



**INDIAN INSTITUTE OF SCIENCE  
BANGALORE - 560012**

**ENTRANCE TEST FOR ADMISSIONS - 2008**

**Program : Research**  
**Entrance Paper : Biological Sciences**  
**Paper Code : BC**

**Day & Date**  
**SUNDAY, 27<sup>TH</sup> APRIL 2008**

**Time**  
**9.00 A.M. TO 12.00 NOON**

## **GENERAL INSTRUCTIONS**

- 1. This paper consists of 100 multiple choice questions and carries a total of 100 marks, one mark for each question.**
- 2. Answers to all questions should be marked only on the OMR sheet provided.**
- 3. For each question, darken (fill) the appropriate bubble on the OMR sheet to indicate your answer.**
- 4. Use only HB pencils to darken the bubbles.**
- 5. Darken only one bubble per question. If you mark more than one bubble to answer a question, it will be evaluated as incorrect.**
- 6. If you wish to change your answer, please erase the existing mark completely before filling in the other bubble.**
- 7. There is no negative marking for wrong answers.**
- 8. Candidates are required to fill in the required fields on the answer sheet attached.**

## BIOLOGICAL SCIENCES

1. A nick in a DNA molecule can be detected by which of the following methods?
  - (A) Nested PCR
  - (B) Primer extension
  - (C) RT-PCR
  - (D) Karyotyping
2. The structure of a double-stranded DNA in a palindromic sequence is
  - (A) G-quartets
  - (B) Triplex DNA
  - (C) Hairpin DNA
  - (D) Cruciform DNA
3. The enzyme responsible for indefinite growth of human cancer cells is
  - (A) Telomerase
  - (B) DNA polymerase I
  - (C) RNA polymerase
  - (D) Reverse transcriptase
4. Spontaneous deamination in a DNA stored at  $-20^{\circ}\text{C}$  will lead to conversion of cytosine into
  - (A) Thymine
  - (B) Guanine
  - (C) Adenine
  - (D) Uracil
5. Which of the following does NOT apply to triplex DNA
  - (A) It is triple-stranded DNA
  - (B) Requires only Hoogsteen hydrogen bonding
  - (C) Requires Watson-Crick hydrogen bonding
  - (D) Forms at neutral or acidic pH
6. The replicative polymerase in *E. coli* is
  - (A) DNA polymerase I
  - (B) DNA polymerase II
  - (C) DNA polymerase III
  - (D) DNA primase

7. A DNA chip contains a complete set of random hexanucleotide (6-mers) probes. Out of the  $4^6 = 4096$  probes, how many will form perfect complementary duplexes with sequences within the 14 nucleotide single-stranded target DNA, 5' -GAACTGCATTGATA-3'?
- (A) 20
  - (B) 9
  - (C) 6
  - (D) 3
8. A major deviation from Mendel's laws occurs because of
- (A) Linkage
  - (B) Mutation
  - (C) Reversion
  - (D) Complementation
9. A mixture of 50-mer oligonucleotide and free nucleotides was loaded onto a Sephadex G-50 gel filtration column, which of the following results can be expected?
- (A) The oligonucleotide and the nucleotides would be retained in the column and they both can bind the resin
  - (B) The oligonucleotide would elute first
  - (C) Nucleotide would elute first
  - (D) Both co-elute on this column
10. Methylation of glutamate residues is typically associated with
- (A) Chemotaxis in bacteria
  - (B) Nuclear translocation in eukaryotes
  - (C) Restriction in bacteria
  - (D) Inter-cellular transport in plants
11. Solute movement through which channel is mainly responsible for the resting voltage?
- (A) Porin
  - (B) Gap junction
  - (C) Glucose
  - (D) Potassium

12. Ribonuclease has four disulfide bonds which were reduced by Dithiothreitol in presence of 8M urea. These reagents were removed by dialysis so that the protein could refold and the disulfide bonds reformed. If the reformation of S-S bonds occurred randomly, the expected recovery of the biological activity would be
- (A) 100%
  - (B) 80%
  - (C) 0.95 %
  - (D) 95 %
13. Myoglobin has 153 amino acid residues. If it was a continuous  $\alpha$ -helix, the length of myoglobin would be
- (A) 36 nm
  - (B) 53 nm
  - (C) 55 nm
  - (D) 23 nm
14. The  $V_{max}$  of an enzyme was 90  $\mu\text{moles}/\text{min}/\text{mg}$  of protein. If the molecular mass of the enzyme is 20,000 Da, the turnover number ( $\text{min}^{-1}$ ) of the enzyme is
- (A) 180
  - (B) 1800
  - (C) 90
  - (D) 18
15. Which of the following are *most* likely to be unstable?
- (A) Holocentric chromosomes in *C. elegans*
  - (B) Metacentric chromosomes in humans
  - (C) Dicentric chromosomes in yeast
  - (D) Monocentric chromosomes in mice
16. The peptide bond is not
- (A) apolar
  - (B) a partial double bond
  - (C) planar
  - (D) *trans* in proteins
17. The Bohr effect in hemoglobin refers to the
- (A) reduced affinity for  $\text{O}_2$  at lower pH
  - (B) higher pH in actively metabolizing tissues
  - (C) increased affinity for  $\text{O}_2$  at lower pH
  - (D) low pH in actively metabolizing tissues

18. IgG
- (A) is found primarily in mucosal secretions
  - (B) is one of the less common immunoglobulin types
  - (C) has the highest molecular weight of all immunoglobulins
  - (D) contains carbohydrate covalently attached to the heavy chain
19. Which of the following genes is defective in patients suffering from severe combined immunodeficiency syndrome?
- (A) cystic fibrosis transmembrane conductor regulator (CFTR)
  - (B) adenosine deaminase
  - (C) ribonucleotide reductase
  - (D) alpha 2 microglobulin
20. For which of the following diseases, a recombinant vaccine is available
- (A) Hepatitis A
  - (B) Hepatitis C
  - (C) Hepatitis B
  - (D) Hepatitis E
21. Which of the following molecules is a poor immunogen in children?
- (A) Bacterial polysaccharides
  - (B) Cholera toxoid
  - (C) Killed rabies virus
  - (D) Live attenuated polio virus
22. Which of the following proteins is NOT required for the growth of *Saccharomyces cerevisiae* cells in a medium containing glucose as the sole carbon source?
- (A) Phosphoglycerate kinase
  - (B) GAPDH
  - (C) Hexokinase
  - (D) Cytochrome C
23. Incubation of GTP with a protein resulted in the formation of GDP and  $P_i$ . The protein is likely to be:
- (A) Ras
  - (B) Myc
  - (C) Fos
  - (D) Myb

24. FOS, JUN and MYC are:
- (A) proteins expressed on the surface of cancerous cells
  - (B) protein kinases that phosphorylate transcription factors regulating expression of cancer genes
  - (C) proteins involved in regulation of expression of genes involved in growth promotion
  - (D) proteins involved in recombination and DNA repair
25. Which one of the following statements is correct?
- (A) Helper T cells express surface CD8 marker
  - (B) Cytotoxic T cells express surface CD4 marker
  - (C) Helper T cells express surface immunoglobulin IgG
  - (D) Cytotoxic T cells express surface CD8 marker
26. If secretory IgA protein subjected to SDS-PAGE under reducing conditions, the number of bands one can visualize after staining is:
- (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
27. A TH1 subset of T cells typically secretes
- (A) IL-5
  - (B) IL-13
  - (C) IL-4
  - (D) IFN- $\gamma$
28. Which of the following are examples of primary lymphoid organs
- (A) Spleen and lymph node
  - (B) Lymph node and Peyer's patches
  - (C) Bone marrow and thymus
  - (D) Tonsils and liver
29. Phagocytes kill bacteria using all of the following EXCEPT
- (A) Hydrogen peroxide
  - (B) Hydrolytic enzymes
  - (C) Low pH
  - (D) Strong reducing agents

30. Which one of the following sequences in proteins corresponds to N-glycosylation site? (X indicates any amino acid residue)
- (A) Asn-Ser/Thr
  - (B) Asn-X-Ser/Thr
  - (C) Asn-X-X-Ser/Thr
  - (D) Ser/Thr-Asn
31. Which of the following secondary metabolites is NOT an anti-cancer drug?
- (A) Paclitaxel
  - (B) Podophyllotoxin
  - (C) Atropine
  - (D) Vincristine
32. C3 and C4 plants differ in their photosynthesis, how?
- (A) C4 plants can separate CO<sub>2</sub> fixation and Calvin cycle temporally or spatially
  - (B) C4 plants can perform the light dependent reactions at night
  - (C) C4 plants require less energy for their carbon acquisition and are, therefore, more efficient
  - (D) C3 plants perform the light independent reactions in the vascular bundles
33. If the average molecular weight of one amino acid is 110 Daltons, the molecular weight of a peptide made up of 10 amino acids is expected to be
- (A) 1100
  - (B) 938
  - (C) 876
  - (D) 744
34. A bacterium has 1000 genes. Among the two daughters following replication, there is a probability of 1/1000 that a gene in either of the daughters has mutated. If a culture of one million cells is raised from one bacterium, the probability that the culture is a true clone (i.e., contains no mutants) is
- (A) about 99 in 100
  - (B) about 1 in 100
  - (C) about 1 in 10000
  - (D)  $<1 \times 10^{-6}$



35. Match the following and choose the correct combination:

- |                         |   |
|-------------------------|---|
| i. Rho and Rac proteins | a. Serine/threonine kinase                        |
| ii. Raf                 | b. Tumour suppressor gene                         |
| iii. Rb                 | c. GTP-binding proteins                           |
| iv. MAPKs               | d. Apoptotic factor                               |
| v. Bad                  | e. Regulate the activity of transcription factors |

- (A) i-c, ii-a, iii-b, iv-e, v-d  
(B) i-b, ii-a, iii-e, iv-c, v-d  
(C) i-c, ii-d, iii-b, iv-e, v-a  
(D) i-c, ii-b, iii-a, iv-c, v-d

36. Which of the following is common to the synthesis of all steroid hormones?

- (A) Conversion of testosterone to estradiol  
(B) Cholesterol side chain cleavage  
(C) Isomerization  
(D) Dehydrogenation

37. Myasthenia Gravis in humans is characterized by increased muscular weakness because of diminishing effects of acetylcholine at neuromuscular junction due to

- (A) Decreased release of acetylcholine at the neuromuscular junction  
(B) Increased activation of acetylcholine receptor  
(C) Production of antibodies against acetylcholine receptor  
(D) Increased release of inhibitory neurotransmitters at the neuromuscular junction

38. The posterior pituitary stores and secretes

- (A) ADH and FSH  
(B) GH and Prolactin  
(C) ACTH and ADH  
(D) ADH and Oxytocin

39. If  $^{14}\text{C}$ -glycine is used for biosynthetic labeling, which one of the following molecules can be labeled in bacterial cells?

- (A) Purines and pyrimidines  
(B) Purines and proteins  
(C) Proteins and lipids  
(D) Pyrimidines and proteins

40. Which one of the following reagents inhibits mammalian cell cycle at M phase?
- (A) Colcemid
  - (B) Adriamycin
  - (C) Mimosine
  - (D) Hydroxyurea
41. In which one of the following metabolic reactions is GTP utilized?
- (A) DNA replication
  - (B) Fatty acid biosynthesis
  - (C) Protein synthesis
  - (D) ATP synthesis
42. Rous Sarcoma virus uses the following enzyme for its replication:
- (A) DNA dependent DNA Polymerase
  - (B) RNA dependent RNA Polymerase
  - (C) DNA dependent RNA Polymerase
  - (D) RNA dependent DNA Polymerase
43. The protection against Small Pox afforded by prior infection with Cow Pox represents
- (A) Antigenic Specificity
  - (B) Antigenic Cross-reactivity
  - (C) Viral Super-infection
  - (D) Innate Immunity
44. The antigenic peptides can bind to the T cell receptor when the peptides are only
- (A) in the free form
  - (B) when bound by antibody
  - (C) when complexed to hapten
  - (D) when loaded on to MHC molecules
45. Which of the following enzymes can be used to radiolabel DNA as well as RNA?
- (A) Klenow fragment of DNA polymerase I
  - (B) Polynucleotide kinase
  - (C) Reverse transcriptase
  - (D) Taq polymerase

46. Which of the following antibiotics resembles the 3' end of a **charged tRNA molecule**?
- (A) Puromycin
  - (B) Streptomycin**
  - (C) Tetracycline
  - (D) Kanamycin
47. When heated, the  $A_{260}$  of DNA sample *A* increases linearly with temperature, whereas that of DNA sample *B* increases co-operatively. Which one of the following is correct?
- (A) Both *A* & *B* are single stranded
  - (B) A is double stranded and B is single stranded**
  - (C) Both *A* & *B* are double stranded
  - (D) A is single stranded and *B* is double stranded
48. Which of the following gases act as signaling molecules in eukaryotes?
- (A) Ethylene and Nitrous oxide**
  - (B) Ethylene and Nitric oxide
  - (C) Carbon dioxide and ethylene
  - (D) Nitric oxide and oxygen
49. You dissolve one mole of sodium acetate in 1 L of pure water. The concentration of sodium acetate in this solution is
- (A) 1.0 M
  - (B) 10.0 M
  - (C) <1.0 M
  - (D) 1.1 M
50. The secondary structure of a protein can be determined by
- (A) NMR spectroscopy, X-ray crystallography and CD spectroscopy
  - (3) NMR spectroscopy, X-ray crystallography and Fluorescence spectroscopy**
  - (C) X-ray crystallography, W-visible spectroscopy and Fluorescence spectroscopy
  - (D) CD spectroscopy, Mass spectroscopy and Fluorescence anisotropy

51. Match the following and choose the correct combination:

- |                       |                       |
|-----------------------|-----------------------|
| (a) Protein structure | (1) Northern blot     |
| (b) DNA transfer      | (2) Frederick Sanger  |
| (c) DNA sequencing    | (3) Ramachandran plot |
| (d) RNA transfer      | (4) Southern Blot     |

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

52. 500 ml of aqueous solution at pH 2 is mixed with 500 ml of aqueous solution at pH 7. Neither solution is buffered; the resulting pH is closest to

- (A) 5  
(B) 2  
(C) 7  
(D) 9

53. The dimension of a subcellular body is  $1.5\text{\AA}$ . Its dimension in meters is

- (A)  $1.5 \times 10^8$   
(B)  $1.5 \times 10^{-9}$   
(C)  $1.5 \times 10^{-7}$   
(D)  $1.5 \times 10^{-10}$

54. The approximate total number of red blood cells (RBC) in a human body is  $25 \times 10^{12}$ . About  $2 \times 10^{11}$  RBCs are produced per day. Therefore, the RBC on an average survives for

- (A) 12.5 days  
(B) 2.5 days  
(C) 125 days  
(D) 200 days

55. The molecular weight of IgG is 150 kDa. If the mass ratio of antibody:antigen in an IgG-antigen complex is 1:1, the molecular weight of the antigen is

- (A) 75 kDa  
(B) 150 kDa  
(C) 25 kDa  
(D) 300 kDa

56. Amino acid **composition** analysis revealed that a peptide has 2 Ala, 2 **Lys** and 1 Phe. Further, **a**) Ala is observed at the **N-terminus** before **and** after **digestion** with chymotrypsin and b) a free Lys **is released** after digestion **with** trypsin. Identify the sequence of the peptide?
- (A) Ala-Ala-Phe-Lys-Lys
  - (B) Ala-Phe-Lys-Ala-Lys
  - (C) **Ala-Phe-Lys-Lys-Ala**
  - (D) **Ala-Phe-Ala-Lys-Lys**
57. An oligomeric protein dissociates to its component subunits when **exposed to temperature below 0°C**, whereas high salt concentration **has** little effect on its dissociation. The quaternary structure of the **protein** is likely to be **stabilized** by
- (A) van **der** Waals interaction
  - (B) **Electrostatic** interaction
  - (C) Hydrophobic interaction
  - (D) **Covalent** bonds
58. **Signal recognition particle** consists of:
- (A) **A single large RNA**
  - (B) A **multi-protein** complex
  - (C) **A complex** of a single RNA and **multiple proteins**
  - (D) A **complex of multiple RNAs** and multiple proteins
59. In influenza virus infected cells, 5' cap-dependent **translation of host cell mRNAs** is severely impaired. The **mechanism involves**:
- (A) **Stealing of 5' cap of the host cell mRNA by the virus**
  - (B) Cleavage of an essential **initiation factor** by viral proteases
  - (C) **Degradation** of host cell mRNA by virus induced nucleases
  - (D) **Competition** with the viral mRNA for the initiating **ribosome**
60. Two-hybrid analysis is used for:
- (A) Studying DNA-protein interactions
  - (B) **Studying** protein-protein interactions
  - (C) Studying **regulatory** proteins
  - (D) Identification of complementary strands of nucleic acids

61. When the nerve cells send a message for muscle cells to contract, acetylcholine attaches to the receptor on the muscle cell membrane and a channel is opened allowing the  $\text{Na}^+$  ions to enter the cell through:
- (A) Diffusion
  - (B) Osmosis
  - (C) Active transport
  - (D) Facilitated diffusion
62. Mitochondria are involved in all of the following, except
- (A) ATP-production
  - (B) Apoptosis
  - (C) Tricarboxylic acid cycle
  - (D) Fatty acid biosynthesis
63. Pluripotent cells are normally derived from
- (A) Foetal tissue
  - (B) Inner cell mass of blastocyst
  - (C) Trophectoderm of blastocyst
  - (D) Foetal gonadal ridge
64. For embryo cloning by nuclear transfer technology, one would require the following to reconstitute an early cleavage-stage embryo:
- (A) Enucleated somatic cell and oocyte nucleus
  - (B) Enucleated oocyte and enucleated somatic cell
  - (C) Enucleated oocyte and somatic cell nucleus
  - (D) Nucleated oocyte and nucleated somatic cell
65. Which one of the following organisms does not have telomeres?
- (A) *Dictyostelium discoideum*
  - (B) *Tetrahymena thermophila*
  - (C) *Saccharomyces cerevisiae*
  - (D) *Haemophilus influenzae*
66. End product repression differs from feedback inhibition by regulating
- (A) Enzyme activity
  - (B) Enzyme synthesis
  - (C) Enzyme stability
  - (D) Enzyme folding

67. What is the  $[S]$  for the enzyme catalyzed reaction which has an **initial** velocity of 12.62 mole/liter/min, **maximum** velocity of 21.85 mole/liter/min, and a  $K_m$  of **3.88** mole/liter?
- (A) 2.51 mole/liter  
 (B) 5.3 mole/liter  
 (C) 0.2 mole/liter  
 (D) 4.31 mole/liter
68. The following genotypes are found in a population:  $AA=70$ ,  $Aa=50$  and  $aa=20$ . What are the allelic frequencies of **A** and **a**?
- (A)  $A=0.68$  and  $a=0.32$   
 (B)  $A=0.63$  and  $a=0.36$   
 (C)  $A=0.36$  and  $a=0.63$   
 (D)  $A=0.86$  and  $a=0.14$
69. A parental cross involving pure tall-round seeded and pure dwarf-wrinkle seeded pea plants produced tall-round seeded plants. Upon interbreeding the  $F_1$  tall-round scdded plants, a total of 400  $F_2$  plants were produced. How many among them *were* dwarf-round seeded plants?
- (A) 25  
 (B) 50  
 (C) 75  
 (D) 250
70. The concept 'central dogma of molecular genetics' was modified by
- (A) Temin and Baltimore  
 (B) Benzer  
 (C) Crick  
 (D) Beadle and Tatum
71. How many molecules of ATP are consumed and produced for two molecules of glucose in glycolysis?
- (A) 2 and 2  
 (B) 2 and 4  
 (C) 2 and 8  
 (D) 4 and 8

72. A 3.2 kb single copy region was amplified by PCR from human genomic DNA. The human genome size is  $3.2 \times 10^9$  bp. Prior to PCR, what proportion of the DNA consists of the 3.2 kb target sequence?
- (A)  $10^{-6}$
  - (B)  $10^{-12}$
  - (C)  $10^{-9}$
  - (D)  $10^{-3}$
73. A protein rich in which of the following amino acids would have a higher buffering capacity at physiologic pH?
- (A) Aspartic acid
  - (B) Arginine
  - (C) Serine
  - (D) Histidine
74. To calculate the membrane potential, which of the following equations is used?
- (A) Einstein-Stokes
  - (B) Nemst
  - (C) Goldman
  - (D) Hodgkin-Huxley
75. The residues that coordinate to the  $Zn^{2+}$  in Zinc finger proteins are
- (A) Asp and Glu
  - (B) Cys and Met
  - (C) Cys and His
  - (D) His and Ser
76. If the residues are arranged in the descending order of hydrophobicity, which one of the following sequences is correct?
- (A) Asp, Ala, Ser, Val, Ile
  - (B) Ile, Val, Ala, Ser, Asp
  - (C) Asp, Ile, Ser, Val, Ala
  - (D) Val, Ala, Ile, Asp, Ser
77. There are two concentric circles. The radius of the outer one is twice the radius of the inner circle. What is the ratio of the area between the circles to that of the inner circle?
- (A) 1:1
  - (B) 2:1
  - (C) 1:3
  - (D) 3:1



78. Cellulose is a polymer of
- (A) -Glu-a1, 3 Glu-
  - (B) -Glu-B1, 4 Glu-
  - (C) -Glu-a1, 4 Gal-
  - (D) -Glu-B1, 3 Gal-
79. Consider the benzene ring in which the C-C bond length is  $1.4 \text{ \AA}$ . What is the distance in  $\text{\AA}$  between diagonally opposite carbon atoms?
- (A) 2.8
  - (B) 1.4
  - (C) 0.7
  - (D) 4.2
80. Which one of the following molecules is a precursor for synthesis of vitamin C in the liver and the kidney of most mammals except higher primates?
- (A) Glucose
  - (B) Phenylalanine
  - (C) Squalene
  - (D) Linolenic acid
81. The lysosomal sorting signal is
- (A) N-acetyl-glucosamine
  - (B) Ran:GTP
  - (C) mannose-6-phosphate
  - (D) ribose-6-phosphate
82. The average density of a soluble protein is  $1.33 \text{ g/cm}^3$ . Calculate the specific volume of a soluble protein, given that the average molecular weight of an amino acid residue is 120 Daltons.
- (A) 0.50 mL/g
  - (B) 0.75 mL/g
  - (C) 0.33 mL/g
  - (D) 1.00 mL/g

83. A guinea pig was given a single injection of  $^{24}\text{NaCl}$ . Periodically, blood samples were withdrawn and analyzed immediately for radioactivity. The data are shown below. Calculate the biological half-life of  $^{24}\text{Na}$  in the blood stream

Time of injection (hr)	Specific activity (CPM/ml)
1	3604
2	2908
5	2376
10	1412
16	756
24	329

- (A) 3 hr  
 (B) 6 hr  
 (C) 9 hr  
 (D) 12 hr
84. Which of the following features of transposons is responsible for genetic polarity?
- (A) The presence of a translation stop signal in the transposon  
 (B) The inversion of base sequence in transposon  
 (C) The presence of a transcription stop signal in the transposon  
 (D) The deletion of base sequence in transposon
85. The pKa values for adenine (N-1) and guanine (N-7) are 4.2 and 3.2, respectively. At pH 7, the percentage of protonated forms of these groups are:
- (A) 0.2 % of adenine and 0.02 % of guanine  
 (B) 100 % of adenine and 0 % of guanine  
 (C) 0 % of adenine and 100 % of guanine  
 (D) 0.02 % of adenine and 0.2 % of guanine
86. Which of the following amino acids would you expect to find inside of a typical globular protein at pH 7?
- (A) Arg, Lys, Thr, Phe  
 (B) Ser, Glu, Asn, Lys  
 (C) Val, Ile, Phe, Met  
 (D) Ser, Met, Asp, Thr

87. Which one of the following reagents should be used to selectively inhibit RNA polymerase II mediated transcription in mammalian cells?
- (A) Alpha-amanitin
  - (B) Colchicine
  - (C) Puromycin
  - (D) Fucomycin
88. Electrophoresis of a purified protein called X in the presence of sodium dodecyl sulfate and beta-mercaptoethanol shows a single band of 60 kDa. In a gel filtration experiment, protein X elutes between alcohol dehydrogenase (160 kDa) and  $\beta$ -amylase (190 kDa). How many identical subunits protein X is composed of?
- (A) One
  - (B) Two
  - (C) Five
  - (D) Three
89. When bacteria develop resistance to an antibiotic, the explanation on the basis of natural selection is that
- (A) Resistant bacteria preexisted which were selected by the presence of the antibiotic
  - (B) Exposure to the antibiotic induced the resistance
  - (C) The antibiotic is mutagenic
  - (D) Resistance is a natural and non-genetic process
90. Removal of gene activity A from a linear pathway results in higher than normal levels of transcripts from gene B. A reasonable hypothesis would be that
- (A) Gene B must act upstream of gene A
  - (B) Gene A has no relation to transcripts of Gene B
  - (C) Gene B acts downstream of gene A and is regulated by A directly or indirectly
  - (D) The increase in transcript B abundance is an experimental error
91. The following plant hormone is synthesized from an amino acid precursor
- (A) Ethylene
  - (B) Abscisic acid
  - (C) Cytokinin
  - (D) Auxin

92. Which enzyme is the target of drugs used to treat disease caused by influenza virus?
- (A) Collagenase
  - (B) Hyaluronidase
  - (C) Neuraminidase
  - (D) Proteinase
93. Which enzyme complex is responsible for majority of the ATP-dependent degradation of cytosolic proteins?
- (A) 26S proteasomes
  - (B) Cathepsins
  - (C) 20S proteasomes
  - (D) Calpains
94. Which family of transcription factors is directly activated by Interferons?
- (A) NF-kappa B
  - (B) NFAT
  - (C) AP-1
  - (D) STAT
95. von Willebrand disease is due to deficiency of a factor involved in
- (A) T cell activation
  - (B) Platelet adhesion
  - (C) NK cell killing
  - (D) Differentiation of B cells
96. What is the principal characteristic of all oxidizing agents?
- (A) Electron donor
  - (B) Removes charge from electrons
  - (C) Electron receptor
  - (D) Burns electrons
97. A cross between two true breeding lines one with dark blue flowers and one with bright white flowers produces F1 offspring that are light blue. When the F1 progeny are selfed, a 1:2:1 ratio of dark blue to light blue to white flowers is observed. What genetic phenomenon is consistent with these results?
- (A) Epistasis
  - (B) Incomplete dominance
  - (C) Codominance
  - (D) Inbreeding depression

98. Which of the following compounds would have the highest boiling point?
- (A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
  - (B)  $\text{CH}_3\text{NH}_2$
  - (C)  $\text{CH}_3\text{OH}$
  - (D)  $\text{CH}_2\text{F}_2$
99. Which of the following molecules was most likely to have been synthesized in the smooth endoplasmic reticulum?
- (A) Protein
  - (B) Phospholipid
  - (C) Glucose
  - (D) Starch
100. Which of the following is related to affinity maturation?
- (A) Class switch recombination
  - (B) Homologous recombination
  - (C) V(D)J recombination
  - (D) Somatic hypermutation