

Part A (Attempt any 15 ONLY)

1. Arun, Kamal and Vinay invested Rs. 8000, Rs. 4000 and Rs. 8000 respectively in a business. Arun left after six months. If after eight months, there was a gain of Rs. 4005, then what will be the share of Kamal?

- (1) Rs. 890 (2) Rs. 1335
(3) Rs. 1602 (4) Rs. 1780

2. What was the day of the week on 28th May, 2006?

- (1) Thursday (2) Friday
(3) Saturday (4) Sunday

3. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 50, what is the compound interest on the same at the same rate and for the same time?

- (1) Rs. 51.25 (2) Rs. 52
(3) Rs. 54.25 (4) Rs. 60

4. The length of a rectangle is halved, while its breadth is tripled. What is the percentage change in area?

- (1) 25% increase (2) 50% increase
(3) 50% decrease (4) 75% decrease

5. A person's present age is two-fifth of the age of his mother. After 8 years, he will be one-half of the age of his mother. How old is the mother at present?

- (1) 32 years (2) 36 years
(3) 40 years (4) 48 years

6. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 min. 48 sec fast at 2 p.m. on the following Monday. When was it correct?

- (1) 2 p.m. on Tuesday (2) 2 p.m. on Wednesday
(3) 3 p.m. on Thursday (4) 1 p.m. on Friday

7. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?

- (1) 5 (2) 10
(3) 15 (4) 20

8. A number consists of 3 digits whose sum is 10. The middle digit is equal to the sum of the other two and the number will be increased by 99 if its digits are reversed. The number is:

- (1) 145 (2) 253
(3) 370 (4) 352

9. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B

becomes 7:9. How many liters of liquid A was contained by the can initially?

- (1) 10 (2) 20
(3) 21 (4) 25

10. A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely?

- (1) 3 hrs 15 min (2) 3 hrs 45 min
(3) 4 hrs (4) 4 hrs 15 min

11. If $0.75 : x :: 5 : 8$, then x is equal to:

- (1) 1.12 (2) 1.2
(3) 1.25 (4) 1.30

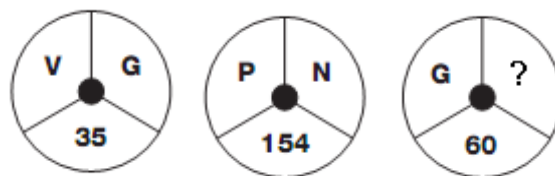
12. Two cards are drawn together from a pack of 52 cards. The probability that one is a spade and one is a heart, is:

- (1) $\frac{3}{20}$ (2) $\frac{29}{34}$
(3) $\frac{47}{100}$ (4) $\frac{13}{102}$

13. The certain worth of a certain sum due sometime hence is Rs. 1600 and the true discount is Rs. 160. The banker's gain is:

- (1) Rs. 20 (2) Rs. 24
(3) Rs. 16 (4) Rs. 12

14. Which letter replaces the question mark?



- (1) C (2) X
(3) D (4) W

15. All the trees in the park are flowering trees.

Some of the trees in the park are dogwoods.

All dogwoods in the park are flowering trees.

If the first two statements are true, the third statement is

- (1) true (2) false
(3) uncertain (4) half truth

16. Which number replaces the question mark?



- (1) 60 (2) 45
(3) 54 (4) 51

17. Look at this series: 4, 7, 25, 10, __, 20, 16, 19, ... What number should fill the blank?

- (1) 13 (2) 15

(3) 20 (4) 28

18. Choose which pair of numbers comes next.

2, 8, 14, 20, 26, 32, 38

(1) 2, 46 (2) 44, 50

(3) 42, 48 (4) 40, 42

19. Two, trains, one from Howrah to Patna and the other from Patna to Howrah, start simultaneously. After they meet, the trains reach their destinations after 9 hours and 16 hours respectively. The ratio of their speeds is:

(1) 2 : 3 (2) 4 : 3

(3) 6 : 7 (4) 9 : 16

20. Two goods train each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km/hr and 30 km/hr respectively. Find the time taken by the slower train to pass the driver of the faster one.

(1) 12 sec (2) 24 sec

(3) 48 sec (4) 60 sec

Part B (Attempt any 35 ONLY)

21. Which of the following kinases evolved later in the time scale of biological evolution?

(1) Tyrosine kinase

(2) Serine-threonine kinase

(3) Receptor tyrosine kinase

(4) Histidine kinase

22. Among the following live vaccine is-

(1) Poliomyelites (2) Small pox

(3) Diphtheria (4) Tetanus

23. Which of the following is correct about dominant-negative mutation?

(1) Loss-of-function mutation that completely abolishes the activity of a gene

(2) Either reduces or abolishes the activity of the gene

(3) Blocks gene activity, causing a loss-of- function even in presence of normal gene product

(4) Increases the activity of the gene or makes it active in inappropriate circumstances

24. The target cells for ADA gene therapy are

(1) bone marrow cells (2) B-lymphocytes

(3) Liver cells (4) Spleen cells

25. Which of the following is a lipid with a signal transducing activity?

(1) Phosphatidyl serine

(2) Phosphatidyl ethanolamine 5

(3) Phosphatidyl inositol 4,5- biphosphate

(4) Phospholipase A2

26. During cytokinesis in plant cells, the cell plate is formed by the fusion of vesicles derived from which of the following?

(1) Microtubules (2) The Golgi complex

(3) The contractile ring (4) The plasma membrane

27. Which of the following is NOT a property of the mammalian signal recognition particle (SRP)?

(1) It targets nascent secretory polypeptides to the rough endoplasmic reticulum.

(2) It temporarily arrests translation.

(3) It binds to the signal sequence of secretory proteins.

(4) It contains a signal peptidase activity.

28. Which of the following statement about mitochondria and chloroplast is generally true?

(1) Plants have chloroplasts but no mitochondria; animals have mitochondria but no chloroplasts.

(2) Plants have chloroplasts but no mitochondria; fungi have mitochondria but no chloroplasts.

(3) Plants and fungi have chloroplasts but no mitochondria; animals have only mitochondria.

(4) Plants have both chloroplasts and mitochondria; animals and fungi have only mitochondria.

29. Refer to the following.

(P) Actin (Q) Tubulin

(R) Fibronectin (S) Troponin

Match with following

X. Bipolar-filament-forming protein that binds and hydrolyzes GTP

Y. Major cytoskeletal protein in microvilli, filopodia, contractile rings, and growth cones

Z. Calcium-binding switch protein in vertebrate skeletal muscle fibers

The most appropriate combination is

(1) X-Q, Y-P, Z-R (2) X-S, Y-Q, Z-P

(3) X-Q, Y-P, Z-S (4) X-P, Y-Q, Z-R

30. PKU (phenylketonuria) is a hereditary condition in which infants and young children who ingest the amino acid phenylalanine risk serious neurological damage. However, the risk of damage can be substantially reduced by the severe restriction of phenylalanine in the diet. Which of the following is the nutritional concept that forms the basis for this preventive treatment?

(1) Enzymatic hydrolysis

(2) Essential nutrients

(3) Symbiosis

(4) Dehydration synthesis

31. Circulatory systems in molluscs

- (1) are open in all species of molluscs
- (2) are closed in all species of molluscs
- (3) are open in species of large-sized molluscs and are closed in species of small-sized molluscs
- (4) are open in species of small-sized molluscs and are closed in species of large-sized molluscs

32. A significant increase in the amount of interstitial fluid surrounding the capillary beds of a human's lungs will cause

- (1) an increase in the amount of carbon dioxide moving from the blood to the lungs
- (2) an increase in the amount of oxygen moving from the lungs into the blood
- (3) a decrease in the amount of oxygen moving from the lungs into the blood
- (4) an increase of pressure that would cause the capillary beds to burst

33. The bacterial fauna found in our large intestines

- (1) are just little parasites that eat our leftover nutrients and do us more harm than good
- (2) don't really hurt us, but don't do us any good, either
- (3) can provide some essential nutrients, and may have more profound health effects
- (4) are absolutely essential to life - you couldn't live 24 hours without them

34. In an enzyme catalyzed reaction, $K_m = 4 \times 10^{-5}$ $\mu\text{mol/l}$, and the rate of reaction (V) at substrate concentration $[S] = 1.2 \times 10^{-2}$ M is 80 $\mu\text{mol/l}\cdot\text{min}$. Assume no inhibitor is present. V_{max} is practically equal to

- (1) 40 $\mu\text{mol/l}\cdot\text{min}$
- (2) 80 $\mu\text{mol/l}\cdot\text{min}$
- (3) 120 $\mu\text{mol/l}\cdot\text{min}$
- (4) 4.8×10^2 $\mu\text{mol/l}\cdot\text{min}$

35. The amino acids with Phi and Psi values (-60, -40); (-59, -47) and (-80, 120) will be adopting which of the following conformation?

- (1) Helix-helix-extended
- (2) Helix-coil-extended
- (3) Extended-extended-loop
- (4) Loop-loop-coil

36. Conversion of glucose to glucose-6-phosphate requires energy. However, critically ill patients are treated with intravenous infusion of glucose rather than glucose -6-phosphate because

- (1) glucose-6-phosphate is unable to enter into cells
- (2) glucose-6-phosphate is degraded very fast
- (3) exogenous glucose-6-phosphate is toxic to the cells

(4) exogenous glucose-6-phosphate will competitively inhibit endogenous enzymes

37. Competitive inhibition of an enzyme by a competitive inhibitor can be overcome by simply

- (1) decreasing the concentration of substrate
- (2) increasing the concentration of substrate
- (3) decreasing the temperature of reaction
- (4) increasing the temperature of reaction

38. The legless condition that is observed in several groups of extant reptiles is the result of

- (1) their common ancestor having been legless.
- (2) a shared adaptation to an arboreal (living in trees) lifestyle.
- (3) several instances of the legless condition arising independently of each other.
- (4) individual lizards adapting to a fossorial (living in burrows) lifestyle during their lifetimes.

39. Mycoplasmas are bacteria that lack cell walls. On the basis of this structural feature, which statement concerning mycoplasmas should be true?

- (1) They are gram-negative.
- (2) They are subject to lysis in hypotonic conditions.
- (3) They lack a cell membrane as well.
- (4) They undergo ready fossilization in sedimentary rock.

40. Protists are alike in that all are

- (1) unicellular.
- (2) eukaryotic.
- (3) symbionts.
- (4) monophyletic.

41. The most recent common ancestor of all land plants was probably similar to modern-day members of which group?

- (1) green algae
- (2) red algae
- (3) charophytes
- (4) brown algae

42. The enzyme of choice for converting DNA with 3' end overhang into a blunt ended one is

- (1) Klenow fragment of DNA Polymerase I
- (2) DNA Polymerase I holoenzyme
- (3) T4 DNA polymerase
- (4) SI nuclease

43. Pyrosequencing derives its name from the fact that

- (1) the bases are detected by pyrolysis
- (2) it uses enzyme apyrase to detect the bases
- (3) it detects pyrophosphate released during base incorporation
- (4) it generates pyrograms as output

44. A BSA stock solution is diluted 10 folds with phosphate buffer. The absorbance of the solution in a quartz cuvette of pathlength 1 mm at 281.5 nm is 0.330. If the extinction coefficient of the protein is 0.66 ml/mg.cm, the concentration of the stock protein solution would be

- (1) 5 mg/ml
- (2) 20 mg/ml
- (3) 33 mg/ml
- (4) 50 mg/ml

45. How does a bacterial cell protect its own DNA from restriction enzymes?

- (1) by adding methyl groups to adenines and cytosines
- (2) by using DNA ligase to seal the bacterial DNA into a closed circle
- (3) by adding histones to protect the double- stranded DNA
- (4) by forming "sticky ends" of bacterial DNA to prevent the enzyme from attaching

46. One of the major reasons of the failure of somatic gene therapy protocol can be assigned to

- (1) Lack of appropriate gene delivery system
- (2) Lack of technique in site specific integration of foreign gene into the chromosome of target cells
- (3) Low level expression of foreign genes in target cells
- (4) High level expression of foreign genes in target cells

47. Plants carrying a transgene for glyphosate resistance will survive a field application of glyphosate that kills weeds. Which of the following enzyme is inhibited by glyphosate?

- (1) Phosphoglycerate
- (2) Phosphoglycolatephosphatase
- (3) Enolpyruvateshikimate -3 - phosphate synthase
- (4) Glycolatedehydrogenase

48. Somatic embryos from cotyledon explant would develop in which of the following sequences?

- (1) Globular, torpedo, heart, cotyledonary stage
- (2) Globular, heart, torpedo & cotyledonary stage
- (3) Cotyledonary, heart, globular & torpedo
- (4) Cotyledonary, torpedo, heart & globular

49. In 1997, Dolly the sheep was cloned. Which of the following processes was used?

- (1) use of mitochondrial DNA from adult female cells of another ewe
- (2) replication and dedifferentiation of adult stem cells from sheep bone marrow
- (3) separation of an early stage sheep blastula into separate cells, one of which was incubated in a surrogate ewe

(4) fusion of an adult cell's nucleus with an enucleated sheep egg, followed by incubation in a surrogate

50. Which of the following was the most significant limiting factor in human population growth in the 20th century?

- (1) Famine
- (2) Non-HIV disease
- (3) HIV
- (4) Clean water

51. Which statement is true with regard to human population growth?

- (1) It is at a zero reproduction rate
- (2) Its rate of increase continues to grow at an exponential rate
- (3) Its rate of growth is slowing
- (4) Its rate of growth is increasing

52. According to bottom-up and top-down control models of community organization, which of the following expressions would imply that an increase in the size of a carnivore (C) population would negatively impact on its prey (P) population, but not vice versa?

- (1) $P \leftarrow C$
- (2) $P \rightarrow C$
- (3) $C \leftrightarrow P$
- (4) $P \leftarrow C \rightarrow P$

53. Ecosystem stability would be more when

- (1) there is linear food chains composed mainly of grazers
- (2) there are more number of carnivores
- (3) there is less than 1% energy flow among trophic level
- (4) food web is complex and multiples species interacting among themselves

54. With reference to lac operon which one of the following merodiploids will show a constitutive expression of β -galactosidase?

- (1) $I^+O^+Z^+Y^-/F' I^+O^+Z^+Y^+$
- (2) $I^+O^CZ^+Y^-/F' I^+O^+Z^+Y^+$
- (3) $I^+O^+Z^+Y^-/F' I^+O^CZ^+Y^+$
- (4) $I^+O^CZ^+Y^-/F' I^+O^+Z^+Y^+$

55. Which of the following statements is true?

- (1) There is a lesser probability for a crossover to occur between 2 genes farther apart from the genes nearer to each other
- (2) There is a greater probability for a crossover to occur between 2 genes farther apart from the genes nearer to each other
- (3) Probability of crossover between 2 genes is not related to the distance between them
- (4) Maximum frequency of recombination that can result from crossing over between linked genes is 100%

56. Mendel accounted for the observation that traits which had disappeared in the F1 generation reappeared in the F2 generation by proposing that

- (1) new mutations were frequently generated in the F2 progeny, "reinventing" traits that had been lost in the F1
- (2) the mechanism controlling the appearance of traits was different between the F1 and the F2 plants
- (3) traits can be dominant or recessive, and the recessive traits were obscured by the dominant ones in the F1
- (4) the traits were lost in the F1 due to dominance of the parental traits

57. Feather color in budgies is determined by two different genes, Y and B, one for pigment on the outside and one for the inside of the feather. YYBB, YyBB, or YYBb is green; yyBB or yyBb is blue; YYbb or Yybb is yellow; and yybb is white. Two blue budgies were crossed. Over the years, they produced 22 offspring, 5 of which were white. What are the most likely genotypes for the two blue budgies?

- (1) yyBB and yyBB
- (2) yyBB and yyBb
- (3) yyBb and yyBb
- (4) yyBB and yybb

58. Women (and all female mammals) have one active X chromosome per cell instead of two. What causes this?

- (1) Modification of the XIST gene so that it is active only on one X chromosome, which then becomes inactive
- (2) Activation of the Barr gene on one of the two X chromosomes that then inactivates
- (3) Crossover between the XIST gene on one X chromosome and a related gene on an autosome
- (4) Inactivation of the XIST gene on the X chromosome derived from the male parent

59. Which of the following is expected to have highest basal metabolic rate?

- (1) Rat
- (2) Cat
- (3) Dog
- (4) Elephant

60. A growing body of literature suggests that mutations are surprisingly frequent on a per genome/per generation basis; most areor.....

- (1) neutral/slightly beneficial
- (2) neutral/slightly deleterious
- (3) slightly deleterious/extremely deleterious
- (4) slightly beneficial/highly beneficial

61. If Darwin had been aware of genes, and of their typical mode of transmission to subsequent

generations, with which statement would he most likely have been in agreement?

- (1) If natural selection can change one gene's frequency in a population over the course of generations then, given enough time and enough genes, natural selection can cause sufficient genetic change to produce new species from old ones
- (2) If an individual's somatic cell genes change during its lifetime, making it more fit, then it will be able to pass these genes on to its offspring
- (3) If an individual acquires new genes by engulfing, or being infected by, another organism, then a new genetic species will be the result
- (4) A single mutation in a single gene in a single gamete will, if perpetuated, produce a new species within just two generations

62. Although each of the following has a better chance of influencing gene frequencies in small populations than in large populations, which one most consistently requires a small population as a precondition for its occurrence?

- (1) Mutation
- (2) Nonrandom mating
- (3) Genetic drift
- (4) Natural selection

63. During senescence of a plant

- (1) the plant displays sequential senescence of the leaves
- (2) metabolites like carbohydrates, proteins etc are transported from young leaves to the ageing leaves
- (3) metabolites like carbohydrates, proteins etc are transported out of the ageing leaves to the young leaves
- (4) secondary plant products accumulate in the tissues and organs during ageing

64. Leaf abscission is a phenomenon regulated by the amount of auxin and ethylene. Which one of the following statements is correct regarding the amount of auxin and ethylene during leaf abscission?

- (1) Reduction in ethylene and increase in auxin
- (2) Increase in both ethylene and auxin
- (3) Reduction in auxin and increase in ethylene
- (4) Decrease in both ethylene and auxin

65. The productivity of crop declines when leaves begin to wilt mainly because-

- (1) the chloroplast of wilting leaves decomposes
- (2) flaccid mesophyll cells are incapable of photosynthesis
- (3) stomata close, preventing CO₂ from entering the leaf
- (4) Photolysis of water cannot occur

66. In electron transport chain

- (1) complex I and III are mobile while cytochrome-C and coenzyme-Q are immobile
- (2) complex I and III are immobile while cytochrome-e and coenzyme-Q are mobile
- (3) complex I and cytochrome-c are mobile while complex III and coenzyme-Q are immobile
- (4) Complex I and cytochrome-c are immobile while complex m and coenzyme-Q are mobile

67. Which of the following techniques is useful in determining the movement of proteins within the nucleus?

- (1) Electron microscopy
- (2) Fluorescence recovery after photobleaching
- (3) Fluorescent in situ hybridization
- (4) Confocal light microscopy

68. In mammals, the nuclei resulting from the union of the sperm and the egg are first truly diploid at the end of the

- (1) acrosomal reaction
- (2) completion of spermatogenesis
- (3) initial cleavage
- (4) activation of the egg

69. The outer-to-inner sequence of tissue layers in a post-gastrulation vertebrate embryo is

- (1) endoderm → ectoderm → mesoderm
- (2) mesoderm → endoderm → ectoderm
- (3) ectoderm → mesoderm → endoderm
- (4) ectoderm → endoderm → mesoderm

70. Meroblastic cleavage occurs in

- (1) sea urchins, but not humans or birds
- (2) humans, but not sea urchins or birds
- (3) birds, but not sea urchins or humans
- (4) both sea urchins and birds, but not humans

Part C (Attempt any 25 ONLY)

71. Which of the following statements *correctly* describes some aspect of protein disposal from prokaryotic cells?

- (1) Prokaryotes are unlikely to be able to excrete proteins because they lack an endomembrane system.
- (2) The mechanism of protein excretion in prokaryotes is probably the same as that in eukaryotes.
- (3) Proteins that are excreted by prokaryotes are synthesized on ribosomes that are bound to the cytoplasmic surface of the plasma membrane.
- (4) In prokaryotes, the ribosomes that are used for the synthesis of secreted proteins are located outside of the cell.

72. When a potassium ion (K⁺) moves from the soil into the vacuole of a cell on the surface of a root, it must pass through several cellular structures. Which of the following correctly describes the order in which these structures will be encountered by the ion?

- (1) plasma membrane → primary cell wall → cytoplasm → tonoplast
- (2) secondary cell wall → plasma membrane → primary cell wall → cytoplasm → tonoplast
- (3) primary cell wall → plasma membrane → cytoplasm → tonoplast
- (4) primary cell wall → plasma membrane → tonoplast → cytoplasm → vacuole

73. When biological membranes are frozen and then fractured, they tend to break along the middle of the bilayer. The best explanation for this is that

- (1) the integral membrane proteins are not strong enough to hold the bilayer together.
- (2) water that is present in the middle of the bilayer freezes and is easily fractured.
- (3) hydrophilic interactions between the opposite membrane surfaces are destroyed on freezing.
- (4) the hydrophobic interactions that hold the membrane together are weakest at this point.

74. The research team used the setup to study the incorporation of labeled nucleotides into a culture of lymphocytes and found that the lymphocytes incorporated the labeled nucleotide at a significantly higher level after a pathogen was introduced into the culture. They concluded that

- (1) the presence of the pathogen made the experiment too contaminated to trust the results.
- (2) their tissue culture methods needed to be relearned.
- (3) infection causes lymphocytes to divide more rapidly.
- (4) infection causes cell cultures in general to reproduce more rapidly.

75. A mutation results in a cell that no longer produces a normal protein kinase for the M phase checkpoint. Which of the following would likely be the immediate result of this mutation?

- (1) The cell would prematurely enter anaphase.
- (2) The cell would never leave metaphase.
- (3) The cell would never enter metaphase.
- (4) The cell would undergo normal mitosis, but fail to enter the next G1 phase.

76. If a horticulturist breeding gardenias succeeds in having a single plant with a particularly desirable set of traits, which of the following would be her most

probable and efficient route to establishing a line of such plants?

- (1) Backtrack through her previous experiments to obtain another plant with the same traits.
- (2) Breed this plant with another plant with much weaker traits.
- (3) Clone the plant asexually to produce an identical one.
- (4) Force the plant to self-pollinate to obtain an identical one.

77. Which of the following statements best describes the difference in approach to studying the environment by early naturalists compared to present-day ecologists?

- (1) Early naturalists employed a descriptive approach; present-day ecologists generate hypotheses, design experiments, and draw conclusions from their observations.
- (2) Early naturalists manipulated the environment and observed changes in plant and animal populations, while modern ecology focuses on population dynamics.
- (3) Early naturalists systematically recorded what they observed in their environment; modern ecology is only concerned with man's impact on the environment.
- (4) Early naturalists were interested with man's interaction with the natural world; present-day ecologists seek to link ecology to developmental biology.

78. Which statement best contrasts environmentalism with ecology?

- (1) Ecology is the study of the environment; environmentalism is the study of ecology.
- (2) Ecology provides scientific understanding of living things and their environment; environmentalism is more about conservation and preservation of life on Earth.
- (3) Environmentalists are only involved in politics and advocating for protecting nature; ecologists are only involved in scientific investigations of the environment.
- (4) Ecologists study organisms in environments that have been undisturbed by human activities; environmentalists study the effects of human activities on organisms.

79. Which of the following groups would be most likely to exhibit uniform dispersion?

- (1) red squirrels, who actively defend territories
- (2) cattails, which grow primarily at edges of lakes and streams

(3) dwarf mistletoes, which parasitize particular species of forest tree

(4) moths in a city at night

80. As you study two closely related predatory insect species, the two-spot and the three-spot avenger beetles, you notice that each species seeks prey at dawn in areas without the other species. However, where their ranges overlap the two-spot avenger beetle hunts at night and the three-spot hunts in the morning. When you bring them into the laboratory, their offspring behave in the same manner. You have discovered an example of

- (1) mutualism.
- (2) character displacement.
- (3) Batesian mimicry.
- (4) facultative commensalism.

81. As big as it is, the ocean is nutrient-limited. If you wanted to investigate this, one reasonable avenue would be to

- (1) follow whale migrations in order to determine where most nutrients are.
- (2) observe Antarctic Ocean productivity from year to year to see if it changes.
- (3) experimentally enrich some areas of the ocean and compare their productivity to that of untreated areas.
- (4) compare nutrient concentrations between the photic zone and the benthic zone in various locations

82. How might the extinction of some Pacific Island bats called "flying foxes" threaten the survival of over 75% of the tree species in those islands?

- (1) The bats eat the insects that harm competitor plants.
- (2) The bats consume the fruit including the seeds that would be part of the trees' reproductive cycle.
- (3) The bats roost in the trees and fertilize soil around the trees with their nitrogen-rich droppings.
- (4) The bats pollinate the trees and disperse seeds.

83. Which of the following statements are TRUE with regard to the similarities between Crassulacean Acid Metabolism (CAM) and C4 cycle?

P. Stomata open during night and remain closed during the day

Q. PEPcase is the carboxylating enzyme to form C4 acid

R. C4 acid is decarboxylated to provide CO₂ for C3 cycle

S. Kranz anatomy is predominant in both CAM and C4 plants

- (1) P, S
- (2) Q, R
- (3) P, Q
- (4) R, S

84. Identify the CORRECT statements with regard to the function of plant hormones

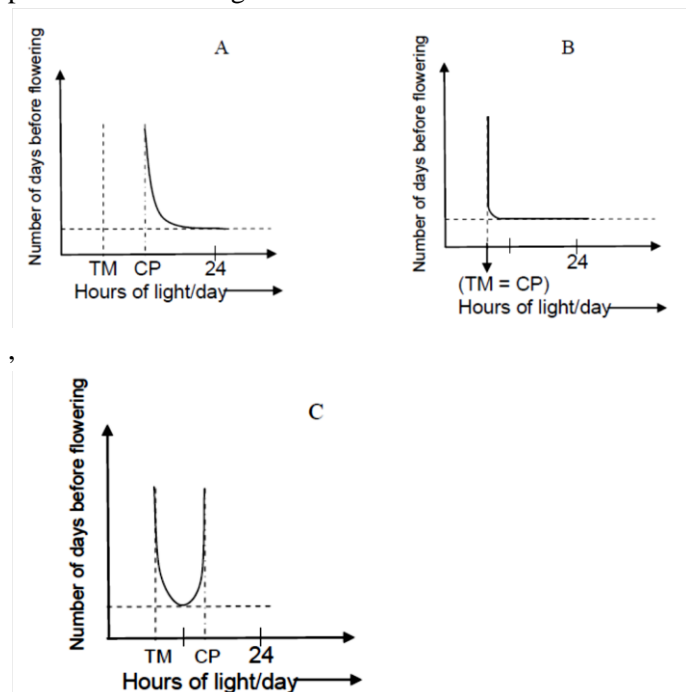
- P. ABA is synthesized from chorismate and promotes viviparous germination
 Q. Auxin induces acidification of cell wall followed by turgour-induced cell expansion
 R. Gibberellin-reponsive genes become activated by the repression of DELLA protein
 S. Cytokinin regulates the G2 to M transition in the cell cycle

- (1) P, Q (2) Q, R
 (3) Q, S (4) P, R

85. On the basis of the photoperiod required for flowering, plants can be described as:

- I. Short-day plants (SDP)
 II. Long-day plants (LDP)
 III. Day-length indifferent plants (DLIP)

The effect of varying light periods on flowering in these three types of plants is depicted in the graphs below, where TM, trophic minimum, is the minimum light that is required to produce the organic matter indispensable to its metabolism and CP is the critical period for flowering.

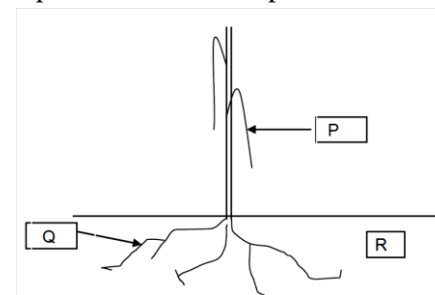


Choose the plant type (I, II or III) for each of the three graphs and choose the correct option from the table.

| Options | Graph A | Graph B | Graph C |
|---------|---------|---------|---------|
| (1) | I | II | III |
| (2) | III | II | I |
| (3) | II | III | I |
| (4) | II | I | III |

86. A mesophyte was planted in soil with high salt concentration and watered. It showed wilting. Assign the appropriate values of water potentials to the

regions marked P, Q, and R in the schematic representation of this plant.

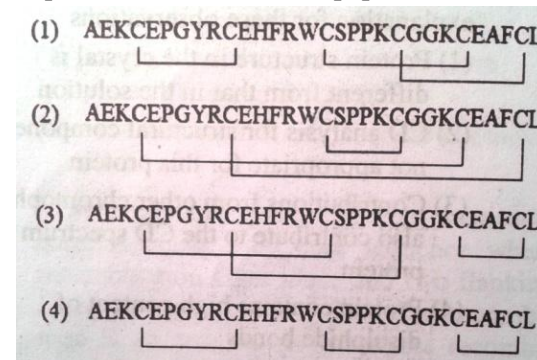


Choose from the options given below

- 1 atm
 -5 atm
 -8 atm

| Options | P | Q | R |
|---------|--------|--------|--------|
| (1) | -1 atm | -5 atm | -8 atm |
| (2) | -5 atm | -1 atm | -8 atm |
| (3) | -5 atm | -8 atm | -1 atm |
| (4) | -8 atm | -1 atm | -5 atm |

87. 4A 30-residue peptide was treated with trypsin and the tryptic peptides were separated by HPLC. Four peaks A, B, C and D were obtained. Peptides corresponding to A, B, C and D were reduced and alkylated selectively at cysteine residues. The sequences obtained from A, B, C and D after reduction and alkylation were: A, AEK; B, C(S-alkyl) EPGYR and WC(S-alkyl)SPPK; C.C(Salkyl) EHFR and C(S-alkyl)GGK; D, C(S-alkyl)EAF C(S-alkyl)L. The sequence of the 30-residue peptide is



- (1) Sequence 1 (2) Sequence 2
 (3) Sequence 3 (4) Sequence 4

88. The most important property of any microscope is its power of resolution, which is numerically equivalent to D ; the minimum distance between two distinguishable objects. D depends on three parameters namely, the angular aperture, α , the refractive index, N , and wavelength, λ , of the incident light. Below are given few options to increase the resolution of the microscope

- A. Decrease the value of λ or increase either N or α to improve resolution
 B. Moving the objective lens closer to the specimen will decrease $\sin \alpha$ and improve the resolution

C. Using a medium with high refraction index between specimen and the objective lens to improve the resolution

D. Increase the wavelength of the incident light to improve resolution

Which of the following combinations of above statement are correct?

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

89. Determine the sequence of hexapeptide based on the following data. Note: When the sequence is not known, a comma separates the amino acids

- Amino acid composition: (2R,A,S,V,Y)
- N-terminal analysis of the hexapeptide: A
- Trypsin digestion: (R,A,V) and (R,S,Y)
- Carboxypeptidase digestion: No digestion
- Chymotrypsin digestion: (A,R,V,Y) and (R.S)

- (1) AVRSYR (2) AVRYSR
(3) ARVYSR (4) AVYSRR

90. Why does one need to make replica plates when screening for a specific DNA sequence among a large number of recombinant bacterial colonies?

- (1) It may take several tries to positively identify the specific sequence of interest.
(2) The screening process requires several different steps, each of which must be done on a new colony of recombinants.
(3) One wants a living culture of recombinant cells available after screening, a process that destroys the cells.
(4) It is good science to replicate all experimental results.

91. The major difference between defined and undefined cell media used in cell culture is

- (1) undefined medium is a recent development in cell culture technology.
(2) undefined medium is completely artificial.
(3) defined medium includes serum, lymph or other fluids from living sources.
(4) defined medium is free of serum, lymph or other fluids from living sources.

92. You are tracing the path of secretory protein from its synthesis to its export from a cell. You have added radioactive amino acids to a culture of cells, and then measured the amount of radioactivity that shows up in the proteins of each of the following fractions at different times after the addition. List the order in which the proteins of these fractions first exhibit radioactivity.

- I secretory vesicles II Golgi

- II rough ER IV smooth ER
V nucleus

- (1) III → II → I → out of the cell
(2) III → II → IV → V → out of the cell
(3) V → III → II → I → out of the cell
(4) IV → II → I → out of the cell

93. The enzyme fumarase catalyzes the reversible hydration of fumaric acid to l-malate, but it will not catalyze the hydration of maleic acid, the cis isomer of fumaric acid. This is an example of:

- (1) biological activity. (2) chiral activity.
(3) racemization. (4) stereospecificity.

94. A compound has a pKa of 7.4. To 100 mL of a 1.0 M solution of this compound at pH 8.0 is added 30 mL of 1.0 M hydrochloric acid. The resulting solution is pH:

- (1) 6.5 (2) 6.8
(3) 7.2 (4) 7.4

95. Which of the following statements about aromatic amino acids is correct?

- (1) All are strongly hydrophilic.
(2) Histidine's ring structure results in its being categorized as aromatic or basic, depending on pH.
(3) On a molar basis, tryptophan absorbs more ultraviolet light than tyrosine.
(4) The major contribution to the characteristic absorption of light at 280 nm by proteins is the phenylalanine R group.

96. The first step in two-dimensional gel electrophoresis generates a series of protein bands by isoelectric focusing. In a second step, a strip of this gel is turned 90 degrees, placed on another gel containing SDS, and electric current is again applied. In this second step:

- (1) proteins with similar isoelectric points become further separated according to their molecular weights.
(2) the individual bands become stained so that the isoelectric focus pattern can be visualized.
(3) the individual bands become visualized by interacting with protein-specific antibodies in the second gel.
(4) the individual bands undergo a second, more intense isoelectric focusing.

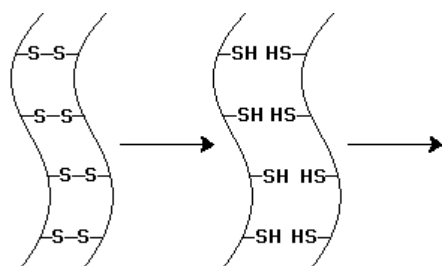
97. An α helix would be destabilized most by:

- (1) an electric dipole spanning several peptide bonds throughout the α helix.
(2) interactions between neighboring Asp and Arg residues.

(3) interactions between two adjacent hydrophobic Val residues.

(4) the presence of two Lys residues near the amino terminus of the α helix.

98. The α -keratin chains indicated by the diagram below have undergone one chemical step. To alter the shape of the α -keratin chains—as in hair waving—what subsequent steps are required?

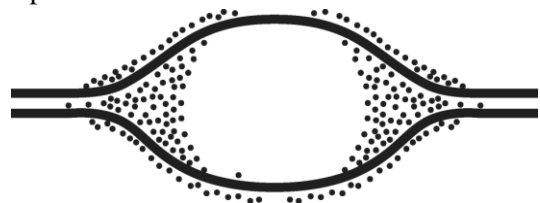


- (1) Chemical oxidation and then shape remodeling
- (2) Chemical reduction and then chemical oxidation
- (3) Chemical reduction and then shape remodeling
- (4) Shape remodeling and then chemical oxidation

99. Which of the following statements about a plot of V_0 vs. $[S]$ for an enzyme that follows Michaelis-Menten kinetics is false?

- (1) As $[S]$ increases, the initial velocity of reaction V_0 also increases.
- (2) At very high $[S]$, the velocity curve becomes a horizontal line that intersects the y-axis at K_m .
- (3) K_m is the $[S]$ at which $V_0 = 1/2 V_{max}$.
- (4) The shape of the curve is a hyperbola.

100. In an experiment, DNA is allowed to replicate in an environment with all necessary enzymes, dATP, dCTP, dGTP, and radioactively labeled dTTP (3H thymidine) for several minutes and then switched to nonradioactive medium. It is then viewed by electron microscopy and autoradiography. The drawing below represents the results.



Grains represent radioactive material within the replicating eye.

Which is the most likely interpretation?

- (1) There are two replication forks going in opposite directions.
- (2) Thymidine is only being added where the DNA strands are furthest apart.
- (3) Thymidine is only added at the very beginning of replication.
- (4) Replication proceeds in one direction only.

101. When DNA is compacted by histones into 10 nm and 30 nm fibers, the DNA is unable to interact with proteins required for gene expression. Therefore, to allow for these proteins to act, the chromatin must constantly alter its structure. Which processes contribute to this dynamic activity?

- (1) DNA supercoiling at or around H1
- (2) methylation and phosphorylation of histone tails
- (3) hydrolysis of DNA molecules where they are wrapped around the nucleosome core
- (4) accessibility of heterochromatin to phosphorylating enzymes

102. A mutant bacterial cell has a defective aminoacyl synthetase that attaches a lysine to tRNAs with the anticodon AAA instead of a phenylalanine. The consequence of this for the cell will be that

- (1) none of the proteins in the cell will contain phenylalanine.
- (2) proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU.
- (3) the cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons.
- (4) the ribosome will skip a codon every time a UUU is encountered.

103. Choose the answer that has these events of protein synthesis in the proper sequence.

V. An aminoacyl-tRNA binds to the A site.

W. A peptide bond forms between the new amino acid and a polypeptide chain.

X. tRNA leaves the P site, and the P site remains vacant.

Y. A small ribosomal subunit binds with mRNA.

Z. tRNA translocates to the P site.

- (1) V, X, W, Y, Z
- (2) Y, V, W, Z, X
- (3) Z, Y, X, W, V
- (4) Y, V, X, W, Z

104. During DNA replication,

- (1) all methylation of the DNA is lost at the first round of replication.
- (2) DNA polymerase is blocked by methyl groups, and methylated regions of the genome are therefore left uncopied.
- (3) methylation of the DNA is maintained because methylation enzymes act at DNA sites where one strand is already methylated and thus correctly methylates daughter strands after replication.
- (4) methylation of the DNA is maintained because DNA polymerase directly incorporates methylated

nucleotides into the new strand opposite any methylated nucleotides in the template.

105. A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture. In one set of experiments using this procedure in *Drosophila*, she was readily successful in increasing phosphorylation of amino acids adjacent to methylated amino acids in histone tails. Which of the following results would she most likely see?

- (1) increased chromatin condensation
- (2) decreased chromatin concentration
- (3) abnormalities of mouse embryos
- (4) decreased binding of transcription factors

106. Which statement about the complement system is true?

- (1) These proteins are involved in innate immunity and not acquired immunity.
- (2) These proteins are secreted by cytotoxic T cells and other CD8 cells.
- (3) This group of proteins includes interferons and interleukins.
- (4) These proteins are one group of antimicrobial proteins acting together in cascade fashion.

107. The genetic rearrangements that occur when antibody-producing cells mature are

- (1) temporary; the original genetic sequences are restored after antibody production ceases.
- (2) phenotypic; they do not involve the DNA.
- (3) permanent; a cell that has undergone genetic rearrangement is forever limited in the kinds of antibodies it can produce.
- (4) nonexistent; they are an artifact of the techniques used to study antibody production.

108. Of the following intracellular cascades invoked by signal transduction, which is novel to activation by cytokines?

- (1) ras and the MAP kinase cascade
- (2) phosphatidylinositol 3-hydroxy kinase (PI3K) and membrane-bound lipid messengers
- (3) phospholipase C and the IP₃ and DAG pathway
- (4) the JAK-STAT pathway for activating tyrosine kinases

109. Mutated mice lacking MDM2 die during embryonic development. Those lacking MDM2 and TP53 survive but are prone to cancer development. A reasonable conclusion from this study is that:

- (1) without p53, there is no need for MDM2 to modulate its influence on the cell cycle and apoptosis.

(2) without p53, the chance of mutated cells being arrested before they proliferate to for cancers is greatly reduced.

(3) neither statement is true.

(4) both statements are true.

110. Which of the following statements is true?

(1) When signal molecules first bind to receptor tyrosine kinases, the receptors phosphorylate a number of nearby molecules.

(2) In response to some G-protein-mediated signals, a special type of lipid molecule associated with the plasma membrane is cleaved to form IP₃ and calcium.

(3) Toxins such as those that cause botulism and cholera interfere with the ability of activated G proteins to hydrolyze GTP to GDP, resulting in phosphodiesterase activity in the absence of an appropriate signal molecule.

(4) Protein kinase A activation is one possible result of signal molecules binding to G protein-linked receptors.

111. One inhibitor of cGMP is Viagra. It provides a signal that leads to dilation of blood vessels and increase of blood in the penis, facilitating erection. cGMP is inhibited, therefore the signal is prolonged. The original signal that is now inhibited would have

(1) hydrolyzed cGMP to GMP.

(2) hydrolyzed GTP to GDP.

(3) phosphorylated GDP.

(4) dephosphorylated cGMP.

112. Which of the following is not a mechanism by which cells communicate with each other?

(1) transcription factors are secreted from one cell and taken up by the target cell, where they influence gene expression

(2) cell surface molecules on adjacent cells interact and initiate a signal transduction process that influences cellular behavior and gene expression

(3) cells form gap junctions with adjacent cells, allowing the passage of small molecules

(4) cells secrete proteins and small hydrophilic molecules, which interact with cell surface receptors on target cells and initiate a signal transduction process that influences cellular behavior and gene expression

113. The adult body plan of the fly is based on reiterating structures called segments; segment precursors (parasegments) are first positioned at the cell-by-cell level by which group of genes?

(1) maternal genes such as bicoid

(2) gap genes such as Kruppel

(3) pair-rule genes such as even-skipped

(4) segmentation genes such as engrailed

114. What property of the mammalian embryo permits the production of chimeric mice?

(1) The inner cell mass is highly regulative, so that extra cells derived from the inner cell mass of a different embryo are incorporated without causing defects.

(2) If half of the cells of the inner cell mass are removed and replaced with cells from half of a different embryo's inner cell mass, the embryo will heal and develop normally.

(3) The embryo can develop outside the womb, making surgical manipulations possible.

(4) Blastomeres separated at the two-cell stage will regulate and each forms a normal embryo.

115. Although the vertebrate body plan outwardly displays a mirror-image symmetry with regard to left and right, the internal organs are not symmetrical. How does this left-right asymmetry develop?

(1) The two cells of the Nieuwkoop center (at the 32-cell stage) signal each other and become either left or right.

(2) Maternal factors that determine left and right are packaged into the egg, just as dorsalizing factors are.

(3) Differential release of Ca^{2+} ions on the left side leads to expression of Nodal and Pitx2 on the left.

(4) Gravity determines the left-right axis: that side which is down becomes right and that side which is up becomes left.

116. In flies, frogs, and chicks, gradients of morphogens determine the future antero-posterior and dorso-ventral axes of the developing embryo. How is the antero-posterior axis determined in *C. elegans*?

(1) bicoid protein is translated in the anterior of the fertilized egg, leading to a gradient that determines the antero-posterior axis

(2) nodal triggers formation of an organizer that will determine the dorsal, and hence the anterior, side of the embryo

(3) β -catenin becomes localized to the nucleus in the future anterior cells after fertilization

(4) sperm entry leads to a reorganization of the cytoskeleton and redistribution of maternally packaged PAR proteins, which in turn determine the antero-posterior axis

117. Recently, it was reported that adult, differentiated cells can be made to behave as pluripotent stem cells by the introduction of a few genes, one of which was Oct4. What was the rationale for this experiment?

(1) Oct4 is a master switch gene that turns on the stem cell program.

(2) Oct4 expression is one of the requisites for the maintenance of pluripotent embryonic stem cells in culture.

(3) the Oct4 gene produces a cell-cell signaling protein that is used by stem cells to stimulate cell division

(4) Oct4 is only expressed in embryonic stem cells, and so its expression automatically reverses any differentiation that may have gone on in a cell

118. How does lateral inhibition work to specify individual neurons in the neural epithelium of invertebrates and vertebrates?

(1) Prospective neurons first arise in a cluster, but then, by chance, one cell will come to signal more strongly through Delta and Notch than its neighbors and become the only neuron in the cluster, by inhibiting its neighbors' specification as neurons.

(2) Stripes of prospective neurons will inhibit formation of neurons in stripes lateral to themselves.

(3) A gradient of inhibition spreads from the cells lateral to the neural epithelium, inhibiting their specification of neurons until a threshold is reached, at which point a single neuron is permitted to develop.

(4) Only one cell in each cluster of prospective neurons is fated to become a neuron, and it does so by inhibiting neural development in its lateral neighbors.

119. Numerous adult humans are currently treated for reflux disorders. However, at an earlier time in medical history these same individuals probably would have been diagnosed with gastric ulcers. Which of the following has most contributed to correct diagnosis of this problem?

(1) better pH monitoring

(2) improvements in X-ray technology

(3) ability to diagnose and treat *H. pylori* infection

(4) ability to perform colonoscopy

120. An anthropologist discovers fossilized animal remains that give strong evidence that the organism had a large, well-formed, most likely 4-chambered heart, with no connection between the right and left sides. Which of the following could most reasonably be hypothesized from this observation?

(1) that the animal and its relatives had evolved from birds

(2) that the animal had a high energy requirement and was endothermic

(3) that the animal was most closely related to reptiles such as alligators and crocodiles

(4) that the animal was a kind of invertebrate

121. A freshwater fish was accidentally placed in salt water. After several minutes in this saline water, it

died. What is the most logical explanation for its death?

- (1) Loss of water by osmosis in cells in vital organs resulting in cell death and eventually organ failure.
- (2) Salt diffused into all the fish's cells causing them to swell and, in some cases, lyse.
- (3) The kidneys were not able to keep up with the water removal necessary in this hyperosmotic environment creating an irrevocable loss of homeostasis.
- (4) The gills became encrusted with salt, resulting in inadequate gas exchange and a resulting asphyxiation.

122. Which of the following statements about hormones is *correct*?

- (1) Steroid and peptide hormones produce different effects but use the same biochemical mechanisms.
- (2) Steroid and peptide hormones produce the same effects but differ in the mechanisms that produce the effects.
- (3) Steroid hormones affect the synthesis of proteins, whereas peptide hormones affect the activity of proteins already present in the cell.
- (4) Steroid hormones affect the activity of certain proteins within the cell, whereas peptide hormones directly affect the processing of mRNA.

123. Genetic mutations in asexually reproducing organisms lead to more evolutionary change than do genetic mutations in sexually reproducing ones because

- (1) asexually reproducing organisms, but not sexually reproducing organisms, pass all mutations to their offspring.
- (2) asexually reproducing organisms devote more time and energy to the process of reproduction than do sexually reproducing organisms.
- (3) sexually reproducing organisms can produce more offspring in a given time than can sexually reproducing organisms.
- (4) more genetic variation is present in organisms that reproduce asexually than is present in those that reproduce sexually.

124. Action potentials are normally carried in only one direction: from the axon hillock toward the axon terminals. If you experimentally depolarize the middle of the axon to threshold, using an electronic probe, then

- (1) no action potential will be initiated.
- (2) an action potential will be initiated and proceed only in the normal direction toward the axon terminal.
- (3) an action potential will be initiated and proceed only back toward the axon hillock.

(4) two action potentials will be initiated, one going toward the axon terminal and one going back toward the hillock.

125. While more Alzheimer's disease is not hereditary, there is one subset of cases, called Familial Alzheimer's Disease (FAD) that can be seen to be transmitted through pedigrees. FAD has earlier age of onset but is otherwise similar. Which of the following groups of genes would you expect to be involved?

- (1) genes for amyloid or amyloid cleaving enzymes
- (2) genes for dopamine precursors
- (3) genes for biogenic amines
- (4) genes for premature aging

126. Why are we able to differentiate tastes and smells?

- (1) The action potentials initiated by taste receptors are transmitted to a separate region of the brain than those initiated by receptors for smell.
- (2) The sensory region of the cerebral cortex distinguishes something we taste from something we smell by the difference in the action potential.
- (3) The brain distinguishes between taste, arising from interoreceptors, from smell arising from exteroceptors.
- (4) Because we are able to see what we are tasting, the brain uses this information to distinguish taste from smell.

127. In cattle, roan coat color (mixed red and white hairs) occurs in the heterozygous (Rr) offspring of red (RR) and white (rr) homozygotes. Which of the following crosses would produce offspring in the ratio of 1 red : 2 roan : 1 white?

- (1) red \times white
- (2) roan \times roan
- (3) white \times roan
- (4) red \times roan

128. Most genes have many more than two alleles. However, which of the following is also true?

- (1) At least one allele for a gene always produces a dominant phenotype.
- (2) Most of the alleles will never be found in a live-born organism.
- (3) All of the alleles but one will produce harmful effects if homozygous.
- (4) There may still be only two phenotypes for the trait.

129. An ideal procedure for fetal testing in humans would have which of the following features?

- (1) Lowest risk procedure that would provide the most reliable information

- (2) The procedure that can test for the greatest number of traits at once
- (3) A procedure that provides a 3D image of the fetus
- (4) The procedure that can be performed at the earliest time in the pregnancy

130. A phenotypically normal prospective couple seeks genetic counseling because the man knows that he has a translocation of a portion of his chromosome 4 that has been exchanged with a portion of his chromosome 12. Although he is normal because his translocation is balanced, he and his wife want to know the probability that his sperm will be abnormal. What is your prognosis regarding his sperm?

- (1) 1/4 will be normal, 1/4 with the translocation, 1/2 with duplications and deletions.
- (2) All will carry the same translocation as the father.
- (3) None will carry the translocation since abnormal sperm will die.
- (4) His sperm will be sterile and the couple might consider adoption.

131. Abnormal chromosomes are frequent in malignant tumors. Errors such as translocations may place a gene in close proximity to different control regions. Which of the following might then occur to make the cancer worse?

- (1) An increase in non-disjunction
- (2) Expression of inappropriate gene products
- (3) A decrease in mitotic frequency
- (4) Death of the cancer cells in the tumor

132. A couple has a child with Down syndrome when the mother is 39 years old at the time of delivery. Which is the most probable cause?

- (1) The woman inherited this tendency from her parents.
- (2) One member of the couple carried a translocation.
- (3) One member of the couple underwent nondisjunction in somatic cell production.
- (4) One member of the couple underwent nondisjunction in gamete production.

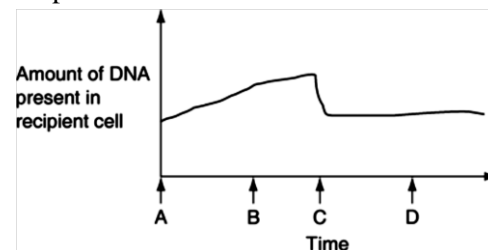
133. If this evolutionary tree is an accurate depiction of relatedness, then which of the following should be correct?

1. The entire tree is based on maximum parsimony.
2. If all species depicted here make up a taxon, this taxon is monophyletic.
3. The last common ancestor of species B and C occurred more recently than the last common ancestor of species D and E.
4. Species A is the *direct* ancestor of both species B and species C.

5. The species present at position 3 is ancestral to C, D, and E.

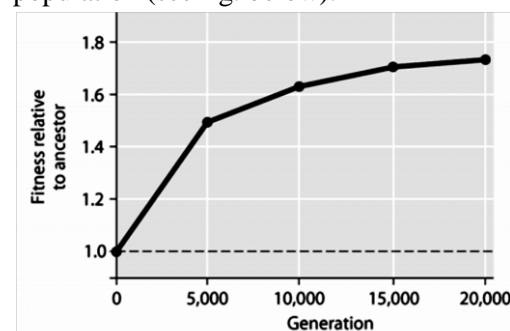
- (1) 2 and 5 (2) 1 and 3
- (3) 2, 3, and 4 (4) 1, 2, and 3

134. Which two processes are responsible for the shape of the curve at Time B?



1. transduction
 2. entry of single-stranded *Hfr* DNA
 3. rolling circle replication of single-stranded *Hfr* DNA
 4. activation of DNA pumps in plasma membrane
 5. "toilet paper" replication of recipient cell's plasmids
- (1) 1 and 4 (2) 2 and 3
- (3) 3 and 5 (4) 1 and 3

135. In this 8-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population (see fig. below).



Among the six statements below, which two best account for the results obtained by the researchers (see Figure)?

1. Low-glucose conditions caused mutations that made individual *E. coli* cells better suited to these conditions.
2. Daughter cells acquired the ability to tolerate low-glucose conditions as they received the enzymes and membrane components that had been modified by their mother cell.
3. The initial *E. coli* population may have included some cells whose genes favored their survival in low-glucose conditions—OR—such genetic variants arose by chance early in the experiment.

4. The first few generations of *E. coli* in low-glucose conditions responded to the challenge by increasing the use of certain enzymes and ion pumps, while decreasing the use of others. This behavior was recorded in their gene sequences, which were later transmitted to daughter cells.

5. From generation to generation, there was an increase in the proportion of the experimental populations adapted to low-glucose conditions, because such bacteria produced relatively more offspring than did ancestral bacteria under low-glucose conditions.

6. During each generation, individual cells evolved to increase their survival in low-glucose conditions.

(1) 3 and 5 (2) 1 and 5

(3) 2 and 4 (4) 1 and 6

136. Which of the following can be used to distinguish a nematode worm from an annelid worm?

1. type of body cavity
2. number of muscle layers in the body wall
3. presence of segmentation
4. number of embryonic tissue layers
5. shape of worm in cross-sectional view

(1) 2 only (2) 2 and 3

(3) 1, 2, and 3 (4) 1, 2, 3, and 5

137. A student observes a worm-like organism crawling about on dead organic matter. Later, the organism sheds its outer covering. One possibility is that the organism is a larval insect (like a maggot). On the other hand, it might be a member of which phylum, and one way to distinguish between the two possibilities is by looking for the presence of

- (1) Platyhelminthes; a cuticle of chitin.
- (2) Nematoda; an alimentary canal.
- (3) Annelida; a body cavity.
- (4) Nematoda; a circulatory system.

138. A team of researchers has developed a poison that has proven effective against lamprey larvae in freshwater cultures. The poison is ingested and causes paralysis by detaching segmental muscles from the skeletal elements. The team wants to test the poison's effectiveness in streams feeding Lake Michigan, but one critic worries about potential effects on lancelets, which are similar to lampreys in many ways. Why is this concern misplaced?

- (1) A chemical poisonous to lampreys could not also be toxic to organisms as ancestral as lancelets.
- (2) Lamprey larvae and lancelets have very different feeding mechanisms.
- (3) Lancelets do not have segmental muscles.
- (4) Lancelets live only in saltwater environments.

139. During a study session about evolution, one of your fellow students remarks, "The giraffe stretched its neck while reaching for higher leaves; its offspring inherited longer necks as a result." Which statement is most likely to be helpful in correcting this student's misconception?

- (1) Characteristics acquired during an organism's life are generally not passed on through genes.
- (2) Spontaneous mutations can result in the appearance of new traits.
- (3) Only favorable adaptations have survival value.
- (4) Disuse of an organ may lead to its eventual disappearance.

140. Which statement about natural selection is *most* correct?

- (1) Adaptations beneficial in one habitat should generally be beneficial in all other habitats as well.
- (2) Different species that occupy the same habitat will adapt to that habitat by undergoing the same genetic changes.
- (3) Adaptations beneficial at one time should generally be beneficial during all other times as well.
- (4) Well-adapted individuals leave more offspring, and thus contribute more to the next generation's gene pool, than do poorly adapted individuals.

141. In a Hardy-Weinberg population with two alleles, *A* and *a*, that are in equilibrium, the frequency of allele *a* is 0.1. What is the percentage of the population that is heterozygous for this allele?

- (1) 90 (2) 81
(3) 49 (4) 18

142. Races of humans are unlikely to evolve extensive differences in the future for which of the following reasons?

- I. The environment is unlikely to change.
 - II. Human evolution is complete.
 - III. The human races are incompletely isolated.
- (1) I only (2) III only
(3) I and II only (4) II and III only

143. A cage containing male mosquitoes has a small earphone placed on top, through which the sound of a female mosquito is played. All the males immediately fly to the earphone and thrust their abdomens through the fabric of the cage. What is the best explanation for this behavior?

- (1) The males learn to associate the sound with females.
- (2) Copulation is a fixed action pattern, and the female flight sound is a sign stimulus that initiates it.

(3) The sound from the earphone irritates the male mosquitoes, causing them to attempt to sting it.

(4) The reproductive drive is so strong that when males are deprived of females, they will attempt to mate with anything that has even the slightest female characteristic.

144. Which of the following could be classified as habituation?

(1) You enter a room and hear a fan motor. After a period of time, you are no longer aware of the motor's noise.

(2) You hear a horn while driving your car. You step on the brakes but notice the sound came from a side street. You resume your previous speed.

(3) One morning you awake to a beep-beep-beep from a garbage truck working on a new early morning schedule. The next week the garbage truck arrives at the same time and makes the same noise, but does not wake you up.

(4) A and C only

145. A researcher has used in vitro mutagenesis to mutate a cloned gene and then has reinserted this into a cell. In order to have the mutated sequence disable the function of the gene, what must then occur?

(1) recombination resulting in replacement of the wild type with the mutated gene

(2) use of a microarray to verify continued expression of the original gene

(3) replication of the cloned gene using a bacterial plasmid

(4) transcription of the cloned gene using a BAC

Mock test V. Answers

| | | | | | | | | | | | |
|-----------|---|-----------|---|-----------|---|------------|---|------------|---|------------|---|
| 1 | 1 | 26 | 2 | 51 | 3 | 76 | 3 | 101 | 2 | 126 | 1 |
| 2 | 4 | 27 | 4 | 52 | 1 | 77 | 1 | 102 | 2 | 127 | 2 |
| 3 | 1 | 28 | 4 | 53 | 4 | 78 | 2 | 103 | 2 | 128 | 4 |
| 4 | 2 | 29 | 3 | 54 | 2 | 79 | 1 | 104 | 3 | 129 | 1 |
| 5 | 3 | 30 | 2 | 55 | 2 | 80 | 2 | 105 | 2 | 130 | 1 |
| 6 | 2 | 31 | 4 | 56 | 3 | 81 | 3 | 106 | 4 | 131 | 2 |
| 7 | 4 | 32 | 3 | 57 | 3 | 82 | 4 | 107 | 3 | 132 | 4 |
| 8 | 2 | 33 | 3 | 58 | 1 | 83 | 2 | 108 | 4 | 133 | 4 |
| 9 | 3 | 34 | 2 | 59 | 1 | 84 | 2 | 109 | 4 | 134 | 2 |
| 10 | 2 | 35 | 1 | 60 | 2 | 85 | 3 | 110 | 4 | 135 | 1 |
| 11 | 2 | 36 | 1 | 61 | 1 | 86 | 1 | 111 | 1 | 136 | 3 |
| 12 | 4 | 37 | 2 | 62 | 3 | 87 | 3 | 112 | 1 | 137 | 4 |
| 13 | 3 | 38 | 3 | 63 | 3 | 88 | 1 | 113 | 3 | 138 | 4 |
| 14 | 1 | 39 | 2 | 64 | 3 | 89 | 2 | 114 | 1 | 139 | 1 |
| 15 | 1 | 40 | 2 | 65 | 3 | 90 | 3 | 115 | 3 | 140 | 4 |
| 16 | 4 | 41 | 3 | 66 | 2 | 91 | 4 | 116 | 4 | 141 | 4 |
| 17 | 1 | 42 | 2 | 67 | 4 | 92 | 1 | 117 | 2 | 142 | 2 |
| 18 | 2 | 43 | 3 | 68 | 3 | 93 | 4 | 118 | 1 | 143 | 2 |
| 19 | 2 | 44 | 4 | 69 | 3 | 94 | 4 | 119 | 3 | 144 | 4 |
| 20 | 2 | 45 | 1 | 70 | 3 | 95 | 3 | 120 | 2 | 145 | 1 |
| 21 | 3 | 46 | 2 | 71 | 3 | 96 | 1 | 121 | 1 | | |
| 22 | 1 | 47 | 3 | 72 | 3 | 97 | 4 | 122 | 3 | | |
| 23 | 3 | 48 | 2 | 73 | 4 | 98 | 4 | 123 | 1 | | |
| 24 | 1 | 49 | 4 | 74 | 3 | 99 | 2 | 124 | 4 | | |
| 25 | 3 | 50 | 4 | 75 | 4 | 100 | 1 | 125 | 1 | | |