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ENTRANCE EXAMINATION, 2021-22
Ph.D. Biotechnology

Time: 2 hours **Maximum Marks: 70**

HALL TICKET NUMBER:

INSTRUCTIONS:

Please read the instructions carefully before answering the questions

1. Write your Hall Ticket Number in the OMR answer sheet given to you. Also write the Hall Ticket Number in the space provided above.
2. Answers are to be marked on the OMR answer sheet.
3. Hand over the OMR answer sheet at the end of the examination to the invigilator.
4. The question paper contains 70 questions of multiple choices. OMR answer sheet provided separately.
5. All questions carry one mark each.
6. There is **no negative** marking for wrong answer.
7. If there is a tie, the marks obtained in Part A will be used to resolve the tie.
8. Non-programmable scientific calculators are permitted.
9. Cell/Mobile Phones are strictly prohibited in the examination hall.
10. There are total 16 pages including the instructions page

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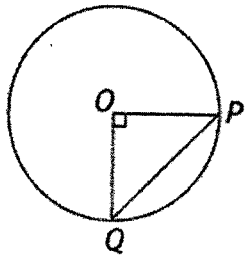
Part A

Q1.



If the length of the chord PQ = $4\sqrt{2}$, what is the circumference of the circle with center O?

A. 8
B. 4π
C. 8π
D. $8\pi\sqrt{2}$

Q2. A ladder is placed against the wall making an angle of 60 degree from the ground. If the foot of the ladder is 3.5 meter away from the wall, what is the length of the ladder?

A. 3.5 m
B. 4.95 m
C. 1.75 m
D. 7 m

Q3. Rahul is older than Vikas, Vikas is older than Priya. Priya is younger than Rahul and Sudeep is older than Rahul. Arrange all four in an order from oldest to youngest.

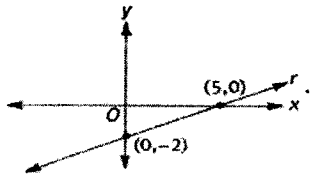
I. Rahul
II. Vikas
III. Priya
IV. Sudeep

A. III, IV, II, I
B. IV, I, III, II
C. IV, I, II, III
D. II, III, IV, I

Q4. An iron sphere with a mass of 200.0 (±10.0) g occupies volume of 25.0 (±5.0) cm^3. The density of the block (with appropriate error) is

A. 8 (±2.6)
B. 8 (±2.0)
C. 8 (±1.9)
D. 8 (±1.7)

Q5.



Line r is a straight line as shown above. Which of the following points lies on line r?

A. (7, 3)
B. (8, 2)
C. (9, 3)
D. (10, 2)

Q6. A number is chosen randomly from a series of numbers 1 to 50. What is the probability that the number is a multiple of 4 or 7?

A. 19/50
B. 9/25
C. 1/3
D. 6/25

Q7. A researcher is working on cancer cells. As the cancer progresses, he is trying to identify the various rearrangements occurring in genome like translocation, deletion, duplication etc. Which among the following would be most appropriate?

A. RAPD
B. Microarray
C. Multi-colour FISH
D. Flow cytometry

Q8. Which of the following is a correct statement?

A. TA cloning vectors are double stranded circular DNA molecules that are suitable to clone PCR products with A overhangs
B. TA cloning vectors are double stranded circular DNA molecules that are suitable to clone PCR products with T overhangs
C. TA cloning vectors are double stranded linear DNA molecules that are suitable to clone PCR products with A overhangs
D. TA cloning vectors are double stranded linear DNA molecules that are suitable to clone PCR products with T overhangs

Q9. In a nitrocellulose filter binding assay, which of the following form of DNA is **NOT** retained on the filter?

A. Linear single strand DNA
B. Double strand DNA with blunt ends
C. Double stranded DNA with overhangs
D. Nicked circular DNA

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Q10. Choose the correct order:

1. Searching homologous sequence in dsDNA
2. Binding to ssDNA regions
3. Helical nucleoprotein formation
4. Strand exchange

A. 1, 2, 3, 4
B. 3, 1, 2, 4
C. 2, 3, 1, 4
D. 1, 3, 2, 4

Q11. Match the viruses with the diseases they cause:

I.	*Enterovirus*	1. Haemorrhagic fever
II.	*Flavivirus*	2. Measles
III.	*Morbillivirus*	3. SARS
IV.	*Beta coronavirus*	4. Polio

Which of the pairs are correctly matched?

	I	II	III	IV
A.	4	2	1	3
B.	4	3	1	2
C.	4	1	2	3
D.	2	3	1	4

Q12. Visual information is received by

A. Frontal lobe
B. Parietal lobe
C. Occipital lobe
D. Temporal lobe

Q13. How many disulphide bridges are present between chain A and B of human insulin?

A. One
B. Two
C. Three
D. Four

Q14. The following type of immune cells rest in the bone marrow and provide long lasting immunity against systemic pathogens

A. NK-cells
B. Histiocytes
C. B cells
D. Memory T-cells

Q15. A student wants to estimate the concentration of glycerol in an aqueous solution of glycerol. Which among the following would be the simplest approach?

A. UV absorption spectroscopy
B. Gas chromatography.
C. pH measurement
D. Viscosity measurement

Q16. Degrees of freedom for water at its triple point is

A. 0
B. 1
C. 3
D. 9

Q17. Which of the following covalent bonds exist in the structure of ATP?

A. N-glycosidic, thioester, phosphodiester
B. Phosphoanhydride, phosphomonoester, N-glycosidic bond
C. Ester, ether, phosphoanhydride bond
D. Ether, thioester, phosphomonoester bond

Q18. NCBI uses the following sequence retrieval tool:

A. SeqIn
B. STAG
C. ENTREZ
D. Text search

Q19. Which of the following is not a chromophore?

A. $-NH_2$
B. $-NO$
C. $-NO_2$
D. $-N{=}N-$

Q20. Consider the following pairs of names of the scientists and their related field of discovery/invention.

I. Karry Mullis	1. Protein
II. Linus Pauling	2. Gene editing
III. Alexander Fleming	3. PCR
IV. Jennifer Doudna	4. Antibiotics

Which of the pairs are correctly matched?

	I	II	III	IV
A.	3	1	4	2
B.	2	3	1	4
C.	1	4	3	2
D.	2	4	1	3

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Q21. In a single letter amino acid code, the letter B represents the presence of

A. either glutamic acid or aspartic acid
B. either glutamic acid or glutamine
C. either aspartic acid or asparagine
D. either glutamine or asparagine

Q22. A hydrophobic protein can be purified using one of the following chromatographic material:

A. Hydroxyapatite
B. Phosphocellulose
C. Phenyl sepharose
D. Ni-NTA

Q23. During the fermentation process, the microbe that converts pyruvate to butyric acid is

A. *Saccharomyces*
B. *Lactobacillus*
C. *Propionibacterium*
D. *Clostridium*

Q24. Match the cleavage reagents of Group I with their primary recognition point in Group II

	Group I	**Group II**
I.	Trypsin	1. Tyrosine
II.	Chymotrypsin	2. Methionine
III.	V8 protease	3. Arginine
IV.	Cyanogen bromide	4. Glutamic acid

	I	II	III	IV
A.	2	3	4	1
B.	2	1	4	3
C.	3	1	4	2
D.	4	3	2	1

Q25. Which of the following is **NOT** the DNA polymorphism?

A. Single nucleotide variant
B. DNA methylation
C. Tandem repeats
D. Microsatellites

Q26. Which of the following is the correct order according to the hydrophobicity of the amino acids?

A. Tyr > Ala > Asp > Val
B. Tyr > Val > Ala > Asp
C. Val > Ala > Tyr > Asp
D. Val > Try > Ala > Asp

Q27. A student found out that, in his experiment, glutamic acid of protein A is converted to glutamine to make protein B. How did he resolve the two proteins?

A. Pulse field electrophoresis
B. SDS-PAGE
C. Isoelectric focussing
D. Gel filtration

Q28. A census on college students indicated that their IQ values show a normal distribution with $\mu(IQ)=100$ and $\sigma(IQ)=10$ [where $\mu(IQ)$ and $\sigma(IQ)$ are the population mean and standard deviation of IQ values]. What is the z-score of a student whose IQ is 120?

A. 3.0
B. -3.0
C. 2.0
D. -2.0

Q29. Match the following:

I.	Vibrational spectroscopy -	1	UV-Visible
II.	Electronic transition -	2	Microwave
III.	Rotational spectroscopy -	3	Radiofrequency
IV.	Nuclear magnetic resonance -	4	Infrared

	I	II	III	IV
A.	3	1	4	2
B.	3	4	1	2
C.	4	3	2	1
D.	4	1	2	3

Q30. Which of the following oligos is used as the first primer in reverse transcriptase PCR for eukaryotic RNA?

A. Oligo dA
B. Oligo dC
C. Oligo dG
D. Oligo dT

Q31. Which of the organelle(s) is (are) involved in phospholipid synthesis?

I. Smooth Endoplasmic Reticulum
II. Cytoplasm
III. Mitochondria
IV. Nucleus

Pick the right answer

A. I and II
B. Only I
C. II and III
D. III and IV

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Q32. The CRISPR sequences are recognized by

A. Zinc finger domains
B. TALE repeats
C. Guide RNA
D. Leucine zippers

Q33. pH of 1 L of 10 mM acetic acid solution is _____. (K_a of acetic acid = 1.6×10^{-5})

A. 6.3
B. 5.2
C. 4.8
D. 3.4

Q34. A PhD student observed an increased activity of the protein of interest while performing an experiment. Subsequently, her supervisor suggested three possible explanations:

1. The protein might have overexpressed
2. There might have been increased phosphorylation
3. Increased interaction with effector protein

She found out upon subsequent analysis that it is due to increased phosphorylation. Which among the following will **NOT** provide the correct evidence against the conclusion drawn by the student?

A. Western blot analysis
B. Analysis of transcription rate
C. Mass spectroscopy
D. Phospho-amino acid analysis

Q35. Match the following amino acids with their respective group:

I. Asp	1. Polar, Uncharged
II. Phe	2. Nonpolar
III. Asn	3. Negatively charge
IV. Gly	4. Aromatic

Find the correct pairs:

	I	II	III	IV
A.	3	4	1	2
B.	1	3	2	4
C.	2	3	1	4
D.	3	4	2	1

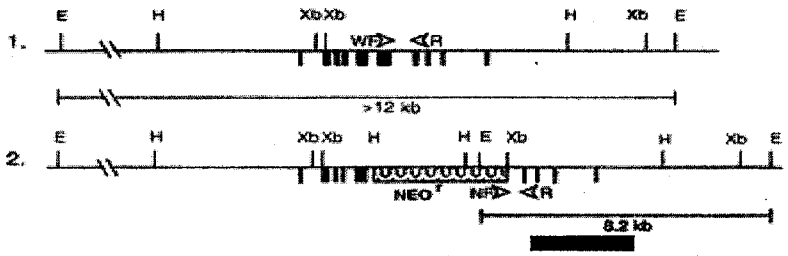
Part B

Q36. Which of the following pairs match with each other?

	Group I	Group II
I.	Reduces the topological strains of dsDNA during replication	1. Helicase
II.	Separates two daughter chromosomes after replication	2. Topoisomerase III
III.	Unwind double Holliday junction along with helicase	3. Gyrase
IV.	Catalyses the formation of single stranded DNA from double stranded DNA	4. Topoisomerase IV

	I	II	III	IV
A.	2	3	4	1
B.	4	1	3	2
C.	3	2	4	1
D.	3	4	2	1

Q37. An experiment was done to "knockout" a gene in embryonic stem cells by homologous recombination. The normal gene is represented in #1 and the transgene construct for the knockout is #2. On the #2 construct, note the presence of the neomycin gene (*NEO*). The probe for a Southern Blot is shown below the map as a dark bar. The DNA from either normal mouse or knockout mouse is digested with EcoRI (shown as E on the map) and probed in a Southern Blot. The blot showed two bands of size 8.2 kb and another band larger than 12 kb. Which of the following conclusions is most likely correct?



A. The mouse is a normal one and no knockout has happened
B. The mouse is homozygous for the knockout
C. Southern blot can't be employed to confirm whether successful knockout has occurred
D. The mouse is heterozygous for the knockout

Q38. In the exponential phase of growth of a bacterial culture, 50 cfu/ml cells increased to 3200 cfu/ml cells in 2 hours. What is the generation time for this bacterium?

A. 12 minutes
B. 20 minutes
C. 15 minutes
D. 24 minutes

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Q39. Pick up the correct statement for the activity of catabolite activator protein (CAP) in lac operon.

A. CAP monomer binds tightly to the promoter stimulating the binding of RNA polymerase
B. cAMP-CAP blocks the recruitment of RNA polymerase to the promoter
C. CAP monomer binds directly to the promoter stimulating RNA polymerase to bind and during this process CAP blocks the alpha subunit of RNA polymerase
D. Binding of the CAP-cAMP to the lac activator binding site recruits RNA polymerase

Q40. Which of the following methods **CANNOT** be used to determine the binding of lac repressor to the cognate operator site?

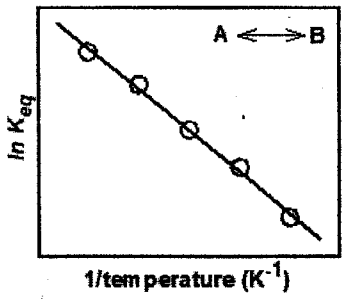
A. Luciferase assay
B. Chromatin immunoprecipitation
C. Co-immunoprecipitation
D. DNase foot printing assay

Q41. The absorption band for proteins observed at (210-220) nm corresponds to the electronic transition of

A. n → π* of peptide bonds
B. π → π* of peptide bonds
C. n → π* of aromatic side chains
D. π → π* of aromatic side chains

Q42. For a chemical equilibrium A ↔ B, from the slope of the given graph, one can evaluate

A. Free energy change
B. Entropy change
C. Heat capacity
D. Enthalpy change



Q43. Match the following:

Group I	Group II
I. Vicillin	1. binds to glycoprotein
II. Lectin	2. present in grasses
III. Prolamins	3. determine quality of bread
IV. Glutenin	4. binds to chitin matrix

Identify the correct matching

	I	II	III	IV
A.	4	1	2	3
B.	2	1	4	3
C.	3	4	2	1
D.	2	3	4	1

Q44. Mark one of the following statements that is **NOT** correct

A. Oxygen binds to cytochrome P450 in reactions catalysed by monooxygenase
B. Cyt-P450 is inhibited by oxygen
C. The largest gene family in plants encode cyt-P450 proteins
D. NADPH is the donor of electrons in the reactions catalysed by monooxygenase

Q45. Which of the following statements is best to describe the reason behind precipitation of proteins by ammonium sulphate?

A. Proteins are rendered insoluble when they bind sulphate ion
B. Proteins are rendered insoluble when they bind the ammonium ion
C. Addition of ammonium sulphate adjusts the pH to the isoelectric point of the proteins
D. Ammonium sulphate binds water molecules, making them less available for hydration of proteins

Q46. The pathway associated with synthesis of 'Vitamin C' in plants

A. Glycolysis
B. Smirnoff-Wheeler
C. Mehler
D. Asada-Halliwell

Q47. Consider following statements:

I. All RNA viruses are having icosahedral structure
II. Adenovirus buds from nuclear membrane
III. Retrovirus integrates in mitochondrial DNA
IV. Viruses possess segmented nucleic acids

Which of the following are correct?

A. I and II
B. II and III
C. I and IV
D. II and IV

Q48. UmuC, UmuD gene family and RecA protein are involved in

A. Recombinational repair
B. BER repair
C. SOS repair
D. NER repair

Q49. Immunoglobulin gene re-arrangement takes place in

A. Bone marrow
B. Thymus
C. Lymph nodes
D. Spleen

Q50. Consider following statements:

I. Purkinje neurons are present in cerebellum
II. Sodium and potassium exchange take place during synapse
III. Mitochondria is enlarged during ageing
IV. Beta gal and mitochondrial membrane potential increase during ageing

Which of the following is correct?

A. I, II and III
B. II, III and IV
C. I, III and IV
D. I, II and IV

Q51. Match the following:

I.	M13	1. ssRNA
II.	Phage Lambda	2. dsRNA
III.	Phi 6	3. Circular dsDNA
IV.	Qβ	4. Circular ssDNA
		5. Linear duplex DNA

Which of the pairs given above is/are correctly matched?

	I	II	III	IV
A.	3	5	2	4
B.	3	2	5	1
C.	4	2	5	1
D.	4	5	2	1

Q52. Your friend has been infected with Covid 19 virus and showed you the RT-PCR result where C_t value for the 'E' gene was 19.2. After 15 days he again did the test and this time the C_t value for the same gene was 27.2. Comment on the implication of his viral load after 15 days.

A. His viral load has been increased by 8-fold
B. His viral load has been decreased by 8-fold
C. His viral load has been reduced by 256-fold
D. His viral load has been increased by 256-fold

Q53. How the steroid hormone progesterone modulates gene expression in responsive cells?

A. By binding to enhancer sequences of target genes
B. By binding to receptors in the cytoplasm which then migrate to the nucleus where they bind to the progesterone response element present in the upstream of the target genes
C. By binding to the receptors that are already present in the nucleus and upon activation, the complex binds to the progesterone response element present in the upstream of the target genes
D. By binding to the receptors that are present in the cell membrane, the signal is then transduced to the nucleus through a signalling pathway

Q54. Which of the following statements are correct?

I. Ydj1 is an important cochaperone of Hsp90 chaperoning pathway
II. The ATP hydrolysis of Hsp90 is enhanced by Aha1
III. p23 is an important cytoplasmic cochaperone of Hsp70
IV. Hsp90 stabilises a number of proteins involved in tumour growth

A. I and II
B. III and IV
C. II and IV
D. I and III

Q55. Among the following statements, which are true for Remdesivir?

I. It is FDA-approved drug for the treatment of COVID-19 patients
II. It is a broad-spectrum antiviral and acts as a nucleotide analogue
III. It inhibits the RNA-dependent RNA polymerase (RdRp) of coronaviruses

A. Only I
B. I and II
C. I and III
D. I, II and III

Q56. Which of the following is **NOT** a way that viruses cause cancer?

A. Converting a proto-oncogene into an oncogene
B. By the viral promoter stimulating high levels of proto-oncogene expression
C. Inducing apoptosis of normal noncancerous cells
D. Producing a protein that inactivates a tumor-suppressor protein

Q57. Vaccination is _____ type of immunological response

A. Natural active
B. Natural passive
C. Artificial active
D. Artificial passive

Q58. One of the land mark properties of 'adaptive immunity' is

A. Toll like receptor recognition
B. Complement activation
C. Non-reactivity to self-antigen
D. Inflammation

Q59. The subunit vaccine is available for

A. Influenza virus
B. Poliovirus
C. Hepatitis A virus
D. Anthrax

Q60. Secondary metabolites are numerous chemical compounds produced by the plant cell through metabolic pathways. Following are some facts about secondary metabolites

I. They protect plants against being eaten by the herbivores and infection by microbial pathogens

II. Terpenes, the largest class of secondary metabolites are produced from the Methylerythritol phosphate pathway and Shikimic acid pathway

III. The most abundant class of phenolic compounds in plants are derived from phenylalanine

IV. Alkaloids are nitrogen containing secondary metabolites in plants

Which one of the following combination of statements are correct about the secondary metabolites?

A. I, III and IV
B. I, II and III
C. I, II and IV
D. II, III and IV

Q61. Which of the following is **NOT** a function of cerebrospinal fluid?

A. To exchange nutrients and metabolic waste
B. To improve conduction of nerve signals between different brain regions
C. To provide mechanical protection to the brain
D. To carry neuroactive hormones in the nervous system

Q62. Broca's area in the brain controls

A. Smell
B. Speech
C. Taste
D. None of the above

Q63. Arrange the following sequences of tumour development in the correct order:

I. Metastasis
II. Progression
III. Promotion
IV. Initiation

A. II, III, IV, I
B. IV, III, II, I
C. I, II, III, IV
D. I, III, IV, II

Q64. The steroid which does **NOT** participate as a precursor in the biosynthesis of Brassinosteroids

A. Campesterol
B. Stigmasterol
C. Teasterone
D. Cathasterone

Q65. The following molecules are polymeric in nature

I. Tannin
II. Viniferin
III. Lignin
IV. Isoprene

A. I and II
B. III and IV
C. I and III
D. II and IV

Q66. Match the following:

I. CATH - 1. protein sequence and annotation data
II. PDB - 2. enzyme classification and function
III. BRENDA - 3. protein structural classification
IV. UniProt - 4. biological macromolecules structural data

	I	II	III	IV
A.	2	3	4	1
B.	2	4	1	3
C.	3	4	2	1
D.	4	3	2	1

Q67. Map the following biological database as primary (1) and secondary (2) database?

I. Genbank
II. PROSITE
III. PDB
IV. ArrayExpress
V. InterPro

	I	II	III	IV	V
A.	1	2	1	2	2
B.	1	2	1	1	2
C.	2	2	2	1	2
D.	1	2	2	1	1

Q68. Arrange them in correct order

I. Regression analysis
II. Molecular design
III. Molecule prediction
IV. IC_{50} estimation
V. Boot strapping

A. IV, II, I, V, III
B. III, II, IV, I, V
C. III, IV, V, I, II
D. IV, III, II, V, I

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Q69. Find the correct hierarchical order for protein classification in SCOP database:

I. Classes
II. Domains
III. Superfamilies
IV. Families
II. Folds

A. I, II, III, IV, V
B. III, V, IV, II, I
C. I, V, III, IV, II
D. V, II, III, IV, I

Q70. Match the following:

	Tools	**Applications**
I.	HMMER	1. Profile based iterative blast
II.	PSI-BLAST	2. Pattern based blast
III.	FASTA	3. Hidden Markov model based local and global search
IV.	PHI-blast	4. Local search with fast k-tuple heuristic

	I	II	III	IV
A.	4	2	3	1
B.	4	1	2	3
C.	3	1	4	2
D.	3	4	1	2

University of Hyderabad

Entrance Examination- 2021

School/Department/Centre: School of Life Sciences/Department of Biotechnology and Bioinformatics

Course/Subject: PhD in Biotechnology

Q. No.	Answer	Q. No.	Answer
1	C	36	D
2	D	37	D
3	C	38	B
4	D	39	D
5	D	40	C
6	B	41	A
7	C	42	D
8	C	43	A
9	B	44	B
10	C	45	D
11	C	46	B
12	C	47	D
13	B	48	C
14	D	49	A
15	D	50	C
16	A	51	D
17	B	52	C
18	C	53	B
19	A	54	C
20	A	55	D
21	C	56	C
22	C	57	C
23	D	58	C
24	C	59	D
25	B	60	A
26	C	61	B
27	C	62	B
28	C	63	B
29	D	64	B
30	D	65	C
31	B	66	C
32	C	67	B
33	D	68	A
34	B	69	C
35	A	70	C

Note/Remarks:

Signature

Department of Biotechnology and Bioinformatics/School of Life Sciences