

पुस्तिका में पृष्ठों की संख्या : 32  
Number of Pages in Booklet : 32

प्रश्न-पत्र पुस्तिका संख्या /  
Question Paper Booklet No. **5201665**

पुस्तिका में प्रश्नों की संख्या : 180  
No. of Questions in Booklet : 180

**BSAPBp-02**

Paper Code : 11

SUBJECT : Biophysics

समय : 3.00 घण्टे  
Time : 3.00 Hours

परीक्षा तिथि :- 11/08/2020

परीक्षा समय :- 2:00 To 5:00 अधिकतम अंक : 180  
Maximum Marks : 180

प्रश्न-पत्र पुस्तिका एवं उत्तर पत्रक के पेपर सील/पॉलिथीन बैग को खोलने के बाद परीक्षार्थी प्रश्न-पत्र पुस्तिका संख्या को उत्तर पत्रक पर सावधानीपूर्वक अंकित करें। इसमें किसी भी प्रकार की त्रुटि होने पर जिम्मेदारी अभ्यर्थी की होगी।

The candidate fill the Question Paper Booklet No. on Answer Sheet carefully after opening the Paper Seal / Polythene bag. Candidate himself shall be responsible for any error.

**परीक्षार्थियों के लिए निर्देश**

1. सभी प्रश्नों के उत्तर दीजिए।
2. सभी प्रश्नों के अंक समान हैं।
3. प्रत्येक प्रश्न का केवल एक ही उत्तर दीजिए।
4. एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा।
5. प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं, जिन्हें क्रमशः 1, 2, 3, 4 अंकित किया गया है। अभ्यर्थी को सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले अथवा बबल को उत्तर पत्रक पर नीले बॉल प्वाइंट पेन से गहरा करना है।
6. OMR उत्तर पत्रक इस परीक्षा पुस्तिका के अन्दर रखा है। जब आपको परीक्षा पुस्तिका खोलने को कहा जाए, तो उत्तर-पत्र निकाल कर ध्यान से केवल नीले बॉल प्वाइंट पेन से विवरण भरें।
7. प्रत्येक गलत उत्तर के लिए प्रश्न अंक का 1/3 भाग काटा जायेगा। गलत उत्तर से तात्पर्य अशुद्ध उत्तर अथवा किसी भी प्रश्न के एक से अधिक उत्तर से है। किसी भी प्रश्न से संबंधित गोले या बबल को खाली छोड़ना गलत उत्तर नहीं माना जायेगा।
8. मोबाइल फोन अथवा इलेक्ट्रॉनिक यंत्र का परीक्षा हॉल में प्रयोग पूर्णतया वर्जित है। यदि किसी अभ्यर्थी के पास ऐसी कोई वर्जित सामग्री मिलती है तो उसके विरुद्ध आयोग द्वारा नियमानुसार कार्यवाही की जायेगी।
9. कृपया अपना रोल नम्बर ओ.एम.आर. पत्रक पर सावधानीपूर्वक सही भरें। गलत अथवा अपूर्ण रोल नम्बर भरने पर 5 अंक कुल प्राप्तांकों में से काटे जा सकते हैं।

**चेतावनी :** अगर कोई अभ्यर्थी नकल करते पकड़ा जाता है या उसके पास से कोई अनधिकृत सामग्री पाई जाती है, तो उस अभ्यर्थी के विरुद्ध पुलिस में प्राथमिकी दर्ज कराते हुए विविध नियमों-प्रावधानों के तहत कार्यवाही की जाएगी। साथ ही विभाग ऐसे अभ्यर्थी को भविष्य में होने वाली विभाग की समस्त परीक्षाओं से विवर्जित कर सकता है।

**INSTRUCTIONS FOR CANDIDATES**

1. Answer all questions.
2. All questions carry equal marks.
3. Only one answer is to be given for each question.
4. If more than one answers are marked, it would be treated as wrong answer.
5. Each question has four alternative responses marked serially as 1, 2, 3, 4. You have to darken only one circle or bubble indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
6. The OMR Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully with blue ball point pen only.
7. 1/3 part of the mark(s) of each question will be deducted for each wrong answer. A wrong answer means an incorrect answer or more than one answers for any question. Leaving all the relevant circles or bubbles of any question blank will not be considered as wrong answer.
8. Mobile Phone or any other electronic gadget in the examination hall is strictly prohibited. A candidate found with any of such objectionable material with him/her will be strictly dealt as per rules.
9. Please correctly fill your Roll Number in O.M.R. Sheet. 5 Marks can be deducted for filling wrong or incomplete Roll Number.

**Warning :** If a candidate is found copying or if any unauthorized material is found in his/her possession, F.I.R. would be lodged against him/her in the Police Station and he/she would liable to be prosecuted. Department may also debar him/her permanently from all future examinations.

इस परीक्षा पुस्तिका को तब तक न खोलें जब तक कहा न जाए।

Do not open this Test Booklet until you are asked to do so.

11-□



1. Cell junction in smooth muscle is –

- (1) Tight junction
- (2) Zonula adherens
- (3) Macula adherens
- (4) Gap junction

2. Synaptic potential can be recorded by

- (1) Patch clamp technique
- (2) Microelectrode
- (3) EEG
- (4) Voltage clamp technique

3. All of the following transport processes follow “Saturation Kinetics” except :

- (1) Simple diffusion
- (2)  $\text{Na}^+$  coupled active transport
- (3)  $\text{Na}^+$ -  $\text{Ca}^{2+}$  exchanger
- (4) Facilitated diffusion

4. The force of muscle contraction can be increased by all of the following except :

- (1) Increasing the frequency of activation of motor units.
- (2) Increasing the number of motor units activated
- (3) Increasing the amplitude of action potentials in the motor neurons.
- (4) Recruiting larger motor units.

5. Which one of the following statements is true for Excitatory Post Synaptic Potential (EPSP) ?

- (1) Are self-propagating
- (2) Show all or none response
- (3) Are proportional to the amount of transmitter released by the presynaptic neuron.
- (4) Are inhibitory at presynaptic terminal.

6. Amongst the muscles, skeletal muscle is the most excitable tissue because :

- (1) There are two “T” tubules per sarcomere and has well developed sarcoplasmic reticulum.
- (2) It is supplied by large myelinated nerve fibres.
- (3) It is nerve regulated
- (4) None of the above

7. The cell junctions allowing exchange of cytoplasmic molecules between the two cells are called :

- (1) Gap junction
- (2) Tight junction
- (3) Focal junction
- (4) None of the above

8. Cell shape and motility are provided by :

- (1) Microfilaments
- (2) Microtubules
- (3) Golgi apparatus
- (4) Nucleus

9.  $D_2O$  (Deuterium oxide) is used to measure volume of

- (1) Blood
- (2) Intracellular fluid
- (3) Total body water
- (4) Extracellular fluid

10. A solution contains 1 gram-mole of magnesium sulfate per litre. Assuming full ionization of this compound, calculate the osmotic pressure of the solution. (1 m osmole/litre concentration is equivalent to 19.3 mm-Hg Osmotic pressure)

- (1) 19.3 mm Hg
- (2) 38.6 mm Hg
- (3) 3.86 mm Hg
- (4) 57.900 mm Hg

11. "Patch-clamp" is used for

- (1) To record facilitated diffusion
- (2) To record flow in voltage gated channel
- (3) To record osmotic pressure around semi-permeable membrane
- (4) To record resting membrane potential

12. All of the following are true about excitation contraction coupling, expect :

- (1) Acetylcholine is released at the nerve terminal
- (2) Calcium is pumped back into the sarcoplasmic reticulum during relaxation
- (3) Calcium is released from sarcoplasmic reticulum during contraction.
- (4) Calcium binds to tropomyosin to initiate muscle contraction.

13. Osmotic pressure can be calculated by using :

- (1) Bernoulli's law
- (2) Ohm's law
- (3) Van't Hoff law
- (4) Poiseulle's law



14. Barometric pressure at 100 metre deep in a sea is
- (1) 11 atm.
  - (2) 3 atm.
  - (3) 4 atm.
  - (4) 10 atm.
15. Knee joint pain in a deep sea diver is due to
- (1) Increased  $O_2$
  - (2) Increased  $N_2O$
  - (3) Increased  $CO_2$
  - (4) Increased  $N_2$
16. Chronaxie is minimum in
- (1) Mixed nerves
  - (2) Unmyelinated nerve
  - (3) Myelinated nerve
  - (4) Sensory nerves
17. Tetanic contraction is due to accumulation of :
- (1)  $Na^+$
  - (2)  $Ca^{++}$
  - (3)  $K^+$
  - (4)  $Cl^-$
18. Cause of myasthenia gravis is :
- (1) Decreased release of Acetylcholine at neuromuscular junction
  - (2) Loss of muscle fibres
  - (3) Destruction of receptors by antibody
  - (4) Destruction of receptors by autolyses.
19. Where do we obtain the magnified image of the specimen in SEM ?
- (1) Cathode ray tube
  - (2) Phosphorescent screen
  - (3) Anode
  - (4) Scanning generator
20. On what factors do the intensity of secondary electrons depend upon ?
- (1) Size of the irradiated object
  - (2) Chemical composition of the irradiated object
  - (3) Number of electrons ejected
  - (4) All of the above

21. Degree of Scattering in transmission electron microscope is a function of
- (1) Wavelength of electron beam used.
  - (2) Number of atoms that lie in the electron path
  - (3) Mass of atoms that lie in the electron path
  - (4) (2) and (3)
22. Which of the following are true for electron microscopy ?
- (1) Specimen should be thin and dry
  - (2) Image is obtained on a phosphorescent screen.
  - (3) Electron beam must pass through evacuated chamber.
  - (4) Specimen should be thin and dry, image is obtained on a phosphorescent screen and electron beam must pass through evacuate chamber.
23. Which of the following is used to visualize live cells ?
- (1) SEM
  - (2) TEM
  - (3) Phase contrast microscope
  - (4) All of these

24. Which of the following is best suited to get the surface view of an object ?
- (1) Scanning electron microscope
  - (2) Transmission electron microscope
  - (3) Both (1) and (2)
  - (4) Compound microscope
25. Resolving power of a microscope can be increased by
- (1) using an illumination of longer wavelength and by decreasing the numerical aperture.
  - (2) using an illumination of longer wavelength and by increasing the numerical aperture.
  - (3) using an illumination of shorter wavelength and by increasing the numerical aperture.
  - (4) using an illumination of shorter wavelength and by decreasing the numerical aperture.
26. In phase contrast microscopy, the rate at which light enters through objects is :
- (1) Constant
  - (2) Inversely proportional to their refractive index
  - (3) Directly proportional to their refractive indices
  - (4) Exponentially related to their refractive indices.



27. In light microscopy, which of the following is used as fixatives prior to staining technique ?
- (1) Osmic acid
  - (2) Glutaraldehyde
  - (3) Heat
  - (4) Osmic acid, glutaraldehyde & heat
28. The fluorescence microscopy, which of the following performs the function of removing all light except the blue light ?
- (1) Exciter filter
  - (2) Barrier filter
  - (3) Dichromic mirror
  - (4) Mercury arc lamp
29. Resolving power of a microscope is a function of :
- (1) Wavelength of light used
  - (2) Numerical aperture of lens system
  - (3) Refractive index
  - (4) Wavelength of light used and numerical aperture of lens system.
30. A microscope is used to focus on an object at the bottom of a beaker. The microscope is raised by 2 cm. To what height should the water be poured to bring the object in focus again ? Refractive index of water is  $\frac{4}{3}$ .
- (1) 8 cm
  - (2) 16 cm
  - (3) 4 cm
  - (4) 2 cm
31. The magnification power of a compound microscope does not depend upon :
- (1) The focal length and aperture of the eye lens.
  - (2) The aperture of the objective lens.
  - (3) The tube length of the microscope.
  - (4) None of the above
32. Hydrogen atoms are not generally shown in X-ray structures of protein because :
- (1) Hydrogen with only one electron is almost invisible
  - (2) Everyone knows where hydrogen belongs in a structure
  - (3) Including hydrogens would make the models too confusing
  - (4) None of the above

33. The following data is usually calculated directly from X-ray diffraction data :

- (1) The number of electrons in the crystal
- (2) The electron density at different locations in the crystal
- (3) The size of protein in the crystal
- (4) The strength of the X-ray beam used in the experiment

34. Which of the following software programmes is used for automated de novo drug design ?

- (1) DOCK
- (2) LUDI
- (3) CHEM3D
- (4) CoMFA

35. Which of the following statements is true in de novo drug design ?

- (1) The design of rigid molecules is superior to flexible ones.
- (2) Molecules should be designed to fit as singly as possible into the target binding site.
- (3) Molecules that have to adopt an unstable conformation in order to bind should be rejected.
- (4) Desolvation energies can be ignored since they are likely to be the same for different molecules having the same pharmacophore.

36. What is meant by docking ?

- (1) The process by which two different structures are compared by molecular modelling.
- (2) The process by which a lead compound is simplified by removing excess functional groups.
- (3) The process by which drugs are fitted into their target binding sites using molecular modelling.
- (4) The process by which a pharmacophore is identified.

37. Which of the following terms refers to the molecular modelling computational method that uses equations obeying the laws of classical physics ?

- (1) Quantum mechanics
- (2) Molecular calculations
- (3) Molecular mechanics
- (4) Quantum theory

38. Which of the following operations or calculations would generally be carried out using molecular mechanics ?

- (1) Molecular orbital energies
- (2) Energy minimisation
- (3) Electrostatic potential
- (4) Transition-state geometries



39. Which one of the following statements is true ?

- (1) Long range electrostatic interaction are unimportant when modelling biological systems.
- (2) It is valid to separate the different components of a force field and interpret the energies on this basis.
- (3) Vander Waals interaction take place between all types of chemical groups, both polar and non-polar.
- (4) Aromatic rings prefer a face-to-face interaction.

40. In energy minimization it is common to use gradient methods. Which one of the following is false ?

- (1) Minimization algorithm always locate the global energy minimum on the energy hypersurface.
- (2) The search direction followed is determined by the forces within the system.
- (3) The most rigorous methods require knowledge of the derivative of force.
- (4) Close to the minimum steepest descents show poor convergence behaviour.

41. Which of the following is not true about Hydrophobicity ?

- (1) The hydrophobic effect plays a dominant role in the folding of proteins.
- (2) Hydrophobic residues aggregate away from contact with water.
- (3) Hydrophobic residues aggregate to form hydrophobic cores with more polar residues.
- (4) Hydrophobic residues form the solvent accessible but restrict the solubility of the protein.

42. Which of the following about Rb tumor suppressor protein is correct ?

- (1) It binds E2F transcription factor and prevents cell from entering S phase until a mitogenic signal is received.
- (2) It is activated when phosphorylated by Cdk.
- (3) It is transcription factor
- (4) None of the above



43. The mutation which cannot give rise to an oncogene :

- (1) Addition or deletion of base producing a nonsense message and an inactive protein product.
- (2) A point mutation changing just one amino acid in protein product.
- (3) A translocation, putting gene under control of strong promoter producing over expression.
- (4) A point mutation producing stop codon; premature termination.

44. The characteristic of malignant other than a benign tumor is

- (1) Undergoes metastasis
- (2) Develops blood supply
- (3) Cell divides an unlimited number of times
- (4) Growth without needing a growth signal.

45. Which property of P53 enables it to prevent the development of cancer ?

- (1) It is a transcription factor that causes protein production which stimulates the cell cycle.
- (2) It prevents replication of cells with damaged DNA.
- (3) It prevents cells from triggering apoptosis.
- (4) It stimulates synthesis of DNA repair enzyme that replaces telomere sequence lost during cell division.

46. How does Ras oncogene contribute to cancers ?

- (1) It codes for an anti-apoptotic protein, produced in abnormally large amounts.
- (2) It codes for a GTPase switch protein, which in its mutated form cannot be switched off.
- (3) It codes for a transcription factor produced abnormally in large amounts.
- (4) A growth factor that is continually active is encoded in its truncated form.

47. Which of the following could be coded by a tumor-suppressor gene ?

- (1) A protein that helps prevent progression through cell cycle.
- (2) A protein that helps prevent apoptosis.
- (3) A protein that codes for a DNA repair enzyme.
- (4) A protein that forms part of a growth factor signalling pathway.

48. Programmed cell death is termed as

- (1) metastasis
- (2) apoptosis
- (3) proliferation
- (4) mitotic termination

49. Oncogenes do not encode for

- (1) Trans-membrane protein receptors
- (2) growth factors
- (3) DNA-dependent RNA polymerase
- (4) Cytoplasmic G-proteins and protein kinases

50. Proto-oncogenes can be transformed to oncogenes by all of the following mechanisms except

- (1) elimination of their start signals for translation
- (2) during a viral infection cycle
- (3) chromosomal rearrangements
- (4) chemically induced mutagenesis

51. On a Ramachandran plot the  $\Psi\Psi$  values for haemoglobin would be in

- (1) the first quadrant
- (2) the second quadrant
- (3) the third quadrant
- (4) the fourth quadrant

52. The portion of proteins having the highest mobility is

- (1)  $\alpha$ -helices
- (2)  $\beta$ -sheets
- (3) peptide bonds
- (4) surface side chains

53. The major element of secondary structure in myoglobin and haemoglobin is

- (1) the  $\beta$ -strand
- (2) the  $\alpha$ -helix
- (3) the  $3_{10}$  helix
- (4) All of the above

54. Molecular dynamics simulations can be used to

- (1) follow the time dependence of a biomolecule
- (2) calculate thermodynamics quantities
- (3) Dock ligands
- (4) All of the above

55. Secondary structure is defined by

- (1) Hydrogen bonding
- (2) Vander walls forces
- (3) Covalent bonding
- (4) Ionic bonding

56. Which of the following does not affect the stability of an  $\alpha$ -helix ?

- (1) Electrostatic repulsion
- (2) Bulkiness
- (3) Interaction between R-groups spaced three residues apart
- (4) Occurrence of alanine and glycine residues

57. Which of the following is not correct about the NMR ?

- (1) It stands for Nuclear Magnetic Resonance
- (2) NMR spectroscopy detects spinning patterns of atomic nuclei in an electric field.
- (3) NMR spectroscopy detects spinning patterns of atomic nuclear in a magnetic field
- (4) Protein samples are labelled with radioisotopes such as  $^{13}\text{C}$  and  $^{15}\text{N}$ .

58. Which of the following is not correct about the X-ray crystallography ?

- (1) In X-ray protein crystallography, proteins need to be grown into large crystals in which their positions are fixed in a repeated, ordered fashion.
- (2) The protein crystals are illuminated with an intense X-ray beam.
- (3) The X-rays are deflected by the electron clouds surrounding the atoms in the crystal producing a regular pattern of diffraction.
- (4) The protein crystals are illuminated with the intense infrared beam.

59. Which of the following is not correct ?

- (1) The rigid double bond structure forces atoms associated with the peptide bond to lie in the same plane, called the dipeptide plane
- (2) A peptide bond is actually a partial double bond owing to shared electrons between O=C-N atoms
- (3) Because of the planer nature of the peptide bond and the size of the R-groups, there are considerable restriction on the rotational freedom by the two bonded pairs of atoms around the peptide bond
- (4) The angle of rotation about the bond is referred to as the dihedral angle (also called as torsional angle)

60. Which of the following is not correct about the  $\alpha$ -helices ?

- (1) An  $\alpha$ -helix has a main chain backbone conformation that resembles a cork screw
- (2) Nearly all known  $\alpha$ -helices are right-handed, exhibiting a leftward spiral form
- (3) Nearly all known  $\alpha$ -helices are right-handed, exhibiting a rightward spiral form
- (4) In right-handed helix there are 3.6 amino acids per helical turn

61. Osmotic pressure of 1 mole of ideal solute relative to pure water is

- (1) 6.5 atm
- (2) 22.4 atm
- (3) 4 atm
- (4) 1 atm

62. What provides most of the energy that is used to maintain a normal resting membrane potential of about 70 millivolt inside the neuronal cell ?

- (1) Potassium pump
- (2) The chloride pump
- (3) The sodium pump
- (4) Diffusion of chloride ions

63. Catharine mediates

- (1) exocytosis
- (2) pericytosis
- (3) receptor mediated endocytosis
- (4) mesocytoses

64. Cardiac muscle is able to work as a syncytium because of the structural presence of

- (1) gap junction
- (2) intercalated disc
- (3) branching fibers
- (4) protoplasmic bridge between the cells

65. Marker enzyme for mitochondria is
- (1) Lactate dehydrogenase
  - (2) Catalase
  - (3) Glucose -6-phosphatase
  - (4) Succinate dehydrogenase
66. Which of the following statements is true ?
- (1) Energy minimisation is carried out using quantum mechanics.
  - (2) Energy minimisation is used to find a stable conformation for a molecule.
  - (3) Energy minimisation is carried out by varying only bond angles and bond lengths.
  - (4) Energy minimisation stops when a structure is formed with much greater stability than the previous one in the process.
67. Beta waveforms in electroencephalogram indicates which of the following state of the patient ?
- (1) Deep anaesthesia
  - (2) Surgical anaesthesia
  - (3) Light anaesthesia, eyes closed and relaxed
  - (4) Awake or alert state

68. Which of the following is not true about EEG (Berger) alpha ( $\alpha$ ) wave ?
- (1) Frequency is 8-13 / sec
  - (2) Voltage is 50 microvolts usually
  - (3) Seen in awake patients at rest with eyes closed and mind wandering
  - (4) These Berger (EEG) waves are seen in hippocampus
69. The first physiological response to high environmental temperature is
- (1) sweating
  - (2) vasodilation
  - (3) decreased heat production
  - (4) decreased non-shivering thermogenesis
70. Staying at space station for prolonged period can result in
- (1) decreased nitric oxide release
  - (2) decreased activation of renin-angiotensin system
  - (3) decrease in type H cells
  - (4) increase in the osteoprogenitor cells

71. All of the following can be the features of positive G except

- (1) black out of vision
- (2) brain edema
- (3) fracture vertebrae
- (4) decreased diastolic blood pressure

72. Which of the following statement is true ?

- (1) Positive G is exerted when a person sitting in an aircraft accelerates towards earth faster than gravity.
- (2) Positive G is when +1G is applied to the body.
- (3) When -3G is applied to the body becomes -2G, it is called positive G.
- (4) Positive G forces are anything that exceeded 1G.

73. Adverse effects of hypothermia are all except

- (1) cardiac arrhythmias
- (2) renal failure
- (3) decreased peripheral resistance
- (4) reversible coagulopathy

74. Which of the following conditions result in sensorineural deafness ?

- (1) Meniere's disease
- (2) Acute otitis media
- (3) Impaction of wax in external auditory canal
- (4) Otosclerosis

75. Brainstem auditory evoked potential is useful in all of the following conditions except

- (1) assesses hearing loss in infants
- (2) localization of brainstem lesions
- (3) diagnosing strokes affecting brainstem
- (4) localising lesion of auditory cortex

76. All of the following conditions result in conductive deafness except

- (1) thickening of tympanic membrane
- (2) immobility of the ossicles
- (3) labyrinthitis
- (4) chronic otitis media

77. Pain and damage to the ear occurs at a sound wave crosses

- (1) 60 dB
- (2) 80 dB
- (3) 100 dB
- (4) 140 dB

78. The human ear is most sensitive to a frequency of

- (1) 100-300 Hz
- (2) 300-500 Hz
- (3) 1000-3000 Hz
- (4) 10,000-20,000 Hz

79. Endocochlear potential is

- (1) + 45 mV
- (2) - 45 mV
- (3) - 60 mV
- (4) + 85 mV

80. The speed of sound in air at 0 °C is

- (1) 33 metre/second
- (2) 330 metre/second
- (3) 500 metre/second
- (4) None of the above

81. The function of ear ossicles is to

- (1) amplify the sound waves to 1.3 times
- (2) pull the foot plate of stapes out of the oval window
- (3) maintain the pressure within middle ear
- (4) increase the tension of tympanic membrane

82. During transmission of sound waves, the pressure within the middle ear is increased by

- (1) 2 fold
- (2) 4 fold
- (3) 12 fold
- (4) 22 fold

83. Which of the following structure is not present in the middle ear ?

- (1) Membranous labyrinth
- (2) Eustachian tube
- (3) Tympanic membrane
- (4) Stapes

84. All of the following are true for cochlea, except :

- (1) contains the receptor for hearing.
- (2) has a broad base and a narrow apex.
- (3) takes  $3\frac{1}{4}$  turn around the modiolus.
- (4) contains perilymph.

85. Endolymph in ear is equivalent to

- (1) blood
- (2) lymph
- (3) ICF
- (4) CSF

86. The depolarization of hair cells is due to influx of

- (1) sodium ion
- (2) potassium ion
- (3) calcium ion
- (4) magnesium ion

87. Which of the following statement is wrong ?

- (1) UV absorption is attributable to electronic transition.
- (2) UV spectra provide information about valence electrons.
- (3) IR absorption is attributed to transitions between rotational energy levels of whole molecules.
- (4) NMR spectrometers use radiofrequency electro-magnetic radiation.

88. Which of the following statements regarding IR spectroscopy is not true ?

- (1) Infrared radiation is higher in energy than UV radiation.
- (2) Infrared spectra record the transmission of IR radiation.
- (3) Molecular vibrations are due to periodic motion of atoms in molecules, and include bond stretching, torsional changes and bond angle.
- (4) Infrared spectra give information about bonding features and functional groups in molecule.

89. Which of the following statements regarding NMR spectroscopy is wrong ?

- (1) NMR signals towards the left of the spectral chart correspond to larger chemical shifts.
- (2) Chemical shifts are larger when the frequencies of the radiation which induces the nuclear transitions are higher.
- (3) Chemical shifts are larger when shielding effects are greater.
- (4) None of the above



90. Which of the following statements is false about the glucose transporter (GLUT)?
- (1) It transports glucose across the plasma membrane via mechanism called facilitated diffusion.
  - (2) It has 12 alpha helical transmembrane segments.
  - (3) A conformational change in the transporter is involved in the transport process.
  - (4) Flow through it is size dependent.
91. The force that drives an ion through a membrane channel depends upon
- (1) the size of the channel
  - (2) the size of the ion
  - (3) the size of the membrane
  - (4) the difference in electrical potential across the membrane
92. What locks all transmembrane proteins in the bilayer ?
- (1) Covalent bonds that form between the phospholipids and the proteins.
  - (2) Hydrophobic interactions between non-polar amino acids of the proteins and the non-polar chains of phospholipids.
  - (3) The addition of sugar molecules to the protein surface facing the external environment.
  - (4) Non-covalent interactions between serine and threonine of the proteins with phospholipids.

93. Which of the following is not correct about freeze-fracture technique ?
- (1) It involves physical breaking of frozen biological samples.
  - (2) Fixation in glutaraldehyde
  - (3) Involves vacuum sublimation
  - (4) Cryoprotection with glycerol
94. Two double stranded DNA samples that are identical with respect to the number of base pairs, but differ significantly in their GC content, can be separated by
- (1) density gradient centrifugation
  - (2) agarose gel electrophoresis
  - (3) dialysis
  - (4) oligo-dT column chromatography
95. 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

96. Which of the following techniques yields the most information about the positional and spatial characteristics of all atoms in a protein ?
- (1) Automated Edman analysis
  - (2) Circular dichroism spectroscopy
  - (3) Magnetic resonance spectroscopy
  - (4) Reversible unfolding/refolding
97. UV spectroscopy is not used to quantitate the following compounds based on absorbance ?
- (1) Nucleic acids have absorbance peak at 260 nm
  - (2) NAD(P)H have absorbance peak at 340 nm
  - (3) Aromatic amino acids have absorption maxima at about 280 nm
  - (4) Sulphur containing amino acids have absorbance at 270 nm
98. In UV-VIS spectrophotometry, a wavelength shift is bathochromic and hyperchromic, when
- (1) The absorption maximum is shifted to a higher wavelength and its intensity does not change.
  - (2) The absorption maximum is shifted to a higher wavelength and its intensity decreases.
  - (3) The absorption maximum is shifted to a lower wavelength and its intensity increases.
  - (4) The absorption maximum is shifted to a higher wavelength and its intensity increases.
99. SDS-polyacrylamide gel electrophoresis and isoelectric focusing method for the separation of protein have which of the following characteristics in common ? Both ?
- (1) Separate native proteins
  - (2) Separate proteins according to their mass
  - (3) Required a pH gradient
  - (4) None of these
100. A mixture of two proteins having similar molecular mass but different oligomeric properties can be separated by
- (1) SDS-PAGE analysis
  - (2) Native PAGE analysis
  - (3) Isoelectric focusing
  - (4) Both (2) and (3)
101. Sodium Dodecyl Sulphate (SDS) is used while separating proteins by SDS-PAGE because
- (1) It helps in solubilisation of proteins there by making it easier to separate.
  - (2) It binds to proteins and confers uniform negative charge density there by making them move during electrophoresis.
  - (3) Decrease the surface tension of the buffer used for electrophoresis.
  - (4) Stabilizes the proteins.

102. The Polymerase Chain Reaction or PCR is a technique that

- (1) was used to demonstrate DNA as a genetic material.
- (2) is used to determine the content of minerals in a soil sample.
- (3) use short DNA primer and a thermostable DNA polymerase to replicate specific DNA sequence *in vitro*.
- (4) measures the ribosome transfer rate during translation.

103. All of the following statements about plasma membrane structure and function are true, except :

- (1) Both sides of a plasma membrane are identical in structure and function.
- (2) Special membrane proteins can co-transport two solutes by coupling diffusion with active transport.
- (3) Diffusion, osmosis and facilitated diffusion do not require any energy input from cell.
- (4) Voltage across the membrane depends on an unequal distribution of ions across the plasma membrane.

104. Which of the following statements regarding mass spectrometry is wrong ?

- (1) Molecular ion peaks always have even numbered values of  $m/z$ .
- (2) In normal mass spectrometer, electron impact causes a molecule to loss an electron and become a molecular radical cation which decomposes into fragment cations and radicals.
- (3) Only cations can be detected by a normal mass spectrometer.
- (4) None of the above

105. NMR spectroscopy is used for determining structure in which of the following materials ?

- (1) Radioactive materials
- (2) Insoluble chemical compounds
- (3) Liquids
- (4) Gases

106. NMR is the study of absorption of \_\_\_\_\_ by nuclei in a magnetic field.

- (1) Radioactive radiation
- (2) IR radiation
- (3) Radio frequency radiation
- (4) Microwaves



107. Ionophores are

- (1) The gating mechanisms associated with the transport of ions.
- (2) Intrinsic proteins that passively transport ions.
- (3) Chemicals that form pores in the plasma membrane and allow ions to cross.
- (4) Intrinsic proteins that actively transport ions.

108. If all proteins from a cell membrane are removed, which of the following can be expected to happen ?

- (1) Transport of ions across the membrane will be stimulated.
- (2) Diffusion of polar solutes of high molecular weight across the membrane will increase.
- (3) Transport of ions across the membrane will not be affected.
- (4) Transport of ions across the membrane will be inhibited.

109. For a mammalian skeletal muscle, if the extracellular  $K^+$  concentration  $[K^+]_{out} = 4 \text{ mM}$ , and the intracellular  $K^+$  concentration  $[K^+]_{in} = 128 \text{ mM}$ , the approximate  $K^+$  potential (mV) is

Assume : Faraday's constant =  $9.65 \times 10^4 \text{ C mol}^{-1}$

Gas constant =  $8.31 \text{ JK}^{-1} \text{ mol}^{-1}$

Temperature =  $37^\circ \text{C}$ .

- (1)  $-47$
- (2)  $-94$
- (3)  $-27$
- (4)  $0$

110. The main difference between active transport and facilitated diffusion is that

- (1) In active transport the molecule moves from areas of high to areas of low conc.
- (2) Carrier protein is involved only in case of active transport.
- (3) In active transport energy is consumed to move molecules against a concentration gradient.
- (4) In active transport only water molecules are transported.

111. All of the following statements about action and myosin are true, except :

- (1) The globular head section of myosin has domain for binding ATP and actin.
- (2) Actin is the major protein of the thick filament.
- (3) Binding of ATP to the actin myosin complex promotes dissociation of actin and myosin.
- (4) F-actin is stabilized when tropomyosin is bound to it.

112. Which of the following statements about the myosin is not true ?

- (1) Myosin binds to polymerized actin.
- (2) In vitro, myosin assembles spontaneously into the thin filaments.
- (3) Myosin is an ATPase.
- (4) Myosin has domain that interact with one another to effect its physiological functions.

113. The common pathway of entry of proteins into the endoplasmic reticulum, lysosomes and plasma membrane is characterized by

- (1) Presence of a signal sequence that targets these proteins to endoplasmic reticulum during synthesis.
- (2) Addition of specific sorting sequences to these proteins after their synthesis.
- (3) Addition of N-linked oligosaccharide to these proteins.
- (4) Biding of their mRNA to special ribosome population attached to endoplasmic reticulum.

114. The common pathway of entry into the endoplasmic reticulum (ER) of Secretary. Lysosomal and Plasma membrane proteins is best explained by which of the following ?

- (1) Binding of their mRNA to a special class of ribosomes attached to the ER.
- (2) Addition of a common strong 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.

115. Which of the following drives directional transport through nuclear pore complexes ?

- (1) Dynamin
- (2) Rho GTPase
- (3) Ran GTPase
- (4) ABC transporter

116. The nucleolus is the site where

- (1) Ribosomal RNA is transcribed and ribosomes are assembled.
- (2) DNA replication occur.
- (3) Proteins recently imported from the cytoplasm are deposited.
- (4) Translation occur.

117. Which of the following is incorrect about mitochondria ?

- (1) Mitochondria possess DNA and functional transcriptional and translational machinery.
- (2) Some of the Mitochondrial proteins are coded by nuclear genes.
- (3) Except for the amino acyl-tRNA synthetases other proteins are coded by nuclear genes.
- (4) Mitochondria of maternal origin are the only mitochondria that they passed down to the progeny.

118. In the cell cycle

- (1) M phase is both the most complex and the longest phase.
- (2) There is a  $G_0$  phase in equilibrium with the  $G_1$  phase ( $G_1$ ).
- (3) Quiescent cells cannot be induced to re-enter the cell cycle.
- (4) Microtubule spindles form during the S phase.

119. DNA was isolated from three samples of normal human cells. In each of these samples cells were at different stages of cell division.

Sample 1 = Cells were in  $G_2$  phase.

Sample 2 = Cells were in anaphase.

Sample 3 = Cells were in telophase.

DNA isolated from which of these samples conforms to Chargaff's rules ?

- (1) Only samples 1 and 2
- (2) Only samples 1 and 3
- (3) Only samples 2 and 3
- (4) Only samples 1, 2 and 3

120.  $P^{53}$ , a tumor suppressor gene :

(P) located on chromosome 17

(Q) encodes 53 kDa protein

(R) Checks the cell cycle progression in the  $G_1$  phase.

(S) termed as guardian of genome.

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

121. One difference between receptor mediated apoptosis and mitochondria-mediated apoptosis is that

- (1) Receptor mediated apoptosis makes use of procaspase-9.
- (2) FADD and TRADD serve as protein kinase in receptor mediated apoptosis.
- (3) Mitochondria mediated apoptosis makes use of executioner caspases.
- (4) Mitochondria mediated apoptosis involves the movement of cytochrome-c into the cytosol.

122. Which of the following event does not occur during t-RNA processing ?

- (1) 5' end cleavage by the RNaseP.
- (2) Addition of Poly(A) site.
- (3) Addition of CCA sequence at 3' end.
- (4) Chemical modification of bases.

123. A leader sequence is an mRNA of eukaryotes can be found

- (1) After the "stop" codon.
- (2) Between transcriptional start site and translational start site.
- (3) Within the first exon.
- (4) In the exon-intron boundaries.

124. In a muscle fibre at rest, the length of I band is 1 mm and A band as 1.5 mm. What is the length of sarcomere ?

- (1) 0.5 mm
- (2) 2.5 mm
- (3) 3.5 mm
- (4) 5.0 mm

125. P-R Interval in the ECG corresponds to

- (1) Time interval between onset of atrial contraction and onset of ventricular contraction.
- (2) Time delay in the A-V Node.
- (3) S-A Nodal conduction time.
- (4) Ventricular depolarisation.

126. Electro-cardiographic leads designated  $V_1, V_2$  etc. refers to

- (1) Unipolar limb leads
- (2) Unipolar chest leads
- (3) Bipolar limb leads
- (4) Bipolar chest leads

127. The basis for Korot koft sound is due to

- (1) AV valve closure
- (2) Aortic valve closure
- (3) Arterial expansion
- (4) Arterial turbulence

128. Viscosity of blood is

- (1) Same as of ECF.
- (2) 10 times of Urine.
- (3) 5-6 times more than of water.
- (4) 5-6 times less than of water.

129. Which of the following is wrongly matched about ECG waves and their duration ?

- (1) P wave – 0.10 sec.
- (2) S wave – 0.04 sec.
- (3) QRS complex – max. 0.10 sec.
- (4) Q wave – 0.10 sec.

130. Increased blood viscosity and slow circulation causes

- (1) RBC rouleux formation
- (2) Increased plasma skimming
- (3) Increased number of RBC in capillaries
- (4) (1) and (3)

131. Isotopes used to measure RBC volume is

- (1) Cr51
- (2) H3
- (3) D<sub>2</sub>O
- (4) I135

132. In Einthoven's triangle, what is the value of lead III when lead I = 2 mV and lead II = 1 mV ?

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

133. Normal plasma osmolality is mOsmol/kg H<sub>2</sub>O.

- (1) 285
- (2) 385
- (3) 485
- (4) 585

134. In a person acclimated for high altitude, O<sub>2</sub> saturation is maintained because of

- (1) Increased Hb concentration.
- (2) Increased blood volume.
- (3) Better diffusion in lungs.
- (4) All of the above.



135. ST segment of ECG corresponds to which phase of action potential ?

- (1) Rapid depolarisation
- (2) Rapid repolarisation
- (3) Final repolarization
- (4) Platen phase

136. Which of the following does not occur in high altitude acclimatisation ?

- (1) Reticulocytosis
- (2) Increase serum erythropoietin
- (3) Increased serum cortisol
- (4) Increased blood glucose

137. A person ascends to 12,000 feet develop acute breathlessness. This is due to

- (1) increased pulmonary blood flow.
- (2) carbon dioxide wash out.
- (3) decreased hypoxic stimulation of respiration.
- (4) mechanical interference of thorax.

138. Respiratory acidosis can cause

- (1) Decreased  $p\text{CO}_2$  and decreased pH.
- (2) Increased  $p\text{CO}_2$  and decreased pH.
- (3) Increased  $p\text{CO}_2$  and increased pH.
- (4) Decreased  $p\text{CO}_2$  and increased pH.

139. Decreased  $\text{O}_2$  affinity of Hb in blood with decreased pH :

- (1) Haldane effect
- (2) Double Haldane effect
- (3) Bohr's effect
- (4) Double Bohr's effect

140. Decompression sickness is seen in

- (1) Diver
- (2) Pilot
- (3) Diver and Pilot
- (4) None of the above

141. Which of the following is seen in high altitude climbers ?

- (1) Hyperventilation
- (2) Decreased  $p\text{CO}_2$
- (3) Pulmonary edema
- (4) All of the above

142. Hyperventilation in high altitude is due to

- (1) Respiratory alkalosis
- (2) Respiratory acidosis
- (3) Hyper capnea
- (4) Decreased concentration of bicarbonate

143. Caisson's disease is

- (1) Gas embolism
- (2) Fat embolism
- (3) Amniotic fluid embolism
- (4) Tumor embolism

144. A 32-year-old high altitude mountaineer is observed to have a hemocrit of 70%.

Which of the following represents the most likely cause ?

- (1) Polycythaemia with increased red cell mass.
- (2) Relative Polycythaemia due to dehydration.
- (3) Polycythaemia due to hemo-concentration.
- (4) None of the above.

145. True about Caisson's disease

- (1)  $\text{O}_2$  release from tissue
- (2)  $\text{CO}_2$  release from tissue
- (3)  $\text{N}_2$  release from tissue
- (4)  $\text{H}_2$  release from tissue

146. Most effective buffer at physiological pH in blood is

- (1) Glutamate
- (2) Phosphate buffer
- (3) Citric acid buffer
- (4) Bicarbonate buffer

147. Who proposed the signal hypothesis for selective translocation of m-RNA ?

- (1) Watson and Crick
- (2) Blaber and Debberstein
- (3) Kornberg and his associates
- (4) Monago and Grunberg

148. Several ribosomes are often attached to and translating the same m-RNA. The entire complex is

- (1) Codon
- (2) Clover leaf
- (3) Polysome
- (4) Anticodon

149. The term "Central dogma" was coined by

- (1) Baltimore
- (2) Crick
- (3) Khorana
- (4) Mathai

150. Transcription requires

- (1) RNA polymerase enzyme
- (2) DNA template
- (3) Ribonucleotide triphosphate
- (4) All of the above

151. The *lac operon* is subject to

- (1) Positive regulation
- (2) Negative regulation
- (3) Both (1) and (2)
- (4) None of the above

152. Regulation of transcription is the most important mode of control of

- (1) Southern blotting
- (2) Northern blotting
- (3) Both (1) and (2)
- (4) Gene expression

153. Gene products that decrease in concentrations in response to a molecular signal are referred to as

- (1) Induction
- (2) Repressible
- (3) Constitutive gene expression
- (4) All of the above

154. Who devised monoclonal antibody technology ?

- (1) Cesar Milstein
- (2) Georges Kohler
- (3) Crick
- (4) Khorana

155. The difference in concentration  $H^+$  in a solution of pH 2.0 compared with one of pH 7.0 is

- (1) 5 fold
- (2) 1/5 as much
- (3)  $10^5$  fold
- (4)  $10^{-5}$  as much

156. In a patient with a plasma pH of 7.1 the  $[HCO_3^-]/[H_2CO_3]$

- (1) 20
- (2) 10
- (3) 1
- (4) 0.1

157. In uncompensated metabolic alkalosis

- (1) The plasma pH, the plasma  $HCO_3^-$  concentration and the arterial  $pCO_2$  are all low.
- (2) The plasma pH is high and the plasma  $HCO_3^-$  concentration and arterial  $pCO_2$  are low.
- (3) The plasma pH and plasma  $HCO_3^-$  concentration are high and the arterial  $pCO_2$  is normal.
- (4) None of the above.

158. The technique used to locate specific genes in chromosomes is

- (1) Colony hybridisation
- (2) In situ hybridisation
- (3) Dot blot technique
- (4) Western blotting

159. The separation technique for charged molecule under the influence of electric current is called

- (1) Colony hybridisation
- (2) Electrophoresis
- (3) Dot blot technique
- (4) Western blotting

160. Equilibrium potential of an ion is calculated by

- (1) Gibbs-Donnan equilibrium
- (2) Nernst-equation
- (3) Goldman equation
- (4) Katz equation

161. All of the following are events in the stimulated skeletal muscle, except :

- (1) Exposure of myosin-binding sites on actin.
- (2) Binding of myosin head to actin.
- (3) Release of Pi and conformational change in myosin head.
- (4) Myosin head pulls the thin filament about  $11 \mu m$  toward center of sarcomere.

162. During the skeletal muscle contraction, the cytoplasmic calcium concentration rises

- (1) 10-fold
- (2) 100-fold
- (3) 1000 fold
- (4) 100000-fold

163. In the extreme stretched state of skeletal muscle, the width of

- (1) A band increases
- (2) H band increases
- (3) I band decreases
- (4) Actin and myosin interaction increases

164. The connective tissue layer around the skeletal muscle fascicle is called

- (1) Epimysium
- (2) Perimysium
- (3) Perineurium
- (4) Edomysium

165. The termination of skeletal muscle contraction occurs when

- (1) Cytoplasmic calcium concentration decreases.
- (2) ACh is hydrolyzed to choline and acetate.
- (3) Closure of ryanodine channels occur.
- (4) Closure of dihydropyridine receptors occurs.

166. In the resting state of skeletal muscle,

- (1) H zone is covered with thin filaments.
- (2) I band has the maximum width.
- (3) I band has the minimum width.
- (4) Overlap of thick and thin filament begins at the outer boundary of H zone.

167. In electromyography (EMG) transient response at the time of electrode indicates

- (1) Spontaneous muscular activity.
- (2) Voluntary muscular activity.
- (3) Induced muscular activity.
- (4) Cell membrane damage.

168. The major constituent of cell membrane is

- (1) Phospholipids
- (2) Protein
- (3) Carbohydrate
- (4) Cholesterol

169. Fluidity of cell membrane depend on :

- (1) Phospholipid
- (2) Glycolipid
- (3) Cholesterol
- (4) Cholesterol – Phospholipid ratio

170. All of the following metabolic processes occur in mitochondria, except :

- (1) Glycolysis
- (2) Electron transport chain
- (3) Fatty acid oxidation
- (4) TCA cycle

171. Catabolism of  $H_2O_2$  is carried by

- (1) Mitochondria
- (2) Peroxisomes
- (3) Endoplasmic reticulum
- (4) Lysomes

172. Osmolarity is defined as :

- (1) Number of osmole per litre
- (2) Number of osmole per kg
- (3) Weight of solute per litre
- (4) Weight of solute per kg

173. In severe exercise, decrease in pH is due to :

- (1) Respiratory acidosis
- (2) Lactic acidosis
- (3)  $H^+$  retention
- (4)  $HCO_3^-$  excretion

174. Skeletal muscle contraction ends when :

- (1) Ions move out of cytoplasm
- (2) Acetylcholine is absorbed from the neuromuscular junction
- (3) Closure and indrawing of receptors
- (4) Decreased calcium outside sarcoplasmic reticulum

175. Interstitial fluid volume can be determined by –

- (1) Radioactive iodine and radiolabelled water
- (2) Radioactive water and radiolabelled albumin
- (3) Radioactive sodium and radioactive water
- (4) Radioactive sodium and radioactive albumin

176. Delta waves are seen in

- (1) Wakefulness
- (2) Deep Sleep
- (3) Stage I REM
- (4) None

177. Which of the following is “not true” for cardiac and skeletal muscle fibres ?

- (1) Both cardiac and skeletal muscles exhibit graded contraction.
- (2) Excitation – contraction coupling in both depends upon increased intracellular calcium.
- (3) Excitation – contraction coupling is not dependent on extracellular  $\text{Ca}^{2+}$  in skeletal muscle.
- (4) Cardiac action potential has a plateau and a longer refractory period.

178. When extracellular potassium is increased from 4 meq. to 10 meq. what will happen ?

- (1) Resting membrane potential becomes more negative
- (2) Increase in conductance of sodium
- (3) Increase in conductance of potassium
- (4)  $\text{Na}^+ - \text{K}^+$  ATPase will be stopped.

179. Regarding transport of substances through the cell membrane, all are true except :

- (1) glucose is transported via facilitated diffusion
- (2) active transport is an energy driven process
- (3) facilitated diffusion requires energy
- (4) facilitated diffusion requires carrier protein

180. Equilibrium potential for an ion is calculated using

- (1) Gibbs Donnan equation
- (2) Goldman equation
- (3) Nernst equation
- (4) Henderson-Hasselbach equation

रफ कार्य के लिए स्थान / SPACE FOR ROUGH WORK

Faint, illegible text, likely bleed-through from the reverse side of the page.

