membrane. There are many classes of these pumps and representatives of each are found in all prokaryotic and eukaryotic cells. Which of the following statements about these pumps is NOT correct?**

**(A) P-type pumps are multipass transmembrane proteins which phosphorylate themselves during pumping and involve in ion transport.**
**(B) F-type pumps normally use the H+ gradient across the membrane to drive the synhesis of ATP.**

**C) V-type pumps normally use voltage gradient for transport of small molecules.**
**(D) ABC transporters primarily pum small molecules across cell membrane.**

**100. Assume that successful reproduction in a rare salamander species, wherein all individuals are females, relies on those females having access to sperm from males of another species but that the resulting embryos show no signs of a genetic contribution from the sperm. In this case, the sperm appear to be used only for**

A. Morphogenesis.
B. Epigenesis.
C. Egg activation.
D. Cell differentiation.

**101. Which of the following is a correct statement about the McArthur/Wilson Island Equilibrium Model?**

A) The more species that inhabit an island, the lower the extinction rate.
B) As the number of species on an island increases, the emigration rate decreases.
C) Competitive exclusion is less likely on an island that has large numbers of species.
D) Small islands receive few new immigrant species.

**102. Which of the following is an example of Müllerian mimicry?**

A) two species of unpalatable butterfly that have the same color pattern
B) a day-flying hawkmoth that looks like a wasp
C) a chameleon that changes its color to look like a dead leaf
D) two species of rattlesnakes that both rattle their tails

**103. Which of the following best describes resource partitioning?**

A) competitive exclusion that results in the success of the superior species
B) slight variations in niche that allow similar species to coexist
C) two species that can coevolve to share identical niches
D) differential resource utilization that results in a decrease in community species diversity

**104. Average annual precipitation and temperature are two important determinants of worlds major biomass. Which of the following combinations are correct?**

| Temperature | | Biome precipitation | |
|---|---|---|---|
| A | $25^0$C and 255 cm | I | Temperate forest |

| | | | |
|---|---|---|---|
| B | $15^0$C and 300 cm | II | Savannah |
| C | $15^0$C and 100 cm | III | Temperate rain forest |
| D | $25^0$C and 255 cm | IV | Tropical rain forest |

a. A-IV; B-III; C-I; D-II
b. A-III; B-II; C-IV; D-I
c. A-II; B-I; C-III; D-IV
d. A-I; B-IV; C-II; D-III

**105. Tigers do not occur in srilanka while they are seen in India. While leopards are seen in both India & Srilanka. The main reason is**

a. Tigers are not good swimmers
b. Srilankans have removed tiger due to excessive hunting
c. India care more for tigers
d. Leopard originated before separation of India & srilanka due to plate shifting

**106. Which of the following alterations in glycolytic enzymes will increase the rate of Glycolysis?**

I. Loss of allosteric site for ATP binding in PFK-1
II. Loss of binding site of Citrate in PFK-1
III. Loss of phosphatase domain from the bifunctional enzyme PFK-2/FBPase-2
IV. Loss of binding site for Fructose 1,6 bisphospate on pyruate kinase

a. I ,II and III
b. II and III
c. III and IV
d. I and IV

**107. When $O^2$ is added to an anaerobic suspension of cells consuming glucose at a high rate, the rate of glucose consumption declines greatly as the O2 is used up, and accumulation of lactate ceases, this effect is called as The Pasteur Effect.**
**A mutant yeast was produced by a lag which lacks cytochrome c oxidase,a deficit that markedly affects their metabolic behavior. Which of the following are true regarding the metabolic behavior of the organism.**

**A. The Pasteur Effect will be eliminated completely from the organism.**
**B. The mutant will show higher Pasteur Effect**
**C. The mutant will not have any change with respect to Pasteur Effect**

a. A is true
b. Both statements A and B can be true

c. Only statement C is true
d. Data not sufficient

108.

18, the ac y of the citric acid cycle can be monitored by measuring the amount of $O_2$ consumed. The greater the rate of $O_2$ consumption, the faster the rate of the cycle. Hans Krebs used this assay to investigate the cycle in 1937. He used as his experimental system minced pigeon-breast muscle, which is rich in mitochondria. In one set of experiments, Krebs measured the $O_2$ consumption in the presence of carbohydrate only and in the presence of carbohydrate and citrate. The results are shown in the following table.

Effect of citrate on oxygen consumption by minced pigeon-breast muscle

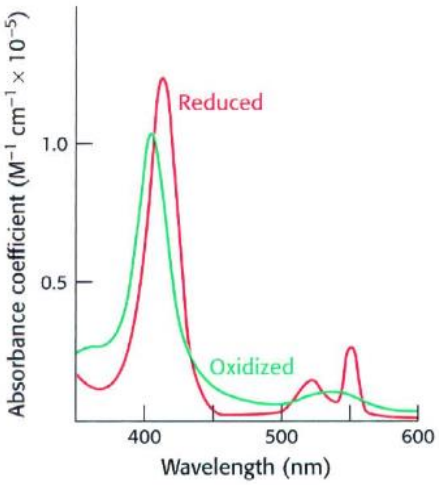
| | Micromoles of oxygen consumed | |
|---|---|---|
| Time (min) | Carbohydrate only | Carbohydrate plus 3 μmol of citrate |
| 10 | 26 | 28 |
| 60 | 43 | 62 |
| 90 | 46 | 77 |
| 150 | 49 | 85 |

**Following are the conclusions made from the above data. Which of the statements are true?**
**A. Presence of Citrate facilitates O2 consumption**
**B. Consumption of O2 increases exponentially with time attaining plateau after a particular time**
**C. Consumption of O2 increases linearly with time infinitely**

a. A is true
b. Both statements A and B can be true
c. Only statement C is true
d. Data not sufficient

109.

13. *Crossover point.* The precise site of action of a respiratory-chain inhibitor can be revealed by the *crossover technique*. Britton Chance devised elegant spectroscopic methods for determining the proportions of the oxidized and reduced forms of each carrier. This determination is feasible because the forms have distinctive absorption spectra, as illustrated in the adjoining graph for cytochrome *c*. You are given a new inhibitor and find that its addition to respiring mitochondria causes the carriers between NADH and $QH_2$ to become more reduced and those between cytochrome *c* and $O_2$ to become more oxidized. Where does your inhibitor act?




a. blocks the reduction of FMN by NADH
b. Blocks the reduction of Cyt-C oxidase
c. Blocks the reduction of Cyt a3
d. Blocks the reduction of cyt c1 by QH2

**110. Prof. Becker was performing an experiment with mitochondrial ATP synthases. While making the sample his student accidentally lost the F0 fraction of the proteins and the purified sample contained only F1 part of the protein. Which of the following statements is true regarding the activity of the purified protein fraction?**

a. The fraction will have only ATP synthase activity
b. The fraction will have only ATPase activity
c. Fraction will have both the activities
d. The fraction will be completely inactive

**111. Conservative site specific recombination involves**

**i. Recombination between inverted repeats leads to inversion of genes**

**ii. Recombination between direct repeats leads to inversion of genes**

**iii. Conservation DNA synthesis by doubling of genes by ser-recombinase**

**iv. Conservation of energy by recombinase**

**v. Involves both single strand and double strand breakage**

a. I, ii, iii & v
b. Ii, iii, I, iv

c. I, iv, ii & V
d. All of the above

**112. BLM's are homologous recombination proteins involved in**

a. Combined action of Srs-II, sgs-I and Top3 (Helicases and Topoisomerase III) proteins involves high rate of recombination

b. Combined action of Srs-II, sgs-I and Top3 (Exonuclease and Topoisomerase III) proteins involves low rate of recombination

c. Combined action of Srs-II, sgs-I and Top3 (Helicases and Topoisomerase III) proteins involves low rate of recombination

d. Combined action of Srs-II, sgs-I and Top3 (Exonuclease and Topoisomerase III) proteins involves high rate of recombination

**113. The distance between the A&C =10cM, A&B=20 cM&A = 10cM and A,C,&B =20cM recombination frequency of the gene is**

**i. More in between A & B**
**ii. More in between A,B,C**
**iii. Same in A&C**
**iv. Same in B&C**

Only I, ii. Iii correct
Only I, ii. Iv correct
Only I, iii. Iv correct
Only I, ii. Iii & iv correct



**114. Cre- Lox system is**

a. It uses Conservative site specific recombination by Tyr recombinase

b. It uses Conservative site specific recombination by Ser recombinase

c. Present in both prokaryotes and eukaryotes

d. Lox enzyme is a Tyr- recombinase recognize specific Cre site in bacterial genome so that bacteriophage DNA integrate in to the genome of the bacteria

**115. Composite transposons found in bacteria which encode transposase and antibiotic resistance gene?**

a. IS element flanked by two IR elements and structural gene flanked by two IS element

b. IR element flanked by two IS elements and structural gene flanked by two IR elements

c. IS element flanked by two IR elements and Transposase gene & structural gene flanked by two IS element

d. None of the above

**116. Myasthenia Gravis in humans is characterized by increased muscular weakness because of diminishing effects of acetyl choline at neuromuscular junction due to**

a. Decreased release of acetylcholine at the neuromuscular junction

b. Increased activation of acetylcholine receptor

c. Production of antibodies against acetylcholine receptor

d. Increased release of inhibitory neurotransmitters at the neuromuscular junction

**117. A nerve impulse or action potential is generated from transient changes in the permeability of the axon membrane to $Na^+$ and $K^+$ ions. The depolarization of the membrane beyond the threshold level leads to Na+ flowing into the cell and a change in membrane potential to a positive value. The $K^+$ channel then opens allowing $K^+$ to flow outwards ultimately restoring membrane potential to the resting value. The $^{Na+}$ and $K^+$ channels operate in opposite directions because**

a) There is an electrochemical gradient growth generated by proton transport

b) There is a difference in Na+ and K+ concentration on either side of the membrane

c) Na+ is a voltage-gated channels, whereas K+ is ligand – gated

d) Na+ is dependent on ATP whereas K+ is not

**118. Which of the following statements are *true*?**

a. If the excitatory effect is greater than the inhibitory effect but less than the threshold of stimulation, the result is a subthreshold EPSP.

b. If the excitatory effect is greater than the inhibitory effect and reaches or surpasses the threshold level of stimulation, the result is a threshold or suprathreshold EPSP and one or more nerve impulses.

c. If the inhibitory effect is greater than the excitatory effect, the membrane hyperpolarizes, resulting in inhibition of the postsynaptic neuron and the inability of the neuron to generate a nerve impulse.

d. The greater the summation of hyperpolarizations, the more likely a nerve impulse will be initiated.

a) 1 and 4

b) 1, 3, and 4

c) 2, 3, and 4

d) , 2, and 3

**119. Match the following**

| | |
|---|---|
| polarization that is less negative than the resting level | spatial summation |
| results from the buildup of neurotransmitter released simultaneously by several presynaptic end bulbs | Hyperpolarizing graded potential |
| the hyperpolarization that occurs after the repolarizing phase of an action potential | depolarizing graded potential |
| polarization that is more negative than the resting level | after-hyperpolarizing phase |

a) A-4; B-3; C-1; D-2
b) A-2; B-1; C-4; D-3
c) A-3; B-1; C-4; D-2
d) A-2; B-3; C-4; D-1

**120. As a torture procedure for his enemies, mad scientist Dr. Moro is trying to develop a drug that will enhance the effects of substance P. What cellular mechanism is assigned to substance P?**

a) It increases the vasoconstriction
b) Substance P causes the sensory neurons numb.
c) Motor neurons are affected by substance P
d) It increases the pain perception

**121. Your patient became ill 10 days ago with a viral disease. Laboratory examination reveals that the patient's antibodies against this virus have a high ratio of IgM to IgG. What is your conclusion?**

a. It is unlikely that the patient has encountered this organism previously.
b. The patient is predisposed to IgE-mediated hypersensitivity reactions.
c. The information given is irrelevant to previous antigen exposure.

d. It is likely that the patient has an autoimmune disease.

**122. Several types of molecules including the transmembrane glycoproteins can function as matrix receptors and co-receptors. However, the principal receptors on animal cells for binding most extracellular matrix proteins are the integrins. Which of the following statements is NOT true for integrins?**

a. Integrins are transmembrane linker proteins that link to the cytoskeleton.
b. An integrin molecule is composed of two non-covalently associated glycoprotein subunits α and β. Both subunits span the cell membrane, with short intracellular C-terminal tails and large N-terminal extracellular domains.
c. The extracellular portion of the integrin dimer binds to specific carbohydrate residues in extracellular matrix proteins or to ligands on the surface of other cells.
d. The intracellular portion binds to a complex of proteins that form a linkage to the cytoskeleton.

**123. The following events occur when a mammalian immune system first encounters a pathogen. Which shows the correct sequence in which they occur?**
**I. Pathogen is destroyed.**

**II. Lymphocytes secrete antibodies.**

**III. Antigenic determinants from pathogen bind to antigen receptors on lymphocytes.**

**IV. Lymphocytes specific to antigenic determinants from pathogen become numerous.**

**V. Only memory cells remain.**

a. I → III → II → IV → V
b. II → I → IV → III → V
c. IV → II → III → I → V
d. III → IV → II → I → V

**124. A researcher is analyzing the immune response of a patient following the patient's exposure to an unknown agent while out of the country. The patient's blood is found to have a high proportion of lymphocytes with CD8 surface proteins. What is the likely cause?**

a. The patient encountered a bacterial infection which elicited CD8 marked T cells.
b. The disease must have been caused by a multicellular parasite, such as can be encountered in polluted water sources.
c. The CD8 proteins marked the surfaces of cytotoxic T cells to attack virus-infected host cells.
d. CD8 marks the surface of cells that accumulate after the infection is over and signal patient recovery.

**125. Mammals have Toll-like receptors (TLRs) that act in a manner similar to those of insects. While not specific to a particular pathogen, a TLR can recognize a kind of**

**macromolecule that is absent from vertebrates but present in/on certain groups of pathogens. Which of the following is most likely to be recognized by a particular TLR that defends against some viruses?**

a. lipopolysaccharides
b. double-stranded DNA
c. double-stranded RNA
d. glycoproteins

**126. What changes are made in B cells when they switch from producing IgM or IgD to IgG immunoglobulins?**

**a.** This change is accomplished by alternative splicing of the RNA transcripts
**b.** this change occurs in the proteome as the IgM/IgD constant regions are proteolytically removed from the IgG protein
**c.** this change occurs in the genome as the genes encoding the constant regions for IgM and IgD are deleted by the RAG1 and RAG2 proteins
**d.** this change occurs in the genome as the genes encoding the constant regions for IgM and IgD are deleted independently of the RAG proteins

**127. In 2 experimental setups A and B, the following steps were performed:**
**A: APCs + Ag → after 1-3 hrs, treatment with Paraformaldehyde**
**B: APCs + Paraformaldehyde → Exposure to Antigens**
**Which of the following can be the right observation in A and B respectively?**

a. Th cell activation; prevention of Th cell activation
b. Prevention of Th cell activation; Tc cell activation
c. Prevention of Th cell activation; Th cell activation
d. Th cell activation; Th cell activation

**128. A group of test mice in which the CD1 family of genes has been knocked out are immunized with *Mycobacterium tuberculosis.* From these mice, spleen cells are isolated and divided into 2 batches, A and B. Batch A is treated with the lipid extract of the bacteria and Batch B is treated with a protein derived from the bacteria known as purified protein derivative (PPD). If + represents immune reaction and – represents no immune reaction, then the results obtained in the 2 batches (A and B) will be respectively**

a. + and –
b. -and +
c. + and +
d. -and –

**129. With reference to clonal selection theory, consider the following statements:**

A. B and T lymphocytes of all antigenic specificities exist prior to contact with antigen.
B. Each lymphocyte carries an antigen receptor on its surface of only a single specificity.
C. Lymphocytes can be stimulated by antigen under appropriate conditions to give rise to progeny with identical antigenic specificity.
D. Lymphocytes bear multi-potential receptors which become specific after contact with antigen.

**The correct statements are**

a. A, B and C
b. B, C and D

c. A, C and D
d. A, B and D

**130. A forensic immunologist has immunized a sheep with purified human albumin, and would like to absorb the resulting antiserum to make it more specific for human bloodstains. In order to produce such an absorbed antiserum, he would best begin by passing it over a column bearing:**

a. whole human serum
b. human serum albumin
c. bovine serum albumin
d. bovine transferrin

**131. The linear and circular forms of the same DNA molecule can be distinguished using**

a. Absorbance at 260 nm
b. Endonuclease digestion
c. Viscosity of the solution
d. Exonuclease digestion

**132. Sodium dodecyl sulphate, an anionic detergent commonly used in SDS-Polyacrylamide gel electrophoresis, works in facilitating electrophoretic separation of a mixture of proteins by its ability to bind to the**

a. negatively charged amino acid side chains in proteins
b. hydrophobic side chains in proteins
c. positively charged amino acid side chains in proteins
d. peptide group in proteins

**133. A dNTP master mix is prepared by combining 50µl each of 10mM dNTP stock. Two micro liters from this dNTP mix are added to the PCR master mix of 25µl reaction volume. What is the total dNTP concentration in the PCR reaction?**

a. 200µM
b. 400 µM
c. 800 µM
d. 250 µM

**134. Analysis of a nucleotide sequence reveals the proportion of A : T : C : G :: 0.40 : 0.85 :1.56 : 1. Type of DNA concluded from this study is a**

a. purine rich DNA
b. cruciform DNA
c. double stranded DNA
d. single stranded DNA

**135. In a population of 200 individuals which is at equilibrium, the frequency of one of the alleles under study is 0.11. What is the expected frequency of heterozygous individual?**

a. 0.89
b. 0.0979
c. 0.1958
d. 0.842

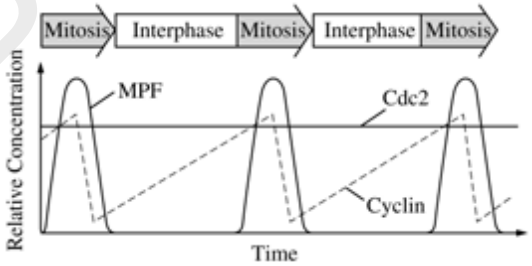
**136. The corpus luteum is a transient endocrine gland that is specialized for the production of progesterone and that plays a critical role in the establishment and maintenance of pregnancy. The life span of the corpus luteum varies between species and, within a species, can be dramatically altered by events such as mating or pregnancy. Regardless of the duration of its life span, the corpus luteum eventually enters a dynamic regression process during which it loses the capacity to produce progesterone and undergoes structural involution. One important hormone is involved in the preventing luteal regression. Which hormone is that**

a. Progesterone
b. Estrogen
c. Human chorionic gonadotropin hormone
d. Pituitary gonadotropin

**137. At certain condition (X), a neuron showed intracellular potential -50mV; While after some treatment (Y), it was -70mV. Given such a condition, which of the following statements is correct?**

a. The neuron is hyperpolarized under condition (X) as compared to that of the condition (Y)
b. To inducee a response, higher intensity stimulation is needed at condition (X) than in condition (Y)
c. The treatment (Y) caused depolarization of the neuron
d. The treatment (Y) induced hyperpolarization of the neuron

138. **M-phase-promoting factor (MPF) triggers mitosis by activating other proteins that function in cell division. Active MPF consists of two associated proteins, cyclin and Cdc2. The Cdc2 component of active MPF is a proteinkinase. The relative concentrations of active MPF, Cdc2, and cyclin were monitored during the cell cycle and are depicted in the figure below.**




**During the cell cycle, active MPF decreases at the end of mitosis. This can be best explained by the**

a. increase in Cdc2 during mitosis
b. increase in cyclin during mitosis
c. decrease in cyclin during mitosis
d. decrease in Cdc2 during mitosis

**139. Injection of *noggin* mRNA into a 1-cell, UV-irradiated embryos of frog completely rescues dorsal development and allows the formation of a complete embryo. Some of the following statements (A-D) could possibly explain this observation.**

I. Noggin is a secreted protein which induces dorsal ectoderm to form neural tissue and it dorsalizes the mesoderm cells which would otherwise contribute to ventral mesoderm.
II. Noggin binds directly to BMP4 and BMP2 thus preventing complex formation with their receptors.
III. Noggin along with other molecules prevents BMP from binding to and inducing ectodenn and mesoderm cells near the organizer.
IV. Noggin is a secreted protein which induces the dorsal ectoderm to form the epidermis and it ventralizes the mesoderm cells which would otherwise contribute to dorsal mesoderm.

**Which of the above statements are correct?**

a. I, II and III.
b. I and II.
c. II and III.
d. I and IV

**140. Early development in angiosperms and gymnosperms differs in that**

a. cells move and change position in angiosperm development but not in gymnosperm development
b. a suspensor forms in the angiosperms but not in the gymnosperms
c. cell walls don't form between daughter nuclei following the initial cell divisions in the zygote of gymnosperms but they do in angiosperms
d. the shoot apical meristem forms near the micropyle in gymnosperms but at the opposite end in angiosperms

**141. In what order will the amino acids E, H, I, K be eluted from a column of DEAE-cellulose ion exchange resin (an anion exchanger) by a buffer at pH 6?**

a. E I H K
b. I E K H
c. H K E I
d. K H I E
e. I K H E

**142. An experimenter generates library of plasmids containing 10-15 kilobase (kb) inserts from the genome of a bacterium by partially digesting the bacterial genomic DNA with *EcoRI* and cloning the resulting fragments into the *EcoRI* site of a Plasmid vector. The experimenter must then identify the plasmids containing the *pur B* gene. To do this 5 of the plasmids from the library were digested with *EcoRI* and the digests were separated by gel electrophoresis. In a second experiment, the same 5 plasmids were analyzed by PCR using primers derived from sequences internal to *pur B* and electrophoresis was performed on the PCR products. Both gels were stained with ethidium bromide to visualize the DNA.**

Figure 1. Electrophoresis of digests

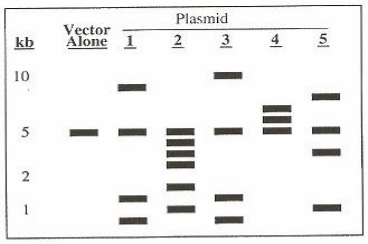
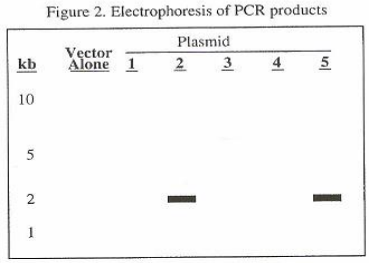



Figure 2. Electrophoresis of PCR products




**The inserts in which of the following pairs of plasmids may overlap?**

a. 3 with 4 only
b. 2 with 5 only
c. 1 with 2 and 4 only
d. 1 with 3 and 5 only

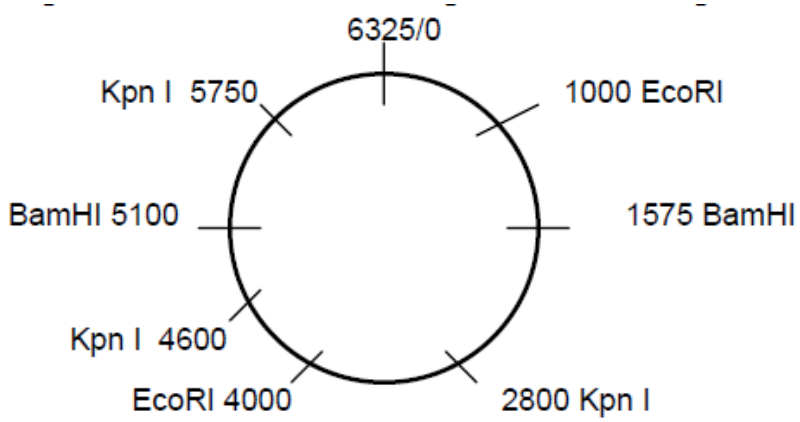
**143. Enhancers can activate promoters even if they are some distance from the promoter. This is thought to be because**

1. architectural transcription factors can bend the DNA and bring the enhancer closer to the promoter.
2. the activators that bind the enhancers then slide along the DNA until they find the promoter.
3. the complex that binds the enhancer is so large that it occupies all of the space between the enhancer and the promoter.
4. insulators can be used loop out DNA between the enhancer and the promoter.
5. looping out of the DNA allow them to "reach" the promoter.

Please choose the most complete answer

a. Numbers 1 and 5 comprise the most complete and best answer.
b. Numbers 2 and 5 comprise the most complete and best answer.
c. Numbers 2 and 3 comprise the most complete and best answer.
d. Numbers 1, 4 and 5 comprise the most complete and best answer

**144. The map of a circular dsDNA is shown below and to the right (the drawing is approximately to scale). This circular DNA is digested completely with the restriction endonuclease BamHI using optimal reaction conditions. What DNA fragments would be produced, assuming that the reaction was completely specific for BamHI activity? [Hint: "6325/0" indicates the position of the last base-pair relative to position 1, the start of numbering.]**




a. One fragment: 3525 bp long
b. Two fragments: 1225 and 1575 bp long
c. Two fragments: 1575 and 5100 bp long
d. Two fragments: 2800 and 3525 bp long
e. Three fragments: 1225, 1575 and 3525 bp long

**145. RFLP and RAPD markers are commonly used in plant breeding and diversity analysis. Which of the following combination of statement about these molecular makers are correct?**

**A.RFLP is co dominant**
**B. RAPD is co dominant**
**C. Both the markers are ubiquitous**
**D. Only RFLP can detect heterozygote**
**E. Only RAPD can detect heterozygote**
**F. RAPD cannot detect allelic variation**

a. A, C, D, E
b. B, C,E,F
c. A, C, D,F
d. C,D,E,F