



Previous Year Question Paper  
of

**JNU**

**Ph.D. / M.Phil. Entrance Test**

**LIFE SCIENCES**

**2012**

**(Jawaharlal Nehru University)**



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A

ENTRANCE EXAMINATION, 2012

M.Phil./Ph.D. LIFE SCIENCES

[ Field of Study Code : SLSP (159) ]

Time Allowed : 3 hours

Maximum Marks : 70

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

- (i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.
- (ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**
- (iii) The Question Paper is divided into two parts : Part—A and Part—B. Choose the most appropriate answer.
- (iv) Answer *all* 30 questions of Part—A.
- (v) Answer *any* 40 questions from Part—B. If you answer more than 40 questions, only first 40 will be checked. **Questions covering both Biological Sciences and Physical Sciences are included. Therefore, it is advised that you read the entire Question Paper.**
- (vi) Each correct answer carries **one** mark. **For every wrong answer, half mark will be deducted.**
- (vii) Both parts have multiple choice questions. All answers are to be entered in the Answer Sheet provided with the question paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with **BALLPOINT PEN** only against each question in the corresponding circle.
- (viii) Calculators and Log Tables may be used.
- (ix) Answer written by the candidates inside the Question Paper will not be evaluated.
- (x) Two Pages at the end have been provided for Rough Work.
- (xi) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination.
- (xii) **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

- 1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
- 2. Please darken the whole Circle.
- 3. Darken **ONLY ONE CIRCLE** for each question as shown in example below :

Wrong <input type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>	Wrong <input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/> (d)	Wrong <input checked="" type="radio"/> (b) <input type="radio"/> (c) <input checked="" type="radio"/>	Wrong <input type="radio"/> (b) <input type="radio"/> (c) <input checked="" type="radio"/>	Correct <input type="radio"/> (a) <input type="radio"/> (b) <input type="radio"/> (c) <input checked="" type="radio"/>
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- 4. Once marked, no change in the answer is allowed.
- 5. Please do not make any stray marks on the Answer Sheet.
- 6. Please don't do any rough work on the Answer Sheet.
- 7. Mark your answer only in the appropriate space against the number corresponding to the question.
- 8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

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**PART—A**

Answer **all** questions

1. The tertiary structure of tRNA
  - (a) is stabilized mostly by Watson-Crick base-pairing
  - (b) is stabilized mostly by non-Watson-Crick base-pairing
  - (c) does not have Hoogsteen base pairs
  - (d) does not have any base intercalations
  
2. What is the minimum number of meiotic divisions required for generating 100 rice seeds?
  - (a) 25
  - (b) 50
  - (c) 100
  - (d) 125
  
3. Vernalization is
  - (a) dark incubation of seeds for uniform and increased germination
  - (b) cold incubation of seeds for uniform and increased germination
  - (c) cold incubation of seeds/plants to induce early flowering
  - (d) cold incubation of seeds/plants to increase the number of flowers
  
4. Leghaemoglobin in nitrogen-fixing nodules helps as
  - (a) cofactor for dinitrogenase enzyme
  - (b) cofactor for dinitrogenase reductase enzyme
  - (c) oxygen presenter for nitrogen-fixing enzyme complex
  - (d) oxygen scavenger for nitrogen-fixing enzyme complex
  
5. The arrangement of sepals, petals and stamens in a flower from a monocotyledonous plant should be
  - (a) 3, 6, 9 respectively
  - (b) 4, 8, 12 respectively
  - (c) 5, 10, 15 respectively
  - (d) 8, 16, 20 respectively

6. Piston-like muscular tongue with horny epidermal teeth is a characteristic feature of
- (a) hemichordates
  - (b) tunicates
  - (c) cyclostomes
  - (d) rotifers
7. Glucose and amino acids are reabsorbed in the
- (a) proximal tubule
  - (b) distal tubule
  - (c) collecting duct
  - (d) loop of Henle
8. A microscope in which an image is formed by passing an electron beam through a specimen and focusing the scattered electrons with magnetic lenses is called a
- (a) transmission electron microscope
  - (b) scanning electron microscope
  - (c) phase-contrast microscope
  - (d) fluorescence microscope
9. Which of the following statements about a cDNA library is **incorrect**?
- (a) A cDNA library contains promoters and introns
  - (b) A cDNA library is made using the enzyme reverse transcriptase
  - (c) A cDNA library contains expressed genes
  - (d) A cDNA library is made by copying RNA to DNA
10.  $PIP_2$  can be cleaved by phospholipase C to
- (a) inactivate a signaling cascade
  - (b) generate the second messengers cAMP and  $IP_3$
  - (c) generate the second messengers DAG and  $IP_3$
  - (d) participate in the tyrosine kinase cascade

11. Glucagon plays a homeostatic role by
- (a) increasing in response to elevated blood glucose levels and then activating liver glycogen synthetase
  - (b) increasing in response to lowered blood glucose levels and then activating liver glycogen phosphorylase
  - (c) stimulating the release of glucose residues from muscle glycogen during intense exercise
  - (d) activating adenylate cyclase in skeletal muscle cells
12. The T-cell receptor antigen recognition signal is transduced by
- (a) TCR alpha chain
  - (b) TCR beta chain
  - (c) CD1
  - (d) CD3
13. Of about  $10^{13}$  cells in an adult human  $\sim 10^{10}$  cells die and are replaced each day. Yet, a given individual is not radically changed on a daily basis. Which of the following is the likely explanation?
- (a) Different cells in the body are replaced at different rates
  - (b) Rate of cell death is too fast
  - (c) Spontaneous mutations rescue the phenotype
  - (d) New cells are replenished very gradually
14. Alpha-amanitin inhibits the enzymatic activity of
- (a) DNA polymerase
  - (b) RNA polymerase I
  - (c) RNA polymerase II
  - (d) RNA polymerase III
15. What is gene imprinting?
- (a) The activity of a gene is affected by its history in a parent
  - (b) Chromatin modification status of a gene
  - (c) The expression status of a gene
  - (d) Tissue-specific expression pattern of a gene
16. *Aurora borealis* is the name of
- (a) a Mexican plant
  - (b) a polar bear
  - (c) northern lights
  - (d) a famous chemist

- 17.** What is a microsatellite?
- (a) Single nucleotide differences between genomic regions
  - (b) Genomic repeat sequences that are variable between individuals in a species
  - (c) Short chromosomal deletions
  - (d) Tandem purine repeat sequences at the telomeric regions
- 18.** If each parent can produce 100 genetically distinct gametes, how many genetically distinct offsprings can be produced from mating of two such parents?
- (a) 10000
  - (b) 200
  - (c) 1000
  - (d) 1000000
- 19.** The frequency of individuals having a dominant trait in a population is 1/100. What is the frequency of the dominant allele responsible for this trait?
- (a) 0.005
  - (b) 0.05
  - (c) 0.95
  - (d) 0.995
- 20.** A couple has six children. Unfortunately both parents are heterozygous for cystic fibrosis. What is the chance that a normal child would be heterozygous for cystic fibrosis?
- (a)  $\frac{1}{4}$
  - (b)  $\frac{1}{3}$
  - (c)  $\frac{2}{3}$
  - (d)  $\frac{3}{4}$
- 21.** Specificity of enzyme function is solely determined by
- (a) spatial arrangements of constituent amino acids and prosthetic groups
  - (b) interactions between the amino acid side chains in its catalytic site and the substrate
  - (c) compatibility in size and shape of the catalytic site and the substrate
  - (d) electronic compatibility between amino acid side chains in the catalytic site and the substrate

22. The  $K_m$  (Michaelis constant) of an enzyme for a substrate is defined operationally as
- (a) half the substrate concentration at which the reaction rate is maximal
  - (b) the substrate concentration at which the reaction rate is half maximal
  - (c) the dissociation constant of the enzyme substrate complex
  - (d) the dissociation constant of the enzyme product complex
23. Hexose monophosphate shunt pathway does not produce
- (a) fructose-6-phosphate
  - (b) glyceraldehyde-3-phosphate
  - (c) NADH
  - (d) ribulose-5-phosphate
24. The development of the anteroposterior axis of *Drosophila* is initiated, when
- (a) the mother packages *bicoid* and *nanos* mRNA into the developing oocyte
  - (b) the toll receptor is activated after fertilization, leading to nuclear localization of dorsal protein
  - (c) the homeotic genes specify the fate of individual segments
  - (d) the terminal group protein torso sets up the anterior and posterior poles of the embryo
25. The 'mid-blastula transition' is the point in development, when
- (a) translation of maternal mRNA is initiated
  - (b) cell determination becomes fixed
  - (c) cell division in the embryo ends
  - (d) transcription of zygotic genes begins
26. Which of the following classes of enzyme is likely to be involved in reorganizing the structure of a molecule?
- (a) Isomerase
  - (b) Ligase
  - (c) Esterase
  - (d) Synthase

27.  $-d[A]/dt = k$ , is the rate equation of a
- (a) first-order reaction
  - (b) enzyme-catalysed reaction
  - (c) mixed-order reaction
  - (d) zero-order reaction
28. In *E. coli*, the inability of the *lac* repressor to bind an inducer would result in
- (a) no substantial synthesis of  $\beta$ -galactosidase
  - (b) constitutive synthesis of  $\beta$ -galactosidase
  - (c) inducible synthesis of  $\beta$ -galactosidase
  - (d) synthesis of inactive  $\beta$ -galactosidase
29. In Alzheimer's disease, which of the following proteases is involved in the generation of amyloid peptide from the amyloid precursor protein (APP)?
- (a) Trypsin
  - (b) Chymotrypsin
  - (c)  $\gamma$ -secretase
  - (d) Papain
30. Mitosis and meiosis accomplish segregation of the replicated DNA to two or more daughter cells. Which of the following is characteristic of both mitosis and meiosis?
- (a) Chromosomes attach to spindle fibres composed of actin
  - (b) Spindle fibres attach to chromosomes at their kinetochores
  - (c) Chiasmata form between chromosome arms
  - (d) The resulting cells are diploid



**PART—B**

Answer *any forty* questions

31. Rabbit fever is caused by
- (a) *Francisella tularensis*
  - (b) *Staphylococcus epidermidis*
  - (c) *Pseudomonas aeruginosa*
  - (d) *Streptococcus pyogenes*
32. In which of the following foods is the antimicrobial chemical benzoic acid naturally found?
- (a) Apples
  - (b) Cranberries
  - (c) Eggs
  - (d) Milk
33. Allosteric inhibition of an enzyme involves which of the following?
- (a) Binding of an inhibitor to a site other than the substrate binding site
  - (b) Binding of an inhibitor competitively to the substrate binding site
  - (c) Binding of an inhibitor noncompetitively to the substrate binding site
  - (d) Cooperative binding of a substrate to an enzyme with four or more subunits
34. If a canning procedure is not properly followed, which type of microbe is most likely to grow in canned food?
- (a) Obligate aerobe
  - (b) Acidophile
  - (c) Obligate anaerobe
  - (d) Mesophile

35. The ability of *Vibrio fischeri* to produce bioluminescent chemicals only when a certain population density has been reached is an example of
- (a) Liebig's law of the minimum
  - (b) the second law of thermodynamics
  - (c) quorum sensing
  - (d) None of the above
36. If you start out with a population density of 200 CFU/ml of a bacterium that divides every 30 minutes, what will the population density be at the end of two hours, assuming the cells are in the log phase of growth?
- (a) 800 CFU/ml
  - (b)  $2^4$  CFU/ml
  - (c) 3200 CFU/ml
  - (d) 12800 CFU/ml
37. Combining a new chemotherapy agent with radiotherapy will only be clinically successful, if the drug
- (a) acts synergistically with radiation
  - (b) increases the response of the tumor
  - (c) decreases the radiation dose needed for tumor control
  - (d) increases the therapeutic ratio
38. Which of the following methods can be used to observe nuclear foci of DNA repair-related proteins in irradiated cells?
- (a) Comet assay
  - (b) Immunofluorescence of phosphorylated H2AX
  - (c) Single-stranded conformational polymorphism
  - (d) Induction of p53
39. *clv3* gene of *Arabidopsis* codes for a small peptide that is secreted by the upper cell layers in shoot apical meristem (SAM) to the neighbouring cells and thereby restricts the size of the SAM. Thus the *clv3* mutants show increased SAM size.
- The above statement supports which property of *clv3*?
- (a) Cell autonomous gene
  - (b) Cell nonautonomous gene
  - (c) Homeotic gene
  - (d) Ligand peptide

40. Which of the following genes of *Agrobacterium* codes for sequence-specific single-stranded DNA binding protein?
- (a) VirE2
  - (b) VirD1
  - (c) VirD2
  - (d) VirA
41. Fatty acid biosynthesis in plants takes place in
- (a) plastids
  - (b) ER membrane
  - (c) peroxisome
  - (d) liposome
42. A plant protein P when expressed in *Xenopus* oocyte and placed in hypotonic solution, oocyte bursted rapidly. What protein P is likely to code for?
- (a) K<sup>+</sup> efflux pump
  - (b) Na<sup>+</sup> efflux pump
  - (c) Ca<sup>2+</sup> pump
  - (d) Aquaporin
43. Ethylene receptor in plants has a transmitter domain and a receiver domain which have phosphorylation taking place at
- (a) histidine and aspartate respectively
  - (b) aspartate and histidine respectively
  - (c) histidine at both places
  - (d) aspartate at both places
44. Triple response—radial swelling, inhibition of elongation of epicotyl, horizontal growth of epicotyl (diageotropism) is shown by *Arabidopsis* seedlings in presence of which plant hormone?
- (a) Ethylene
  - (b) Cytokinin
  - (c) Auxin
  - (d) Gibberellin
45. 'Refugia' is a practice recommended for
- (a) integrated pest management
  - (b) improve cultivation and tillage practices
  - (c) intercropping and strip harvesting
  - (d) crop rotation and disposal of crop residues

46. For *Arabidopsis* (*Arabidopsis thaliana*) and rice (*Oryza sativa*), the exon-intron boundaries for gene structures are annotated by
- spliced alignment of ESTs and full-length cDNAs to their respective complete genome sequences
  - aligning the sequence of the two strands of DNA
  - aligning UTR (untranslated region) with cDNA sequence
  - aligning UTR with its DNA sequence
47. Both HCV and HBV are associated with viral hepatitis in human. Which one of the following statements is **not** true in regard to their infection?
- HBV is dsRNA
  - HCV is ssRNA
  - Both viruses can grow in cell culture
  - HBV has not chronicity complication
48. Which of the following groups of enzymes is unique to the Calvin cycle?
- Ribulose biphosphate carboxylase, phosphoribulokinase and sedoheptulose 1,7-biphosphate
  - Ribose 5-phosphate isomerase, epimerase and aldolase
  - Glyceraldehyde 3-phosphate dehydrogenase, phosphofructokinase and phosphoenolpyruvate carboxylase
  - Phosphoglycolate phosphatase, glycerol kinase and serine synthetase
49. First model angiosperm for which whole genome sequence has been made available to the international community has  $2n =$
- 10 chromosomes
  - 22 chromosomes
  - 24 chromosomes
  - 46 chromosomes
50. On stimulation of Xth cranial nerve 'the vagus', heart rate decreases because the increased release of
- acetylcholine at and around SA node dampens heart pacemaker
  - norepinephrine inhibits muscle contraction of the entire heart
  - norepinephrine hyperpolarizes the pacemaker cells
  - acetylcholine inhibits conduction of impulse through the Purkinje fibres in the ventricle of heart

- 51.** Which one of the following maintains the continuous partial contraction of the blood vessels?
- (a) Sympathetic vasoconstrictor tone
  - (b) Sympathetic vasodilator tone
  - (c) Parasympathetic vasoconstrictor tone
  - (d) Parasympathetic vasodilator tone
- 52.** We lose the feeling of warmth after keeping our hand in warm water bath for a while. This is an example of
- (a) sensitization
  - (b) adaptation
  - (c) habituation
  - (d) skin numbness
- 53.** 'Pavlovian conditioning' is an example of
- (a) declarative memory
  - (b) priming
  - (c) associative memory
  - (d) procedural memory
- 54.** In a 'typical' 28-day female reproductive cycle, on which day following the beginning of the menstrual period is the level of luteinizing hormone most likely to be highest?
- (a) Day 7
  - (b) Day 14
  - (c) Day 21
  - (d) Day 24
- 55.** Which of the following is the common component of oral contraceptives?
- (a) Testosterone
  - (b) Prolactin
  - (c) Progesterone
  - (d) Luteinizing hormone
- 56.** ECG is associated with
- (a) electrical conductivity through the heart muscles
  - (b) physical condition of the heart
  - (c) blood pressure in the aorta
  - (d) force of contraction of the ventricles

57. The dark bands in the myofibrils are called A-bands, because they
- (a) are anisotropic to polarized light
  - (b) contain actin filaments
  - (c) contain both actin and myosin filaments
  - (d) were the first to be discovered
58. A 180° twisting of the visceral mass, called torsion, which occurs during development in the veliger larva, is characteristic of which class?
- (a) Gastropoda
  - (b) Pseudopoda
  - (c) Apoda
  - (d) Scaphopoda
59. Which one of the following pairs has cytoplasmic receptors?
- (a) Noradrenalin and estrogen
  - (b) Growth hormone and progesterone
  - (c) GABA and growth hormone
  - (d) Estrogen and progesterone
60. Mark the correct statement for  $\text{Na}^+ - \text{K}^+$  ATPase.
- (a) 3  $\text{Na}^+$  are taken in and 2  $\text{K}^+$  are extruded in every cycle
  - (b) 3  $\text{Na}^+$  are extruded and 2  $\text{K}^+$  are taken in every cycle
  - (c) 2  $\text{Na}^+$  are extruded and 3  $\text{K}^+$  are taken in every cycle
  - (d) 1  $\text{Na}^+$  is extruded and 1  $\text{K}^+$  is taken in every cycle
61. Which one of the following is correct?
- (a) Cancer cells proliferate under normal regulation of cell cycle checkpoints
  - (b) Cancer cells have fixed genetic mutations which do not change during the development of advanced stages of the cancer
  - (c) Cancer cells acquire constitutively active mitogenic and survival signaling
  - (d) Cancer cells essentially undergo the process of proliferation, differentiation and aging

- 62.** A dicentric chromosome is unstable, because it
- (a) cannot resynthesize its telomeres during replication
  - (b) pairs with nonhomologous chromosomes in meiosis
  - (c) pairs with nonhomologous chromosomes in mitosis
  - (d) is often simultaneously drawn to opposing spindle poles in mitosis
- 63.** Which of the following characterizes which cyclins are involved in Rb phosphorylation and the ultimate effect on transcription?
- (a) Cyclin A is primarily involved and Rb phosphorylation increases transcription by E2F
  - (b) Cyclin A is primarily involved and Rb phosphorylation decreases transcription by E2F
  - (c) Cyclins D and E are primarily involved and Rb phosphorylation increases transcription by E2F
  - (d) Cyclins D and E are primarily involved and Rb phosphorylation decreases transcription by E2F
- 64.** Which of the following cell junctions is responsible for metabolic coupling?
- (a) Tight junction
  - (b) Gap junction
  - (c) Adherens junction
  - (d) Desmosome
- 65.** Tom/Tim and Toc/Tic protein complexes are involved in
- (a) post-receptor recognition events in the cytosolic folding of proteins prior to import into mitochondria or chloroplasts
  - (b) pre-proteasomal steps in tagging aged proteins for degradation
  - (c) protein translocation into mitochondria and chloroplasts, respectively
  - (d) resetting biological clocks following rounds of intense protein synthesis
- 66.** The smooth ER is especially abundant in cells that synthesize extensive amounts of
- (a) toxins
  - (b) proteins
  - (c) nucleic acids
  - (d) lipids
- 67.** Formation of acrosomal process during fertilization involves extensive polymerization of
- (a) actin inside the vitelline membrane of the egg
  - (b) myosin inside the acrosomal process
  - (c) actin inside the acrosome
  - (d) both actin and myosin inside the acrosome

- 68.** In humans, the Barr body is an
- (a) active X chromosome in females
  - (b) inactive X chromosome in females
  - (c) inactive Y chromosome in males
  - (d) active Y chromosome in males
- 69.** If the nerve supply to a newt limb is severed before amputation, how will this affect regeneration?
- (a) It will have no effect, since regeneration involves growth of new muscle, bone, and connective tissue
  - (b) Regeneration of most tissues will occur normally, but regeneration of the nerves will not occur
  - (c) Outgrowth will occur, but the identity of the limb will be lost and normal proximo-distal patterning will not occur
  - (d) A blastema will form but will not grow, and regeneration will fail
- 70.** 'Intercalary growth' in a regenerating amphibian limb means that if a distal blastema is grafted to a proximal stump
- (a) the distal blastema grows back to regenerate proximal elements, then out to regenerate distal structures
  - (b) the stump grows out to regenerate proximal structures, until the positional values of the blastema are produced, at which time the distal blastema takes over and completes outgrowth of distal structures
  - (c) the distal blastema grows out regenerating distal structures, resulting in a limb lacking intermediate structures
  - (d) the distal blastema grows proximally intercalating intermediate structures between it and the stump, then growth stops resulting in a regenerate lacking distal structures
- 71.** How does the dose-dependence of retinoic acid treatment support the notion that a gradient of retinoic acid can act as a morphogen along the proximo-distal axis in the limb?
- (a) Treatment with high levels of retinoic acid causes a proximal blastema to be respecified as a distal blastema, and only distal structures are regenerated
  - (b) Treatment with high levels of retinoic acid causes any blastema to form only distal structures
  - (c) Treatment with high levels of retinoic acid causes any blastema to be respecified as a proximal blastema, but it will form only proximal structures
  - (d) Treatment with high levels of retinoic acid causes a distal blastema to be respecified as a proximal blastema, and regeneration of a full limb may be initiated from proximal values



72. What molecular marker of head identity is found in the apical tip of a *Hydra* during head regeneration?
- (a) A bud characteristic of the budding region
  - (b) BMPs
  - (c) Nodal
  - (d) Wnt
73. Isoelectric focusing is a technique that can be used to analyse proteins. Which of the following is true of isoelectric focusing?
- (a) It is commonly used to quantitate IgA
  - (b) It separates proteins in an aqueous environment where one is able to maintain a net charge of +1 on the proteins
  - (c) It is restricted to the analysis only in an acidic environment (pH < 6)
  - (d) It separates proteins based on the pH at which the net charge on a protein is zero
74. Which of the following best describes the hyperchromicity of DNA?
- (a) The shift in UV absorbance to longer wavelengths upon denaturation
  - (b) The shift in UV absorbance to shorter wavelengths upon hydrolysis
  - (c) The increase in absorbance at 260 nm upon annealing
  - (d) The increase in absorbance at 260 nm upon denaturation
75. You fuse spleen cells having a normal genotype for immunoglobulin heavy chains (H) and light chains (L) with a myeloma-cell preparation having immunoglobulin genotype H<sup>-</sup>, L<sup>+</sup>. Which of the following possible antibody molecules [indicating whether the chains would originate from the spleen (s) or from the myeloma (m) fusion partner] will **not** be made by the resulting hybridomas?
- (a) HsLs/HsLs
  - (b) HmLs/HmLs
  - (c) HsLs/HsLm
  - (d) HsLm/HsLm
76. Considering only combinatorial joining of gene segments and association of light and heavy chains, how many different antibody molecules potentially could be generated from germ-line DNA containing 500 V<sub>L</sub> and 4 J<sub>L</sub> gene segments and 300 V<sub>H</sub>, 15 D<sub>H</sub> and 4 J<sub>H</sub> gene segments?
- (a)  $2 \times 10^3$
  - (b)  $1.8 \times 10^4$
  - (c)  $3.6 \times 10^7$
  - (d)  $3.24 \times 10^8$

77. A polyclonal antibody was raised in mice against a monoclonal rat IgM antibody. The antiserum was adsorbed against rat light chains. The adsorbed antiserum will most likely react with which of the following molecules?
- (a) Rat  $\kappa$  chains
  - (b) Mouse light chains
  - (c) Human IgM
  - (d) Rat  $\lambda$  chains
78. Which enzyme is activated by phosphorylation?
- (a) Acetyl CoA carboxylase
  - (b) Fructose-1,6-bisphosphatase
  - (c) Fructose-2,6-bisphosphatase
  - (d) Pyruvate kinase
79. Sucrose does not have anomeric forms, because
- (a) there is no free sugar group present for undergoing mutarotation
  - (b) it cannot rotate the plane polarized light in any direction
  - (c) it is an internally compensated molecule for optical rotation
  - (d) it lacks a free anomeric carbon to undergo mutarotation
80. If you isolate mitochondria and place them in buffer with a low pH, they begin to manufacture ATP. Why?
- (a) Low pH increases the concentration of base causing mitochondria to pump out  $H^+$  to the intermembrane space leading to ATP production
  - (b) The high external acid concentration causes an increase in  $H^+$  in the intermembrane space leading to increased ATP production by ATP synthetase
  - (c) Low pH increases the acid concentration in the mitochondrial matrix, a condition that normally causes ATP production
  - (d) Low pH increases the  $OH^-$  concentration in the matrix resulting in ATP production by ATP synthetase
81. Dinitrophenol (DNP) uncouples mitochondrial electron transport from oxidative phosphorylation by
- (a) dissipating the proton gradient
  - (b) inhibiting cytochrome oxidase
  - (c) dissociating the F<sub>0</sub> and F<sub>1</sub> units of the ATP synthase complex
  - (d) binding irreversibly to ubiquinone

82. Acetyl CoA, the cytoplasmic substrate for fatty acid synthesis, is formed in mitochondria. The inner mitochondrial membrane is impermeable to acetyl CoA. Which of the following compounds is the form in which the carbon of acetyl CoA is transported to the cytoplasm?
- (a) Malate
  - (b) Acetate
  - (c) Citrate
  - (d) Pyruvate
83. The unit of the molar extinction coefficient is
- (a)  $\text{L} \cdot \text{mole}^{-1} \cdot \text{cm}^{-1}$
  - (b)  $\text{L} \cdot \text{mole} \cdot \text{cm}^{-1}$
  - (c)  $\text{mole}^{-1} \cdot \text{cm}^{-1}$
  - (d)  $\text{mL} \cdot \text{mg}^{-1} \cdot \text{cm}^{-1}$
84. Digestion of genomic DNA with a restriction enzyme, leads to a smear on an ethidium-bromide stained gel. How would you pick the fragment you are interested in?
- (a) By digesting with an enzyme, which will give you fragments of size that you are interested in
  - (b) By probing the gel with a piece of the sample DNA
  - (c) By digesting with multiple enzymes
  - (d) By performing a PCR
85. Which of the following statements is **not** true about enhancers?
- (a) Enhancers contain multiple binding sites for transcription factors
  - (b) Enhancers function in an orientation-dependent manner
  - (c) Enhancers can be present within the intron of the untranslated region of a gene
  - (d) Enhancers present on one gene can influence the transcription of another gene
86. Which of the following is **not** involved in the processing of mRNA precursors in eukaryotic cells?
- (a) Capping of the 5' end
  - (b) Addition of polyA
  - (c) Transport of the pre-mRNA to the cytoplasm
  - (d) Excision of introns

- 87.** Which of the following statements is **not** true about histone code?
- (a) Histone code is faithfully transmitted through cell divisions
  - (b) Histones are modified by histone-modifying enzymes
  - (c) Histone modifications help in recruiting other proteins
  - (d) Nucleosomes are repositioned
- 88.** The urea cycle occurs in
- (a) mitochondria and cytoplasm
  - (b) mitochondria and lysosome
  - (c) endoplasmic reticulum
  - (d) Golgi complex
- 89.** Sanger's method of DNA sequencing requires incorporation of dideoxy NTPs for chain termination. The ddNTPs are known to
- (a) stop the chain extension
  - (b) disrupt the formation of hydrogen bonds
  - (c) inhibit the activity of DNA polymerase
  - (d) generate breaks in the newly synthesized chain
- 90.** You are studying a large protein complex consisting of 12 subunits. You have purified the complex from the cells. Which of the following approaches will you select to measure the approximate mass of the purified complex and determine its subunit composition?
- (a) Polyacrylamide gel electrophoresis and molecular cloning
  - (b) Ion-exchange chromatography and density-gradient centrifugation
  - (c) Genomics and recombinant DNA technology
  - (d) Gel-filtration chromatography and Western blotting
- 91.** The term 'epigenetics' refers to
- (a) gene silencing by promoter looping
  - (b) heritable phenotypic changes of a cell not involving nucleotide-level changes in the chromosomes
  - (c) activation of gene expression in chromosomal territories
  - (d) reversible genetic rearrangements of regulatory sequence elements in the promoters
- 92.** Two nucleotide sequences found in two different species are almost exactly the same. This suggests that these species
- (a) are evolving into the same species
  - (b) contain identical DNA
  - (c) may have similar evolutionary histories
  - (d) have the same number of mutations

93. The structural similarities between the flippers of whales and the arms of humans are used to show that the
- (a) human species began life in the oceans
  - (b) human species and the whales have a common ancestry
  - (c) whales are older than the human species
  - (d) whales evolved from the human species
94. Only 10 percent of the energy stored in an organism can be passed onto the next trophic level. Of the remaining energy, some is used for the organism's life processes, and the rest is
- (a) used in reproduction
  - (b) stored as body tissue
  - (c) stored as fat
  - (d) eliminated as heat
95. An organism's niche is
- (a) the way the organism uses the range of physical and biological conditions in which it lives
  - (b) all the physical and biological factors in the organism's environment
  - (c) the range of temperature that the organism needs to survive
  - (d) a full description of the place an organism lives
96. Which of the following would be most useful for constructing a phylogenetic tree for several fish species?
- (a) Several analogous characteristics shared by all the fishes
  - (b) A single homologous characteristic shared by all the fishes
  - (c) Several characteristics thought to have evolved after different fishes diverged from one another
  - (d) The total degree of morphological similarity among various fish species
97. In a two-colour microarray experiment, scanning the microarray slides showed that only a few spots are bright but most spots are not visible. Which of the following steps would be most appropriate such that several of the missing spots become visible?
- (a) Scanning the microarray at a higher PMT setting
  - (b) Scanning the microarray at a reduced PMT setting
  - (c) Normalization of the two channel intensities
  - (d) Derivation of log ratios for the two-channel intensity

98. The following genotypes are found in a population :

AA/70, Aa/50, aa/20

What are the allele frequencies of A and a?

- (a) A = 0.86 and a = 0.14  
 (b) A = 0.63 and a = 0.32  
 (c) A = 0.63 and a = 0.36  
 (d) A = 0.32 and a = 0.68

99. The following data are the times in minutes at which you observed recombinant progeny containing indicator amino acid marker :

	Hfr1 × F <sup>-</sup>	Hfr2 × F <sup>-</sup>
Arginine (arg)	5	40
Cysteine (cys)	65	70
Methionine (met)	75	60
Phenylalanine (phe)	35	10
Proline (pro)	10	35

Using the data given above, the origin of transfer in the two Hfr strains are located

- (a) next to met for Hfr 1 and next to cys for Hfr 2  
 (b) between met and arg for Hfr1 and between met and arg for Hfr 2  
 (c) between cys and phe for Hfr 1 and between met and arg for Hfr 2  
 (d) next to cys for Hfr 1 and next to met for Hfr 2
100. Two genes A and B are located at a distance of 60cM on a linkage group. The distance was estimated by
- (a) observing 60% recombination between A and B  
 (b) observing recombination between A, B and gene (s) between them and then deriving the distance  
 (c) observing 30% recombination between A and B  
 (d) the observation is wrong; the genes A and B are actually unlinked

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