



श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकीसंस्थान, तिरुवनंतपुरम्-11  
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY  
THIRUVANANTHAPURAM—695 011

ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2022

Program: PhD Biological Sciences

Time:90 Minutes

Max. Marks: 100

(Select the most appropriate answer)  
(There are **no negative** marks for wrong answers)

- 1 The main difference between normal and transformed cells are
  - a. inactivation of oncogenes and shorter doubling time
  - b. immortality and contact inhibition
  - c. shorter doubling time and cell motility
  - d. apoptosis and tumour suppressor gene hyperfunction
  
- 2 A core of three transcription factors that maintains the pluripotency of inner cell mass in mammals are
  - a. Sox 2, Nanog and Cdx2
  - b. Oct 4, Sox 2 and Cdx2
  - c. Oct 4, Cdx2 and Nanog
  - d. Oct 4, Sox 2 and Nanog
  
- 3 Which one of the following techniques is cannot determine the protein conformational dynamics
  - a. NMR spectroscopy
  - b. Differential scanning calorimetry
  - c. Mass spectroscopy
  - d. Fluorescence microscopy
  
- 4 A multimeric protein when run on an SDS gel showed 2 bands at 30 kDa and 50kDa. However, when the protein was run on a native gel, it showed a single band at 160 kDa. The native form of the protein would be
  - a. homotrimer
  - b. heterodimer
  - c. heterotrimer
  - d. heterotetramer
  
- 5 Which one of the following does not belong to human antimicrobial proteins and peptides at epithelial surfaces forming part of innate immunity
  - a. Calprotectin
  - b. Defensin
  - c. Vimentin
  - d. Lactoferrin



- 13 The recording of electrical activity of a patient's heart shows that the atrial are contracting regularly and normally, but every few beats the ventricles fail to contract. Which of the following is probably not functioning properly?
- AV node
  - Semilunar valve
  - Coronary artery
  - Pacemaker
- 14 Signaling molecule that travel farthest are
- Paracrine
  - Juxtacrine
  - Endocrine
  - Neurotransmitter
- 15 The carbon monoxide emitted by automobiles prevents transport of oxygen by
- changing oxygen into carbon dioxide
  - forming a stable compound with haemoglobin
  - destroying the haemoglobin
  - obstructing the reaction of oxygen with haemoglobin
- 16 Certain statements on stem cells are given below
- All type of stem cells have the ability to form complete embryo.
  - Stem cells whose commitment is limited to a relatively small subset of all possible cell types is called multipotent stem cells.
  - Adult cells may be reprogrammed to gain pluripotency by modifying Oct 3/4, Sox2, c-myc, Klf-4 genes.
  - The pluripotency of the stem cells in an embryo is essentially maintained by FGF-b, Nanog and TGF-b.
- In which of the following combinations, all statements are correct?
- A, B and C
  - B and C
  - C and D
  - A and D
- 17 DNA double-strand breaks are considered to be critical primary lesions in the formation of chromosomal aberrations. Error-free repair of double strand breaks in DNA is accomplished by
- Non-homologous end-joining.
  - Base excision repair
  - Homologous recombination.
  - Mismatch repair-
- 18 A mutant cell line was developed which defective in salvage pathway for nucleotide biosynthesis. These cells was fed with culture medium containing  $^{15}\text{N}$  labelled amino acids. Treatment with which one of the following amino acids is likely to produce  $^{15}\text{N}$  labelled purines?
- Glycine
  - Aspartamine
  - BOTH 1& 2
  - NONE
- 19 Which one of the following is a DNA intercalator?
- 5-Bromouracil
  - Ethidium bromide
  - Acridine orange
  - Both A & B
- 20 Which of the following amino acid contain sulphur
- Methionine
  - serine
  - Tryptophan
  - none

- 21 Which technique is best for analysing lateral diffusion of proteins in membrane and calculating its diffusion rate
- Atomic force microscopy
  - Scanning electron microscopy
  - Transmission electron microscopy
  - FRAP
- 22 Fluorescence microscopy is based on the ability of certain molecules to
- Continuously emit light of a constant wavelength
  - Absorb light of many different wavelengths.
  - Absorb light of a given wavelength and then emit light of a longer wavelength.
  - Absorb light of a given wavelength and then emit light of a shorter wavelength.
- 23 The sequence of the peptide KGLITRTGLIKR can be unequivocally determined by which technique
- Only Edman degradation.
  - Amino acid analysis and MALDI MS/MS mass spectrometry.
  - MALDI MS/MS mass spectrometry
  - MALDI mass spectrometry after treatment of the peptide with trypsin.
- 24 RNA polymerase II is a multiprotein complex that transcribes DNA into precursors of messenger. Which of the following are NOT transcribed by RNA polymerase II?
- miRNA and some snRNA
  - miRNA and snoRNA
  - mRNA and snoRNA
  - tRNA and 5S rRNA
- 25 Which of the following is not a bacterial disease
- COVID-19
  - small pox
  - tetanus
  - Both A & B
- 26 Which one of the following immunoglobulins takes part in classical complement fixation pathway?
- IgD
  - IgE
  - IgA
  - IgG
- 27 In which of the human body fluids is  $K^+$  concentration higher than that of  $Na^+$  ?
- Plasma
  - Perilymph
  - Endolymph
  - Cerebrospinal fluid
- 28 What will be the peptide produced by the translation of the transcript produced by the translation of a DNA sequence, '5-AAGTACTCT-3'
- Tyr-Phe-Trp
  - Tyr-Leu-Gly
  - Thr-Lys-Ser
  - Phe-Met-Arg
- 29 Among the following vitamins, which vitamin is not important for the maturation of RBC
- folic acid
  - vitamin B12
  - pyridoxin
  - tocopherol

- 30 How many double bonds are there in linoleic acid
- 2
  - 3
  - 4
  - 0
- 31 Provitamins of vitamin A
- Beta-Carotene
  - alpha-Carotene
  - gamma-Carotene
  - All the above
- 32 A mutation in a protein coding gene in mouse resulted in loss of function of protein. The phenotypic effect of the mutation was observed in homozygous mutant mice, in heterozygous mice that inherited the mutation from the mother and in heterozygous mice that inherited the mutation from the father. This suggests that
- The gene is imprinted
  - The mutation acts as a dominant negative
  - The gene possibly has more than two alleles
  - The gene is X-linked
- 33 Mitochondria isolated and placed in a buffered solution with a low pH start to produce ATP. This is likely due to:
- Lower pH inside mitochondria
  - Increased OH<sup>-</sup> concentration in the mitochondrial matrix
  - Increased movement of H<sup>+</sup> from the inter-membrane space to the matrix
  - Decreased H<sup>+</sup> in the inter-membrane space
- 34 Which among the following is called the 'hormone of darkness'?
- Melatonin
  - Serotonin
  - Vasopressin
  - Oxytocin
- 35 Which of the following is **NOT** an autophagy related protein?
- Beclin-1
  - LC3
  - p62
  - E-Cadherin
- 36 Which of the following are true for electron microscopy?
- Specimen should be thin and dry
  - Image is obtained on a phosphorescent screen
  - Electron beam must pass through evacuated chamber
  - All of the above
- 37 A live vaccine is:
- Low dose of infectious pathogen administered as a prophylactic
  - A dose of the pathogen in a modified form which retains immunogenicity but is not pathogenic
  - A low dose of toxin that is produced by the pathogen
  - A sample of cells from a patient who recently recovered from the disease
- 38 Excess oxygen consumed after vigorous exercise is to:
- Pump out lactic acid from muscles
  - Increase the concentration of lactic acid in muscles
  - Reduced dissolved CO<sub>2</sub> in blood
  - Make ATP for gluconeogenesis

- 39 Which class of immunoglobulins is the first to respond to an infection?
- IgA
  - IgE
  - IgG
  - IgM
- 40 The terminal electron acceptor during mitochondrial respiration is
- Oxygen
  - FAD<sup>+</sup>
  - NAD<sup>+</sup>
  - ATP
- 41 Which of the following is involved in anchoring of cells to an extracellular matrix
- Integrins
  - Interleukins
  - Angiotensin
  - Cyclins
- 42 What is cas9 in CRISPR-Cas9 based DNA editing tool?
- It's a RNA molecule which provides specificity to the editing process
  - It's a RNA molecule that cleaves target DNA
  - It's a protein molecule that cleaves the target DNA
  - It's a protein molecule that cleaves the guide RNA
- 43 Which of the following is a polar amino acid?
- Lysine
  - Glycine
  - Methionine
  - Tryptophan
- 44 Which of the following treatments can induce hypoxia in mammalian cell culture?
- Cobalt chloride at 100mM for 24 h
  - Glucose at 25 mM for 24 h
  - Serum free Medium for 12 h
  - All-trans retinoic acid at 1mM for 6 h
- 45 If a solution has to be a buffer, its pH should be
- At its K<sub>a</sub> value
  - At pH 7
  - At pH 14
  - At its pK<sub>a</sub> value
- 46 How does IPTG induction works?
- By removing a repressor from lac operon to induce gene expression
  - By deliberately introducing a foreign nucleic acid to the host cell
  - By reducing the synthesis of protein.
  - By cleaving the target DNA at specific recognition sites.
- 47 Before starting transcription, the following factor helps in activation of chromatin loop
- Taq polymerase
  - Topoisomerase I
  - DNA polymerase III
  - All of the above
- 48 The following process in developmental biology of animals is dependent on cellular movements?
- Morphogenesis
  - Differentiation
  - Cell cycle
  - Pattern formation

- 49 Which of the following tool is used to find sequence similarly?
- NCBI
  - PDB
  - BLAST
  - All of the above
- 50 In the context of cell to cell communication, the ability of cells to respond to inductive signal is known as:
- Inductivity
  - Competence
  - Specificity
  - None of the above
- 51 When there are four chormatids and two centromeres, it is called
- Monovalent
  - Bivalent
  - Trivalent
  - Tetavalent
- 52 Division of nuclear contents in cell division is known as
- Meiosis
  - Mitosis
  - Cytokinesis
  - Karyokinesis
- 53 Which of the following is a membrane-less organelle?
- Centriole
  - Peroxisome
  - Glyoxisome
  - All of the above
- 54 Ribosomes are formed in
- Mitochondrion
  - Chloroplast
  - Nucleolus
  - None of the above
- 55 If the template [A+G/C+T] value was 0.97, what would be the [A+G/C+T] value of the product in a PCR reaction
- 0.01
  - 1.01
  - 2.01
  - 3.01
- 56 Which of the following is used for phage display technique
- M13
  - H15
  - H1N1
  - T7
- 57 Example of gaseous chemical messenger is
- Carbon dioxide
  - Oxygen
  - Carbon monoxide
  - Nitric oxide
- 58 Small membrane bound vesicles secreted by cells are called
- Endosomes
  - Isosomes
  - Lysosomes
  - Exosomes
- 59 When a cell ceases motility or changes its trajectory upon clash with another cell, it is called
- Contact inhibition
  - Apoptosis
  - Conflict of interest
  - Senescence

- 60 Tumor necrosis factor triggers
- Extrinsic apoptosis pathway
  - Intrinsic apoptosis pathway
  - Induced apoptosis pathway
  - All of the above
- 61 Genome of COVID-19 causing virus genome is made of
- ssDNA
  - dsDNA
  - ssRNA
  - dsRNA
- 62 PPE means?
- Public private enterprise
  - Personal protective equipment
  - Public protection entity
  - Personal protection enterprise
- 63 In a certain code "DIVISION" is written as "DVISOIN", then how is "STATES" written?
- SATETS
  - SATTES
  - SAETTS
  - STTAES
- 64 A room has 10 doors. In how many ways one can enter through a door and exit through a different door?
- 9
  - 10
  - 100
  - 90
- 65 In this "see and tell" sequence, what is the next number?: 1, 11, 21, 1211, 111221, \_\_\_\_\_.
- 312211
  - 1112221
  - 1112222
  - 112131
- 66 At extreme depths in the sea (beyond 170 m depth), divers experience hallucinations, dizziness, tremors etc because of ----- .
- hyperventilation
  - decompression sickness
  - high-pressure neurological syndrome
  - diving reflex
- 67 Which is the primary stress hormone
- cortisol
  - aldosterone
  - adrenaline
  - noradrenaline
- 68 Name a plastic-degrading systems
- PETase
  - ACE
  - MHETase
  - both 1 &3
- 69 SARS-CoV-2 spike protein is a
- surface glycoprotein
  - small envelope protein
  - nucleocapsid protein
  - matrix protein

- 70 Covishield is a ----- type of vaccine
- whole virion inactivated
  - recombinant, replication-deficient adenovirus vector encoding Spike protein
  - mRNA
  - DNA
- 71 Paralympic Games 2020 was conducted at
- Abu Dhabi
  - Tokyo
  - Rio
  - Beijing
- 72 Nobel Prize for Physics in 2020 was awarded for the discovery of
- cosmology
  - optical tweezers
  - theory for Black hole formation
  - discovery in alloys
- 73 The theory of relativity is presented by which scientist
- Albert Einstein
  - Isaac Newton
  - Stephen Hawking
  - Marie Curie
- 74 Total number of elements in the Periodic table
- 112
  - 118
  - 115
  - 127
- 75 Which one is the purest form of carbon
- coal
  - diamond
  - graphite
  - iron
- 76 The membrane proteins can span across the lipid bilayer strictly due to the presence of
- alpha helices
  - parallel beta sheet
  - antiparallel beta sheet
  - zinc finger domain
- 77 To detect specific macromolecule or structure by electron microscopy, the frequently used procedure is to couple the antibody with
- Osmium tetroxide
  - Alexa 568
  - Gold Particle
  - Cy5
- 78 The inner cell mass of mammalian embryo in the blastocyst stage are
- totipotent
  - pluripotent
  - multipotent
  - unipotent
- 79 Which of the following number is a prime number
- 121
  - 163
  - 183
  - 1020
- 80 The enzyme Rennin is secreted in which among the following parts of the Alimentary Canal?
- Mouth
  - Duodenum
  - Pancreas
  - Stomach

- 81 Both prokaryotic as well as eukaryotic cells have
- Lysosomes
  - Mitochondria
  - Ribosomes
  - Golgi Bodies
- 82 Which one of the following does not involve in maturation of red blood cells
- pyridoxine
  - tocopherol
  - vitamin B12
  - folic acid
- 83 Migration of individual cells from the surface into the embryo's interior is termed as
- ingression
  - involution
  - invagination
  - delamination
- 84 Which of the following hormone is detected by pregnancy kits?
- Estrogen
  - Progesterone
  - Human Chorionic Gonadotropin
  - Lutinizing Hormone
- 85 Five persons A, B, C, D, and E are sitting in a row. C in the middle of the group and D is at an extreme end. There are at least two persons between B and E. Which of the following statements is incorrect?
- E can be on extreme left
  - A is always a neighbour of B or D
  - A cannot be on extreme left
  - E can be on extreme right
- 86 Each pixel in a liquid crystal display (LCD) television is composed of 3 sub-pixels that can transmit red, green and blue colours because
- White light is made of three primary colours viz red, green, blue
  - Liquid crystals can only filter these primary colours
  - The human retina contains only three types of colour-sensitive cells
  - These colours are the most pleasing to the human eye.
- 87 The Nobel prize in physiology or medicine 2020 was shared by Harvey J. Alter, Michael Houghton and Charles M. Rice for
- The development of a method for genome editing
  - The discovery of Hepatitis C virus
  - The discoveries of how cells sense and adapt to oxygen availability
  - The discoveries of molecular mechanisms controlling the circadian rhythm
- 88 The first WHO recognized outbreak of Nipah virus was reported in
- Malaysia
  - Bangladesh
  - Singapore
  - India
- 89 Who among the following is a climate campaigner?
- Verghese Kurien
  - Malala Yousafzai
  - Greta Thunberg
  - Michelle Obama
- 90 The only active volcano of India is located at
- Gujarat
  - Haryana
  - Maharashtra
  - Andaman & Nicobar Islands

- 91 EJOT, DHLP, CFIL, ?
- a. BHLM  
b. BDFH  
c. DGKL  
d. DEIJ
- 92 A man walks 30 meters towards south. Then turning to his right, he walks 30 meters. Then turning left, he walks 20 meters. Again, he turns to his left and walks 30 meters. How far is he from his initial position?
- a. 110 meters  
b. 80 meters  
c. 60 meters  
d. 50 meters
- 93 The ratio of the ages of a man and his wife is 4:3. After 4 years, this ratio will be 9:7. If at the time of marriage, the ratio was 5:3, then how many years ago were they married?
- a. 15 years  
b. 12 years  
c. 10 years  
d. 8 years
- 94 The first track and field athlete to win a gold medal for India at the Olympics
- a. AbhinavBindra  
b. PV Sindhu  
c. Neeraj Chopra  
d. Nirav Modi
- 95 By the end of next month my grandmother \_\_\_\_\_ in the same house for more than 80 years
- a. will have been living  
b. will live  
c. will have lived  
d. will be living
- 96 Leaf of a plant appears green in daylight. If this plant were observed in red light, what colour would its leaf appear ?
- a. green  
b. black-brown  
c. red  
d. blue
- 97 Twenty one liters of milk in a tank is to be divided into three equal parts using only 5, 8 and 12 liters capacity cans. The minimum number of transfers needed to achieve this is.....
- a. 3  
b. 4  
c. 5  
d. 7
- 98 How many times starting at 1:00 pm would the minute and hour hands of a clock make an angle of 40 Degree with each other in the next 360 minutes?
- a. 6  
b. 7  
c. 11  
d. 12
- 99 Which is not an essential amino acid
- a. proline  
b. methionine  
c. valine  
d. lysine
- 100 Which Indian city has the Drink-from-Tap facility for the first time in India?
- a. Bangalore  
b. Srinagar  
c. Trivandrum  
d. Puri

Academic Session: January 2022

PhD Biological Sciences: Answer key

1	b ✓
2	d ✓
3	b ✓
4	d ✓
5	c ✓
6	b ✓
7	c ✓
8	a ✓
9	b ✓
10	d ✓
11	c ✓
12	a ✓
13	a ✓
14	c ✓
15	b ✓
16	b ✓
17	c ✓
18	a ✓
19	d ✓
20	a ✓

21	d ✓
22	c ✓
23	a ✓
24	d ✓
25	d ✓
26	d ✓
27	c ✓
28	d ✓
29	d ✓
30	a ✓
31	d ✓
32	b ✓
33	c ✓
34	a ✓
35	d ✓
36	d ✓
37	b ✓
38	d ✓
39	d ✓
40	a ✓

41	a ✓
42	c ✓
43	a ✓
44	a ✓
45	d ✓
46	a ✓
47	b ✓
48	a ✓
49	c ✓
50	b ✓
51	b ✓
52	d ✓
53	a ✓
54	c ✓
55	b ✓
56	a ✓
57	d ✓
58	d ✓
59	a ✓
60	b ✓

61	c ✓
62	b ✓
63	a ✓
64	d ✓
65	a ✓
66	c ✓
67	a ✓
68	d ✓
69	a ✓
70	b ✓
71	b ✓
72	c ✓
73	a ✓
74	b ✓
75	b ✓
76	a ✓
77	c ✓
78	b ✓
79	b ✓
80	d ✓

81	c ✓
82	b ✓
83	c ✓
84	c ✓
85	b ✓
86	c ✓
87	b ✓
88	a ✓
89	c ✓
90	d ✓
91	b ✓
92	d ✓
93	b ✓
94	c ✓
95	a ✓
96	b ✓
97	d ✓
98	c ✓
99	a ✓
100	d ✓