Question Booklet Series: **A** *Question Booklet Serial No.:* **100047**

Ph.D. Entrance Test : 2020-21

Subject: Biotechnology

Paper – I

Important: *Please consult your Admit Card/Roll No. slip before filling your Roll Number on the Test Booklet and Answer Sheet.*

Roll No. ***(In Figure)*** ***(In Words)***

O.M.R. Answer Sheet Serial No.

Signature of Candidate: _____ *Signature of Invigilator:* _____

Time: 60 Minutes **Number of Questions: 50** **Maximum Marks: 50**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.

INSTRUCTIONS:

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen**.
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. Please check that this Question Booklet contains **50** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
5. Each question has four alternative answer (A,B,C,D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen. <u>There shall be no negative marking for wrong answers.</u>**
6. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Booklet. No marks will be deducted in such cases.
7. **20 minutes Extra** would be **given** to the **visually handicapped/PwD Candidates**.
8. **Darken** the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
9. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
10. For rough work only the blank sheet at the end of the Question Booklet be used.
11. The University will provide Logarithmic table. Borrowing of log table or other material is not allowed.
12. The Answer Sheet is designed for computer evaluation. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e. not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Communication equipment such as mobile phones, pager, wireless set, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. Use of calculators is not allowed.**
17. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

1. The nested PCR is useful for amplifying genes present in ____abundance.
   (A) Low
   (B) High
   (C) Very high
   (D) There is no such concept as nested PCR.

2. Of the different types of biological variables, "4.5 mm" and "male" are examples of:
   (A) Measurement and ranked variables, respectively.
   (B) Ranked and nominal variable, respectively.
   (C) Measurement and nominal variables, respectively.
   (D) Both are ranked variables.

3. While designing primers, which of the following is not True:
   (A) Primer pairs should not have complementary regions
   (B) Length of 18-24 bases
   (C) 40-60% G/C content
   (D) Tm difference between primers should be more than 10°C.

4. The h-index, or Hirsch index, measures the impact of:
   (A) Journal
   (B) Researcher
   (C) publishing group
   (D) database

5. _____ is the global forum for intellectual property (IP) services, policy, information and cooperation, which is a self-funding agency of the United Nations.
   (A) UNWTO
   (B) WIPO
   (C) EPO
   (D) USPTO

6. A technique that is specifically used for detection of RNA is known as:
   (A) Western blotting
   (B) Northern blotting
   (C) Eastern blotting
   (D) Southern blotting

7. In gas chromatography, the basis for separation of the components of the volatile material is the difference in
   (A) Partition coefficients
   (B) Conductivity
   (C) Molecular weight
   (D) Molarity

8. In order to assess the purity of isolated nucleic acids, which of the following ratios of absorbance should be checked:

   (A) A280/260 and A220/280
   (B) A260/280 and A260/230
   (C) A220/280 and A260/220
   (D) A320/230 and A280/280

9. What is the role of SDS in SDS-PAGE

(A) Protein denaturing and imparting net negative charge
(B) Imparting overall negative charge to the protein
(C) Imparting equal mass to proteins
(D) Protein unfolding and imparting net positive charge.

10. The samples that ensure the validity of positive and negative results are called
(A) Controls
(B) Standards
(C) Exogenous normalizing variables
(D) Endogenous normalizing variables

11. Hydropathy plots are used to predict:
(A) Beta secondary structures
(B) Transmembrane domain
(C) Alpha secondary strcutures
(D) Tertiary structures

12. Which of the following tools would be suitable for constructing phylogenetic trees:

(A) psRNA Target
(B) Gephi
(C) MEGA
(D) Primer3

13. IAEC and CPCSEA are regulatory bodies associated with:

(A) Safe disposal of radioactive waste
(B) Patents and copyrights
(C) Animal experimentation and ethics
(D) Bioinformatics data safety and management

14. The Hybridomas are produced by
(A) Fusing T cells with myeloma cells
(B) Fusing T helper cells with myeloma cells
(C) Fusing B cells with myeloma cells
(D) Fusing WBC with RBC

15. Androgenesis is production of:
(A) Triploids Plants
(B) Haploid Plants
(C) Virus free plants
(D) There is no such term.

16. How much volume of stock solution of 0.5M EDTA, pH 8.0, would one need to make 10 ml of 0.01M EDTA?
(A) 500 µl
(B) 1 ml
(C) 200 µl
(D) 2 ml

17. India's first paper-strip test for Covid-19 developed by CSIR-IGIB is based on:
(A) Antisense technology
(B) CRISPR/Cas9 technology
(C) Virus-induced gene silencing
(D) Paper chromatography

18. A Single piece of information in a database is called as
(A) File
(B) Record
(C) Field
(D) Dataset

19. Generation of light upon nucleotide incorporation would be observed for which of the following DNA sequencing strategies:
(A) Nanopore sequencing
(B) SOLiD sequencing
(C) Ion Torrent sequencing
(D) Pyrosequencing

20. GENSCAN, and CONTRAST are *ab initio* methods for:
(A) Phylogenetic analysis
(B) Gene prediction
(C) Multiple Sequence Alignment
(D) Primer designing

21. Pixels are associated with computational image processing in microscopy and are the basic units of the image. _____ is the 3D analog to the pixel.
(A) Pixel 3
(B) Voxel
(C) Dots per inch
(D) GFP

22. In biological networks, (i)_____ represent different entities (e.g. proteins or genes in biological networks), and (ii)_____ convey information about the links amongst (i).
(A) (i) edges and (ii) nodes
(B) (i) nodes and (ii) edges
(C) (i) nodes and (ii) inter-nodes
(D) (i) points and (ii) lines

23. RNA sequencing (RNA-seq) is the application of next generation sequencing technologies to _____.
(A) RNA
(B) DNA
(C) cDNA
(D) There is no such concept as RNA-seq.

24. SYBR green is a dye that fluoresces only when bound to _____.
(A) ssDNA
(B) ssRNA
(C) dsDNA
(D) Proteins

25. Histone modifications can be detected using a variety of techniques including: (i)_____ and genomics approaches such as (ii)_____.
(A) (i) mass spectrometry; (ii) ChIP-seq
(B) (i) mass spectrometry; (ii) RNA-seq
(C) (i) RAPD; (ii) mass spectrometry
(D) (i) AFLP; (ii) microarray

26. Two of the most common secondary messengers are:

(A) Hormones and ATP.
(B) ATP and cyclic AMP.
(C) Calcium ions and cyclic AMP.
(D) Lectins and calcium ions.

27. SARS-CoV-2 contains genes that encode four structural proteins, which are involved in infectious virus assembly. The N protein holds the_____, and the S, E, and M proteins together create the _____, respectively.
(A) DNA genome, viral envelope
(B) RNA genome, viral envelope
(C) Nucleolus, viral envelope
(D) Viral envelope, DNA genome

28. Restriction endonucleases:

(A) Are synthesized by bacteria as part of their defense mechanism
(B) Are used for in vitro DNA synthesis
(C) Are used in genetic engineering for ligation of two DNA molecules
(D) Are present in mammalian cells for degradation of DNA when the cell dies

29. The food reserve in brown algae is
(A) Chitin
(B) Chrysolaminarin
(C) Laminarin
(D) GLYCOGEN

30. _____ are inheritable genetic elements that are similar to functional genes but are considered non-functional:
(A) Pseudogenes
(B) Epigenes
(C) Transgenes
(D) Housekeeping genes

31. _____ and _____ are examples of constitutive heterochromatin and facultative heterochromatin, respectively.
(A) Barr body, Telomeres
(B) Centromeric region, Telomeres
(C) Centromeric region, Barr body
(D) Telomeres, satellite DNA

32. The recent Nobel Prize in Physiology or Medicine for 2019 was awarded to William Kaelin, Jr., Sir Peter Ratcliffe, and Gregg Semenza. They discovered:
(A) How cells can sense and adapt to changing oxygen availability
(B) Cancer therapy by inhibition of negative immune regulation
(C) Molecular mechanisms controlling the circadian rhythm
(D) Mechanisms for autophagy

33. Respiratory enzymes catalyze
(A) Hydrolysis
(B) Hydrogenases
(C) Redox reactions
(D) Polymerase reactions

34. The first organism to have its entire genome sequenced was
(A) T2 bacteriophage
(B) *M. tuberculosis*
(C) *E. coli*
(D) *Haemophilus influenzae*

35. Any favorable movement of solute across membrane is called
(A) Active transport
(B) Passive transport
(C) Solute transport
(D) Solvent transport

36. DNA fingerprint pattern of child is
(A) 25% similar to mother's and 75% similar to father's DNA fingerprint
(B) 25% similar to father's DNA and 75% similar to mother's DNA fingerprint
(C) 50% similar to father's and 50% similar to mother's DNA fingerprint
(D) 100% similar to both parent's DNA fingerprint

37. The chain of nucleosomes is wrapped into a 30 nm spiral called a solenoid, where additional ___ histone proteins are associated with each nucleosome to maintain the chromosome structure:
(A) H2B
(B) H4
(C) H3
(D) H1

38. Human _____ is a functional receptor hijacked by SARS-CoV-2 for cell entry
(A) Angiotensin-converting enzyme 2 (ACE2)
(B) Hemagglutinin-esterase
(C) Tumor necrosis factor (TNF)
(D) Vascular endothelial growth factor (VEGF)

39. Tendency of alleles that are located close together on chromosome to be inherited together during meiosis is
(A) Genetic linkage
(B) Genetic code
(C) Inheritance
(D) Gene expression

40. In yeasts, meiosis occurs within the:
(A) Antheridium
(B) Crozier
(C) Basidium
(D) Ascus

41. Which of the following is considered as the 21st amino acid
(A) Hydroxylysine
(B) Ornithine
(C) Citrulline
(D) Selenocysteine

42. ..... is added to the 3' end of the most of the newly synthesized tRNA after transcription
(A) Poly A
(B) Cap
(C) Intron
(D) CCA

43. ARDS stands for:
(A) Acute respiratory disorder stress
(B) Acute respiratory distress syndrome
(C) Acute renal disease stress
(D) Active respiratory development syndrome

44. Which of the following can cross the placenta and provides passive immunity to new born:
(A) IgM
(B) IgG
(C) IgA
(D) IgE

45. First successful plastid transformation was reported in 1988 for _____
(A) *Chlamydomonas*.
(B) Tobacco.
(C) Mammalian cells.
(D) *Volvox*

46. DICER proteins recognize only
(A) ssRNA
(B) dsRNA
(C) gDNA
(D) rRNA

47. A peptide bond formation between 2 amino acids is accompanied by
(A) Deamination
(B) Addition of water
(C) Loss of water
(D) Decarboxylation

48. Plants have additional plant-specific RNA Polymerases:
(A) Pol IV
(B) Pol V
(C) Pol IV and Pol V
(D) Pol X

49. Plant-derived small molecules such as _____ induce *Agrobacterium vir* genes
(A) Acetosyringone
(B) Jasmonic acid
(C) ABA
(D) Salicylate

50. Which of the following is **not** an investigational therapy for COVID-19 in India?
(A) Remdesivir
(B) Tocilizumab
(C) Convalescent plasma
(D) Gene therapy

x-x-x

Anthropology (ANTH)

1. The major purpose to conduct aPilot study is
(A) To check the field area
(B) To draw sample
(C) To test logistics
(D) To create a hypothesis

2. The study carried out with the assistance of data points (either primary or secondary) is termed as
(A) Conceptual
(B) Empirical
(C) Observational
(D) Qualitative

3. The purpose of piloting a literature review is
(A) To reduce accountability as the researcher gives credit & disowns the quote
(B) To help readers in reading further details from the quoted work
(C) Satisfaction of the Researcher that s/he is on right track
(D) To enhance credibility as researcher is in sync with predecessors

4. Which of the following is not a non-probabilistic sampling method?
(A) Systematic
(B) Snowball
(C) Quota
(D) Purposive

5. Where do you give a step-by-step record of what the researcher and participants did during the study?
(A) Design
(B) Abstract
(C) Summary
(D) Procedure

6. The association between two categorical variables is best exemplified in a
(A) Scatter plot
(B) Bar chart
(C) Cross – tabulation
(D) Pie chart

7. Which of the following is a not data-collection method?
(A) Research questions
(B) Participant observation
(C) Unstructured interviewing
(D) Postal survey questionnaires

8. A research which follow case study method is called
(A) Quantitative
(B) Qualitative
(C) Analytical
(D) Empirical

9. Action research is
(A) A research initiated to solve an immediate problem
(B) A longitudinal research
(C) An applied research
(D) A research with socioeconomic objective

10. In the process of conducting research, 'Formulation of Hypothesis' is followed by
(A) Data collection
(B) Selection of Research Tools
(C) Data analysis
(D) Statement of Objectives

11. Which of the following is not an appropriate source of data for qualitative research

(A) Interviews
(B) Schedules
(C) Historical documents
(D) Experiments

12. t-distribution is used to test
(A) The validity of a postulated value of the population mean
(B) To test the equality of two population means
(C) To test the significance of sample correlation coefficient
(D) To test the equality of more than two population means

13. A friendly relationship between interviewer and respondent is called
(A) Management
(B) Personal
(C) Rapport
(D) Morale

14. An airlines company needs to assess the effect of a promotional offer of thousand rupees off on return tickets fares on ticket sales. The kind of research being conducted is
(A) Applied research
(B) Basic research
(C) Action research
(D) Research question

15. Whenever the median is reported as the measure of central tendency of a continuous variable, the associated appropriate measure of dispersion is
(A) Standard Deviation
(B) Variance
(C) Range
(D) Interquartile Range

16. BMI categories is measured on
(A) Ratio Scale
(B) Ordinal Scale
(C) Nominal Scale
(D) Interval Scale

17. An example of probability sampling is
(A) Snow-Ball sampling
(B) Lottery method
(C) Purposive sampling
(D) Quota sampling

18. If a constant 7 is added to each observation of a set, the mean is:
(A) 7 times the original mean
(B) Decreased by 7
(C) Increased by 7
(D) No change

19. The value of R^2 always lies between
(A) -1 to 0
(B) -3 to 3
(C) -1 to 1
(D) 0 and 1

20. BMI (Body mass index) is given by:
(A) Ht^2 m/Wt in Kg
(B) Wt in Ibs/Ht^2 in
(C) Wt in Kg/Ht m^2
(D) Ht in^2/Wt in Ibs

21. Type-I Error occurs if
(A) Null hypothesis is accepted even though it is false
(B) Null hypothesis is rejected even though it is true
(C) Both the null hypothesis as well as alternative hypothesis is rejected
(D) Both the null hypothesis as well as alternative hypothesis is accepted

22. One way ANOVA is used
(A) To compare the means of more than two groups
(B) To test for linear trend
(C) To compare several proportions
(D) To compare ratio of two variances

23. MANOVA stands for
(A) Multivariate analysis of non-normal data
(B) Multiple analyses of data
(C) Multivariate analysis of covariance
(D) Multivariate analysis of variance

24. The equivalent nonparametric test for paired 't' test is
(A) Sign test
(B) Median test
(C) Wilcoxon-signed rank test
(D) Kruskal-Wallis test

25. The Census carried out by the Government of India is an example of
(A) Cross-sectional research
(B) Empirical research
(C) Descriptive research
(D) Longitudinal research

26. The concept of "Inborn Errors of Metabolism" was developed by
(A) Eugene Fischer
(B) J.B.S. Haldane
(C) Francis Galton
(D) Archibald Garrod

27. Maternal-foetal incompatibility in the Rh blood group system is present with
(A) Rh –ve man and Rh +ve woman
(B) Rh +ve man and Rh +ve woman
(C) Rh +ve man and Rh –ve woman
(D) Rh –ve man and Rh –ve woman

28. The classical example of 'a balanced polymorphism' maintained by heterozygous advantage is
(A) Sickle cell trait
(B) Haemophilia
(C) Thalassemia
(D) Thrombocytopenia

29. Which one of the following pairs is not correctly matched?
(A) Cross-cultural comparison: G.P. Murdock
(B) Participant observation: Bronislaw Malinowski
(C) Sacred complex: Emile Durkheim
(D) Sanskritization: M.N. Srinivas

30. Which one of the following emerged during post Neolithic period?
(A) Microlithic Tools
(B) Megalithic Monuments
(C) Wheel Made Pottery
(D) Polished Chisel

31. What among the following is also called controlled percussion technique?
(A) Block-on-block technique
(B) Stone hammer technique
(C) Cylinder hammer technique
(D) Grinding and polishing technique

32. Identify the correct sequence in descending order:
(A) Species – Subspecies – Populations – Individuals

(B) Subspecies – Species – Populations – Individuals
(C) Individuals – Subspecies – Species – Populations
(D) Populations – Individuals – Subspecies – Species

33. Arrange the following theories in order they appeared:
(A) Diffusionism – Evolutionism – Structuralism – Functionalism
(B) Evolutionism – Diffusionism – Functionalism – Structuralism
(C) Evolutionism – Functionalism – Diffusionism – Structuralism
(D) Diffusionism – Functionalism – Evolutionism – Structuralism

34. Match an item in List – I with an item in List – II. Use code given below:

List – I	List – II
(a) Turner's syndrome	(i) (47, XXY)
(b) Down's syndrome	(ii) Trisomy – 18
(c) Klinefelter's syndrome	(iii) (45, X)
(d) Edward's syndrome	(iv) Trisomy – 21

Code:

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iii)	(iv)
(B)	(iii)	(ii)	(iv)	(i)
(C)	(iii)	(iv)	(i)	(ii)
(D)	(i)	(iv)	(ii)	(iii)

35. Match an item in List – I with an item in List – II. Use code given below:

List – I	List – II
(a) Barter	(i) Direct exchange of commodities
(b) Gift	(ii) An inter-tribal ceremonial exchange operative in Trobriand Islanders
(c) Kula	(iii) Exchange of things and objects as an essential element
(d) Potlatch	(iv) Institution of ceremonial feasting.

Code:

	(a)	(b)	(c)	(d)
(A)	(i)	(iii)	(ii)	(iv)
(B)	(i)	(iv)	(ii)	(iii)
(C)	(iii)	(iv)	(ii)	(i)
(D)	(ii)	(iii)	(i)	(iv)

36. *Australopithecus anamensis* was discovered by:
(A) Donald Johnson (B) Meave Leakey
(C) Richard Leakey (D) L.B.S. Leakey

37. Holandric inheritance involves the transmission of characteristics from:
(A) Male to female (B) Female to male
(C) Male to male (D) Female to female

38. Manchestar school of thought was led by:
(A) Clyade Kluckhohn (B) Max Gluckman
(C) Elizabeth Colson (D) Radcliffe Brown

39. Ethology deals with the study of:
(A) Adaptation (B) Behaviour of animals

(C) Fossils (D) Fauna

40. Radiometric dating is based on a principle of:
(A) Half-life value of isotope (B) Galcialvarves
(C) Ceramic absorbtion of radiation (D) Flourineabsorbtion

41. Steatopygia is found among the females of:
(A) Gypsies (B) Bushman Hottentots
(C) Todas (D) Apache Indians

42. Identify the correct cephalo-caudal sequence of the following vertebrae:
(A) Lumbar – Sacrum – Coccyx –Thoracic – Cervical
(B) Cervical – Thoracic – Lumbar– Sacrum – Coccyx
(C) Thoracic – Cervical – Lumbar– Coccyx – Sacrum
(D) Sacrum – Lumbar – Cervical –Coccyx – Thoracic

43. Match each item of List-I with items of List-II.

List-I (Names of the prehistoric sites)	List-II (Location of the prehistoric sites)
(a) Mehergarh	i) Madhya Pradesh
(b) Adamgarh	ii) Orissa
(c) Kuliana	iii) Baluchistan
(d) DaojaliHading	iv) Assam

Codes:

	(a)	(b)	(c)	(d)
(A)	ii	iii	iv	i
(B)	i	iv	ii	iii
(C)	iii	i	ii	iv
(D)	iv	iii	i	ii

44. As per the 2001 census, which among the following states showed highest percentage of Scheduled Tribe population?
(A) Meghalaya (B) Assam (C) Tripura (D) Mizoram

45. Among the following who is known as the father of field-work in Anthropology?
(A) Durkheim (B) Radcliffe-Brown
(C) Malinowski (D) Franz Boas

46. 'DNA Finger printing' was discovered by:
(A) Alec Jefferys (B) Tzio& Levin
(C) Watson & Crick (D) Kary Mullis

47. 'One gene one enzyme' concept was propounded by:
(A) A.E. Garrod (B) Sewall Wright (C) Harry Harris (D) Beadle and Tatum

48. Some of the iron age sites of India has the evidence of megalithic structure. Iron age site with megalithic structure is found at:
(A) Utnur (B) Brahmagiri (C) Hallur (D) Ahichchatra

49. Indus people had a knowledge of metallurgy. It is proved by the presence of:
(A) Seals of stealite (B) Copper tools (C) Conch shell bangle (D) Terracotta vessels

50. Which of the following are the correct type of sampling procedures?
(i) Random sampling
(ii) Purposive sampling
(iii) Stratified sampling
(iv) Self-selected sampling
Codes:
(A) (i), (ii) and (iii) are correct
(B) (ii) and (iv) are correct
(C) (i) and (iv) are correct
(D) All are correct

x-x-x

(BIO-CHEMISTRY)

1. The core elements of a dissertation are:
(A) Introduction; Literature review; Research Methodology; Results; Discussion and Conclusion
(B) Research Plan; Research Data; Analysis; References
(C) Executive Summary; Literature review; Data gathered; Conclusions; Bibliography
(D) Introduction; Data Collection; Data Analysis; Conclusions and Recommendations

2. What is a Research Design?
(A) A way of conducting research that is not grounded in theory so one frames a method.
(B) The researcher makes a choice between using qualitative or quantitative methods
(C) The style in which research findings are presented e.g. a graph, tables, figures.
(D) Set of methods & procedures used in collecting/analyzing measures of the variables specified in the problem

3. A detailed description of methodology of research is required in
(A) Thesis/ Dissertation
(B) Workshop/ Seminar
(C) Conference/ Seminar
(D) Review article

4. Research ethics has a direct connection more often with which stages of research?
(A) Defining and delimiting the scope of research
(B) Problem formulation and reporting of research findings.
(C) Defining the population and deciding the sampling technique for research
(D) Deciding about statistical techniques and data analysis

5. In statistics, ---------- is a representation that displays the number of observations within a given interval.
(A) Frequency distribution
(B) Mode
(C) Correlation Analysis
(D) Average

6. All cause non-sampling errors except.
(A) Inadequate methods of data collection
(B) Data tabulation
(C) Inadequate sample
(D) Non response of subject

7. Correlation is said to be linear if
(A) The ratio of change between the variables is constant.
(B) Change in variables are haphazard.
(C) Change in one variable is equal to the percentage change in another variable
(D) The ratio of change between the variable is not constant

8. When the relationship is of quantitative nature, the appropriate statistical tool for discovering and measuring the relationship and expressing it, in brief formula is known as
(A) Sampling Theory
(B) Correlation
(C) Average
(D) Regression Analysis

9. Which of the following is the first step in starting the research process?
(A) Searching sources of information to locate problem.
(B) Survey of related literature
(C) Identification of problem
(D) Searching for solutions to the problem

10. A method of logical thinking in which you use observations combined with experiential information you already know to be true to reach a conclusion is:
(A) Deductive Reasoning (B) Inductive reasoning
(C) Abnormal reasoning (D) Transcendental Reasoning

11. In the process of conducting research, steps in formulation of Hypothesis includes all except:
(A) Definition of variables (B) In-depth study of variables
(C) Selection of Research Tools (D) Ensure that variables are testable

12. A research paper is a brief report of research work based on
(A) Primary Data only (B) Secondary Data only
(C) Both Primary and Secondary Data (D) Review of literature

13. Conference proceedings are considered as.....documents.
(A) Conventional (B) Primary (C) Secondary (D) Tertiary

14. "Controlled Group" is a term used in..... .
(A) Survey research (B) Historical research
(C) Experimental research (D) Descriptive research

15. Which of the following is not a "Graphic representation"?
(A) Pie Chart (B) Bar Chart (C) Table (D) Histogram

16. All are essential qualities of a researcher except:
(A) Spirit of free enquiry
(B) Reliance on observation and evidence
(C) Systematization or theorizing of knowledge

(D) Poor management of data

17. Research is
(A) Searching again and again for something
(B) Finding solution to any problem
(C) Working in a scientific way to search for truth of any problem
(D) Carried out in good faith

18. The research stream of immediate application is:
(A) Action Research (B) Conceptual Research
(C) Fundamental Research (D) Empirical Research

19. In sampling, the lottery method is used for
(A) Interpretation (B) Theorisation
(C) Conceptualisation (D) Randomisation

20. Sampling error decreases with :
(A) Decrease in sample size (B) Process of analysis
(C) Increase in sample size (D) Process of analysis

21. Which one of the following is not a non-parametric test?
(A) Psi test (B) t-test (C) Chi-square test (D) Run test

22. The variable which impacts the relationship between an independent variable and a dependent variable is known as
(A) Antecedent variable (B) Control variable
(C) Predictor variable (D) Precedent variable

23. A research paper
(A) Is a compilation of information on a topic
(B) Contains original research as deemed by the author
(C) Is peer reviewed original research
(D) Can be published an several journals

24. A workshop is:
(A) Brief intensive course for small group emphasizing development of skill/technique for solving a specific problem
(B) A conference for discussion on a topic
(C) A meeting for discussion on a topic
(D) A class in university where teacher and students discuss a topic

25. Which one of the following is a research tool?
(A) Graph (B) Illustration (C) Questionnaire (D) Diagram

26. In sickle cell disease, the behavior of hemoglobin protein can be described as:
(A) The haemoglobin protein dissociates into four subunits.
(B) The haemoglobin protein lacks a haem group.
(C) Neighbouring haemoglobin proteins aggregate together.
(D) The haemoglobin protein possesses an iron atom in the Fe (III) form rather than the normal Fe (II) form.

27. In order to determine the N-terminal amino acid of polypeptide, which of the following reagent will you use:
(A) Trypsin
(B) Cyanogen bromide
(C) Phenylisothiocyanate
(D) Propidium Iodide

28. Selectins are
(A) Plasma membrane lectins involved in cell-cell recognition
(B) Plasma membrane glycoproteins involved in cell to cell interaction
(C) Plasma membrane glycoproteins that act as second messengers
(D) Cytosolic lectins involved in intracellular signaling

29. Which of the following would have high content of Triglycerides?
(A) LDL
(B) Chylomicrons
(C) HDL
(D) VLDL

30. Which of the following techniques will you use in order to determine the 3-D structure of protein?
(A) Nuclear Magnetic resonance
(B) Spectrophotometry
(C) Flowcytometry
(D) Magnetic resonance imaging

31. In order to identify self DNA from non-self DNA, the self DNA may be
(A) Glycosylated
(B) Carboxylated
(C) Phosphorylated
(D) Methylated

32. Isoprenoid alcohol involved in activation & attachment of sugars on cellular membranes
(A) Inositol tri phosphate
(B) Diacyl glycerol
(C) Dolichol
(D) cAMP

33. Plants cannot absorb molecular Nitrogen from atmosphere because
(A) Nitrogen has triple bonds making it highly stable
(B) Abundance in atmosphere inhibits absorption
(C) Nitrogen has double bonds making it highly stable
(D) Nitrogen is hindered by cells

34. Non essential amino acids include
(A) Methionine, lysine, leucine
(B) Alanine, aspartate, glutamate
(C) Threonine, valine, histidine

(D) Isoleucine, valine, histidine

35. In which of the following groups are all polysaccharides:
(A) Sucrose, glucose, fructose
(B) Maltose, lactose, fructose
(C) Glycogen, sucrose, maltose
(D) Glycogen, cellulose, starch

36. Given below are nucleotide sequences. Find the one with four pyrimidine bases:
(A) GCUAGACAA
(B) GATCAATGC
(C) UAGCGGUAA
(D) CAAGGTGAG

37. Which of the following drug is not isolated from a natural source:
(A) Quinine
(B) Morphine
(C) Isoniazid
(D) Artemisinin

38. Of the 20 standard amino acids, only _____ is not optically active. The reason is that its side chain _____.
(A) Glycine; is a hydrogen atom
(B) Alanine; is a simple methyl group
(C) Lysine; contains only nitrogen
(D) Proline; forms a covalent bond with the amino group

39. Milk protein Casein would be placed in which of the following categories:
(A) Nucleoprotein
(B) Phospho protein
(C) Lipoprotein
(D) Glycoprotein

40. Cerebrosides are glycolipids that are important constituent of:
(A) Biological membrane
(B) Lungs
(C) Brain
(D) Bones

41. A sample of starch suspension was tested with iodine solution and the result was a blue black colour. A second sample of starch suspension was tested with Benedict's reagent and the result was a blue colour. A third sample of starch suspension was mixed with amylase and incubated at 30°C for 10 minutes and then tested with Biuret reagent. What was the resulting colour of the third sample?
(A) Blue (B) Blue-black (C) Brick red (D) Purple

42. Which of the following convey the long lasting immunity to an infectious agent?
(A) Naturally acquired passive immunity
(B) Artificially acquired passive immunity

(C) Naturally acquired active immunity
(D) Minimal dose of pooled human sera

43. Which of the following is NOT the characteristic of the normal urine?
(A) Yellow or amber color
(B) Mildly aromatic
(C) pH=3-4
(D) 1.001 to 1.035 specific gravity

44. What is the location of photosynthetic pigment in an oxygenic photosynthetic organism?
(A) Plasma membranes
(B) Thylakoid membranes
(C) Chromatophores
(D) Chlorosome

45. What is the Warburg effect?
(A) Shows increased glycolysis in Cancer cell
(B) Disease caused by pesticide
(C) Blockage of ATP synthesis
(D) Inhibitor of glycolysis

46. Which of the following integral membrane protein is a special class of membrane rafts?
(A) Caveolin (B) Integrin (C) Cadherin (D) Selectin

47. Which of the following inactivates the 60S subunit of eukaryotic ribosomes?
(A) Chloramphenicol
(B) Cycloheximide
(C) Diphtheria toxin
(D) Ricin

48. The antibiotic aided in elucidating the steps of protein glycosylation is _____
(A) Streptomycin
(B) Tunicamycin
(C) Penicillin
(D) Crocin

49. A set of overlapping DNA segments that together represent a consensus region of DNA is _____.
(A) Expressed sequence tag
(B) Sequence tagged site
(C) Contig
(D) YAC

50. Which of the following enzyme is responsible for the regulation of biological nitrogen fixation?
(A) Dinitrogenase reductase
(B) Dinitrogenase oxidase
(C) Phosphatase
(D) Kinase

x-x-x

BIOPHYSICS

1. In SARS-CoV-2, the genomic structure is organized in a +ssRNA of approximately 30 kb in length — the largest known RNA viruses — and with a 5′-cap structure and 3′-poly-A tail. It has round or elliptic and often pleomorphic form, and a diameter of approximately:
(A) 1- 5 nm (B) 60–140 nm (C) 5-10 μm (D) 100-500 A^0

2. Which of the following statement describes the coronavirus structure?
(A) Club shaped glycoprotein spikes protrude through a lipid bilayer
(B) An icosahedral structure with an envelope
(C) An icosahedral large pleomorphic virus
(D) Large regimented barrel shaped virus

3. Cloning vectors that can be used to transfer DNA from eukaryotic to prokaryotic cells are called:
(A) Expression vectors (B) Bacteriophages
(C) Shuttle vectors (D) Transposons

4. Which of the following is a yeast plasmid that can integrate into the host's chromosome:
(A) YEp (B) YRp (C) YCp (D) Yip

5. Which of the following is a function of membrane proteins?

(A) To process lipids and proteins for secretion through the plasma membrane
(B) To act as receptors for hormones
(C) To synthesise proteins from amino acids
(D) To act as a cytoskeleton to support and shape the cell

6. G-protein stands for:
(A) Guanyl nucleotide binding protein (B) C-GMP responsive element protein
(C) Gram negative bacterial protein (D) None of the above

7. Which form of transport through the plasma membrane requires the expenditure of energy by the cell?

(A) Facilitated diffusion (B) Osmosis
(C) Active transport (D) Diffusion

8. Carcinoma is the cancer of:
(A) Epthilial tissue (B) Nervous tissue
(C) Muscle tissue (D) Connective tissue

9. The resting membrane potential of a cell is the consequence of which of the following concentrations of ions?

(A) High K + and Cl − outside the cell and high Na + and large anions inside the cell.
(B) High K + and Na + outside the cell and high Cl − and large anions inside the cell.
(C) High Cl − and Na + outside the cell and high K + and large cations inside the cell.
(D)High Ca 2+ and Na + outside the cell and high K + and large cations inside the cell.

10. Lipids are synthesized in:

(A) Smooth endoplasmic reticulum (B) Rough endoplasmic reticulum
(C) Golgi complex (D) None of these

11. Antibodies are produced by:

(A) T-cells (B) NK-cells
(C) Plasma cells (D) B-cells

12. Genetically programmed cell death is called

(A) Apoptosis (B) Necrosis
(C) Phagocytosis (D) All of these

13. Which of the listed terms is described by: "All the chemical processes that take place in the organelles and cytoplasm the cells of the body"?

(A) Metabolism (B) Cellular respiration
(C) Homeostasis (D) Physiology

14. Live cells can be studied by:

(A) Phase contrast microscopy (B) Fluorescent microscopy
(C) Light microscopy (D) All of these

15. Which one of the following is not a type of connective tissue?

(A) Blood (B) Lymph
(C) Adipose tissue (D) Muscle

16. To which of the following does the "tissue level" of structural organisation refer?

(A) Atoms, ions, molecules and electrolytes
(B) Mitochondria, ribosomes, nucleus, endoplasmic reticulum
(C) Nephron, alveolus, villus, lobule
(D) Muscle, nervous, connective, epithelial

17. This volume of air cannot be exhaled from the lungs regardless of the magnitude of expiration:

(A) Vital capacity (B) Inspiratory reserve volume
(C) Residual volume (D) Expiratory reserve volume

18. Ventilator is applied to:

(A) Assist for respiration (B) Assist for blood circulation
(C) Assist for metabolism (D) Assist motor function

19. In a Ventilator the pressure applied is about:

(A) 10-20 cm of H_2O (B) 760 mm of Hg
(C) 1-5 mm of H_2O (D) 0.1 torr

20. The site of oxidation in a cell is the :
(A) Mitochondrion (B) Endoplasmic reticulum
(C) Golgi apparatus (D) Ribosomes

21. Different components on the motherboard of a PC processor unit are linked together by sets or parallel electrical conducting lines. What are these lines called ?
(A) Conductors (B) Buses (C) Connectors (D) Interfaces

22. Which one of these translates a high level language to machine code ?
(A) Assembler (B) Compiler (C) Modem (D) Interpreter

23. The word length of a computer is measured in :
(A) Bytes (B) Millimeters (C) Meters (D) Bits

24. Device that converts one form of signal into another form is called:
(A) Transformer (B) Transducer (C) Amplifier (D) Condenser

25. Which of the following is known as the Schrodinger equation:
(A) $E=mc^2$ (B) $\lambda=h/p$ (C) $H\psi=E\psi$ (D) $(-\hbar^2/2m)\ \nabla^2$

26. All the following are considered "weak" interactions in proteins, except:
(A) Ionic bonds (B) Peptide bonds
(C) vander Waal's interactions (D) Hydrophobic interactions

27. A resistor has a colour band sequence yellow, violet, orange and gold. Its value is :
(A) 27 kΩ with a tolerance of ± 10% (B) 37 kΩ with a tolerance of ± 5%
(C) 45 kΩ with a tolerance of ± 1% (D) 47 kΩ with a tolerance of ± 5%

28. Apart from the proton which other nuclei of the following is used for NMR :
(A) ^{13}C (B) ^{12}C (C) ^{16}O (D) ^{32}P

29. Component of atom involved in study of structure with X-ray crystallography is:
(A) Nucleus (B) Electron (C) Proton (D) Neutrons

30. The structure of collagen is :
(A) Triple helix (B) Double helix (C) Single helix (D) Beta stranded

31. Mass spectroscopy is an analytical technique for identification of molecules by way of measuring their :
(A) Mass only (B) Charge only
(C) Mass to charge ratio (D) Charge to mass ratio

32. At pH 10 which of the amino acid would function as a buffer:
(A) Glycine (B) Arginine (C) Glutamine (D) Lysine

33. Two amino acids of the standard 20 amino acids contain sulfur atoms. They are:
(A) Cysteine and serine (B) Cysteine and threonine
(C) Methionine and cysteine (D) Methionine and serine

34. What is the resting membrane potential of a neuron?
(A) -55 mV (B) -65 mV (C) -80 mV (D) -70 mV

35. The number of cranial nerves in human body are:
(A) 16 (B) 12 (C) 8 (D) 20

36. Which of the following layer of retina is important for preventing reflection of light within the eye?
(A) Inner Plexiform layer (B) Pigment layer
(C) Outer Nuclear layer (D) Layer of Rods and Cones

37. The secondary structure of a protein can be determined by
(A) NMR spectroscopy, X-ray crystallography and CD spectroscopy
(B) NMR spectroscopy, X-ray crystallography and Fluorescence spectroscopy
(C) X-ray crystallography, UV-visible spectroscopy and Fluorescence spectroscopy
(D) CD spectroscopy, Mass spectroscopy and Fluorescence anisotropy

38. The bending of a beam of light when it passes obliquely from one medium to another is known as _____.
(A) Reflection (B) Refraction (C) Dispersion (D) Polarisation

39. Which of the following statements concerning phospholipids is FALSE?
(A) They have two distinct regions, one strongly hydrophobic and the other strongly hydrophilic.
(B) They have cylindrical shapes that allow them to associate with water most easily as a bilayer structure.
(C) They contain a polar organic group attached to a phosphate group.
(D) They contain three fatty acids chains.

40. Which of the following is not related to chromosome?
(A) Centromere (B) Chromonema (C) Kinetochore (D) Chromaffin

41. The Φ and Ψ values for β-sheets lie in:
(A) 1^{st} quadrant of Ramachandran plot (B) 2^{nd} quadrant of Ramachandran plot
(C) 3^{rd} quadrant of Ramachandran plot (D) 4^{th} quadrant of Ramachandran plot

42. Human Genome contains about
(A) 2 billion base pairs (B) 3billion base pairs
(C) 4 billion base pairs (D) 5 billion base pairs

43. A free radical is:
(A) Any charged particle.
(B) An atom or molecule with an unpaired electron in the outer shell.
(C) An atom with an even number of electrons.
(D) A chemically stable atom.

44. The correct order of electromagnetic spectrum with decreasing wavelength is :
(A) Radiowaves, Microwaves, Infrared rays, Ultraviolet rays, X-rays
(B) X-rays, Ultraviolet rays, Infrared rays, Microwaves, Radiowaves
(C) Radiowaves, Infrared rays, Ultraviolet rays, Microwaves, X-rays
(D) Radiowaves, Infrared rays, Microwaves, Ultraviolet rays, X-rays

45. The major class immunoglobulin in external secretion is:
(A) IgG (B) IgM (C) IgA (D) IgD

46. SI unit of radioactivity is:
(A) Sieverts (B) Ci (C) Rutherford (D) Bq

47. Which one of the following detectors cannot be used for the energy determination of gamma rays ?
(A) Ionization chamber (B) Proportional counter
(C) Geiger-Muller counter (D) NaI(Tl) detector

48. What is the difference between X-rays and gamma rays?
(A) X-rays are produced extranuclearly whereas gamma rays are produced in nuclear decays.
(B) X-rays have higher energies than gamma rays.
(C) Gamma rays are produced by bremsstrahlung.
(D) X-rays and gamma rays interact with matter differently.

49. Roentgen equivalent man (REM) is equal to
(A) 0.001 sievert (B) 0.01 sievert (C) 100 sievert (D) 1000 sievert

50. Which of the following is a gamma ray emitter:
(A) ^{3}H (B) ^{14}C (C) ^{99m}Tc (D) ^{32}P

x-x-x

(BOTANY)

1. Impact factor is
(A) Addition of citation and recent citable items publish
(B) Ratio between recent citable items publish and citations
(C) Ratio between citations and recent citable items publish
(D) Deletion of citation and recent citable items publish

2. An h-index of 30 means that the author has published
(A) Atleast 30 papers, of which each has been cited atleast 30 times.
(B) Atleast 3 papers, of which each has been cited more than 30 times.
(C) Atleast 30 papers, of which each has been cited exactly 3 times.
(D) Atleast 3 papers, of which each has been cited exactly 10 times

3. Plagiarism refers to
(A) Illegal duplication of print and electronic work
(B) Converting data in survey and research reports
(C) Making errors in paraphrasing or citations
(D) Presenting ideas and expressions of others as your own without proper acknowledgement

4. Which of the following is not a scientific site?
(A) Scopus
(B) Web of Science
(C) Research gate
(D) Google plus

5. Field survey is related to
(A) Real life situations
(B) Experimental Situations
(C) Laboratory Situations
(D) Hypothetical Situations

6. The closeness of the measured value to the standard value is called as
(A) Precision
(B) Accuracy
(C) Replication
(D) Duplication

7. Which of the following statements is true about the data in research?
(A) Data can be qualitative
(B) Data can be quantitative
(C) Data can be both qualitative and quantitative
(D) Data can be quantitative but never be qualitative

8. Attributes of objects, events or things which can be measured are called
(A) Qualitative measure
(B) Data
(C) Variables
(D) All of the above

9. During histological studies, the first step of fixation of fresh plant tissue is essential to
(A) Remove water
(B) Prevent deterioration
(C) Replace alcohol
(D) Clear the sections

10. For dehydration of the tissue, different grades of which of the following chemical are used
(A) Formaldehyde
(B) Alcohol
(C) Xylol
(D) Acetic Acid

11. The most commonly used basic and acidic dyes are
(A) Methylene blue and Eosin
(B) Toluidine blue and Hematoxylin
(C) Hematoxylin and Methylene blue
(D) Hematoxylin and Eosin

12. Cryopreservation is a process to preserve plant cells, tissues or organs
(A) At very low temperature, by using Ether
(B) At very high temperature, by using liquid nitrogen
(C) At very low temperature of -196^{o}C, by using liquid nitrogen
(D) At very low temperature, by using Xylene

13. Which one of the following is a DNA specific stain, used for viewing mitosis in onion root tip cells?
(A) Nigrosin stain
(B) Carbolfuchsin stain
(C) Phloroglucinol stain
(D) Feulgen stain

14. The concept of Polymerase Chain Reaction (PCR) was invented by
(A) Thomas D. Brock, 1966
(B) Kary B. Mullis, 1985
(C) James Watson, 1987
(D) Carl S. Ehrlich, 1956

15. BLAST is
(A) Basic Local Allocation Search Tool
(B) Basic Live Alignment Search Tool
(C) Basic Local Alignment Search Tool
(D) Basic Logical Alignment Search Tool

16. Virus free plants can be obtained through
(A) Shoot bud culture
(B) Root culture
(C) Shoot meristem culture
(D) Leaf culture

17. Consistence of a set of measurements is called
(A) Reliability
(B) Validity
(C) Generalization
(D) Conclusion

18. The method of sterilization, in a laboratory, using Autoclave is a form of
(A) Surface Sterilization
(B) Steam Sterilization
(C) Dry Sterilization
(D) Flame Sterilization

19. The material used for embedding of plant tissues is
(A) Bee Wax
(B) Agar Agar
(C) Paraffin Wax
(D) Gelrite

20. Chi- square test is used for assessing
(A) Scores
(B) Ranks
(C) Frequencies
(D) Degrees

21. The standard size of the herbarium sheet is
(A) 16.5 x 11.5 inches
(B) 14.5 x 15.5 inches
(C) 14 x 15 inches
(D) 16 x 11 inches

22. The procedure used to measure the size of microscopic objects like cell spore etc. is called
(A) Microscopy
(B) Micrometry
(C) Microtomy
(D) Microspory

23. What is dimethyl sulfoxide used as?
(A) A gelling agent
(B) Cryoprotectant
(C) Chelating agent
(D) An alkylating agent

24. The meiotic division takes place in
(A) Meristematic cells
(B) Conductive cells
(C) Reproductive cells
(D) Vegetative cells

25. Chromosome structure can be observed best at
(A) Anaphase
(B) Metaphase
(C) Prophase
(D) None of the above

26. Rhizoids of *Funaria* are:
(A) Unicellular and pigmented
(B) Multicellular and unbranched
(C) Unicellular and non-pigmented
(D) Multicellular and branched with oblique septa

27. Gymnosperms originated in:
(A) Coenozoic era
(B) Palaeozoic era
(C) Pre-cambrian era
(D) Mesozoic era

28. Which of the following is proved to be an excellent cryoprotectant?
(A) DMSO
(B) Mannose
(C) Ribose
(D) Glucose

29. If plant cells produce metabolites *in vivo* or *in vitro*, which are not directly needed by the plant itself, then these are termed
(A) Secondary products
(B) Secondary metabolites
(C) Primary metabolites
(D) Metabolites

30. Who discovered production of first haploids plants from pollen grains of *Datura*
(A) Guha and Maheshwari (1964)
(B) Meselson and Yuan (1986)
(C) Power *et al.* (1966)
(D) Takebe *et al.* (1965)

31. The enzymatic method for the isolation of protoplasts was first given by
(A) Takebe *et al.* (1968)
(B) Power and Cocking (1968)
(C) Hanstein (1880)
(D) Klercker (1892)

32. Abnormal secondary growth due to accessory cambia is found in:
(A) *Helianthus*
(B) *Cucurbita*
(C) *Draceana*
(D) Maize

33. The major role of minor elements inside living organisms is to act as:
(A) Co factors of enzymes
(B) Binders of cell structure
(C) Constituents of hormones
(D) Building blocks of amino acids

34. Which of the following produces gametes that show amoeboid movement?
(A) *Ulothrix*
(B) *Cladophora*
(C) *Spirogyra*
(D) *Chlamydomonas*

35. Discovery of Emerson effect has shown the existence of:
(A) light and dark reaction
(B) photorespiration
(C) photophosphorylation
(D) two distinct pigment systems

36. The first stable product of carbon assimilation in C_3 plants is:
(A) 3-Phosphogylceraldehyde
(B) glucose
(C) starch
(D) pyruvic acid

37. *Cleviceps purpurea* is the causal organism of:
(A) Powdery mildew of pea
(B) Smut of barley
(C) Rust of wheat
(D) Ergotism of rye

38. The most popular method for encapsulation of hydrated somatic embryos is coating with
(A) Calcium chloride
(B) Magnesium sulphate
(C) Sodium alginate
(D) Calcium alginate

39. Who was the first to show that both the sperms released by a pollen tube are involved in fertilization?
(A) Nawaschin (1898)
(B) Jensen (1972)
(C) Hanstein (1880)
(D) Russell (1982)

40. Reserpine, a drug used in the treatment of hypertension is extracted from
(A) Fruits of *Solanum xanthocarpum*
(B) Roots of *Rauwolfia serpentina*
(C) Barks of *Cinchona officinalis*
(D) Seeds of *Plantago ovata*

41. Most of the metabolic pathways are either anabolic or catabolic. Which of the following pathways is considered as "amphibolic" in nature?

(A) Glycogenesis

(B) Glycolytic pathway

(C) Lipolysis

(D) TCA cycle

42. In some plants, meiosis and syngamy are interrupted but still a viable embryo is formed within the confinement of the seed coat, this phenomenon is known as

(A) Apogamy

(B) Apospory

(C) Parthenocarpy

(D) Apomixis

43. Colchicine induces polyploidy because

(A) It increases the number of chromosomes

(B) It stops the formation of spindle

(C) Number of chromosome sets becomes double

(D) It produces large size cells.

44. Endemic species are those species which are

(A) Widely distributed

(B) Restricted to small area

(C) Found only in Andaman and Nicobar Islands

(D) Found only in one state

45. Microscopic and non-endospermic seeds are present in

(A) Gramineae

(B) Asteraceae

(C) Orchidaceae

(D) Fabaceae

46. The sum total of the populations of the same kind of organisms constitute

(A) Colony

(B) Species

(C) Genus

(D) Community

47. RFLP analysis is a technique that

(A) Uses hybridization to detect specific DNA restriction fragments in genomic DNA

(B) Determine whether a gene is transcribed in specific cells

(C) Measures the transfer frequency of genes during conjugation

(D) Used to detect genetic variation at the protein level

48. The headquarter of IUCN (The International Union For Conservation Of Nature And Natural Resources) is at
(A) Morges, Switzerland
(B) Paris, France
(C) Vienna, Austria
(D) New York, USA

49. The term 'Perisperm' is given to the
(A) Remnant of the nucellus
(B) Peripheral of the nucellus
(C) Disintegrated antipodals
(D) Disintegrated Synergids

50. Which of the following is antiauxin?
(A) 2.4,5-T
(B) NOAA
(C) TIBA
(D) ABA

x-x-x

(CHEMISTRY)

1. Identify the correct sequence of research steps:
(A) Selection of topic, review of literature, data collection, interpretation of findings
(B) Review of literature, selection of topic, data collection, interpretation of findings
(C) Selection of topic, data collection, review of literature, interpretation of findings
(D) Selection of topic, review of literature, interpretation of findings, data collection

2. Which one of the following is not a non-parametric test?
(A) t-test
(B) Sign test
(C) Chi-square test
(D) Run test

3. The problem of 'research ethics' is concerned with which aspect of research activities?
(A) Following the prescribed format of a thesis
(B) Data analysis through qualitative or quantitative analysis
(C) Defining the population of research
(D) Evidence based research reporting

4. In which of the following activities, potential for nurturing creative and critical thinking is relatively greater?
(A) Preparing research summary
(B) Presenting a seminar paper
(C) Participation in a workshop
(D) Participation in research conference

5. Which of the following research type focuses on ameliorating the prevailing situations?
(A) Experimental research
(B) Applied research
(C) Fundamental research
(D) Action research

6. A researcher attempts to evaluate the effect of method of feeding on anxiety-proneness of children. Which method of research would be appropriate for this?
(A) Case study method
(B) Experimental method
(C) Ex-post-facto method
(D) Survey method

7. In which of the following arrangements, a wide spectrum of ideas and issues may be made possible?
(A) Research article
(B) Conference
(C) Workshop mode
(D) Symposium

8. Which of the following is susceptible to the issue of research ethics?
(A) Inaccurate application of statistical techniques
(B) Faulty research design
(C) Choice of sampling techniques
(D) Reporting of research findings

9. In which of the following, reporting format is formally prescribed?
(A) Doctoral level thesis
(B) Conference of researchers
(C) Workshops and Seminars
(D) Symposia

10. In doing action research, what is the usual sequence of steps?
(A) Reflect, observe, plan, act
(B) Plan, act, observe, reflect
(C) Plan, reflect, observe, act
(D) Act, observe, plan, reflect

11. Match the two sets and indicate your answer by selecting the correct code:

Set-I (Research Methdos)	**Set-II (Data Collection Tools)**
a. Experimental method	i. Using primary and secondary sources
b. Ex-post facto method	ii. Questionarre
c. Descriptive survey method	iii. Standardized tests
d. Historical method	iv. Typical characteristic tests

Codes:

	a	b	c	d
(A)	ii	i	iii	iv
(B)	iii	iv	ii	i
(C)	ii	iii	i	iv
(D)	ii	iv	iii	i

12. A researcher intends to explore the effect of possible factors for the organization of effective mid-day meal interventions. Which research method will be most appropriate for this study?
(A) Historical method
(B) Descriptive Survey method
(C) Experimental method
(D) Ex-post Facto method

13. Which of the following is an initial mandatory requirement for pursuing research?
(A) Developing a research design
(B) Formulating a research question
(C) Deciding about the data analysis procedure
(D) Formulating a research hypothesis

14. In qualitative research paradigm, which if the following features may be considered critical?
(A) Data collection with standardized research tools
(B) Sampling design with probability sampling techniques
(C) Data collection with bottom-up empirical evidences
(D) Data gathering to take place with top-down systematic evidences

15. From the following list of statements, identify the set which has negative implications for research ethics.
(i) a researcher critically looks at the findings of another research
(ii) Related studies are cited without proper references
(iii) Research findings are made the basis for policy making
(iv) Conduct of practitioner is screened in terms of reported research evidences
(v) a research study is replicated with a view to verify the evidences from other Researches
(vi) both policy making and policy implementing processes are regulated in terms of preliminary studies.

Codes:

(A)	i	ii	iii
(B)	ii	iv	vi
(C)	ii	iii	iv
(D)	i	iii	v

16. The format of thesis writing is the same as in
(A) Preparation of a research paper/article
(B) Writing of seminar presentation
(C) A research dissertation
(D) Presenting a workshop/conference paper

17. Which of the following statements is not true in the context of participatory research?
(A) It recognizes knowledge as power
(B) It emphasizes on people as experts
(C) It is a collective process of enquiry
(D) Its sole purpose is production of knowledge

18. Which of the following statements is true in the context of testing a hypothesis?
(A) It is only the alternative hypothesis, that can be tested
(B) It is only the null hypothesis, that can be tested
(C) Both, the alterative and null hypothesis can be tested
(D) Both, the alternative and null hypothesis cannot be tested

19. Which of the following are the characteristics of a seminar?
(i) It is the form of academic instruction
(ii) It involves questioning, discussion and debates

(iii) It involves large group of individuals
(iv) It needs involvement of skilled persons
Select correct answer codes given below:
(A) (ii) and (iii)
(B) (ii) and (iv)
(C) (ii), (iii) and (iv)
(D) (i), (ii) and (iv)

20. Ethical norms in research do not involve guidelines for:
(A) Thesis format
(B) Copyright
(C) Patenting policy
(D) Data sharing policies

21. There are two sets given below. Set-I specifies the types of research, while set-II indicates their characteristics. Match the two and give answer by selecting the appropriate codes.

Set-I (Research Types)	Set-II (Charactersitics)
(a) fundamental Research (b) Applied Research (c) Action Research (d) Evaluative Research	(i) Finding out the extent of perceived impact of an intervention (ii) Developing an effective explanation through theory building (iii) Improving an existing situation through use of interventions (iv) Exploring the possibility of a theory for use in various situations (v) Enriching technological resources

Codes:

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

22. A researcher is interested in studying the prospects of a particular political party in an urban area. What tool should be prefer for the study?
(A) Rating scale (B) Interview (C) Questionnaire (D) Schedule

23. The principal of a school conducts an interview session of teachers and students with a view to explore the possibility of their enhanced participation in school programmes. This endeavor may be related to which type of research?

(A) Evaluation research (B) Action research

(C) Fundamental research (D) Applied research

24. A working hypothesis is

(A) A proven hypothesis for an argument

(B) Not required to be tested

(C) A provisionally accepted hypothesis for further research

(D) A scientific theory

25. Plagiarism in research is

(A) Creative use of previous data

(B) Copying unscrupulously and making use of it

(C) Quoting someone and citing him/her

(D) Referring to previous data and working over it with new objectives.

26. A particle is in one-dimensional box with a potential V_o inside the box and infinite outside. An energy state corresponding to n = 0 (n: quantum number) is not allowed because

(A) The total energy becomes zero

(B) The average momentum becomes zero

(C) The wave function becomes zero everywhere

(D) The potential $V_o \neq 0$

27. An eigen state of energy satisfies $H\Psi_n = E_n\Psi_n$. In the presence of an extra constant potential V_o

(A) Both E_n and Ψ_n will change

(B) Only E_n will change but not Ψ_n

(C) Both E_n and the average kinetic energy will change

(D) Only Ψ_n will change but not E_n

28. The intensity of light beam decreases by 50% when it passes through a sample of 1.0 cm path length. The percentage of transmission of the light passing through the same sample, but of 3.0 cm path length would ne

(A) 50.0 (B) 25.0 (C) 16.67 (D) 12.5

29. The electric-dipole allowed transition among the following is

(A) $^3S \rightarrow {}^3D$ (B) $^3S \rightarrow {}^3P$ (C) $^3S \rightarrow {}^1D$ (D) $^3S \rightarrow {}^1F$

30. In a chemical reaction: PCl_5 (g) $\leftrightarrow$ PCl_3 (g) + Cl_2 (g), xenon gas is added at constant volume. The equilibrium

(A) Will shift towards the reactant

(B) Will shift towards the products

(C) Will not change the amount of reactant and products

(D) Will increase both reactants and products

31. The correct ΔG for the cell reaction involving steps

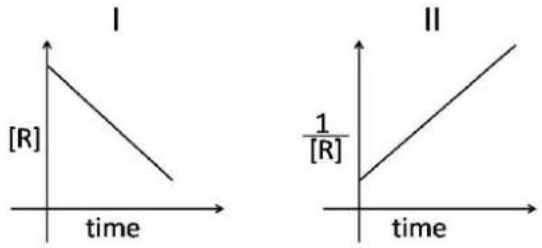
$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ is

(A) $\Delta G° - RT \ln(a_{Zn2+} / a_{Cu2+})$ (B) $\Delta G° + RT \ln(a_{Zn2+} / a_{Cu(s)})$

(C) $\Delta G° - RT \ln(a_{Zn(s)} / a_{Cu2+})$ (D) $\Delta G° + RT \ln(a_{Zn2+} / a_{Cu2+})$

32. The concentration of reactant R varies with time for two different reactions as shown in following plots:



The orders of these two reactions I and II, respectively are

(A) Zero and one (B) One and zero

(C) Zero and two (D) Two and zero

33. ΔH of a reaction is equal to slope of the plot of

(A) ΔG versus (1/T) (B) ΔG versus T

(C) $(\Delta G/T)$ versus T (D) $(\Delta G/T)$ versus (1/T)

34. The correct expression for the product $\{(M_n).(M_w)\}$ [M_n and M_w are the number average and weight average molar masses, respectively, of a polymer] is

(A) $N^{-1}\sum_i N_i M_i$ (B) $N^{-1}\sum_i N_i M_i^2$ (C) $N / \sum_i (N_i M_i)$ (D) $N / \sum_i (N_i M_i^2)$

35. CFSE will be highest for

(A) CoF_6^{3-} (B) $[Mn(H_2O)_6]^{2+}$

(C) $[Co(CNS)_4]^{2-}$ (D) $[Co(NH_3)_6]^{3+}$

36. The shape of $XeOF_5^-$ ion is

(A) Octahedral (B) Distorted octahedral

(C) Pentagonal pyramidal (D) Pentagonal bipyramidal

37. Among the following isostructural compounds, identify the compound, which has the highest Lattice energy

(A) LiF (B) LiCl (C) NaCl (D) MgO

38. The coordination number of cation and anion in Fluorite CaF_2 and CsCl are respectively

(A) 8:4 and 6:3 (B) 6:3 and 4:4 (C) 8:4 and 8:8 (D) 4:2 and 2:4

39. The acidic character of BF_3, BMe_3 and BH_3 follows the order :

(A) $BF_3 > BH_3 > BMe_3$ (B) $BF_3 > BMe_3 > BH_3$

(C) $BMe_3 > BH_3 > BF_3$ (D) $BH_3 > BF_3 > BMe_3$

40. M-M bond is present in

(A) $[Mo(CN)_7]^{5-}$ (B) WF_8^{2-} (C) Fe_2Cl_6 (D) $Mo_2(OR)_6$

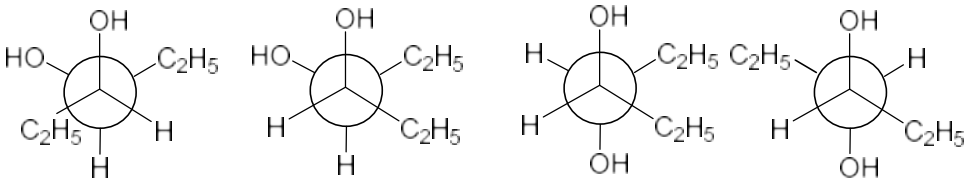
41. How many nodes does a 4d orbital possess?
(A) 3, of which 1 is an angular node and 2 are radial nodes
(B) 3, of which 2 are angular nodes and 1 a radial node
(C) 3, of which all are radial nodes
(D) 3, of which all are angular nodes

42. Which of the following belongs to the C_{3v} point group?
(A) SO_3 (B) BBr_3 (C) NH_3 (D) $AlCl_3$

43. The intermediacy of carbene in a reaction can be detected by reaction with:
(A) Electophile (B) Free radical (C) Nitrene (D) Alkene

44. Which sodium salt of which carboxylic acid is required for the synthesis of 2,5-dimethylhexane via Kolbe reaction?
(A) 2-Methybutanoic acid (B) 3-Methybutanoic acid
(C) n-Valeric acid (D) 1,1-Dimethylproponic acid

45. Which one of the following is the most stable conformation of hexane-3,4-diol?



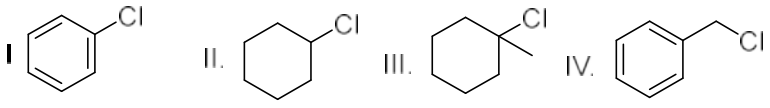
(A) I (B) IV (C) II (D) III

46. The major product in hydoboration-oxidation of phenyl acetylene is:
(A) Acetophenone (B) Phenyl acetaldehyde
(C) 2-Phenylethyl alcohol (D) 1-Phenylethyl alcohol

47. Which of the following species participates in the sulphonation of benzene?
(A) SO_2 (B) SO_4^{-2} (C) SO_3 (D) HSO_4^-

48. The major product in Friedal-Craft reaction between benzene, isobutyl alcohol and phosphoric acid is:
(A) *iso*-Butyl benzene (B) *n*-Butyl benzene
(C) *p*-Diethyl benzene (D) *tert*.Butyl benzene

49. Arrange the following alkyl halide in order of increasing reactivity towards S_N1 reaction (least reactive first):



(A) I. < III. < II. < IV. (B) I. < II. < III. < IV.
(C) IV. < III. < II. < I. (D) III. < I. < IV.< II

50. The ^{1}H NMR spectrum of a compound with molecular formula C_7H_{14} gives only one signal at δ 1.6 (singlet). The possible structure of compound is:

(A) Hep-1-tene (B) Hept-3-ene (C) 3-Methylhex-3-ene (D) Cycloheptane

x-x-x

(ENVIRONMENT SCIENCE)

1. Electronic documents have
(A) Digital Object Identifier (DOI)
(B) International Standard Book Number (ISBN)
(C) Serial Item and Contribution Identifier (SICI)
(D) PubMed Identifier

2. Output value generated by chi-square test is
(A) Always positive
(B) Always negative
(C) Always infinity
(D) Always Zero

3. Second moment about mean is
(A) SD
(B) variance
(C) coefficient of variation
(D) none

4. Which of the following is not a measure of central tendency?
(A) Mode
(B) Variability
(C) Median
(D) Mean

5. Median of 36,72,49,45,60,33,61,72 and 52 is
(A) 33
(B) 52
(C) 61
(D) 60

6. Geometric mean of 6,64 and 512 is
(A) 194
(B) 64
(C) 16
(D) 512

7. Sample is a sub-set of
(A) Data
(B) Distribution
(C) Set
(D) Population

8. Which of the following is not a probability sampling?
(A) Quota sampling
(B) Cluster sampling

(C) Stratified random sampling
(D) Simple random sampling

9. Sampling error can be reducing by
(A) Increasing the sample size
(B) Non-probability sampling
(C) Increasing the population
(D) Decreasing the sample size

10. ISSN have how many digits
(A) 8
(B) 10
(C) 12
(D) 16

11. Action research means
(A) A longitudinal research
(B) A research initiated to solve an immediate problem
(C) A research with socioeconomic objective
(D) An applied research

12. Questionnaire is a
(A) Tool for data collection
(B) Research method
(C) Measurement technique
(D) Data analysis technique

13. Which of the following is not a reference citation style?
(A) MLA
(B) APMA
(C) Vancouver
(D) Harvard

14. Poisson distribution is a
(A) Normal distribution
(B) Symmetrical distribution
(C) Systematic distribution
(D) Discrete probability distribution

15. Which of the following is not a type of matrix?
(A) Unit Matrix
(B) Alpha Matrix
(C) Zero Matrix
(D) Row Matrix

16. If one value in series of values is zero, then Geometric Mean will be
(A) Positive

(B) Negative
(C) Zero
(D) Infinity

17. Harmonic mean of series 2,2, and 1 is
(A) 3/2
(B) 5/3
(C) 3/5
(D) 2/3

18. Data which is collected directly from population under study is called
(A) Secondary data
(B) Primary data
(C) Direct Data
(D) Indirect data

19. When is it not necessary to cite a source?
(A) When your ideas build on someone else's.
(B) When you are paraphrasing someone else's ideas.
(C) When you use someone else's words or text.
(D) If your ideas build on your own work

20. Which of the following is not an anti-plagiarism software?
(A) Turnitin
(B) Urkund
(C) Grammarly
(D) Mendeley

21. Which style is used for the following citation?
(A) MLA format
(B) London format
(C) Chicago format
(D) Vancouver

22. The impact factor (IF) of journal is
(A) Indicator of the importance of a journal to its field
(B) Indicator of no. of paper published
(C) Indicator of quality of English in paper
(D) Indicator of no. of authors

23. Citation means that a particular paper has been:
(A) Reproduced how many times
(B) Sold how many times
(C) Quoted in another paper by another author
(D) Discussed orally by another author

24. The impact factor (IF) of journal is in
(A) Letter

(B) Number
(C) Sentence
(D) Alphabet

25. When you cite Internet resources, you do not need to find:
(A) Date last updated
(B) Date of access
(C) Date created
(D) Date of birth of the author

26. In chromatographic techniques area under peak indicates
(A) Type of compound
(B) Concentration of compound
(C) Composition of compound
(D) Color of compound

27. The concentration of unknown solution can be calculated by the equation
(A) Absorbance x Concentration= Slope
(B) Concentration= Slope x Absorbance
(C) Concentration= Slope/ Absorbance
(D) Absorbance= Slope x Concentration

28. It is not good idea to model a pollutant by using Gaussian Plume Method when
(A) The terrain is flat
(B) Using simple meteorology
(C) Modelling a point source
(D) The atmosphere carries the plume for long distance

29. In flame photometry undesirable wavelength is removed by using
(A) Chopper
(B) Monochromator
(C) Filter
(D) Mirror

30. For incineration which type of pre-treatment is prohibited:
(A) Hydroclaving
(B) Chemical
(C) Microwaving
(D) Autoclaving

31. Which one of the following is used to measure absorption in visible region only
(A) AAS
(B) Spectrophotometer
(C) Colorimeter
(D) Flame photometry

32. Electromagnetic pollution is caused by
(A) Vehicle
(B) Mobile phone
(C) Aircraft

(D) Lightening and thunder storm

33. Which biological indicator is used for spore testing in the autoclave unit:
(A) Bacillus stearothermophilus
(B) Bacillus subtilis
(C) E.Coli
(D) Salmonella species.

34. As part of National Climate Change Policy, Indian government is planning to raise the installed capacity of renewable energy by the year 2030 to
(A) 175 GW
(B) 200 GW
(C) 250 GW
(D) 350 GW

35. Identify the air pollutant in urban areas which irritates eyes and also respiratory tract of human beings.
(A) Particulate matter
(B) Oxides of nitrogen
(C) Surface ozone
(D) Carbon monoxide

36. Sustainable development goals have specific targets to be achieved by
(A) 2022
(B) 2030
(C) 2040
(D) 2050

37. Which of the following natural hazards is not hydro-meteorological?
(A) Snow avalanche
(B) Sea erosion
(C) Tropical cyclone
(D) Tsunami

38. Which of the following pollutants does not cause adverse effect on plants?
(A) Carbon Monoxide
(B) SO_2
(C) Ozone
(D) VOC's

39. Ratio of energy transfer at different trophic levels in the food chain is called:
(A) Metabolic efficiency
(B) Ecological efficiency
(C) Energy flow rate
(D) Food chain complexity

40. Which online system has been launched by Union Government for recommending appropriate mix of fertilizers to plantations of rubber growers depending upon their soil nature?
(A) Rubber Soil Information System (RubSIS)
(B) Soil Information System

(C) Plant Information System
(D) All of the above

41. Which country developed the biggest solar park?
(A) Brazil
(B) India
(C) China
(D) Germany

42. Swachh Bharat Mission or Clean India Mission a national campaign by the Government of India, was officially launched on
(A) 2 October 2014
(B) 15 August 2015
(C) 26 January 2015
(D) 15 August 2014

43. Which radioactive element is considered under Indoor pollutants category?
(A) N –13
(B) Carbon 14
(C) Radon
(D) O–16

44. Vadose water is present in which zone
(A) saturated zone
(B) unsaturated zone
(C) capillary fringe
(D) confined bed

45. Global Warming Potential (GWP) of a greenhouse gas (GHG) is a comparison of global warming impact between
(A) 1 kg of GHG and 1 kg of methane
(B) 1 kg of GHG and 1 kg of CO2
(C) 1 kg of GHG and 1 kg of N2O
(D) 1 kg of GHG and 1 kg of CFC-11

46. Traffic noise index TNI is calculated as
(A) 4 ($L_{90} – L_{10}$) + (L_{90} - 30) (dB)
(B) 4 ($L_{10} - L_{90}$) + (L_{90} - 30) (dB)
(C) 4 ($L_{90} – L_{10}$) + (L_{10} - 30) (dB)
(D) 4 ($L_{10} – L_{90}$) + (L_{10} - 30) (dB)

47. Aerosol is
(A) Carbon particle of microscopic size
(B) Dispersion of small solid or liquid particle in gaseous media
(C) Ash particles
(D) Diffused liquid particle

48. 1st International Day of Clean Air for blue skies was celebrated on
(A) 7th September 2020
(B) 8th September 2020

(C) 9th September 2020
(D) 10th September 2020

49. Jar test is used to determine
(A) Turbidity of water
(B) Settling of colloids
(C) Coagulant dose
(D) Coagulation time

50. In a solar pond salt is used to create
(A) Temperature difference
(B) Density difference
(C) Turbidity
(D) Uniform heating

x-x-x

(GEOLOGY)

1. The only isotope with a decay rate that is relevant in fission track dating method is:
(A) Potassium 40 (B) Rubidium 87 (C) Uranium 238 (D) Lutetium 176

2. When a dipping rock is exposed on a horizontal surface and its outcrop thickness is "d" and the angle of dip is θ then the true thickness will be:
(A) d x cos θ (B) d + cos θ (C) d x sin θ (D) d + sin θ

3. In the field if you find a sedimentary deposit showing root casts, burrows, nodules, concretions and variegated coloration, then that deposits could represent a:
(A) Turbidite (B) Palaeosol (C) Sand Dune (D) Alluvial fan

4. In the field a Post-Kinematic porphyroblast would show:
(A) Elongation in one direction (B) Augen shape
(C) Cracking (D) Undeformed coronas and reaction zones

5. Which one of the following stable isotopic ratios is used mainly to estimate palaeovegetation?
(A) 13C/12C (B) 18O/16O (C) 87S/86Sr (D) 15N/ 14N

6. U-Pb isotope age dating can be done using a:
(A) ICPMS (B) IRMS (C) GCMS (D) LCMS

7. The mineral favoured for luminescence dating is:
(A) Muscovite (B) Feldspar (C) Quartz (D) Zircon

8. For Thermoluminescence (TL) dating the grains are heated to:
(A) 950°C (B) 100°C (C) 450°C (D) 50°C

9. Spatially-resolved luminescence (HR-OSL) dating involves:
(A) Heating of Quartz (B) Dating sediments with feldspar
(C) Dating of rock surfaces (D) Dating organic matter

10. The Curie temperature of magnetite is
(A) 580°C (B) 950°C (C) 320°C (D) 120°C

11. _____ region of the electromagnetic spectrum is useful in identifying hydrocarbon occurrences using remotely sensed data.
(A) Radiowave (B) Gamma (C) Ultraviolet (D) Infrared

12. Total Organic Carbon (TOC) is determined by treating an aliquot of dried sample with phosphoric acid in the ratio of:
(A) 1:1 (B) 1:2 (C) 1:3 (D) 1:4

13. Cross dating method is used in:
(A) Magnetostratigraphy (B) Dendrochronology
(C) Seismic stratigraphy (D) Biochronology

14. Munsell Chart is used for:
(A) Grain size analyses (B) Recording the colour of soils
(C) Crystal parameters (D) Ground water quality

15. In palaeontology a key technique "Camera Lucida" is used for:
(A) Hand Drawing (B) Photography
(C) Imaging (D) Printing

16. Identify the ferromagnetic mineral among the following
(A) Chromite (B) Siderite (C) Ilmenite (D) Pyrrhotite

17. A Develocorder is a machine that records:
(A) Magnetic data (B) Seismic data
(C) Resistivity data (D) Electrical conductivity data

18. In palynology, pollens and spores are mounted on a glass slide using:
(A) Silver paint (B) Glycerol
(C) Canada balsam (D) Carbon film

19. The following instrument is NOT used in gemology:
(A) Periscope (B) Dichroscope (C) Spectroscope (D) Polariscope

20. The maceral Telovitrinite belongs to the Microlithotype group of:
(A) Bitumite (B) Textite (C) Detrite (D) Inertite

21. _____ is the most commonly used type of paleoseismic trenching.
(A) One-side stepped (B) Single Slot
(C) Two-side stepped (D) One-side sloped

22. Ground-penetrating radar (GPR) is a geophysical method that uses electromagnetic radiation in the …… of the radio spectrum.
(A) Extremely low frequency (B) Ultra low frequency
(C) Ultra High frequency (D) Medium frequency

23. Spinning Disc microscope is a type of _____.
(A) Phase contrast microscope (B) Confocal microscope
(C) Fluorescence microscope (D) Electron microscope

24. Heavy liquids typically used for separation of fossils from minerals have a density around _____.
(A) 2.85 gm/ml (B) 2.2 gm/ml (C) 3.5 gm/ml (D) 4. 25gm/ml

25. Graphic correlation is a powerful tool for correlation and comes under:
(A) Lithostratigraphy (B) Magnetostratigraphy
(C) Seismostratigraphy (D) Biostratigraphy

26. *Glossopteris* is a typical_____ flora.
(A) Carboniferous (B) Permian (C) Triassic (D) Jurassic

27. Meghalayan is the uppermost stage of _____.
(A) Tertiary (B) Pliocene (C) Miocene (D) Quaternary

28. Devonian is known as:
(A) The age of reptiles (B) The age of mammals
(C) The age of fishes (D) The age of amphibians

29. Submarine fans commonly occur in
(A) Lagoonal environment (B) Deep marine environment
(C) Tidal flat environment (D) Beach environment

30. A fault formed by the rotation of an initially high angle normal fault is called a
(A)Pivot Fault (B) Detachment Fault
(C)Wrench Fault (D) Gravity Fault

31. Spessartine is a variety of:
(A) Garnet (B) Beryl (C) Chrysoberyl (D) Epidote

32. A sedimentary rock rich in carbonate mud:
(A) Sparite (B) Micrite (C) Dolomite (D) Bentonite

33. An ultramafic igneous rock consisting mostly of Olivine and low calcium Pyroxene (enstatite).
(A) Oceanite (B) Saxonite (C) Harzburgite (D) Izolite

34. Apatite is
(A) Uniaxial positive (B) Biaxial positive
(C) Uniaxial negative (D) Biaxial negative

35. Biotite shows
(A) 1^{st} order interference colours (B) 2^{nd} order interference colours
(C) 3^{rd} order interference colours (D) 4^{th} order interference colours

36. The most common source of copper in the world is:
(A) Chalcopyrite (B) Chalcocite (C) Cuprite (D) Covelite

37. Khondalite rock contains which of the following assemblage:
(A) Quartz-Calcite-Hypersthene
(B) Plagioclase-Orthoclase-Hypersthene
(C) Quartz-Manganese rich Garnet-Rhodonite
(D) Quartz-Haematite-Hypersthene

38. Which one is a cephalopod with a simple suture pattern?
(A) Ceratites (B) Nautilus (C) Baculites (D) Ammonites

39. Which one among these trilobites appeared first in the palaeozoics?
(A) Asaphus (B) Olenellus (C) Agnostus (D) Phacops

40. *Treptichnus pedum* marks the beginning of
(A) Mesozoics (B) Palaeozoics (C) Cainozoics (D) Proterozoics

41. 14C dating is generally limited to dating samples not older
(A) 10,000 years (B) 100,000 years (C) 50,000 years (D) 1 million years

42. The Orbital precession cycle (Milankovitch) occurs every:
(A) 10,000 years (B) 21,000 years (C) 41,000 years (D)100,000 years

43. Which of the following is NOT associated with a convergent plate boundary?
(A) Flood basalt (B) Trench (C) Island arc (D) Accretionary prism

44. Trace fossils are also known by the term:
(A) Pseudofossils (B) Ichnofossils (C) Body fossils (D) Microfossils

45. _____ is a mineral found to be stable in metamorphic rocks formed under ultra high pressure.
(A) Muscovite (B) Garnet (C) Coesite (D) Orthopyroxene

46. Conchoidal fracture is typical of:
(A) Microclastic rocks (B) Microcrystalline rocks
(C) Sandstones (D) Shales

47. Conodonts became extinct at the end of:
(A) Cambrian (B) Triassic (C) Permian (D) Cretaceous

48. The name "Karst Topography" come from the Karst Region of:
(A) Italy (B) France (C) Yugoslavia (D) Germany

49. *Hipparion* an ancient horse appeared for the first time some:
(A) 2 million years ago (B) 11 million years ago
(C) 20 million years ago (D) 5 million years ago

50. The Indian dinosaur *Rajasaurus narmadensis* occurs in:
(A) Jurassic rocks (B) Triassic rocks
(C) Permian rocks (D) Cretaceous rocks

x-x-x

(HUMAN GENOMICS)

1. A scientific theory is
   (A) Always true (B) Static (C) Dynamic (D) Always false

2. Scientific methods involves
   (A) Framing of hypothesis (B) Testing of hypothesis
   (C) Data collection, analysis and inference (D) All of the above

3. A null hypothesis is a hypothesis which a researcher is trying to
   (A) Prove (B) Disprove (C) Validate (D) Discover

4. During an experiment, a researcher
   (A) Tests a hypothesis (B) Frames a hypothesis
   (C) Creates a hypothesis (D) Discovers a hypothesis

5. An universially accepted theory capable of making of making true predictins is called
   (A) Theory (B) Law (C) Proof (D) Evidence

6. Information gained through experimentation/experience is called as
   (A) Empirical (B) Scientific
   (C) Facts (D) Scientific evidences

7. The variables that are measured throughoput the experiment are called
   (A) Dependent variable (B) Control
   (C) Independent variable (D) Responding variable

8. Zero error is a
   (A) Random error (B) Systematic error (C) Relative error (D) All of these

9. The data collected by a researcher on NCBI comes under
   (A) Primary data (B) Secondary data (C) Tertiary data (D) Derived data

10. A research student conducting experiments in lab and collecting data comes under
    (A) Primary data (B) Derived data (C) Secondary data (D) No data

11. The changes in a dependent variable is caused by
    (A) Control (B) Dependent variable
    (C) Independent variable (D) Responding variable.

12. Accuracy and precision during a measurement are
    (A) Required (B) Not required
    (C) Has no meaning during measurement (D) Zero during a measurement

13. Which of the following can be considered as evaluation of research?
    (A) What are we doing (B) Why are we doping
    (C) How well we are doing (D) How fast we are doing

14. In research plagiarism should
    (A) Not be tolerated at all (B) Shall be minimum
    (C) May be allowed to some extent (D) Be avoided

15. IPR stands for
(A) Individual property rights (B) Intellectual property rights
(C) Individual propriety rights (D) Intellectual propriety rights

16. A publication in a scientific journal is called as
(A) Report (B) Research paper (C) Story (D) Thesis

17. A research synopsis is
(A) Blue print of research to be carried out (B) Summary of research
(C) Data (D) Hypothesis

18. "All living beings are made up of cells, elephant is a living being, thus elephant is made up of cells." The reasoning used here is
(A) Inductive (B) Deductive (C) Hypothetical (D) Imaginary

19. The reasoning which uses specific observations to frame general principles is called as
(A) Inductive (B) Deductive
(C) Hypothetical (D) Inductive and deductive both

20. The imitation of a real thing or process is called as
(A) Simulation (B) Imitation (C) Virtual testing (D) *In silico*

21. Scientific method starts with
(A) Careful observations (B) Framing hypothesis
(C) Review of literature (D) Inductive reasoning

22. The detailed study of the available data on the topic selected is called as
(A) Review of literature (B) Peer review
(C) Blind review (D) Scientific evidence

23. Making a hypothesis refers to
(A) An educative guess based on experience
(B) The possible answer based on intuition
(C) An educated guess that can be tested scientifically
(D) A predicted statement for conducting experiment

24. The expert scrutiny of result of a scientific paper before publication is called as
(A) Peer review (B) Expert review
(C) Self-review (D) Review of literature

25. Formulation of theory of gravitation by Newton is an example of
(A) Serendipity (B) Invention (C) Discovery (D) Experimentation

26. Which of the following techniques do not use antibodies
(A) Northern blotting (B) Western blotting
(C) Immunohistochemistry (D) ELISA

27. SDS gel electrophoresis is carried out to identify molecular weight of protein. Which of the following statements is correct?
(A) Homodimeric protein can be detected through the SDS Gel electrophoresis.
(B) Molecular weight of a hetero-trimeric protein can be detected through SDS Gel electrophoresis
(C) A protein-protein complex would appear as a single band in the SDS Gel electrophoresis.
(D) Disulphide bonds in proteins remain intact during SDS Gel electrophoresis.

28. Histone deacytalase (HDAC) catalyses the removal of acetyl group from N-terminal of histones. Which amino acid of histone is involved in this process?
(A) Lysine (B) Arginine (C) Asparagine (D) Histidine

29. The –COOH group of cellular amino acids can form which of the following bondsinside the cell?
(A) Ether and ester bonds (B) Ester and amide bonds
(C) Amide and ether bonds (D) Amide and carboxylic anhydride bonds

30. RNA interference is mediated by both siRNA and miRNA. Which one of the following statement about them is NOTtrue?
(A) Both siRNA and miRNA are processed by DICER.
(B) Both siRNA and miRNA usually guide silencing of the same genetic loci from which they originate
(C) miRNA is a natural molecule while siRNA is either natural or a synthetic one.
(D) miRNA, but not siRNA is processed by Drosha

31. Which of the following bacteriahas subcellular localization in lysosomes?
(A) *Salmonellatyphi* (B) *Streptococcus pneumonia*
(C) *Vibrio cholera* (D) *Mycobacterium tuberculosis*
32. Which one of the following statements about receptor –enzyme is FALSE?
(A) A receptor –enzyme has an extracellular ligand binding domain, a trans membrane domain and an intracellular catalytic (enzyme) domain.
(B) Many types of receptor enzymes are found in animals.
(C) The signal transduction pathways of receptor –enzyme involve phosphorylation cascades.
(D) Receptor –enzymes interact directly with intracellular G-proteins
33. Which one of the following statements is INCORRECT?
(A) Quantitative inheritance results in a range of measurable phenotypes for a polygenic trait.
(B) Polygenic traits often demonstrate continuous variation
(C) Certain alleles of quantitative trait loci (QTL) have an additive effect on the character/trait.
(D) Alleles governing quantitative traits do not segregate and assort independently.
34. Which of the following is NOTan attribute of a species that makes it vulnerable to extinction?
(A) Specialized diet (B) Low dispersal ability
(C) Low trophic status (D) Variable population density

35. Which one of the following statements is correct for amplified-fragment length polymorphism (AFLP)?
(A) PCR using a combination of random and gene-specific primers.
(B) PCR amplification followed by digestion with restriction enzymes.
(C) Digestion of DNA with restriction enzymes followed by one PCR step.
(D) Digestion of DNA with restriction enzymes followed by two PCR steps.

36. Indicate which one of the following statements about nucleic acids and protein structures is correct.
(A) Hydrogen bonding between the bases in the major and minor grooves of DNA is absent.
(B) Both uracil and thymine have a methyl group but at differentpositions.
(C) The backbone dihedral angles of α-helices andβ -sheets are very similar. Only the hydrogen bonding pattern is different.
(D) A β -turn is formed by four amino acids. The type of β-turn is determined by the dihedral angles of the second and third amino acid.

37. Transposons can be primarily categorized into two types, DNA transposons and retrotrans-posons. Given below is some information regarding the above.
1. Eukaryotic DNA transposons excise themselves from one place in the genome and integrate into another site.
2. Retrotransposons are RNA sequences that are first reverse transcribed into cDNA and then integrate into the genome.
3. Retrotransposons move by a copy and paste mechanism through an RNA intermediate.
4. As DNA transposons move via a cut and paste mechanism, there can never be an increase in the copy number of a transposon. Which of the statement(s) is/are true?

(A) 1 and 3 (B)2 and 4 (C)2 only (D)4 only

38. Which of the following is an equilibrium method that can be used to accurately determine DNA-protein dissociation constants?
(A) Site directed mutagenesis (B) Chromatin Immunoprecipitation
(C) ELISA (D) Footprinting

39. In an EMSA experiment free DNA is separated from protein-DNA complexes in a native gel by which following principle?
(A) Charge (B) Molecular weight
(C) DNA digestion with DNAse (D) Antibody immunoprecipitation

40. Which statement best describes the main distinction between the origin of the two classes of small regulatory RNAs: siRNA and miRNA?
(A) siRNAs originate within the cell cytoplasm; miRNAs originate from the cell genome

(B) siRNAs originate from predominantly exogenous dsRNA; miRNAs originate from the cell genome

(C) miRNAs are expressed whenever siRNAs are unable to appropriately degrade RNA sequences

(D) miRNAs are processed from dsRNA viruses, siRNAs are processed from ssRNA viruses

41. For an application where you require a sample of your target protein at high purity, what would be a good purification strategy? Assume that your starting point is E. coli cells in which the target protein fused to an affinity tag has been over-expressed.

(A) Affinity chromatography (AC followed by size exclusion chromatography SEC
(B) AC only
(C) AC followed by ion-exchange (IEX) followed by SEC
(D) AC followed by IEX, followed by hydrophobic interaction HIC and then SEC

42. Which of these techniques is often considered a suitable "polishing" step in a protein purification strategy?
(A) Affinity chromatography (AC)
(B) Ion-exchange chromatography (IEX)
(C) Hydrophobic interaction chromatography (HIC)
(D) Size-exclusion chromatography (SEC)

43. What properties of a protein does hydrophobic interaction chromatography exploit for purification?
(A) Charged amino acids
(B) Hydrophobic amino acids on the protein surface
(C) Molecular weight
(D) Enzyme activity

44. A diabetic patient has a high blood glucose level due to reduced entry of glucose into various peripheral tissues in addition to other causes. There is no problem of glucose absorption, however, in the small intestine of these patients. The following statements are put forward to explain this observation:
1. Glucose is transported into the cells of muscles by glucose transporters (GLUTs) which are influenced by insulin receptor activation
2. Glucose transport into the enterocytes is mediated by sodium-dependent glucose transporters (SGLTs) which are not dependent on insulin.
3. Glucose molecules are transported in the small intestine by facilitated diffusion.
4. The secondary active transport of glucose occurs in muscles.

Which one of the above statement(s) is INCORRECT?
(A) Only 1 (B) 1 and 2 (C) Only 3 (D) 3 and 4

45. Which of the following types of genetic manipulations allow a researcher to experimentally increase gene expression in a mouse model?
(A) Knockin (B) Conditional knockout
(C) Transgenic (D) Knockout

46. A male mouse cell line has a large translocation from X chromosome into chromosome 1 When a GFP containing transgene is inserted in this chromosome 1 with translocation, it is often silenced. However when inserted in the other homologue of chromosome 1 that does not contain the translocation, it is almost always expressed. Which of the following phenomenon best describes this effect?
(A) Genome imprinting (B) Gene balance
(C) Sex-specific expression (D) Dosage compensation

47. Which one of the following terms describes a positive and negative charge, which are separated in space within a molecule?
(A) Salt bridge (B) Polar bond
(C) Dipole (D) van der Waals interaction

48. One hundred independent populations of Drosophilaare established with 10 individuals in each population, of which, one individual is of *Aa* genotype and the other nine are of *AA* genotype. If random genetic drift is the only mechanism acting on these populations, then, after a large number of generations, the expected number of populations fixed for the "*a*" allele is
(A) 75 (B) 50 (C) 25 (D) 5

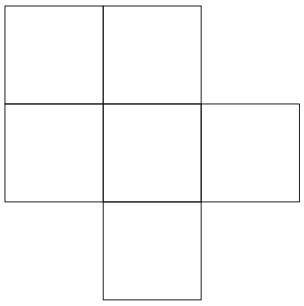
49. Molecular polymorphic markers are already known with respect to tobacco mosaic virus (TMV) resistance in tobacco. Among these, which marker system you will select that will be simple, economic and less time consuming:
(A) RAPD (B) RFLP (C) AFLP (D) EST-SSR

50. The sequence of the peptide KGLITRTGLIKR can be unequivocally determined by
(A) Only Edman degradation.
(B) Amino acid analysis and MALDI MS/MS mass spectrometry.
(C) MALDI MS/MS mass spectrometry.
(D) MALDI mass spectrometry after treatment of the peptide with trypsin.

x-x-x

(MEDICAL PHYSICS)

1. The number of quadrilaterals in the following figure is:-



(A) 17
(B) 18
(C) 19
(D) 20

2. Which of the following is largest?
(A) 2^{50}
(B) 3^{40}
(C) 4^{30}
(D) 5^{20}

3. 12 balls, 3 each of the colours red, green, blue and yellow are put in a box and mixed. If 3 balls are picked at random, without replacement, the probability that all 3 balls are of same colour is
(A) 1/4
(B) 1/12
(C) 1/36
(D) 1/55

4. In case of normal distribution, full width at half maximum is equal to
(A) Standard deviation
(B) Twice the standard deviation
(C) 2.35 times the standard deviation.
(D) Three times the standard deviation

5. Poisson distribution is
(A) Negatively skewed and mesokurtic
(B) Positively skewed and leptokurtic
(C) Symmetric and mesokurtic
(D) Negatively skewed and mesokurtic

6. A bag contains 6 red and 8 green balls. If two balls are drawn at random, then the probability that first ball is red and second ball is green, is
(A) 48/91
(B) 24/91
(C) 4/13
(D) 1/48

7. The median of a set of numbers 4, 5, 8, 6, 3, 4, 8, 10, 8 is
(A) 6
(B) 3
(C) 4.5

(D) 6.2

8. Given the numbers 7.485, 8.995, and 6.755000. These numbers rounded off to two decimal places are
   (A) 7.5, 9.0 and 6.8, respectively
   (B) 7.48, 9.00, 6.76, respectively
   (C) 7.48, 8.99, 6.75, respectively
   (D) 7.49, 8.99, 6.75, respectively

9. In case uncertainty in the measured values A = 0.745, B = 2.2 and C = 3.885 is represented by significant figures. Then value of the calculated Y= (AB)/C will be represented by
   (A) 0.42
   (B) 0.4219
   (C) 0.4
   (D) 0.422

10. Actual value of acceleration due to gravity is 9.70 m/sec^2. Which of the following sets of the measurements is most precise?
   (A) 9.40, 9.51, 9.74, 9.89, 9.92
   (B) 9.45, 9.54, 9.71, 9.84, 9.82
   (C) 9.35, 9.44, 9.54, 9.71, 9.84
   (D) 9.41, 9.44, 9.54, 9.69, 9.59

11. Geometric mean of the numbers 2, 4, 8 is
   (A) 4
   (B) 4.6
   (C) 3.4
   (D) 2.4

12. The height of Gaussian distribution with centroid μ and standard deviation σ, at $x = \mu + \sigma$ will be
   (A) half of the maximum value
   (B) 1/4 of the maximum value
   (C) $1/\sqrt{e}$ of the maximum value
   (D) 1/e of the maximum value

13. One nibble is
   (A) Two bits
   (B) Half byte
   (C) One bit
   (D) Eight bits

14. The square root of complex number (5 + 12i) is
   (A) $\pm$ (2+ 3i)
   (B) $\pm$ (1.41+ 1.7i)
   (C) $\pm$ (3+ 5i)
   (D) $\pm$ (3+ 2i)

15. Select the missing term from the number series : 620, 632, 608, 644, 596, ?
    (A) 642
    (B) 652
    (C) 656
    (D) 662

16. In a normal distribution, the proportion of observations that lie within three standard deviations from the mean is
    (A) 68.3%
    (B) 50.8%
    (C) 95.4%
    (D) 99.7%

17. The degrees of freedom for a confidence interval for the difference between two means when the samples (sizes n_1 and n_2) are independent is:
    (A) $n_1 + n_2$
    (B) $(n_1 - 1) + (n_2 - 1)$
    (C) $n_1 - n_2$
    (D) $n_1 + n_2 - 1$

18. Five numbers 10, 7, 5, 4 and 2 are to be arranged in a sequence from left to right following the direction given below
    (i) No two odd or even numbers are next to each other.
    (ii) The second number from the left is exactly half of the left-most number.
    (iii) The middle number is exactly twice the rightmost number.
    The second number from right is
    (A) 5
    (B) 7
    (C) 2
    (D) 4

19. The wrong number in the number series 6, 10, 14, 34, 66, 130, 258 is
    (A) 34
    (B) 66
    (C) 10
    (D) 14

20. Which of the following sets does not contain number with 4 significant digits
    (A) 1234, 123400, 123.4
    (B) 100.0, 0.0001010, 1001
    (C) 1001, 1000., 1010
    (D) 1001, 1000., 10.10

21. In GM counter experiment the measured data is 3600, the statistical error quoted with 95 % confidence level will be will be
    (A) 180
    (B) 60

(C) 120
(D) 104

22. RMS value of i(t) = 10[1 + sin (- t)] is
(A) 10
(B) 5.1
(C) 12.2
(D) 17.3

23. The correct order of electromagnetic radiation in increasing order of wavelength is
(A) X-rays, UV, Visible, Infrared, Microwave, Radiowaves
(B) Infrared, Visible, UV, Microwaves, X-rays
(C) Infrared, Visible, UV, Microwaves, Radiowaves, X-rays
(D) Microwaves, Infrared, Visible, UV, Radiowaves, X-rays

24. $\overline{\overline{AB} + \overline{AC}}$ is equivalent to
(A) ABC
(B) $A\overline{BC}$
(C) A + B + C
(D) $AB\overline{C}$

25. The Laplace transform function f(t) is F(s), then Laplace transform of its first derivative w.r.t. 't' is
(A) s F(s) + f(0)
(B) s^2 F(s) – f(0)
(C) s F(s)
(D) s F(s) – f(0)

26. In NaI scintillation crystal, the incident gamma rays are converted to
(A) UV photons ($\lambda \sim 150$ nm)
(B) Infrared photons ($\lambda \sim 1500$ nm)
(C) Photons ($\lambda \sim 420$ nm)
(D) Electrons (E ~ 150 keV)

27. The correct positron emitting radionuclide – Generator combination used for PET applications is
(A) ^{11}C ^{14}C
(B) ^{18}F – ^{19}O
(C) ^{64}Cu - ^{64}Ni
(D) ^{68}Ga - ^{68}Ge

28. The number of charge carriers produced per unit energy loss in a semiconductor detector, is doubled. The percentage energy resolution will
(A) Improved by $\sqrt{2}$
(B) Improved by 2
(C) Worsen by $\sqrt{2}$
(D) Worsen by 2

29. Curie was originally defined as activity of
(A) 1 gm of ^{235}U and its value is 3.7×10^{10} decays/sec
(B) 1 gm of ^{226}Ra and its value is 1.7×10^{10} decays/sec
(C) 1 gm of ^{226}Ra and its value is 3.7×10^{6} decays/sec
(D) 1 gm of ^{226}Ra and its value is 3.7×10^{10} decays/sec

30. Energy of thermal neutrons is
(A) ~0.026 MeV
(B) ~ 0.026 GeV
(C) ~ 0.026 keV
(D) ~ 26 meV

31. The half life free neutrons is
(A) Infinity (stable)
(B) ~ 900 s
(C) more than the life of universe
(D) $\sim 10^9$ years

32. The process competing the gamma ray emission is
(A) Electron capture
(B) Internal conversion
(C) External conversion
(D) Auger emission

33. In the β^+ decay,
(A) The recoiling nucleus, positron and neutrino are emitted in a plane.
(B) The recoiling nucleus, positron and antineutrino are emitted in a plane
(C) The recoiling nucleus moves in a direction out of the plane of emission of the β^- particle and antineutrino.
(D) The recoiling nucleus and electron are emitted in one direction, and the antineutrino moves in the opposite direction.

34. For N_o gamma rays incident on an absorber (thickness t, absorption coefficient μ), the number of gamma rays absorbed in the absorber is given by
(A) $[N_o \exp(-\mu t)]$
(B) $[\mu \exp(-\mu t)]$
(C) $[1 - N_o \exp(-\mu t)]$
(D) $N_o[1 - \exp(-\mu t)]$

35. The primary cosmic rays consist of
(A) Electrons and positrons
(B) ^{14}C nuclei
(C) Pions and muons
(D) Protons

36. A 12 bit ADC is used to convert analog voltage of 0 to 10 V into digital. The resolution is
(A) 0.244 V

(B) 24.4 mV
(C) 2.44 mV
(D) 1.2 V

37. Transverse electric (TE) waves have
(A) Electric field component E in the direction of propagation and no component of magnetic field H in this direction
(B) Magnetic field component H in the direction of propagation
(C) magnetic field component H in the direction of propagation and no component of Electric field E in this direction
(D) Electric field component E in the direction of propagation

38. Kerma is the energy per unit mass:
(A) Deposited in soft tissue
(B) Transferred from photons to charged particles
(C) Deposited in air
(D) Transferred from charged particles to photons

39. *A deterministic effect has*
(A) A threshold in dose but the severity of the effect is otherwise dose-independent.
(B) No threshold in dose and the severity of the effect is a constant function of dose.
(C) No threshold in dose and the severity of the effect increases with dose.
(D) A Threshold In Dose And The Severity Of The Effect Increases With Dose.

40. *The recommended level for manmade sources other than medical in the case of continuous exposure for the public is (annual effective dose)*
(A) 20 mSv.
(B) 5 mSv.
(C) 2 mSv.
(D) 1 mSv.

41. *Which of the following statements is false?*
(A) A cancer induced by 1 Gy is not worse than a cancer induced by 0.5 Gy.
(B) The severity of a stochastic effect increases with dose.
(C) The probability of induction of a stochastic effect increases with dose.
(D) Stochastic effects have no threshold in dose.

42. *Mitotic cells under conditions of hypoxia are as radiosensitive as:*
(A) Mitotic cells that are aerated.
(B) Cells in the late S phase.
(C) Cells In The G_1 Phase.
(D) Cells in the early S phase.

43. The smallest unit in the reconstruction/projection of an MRI image is called as
(A) Pixel
(B) Nibble
(C) Voxel
(D) Byte

44. *The dose $LD_{50/30}$ denotes*
    (A) The dose required to induce sublethal damage in 50% of a given population by irradiation with a beam which has a LET value of 30.
    (B) The dose required to induce death of 30% - 50% of the population.
    (C) The dose required to sublethal damage in 30% of a given population by 50 days after irradiation.
    (D) The dose required to induce death in 50% of a given population by 30 days after irradiation.

45. *The most radiosensitive cells and the least radiosensitive cells considered are*
    (A) The bone-marrow cells and Lymphoid tissues, respectively.
    (B) The Mammary Cells and skin cells, respectively.
    (C) The thyroid cells and neuronal cells, respectively.
    (D) The ataxia telangiectasia cells and neuronal cells, respectively.

46. *The main effects on children irradiated in utero in Hiroshima and Nagasaki are:*
    (A) Fetal Loss And Mental Retardation.
    (B) Infant mortality and microcephaly.
    (C) Microcephaly and mental retardation.
    (D) Growth retardation and teratogenesis.

47. *The effective dose for a multiple-slice chest CT-scan is*
    (A) 8 mSv.
    (B) 1 mSv.
    (C) 2 mSv.
    (D) 4 mSv.

48. *What does a "cell survival curve" in case of radiation exposure describe?*
    (A) The relationship between the radiation dose and the number of cells that have gone through one mitosis after irradiation.
    (B) The relationship between the radiation dose and the number of cells that have not suffered the loss of a specific function.
    (C) The relationship between the radiation dose and the proportion of cells that remain clonogenic.
    (D) The relationship between the radiation dose and the proportion of cells that can produce DNA.

49. *The thresholds for permanent sterility in men for an acute exposure and under prolonged exposure conditions are:*
    (A) 0.5 to 1 Gy and 0.2 Gy/y, respectively.
    (B) 2.5 to 3 Gy and 1.5 Gy/y, respectively.
    (C) 3.5 to 6 Gy and 2 Gy/y, respectively.
    (D) 7.5 to 10 Gy and 6 Gy/y, respectively.

50. The radiation cell survival curve for photonic irradiation in mammals exhibits a shoulder that is more evident in some tissues than other but is generally there. The presence of this shoulder is generally taken to indicate the presence of which of the following processes
    (A) Symmetric translocations and small deletions are chromosomal aberrations that are not lethal but they are can cause malignancies.
    (B) Repair
    (C) Reoxygenation

(D) Repopulation

x-x-x

Microbial Biotechnology (MBT)

1. If we know the value of one variable in an individual & wish to know the value of another variable, we calculate
(A) Coefficient of correlation (B) Coefficient of regression
(C) SE of mean (D) Geometric mean

2. A normal distribution curve depends on
(A) Mean and sample size (B) Range and sample size
(C) Mean and standard deviation (D) Mean and median

3. Which of the following features are considered as critical in qualitative research?
(A) Collecting data with the help of standardized research tools.
(B) Design sampling with probability sample techniques.
(C) Collecting data with bottom-up empirical evidence.
(D) Gathering data with top-down schematic evidence.

4. In order to pursue the research, which of the following is priorly required?
(A) Developing a research design
(B) Formulating a research question
(C) Deciding about the data analysis procedure
(D) Formulating a research hypothesis

5. The format of thesis writing is the same as in
(A) Writing of Seminar representation
(B) Preparation of research paper/article
(C) A research dissertation
(D) Presenting a workshop/conference paper

6. Which one among the following statement is true in the context of the testing of hypotheses?
(A) It is only the alternative hypotheses that can be tested.
(B) It is only the null hypotheses that can be tested.
(C) Both the alternative and the null hypotheses can be tested.
(D) Both the alternative and the null hypotheses cannot be tested.

7. What do you understand by the term "Anusandhan"?
(A) Goal-oriented (B) Following an aim
(C) Attaining an aim (D) Praying to achieve an aim

8. What is the main aim of interdisciplinary research?
(A) To over simplify the problem of research
(B) To bring out the holistic approach to research
(C) To create a new trend in research methodology
(D) To reduce the emphasis on a single subject in the research domain

9. The main aim of the scientific method in the research field is to _____
(A) Improve data interpretation
(B) Confirm triangulation

(C) Introduce new variables
(D) Eliminate spurious relations

10. A researcher is interested in studying the prospects of a particular political party in an urban area. So, what tool should he prefer for the study?
(A) Rating Scale (B) Interview
(C) Questionnaire (D) Schedule

11. Which of the following is not the method of Research?
(A) Survey (B) Historical
(C) Observation (D) Philosophical

12. Which one is called non-probability sampling?
(A) Quota sampling (B) Cluster sampling
(C) Systematic sampling (D) Stratified random sampling

13. The F-test:
(A) Is essentially a two-tailed test.
(B) Is essentially a one-tailed test.
(C) Can be one-tailed as well as two-tailed depending on the hypotheses.
(D) Can never be one tailed test.

14. What is the use of Factorial Analysis?
(A) For setting the hypotheses
(B) To understand the difference between two variables
(C) To understand the relationship between two variables
(D) To understand the difference between various variables

15. What is the best-suited name for a process that doesn't necessitate experimental research?
(A) Manipulation (B) Controlling
(C) Content analysis (D) Observation

16. Which one among the following variables cannot be expressed in quantitative terms?
(A) Numerical Aptitude (B) Marital Status
(C) Socio-economic Status (D) Professional Attitude

17. Which one among the following phrases does not correspond to the meaning of research as a process?
(A) Problem Solving (B) Trial and Error
(C) Objective Observation (D) Systematic Activity

18. Which of the following is the first step in starting the research process?
(A) Searching sources of information to locate problem.
(B) Survey of related literature
(C) Identification of problem
(D) Searching for solutions to the problem

19. In the process of conducting research ‘Formulation of Hypothesis” is followed by
(A) Statement of Objectives (B) Analysis of Data
(C) Selection of Research Tools (D) Collection of Data

20. Information is…..

(A) Raw Data (B) Processed Data

(C) Input data (D) Organized data

21. One of the following search engine is exclusively meant for scientific information

(A) Google (B) Yahoo (C) SCIRUS (D) Altavista

22. "Controlled Group" is a term used in..... .

(A) Survey research (B) Historical research

(C) Experimental research (D) Descriptive research

23. Histogram is used to describe:

(A) Quantitative data of a group of patients

(B) Qualitative data of a group of patients

(C) Data collected on nominal scale

(D) Data collected on ordinal scale

24. A Scatter diagram is drawn to study:

(A) Trend of a variable over a period of time

(B) Frequency of occurrence of events

(C) Mean & median values of the given data

(D) Relationship between two given variables

25. Which of the following is not true about 'correlation'?

(A) It indicates degree of association between two characteristics

(B) Correlation coefficient of 1 means that the two variables exhibit linear relationship

(C) Correlation can measure risk

(D) Causation implies correlation

26. The date and Theme for the World Environment Day, 2020 was

(A) 5^{th} June; Biodiversity

(B) 15^{th} June; Natural resources

(C) 25^{th} June; Bioavailability

(D) 5^{th} June; Natural resources

27. Fluorescence microscopy is based on the ability of certain molecules to

(A) Absorb light of a constant wavelength

(B) Absorb light of many different wavelengths

(C) Absorb light of a given wavelength and then emit light of a longer wavelength

(D) Absorb light of a given wavelength and then emit light of a shorter wavelength

28. Which of the following condition belongs to reverse phase chromatography?

(A) The mobile phase is non-polar and stationary phase is polar

(B) The mobile phase is polar and stationary phase is non-polar

(C) Both the mobile phase and stationary phase are organic

(D) Both the mobile phase and stationary phase are inorganic

29. In the pentose phosphate pathway
(A) Only the C-1 carbon of glucose are oxidized to CO_2
(B) All the carbons of glucose are oxidized to CO_2
(C) No decarboxylation occurs
(D) C-4 and C-5 of glucose is oxidized to CO_2

30. Who won the Nobel Prize in 2020 for discovering the method for genome editing?
(A) George Smith, Frances Arnold and Greg Winter
(B) Emmanuelle Charpentier and Jennifer A. Doudna
(C) Jacques Dubochet, Joachim Frank and Richard Henderson
(D) John B. Goodenough, M. Stanley Whittingham and Akira Yoshino

31. miRNA based silencing of genes is a type of
(A) Transcription gene silencing
(B) Post transcription gene silencing
(C) Translational gene silencing
(D) Post translation gene silencing

32. The yeast two-hybrid system is designed to identify which of the following?
(A) All the components of a multiprotein complex
(B) Human proteins that are required for binding RNA polymerase
(C) Two proteins that directly interact with one another
(D) Two proteins that are involved in the same metabolic pathway

33. Which of the following bacterial toxins does not have ADP-ribosyl transferase activity?
(A) Cholera toxin
(B) Diphtheria toxin
(C) Exotoxin A
(D) *Staphylococcus aureus* toxin

34. In Scanning Electron Microscope, to form an image of the specimen
(A) Electron should pass through the specimen
(B) Electrons are scattered from the surface of the specimen
(C) A thin film of heavy metal is evaporated
(D) Specimens are stained

35. Which of the following reporter gene does not require addition of a specific substrate for its detection?
(A) Luciferase
(B) β-glucuronidase
(C) β-glucosidase
(D) Green Fluorescent Protein

36. The chemokine receptor expressed preferentially on T cells is
(A) CXCR4
(B) CCR3
(C) CCR5
(D) CXCR2

37. Oxygenase activity of RUBiSCO generates
(A) Two molecules of PGA (3C)
(B) Two molecules of phosphoglycolate (2C)
(C) One molecule of PGA and phosphoglycolate
(D) Two molecules each of PGA and phosphoglycolate

38. Which of the following is an unusual feature of the replication cycle in coronaviruses?
(A) The RNAs all terminate in a common 3′ and produce nested set transcripts
(B) They take advantage of recombination with the long RNA genome
(C) They are not highly mutable
(D) They use capped cellular mRNA's

39. Steroid hormone receptors, when bound by an appropriate hormone, bind to
(A) rRNA
(B) mRNA
(C) snRNA
(D) DNA

40. The energy charge of the cell is
(A) The difference between the charge on the outside and inside of a cell
(B) Generated by the sodium-potassium ATPase
(C) The overall rate of energy used by the cell
(D) The extent to which the total adenine nucleotide pool is phosphorylated

41. 'Flavr Savr' transgenic tomato variety was made more resistant to rotting by adding an antisense gene which interferes with the production of
(A) 1-amino cyclopropane-1-carboxylic acid synthase
(B) 1-amino cyclopropane-1-carboxylic acid oxidase
(C) Expansin
(D) Polygalacturonase

42. Harvey J. Alter, Michael Houghton and Charles M. Rice won Nobel Prize 2020 in which field?
(A) Physiology or Medicine
(B) Literature
(C) Peace prize
(D) Economic Science

43. Name a clinical trial in which blood is transfused from recovered COVID-19 patients to a coronavirus patient who is in critical condition?
(A) Plasma Therapy
(B) Solidarity
(C) Remdesivir
(D) Platelet therapy

44. Who is the director general of WHO at present?
(A) Margaret Chan
(B) Tedros Adhanom

(C) Sania Nishtar
(D) Audrey Azoulay

45. The cellular productivity in a continuous stirred tank fermenter increases with an increase in dilution rate and reaches a maximum value. If the dilution rate is increased beyond the maximum point, the productivity will
(A) Decrease abruptly
(B) Increase
(C) Increase drastically
(D) Be zero

46. Interferon-γ induces the synthesis of a surface protein that presents antigens to T lymphocytes. What are the antigen-presenting molecules that stimulate cytotoxic-T cells?
(A) Antibodies
(B) Fc receptors
(C) Type I major histocompatibility complexes
(D) Type II major histocompatibility complexes

47. The fungus that degrades the so called BTEX compounds is
(A) *Fusarium moniliforme*
(B) *Phanerochaete chrysosporium*
(C) *Aspergillus niger*
(D) *Penicillium notatum*

48. The wall-less mycoplasmas are considered to be related to gram-positive bacteria. Which of the following would provide the most compelling evidence for this?
(A) They share common rRNA sequences
(B) Some gram-positive bacteria and some mycoplasmas produce catalase
(C) Some gram-positive bacteria and some mycoplasmas have coccus-shaped cells
(D) Both groups are prokaryotic

49. Name the vaccine that is jointly developed by the German company BioNTech and US pharma giant Pfizer for COVID-19?
(A) BNT162
(B) PICOVACC
(C) COVAX
(D) mRNA 1273

50. When changes in the phenotype or gene expression occur without changes in the underlying DNA sequence, the phenomenon is called
(A) Mutation
(B) Eugenics
(C) Epigenetics
(D) Epistasis

x-x-x

(MICROBIOLOGY)

1. Replica plating is used to detect
(A) Prototroph
(B) Auxotroph
(C) Autotrophs
(D) Chemotrophs

2. TEM magnifies microbes upto
(A) 10,000X
(B) 25,00X
(C) 50,000X
(D) 500,000X

3. Atomic Force Microscope is used for
(A) Bidimensional imaging
(B) Size measuring
(C) Three-dimensional imaging and chemical analysis
(D) Shape analysis

4. In report writing "KIS" means
(A) Keep it short
(B) Keep it simple
(C) Keep it small
(D) Keep it sweet

5. Autoclave was discovered by
(A) Lister
(B) Louis Pasteur
(C) Charles Chamberland
(D) John Phips

6. Sugars are sterilized at
(A) 10 pounds for 20 minutes
(B) 10 pounds for 15 minutes
(C) 15 pounds for 15 minutes
(D) 15 pounds for 20 minutes

7. MacConkey agar is a
(A) General purpose medium
(B) Differential medium
(C) Differential and Selective medium
(D) Enrichment medium

8. Capsule of a bacteria is seen by
(A) Gram's staining
(B) Differential staining
(C) Positive staining
(D) Simple staining

9. Inoculating needle is made up of
(A) Iron
(B) Nickle
(C) Gold
(D) Copper

10. Incineration refers to
(A) Heating in fire directly
(B) Boiling
(C) Incubating in Water bath
(D) Heating in oven

11. A culture having dilution of 10^9 shows _____colonies and will be used for cell count.
(A) 3-30
(B) 25-500
(C) 45-250
(D) 200-300

12. In compliment fixation test _____indicates the test is positive
(A) Lysis of rbc
(B) Button formation of rbc
(C) Hemolysis
(D) No lysis of rbc

13. In ELISA, positive result is read as the
(A) Highest dilution of antigen showing no color
(B) Highest dilution of antigen having color
(C) Lowest dilution with color
(D) Dilution without antigen showing color

14. In microscopy basic principle is
(A) Higher the wavelength better the resolution
(B) Lower the wavelength lower the resolution
(C) Higher the wavelength worst the resolution
(D) Lower the wavelength better the resolution

15. In TEM, sample is fixed with
(A) Formaline solution
(B) Acetone
(C) Osmium tetra oxide solution
(D) Gluteraldehyde solution

16. Best way to discard mask and gives in today's scenario are
(A) Autoclave
(B) Dry Sterilization
(C) Boiling
(D) Keeping in paper bag for 72 hours

17. Non lactose fermenters can be identified by
(A) Pink colonies

(B) Yellow colonies
(C) ONPG test
(D) Black colonies

18. Pathogenic bacteria are allowed to be used only with Laboratory having _____facility
(A) BSL-2
(B) BSL-1
(C) BSL-3
(D) Laminar flow

19. Heeps of lab coats can be sterilized by
(A) Ethylene oxide
(B) Autoclave
(C) Oven
(D) Boiling

20. Agar melts at
(A) 110^0 C
(B) 93^0 C
(C) 100^0C
(D) 65^0C

21. Normal saline is prepared by dissolving
(A) 9 gm of NaCl in 100 ml H_2O
(B) 9 gm of NaCl in 1000 ml H_2O
(C) 0.9 gm of NaCl in 1000 ml H_2O
(D) 9.9 gm of NaCl in 100 ml H_2O

22. Plastic Petri plates, suturing needles and catheters are sterilized by
(A) Moist Heat
(B) Dry Heat
(C) Oven
(D) UV radiations

23. Dienes Phenomenon is observed by
(A) Klebsiella
(B) Shigella
(C) Proteus
(D) Escherichia

24. Catalase production is negative in
(A) Proteus
(B) Staphylococcus
(C) Streptococcus
(D) Salmonella

25. Which of the following is nonsense codon?
(A) UAA
(B) GGC
(C) AAG

(D) CGA

26. Biosensor is used to determine
(A) Air quality in environment
(B) H_2O quality
(C) Temperature of food
(D) Flavor compounds in foods

27. MHC-II molecules comprise of
(A) Heavy and light chains only
(B) α and β glycoprotein chain
(C) Heavy chain linked to macroglobulin
(D) α glycoprotein linked to light chain

28. Tufft of flagella is present at anterior end of
(A) Giardia lamblia
(B) Trichomonas hominis
(C) Trypanosomes
(D) Salmonella typhi

29. Cytokines are messenger molecules produced by
(A) Macrophages
(B) B cells
(C) T cells
(D) NK cells

30. Endocrine gland secretes hormones and release via _____into blood stream.
(A) Duct
(B) Without Duct
(C) Arteries
(D) Veins

31. Probiotics are used as
(A) Prophylactic agent
(B) Supplementing agent
(C) Therapeutic agent
(D) Biotics

32. COVID-19 is a
(A) Double stranded DNA virus
(B) Positive stranded DNA virus
(C) Positive Stranded RNA virus
(D) Negative Stranded RNA virus

33. Relapse is much more common in
(A) Amoebiasis
(B) Giardiasis
(C) Salmonellosis'
(D) Shigellosis

34. Vaccination is a

(A) Innate Immunization
(B) Active Immunization
(C) Passive Immunization
(D) Active and Passive Immunization

35. Microbes are best identified by
(A) Metabolic characters
(B) Molecular characters
(C) Phenotypic characters
(D) Polyphagic characters

36. _____ is a fungal disease
(A) Scabies
(B) Sporotrichosis
(C) Loaisis
(D) Pyoderma

37. Yeast is a good source of
(A) Protein and Vitamins
(B) Amino Acids
(C) Starch and sugars
(D) Minerals

38. Single cell proteins are
(A) Proteins derived bacterial cells
(B) Whole organisms rich in proteins
(C) Algal cell wall
(D) Fungal cell wall

39. Remdesivir is used to treat
(A) EBOLA
(B) FLU
(C) SARS
(D) COVID-19

40. Tyndalization is a process to kill
(A) Endospores
(B) Cysts
(C) Viruses
(D) Bacteria

41. Bioconversion is commonly used for
(A) Antibiotics
(B) Vaccines
(C) Animal feed
(D) Steroid hormones

42. Canned foods remain edible for
(A) 6 months
(B) 1 months
(C) 1 year

(D) Many Years

43. HTST stands for
(A) High time small temperature
(B) High Temperature short time
(C) High Temperature small time
(D) High Temperature short tenure

44. Erythrocytes of individuals with 'O' blood group have
(A) A antigens
(B) Both B and A antigens
(C) B antigens
(D) Neither A nor B antigens

45. Food poisoning is caused by
(A) Salmonella species
(B) Vibrio Cholera
(C) Bacillus cereus
(D) Camphylobacter hominis

46. Tytpe III hypersensitivity is mediated by
(A) Ig E and Ig G
(B) Ig E and T cells
(C) Ig E and Ig M
(D) Ig G and Ig M

47. Bipolar staining is a characteristic feature of
(A) Salmonella species
(B) Helicobacter pylon
(C) Shigella sps
(D) Yersinia pestis

48. Beer is made from
(A) Malted grains
(B) Grapes
(C) Fruit juice
(D) Kitchen wastes

49. Genes in all cells are composed of
(A) Purines
(B) Pyrimidines
(C) DNA
(D) RNA

50. RNA polymerase from bacteria have
(A) 3 different subunits
(B) 4 different subunits
(C) 2 different subunits
(D) 5 different subunits

(Nuclear Medicine)

1. Which spectroscopy is used to detect -SH group and disulphide linkages in proteins

(A) CD spectroscopy
(B) Fluorescence spectroscopy
(C) NMR spectroscopy
(D) FTIR spectroscopy

2. For the separation of DNA by electrophoresis, which of the method is commonly used?

(A) Agarose-Vertical
(B) Agarose –Horizontal
(C) PAGE-Vertical
(D) PAGE-Horizontal

3. In an isochoric process

(A) Temperature remains constant
(B) Pressure remains constant
(C) Volume remains constant
(D) Kinetic energy remains constant

4. Electrophoresis is not used for the separation of

(A) Lipids
(B) Proteins
(C) Nucleic Acids
(D) Amino Acids

5. The recent atomic weight scale is based on

(A) $^{1}H_{1}$
(B) $^{1}H_{2}$
(C) $^{6}C_{12}$
(D) $^{8}O_{16}$

6. Which of the following is not in the pelvis

(A) The ileu
(B) The ischium
(C) Iridium
(D) None of the above

7. Bone is made up of

(A) Hydrogen peroxide
(B) Hydroxypatite mineral only
(C) Collagen only
(D) Hydroxypatite mineral and collagen

8. CSF is made mostly of

(A) Protein
(B) Water
(C) Glucose
(D) Blood cells

9. Cardiac contraction is initiated in the
(A) SA node
(B) AV node
(C) Bundle of Hiss
(D) P wave

10. R-R interval represents
(A) Only repolarizaton
(B) Arrhythemia filtering
(C) Length of cardiac cycle
(D) Ventricular systole

11. Oncogenes are the cancer causing genes in the cells but they do not express usually. This is because of the presence of

A. Preprooncogenes
B. Protooncogenes
C. Tumor suppressor genes
D. Transposons

12. The valence electronic transitions take place in
(A) X-ray region
(B) UV-visible region
(C) Microwave region
(D) Radiofrequency region

13. What cell type in the stomach takes up 99mTc-pertechnetate
(A) Mucin producing parietal cells
(B) Chief cells
(C) Smooth muscle cells
(D) Smooth muscle cells and Chief cells

14. A whole-body survey (post-thyroidectomy) for metastatic thyroid cancer is generally performed with what dose of radioiodine?
(A) 1---200 µCi of ^{131}I
(B) 0.5-1.0 mCi of ^{131}I
(C) 1-5 mCi of ^{131}I
(D) 9-15 mCi of ^{131}I

15. Perchlorate washout test of thyroid is useful in the diagnosis of

(A) Organification defects
(B) Plummer disease
(C) Lingual thyroid
(D) Acute thyroditis

16. The amount of injected dose of ^{99m}Tc HMPAO that actually localizes in brain is

(A) 4-6%
(B) 10-15%
(C) 20-25%
(D) 40-50%

17. Concerning PET versus SPECT imaging, which of the following statement is false?

(A) PET is more sensitive
(B) PET has better spatial resolution
(C) PET is inferior for quantification
(D) PET imaging agents are generally of short half life

18. Which of the following components of a two headed gamma camera system is not necessary for coincidence detection?

(A) Crystals
(B) Photomultiplier tubes
(C) Computer
(D) Collimators

19. Which of the following is not a pharmacological stress agent in association with myocardial perfusion imaging?

(A) Dobutamine
(B) Furosemide
(C) Dipyridamole
(D) Adenosine

20. Absence of ventricular contraction is

(A) Akinesis
(B) Dyskinesis
(C) Hypokinesis
(D) Tardokinesis

21. What is the clearance time of 99mTc-sestamibi from the myocardium?

(A) 1 hour
(B) 3 hours
(C) 5 hours
(D) 7 hours

22. What does gallium primarily bind to in plasma?

(A) Transferrin
(B) Albumin
(C) Globulin
(D) Glycine

23. If a solution of double stranded DNA is heated above its melting temperature, its absorbance will:

(A) Decrease
(B) Increase
(C) Remain unchanged
(D) Initially increase and then decrease

24. Radiocolloids are cleared from the circulation by

(A) Liver parenchymal cells
(B) Kupffer cells
(C) Hepatocytes
(D) Hemangiomas

25. If the lead HVL for ^{99m}Tc is 2.6mm and a lead shield containing ^{99m}Tc eluate is 13mm thick, what will the exposure rate be from the shielded vial, if the unshielded vial had a rate of 100mR/hr?

(A) 1.6 mR/hr
(B) 3.1 mR/hr
(C) 6.3 mR/hr
(D) 12.5 mR/hr

26. What is the distance required to reduce the radiation level from a 20 MBq ^{60}Co source to 0.025 mGy/h? (exposure rate constant for ^{60}Co = 3.1 mGy/h/MBq at 1cm)

(A) 49.8 cm
(B) 40.8 cm
(C) 14.8 cm
(D) 33.8 cm

27. The tissue weighing factor for brain is

A. 0.12
B. 0.08
C. 0.04
D. 0.01

28. If excessive aluminium is present in ^{99m}Tc eluate, which one of the following would be expected on a bone scan

(A) Lung uptake
(B) Liver uptake
(C) Thyroid uptake
(D) Gastric uptake

29. What is the resting membrane potential of a neuron?

(A) -70 mV
(B) -65mV
(C) -80 mV
(D) -55mV

30. Heavy nuclei have

(A) More protons than neutrons
(B) More electrons than neutrons
(C) More neutrons than electrons
(D) More neutrons than protons

31. *A deterministic effect:*

(A) Has a threshold in dose but the severity of the effect is otherwise dose-independent.
(B) Has no threshold in dose and the severity of the effect is a constant function of dose.
(C) Has a threshold in dose and the severity of the effect increases with dose.
(D) Has no threshold in dose and the severity of the effect increases with dose.

32. Particle which explain mass of matter is

(A) Higgs boson
(B) Proton
(C) Lepton
(D) Neutron

33. The electrical charge on neutrino is

(A) 3
(B) 2
(C) 1
(D) 0

34. Which quantity is conserved in a nuclear process?

(A) Momentum and Energy
(B) Mass and Momentum
(C) Energy and Momentum
(D) Mass and Energy

35. The $LD_{50/60}$ dose for humans is approximately equal to

A. 1 Gy
B. 4 Gy
C. 10Gy
D. 12Gy

36. You want to know if a culture of cells is in the process of DNA synthesis. You incubate your cells in the presence of radioactive thymidine to see if it is being incorporated into the DNA. What is the best technique to detect the labeled deoxynucleotide in nuclear DNA?

A. Autoradiography
B. Polyacrylamide gel electrophoresis
C. Agarose gel electrophoresis
D. Two-dimensional gel electrophoresis

37. 1 Fermi is equal to

(A) 10^{-13} m
(B) 10^{-14} m
(C) 10^{-15} m
(D) 10^{-16} m

38. The main interaction processes of neutrons in biological matter are:

(A) Magnetic scattering
(B) Coulomb scattering by orbital electrons
(C) Fission
(D) Elastic and inelastic scattering by nuclei

39. The Z component of the signal in PMT tube will

(A) Be processed by pulse height analyser
(B) Be recorded on CRT
(C) Not be processed by pulse height analyser
(D) Be removed by PMT

40. The auger effect occurs most frequently in elements with atomic number (Z)

(A) Z<150
(B) Z<100
(C) Z<50
(D) Z<25

41. The Henderson-Hasselbalch equation states that:

(A) $P^k = P^H + \log R$
(B) $P^H = Pk + \log R$
(C) $P^H = pk - \log R$
(D) $R = p^k - p^H$

42. The linear energy transfer is maximum in case of

(A) 100 Kev gamma ray
(B) 100 Kev alpha particle
(C) 100 Kev beta particle
(D) 100 Kev protons

43. Radiation induced chromosome type abberations does not include

A. Interstitial deletions
B. Dicentrics
C. Achromatic lesions
D. Translocations

44. Which is the correct order of cellular radiosenstivity

A. Eyrthroblasts > Intestinal crypt cells > spermatids > chondrocytes
B. Intestinal crypt cells > spermatids > Eyrthroblasts > chondrocytes
C. spermatids > Eyrthroblasts > chondrocytes > Intestinal crypt cells
D. spermatids > Eyrthroblasts > Intestinal crypt cells > chondrocytes

45. Photographic film badge monitoring devices are unable to detect:

(A) Neutrons
(B) Beta particle
(C) Gamma rays
(D) X-rays

46. The neutrino hypothesis was put forward by

(A) Einstein
(B) Rutherford
(C) Pauli
(D) Fermi

47. ^{15}O, ^{16}O and ^{18}O are an example of

(A) Isotopes
(B) Isotones
(C) Isobars
(D) Isomers

48. What ratio of protons to neutrons favors beta decay

(A) A low proton to neutron ratio as compared to stable nuclei
(B) A high proton to neutron ratio as compared to stable nuclei
(C) Both high and low proton to neutron ratio as compared to stable nuclei
(D) Ratio has no role in favoring beta decay

49. The first several FDA approved antibodies have been based on monoclonal antibods derived from what animal?

(A) Rat (B) Mouse (C) Guinea Pig (D) Hamster

50. What biologically important element does gallium most closely mimic?

(A) Calcium (B) Manganese (C) Iron (D) Potassium

(Optometry)

1. All are true except
(A) P value is the probability that observed finding due to chance
(B) 0.05 is an arbitrary cut-off for p value
(C) 95% CI is the range of values within which the truth is likely to be found
(D) None of the above is wrong

2. Research aims at finding "answers" to "questions" it implies
(A) A framework of philosophies
(B) Using valid and reliable methods and techniques
(C) An unbiased design
(D) All of the above

3. An abstract of the journal article doesn't contain
(A) Methodologies
(B) Result
(C) Objectives
(D) Ethical consideration

4. The main characteristic of scientific research is
(A) Empirical
(B) Theoretical
(C) Experimental
(D) All the above

5. Following is correct for statistical errors
(A) Alpha error is the probability of picking up a difference where none truly exists
(B) Beta error is the probability of NOT picking up a difference that truly exists
(C) Larger the sample size, higher is the random error
(D) Both A and B

6. Research hypothesis are
(A) Formulated after review of literature
(B) Statements of predicted relationship between variables
(C) Stated such that they can be confirmed or refuted
(D) All the above

7. Prevalence of a disease is defined as
(A) Number of cases of a disease that are present in a particular population at a given time
(B) Occurrence of new cases of *disease* or injury in a population over a specified period of time
(C) None of the above
(D) Either of the above

8. Which of the following is NOT a Step of sampling design
(A) What is the target population
(B) What are the parameters of interest
(C) What are the likes of population of interest
(D) What is the sampling frame

9. The following is not a method to decrease error in an study
(A) Allocation concealment
(B) Randomisation
(C) Blinding

(D) Changing the outcome parameter

10. The hierarchy of research designs is as under
(A) Systematic review, RCT, Cohort studies, case- control studies, case reports, expert opinion
(B) Expert opinion, Systematic review, RCT, Cohort studies, case- control studies, case reports,
(C) RCT, case- control studies, Cohort studies, case reports, expert opinion, Systematic review
(D) RCT, Systematic review, Cohort studies, case- control studies, case reports, expert opinion

11. The valid sample size in RCT does NOT depends on
(A) Incidence of disease
(B) Population variance
(C) Treatment effect size
(D) Studies done by principal investigator in past

12. Following is the correct Vancouver system
(A) Int J Retina Vitreous. 2021 Jan 6;7(1):2
(B) Int J Retina Vitreous. 2021;7:2
(C) Int J Retina Vitreous. 2021 (1):2
(D) Int J Retina Vitreous. 7(1):2(2021)

13. Ministries and departments of the Government of India that provide funds for extramural research are following EXCEPT
(A) Indian council of medical research
(B) Department of science and technology
(C) Indian native science academy
(D) Ministry of nonconventional Energy Sources

14. Ad-hoc research projects deal with
(A) Projects where host institute should have basic facilities and ultra structure
(B) Research projects with the aim to support new institutes
(C) Principal investigator can generate self funding
(D) All the above

15. The characteristic of correlation analysis to seek out
(A) Differences among variables
(B) Variations among variables
(C) Association among variables
(D) Regression among variables

16. Which of the following steps are required to design a questionnaire
a) Writing primary and secondary aims of the study
b) Review of current literature
c) Prepare the draft of questionnaire
d) Revision of the draft
(A) a, b, c and d
(B) a, b and c
(C) a, c and d
(D) b, c and d

17. Field study is related to
(A) Real life situation

(B) Experimental situation
(C) Laboratory situation
(D) None of the above

18. Attribute of object, event or things which can be measured
(A) Qualitative measure
(B) Data
(C) Variable
(D) None of the above

19. While writing research report a researcher
(A) Must not use numerical figure at beginning of sentence
(B) Must arrange it in logical, topical and chronological order
(C) Must compare his results with other studies
(D) All of the above

20. Ten-year-old children are taller than 8 year old one. It is an example of
(A) Vertical study
(B) Cross-sectional study
(C) Case study
(D) Experimental studies

21. The other name of independent variable for an experimental research is/are
(A) Treatment variable
(B) Experimental variable
(C) Manipulated variable
(D) All of the above

22. Which of the following statement is correct
(A) Discoveries are researches
(B) Researches lead to discoveries
(C) Invention and research are related
(D) None of the above

23. All cause sampling error except
(A) Faulty tools of measurement
(B) Inadequate sample
(C) Non-response
(D) Defect in data collection

24. A research question NOT should be
(A) Clear
(B) Well defined
(C) Should give answer to multiple problems
(D) Arguable

25. Incidence of disease is defined as
(A) Occurrence of new cases of *disease* or injury in a population over a specified period of time
(B) All cases of *disease* or injury in a population over a specified period of time
(C) None of the above
(D) Either of the above

26. Aniseikonia may be corrected using
(A) Prisms

(B) A Galilean telescope
(C) Decentration of the lens
(D) Aspheric lenses

27. Which of the following is NOT matched correctly
(A) Prism dioptre --- centimeter per meter
(B) Refractive index---dimention less
(C) Wavelength---nanometers
(D) Spatial frequency---cycles per second

28. The axially ametropic eye is best corrected with
(A) Glasses located at near point
(B) Hard contact lenses
(C) Glasses located at the anterior focal point of eye
(D) Soft contact lenses

29. Following is true about the far point of non-accommodative myopic eye
(A) Fovea is the corresponding point for this
(B) Is poisterior to the eye optically speaking
(C) Is nearer to the eye than the point of focus of fully accommodated eye
(D) Cannot be moved by placing the lens in front of the eye

30. An angle of 45* corresponds to
(A) 100 prism dioptres
(B) 90* prism dioptres
(C) 22.5 prism dioptres
(D) 45 prism dioptres

31. Which is true for refractive myopia
(A) Increased incidence of retinal detachment
(B) Macular changes
(C) Myopic crescent
(D) Lens changes

32. In a patient with -3.50 dioptre myopia, fitting of RGP contact lens that is flatter than K, gives the shape of tear lens as
(A) Plano
(B) Tear drop
(C) Concave
(D) Convex

33. In the patient in question 7, what power RGP lens should be ordered
(A) -3.50D
(B) -4.00 D
(C) -2.50 D
(D) -4.50D

34. All cause an decrease in amplitude of accommodation except
(A) Siderosis
(B) Phospholine iodide
(C) Cycloplegic eye drops
(D) Ocular trauma

35. Compared to spectacles, contact lens
(A) Increase the accommodative requirements of myopic eyes

(B) Increase the accommodative requirements of hyperopic eyes
(C) Increase the convergence demands of myopic eyes
(D) Increase the convergence demands of hyperopic eyes

36. We should aim for a slight residual myopia in IOL power selection because
(A) Weaker lenses are thinner and less likely to cause surgical or postoperative complications due to size, disruption of tissues and inflammation
(B) The A constant is calculated for a slight degree of residual myopia
(C) Residual myopia is closer to emmetropia than residual hyperopia
(D) An error in power calculation is less likely to produce a resultant hyperopia, which would result in blurry vision at all distances.

37. A patient comes for refractive surgery with K reading of 43.0D/42.0D and a manifest refraction of -9.5 D. If LASIK were performed, you would expect the post-operative average keratometry reading to be
(A) 34.9
(B) 36.3
(C) 37.3
(D) 34.0

38. Which of the following is not a component of optical coherence tomography (OCT) system?
(A) Movable mirror
(B) Beam splitter
(C) Reference beam
(D) Split prism

39. Proper distance visual acuity testing for low vision patients includes all of the following except
(A) A testing chart with equal number of symbols in each line
(B) Non-standardized room illumination
(C) A snellen's visual acuity chart at 20 ft
(D) A test distance of 10ft.

40. All the following conditions cause glare except
(A) Iritis
(B) Corneal scarring
(C) Posterior subcapsular cataract
(D) albinism

41. The following is not a symptom of steep fit of RGP lens
(A) Pain on removal
(B) Difficulty in removal
(C) Vision better before eye blink
(D) Initially is comfortable, will get painful towards end of the day

42. The indications for soft contact lenses are except
(A) Patient unable to tolerate RGP
(B) Astigmatism $\geq 1/3^{rd}$ of sphere power
(C) Regular corneal surface with Astigmatism <1.5 D
(D) Patient keen on soft CL only

43. Pick up the wrong statement for visual rehabilitation
(A) Fit contact lenses for unilateral aphakia
(B) Glasses for bilateral aphakia
(C) Bifocals should be avoided children
(D) Treat amblyopia if indicated

44. The usual age at which myopia first becomes apparent is
(A) At birth
(B) 8 years
(C) 12 years
(D) 20 years

45. Which of the following properties of a laser is least clinically important in ophthalmic applications?
(A) Energy level
(B) Power level
(C) Pulse duration
(D) Polarity

46. Multifocal IOLs
(A) Offer increased image clarity and contrast between near and far viewing
(B) Are independent of pupil size if they are well centres=d
(C) Offer a trade off between increased image quality and increased depth of focus
(D) Are indicated in all patients

47. Myopia can be associate with all except
(A) Excessive plus power
(B) Decreased convexity of the lens
(C) Increased corneal curvature
(D) Increased axial length of eye

48. Bifocal lenses prescribed in myopes
(A) The practitioner should leave the choice of the segment type to the optician
(B) Around top segment is preferred because the rhin upper edge , which causes less prismatic effect
(C) A flat top segment is preferred because it lessens image jump
(D) The one piece shape is indicated for adds greater than +2.00 Dioptre

49. Candela is the unit of measure for—
(A) Luminous intensity
(B) Luminous flux
(C) Illuminance
(D) Luminance

50. A lensometer measures
(A) Vertex power of the lens
(B) True power of the lens
(C) Front power of the lens
(D) All of these

x-x-x

(PHYSICS)

1. Of the following, which is the odd one out?
(A) Cone
(B) Torus
(C) Sphere
(D) Ellipsoid

2. The set of numbers $(5,6,7,m,6,7,8,n)$ has an arithmetic mean of 6 mode (most frequently occurring number) of 7. Then $m \times n =$
(A) 18
(B) 35
(C) 28
(D) 14

3. A solid contains a spherical cavity. The cavity is filled with a liquid and includes a spherical bubble of gas. The radii of cavity and gas bubble are $2mm\ and\ 1mm,$ respectively. What portion of the cavity is filled with liquid?
(A) $\frac{1}{8}$
(B) $\frac{3}{8}$
(C) $\frac{5}{8}$
(D) $\frac{7}{8}$

4. In how many distinguishable ways can the letters of the word CHANCE be arranged?
(A) 120
(B) 720
(C) 360
(D) 240

5. Two iron spheres of radii 12 cm and 1 cm are melted and fused. Two new spheres are made without any loss of iron. Their possible radii could be
(A) 9 and 4 cm
(B) 9 and 10 cm
(C) 8 and 5 cm
(D) 2 and 11 cm

6. Symposium is a
(A) A well organised group of a few speakers with large audience
(B) Arrival at the certain goal through mutual exchange of ideas
(C) Process of taking decision in a group
(D) All of the above

7. Seminar provides the following opportunity to a researcher
(A) Expression of feelings
(B) Exchange of ideas
(C) Spontaneous learning
(D) All of the above

8. What is the next number of the following sequence ? $2,3,4,7,6,11,8,15,10,\ldots\ldots\ldots$
(A) 12
(B) 13
(C) 17
(D) 19

9. If n is a positive integer, then $(n(n+1)(n+2)(n+3)(n+4)(n+5)(n+6))$ is divisible by
(A) 3 but not 7
(B) 3 and 7
(C) 7 but not 3
(D) Neither 3 nor 7

10. A rectangular area of sides 9 and 6 units is to be covered by square titles of sides 1, 2 and 5 units. The minimum number of tiles needed for this is
(A) 3
(B) 11
(C) 12
(D) 15

11. Suppose n is a positive integer. Then $(n^2+n)(2n+1)$
(A) May not be divisible by 2
(B) Is always divisible by 2 but may not be divisible by 3
(C) Is always divisible by 3 but may not be divisible by 6
(D) Is always divisible by 6

12. Every time a ball falls to ground, it bounces back to half the height it fell from. A ball is dropped from a height of 1024 cm. The maximum height from the ground to which it can rise after the tenth bounce is
(A) 102.4 cm
(B) 1.24 cm
(C) 1 cm
(D) 2 cm

13. A student buys a book from an online shop at 20% discount. His friend buys another copy of the same book in a book fair for Rs. 192 paying 20% less than his friend. What is the full price of the book?
(A) Rs. 275
(B) Rs. 300
(C) Rs. 320
(D) Rs. 392

14. There is an equilateral triangle in the XY plane with its centre at the origin. The distance of its sides from the origin is 3.5cm. The area of its circumcircle in $cm^2$is
(A) 38.5
(B) 49
(C) 63.65
(D) 154

15. A square pyramid is to be made using a wire such that only one strand of wire is used for each edge. What is the minimum number of times that the wire has to be cut in order to make the pyramid?
(A) 3
(B) 7
(C) 2
(D) 2

16. A daily sheet calendar of the year 2013 contains sheets of 10×10 cm size. All the sheets of the calendar are spread over the floor room of $5m \times 7.3\ m$ size. What percentage of the floor will be covered by these sheets?
(A) 0.1
(B) 1
(C) 10
(D) 100

17. During a summer vacation, 20 friends from Panjab University Hostels, each wrote a letter to each of all others. The total number of letters written was
(A) 20
(B) 400
(C) 200
(D) 380

18. 1200 men and 500 women can build a bridge in 2 weeks. 900 men and 250 women will take 3 weeks to build the same bridge. How many men will be needed to build the bridge in one week?
(A) 3000
(B) 3300
(C) 3600
(D) 3900

19. If $y = 5x^2 + 3$, then the tangent at $x = 0, x = 3$
(A) Passes through $x = 0, y = 0$
(B) Has a slope of $+1$
(C) Is parallel to the $x - axis$
(D) Has a slope of -1

20. One percent of the people of country X are taller than 6ft. Two percent of the people of Country Y are taller than 6ft. There are thrice as many people in country X as in country Y. Taking both countries together, what is the percentage of people taller than $6ft$?
(A) 3.0
(B) 2.5
(C) 1.5
(D) 1.25

21. Longitudinal approach in research is related with
(A) Long term researches
(B) Transverse researches
(C) Horizontal researches
(D) All of the above

22. Action research is
(A) An applied research
(B) A research carried out to solve immediate problem
(C) A long term research
(D) All of the above

23. The quality of a problem is
(A) Clarity
(B) Worth for solution
(C) Hypothesis oriented
(D) All of the above

24. Ethics is related with
(A) Belief of the person
(B) Nature of Law
(C) Civic Principles and rights
(D) All of the above

25. A number is as much greater than 75 as it is smaller than 117. The number is
(A) 91
(B) 93
(C) 96
(D) 89

26. The greatest negative number which can be stored in computer that has 8-bit word length and uses 2's complement arithmetic is
(A) -256
(B) -255
(C) -128
(D) -138

27. The frequency and wavelength of the surface tension wave in shallow water are related by $\nu = \sqrt{(\frac{2\pi T}{\rho\lambda^3})}$ where T is the surface tension and ρ is the density. The group velocity of such a wave is
(A) $\frac{3}{2}\sqrt{(\frac{2\pi T}{\rho\lambda})}$
(B) $\frac{3}{2}\sqrt{(\frac{2\pi T}{\rho\lambda^2})}$
(C) $\frac{3}{2}\sqrt{(\frac{\pi T}{\rho\lambda^2})}$
(D) None of the above

28. Commutator of two non-commuting Hermitian operator is
(A) Hermitian
(B) Anti-Hermitian
(C) Neither
(D) Either Hermitian or anti-Hermitian

29. Neutrons are observed in a nuclear reaction$Li^7\ (p,n)Be^7$. Then the bombarding energy of proton at which neutrons of zero energy is obtained, will be $(Q - value\ of\ reaction\ is - 1.65\ MeV)$:

(A) $1.7\ MeV$
(B) $1.9\ MeV$
(C) $2.1\ MeV$
(D) $5.2\ MeV$

30. According to nuclear shell model which includes spin orbit coupling, the spin and parity of the ground state of B_5^{11} is

(A) $\left(\frac{3}{2}\right)^-$
(B) $\left(\frac{3}{2}\right)^+$
(C) $\left(\frac{1}{2}\right)^-$
(D) $\left(\frac{1}{2}\right)^+$

31. Fast neutron may be easily slowed down by

(A) Passing them through a substance rich in hydrogen
(B) Using shield of lead
(C) Diffraction through a slit
(D) None of the above

32. Which of the following particles have strangeness quantum numbers $s = +1$?

(A) K^+
(B) π^+
(C) K^0
(D) Both K^+ and K^0

33. Which of the elementary particle is a lepton

(A) Photon
(B) μ-meson
(C) π-meson
(D) Proton

34. Which of the following is true regarding common emitter transistor amplifier?

(A) It is used for impedance matching
(B) It is also known as emitter follower
(C) Output voltage is 180^0 out of phase with respect to input voltage
(D) It is used in high frequency application.

35. A Pyrometer can measure

(A) Thermal radiation
(B) Gamma radiation
(C) Beta radiation
(D) Alpha radiation

36. Which of the following statement is true for an Ionization chamber

(A) No charge multiplication takes place

(B) Height of the signal is very large

(C) The output signal is not proportional to the particle energy

(D) None of the above

37. In a normal Zeeman Effect experiment using a magnetic field of strength $0.3T$, the splitting between the components of a $660nm$ spectral line is

(A) $12\,pm$

(B) $10\,pm$

(C) $08\,pm$

(D) $06\,pm$

38. A loop of diameter d is rotated in a uniform electric field until the position of maximum electric flux is found. The flux in this position is measured to be ϕ . What is the electric field strength?

(A) $\frac{4\phi}{\pi d^2}$

(B) $\frac{2\phi}{\pi d^2}$

(C) $\frac{\phi}{\pi d^2}$

(D) $\frac{\pi\phi d^2}{4}$

39. A proton, deuteron and α-particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If r_p, r_d and r_α denote respectively the radii of the trajectories of these particles, then the ratio $r_p : r_d : r_\alpha$ is

(A) $1:1:\sqrt{2}$

(B) $1:\sqrt{2}:1$

(C) $\sqrt{2}:1:1$

(D) $1:1:1$

40. An electromagnetic wave propagates inside a conductor. Then which of the following statement is not true.

(A) The amplitude of E and B decreases exponentially

(B) There is phase delay between E and B

(C) E and B are perpendicular to each other

(D) Phase delay does not depend in particular conductor used

41. A box of volume V containing N molecules of an ideal gas, is divided by a wall with a hole into two compartments. If the volume of the smaller compartment is $\frac{V}{3}$, the variance of the number of particles in it, is

(A) $\frac{N}{3}$

(B) $\frac{2N}{9}$

(C) $\sqrt{N}$

(D) $\frac{\sqrt{N}}{3}$

42. Sodium atoms crystallic in BCC metal. The atomic radius of sodium is $1.86\ A$, The Fermi energy of sodium at $0K$ is

(A) 5.11 eV

(B) 6.01eV

(C) 3.11eV

(D) 4.21eV

43. An electron collides with a hydrogen atom in its ground state and excites it to a state of $n = 3$. How much energy was given to the hydrogen atom in this inelastic collision?

(A) 13.6eV

(B) 6.8eV

(C) 12.1eV

(D) 1.51eV

44. The numbers of Zeeman components for $D_3^3 \rightarrow P_2^3$ transition are

(A) 6

(B) 9

(C) 12

(D) 15

45. If the standard deviation of the Poisson's distribution is $\sqrt{2}$, the probability for $r = 2$ is

(A) $\frac{1}{e}$

(B) $\frac{1}{e^2}$

(C) $\frac{2}{e^2}$

(D) $\frac{8}{e^4}$

46. The number of different components for a symmetric tensor is

(A) N

(B) N^2

(C) $\frac{N(N+1)}{2}$

(D) N^2-1

47. A particle is moving in a circle of radius a under a central potential $V = kr^4$. KE of the particle is

(A) $4\,ka^4$
(B) $3\,ka^4$
(C) $2\,ka^4$
(D) ka^4

48. A particle is constrained to move on a circle the number of degrees of freedom are

(A) 0
(B) 1
(C) 2
(D) 3

49. Which of the following is not true for Nuclear force

(A) Nuclear force is strong in nature
(B) Spin dependent
(C) Tensor in character
(D) It is a weak force compared to gravitational force

50. Frank-Hertz experiment tell us about

(A) Particle nature of the particle
(B) Wave nature of the particle
(C) Dual nature of the particle
(D) None of the above

x-x-x

(STATISTICS)

1. The statistic defined as the distance between 70^{th} and 30^{th} percentile gives us the information concerning:
   A. Central tendency
   B. Dispersion
   C. Skewness
   D. Kurtosis

2. Which of the following is the least for any data?
   A. Q_2
   B. P_{50}
   C. D_4
   D. P_{75}

(The symbols used have their usual meanings)

3. The distribution of a large number of means based on samples of the sample size selected from the same population is known as
   A. Normal distribution
   B. Sampling distribution
   C. Standard distribution
   D. Rectangular distribution

4. In the context of Survey Research, the following steps are taken in a certain order

   1. Sampling
   2. Inference
   3. Data analysis
   4. Data collection

   Which of the following is the right order of these steps?

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

5. A researcher has evaluated responses of the students and committed a constant error of 2 by overestimating. How will the variability of the group be affected?
   A. Variability would increase by 2
   B. Variability would increase by $\sqrt{2}$
   C. Variability would increase by 4
   D. It will remain unaffected
6. Which of the following is the main characteristic of the interval scale?
   A. No fixed zero point and unequal intervals
   B. Fixed zero point and equal intervals
   C. Fixed zero point and unequal intervals
   D. No fixed zero point and equal intervals

7. Use of product moment coefficient of correlation is appropriate for the pair of scores obtained from which types of scales?
   A. Nominal and Interval
   B. Ordinal and Nominal
   C. Interval and Interval
   D. Ordinal and Interval
8. What percent of IQ scores lie between 85 and 115 in a normal distribution with a mean of 100 and standard deviation of 5 points?
   A. 99.1
   B. 99.3
   C. 99.5
   D. 99.7
9. Sampling frame means
   A. Defining the population
   B. Listing the population
   C. Selecting representative sample
   D. Selecting adequate sample
10. An investigator approached the nearby schools and collected data from those, which cooperated. Such a sample is termed as
   A. Simple random sample
   B. Stratified sample
   C. Systematic sample
   D. Incidental sample
11. A market research survey in which 64 consumers were contacted, states that the product advertising motivated 64 percent of all consumers of a certain product. Assuming that the underlying population is normally distributed, the confidence limits for the proportion of consumers motivated by advertising in the population, with a confidence level equal to 0.95, are:
   A. 0.64 ± 0.1176
   B. 0.64 ± 0.1532
   C. 64 ± 0.1532
   D. 64 ± 0.1176
   (Use critical value at 5 percent level of significance = 1.96)
12. How many ways can *r* different balls be placed in *n* different boxes? Consider the balls and boxes distinguishable.
   A. $\binom{n}{r}$
   B. $\binom{r}{n}$
   C. n^r
   D. r^n
13. Standard deviation of -1, -2, -3, -4, -5, -6, -7 is
   A. – 4
   B. 4
   C. 2
   D. – 2
14. Standard deviation of two observations is 3.5, one observation is 3, then second observation is
   A. 9
   B. 10
   C. 7
   D. 3

15. Classification of MBA students by field of specialization is an example of
    A. Nominal data
    B. Ordinal data
    C. Interval data
    D. Ratio data
16. If the correlation between two variables x and y is 0.8, then the correlation coefficient between $((x-10)/5)$and $((y-20)/5)$ is
    A. 0.2
    B. 0.5
    C. 0.8
    D. 0.9

17. If a sample contains only two observations on each of the two variables, the value of product moment correlation coefficient will work out to be
    A. 0
    B. +0.5 or -0.5
    C. +1 or -1
    D. Any value within $(-1, 1)$ except those in A, B and C above

18. Which one of the following is not a step in conducting a test of hypothesis
    A. Set up the null hypothesis
    B. Decide the level of significance
    C. Decide on the appropriate statistic
    D. Decide the power of the test

19. The p-value indicates the
    A. Minimum level of significance at which the null hypothesis would be rejected
    B. Maximum level of significance at which the null hypothesis would be accepted
    C. Maximum level of significance at which the null hypothesis would be rejected
    D. Minimum level of significance at which the null hypothesis would be accepted
20. A, B, C can hit the target with probability (1/2), (1/3), (1/4) respectively. What is the probability that exactly two of them can hit the target?
    A. (1/2)
    B. (1/3)
    C. (1/4)
    D. (1/5)
21. In bivariate regression, mean of the predicted values of variable (say y) is
    A. Different from the mean of observed values of variable y
    B. Same as the mean of observed values of variable y
    C. May or may not be same as the mean of observed values of variable y
    D. 0
22. A bag contains 11 white balls and some red balls. If the probability of drawing a red ball is double that of a white ball, then the number of red balls in the bag are
    A. 18
    B. 20
    C. 22
    D. 24
23. The first population census of India was held in
    A. 1827
    B. 1872
    C. 1892
    D. 1897

24. National Statistics Day in India is observed on
    A. June 29
    B. February 17
    C. August 15
    D. January 26

25. In simple random sampling of size *n*without replacement from a finite population of size *N*, the variance of sample proportion $(p)$is

    A. $\left(\frac{N-n}{N}\right)\left(\frac{P(1-P)}{n}\right)$

    B. $\left(\frac{N-n}{N+1}\right)\left(\frac{P(1-P)}{N}\right)$

    C. $\left(\frac{N-n}{N-1}\right)\left(\frac{P(1-P)}{N}\right)$

    D. $\left(\frac{N-n}{N-1}\right)\left(\frac{P(1-P)}{n}\right)$

    (Here P denotes population proportion)

26. If p and q are chosen from {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} with replacement, then the probability that the roots of $x^2 + px + q = 0$are real is
    A. 0.62
    B. 0.61
    C. 0.60
    D. 0.59

27. A dice is tossed until 1 comes. Then the probability that 1 comes in even number of trials is
    A. $(5/11)$
    B. $(5/6)$
    C. $(6/11)$
    D. $(1/6)$

28. Let R be the range and $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$ be the variance of a set of observations $X_1, \ldots, X_n$, then
    A. $S^2 \leq \frac{nR^2}{n-1}$

    B. $S^2 \geq \frac{nR^2}{n-1}$

    C. $S^2 \geq \frac{nR^2}{n+1}$

    D. $S^2 \leq \frac{nR^2}{n+1}$

29. In an agricultural study, a two-way analysis of variance fixed effect experiment is performed, with 4 varieties of a crop and 5 types of fertilizers. Every pair of treatment and fertilizer is applied to 3 plots each. Assuming that there are interaction effects, the error degrees of freedom in the ANOVA table is
    A. 38
    B. 39
    C. 40
    D. 41

30. Let X is a continuous random variable with mean 2 and variance 9. Then the probability $P[|X-2| \geq 6]$ is
    A. Bounded below by 1/4
    B. Bounded above by 1/4
    C. Bounded below by 1/4
    D. Bounded above by 1/4

31. The point of inflexion of $N(\mu, \sigma^2)$ are
    A. $\mu \pm \sigma$
    B. $\mu \pm 2\sigma$
    C. $\mu \pm 3\sigma$
    D. $\mu \pm 4\sigma$

32. If χ_1^2 and χ_2^2 are two independent χ^2 random variables with n_1 and n_2 degrees of freedom, respectively, then
    A. $\frac{\chi_1^2}{\chi_2^2} \sim \beta_1\left(\frac{n_1}{2}, \frac{n_2}{2}\right)$
    B. $\frac{\chi_1^2}{\chi_1^2+\chi_2^2} \sim \beta_2\left(\frac{n_1}{2}, \frac{n_2}{4}\right)$
    C. $\frac{\chi_1^2}{\chi_1^2+\chi_2^2} \sim \beta_2\left(\frac{n_1}{n_2}, \frac{1}{2}\right)$
    D. $\frac{\chi_1^2}{\chi_2^2} \sim \beta_2\left(\frac{n_1}{2}, \frac{n_2}{2}\right)$

33. The angle between two regression lines, when correlation coefficient = 0, is
    A. $\frac{\pi}{4}$
    B. $\frac{\pi}{2}$
    C. $\frac{\pi}{3}$
    D. π

34. Let $X_1, \ldots, X_n$ be independent and identically distributed $Bernoulli(1, p)$ random variables. Let $T = \sum_{i=1}^{n} X_i$. The uniformly minimum variance unbiased estimator for $\psi(p) = p(1-p)$ is
    A. $\frac{nT-T^2}{n(n-1)}$
    B. $\frac{nT+T^2}{n(n-1)}$
    C. $\frac{T-nT^2}{n(n-1)}$

D. $\frac{T+nT^2}{n(n-1)}$

35. Let $X_1, \ldots, X_n$ be a random sample from $U\left[\theta - \frac{1}{2}, \theta + \frac{1}{2}\right]$. Then a maximum likelihood likelihood estimator for the parameter θ

A. $X_{[1]}$
B. $X_{[n]}$
C. $\left(X_{[1]} + X_{[n]}\right)$
D. $\left(X_{[1]} + X_{[n]}\right)/2$

Here $X_{[1]} = minimum(X_1, \ldots, X_n)$ and $X_{[n]} = minimum(X_1, \ldots, X_n)$

36. Nonparametric analogue of the two-way ANOVA is
A. Kruskalwallis test
B. Jonckheere – Trepstra test
C. Friedman test
D. Wilcoxon-Mann-Whitney test

37. The error degrees of freedom of a Graeco-Latin square design of order 4 is
A. 3
B. 4
C. 5
D. 6

38. Consider a2^3 factorial experiment with three factors A, B and C, each at two levels. Denoting a, b and c the second level of the factors A, B and C, respectively. The first level of A, B or C is signified by the absence of the corresponding letter in the treatment combination. Then, the interaction of A and B when C is at the second level is
A. $\frac{1}{2}[(abc) - (bc) - (ac) + (c)]$

B. $\frac{1}{2}[(abc) + (bc) + (ac) - (c)]$

C. $\frac{1}{2}[(abc) - (bc) + (ac) - (c)]$

D. $\frac{1}{2}[(abc) + (bc) - (ac) + (c)]$

39. An almost unbiased estimator of the variance of regression estimator of population mean for large samples is

A. $\frac{N-n}{nN}\left(\frac{s_y^2}{s_x^2 s_y^2 - s_{xy}^2}\right)$

B. $\frac{N-n}{nN}\left(\frac{s_x^2}{s_x^2 s_y^2 - s_{xy}^2}\right)$

C. $\frac{N-n}{nN}\left(\frac{s_{xy}^2 - s_x^2 s_y^2}{s_x^2}\right)$

D. $\frac{N-n}{nN}\left(\frac{s_x^2 s_y^2 - s_{xy}^2}{s_x^2}\right)$

40. Ratio to link method in time series is a method of measurement of
    A. Secular trend
    B. Seasonal fluctuations
    C. Cyclical fluctuations
    D. Irregular fluctuations

41. In single sampling inspection plan for attributes, Average Outgoing Quality (AOQ), under usual assumptions, is given by the relation
    A. $\frac{(N-n)p}{n} L_p$

    B. $\frac{(N-n)}{n} L_p$

    C. $\frac{(N-n)}{N} L_p$

    D. $\frac{(N-n)p}{N} L_p$

    Here p is the fraction defective in the process and $L(p)$ is the probability of accepting a lot of process defective p.

42. In the construction of life tables, which of the following approximate relations hold

    A. $q_x \approx \frac{m_x}{2+m_x}$

    B. $q_x \approx \frac{2m_x}{1+m_x}$

    C. $q_x \approx \frac{2m_x}{2+m_x}$

    D. $q_x \approx \frac{m_x}{1+m_x}$

    Here q_x is the probability that a person of exact age x will die before reaching age $(x+1)$ and m_x is the observed age-specific death rate for the community.

43. In a Markov chain, for any state i, we define

    $f_{ii} = P(X_n = i, for\ some\ n \geq 1 | X_0 = i)$.
    Then

    A. State i is recurrent if $f_{ii} = 1$, and it is transient if $f_{ii} < 1$
    B. State i is recurrent if $f_{ii} < 1$, and it is transient if $f_{ii} = 1$

C. State i is recurrent if $f_{ii} = 1$, and it is transient if $f_{ii} > 1$

D. State i is recurrent if $f_{ii} > 1$, and it is transient if $f_{ii} = 1$

44. For the sequential probability ratio test with stopping bounds P and $Q(< P)$ and strength (α, β), with $0 < \alpha < 1$ and $0 < \beta < 1$, which of the following hold

A. $P \leq \frac{1-\beta}{\beta}, Q \geq \frac{\alpha}{1-\alpha}$

B. $P \leq \frac{1-\beta}{\alpha}, Q \geq \frac{\beta}{1-\alpha}$

C. $P \leq \frac{1-\beta}{\alpha}, Q \geq \frac{\alpha}{1-\alpha}$

D. $P \leq \frac{1-\beta}{\beta}, Q \geq \frac{\beta}{1-\alpha}$

45. Let $\underline{X} = \left(\underline{X_{(1)}}, \underline{X_{(2)}}\right)' \sim N_p\left(\underline{\mu}, \Sigma\right), \underline{X_{(1)}} = \left(X_1, \ldots, X_q\right)', \underline{X_{(2)}} = \left(X_{q+1}, \ldots, X_p\right)'$, let $\underline{\mu}$ be partitioned as $\left(\underline{\mu_{(1)}}, \underline{\mu_{(2)}}\right)'$, and Σ be partitioned as $\begin{pmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{pmatrix}$. Then conditional distribution of $X_{(2)}$ given $X_{(1)} = x_{(1)}$is normal with

A. Mean $\mu_{(1)} + \Sigma_{21}\Sigma_{11}^{-1}\left(x_{(1)} - \mu_{(1)}\right)$ and covariance matrix $\Sigma_{22} - \Sigma_{21}\Sigma_{11}^{-1}\Sigma_{12}$

B. Mean $\mu_{(2)} + \Sigma_{21}\Sigma_{11}^{-1}\left(x_{(1)} - \mu_{(1)}\right)$ and covariance matrix $\Sigma_{11} - \Sigma_{12}\Sigma_{22}^{-1}\Sigma_{21}$

C. Mean $\mu_{(1)} + \Sigma_{21}\Sigma_{11}^{-1}\left(x_{(1)} - \mu_{(2)}\right)$ and covariance matrix $\Sigma_{11} - \Sigma_{12}\Sigma_{22}^{-1}\Sigma_{21}$

D. Mean $\mu_{(2)} + \Sigma_{21}\Sigma_{11}^{-1}\left(x_{(1)} - \mu_{(1)}\right)$ and covariance matrix $\Sigma_{22} - \Sigma_{21}\Sigma_{11}^{-1}\Sigma_{12}$

46. Let $\underline{X_\alpha} = \left(X_{\alpha 1}, \ldots, X_{\alpha p}\right)', \alpha = 1, \ldots, N,$ be a random sample of size $N(> p)$ from a p-variate normal distribution with unknown mean $\underline{\mu}$ and unknown positive definite covariance matrix Σ. Which of the following tests/criteria is used for testing the null hypothesis H_0: $\Sigma = \sigma^2\Sigma_0$against the alternative hypothesis H_0: $\Sigma \neq \sigma^2\Sigma_0$, where Σ_0 is fixed positive definite matrix and $\underline{\mu}$ and σ^2 are unknown

A. Hotelling's T^2 test
B. Sphericity test
C. Wilk's criteria
D. Bartlett's test

47. If a Durbin Watson statistic for large sample size takes a value close to zero, what will be the value of first order autocorrelation coefficient?

A. Close to zero
B. Close to plus 1
C. Close to minus 1
D. Close to either plus 1 or minus 1

48. Let $f_1, f_2: \Omega \to \mathbb{R}$ be two functions. Identify the incorrect statement from the following

A. If f_1 and f_2 are Borel measurable, then so is $f_1 + f_2$
B. If f_1 and f_2 are Borel measurable, then $f_1 + f_2$ is simple function
C. If f_1 and f_2 are simple functions, then so is $f_1 + f_2$
D. If f_1 and f_2 are simple functions, then $f_1 + f_2$ is Borel measurable

49. Suppose you are interested in describing whether social status, as measured by a (0,1) variable called SOC, is associated with cardiovascular disease mortality, as defined by a (0,1) variable called CVD. Suppose further that you have carried out a 12-year follow up study of 200 men who are 60 years old. In assessing the relationship between SOC and CVD, you decide that that you want to control for smoking status [SMK, a (0,1) variable] and systolic blood pressure (SBP, a continuous variable). In analyzing the data, you decide to fit logistic model involving the dependent variable CVD, with independent variable as SOC, SBP and SMK. The variable involved and their estimates coefficients are listed below:

Variable	**Coefficient**
Constant	- 1.19
SOC	- 0.50
SBP	0.01
SMK	- 0.42

The fitted logistic model is

$$A.\ \frac{1}{1 + exp\{-(-1.19 - 0.50(SOC) + 0.01(SBP) - 0.42(SMK))\}}$$

$$B.\ \frac{1}{1 + exp\{(-1.19 - 0.50(SOC) + 0.01(SBP) - 0.42(SMK))\}}$$

$$C.\ \frac{1}{exp\{-(-1.19 - 0.50(SOC) + 0.01(SBP) - 0.42(SMK))\}}$$

$$D.\ \frac{1}{exp\{(-1.19 - 0.50(SOC) + 0.01(SBP) - 0.42(SMK))\}}$$

50. The area of the feasible region for the following constraints $3y + x \geq 3$ with $x \geq 0, y \geq 0$ will be

A. Bounded
B. Unbounded
C. Convex
D. Concave

x-x-x

Stem Cell Tissue Engineering & Biomedical Excellence

1.All the following, except one represent key components of applied research;

A) The outcome results in patent generation
B) The outcome results in technology development
C) The outcome results in furtherance of knowledge
D) The outcome results in disease cure

2.Which one of the following term is used when you cite a source of reference from the preceding reference;

A) *PMID*
B) *et al*
C) *DOI*
D) *Ibid*

3.Which database would you use for finding medical literature;

A) PUBMED
B) NCBI
C) SCOPUS
D) Research Gate

4. The ethical way of performing research in stem cells necessitates registering every stem cell protocol from the institutional committee regulating the stem cell use, this committee is represented by which of the following body;

A) National Apex Committee for Stem Cell Research and treatment
B) National Apex Committee for Stem Cell and Regenerative treatment
C) National Apex Committee for Stem Cell Research and Therapy
D) National Apex Committee for Research on Stem Cell and Tissue Engineering

5.The term biosafety refers to;

A) Safety of human and environment from unintentional release of pathogenic microorganisms and biohazards.
B) Protection of human and environment from intentional release of biohazards.
C) Safety measures against chemical material
D) Safety measures against physical materials

6. By taking a level of significance of 5% it is the same as saying

A) We are 5% confident the results have not occurred by chance
B) We are 95% confident that the results have not occurred by chance
C) We are 95% confident that the results have occurred by chance
D) We are 5% confident of results being completely false

7. A biohazard warning display at the entry point of a laboratory provides all the following except one;

A) Biosafety level
B) Name of responsible investigator
C) Calling number in case of emergency
D) Weight and height of each laboratory personnel's

8. In a published research paper supplementary information helps to provide which one of the following information;

A) Information directly relevant to review
B) Information directly relevant to conclusion
C) Information directly relevant to ethics
D) Information directly relevant to biosafety

9. CPCSEA is a statutory body framed under preventing cruelty to animal act 1960. The term CPCSEA is best described by which of the following;

A) Committee permitting, crossbreeding and safety of endangered animals
B) Committee for the purpose of control and supervision of experimental animals
C) Committee providing the courses for safety of endangered animals
D) Committee promoting commercial sale of experimental animals

10. All the following except one represent route of administering drug to experimental animals;

A) Intraperitoneal
B) Intervention
C) Intravenous
D) Sublingual

11. Which one of the following is not used as a radiotracer in experimental studies;

A) ^{32}P
B) ^{14}C
C) ^{15}N
D) ^{3}H

12. For maintaining the sterility in a laboratory HEPA filters are used, the term HEPA stands for;

A) High efficiency particulate Air
B) Highly efficient particular Air
C) High efficient pertinent Air
D) Highly efficient and preventable Air

13. The term euthanasia is commonly used during research involving animals. Which one of the following best describes this term;

A) Sacrificing animal quickly and painlessly in absence of fear and anxiety
B) Sacrificing animal slowly and purposely and aggressively
C) Saving animals after anesthetizing as a part of survival surgeries
D) Saving animal following hazardous spill in animal facility

14. The term inbred strain of animal in the research involves which of the following;

A) Line of Animals produced following mating of related animals
B) Line of Animals produced following mating of non-related animals
C) Line of Animals produced following cloning procedure only.
D) Line of Animals produced following *in vitro* fertilization only.

15. The research involving use of genetic engineering requires prior approvals from which of the following committee;

A) Institutional Human Ethics Committee
B) Institutional Biosafety Committee
C) Institutional Animal Ethics Committee
D) Institutional Stem Cell Research and Therapy Committee

16. For the conclusion section in a research dissertation, which of the following is best to justify it;

A) It provides justification to the use of methodology for the research question
B) It provides key outcome of the research question
C) It provides justification to the research citation in the dissertation
D) It validates the research finding in the dissertation

17. In one of simple experiment, a drug was administered to group of 6 mice. The blood parameters were analysed in these animals before and after the drug treatment. Which of the following most commonly used statistical analysis would you carry out to analyse the data;

A) Paired t-test
B) Unpaired t-test
C) Two-way ANOVA
D) Chi square test

18. All the following except one of the following does not form the part of the final report of the successfully completed project;

A) The research plan
B) The observations of the report
C) The statistical significance of the observations
D) The outcome of the objectives

19. For developing a critical thinking and creativity in research which of the following can accordingly equip a researcher;

A) Training workshops
B) Paper presentation
C) Statistical analysis of data
D) Fulfilling the objectives of study

20. The disposal of biohazardous material requires which of the following important step;

A) Draining after diluting with water
B) Chemical decontamination and heat sterilization
C) Draining after diluting with solution containing normal saline
D) Draining after diluting with solution containing glucose

21. While developing the hypothesis for research question, the statement reads that "the drug in question gives no significant curative effect" this statement pertains to which of the following hypothesis;

A) Logical hypothesis
B) Complex hypothesis
C) Null hypothesis
D) Statistical hypothesis

22. When a researcher makes a podium presentation to the audience on the outcome of his/her research with other aspects which are important in furtherance of research in that topic, such presentations are termed as;

A) A modular training programs
B) A Journal Club
C) A workshop
D) Research seminar

23. Biostatistics utilizes statistical tools for the data analysis for different biological samples. In case it involves studying effect of a drug in a select number of animals, then these animals would actually represent which of the following;

A) A population
B) A assemblage
C) A congregate
D) A pack

24. The ages of the 10 subjects in a study were
$x_1 = 42$, $x_2 = 28$, $x_3 = 28$, $x_4 = 61$, $x_5 = 31$, $x_6 = 23$, $x_7 = 50$, $x_8 = 34$, $x_9 = 32$, $x_{10} = 37$
The mean age and median age of this dataset would be;

A) 36.6 and 33, respectively
B) 33 and 36.6, respectively
C) 36.6 for both
D) 33 for both

25. Which of the following best describe the biosafety level when an agent is associated with human disease that is rarely serious and for which preventive and or therapeutics are often available;

A) Biosafety level-1
B) Biosafety level -2
C) Biosafety level -3
D) Biosafety level -4

26. Having generated a stem cell line you were given an option to use either of the growth medium. Identify which one of the following medium does not form the part of commonly used medium for supporting stem cell growth;

A) RPMI 1640.
B) DMEM/F12.
C) M9 minimal medium
D) Amniotic fluid

27. A researcher transported a Cell line "X" in your laboratory, which of the following methodology would you exploit to confirm the authentication of the cell line;

A) Iso-enzyme analysis.
B) Iso-electric focussing
C) DNA foot printing
D) Multi-locus DNA fingerprinting

28. You isolated a novel tetrameric protein, which of the following protein structural hierarchy does exist in this protein;

A) Tertiary and Quaternary Structure
B) Primary, Secondary and Tertiary Structure
C) Primary, Tertiary and Quaternary Structure
D) Primary, Secondary, Tertiary and Quaternary Structure

29. You were asked to identify the richest source of mesenchymal stem cells, which of the following source would you work with;

A) Wharton Jelly
B) Adipose tissue
C) Bone marrow
D) Day 5.5 embryo

30. All the following cells, except one represent the cells localized within the germ stem cell niche in the drosophila ovary;

A) Cystoblast
B) Cap Cell
C) Germ Stem cell
D) Escort cells

31. The BARRET'S metaplasia or popularly known as BARRET'S oesophagus is outcome of which of the following event in the body;

A) The acid reflux causing Conversion of stratified squamous epithelial cells to columnar epithelial cells
B) The acid reflux causing Conversion of columnar epithelial cells to stratified squamous epithelial cells
C) The Alkali over release causing Conversion of columnar epithelial cells to stratified squamous epithelial cells
D) The Alkali over release causing Conversion of stratified squamous epithelial cells to columnar epithelial cells

32. You have isolated the hepatic liver stem cell named oval cell, when you exposed these cells to high level of glucose these cells differentiated to express glucagon, identify which of the following represent the best possible explanation for this effect;

A) Antisense activation of insulin led to glucagon expression in these cells
B) It is an artefact of *in vitro* cell culture
C) It is simply due to the fact that hepatic oval cells also contain pancreatic progenitors
D) Trans-differentiation of liver progenitors to pancreatic lineage

33. You were asked to generate a feeder cell line from skin fibroblasts, which of the following method would you exploit to achieve this;

A) IR exposure and mitomycin treatment
B) UV exposure and mitomycin treatment
C) IR exposure and high glucose treatment
D) UV exposure and high glucose treatment

34. A Structure obtained during the development of *Drosophila melanogaster,* shows that cells are arranged on periphery separated from each other through a septum. This structure is termed as;

A) Syncytial blastoderm
B) Cellular blastoderm
C) Cocoon
D) Larva

35. All the following natural processes, except, one of the following are important in regulating the stem cell character;

A) Protein covalent modification
B) Cell senescence
C) miRNA silencing
D) Epigenetic modification

36. Which one of the following is the prerequisite for the process of trans-differentiation;

A) Process of Apoptosis
B) Process of differentiation
C) Process of dedifferentiation
D) Process of Necrosis

37. Which one of the following is considered to possess totipotential character;

A) Epiblast
B) Inner cell mass
C) Embryoid bodies
D) Two stage Blastomere

38. During the embryonic development two extra embryonic lineages are formed i.e. Trophectoderm and primitive endoderm, which of the following differentiated structures are generated from these two lineages;

A) Placenta only
B) ICM and yolk sac mesoderm component
C) Placenta and ICM
D) Placenta, amnion, and allantois

39. You injected two separate somatic cell populations in a nude mouse, how would you analyse as to which cell population represented embryonic stem cell population;

A) The one that formed teratoma in nude mice
B) The one that prevented formation of teratoma in nude mice
C) The one that formed blastomere in nude mice
D) The one that formed zygote in nude mice

40. During *Drosophila* development you injected a protein that caused formation of head structures at the site of injection, identify which of the following character does this protein possess;

A) Mutagen
B) Morphogen
C) Mitogen
D) Teratogen

41. Upon differentiation of embryonic stem cells to muscle lineage, variations in the methylation pattern of genes regulating cell cycle was observed. You were asked to identify the methylation pattern on these genes, which methodology would you exploit to achieve it;

A) Shotgun sequencing
B) Dideoxy sequencing
C) Bisulfite sequencing
D) Sanger sequencing

42. Yamanaka transfected one of the following group of transcription factors to convert fibroblast cells to pluripotent stem cells which of transcription factors brought this change;

A) OCT 3/4, Sox2, KIF4, c-Myc
B) OCT 3/4, GRB, KIF4, HIF1
C) OCT 3/4, GRB, HIF1, c-Myc
D) OCT 3/4, Sox2, Nanog, HIF1,

43. The development of transgenic mouse using microinjection methodology involves generation of pseudo-pregnant female mouse. These animals are produced for which of the following purpose;

A) For implanting genetically manipulated fertilized eggs
B) For implanting genetically manipulated unfertilized eggs
C) For inducing superovulation in the mouse
D) For retrieving fertilized eggs for genetic manipulation

44. You were asked to isolate a protein important for energy store house of the cell, which methodology would you employ to reach to this organelle to enrich this protein;

A) Sonication
B) Differential Centrifugation
C) Electrophoresis
D) Fluorescence microscopy

45. You isolated condition media from the cells which got differentiated to myogenic lineage. Treating this condition media with charcoal for 4 hours now prevented the condition media's ability to differentiate MSC to myogenic lineage compared to non-charcoal treated condition media. From this observation, identify which of the following biomolecules was responsible for the differentiation of the MSC's to myogenic lineage;

A) Calcium
B) Protein
C) Lipid
D) Antisense RNA

46. You were asked to generate an obese mouse transgenic for gene "x", All the following methods except one will not give the desired outcome, identify that one methods;

A) Retroviral vector method
B) DNA microinjection method
C) Introduction of genetically engineered stem cells
D) Through injection of adipocytes from brown adipose tissue to nude mice

47. Which one of the following stem cell marker is not discriminatory between the human and mouse stem cells

A) Liver alkaline phosphatase
B) SSEA-3
C) SSEA-1
D) SSEA-4

48. Which of the following *in vivo* structure possesses the similar characters as provided by embryonic stem cells under *in vitro* state;

A) Epiblast
B) Trophoblast
C) Hemangioblast
D) Hypoblast

49. A method of selectively removing the external cell layer of a blastocyst through a cytotoxicity procedure employing antiserum to retrieve the cells of ICM is termed as;

A) Immunotherapy
B) Immunodetection
C) Immunosurgery
D) Immunosorting

50. While carrying out the PCR reaction for identifying pluripotent stem cell marker for a newly generated cell line, a mistake happened wherein Mg^{2+} ion concentration was drastically increased in the reaction tube, what would be the outcome of this effect;

A) It increases the fidelity and specificity of Polymerase
B) It has not affect on the fidelity and specificity of Polymerase
C) It decreases the fidelity and specificity of Polymerase
D) It would interfere with annealing of primers

x-x-x

System Biology & Bioinformatics

1. Research problem is selected from the standpoint of
   A) Social relevance
   B) Financial support
   C) Researcher's interest
   D) Availability of relevant literature

2. Which one among the following statements is correct in context to research?
   a) Research refers to a series of systematic activity or activities undertaken to find out the solution to a problem.
   b) It is a systematic, logical and unbiased process wherein verification of hypotheses, data analysis, interpretation and formation of principles can be done.
   c) It is an intellectual inquiry or quest towards truth,
   d) It enhances knowledge.

   Select the correct answer from the codes given below:
   A) a), b), c) and d)
   B) a), b) and c)
   C) b), c) and d)
   D) a), c) and d)

3. How to judge the depth of any research?
   A) By research title
   B) By research duration
   C) By research objectives
   D) By total expenditure on research

4. What is the main aim of interdisciplinary research?
   A) To over simplify the problem of research
   B) To bring out the holistic approach to research
   C) To create a new trend in research methodology
   D) To reduce the emphasis on a single subject in the research domain

5. What is the major attribute of Correlation Analysis?
   A) Association among variables
   B) Difference among variables
   C) Regression among variables
   D) Variations among variables

6. A systematic literature review is:
   A) One which starts in your own library, then goes to on-line databases and, finally, to the internet
   B) A replicable, scientific and transparent process
   C) One which gives equal attention to the principal contributors to the area
   D) A responsible, professional process of time-management for research

7. What is self-plagiarism?
   A) When a person lifts material that they have previously written and pass it off as their own work
   B) Taking about yourself too much
   C) Using somebody else's work and passing it off as your own
   D) An epistemological stance

8. When accessing the internet, which of these steps is the most essential?
   A) Recording the full URL
   B) Noting the access dates
   C) Downloading material to be referenced
   D) They are all equally important

9. A meta-analysis would allow you to:
   A) Replicate many studies.
   B) Assess the reliability of a study
   C) Explore the variations or inconsistencies in the outcomes of lots of studies.
   D) Identify the antecedents of a behaviour

10. If you find that someone else publishes work similar to yours before your project is completed, what could you do?
   A) Change your hypotheses and aims.
   B) There is nothing you can do so do not mention it in your study.
   C) Completely revamp your ideas so you are not replicating their study.
   D) Acknowledge it in your report and evaluate the study.

11. Triangulation refers to what?
   A) Triangulation refers to the attempt to dispute prior findings
   B) Triangulation refers to the replication of findings within settings, using different methods of data collection or analysis.
   C) Triangulation refers to something you use a map and compass for.
   D) Triangulation refers to a stage of the literature reviewing process.

12. What are the core elements of a dissertation?
   A) Introduction; Data Collection; Data Analysis; Conclusions and Recommendations
   B) Executive Summary; Literature Review; Data Gathered; Conclusions; Bibliography
   C) Research Plan; Research Data; Analysis; References
   D) Introduction; Literature Review; Research Methodology; Results; Discussions and Conclusions

13. Which of the following describe the middle part of a group of numbers?
   A) Measure of Variability
   B) Measure of Central Tendency
   C) Measure of Association

D) Measure of shape

14. In an ER model, _____ is described in the database by storing its data.
A) Entity
B) Attribute
C) Relationship
D) Notation

15. _____ is a full form of SQL.
A) Standard query language
B) Sequential query language
C) Structured query language
D) Server side query language

16. _____ programs are automatically loaded and operates as a part of browser.
A) Utilities
B) Plug-ins
C) Add-ons
D) Widgets

17. The process not needed in Experimental Researches is
A) Controlling
B) Manipulation
C) Observation
D) Content Analysis

18. Newton gave three basic laws of motion. This research is categorized as
A) Sample Survey
B) Applied Research
C) Descriptive Research
D) Fundamental Research

19. Which one of the following is an indication of the quality of a research journal?
A) h-index
B) g-index
C) i10-index
D) Impact factor

20. The variable which impacts the relationship between an independent variable and a dependent variable is known as
A) Precedent variable
B) Control variable
C) Predictor variable
D) Antecedent variable

21. When academicians are called to deliver lecture or presentations to an audience on certain topics or a set of topics of educational nature, it is called
A) Seminar
B) Training Program
C) Workshop

D) Symposium

22. What type of coding would this multiple choice question produce?
A) Pre-coded
B) Qualitative coding
C) Coding emerging from the data
D) Researcher imposed coding

23. Research ethics has a direct connection more often with which stages of research?
A) Problem formulation and reporting of research findings.
B) Defining and delimiting the scope of research.
C) Deciding about statistical techniques and data analysis.
D) Defining the population and deciding the sampling technique for research.

24. Concerning the expression of numbers in research reports, which of the following sentences is correct?
A) Thirty 4 participants completed the questionnaire, of which 20 were female.
B) Thirty-four participants completed the questionnaire, of which 20 were female.
C) Thirty-four participants completed the questionnaire, of which twenty were female.
D) 34 participants completed the questionnaire, of which 20 were female.

25. Who is an effective communicator?
A) The one with histrionic talents
B) The one who is clear with what he says
C) The one who is a humourous speaker
D) The one who can speak in many languages

26. IP_3 initially causes calcium ions to be released into the cytoplasm from
A) Mitochondria
B) Lysosome
C) Endoplasmic reticulum
D) Plasma membrane (extracellular to intracellular)

27. A prophage is
A) An auxotropic mutant
B) A gene
C) A phage DNA incorporated into the host genome
D) The DNA of a lytic phage

28. Somatic mutation of immunoglobin genes accounts for
A) Allelic exclusion
B) Class switching from IgM to IgG
C) Affinity maturation
D) Increased expression of Ig gene

29. The Proteome
A) Can only usefully be studied in conjunction with the phenome
B) Refers to the entire complement of proteins
C) Is what functional genomics is primarily interested in understanding

D) Is now most commonly studied using microarray

30. Highly cooperative binding of a ligand to multiple binding sites on a biomolecule is best demonstrated by
A) Adair Plot
B) Hill plot
C) Lineweaver Burk plot
D) Arrhenius plot

31. One Dimensional polyacrylamide gel electrophoresis in the absence of SDS resolves proteins based on their mass and
A) Charge
B) Hydrodynamic volume
C) Secondary structure
D) Hydrophobicity

32. The di-peptide Lys-Glu on electrophoresis at pH 6.0 would
A) Move towards anode (+)
B) Move towards cathode (-)
C) Remain stationary
D) Get degraded

33. Which of the following contributes nitrogen atoms to both purine and pyrimidine rings?
A) Aspartate
B) Carbamoyl phosphate
C) Carbon dioxide
D) Glutamine

34. A collection of interacting elements that carry out a specific biological task is the definition of a _____.
A) Proteome
B) Biological context
C) Genome
D) Biological system

35. The channeling of biological information for use in the execution of particular biological functions is the role of a _____.
A) Molecular machine
B) Protein network
C) Basal transcription apparatus
D) *cis*-control element

36. Transcription factors and cis-control elements act as components of _____.
A) Gene regulatory networks
B) Protein networks
C) Molecular machines
D) The interactome

37. A data base of current sequence map of the human genome is called
A) OMIM

B) HGMD
C) Golden Path
D) GeneCards

38. PRINTS is a software used for
A) Detection of genes from genome sequences
B) Detection of tRNA
C) Prediction of function of a new gene
D) Identification of functional domains and motifs of proteins

39. Which type of genomics studies the physical nature of genomes?
A) Comparative genomics
B) Structural genomics
C) Functional genomics
D) Sequence genomics

40. The goal of _____ is to determine the location of specific genes within the genome.
A) Cloning
B) Annotation
C) Proteomics
D) Microarray

41. In an analysis of eukaryotic gene, you identify several non-overlapping open reading frames, but they are not all in the same frame. Which explanation makes the most sense?
A) By random chance, a second reading frame within the gene also has an open reading frame.
B) This gene includes introns which are not multiples of three.
C) This is a mutant allele that has had several small insertions.
D) The software has errors.

42. Why might you want to search a database for a protein motif?
A) A specific motif may impart a specific function to the molecule. You could then identify groups of proteins that may have similar functions.
B) Presence of a specific motif in several proteins indicates that they are likely to be all from the same species.
C) Absence of a specific motif from one of a pair of otherwise similar proteins indicates that they are produced by alternative splicing of the same gene.
D) To identify the gene.

43. If computers were not able to access the entire genomic sequence of an organism, which of the following techniques might allow determination of the gene sequence that encodes a particular protein?
A) PCR amplification of related gene sequences
B) Hybridization of a genomic library with a degenerate probe.
C) Production of synthetic peptides
D) Microarray

44. The symbiotic bacteria responsible for producing bio luminescence is
A) *Vibrio cholerae*
B) *Pseudomonas putida*

C) *Vibrio fischeri*
D) Chromobacterium sp.

45. Conversion of glucose to glucose-6- phosphate requires energy. However, critically ill patients are treated with intravenous infusion of glucose rather than glucose -6-phosphate because
A) Glucose-6-phosphate is unable to enter into cells
B) Glucose-6-phosphate is degraded very fast
C) Exogenous glucose-6-phosphate is toxic to the cells
D) Exogenous glucose-6-phosphate will competitively inhibit endogenous enzymes

46. HeLa cell line is derived from which type of carcinoma?
A) Lung
B) Colon
C) Cervical
D) Brain

47. The E-value in a BLAST search measures
A) The probability that the search result is non-random
B) The significance of the search result
C) The probability that the search result is obtained randomly
D) The reliability of the search

48. The technique for identifying the nucleic acid sequences bound by a DNA/RNA binding protein is
A) Finger printing
B) Foot printing
C) Array printing
D) AFLP

49. Which is a model organism database?
A) GOLD
B) SGD
C) PROMISE
D) SCOP

50. DBMS is a collection of _____ that enables user to create and maintain a database.
A) Keys
B) Translators
C) Program
D) Language Activity

x-x-x

(ZOOLOGY)

1. FISH analysis is useful for
A. Determining the order of DNA fragments in a YAC.
B. Determining the chromosomal location of a gene.
C. Determining the pattern of expression of cloned genes.
D. Determining the map order of two closely linked genes.

2. Aerosol-tight enclosure with a non-opening, completely sealed, front window, so that the operator is separated from their work by a physical barrier
A. Biosafety cabinet Class I
B. Glove Box
C. Fume hoods
D. Horizontal Laminar flow

3. To elute target proteins from an affinity chromatography matrix, which of the following condition would be the most appropriate?
A. Low salt concentrations.
B. High salt concentrations.
C. Adding a soluble ligand which competes with the affinity tagged protein for binding to the column.
D. Just keep washing buffer through the column isocratic elution.

4. Which of the following is a false statement regarding the separation of DNA fragments using gel electrophoresis?
A. A pH gradient is created within agarose gel allowing for the separation of DNA fragments based on their isoelectric point.
B. Since nucleic acids are negatively charged, DNA fragments will migrate towards the positively charged electrode (anode).
C. DNA fragments are separated from each other according to relative size with smaller DNA fragments migrating faster through the agarose gel than larger fragments.
D. Ethidium bromide added to DNA sample, gel and buffer can insert within the DNA based on double helix and can fluoresce when exposed to UV light, thus allowing the DNA fragments to be visualized.

5. How many rpm is needed to centrifuge a sample at 100,000 x g in a rotor with a radius of 7.2 cm?
A. 30,100
B. 35,246
C. 43,758
D. 500,300

6. Fluorescence microscopy is based on the ability of certain molecules to
A. Continuously emit light of a constant wavelength
B. Absorb light of many different wavelengths
C. Absorb light of a given wavelength and then emit light of a longer wavelength
D. Absorb light of a given wavelength and then emit light of a shorter wavelength

7. A p value greater than 0.05 means

A. Null hypothesis is true
B. Hypothesis is false and should be rejected
C. No effect was observed.
D. Alternate hypothesis is true.

8. In Native PAGE proteins are separated on the basis of

A. Net negative charge
B. Net charge and Mass
C. Net positive charge and Mass
D. Net positive charge

9. Degree of scattering in transmission electron microscope is a function of

A. Wavelength of electron beam used
B. Number of atoms that lie in the electron path
C. Number and mass of atoms that lie in the electron path
D. Mass of atoms that lie in the electron path

10. What is the order of the steps during western blotting?

A. Blocking, protein detection, primary antibody incubation, transfer and secondary antibody incubation
B. Primary antibody incubation, blocking, transfer, protein detection and secondary antibody incubation
C. Transfer, primary antibody incubation, secondary antibody incubation, blocking and protein detection
D. Transfer, blocking, primary antibody incubation, secondary antibody incubation and protein detection

11. Blue-white selection is used

A. To test for the presence of a plasmid in bacteria.
B. To reveal the identity of a cloned DNA fragment.
C. To express the product of a cloned gene.
D. To test for the presence of a cloned insert in a plasmid.

12. FSC and SSC in a flow cytometer determines

A. Cell Size and granularity respectively
B. Cell Granularity and size respectively
C. Cell granularity and fluorescence respectively.
D. Cell fluorescence and size respectively.

13. Anchorage-dependent culture of usually one cell in thickness with a continuous layer of cells at the bottom of the culture vessel is called

A. Suspension culture
B. Monolayer culture
C. Lymphocyte culture
D. Polyxenic culture

14. A statutory body established to monitor the experimentation on animals in medical education and research is

A. CPCSEA
B.CSCPEA
C. IBSC
D. IAEC

15. A plate-based immunosorbent assay in which the enzyme-labelled primary antibody binds to the antigen

A. Indirect ELISA
B. Competitive ELISA
C. Direct ELISA
D. Sandwich ELISA

16. Process of correcting the fluorescence spill over in flow cytometer is called

A. Compensation
B. Voltage gating
C. Threshold setting
D. Cell sorting

17. Parasite culture containing many unknown associated microorganisms is called

A. Dixenic
B. Monoxenic
C. Axenic
D. Xenic

18. In Laminar air flow which type of filter is used.

A. Membrane filter
B. Seitz Filter
C. HEPA filter
D. Band Reject filters

19. The THP1 is a

A. Human monocyte suspension cell line
B. Mouse monocyte adherent cell line
C. Human macrophage suspension cell line
D. Mouse macrophage suspension cell line

20. The administration route for a drug injected just beneath the top layer of the skin is called

A. Intradermal
B. Intramuscular
C. Intraosseous
D. Intravenous

21. Which of the following is correct about freeze fracture technique?

A. It involves physical breaking of frozen biological samples.
B. Cryoprotection with ethyl alcohol.
C. It involves physical breaking of live biological samples.
D. Fixation in formaldehyde.

22. Lamp used as the light sources of a spectrophotometer in the ultraviolet range is
A. Tungsten lamp
B. Deuterium lamp
C. Argon lamp
D. Krypton Lamp

23. In which microscope, only refracted or reflected light by specimen enters the objective and forms the image
A. Compound microscope
B. Phase contrast microscope
C. Dark field microscope
D. Fluorescence microscope

24. What is the term of a patent in the Indian system?
A. 10 years
B. 15 years
C. 20 years
D. 25 years

25. Disadvantage of formalin fixed stool samples is
A. Bacterial overgrowth of the sample
B. Further development of helminthic ova
C. Unsuitability for the preparation of permanent stained smears
D. Distortion of cyst morphology

26. The rough endoplasmic reticulum is required for the synthesis of which of the following?
A. Peroxisomes
B. Lysosomes
C. Nucleus
D. Chloroplasts

27. Interaction at close range between two or more cells or tissues of different history and properties is called as
A. Equivalence group
B. Competence
C. Induction
D. Potency

28. The portion of circulatory system with the largest cross-sectional area is the
A. Large arteries
B. Arterioles
C. Capillaries
D. Large veins

29. The 'A' band of voluntary muscle contains
A. All myosin but no actin
B. All actin but no myosin
C. All myosin but some actin
D. All actin and some myosin

30. The most common of the pleiotropic effect of a gene is due to

A. The same product of the given gene being involved in different metabolic pathways.
B. The gene making very different products in cell types.
C. The DNA sequence of the gene getting changed in cell specific manner
D. The gene not functioning in some cells.

31. In drosophila sex is determined by

A. X and Y chromosomes
B. Ratio of pairs of X-chromosomes to the pairs of autosomes
C. Ratio of number X chromosomes to the set of autosomes
D. Whether the egg is fertilized or develops parthenogenetically.

32. If corpora allata is removed from nymph,

A. Nymph will metamorphose into adult
B. Nymph will metamorphose into IInd stage and will remain in the same stage
C. Nymph will die
D. It will always remain a nymph

33. If prospective neural ectoderm of late gastrulae is transplanted to prospective skin ectoderm region of another late gastrula it gives rise to

A. Neural plate
B. Epidermis
C. Notochord
D. Somites

34. Which of the following biomes is more vulnerable to invasion by outside animals and plants?

A. Temperate forest
B. Tropical evergreen
C. Oceanic island communities
D. Mangroves

35. Which of the following is not coded by MHC genes?

A. Components of complement pathway
B. Immunoglobulins
C. Glycoproteins
D. Antigen presenting proteins

36. Find the incorrect statement

A. All allotypes cannot be neotypes
B. Paratypes and Lectotypes cannot exist together.
C. Paralectotypes are unlabeled syntypes
D. Holotype, lectotype and syntype are the name bearing specimens.

37. Frequency of a recessive is 0.4. What is the frequency of heterozygous carriers in a population of 400?

A. 144
B. 100
C. 192
D. 64

38. A Type 1 survivorship curve is characteristic of the species with a rapid increase in mortality in old age. This type of curve is

A. Typical of many invertebrates that produce a large number of offspring.
B. Typical of humans and other large mammals.
C. Almost never found in nature
D. Typical of all species of birds

39. Pattern of 'bee dance' used for foraging and communication are

A. Spiral and round dance
B. Round and tail wagging dance
C. Elliptical and spiral dance
D. Tail wagging and wing flippering dance.

40. Which enzyme catalyzes the phosphodiester bond formation between two adjacent okazaki fragments after the primers have been removed and the gap has been filled with appropriate nucleotides?

A. DNA polymerase III
B. DNA polymerase alpha
C. DNA ligase
D. DNA polymerase I.

41. Affinity maturation results in

A. More macrophage populations
B. Antibodies with a capacity to bind more tightly to a foreign antigen.
C. Slower immune complex formation
D. Rapid immunoglobulin gene rearrangements

42. A fellow scientist identifies a KDEL sequence in the amino acid sequence of protein X. The student is interested in determining where protein X is localized in the cell and makes a GFP fusion to express in animals' cells. Where do you predict protein X GFP to be located?

A. The nucleus
B. Peroxisome
C. All in the endoplasmic reticulum
D. Mainly in the endoplasmic with some in the cis-Golgi network.

43. Class Cephalopoda includes those animals which have

A. Head located on foot
B. Notochord extends upto head
C. Foot located on head
D. Head fused with thorax

44. Which character differentiates the fertilized eggs of *Ascaris lumbricoides* from unfertilized eggs

A. Don't float on the concentrated salt solution
B. Larger in size
C. Always non mammillated
D. Possess a clear crescentic space at each pole

45. The swimming movement of Scoliodon is controlled by

A. Cerebrum
B. Mid brain
C. Hind brain
D. Spinal cord

46. The bottom cold zone of a lake showing no temperature gradient is called

A. Epilimnion
B. Thermocline
C. Hypolimnion
D. Metalimnion

47. Identify the odd combination of the habitat and the particular animal concerned.

A. Kaziranga national Park- One horned Rhinoceros
B. Bharatpur National park- Birds
C. Kanha National Park- Tiger
D. Dudhwa national park-Orangutan

48. Chloragogen cells of earthworm are

A. Present in the coelomic fluid and are similar to liver in vertebrates
B. Present in the coelomic fluid and similar to kidney in vertebrates
C. Present in the cuticle and similar to liver in vertebrates
D. Present in the cuticle and similar to kidney in vertebrates

49. Which of the following is a freshwater shark?

A. *Tor tor*
B. *Catlacatla*
C. *Wallago attu*
D. *Cirrhinusmrigala*

50. Two intermediate hosts are essential to complete the life cycle in

A. Cestodes, except *Diphyllobothrium latum*
B. Nematodes
C. Trematodes
D. Sporozoa