IFAS

STUDY MATERIAL

MODEL PAPER-I

PART-A and B

CSIR NET LIFESCIENCES

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INSTITUTE FOR ADVANCED STUDIES

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1. The derivative of $\frac{1-sin2\,X}{cos2\,X}$ is

1. $\frac{1-2\sin X\cos X}{-2\cos X\sin X}$ 2. $\frac{cos2\,X}{sin2\,X}$

3. -tan^2 4. 0

12. The product of roots of $5x^2 + 28x + 15 = 0$ is
1. 3 2. -15
3. 15 4. 5

3. The periodic table is based on
1. The number of electron
2. The number of nucleons
3. Core electronic configurations
4. Valance electronic configurations

4. A group of 425 people are registered serially starting from 1086. If we make pairs of one even and one odd numbered candidates based on their registration numbers
1. At least 3 people will be left out
2. At odd numbered person will be left out
3. An even numbered person will be left out
4. None of them will be left out

5. If the mass of an object on the moon is 60 Kg, its mass on the earth will be
1. 60 Kg 2. More than 60 Kg
3. Less than 60 Kg 4. 93 Kg

6. The third largest constituent of our atmosphere is
1. Water vapors 2. Argon
3. Carbon monoxide 4. Methane

7. Moon's surface shows far more craters than the earth's surface because
1. of an optical illusion
2. Moon was bombarded more heavily
3. of different volcanic mechanisms
4. of absence of weathering and erosion on the moon

8. When we walk on a slope we tend to bend
1. To raise our centre of gravity
2. To lower our centre of gravity
3. To reduce the frictional force
4. To increase our frictional force

9. The work done by a radial force of 10 N acting on a particle of mass 2 Kg moving in a circular orbit of radius 1 meter is
1. 10 joule 2. 20 joule
3. 5 joule 4. Zero

10. When a particle of charge q is at rest, its produces
1. Only electric field
2. Only magnetic field
3. Both electric and magnetic field
4. A magnetic field depending upon the sign of the charge

11. A person standing on the top of a hill fires a gun. The echo of the gun comes back from a nearby hill in 3 seconds. What is the distance between the hills (Velocity of sound in air is 340 m/s)
1. 1020 m 2. 510 m
3. 205 m 4. 430 m

12. For hydrogen atom n^{th} states energy level is proportional to
1. $1/n^2$ 2. $1/n$
3. n 4. n^2

13. Which is faster, RAM or ROM
1. RAM is faster
2. ROM is faster
3. Both have the same speed
4. Both of them are very slow

14. ABC is a triangle of sides 15, 20 and 25. Let P, Q and R be the mid points of the sides. Then the perimeter of PQR is.
1. 10 2. 15
3. 20 4. 30

15. Which of the following is not an input output device?
1. CDROM 2. Hard disc
3. Floppy drive 4. DAT drive

16. What is the major difference between a 386 PC and 286 PC.
1. 386 PC has a Math Co-Processor built in, 286 PC does not
2. 286 PC needs only 286 cycles to complete its works while a 386 PC requires a 386s cycles
3. 386 PC is 32 bit processor, while a 286 is a 16 bit processor
4. 386 PC is bigger in size than a 286 PC

17. The deepest trenches in the oceans are found
1. Next to mid-ocean ridges
2. Along Transform faults
3. behind passive plate margins
4. along subduction zones

18. The clock speed of Intel Pentium Chip is approximately
1. 10 Hz 2. 10^3 Hz
3. 10^6 Hz 4. 10^9 Hz

19. Which of the following is an operating system
1. UNIX 2. LOTUS
3. FORTRAN 4. PASCAL

20. On a cement floor, the portion beneath a patch of water appears darker than the dry part of the floor because light undergoes.
1. Total internal reflection 2. Interference
3. Diffraction 4. Polarization

21. A stone dropped vertically from the top of a hill takes 10 seconds to hit the ground. If the same stone is thrown out horizontally from the top of the hill with a speed of 25 m/sec, the time it takes to hit the ground will be.
1.98 sec 2.49 sec
3.25 sec 4. 10 sec

22. A brick shaped metal block has sides of length 2 cm, 3 cm and 4 cm respectively. The block is heated. Due to thermal expansion, each edge increases in length by 1%. The percentage increase in the volume of the metal block
1. 1% 2.3%
3.9% 4.24%

23. On addition of a tablespoon of common salt to glass of water, the electrical conductance will
1. Decreases 2. Increases
3. Remain constant 4. Become zero

24. To convert a galvanometer as a voltmeter we connect which one of the following to the galvanometer?
(1) A low resistance in series
(2) A high resistance in series
(3) A high resistance in parallel
(4) A low resistance in parallel

25. For a reaction to occur spontaneously at a given temperature and pressure
(1) $\Delta H > 0$ and $\Delta S < 0$ (2) $\Delta S < O$
(3) $\Delta S > O$ (4) $\Delta H < T\Delta S$

26. The colours produced when white light is incident on the thin film of a soap bubble are due to
(1) scattering of light (2) interference of light
(3) dispersion of light (4) refraction of light

27. About how much of the net primary productivity of an aquatic ecosystem is eaten and digested by herbivores?
(1) 1% (2) 10%
(3) 40% (4) 90%

28. The part of a mushroom that is visible above the ground is a
(1) basidiocarp (2) zygospore
(3) ascarp (4) ascogonium

29. Which of the following can add up to N-economy of soils?
(1) Aulosira (2) Oscillatoria
(3) Spirulina (4) Spirogyra

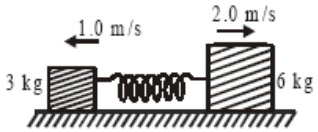
30. Which of the following processes releases a carbon dioxide molecule?
(1) Glycolysis
(2) Lactic acid fermentation
(3) Alcohol fermentation
(4) Hydrolysis of glycogen

31. Root like and leaflike structures of a moss, and the roots and leaves of a vascular, plant are
(1) analogous structures
(2) homologous structures
(3) embryonic structures
(4) vestigial structures

32. The microspore of a conifer, on release from the sporangium divides by mitosis to produce a
(1) multicellular embryo (2) female gametophyte
(3) pollen grain (4) needle

33. In spermatogenesis, the acrosome of the sperm is formed by
(1) mitochondria (2) nucleus
(3) Golgi complex (4) lysosome

34. Two blocks of mass 3 kg and 6 kg respectively are placed on a smooth horizontal surface. They are connected by a light spring of force constant k = 200 N/m. Initially the spring is unstretched. The indicated velocities are imparted to the blocks. The maximum extension of the spring will be :-



(1) 30 cm (2) 25 cm
(3) 20 cm (4) 15 cm

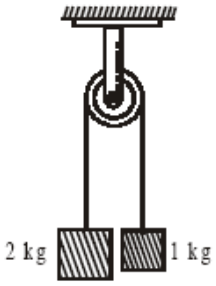
35. Consider the following programme and write the result that will print at end of program-

```
A=4
B=5
Do While A ≠ 0
If A ≥ B
A=A-B
Else
B=B-A
End If
PRINT A, B
```

(1) 0, 0 (2) 0, 1
(3) 1, 1 (4) 1, 0

36. From an elevated point A of a building a stone is projected vertically upwards. When the stone reaches a distance h below A, its Velocity is double of what it was a height h above A. Maximum height achieved by stone above A is :-
(1) 3/5 h (2) 5/6h
(3) 6/5h (4) 5/3h

37. Two blocks of masses 2 kg and 1 kg respectively are tied to the ends of a string which passes over a light frictionless pulley. The masses are held at rest at the same horizontal level and then released. The distance traversed by centre of mass in 2 seconds is: (g = 10 m/s^2)
(1) 1.42 m (2) 2.22 m
(3) 3.12 m (4) 3.33 m



38. Antivirus, in computer terminology means-
(1) Drug that inhibit viral replication
(2) Drug that kills virus
(3) Organism that feed on computer virus
(4) High level Program which crack viral codes

39. A cheetah can sprint with a maximum speed of 120 km/h, but has to stop after every 20 seconds. The maximum speed of a gazelle can achieve is 75 km/h, but it can maintain it-for several minutes. What is the maximum distance between the cheetah and gazelle at which the cheetah could still catch the gazelle by sprinting at the maximum speed?
(1) 250 meters (2) 175 meters
(3) 240 meters (4) 225 meters

40. Two solutions A and 8 differ in pH by 4 units. Their hydrogen ion concentration differs by
(1) 4 (2) 40000
(3) 4000 (4) 10,000

41. How many different types of gametes could be produced by an individual with the arbitrary genotype of *AAbbCCDdEe* ?
(1) Two (2) Four
(3) Six (4) Eight

42. During cytokinesis in an animal cell, a constricting ring pinches the dividing cell into the two daughter cells. This contractile ring is formed by which of the following structures?
(1) Centrioles (2) Microtubules
(3) Microfilaments (4) The spindle apparatus

43. An X-linked recessive gene produces red-green color blindness in humans. A woman with normal color vision whose father was color-blind marries a color-blind man. What is the probability that their son will be color-blind?
(1) 0 (2) 1/4
(3) ½ (4) 3/4

44. Which of the following is NOT a correct statement about the process of meiosis?
(1) Meiosis I separates chromosomes; meiosis II separates chromatids.
(2) Synapsis and crossing-over occur during meiosis I.
(3) Kinetochores are responsible for aligning chromatids during meiosis I.
(4) Karyokinesis occurs before cytokinesis.

45. Endoplasmic reticulum (ER) is the site of all of the following EXCEPT
(1) drug detoxification by means of mixedfunction oxidases
(2) synthesis of proteins that are secreted from the cell
(3) N-linked glycosylation of newly formed polypeptides
(4) hydrolytic activities carried by acid hydrolases

46. Exons of a gene are defined as
(1) the untranslated regions of the corresponding mRNA
(2) regions in the corresponding mRNA that are involved in initiation of transcription
(3) regions that are not transcribed by RNA polymerase
(4) regions that remain in the corresponding mRNA after splicing

47. In *Drosophila*, regions of polytene chromosomes show puffs at different times in development. Studies with labeled compounds have indicated that the localization to the puffs of tritiated
(1) thymidine indicates that RNA is being synthesized
(2) leucine indicates that new proteins are being synthesized
(3) uridine indicates that DNA is being synthesized
(4) uridine indicates that RNA is being synthesized

48. In *Drosophila*, a homeotic mutation would be the most likely explanation for which of the following?
(1) A decrease in the number of parasegments
(2) A leg developing where an antenna would normally be located
(3) Forked and dense body bristles instead of straight and sparse ones
(4) A significantly shorter life span

49. Humoral immunity is characterized by all of the following EXCEPT
(1) a memory response
(2) antigen-antibody interaction
(3) the synthesis of immunoglobulins
(4) the production of cytotoxic T cells

50. In adult mammals, the primary site for the final stage of differentiation of T lymphocytes is the
(1) bone marrow (2) bursa of Fabricius
(3) thymus (4) liver

51. In the DNA sequence 5' CGA TCG GCT '3 , which of the following is considered a transition type mutation?
(1) 5 CGA CCG GCT 3 (2) 5 CGA TGG CT 3
(3) 5 CGA TCG CCT 3 (4) 5 CGA UCG GCU 3

52. The receptive surface for pollen on an angiosperm flower is the
(1) anther (2) ovary
(2) style (4) stigma

53. Immediately after fertilization in animals, the first structural and biochemical changes in the egg are initiated by
(1) new gene transcription
(2) the release of Ca^{2+} from internal reservoirs
(3) the initiation of DNA synthesis
(4) a lowering of cytosolic pH

54. It is possible for a cell to make proteins that last for months; hemoglobin in red blood cells is a good example. However, many proteins are not this long-lasting. They may be degraded in days or even hours. Why do cells make proteins with such short lifetimes if it is possible to make them last longer?
(1) Most proteins are used only once.
(2) Most cells in the body live only a few days.
(3) Cells lack the raw materials to make most of the proteins they need.
(4) This enables cells to control the amount of protein present.

55. Which of the following is true of homeotic genes?
(1) the homeodomain functions in binding to DNA
(2) they serve as an example of genomic gene control
(3) all homeotic genes contain a promoter called a homeobox
(4) all of the above are correct

56. Dioxin, produced as a by-product of various industrial chemical processes, is suspected of causing cancer and birth defects in animals and humans. It apparently acts by entering cells and binding to proteins, altering the pattern of gene expression. The proteins affected by dioxin are probably
(1) water-soluble proteins. (2) DNA polymerase.
(3) transcription factors. (4) enhancers.

57.QTL analysis is used to:
(1) identify RNA polymerase binding sites
(2) map genes in bacterial viruses
(3) determine which genes are expressed at a developmental stage
(4) identify chromosome regions associated with a complex trait in a genetic cross

58. When dominant epistasis is operative between two gene loci, the classical 9 : 3 : 3 : 1 ratio becomes modified into
(1) 9: 3: 4 ratio (2) 9: 6: 4 ratio
(3) 12: 3: 1 ratio (4) 15: 1 ratio

59. Phytochromes are bluish chromoproteins. The phytochrome chromophores are called as
(1) Phycobillins (2) Caretenoids
(3) Xanthophylls (4) Porphyrins

60. What are the sexual phenotypes of the following genotypes in Drosophila XXY,XO?
(1) Male, female (2) Male, male
(3) Intersex, female (4) Female, male

61. The most likely explanation for the observation that humans from entirely different societies smile when they greet a friend is that
(1) they share a common culture.
(2) they have imprinted on smiling faces when they were infants.
(3) they have learned that smiling does not stimulate aggression.
(4) smiling is an inherited behavior pattern.

62. To be able to pilot, an animal must
(1) have a time-compensated solar compass.
(2) orient to a fixed point in the night sky.
(3) know the distance between two points.
(4) know landmarks.

63. Which of the following is true about the building of a web by a spider?
(1) Spiders use a different design depending on the environment.
(2) A young spider learns to build a web by copying the web of its mother.
(3) A young spider imprints on its mother's web, and when it is sexually mature, it replicates that design.
(4) The motor patterns for web building are largely inherited.

64. The digestive enzymes of the small intestine
(1) do not function best at a low pH.
(2) are produced and released in response to circulating secretin.
(3) are produced and released under neuronal control.
(4) are all secreted by the pancreas.

65. Which statement about nutrient absorption by the intestinal mucosal cells is true?
(1) Carbohydrates are absorbed as disaccharides.
(2) Fats are absorbed as fatty acids and monoglycerides.
(3) Amino acids move across the plasma membrane only by diffusion.
(4) Bile transports fats across the plasma membrane.

66. Chylomicrons are like the tiny micelles of dietary fat in the lumen of the small intestine in that both
(1) are coated with bile.
(2) are lipid-soluble.
(3) travel through the lymphatic system.
(4) are coated with lipoproteins.

67. Microbial fermentation in the gut of a cow
(1) produces fatty acids as a major nutrient for the cow.
(2) occurs in specialized regions of the small intestine.
(3) occurs in the cecum, from which food is regurgitated, chewed again, and swallowed into the true stomach.
(4) produces methane as a major nutrient.

68. Which of the following is stimulated by cholecystokinin?
(1) Stomach motility
(2) Release of bile
(3) Secretion of hydrochloric acid
(4) Secretion of bicarbonate ions

69. The nucleotide sequence of a DNA codon is ACT. A messenger RNA molecule with a complementary codon is transcribed from the DNA. In the process of protein synthesis, a transfer RNA pairs with the mRNA codon. What is the nucleotide sequence of the tRNA anticodon?
(1) TGA (2) UGA
(3) TGU (4) ACU

70. Which of the following are arranged in the correct order by size, from largest to smallest?
(1) chromosome-gene-codon-nucleotide
(2) nucleotide-chromosome-gene-codon
(3) codon-chromosome-gene-nucleotide
(4) gene-chromosome-codon-nucleotide

71. One of the parents of a cross has a mutation in its mitochondria. In that cross, that parent is taken as a male. During segregation of F2 progenies that mutation is found in
(1) one-third of the progenies
(2) none of the progenies
(3) all the progenies
(4) fifty percent of the progenies

72. When a fresh-water protozoan possessing a contractile vacuole, is placed in a glass containing marine water, the vacuole will
(1) Increase in number (2) Disappear
(3) Increase in size (4) Decrease in size

73. One of the following is a very unique feature of the mammalian body:
(1) Homeothermy
(2) Presence of diaphragm
(3) Four chambered heart
(4) Rib cage

74. Chemically hormones are
(1) Biogenic amines only
(2) Proteins, steroids and biogenic amines
(3) Proteins only
(4) Steroids only

75. Which one of the following pairs is not correctly matched?
(1) Vitamin B12 – Pernicious anaemia
(2) Vitamin B6 – Loss of appetite
(3) Vitamin B1 – Beri-beri
(4) Vitamin B2 – Pellagra

76. Duodenum has characteristic Brunner's glands which secrete two hormones called
(1) Kinase, estrogen
(2) Secretin, cholecystokinin
(3) Prolactin, parathormone
(4) Estradiol, progesterone

77. Mast cells of connective tissue contain
(1) Vasopressin and relaxin
(2) Heparin and histamine
(3) Heparin and calcitonin
(4) Serotonin and melanin

78. Cancer cells are more easily damaged by radiation than normal cells because they are
(1) starved of mutation
(2) undergoing rapid division
(3) different in structure
(4) non-dividing

79. ATPase enzyme needed for muscle contraction is located in
(1) Actinin (2) Troponin
(3) Myosin (4) Actin

80. Which one of the following pairs is not correctly matched?
(1) Streptomyces – Antibiotic
(2) Serratia – Drug addiction
(3) Spirulina – Single cell protein
(4) Rhizobium – Biofertilizer

81. A free living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern Azolla is
(1) Tolypothrix (2) Chlorella
(3) Nostoc (4) Anabaena

82. In the ABO system of blood groups, if both antigens are present but no antibody, the blood group of the individual would be
(1) B (2) O
(3) AB (4) A

83. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency?
(1) Luteinizing hormone – Failure of ovulation
(2) Insulin– Diabetes insipidus
(3) Thyroxine – Tetany
(4) Parathyroid hormone – Diabetes mellitus

84. In a mutational event, when adenine is replaced by guanine, it is a case of
(1) Frame shift mutation (2) Transcription
(3) Transition (4) Transversion

85. Which of the following hormones is not a secretion product of human placenta?
(1) Human chorionic gonadotropin
(2) Prolactin
(3) Estrogen (4) Progesterone

86. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them will you not use for the purpose?
(1) Test tube containing calcium bicarbonate
(2) Chilled test tube
(3) Test tube containing heparin
(4) Test tube containing sodium oxalate

87. What is a keystone species?
(1) A species which makes up only a small proportion of the total biomass of a community, yet has a huge impact on the community's organisation and survival
(2) A common species that has plenty of biomass, yet has a fairly low impact on the community's organization
(3) A rare species that has minimal impact on the biomass and on other species in the community
(4) A dominant species that constitutes a large proportion of the biomass and which affects many other species

88. DNA fingerprinting refers to
(1) Molecular analysis of profiles of DNA samples
(2) Analysis of DNA samples using imprinting devices
(3) Techniques used for molecular analysis of different specimens of DNA
(4) Techniques used for identification of fingerprints of individuals

89. Flagella of prokaryotic and eukaryotic cells differ in
(1) Type of movement and placement in cell
(2) Location in cell and mode of functioning
(3) Microtubular organization and type of movement
(4) Microtubular organization and function

90. The animals with bilateral symmetry in young stage, and radial pentamerous symmetry in the adult stage, belong to the phylum
(1) Annelida (2) Mollusca
(3) Cnidaria (4) Echinodermata

91. Which of the following is LEAST likely to cause a proto-oncogene to become an oncogene?
(1) A gene is incorporated into a retroviral genome.
(2) A gene is moved close to an enhancer, causing excess product to be made.
(3) A gene is truncated, yielding a protein with modified activity.
(4) A gene is moved into centromeric heterochromatin, silencing its transcription.

92. The physiological role of restriction endonucleases is to
(1) allow the *in vitro* construction of recombinant DNA molecules
(2) methylate host DNA
(3) remove RNA primer during DNA synthesis
(4) cleave foreign DNA molecules that enter the cell

93. During the evolution of life on Earth, the photosynthetic organisms initially responsible for raising atmospheric oxygen concentrations from less than 1 percent to about 20 percent were
(1) cyanobacteria (2) archaea
(3) diatoms (4) flowering plants

94. Plant species *A* has a diploid number of 12, while species *B* has a diploid number of 16. Which of the following would be the diploid number of an

allotetraploid derived from a hybrid between these two species?
(1) 14 (2) 28
(3) 40 (4) 44

95. If two parents that are heterozygous (*Aa*) at a single locus give rise to offspring that are 25 percent *AA*, 50 percent *Aa*, and 25 percent *aa*, then all of the following are true EXCEPT:
(1) The parents are diploid organisms.
(2) The *a* allele is recessive lethal.
(3) The alleles assort independently.
(4) The gametes combine at random.

96. The mating system in which a female defends a large, multipurpose territory within which several males defend smaller, exclusive territories is known as
(1) polygynandry
(2) resource defense polygyny
(3) resource defense polyandry
(4) harem defense polygyny

97. One theory of the evolution of cooperation in animals states that under conditions of low resource availability, some members of a population are willing to sacrifice their own efforts to reproduce to ensure that the population as a whole will not exhaust all its resources and go extinct. Which level of selection is described in this model?
(1) Directional selection (2) Individual selection
(3) Disruptive selection (4) Group selection

98. Charles Darwin discussed all of the following EXCEPT:
(1) Natural selection tends to remove those organisms that are poorly adapted to their environments.
(2) Individuals in a population compete with one another for limited resources.
(3) Gene mutations are the source of variation for evolution.
(4) Organisms tend to produce more offspring than can survive in each generation.

99. When numbers of organisms and amounts of living material in successively higher trophic levels are compared, the values usually take the form of a pyramid, with the largest numbers and greatest biomass in the producer trophic level. However, in some marine ecosystems, the consumer trophic levels contain significantly greater amounts of living material than does the primary-producer trophic level. The best explanation for this is which of the following?
(1) The main primary producers in marine ecosystems are microscopic algae with extremely high rates of population turnover.
(2) Most consumers in marine ecosystems are filter feeders that must maintain large basket like structures for extracting food from the water.
(3) The increased availability of solar radiation in marine ecosystems means that fewer primary producers are required to support marine food chains.
(4) Marine zooplankton often produce large extensions of their bodies in order to increase buoyancy.

100. The fitness of a genotype is higher when it is rare in a population than when it is common. Which of the following types of selection is most likely operating?
(1) Density-independent selection
(2) Frequency-dependent selection
(3) Directional selection
(4) Stabilizing selection

101. Which of the following represents the most reduced form of carbon?
(1) R-CH_3 (2) R-COOH
(3) R-CHO (4) R-CH_2OH

102. The *K*m (Michaelis constant) of an enzyme for a substrate is defined operationally as
(1) half the substrate concentration at which the reaction rate is maximal
(2) the substrate concentration at which the reaction rate is half maximal
(3) the dissociation constant of the enzyme substrate complex
(4) the dissociation constant of the enzyme product complex

103. The reversible reaction in which dihydroxyacetone phosphate and glyceraldehyde 3-phosphate combine to form fructose 1,6-bisphosphate is best characterized as
(1) an aldol condensation (2) a Grignard reaction
(3) a free-radical reaction (4) a hydrolytic reaction

104. Dinitrophenol (DNP) uncouples mitochondrial electron transport from oxidative phosphorylation by
(1) dissipating the proton gradient
(2) inhibiting cytochrome oxidase
(3) dissociating the F0 and F1 units of the ATP synthase complex
(4) binding irreversibly to ubiquinone

105. Most of the dry mass in the trunk of a tree was originally derived from
(1) the soil (2) light energy
(3) amino acids (4) CO2

106. Which of the following cell compartments is associated with a protein skeleton composed of lamins?
(1) Chloroplast (2) Basement membrane
(3) Mitochondrion (4) Nucleus

107. Initiation of mitogenesis by epidermal growth factor and depolarization of the membrane of a skeletal muscle cell by acetylcholine are similar in that each
(1) involves, as an essential early step, an ion flux across the plasma-membrane receptor of the responding cell
(2) requires a ligand-mediated conformational change in a plasma-membrane receptor of the responding cell
(3) requires activation of a G protein on the cytoplasmic face of the plasma membrane in the responding cell
(4) is mediated by phosphorylation of the ligand receptor in the responding cell

108. The principal site of peptide neurohormone biosynthesis is the
(1) nucleus
(2) rough endoplasmic reticulum
(3) dendrite (4) synaptic vesicle

109. A previously unknown organism that lacks a nuclear membrane and mitochondria has just been discovered. Which of the following would this organism most likely possess?
(1) Lysosomes (2) Cilia
(3) Ribosomes
(4) Endoplasmic reticulum

110. Drugs that either stabilize or depolymerize microtubules can be used in cancer chemotherapy. Which of the following is correct concerning such drugs?
(1) They stimulate the immune system.
(2) They prevent chromatin condensation.
(3) They prevent movement of tumor cells into other tissues.
(4) They interfere with mitosis.

111. If the genetic code consisted of four bases per codon rather than three, the maximum number of unique amino acids that could be encoded would be
(1) 16 (2) 64
(3) 128 (4) 256

112. In humans, the Barr body is an
(1) active X chromosome in females
(2) active X chromosome in males
(3) inactive Y chromosome in males
(4) inactive X chromosome in females

113. Which of the following types of molecules is always found in virions?
(1) Lipid (2) Protein
(3) DNA (4) RNA

114. An RNA-dependent RNA polymerase is likely to be present in the virion of a
(1) DNA virus that multiplies in the cytoplasm
(2) DNA virus that multiplies in the nucleus
(3) minus-strand RNA virus
(4) plus-strand RNA virus

115. In *E. coli*, the inability of the *lac* repressor to bind an inducer would result in
(1) no substantial synthesis of **β**-galactosidase
(2) constitutive synthesis of **β** -galactosidase
(3) inducible synthesis of **β** -galactosidase
(4) synthesis of **β** -galactosidase only in the absence of lactose

116. If sucrose and monosodium glutamate (MSG) are added to a vinegar and oil salad dressing and shaken, the mixture will eventually separate into two phases of different density and polarity. Where will most of the sucrose and the MSG be located following phase separation?
(1) Both will concentrate in the vinegar.
(2) Both will concentrate in the oil.
(3) Both will concentrate at the interface.
(4) Sucrose will concentrate in the oil and MSG will concentrate in the vinegar.

117. A major advantage of monoclonal antibodies compared to polyclonal antibodies is that monoclonal antibodies
(1) have identical binding sites that recognize a specific epitope
(2) cross-link molecules that share antigenic sites
(3) are more easily coupled with probes such as fluorescent dyes
(4) can be produced against proteins that are immunogenic in rabbits

118. The initial product of photosynthetic CO_2 fixation in C3 plants is
(1) glyceraldehyde 3-phosphate
(2) dihydroxyacetone phosphate
(3) 3-phosphoglycerate
(4) phosphoenolpyruvate

119. In which of the following systems is the entropy the greatest?
(1) Water vapor
(2) Liquid water at pH 7.0, 37°C
(3) Water with sufficient acid added to lower the pH to (2)0
(4) Supercooled water (liquid water at a temperature less than 0°C)

120. Which enzyme is activated by phosphorylation?
(1) Acetyl-CoA carboxylase
(2) Fructose-1,6-bisphosphatase
(3) Glycogen synthase
(4) Fructose-2,6-bisphosphatase

121. All of the following statements about monomeric G proteins are true EXCEPT:
(1) They are regulated by GTP-GDP exchange proteins.
(2) They are regulated by GTPase activating proteins.
(3) They regulate enzymes that synthesize cGMP.
(4) They regulate vesicle fusion.

122. All of the following are known to be part of a signal transduction cascade EXCEPT
(1) phosphorylation of fibronectin
(2) dissociation of the components of a heterotrimeric G-protein
(3) enzymatic breakdown of phosphatidyl inositol bisphosphate (PIP2)
(4) elevation of intracellular [Ca2+]
(5) activation of cGMP phosphodiesterase

123. Which of the following will result if the level of potassium ions in a solution bathing a nerve cell is raised tenfold while the cell is at its resting state?
(1) The decrease in the normal K^+ gradient will cause partial depolarization.
(2) The amplification of the normal K^+ gradient will cause partial hyperpolarization.
(3) The added extracellular K^+ will accelerate Na^+/K^+ pumping and cause partial depolarization.
(4) The added extracellular K^+ will cause ligand-gated ion channels to open.

124. SNARE proteins are found in the membranes of all of the following compartments EXCEPT
(1) Mitochondria (2) Golgi complex
(3) Early endosome
(4) Endoplasmic reticulum

125. Treatment of root tip meristem cells with the microtubule inhibitor colchicine results in all of the following EXCEPT
(1) induction of polyploidy
(2) prevention of cytokinesis
(3) inhibition of mitotic spindle assembly
(4) cessation of DNA replication

126. Genes *a, b,* and *c* are widely spaced in the bacterial genome. Transducing phage from an *a*+ *b*+ *c*+ bacterium were used to infect a culture of *a*− *b*− *c*− cells, and *b*+ transductants were selected. Which of the following best describes the predicted genotypes of these transductants?
(1) Mostly *a*− *b*+ *c*− (2) Mostly *a*− *b*+ *c*+
(3) Mostly *a*+ *b*+ *c*+
(4) *a*+ *b*+ *c*+ and *a*− *b*+ *c*− in equal frequencies

127. If a cell has one chromosome in excess of the normal number of chromosomes present in the nucleus, it is referred to as
(1) aneuploid (2) polyploid
(3) tetraploid (4) haploid

128. Which of the following statements about retrotransposons is correct?
(1) They transpose via an RNA intermediate.
(2) They contain genes for ribosomal proteins.
(3) They possess a gene for RNA-dependent RNA polymerase.
(4) They possess genes that encode proteins that integrate RNA into chromosomes.

129. When bacteria produce mammalian proteins, cDNA is used rather than genomic DNA. Which of the following is the best explanation?
(1) It is easier to clone cDNA than genomic DNA of comparable size.
(2) It is easier to clone RNA than DNA.
(3) It is not possible to clone the entire coding region of the gene.
(4) Most eukaryotic genes have introns that cannot be removed in bacteria.

130. A mutation deleting an upstream activating sequence for a single gene would be expected to be
(1) polar (2) *trans*-dominant
(3) *cis*-dominant (4) silent

131. The difference between the molecular weight of sucrose and that of the sum of the molecular weights of its components (glucose and fructose) is
(1) 0 (2) 16
(3) 18 (4) 180

132. Proline disrupts α-helical structure in proteins because it is
(1) an acidic amino acid (2) a aromatic amino acid
(3) an imino acid (4) a basic amino acid

133. Glycogen phosphorylase exists in two forms in skeletal muscle. The active form, phosphorylase *a*, is generated from phosphorylase *b* by
(1) reversible dimerization of phosphorylase *b*, triggered by calcium ion
(2) proteolytic cleavage of a decapeptide from the N-terminus of phosphorylase *b*
(3) protonation of the active-site histidine residue by a decrease in intracellular pH
(4) ATP-dependent phosphorylation of a specific serine residue on each subunit

134. An alpha-helical conformation of a globular protein in solution is best determined by which of the following?
(1) Ultraviolet-visible absorbance spectroscopy
(2) Fluorescence spectroscopy
(3) Electron microscopy
(4) Circular dichroism

135. The nucleoside adenosine exists in a protonated form with a p*K*a of 3.8. The percentage of the protonated form at pH 4.8 is closest to
(1) 1 (2) 9
(3) 50 (4) 91

136. Membrane carrier proteins differ from membrane channel proteins by which of the following characteristics?
(1) Carrier proteins are glycoproteins, while channel proteins are lipoproteins.
(2) Carrier proteins transport molecules down their electrochemical gradient, while channel proteins transport molecules against their electrochemical gradient.
(3) Carrier proteins can mediate active transport, while channel proteins cannot.
(4) Carrier proteins do not bind to the material transported, while channel proteins do.

137. Particular RNAs that are important for development are located in distinct regions of the *Drosophila* embryo. This is most directly demonstrated by using
(1) western blotting (2) northern blotting
(3) *in situ* hybridization (4) *in vitro* translation

138. Which of the following events can induce a transient arrest in the translation of a secretory protein?
(1) Binding of a polysome to an ER receptor
(2) Binding of SRP to an N-terminal signal sequence
(3) Binding of snRNPs to the large ribosomal subunit
(4) Presence of a stop-transfer sequence in the polypeptide

139. The common pathway of entry into the endoplasmic reticulum (ER) of secretory, lysosomal, and plasma membrane proteins is best explained by which of the following?
(1) Binding of their mRNAs to a special class of ribosomes attached to the ER
(2) Addition of a common sorting signal to each type of protein after completion of synthesis
(3) Addition of oligosaccharides to all three types of proteins
(4) Presence of a signal sequence that targets each type of protein to the ER during synthesis

140. Eukaryotic cells with DNA damage often cease progression through the cell cycle until the damage is repaired. This type of control over the cell cycle is referred to as
(1) proteosome control (2) damage control
(3) checkpoint control (4) anticyclin control