Anthropology(Ph.D.)

1. The theory of natural selection was postulated by

   A) Darwin B) Lamarck C) Mendel D) Weisman

2. *Origin of Species* is written by

   A) Buffon B) Linnaeus C) Lamarck D) Darwin

3. The earliest primate emerged

   A) 200 mya B) 100 mya C) 30 mya D) 65 mya

4. Linea aspera is found in

   A) Humerus B) Cranium C) Femur D) Tibia

5. Mutation theory of evolution was proposed by

   A) Mendel B) Hugo de Vries C) Johannsen D) Weisman

6. Dental formula of Chimpanzee is

   A) 2.1.2.3 B) 2.1.3.3 C) 3.1.3.3 D) 2.1.2.2

7. *Homo erectus sinanthropus* was discovered from

   A) Germany B) England C) China D) Tanzania

8. Gorilla belongs to the family

   A) Hominidae B) Pongidae C) Himininae D) Ponginae

9. Cranial capacity of *Australopithecus*

   A) 800-900cc B) 400-700 cc C) 900-1200cc D) 1000-1300cc

10. The driving force of evolution is

    A) Natural selection B) Mutation C) Variation D) Genetic drift

11. Mendel formulated the law of purity of gametes on the basis of

    A) Monohybrid cross B) Test cross C) Back cross D) Dihybrid cross

12. The 'Descent of man' was written by

    A) Raymond Dart B) Charles Darwin
    C) Robert Broom D) H.J. Muller

13. Scientist who along with Darwin postulated the mechanism of natural selection.

    A) Carl Linnaeus B) Jean-Baptiste Lamarck
    C) Alfred Russel Wallace D) Augustus Weismann

14. *Ramapithecu*s is considered as most probable ancestor of Homo sapiens because

A) It has big cranial capacity
B) It has well developed supra-orbital torus
C) Probably an erect biped with hands free
D) Did not use teeth as weapons

15. *Propliopithecus* considered as ancestral form of modern

A) Chimpanzee B) Gorilla C) Gibbon D) Orangutan

16. Occurrence in the same population of two or more alleles at one locus, each with appreciable frequency is called?

A) Genetic mutation B) Genetic polymorphism
C) Genetic drift D) Homozygote

17. Which part of human skeleton is most sex dimorphic?

A) Long bones B) Pelvic girdle C) Skull D) Ribs

18. The Hardy Weinberg equation is? (p & q represents the allelic frequencies)

A) $p^2 + 2pq + q^2 = 1$ B) $p^2 - 2pq + q^2 = 1$
C) $p + q = 0$ D) $p - q = 0$

19. CroMagnon, Grimaldi, and Chancelade belong to

A) Early Pleistocene B) Holocene
C) Pliocene D) Late Pleistocene

20. Which one of the following is not included under the mitosis process?

A) Prophase B) Metaphase
C) Anaphase D) None of these

21. Chemical composition of chromosome is

A) DNA and proteins B) DNA and lipids
C) DNA and carbohydrates D) Proteins and lipids

22. The representative stone tools of Abbevillian and Acheulian cultures are

A) Cleavers B) Choppers C) Handaxes D) Burins

23. The deposits caused by permanent course of water flow are called

A) Alluvial deposits B) Fluvial deposits
C) Morains D) Both A and B

24. Mousterian culture belongs to

A) India B) Europe C) Africa D) America

25. Dart thrower belongs to which phase of Upper Palaeolithic culture

A) Perigordian B) Aurignacian C) Solutrean D) Magdalenian

26. The discovery of Bhimbetka is associated with

A) HD Sankalia
B) VN Misra
C) VS Wakankar
D) Robert Bruce Foote

27. Venus of Willendorf belongs to

A) Aurignacian
B) Perigordian
C) Solutrean
D) Magdalenian phase

28. Scrapers belong to

A) Lower Palaelithic Culture
B) Middle Palaeolithic Culture
C) Upper Palaeolithic Culture
D) Mesolithic Culture

29. Osteodontokeratic Culture was discovered by

A) Raymond Dart
B) LSB Leakey
C) De Terra and Paterson
D) Lessile White

30. Bagor is a

A) Lower Palaeolithic site
B) Middle Palaeolithic site
C) Upper Palaeolithic site
D) Mesolithic site

31. The concept of post-industrial society was first formulated by

A) Elton Mayo B) D. Bell C) Saint Simon D) None of these

32. The term in Socio-cultural anthropology stands for a process of transmission of culture traits from one culture to the other, thereby bringing about change in the recipient culture. It is concerned with the phenomenon of traits belonging to a culture reaching in new geographical location by contract or migration

A) Acculturation B) Transculturation C) Diffusion D) Evolution

33. Which of the following term refers to the dynamic inter-relationship between Man and the natural and cultural component of his environment

A) Cultural materialism
B) Cultural focus
C) Shock
D) Cultural ecology

34. Which of the following is true for peasant societies?

A) Cultivators constituting the total population
B) Cultivators and others involved in the economy
C) Cultivators and money lenders as the core segment of population
D) None of the above

35. Who claimed that the culture is a part of nature?

A) EB Taylor B) AL Kroeber C) Klyde Kluckhonn D) Franz Bose

36. Who among the following is associated with Neo-Evolutionism?

A) Margaret Mead B) Leslie A White C) R. Linton D) EB Tylor

37. Which of the following is not a feature of modern family?

A) Economic independence B) Corporate character
C) Decline of religious control D) Small size

38. Observing the people and writing the accounts of observation of the lives of the people in a particular society or culture at a time is called ethnography. Ethnographic data from many societies when put on a comparative scale yield anthropological theories is known as:-

A) Field-Work B) Technique of Field-Work
C) Participant Observation D) Ethnography

39. Matrilineal family is found in India among the

A) Gonds of Madhya Pradesh B) Kadars of Malabar forest
C) Khasis of Meghalaya D) Todas of South India

40. A rule of preference of marriage between specifically related persons is

A) Levirate B) Preferential C) Sorogate D) Exogamy

41. The concept of Sanskritization was first used by M.N. Srinivas in his work:-

A) *The Remembered Village* B) *Social Change In Modern India*
C) *Religion and Society among the Coorgs* D) *India's Village*

42. Marriage of a man of a higher caste with a woman of a lower cast is called

A) Sorogate B) Concubinage C) Hypogamy D) Hypergamy

43. "The interpretation of cultures: Selected essays" was written by

A) Radcliff Brown B) Malinowski C) Clifford Geertz D) Emile Durkheim

44. The 'Jajmani system' represents the

A) Relationship between higher and lower castes
B) Ritualistic superiority of the higher caste
C) Binary opposition between pure and impure
D) Functional interdependence of different castes in villages

45. Westernization refers to

A) Adoption of Western/European/American fashions
B) Adoption of new values
C) Wholesale cultural emulation of a reference group of collective level
D) An individual's quest for upward social mobility

46. Who has described empathy, mobility and high participation as the three basic features of modernized personality

A) Eisenstadt B) Marx C) Pareto D) Lerner

47. Who among the following anthropologists applied cultural materialist principles to the solution of concrete problems concerning cultural differences and similarities. His/her research strategy is 'Method of Cultural Ecology'

A) Clifford Geertz B) Steward C) Peter Worsley D) James Clifford

48. Who amongst the following Indian anthropologist wrote extensively on the regional dimensions of India?

A) GS Ghurye B) NK Bose C) MN Srinivas D) SC Dube

49. Match an item in List-I with an item in List-II. Use the codes given below:-

List- I	**List-II**
a) Lucy Mair	I. The Elementary Structure Of Kinship
b) Marvin Harris	II. Anthropology, The Study Of Man
c) E. A. Hoebel	III. The Cultural Anthropology
d) Levi-Strauss	IV. An Introduction to Social Anthropology

Codes :

	a)	b)	c)	d)
A)	IV	III	II	I
B)	I	III	IV	II
C)	IV	II	III	I
D)	I	II	III	IV

50. Match an item in List-I with an item in List-II. Use the codes given below:-

List- I	**List-II**
a) D.N. Majumdar	I. A Fortune of Primitive Tribes
b) S.C. Dube	II. Power and Conflict in Village India
c) M.N. Srinivas	III. Caste in Modern India
d) L.P. Vidyarthi	IV. Sacred Complex in Hindu Gaya

Codes :

	(a)	(b)	(c)	(d)
A)	IV	III	II	I
B)	I	III	IV	II
C)	IV	II	III	I
D)	I	II	III	IV

x-x-x

Bio-Chemistry(Ph.D.)

1. In prokaryotes the protein synthesis begins with

   A) N-formyl glycine
   B) N-formyl serine
   C) N-formyl methionine
   D) N-formyl cysteine

2. Which binding step is inhibited by chloramphenicol?

   A) Initiator-tRNA to 30S/40S initiation complexes
   B) Aminoacyl-tRNA to the A-site of 30S subunit
   C) Peptidyl t-RNA to the 50S subunit
   D) Formation of peptide bond in P site

3. DNA repair mechanisms can distinguish old strand of DNA from newly synthesized strands because

   A) New strands are glycosylated while old are not
   B) Old strands are methylated while new strands are not
   C) New stands are methylated while old strands are not
   D) New strands do not contain cytosine bases

4. A nontranslated sequence which is located between transcription and the translation start site?

   A) Ending frame
   B) Leader sequence
   C) Trailer sequence
   D) Reading frame

5. Of immunoglobulin pool in human serum which of the following accounts for major immunoglobulin fraction?

   A) IgA B) IgD C) IgG D) IgM

6. In which of the following order, distinct temperature governed steps in PCR proceed

   A) Annealing, Synthesis, Denaturation
   B) Synthesis , Annealing, Denaturation
   C) Denaturation, Annealing, Synthesis
   D) Denaturation, Synthesis, Annealing

7. Which one is correctly matched?

   A) *Bacillus thuringiensis* – Taq polymerase
   B) Thermus aquaticus- DNA Ligase
   C) Agrobacterium tumefaciens – plasmid
   D) Bam HI- vector

8. In a double-stranded DNA sequence given below

   5’- ATGTTTAGGGCC -3’
   3’- TACAAATCCCGG -5’

   If, top strand is the sense strand , coding for mRNA molecule. What would be the sequence of corresponding segment of anti-sense RNA.

   A) 5’-CCGCGAUUUGUA-3’
   B) 5’-GGCCCUAAACAU-3’
   C) 5’-UACAAAUCGCGG-3’
   D) 5’-AUGUUUAGGGCC-3’

9. Cloning vector differ from expression vector in not having

   A) An ori sequence
   B) Marker genes
   C) Multiple cloning sites
   D) Regulatory and Control elements

10. In transgenic animals, in order to express heterologous protein in animal milk, gene must be expressed under which promoter

A) LacZ B) Preproinsulin C) β lactoglobulin D) β globin

11. Absorbance spectra values of a DNA sample at wavelength 210, 225, 260, 277, 280 and 290 were recorded as 1, 1.2, 2.0, 1.4, 1.5 and 1.45. What would be the quantity and quality of the given DNA sample (given 1.0 OD at A_{260} =50µg/ml DNA amount)

A) 50 µg/ml, contaminated with protein
B) 100 µg/ml, contaminated with protein
C) 50 µg/ml, DNA free of protein contamination
D) 100 µg/ml, DNA free of protein contamination

12. The linking number in a relaxed DNA molecule is 200. If four turns are removed from this molecule linking number changes to 198. What would be the super helical density (σ) of such molecule

A) -0.02 B) +0.02 C) -0.0204 D) +0.0204

13. In which order different gene segments encoding for immunoglobulin heavy chain (H) are arranged in genome

A) V, J, D and C B) D, J, V and C C) V, D, J, and C D) V, D, C, and J

14. Opsonization term is related with

A) Antibody or complement mediated phagocytosis of antigens
B) Complement mediated phagocytosis of antibody
C) Antibody mediated viral inactivation
D) Antibody mediated degranulation

15. The process of replacement of vir region from Ti plasmid is called as

A) Gene inactivation B) Gene displacement
C) Disarming D) Gene insertional inactivation

16. Which of the following is not able to illicit an immune response unless bound to another molecule?

A) Virus B) Hapten C) Antigen D) Antibody

17. In Nucleosome structure, histone octamer is comprised of

A) Eight positively charged histone proteins (two of each H2A, H2B, H3 and H4)
B) Eight negatively charged histone proteins (two of each H2A, H2B, H3 and H4)
C) Nine positively charged histone proteins (H1 and two of each H2A, H2B, H3 and H4)
D) Nine negatively charged histone proteins (H1 and two of each H2A, H2B, H3 and H4)

18. Which of the following acts as stop codon

A) UGG, UUG, UAG B) UAG, UGA, UAA
C) UAG. UAA, UUG D) UGA, UAA, UGG

19. Content of triglyceraldehyde is highest in

A) HDL B) Chylomicrons C) LDL D) VLDL

20. Glycogen is degraded by which enzyme

A) Thiolase B) Dehydrogenas C) Phosphorylase D) Kinase

21. Which of the following is a tetrose sugar

A) Arabinose B) Erythrose C) Ribose D) Xylose

22. For the detailed study of a protein, which of the following is a prerequisite

A) Isoelectric pH of a protein
B) Amino acid composition of a protein
C) Purity of a protein
D) Denaturation of a protein

23. Most abundant RNA in a cell is

A) mRNA B) rRNA C) tRNA D) SiRNA

24. Virus having a double stranded RNA is

A) Papilloma virus B) Cytomegalovirus C) Rotavirus D) Adenovirus

25. DNA replication in *E.coli* is

A) Conservative and unidirectional
B) Semiconservative and unidirectional
C) Semiconservative and bidirectional
D) Conservative and bidirectional

26. Prostaglandins are synthesized from

A) C18 saturated fatty acid
B) C18 unsaturated fatty acid
C) C20 saturated fatty acid
D) C20 unsaturated fatty acid

27. Shine Dalgarno sequence is

A) Reading frame of a gene
B) A short sequence that acts as a ribosomal binding site
C) Stop sequences
D) Control elements

28. Which of the following is a non-organ-specific autoimmune disease

A) Myasthenia gravis
B) Systemic lupus erythematosus (SLE)
C) Hashimoto's thyroiditis
D) Insulin-dependent diabetes mellitus

29. The first reaction in the degradation of majority of the common amino acids involves the participation of

A) NAD^+
B) Thiamine pyrophosphate (TPP)
C) Pyridoxal Phosphate
D) FAD

30. The membrane fluidity is controlled by

A) Phospholipid content
B) Protein content
C) Fatty acid and cholesterol content
D) Carbohydrate content

31. Native RUBISCO enzyme present in plants for photosynthesis represents

A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure

32. CO_2 is not produced in the reaction catalysed by the enzyme

A) Pyruvate dehydrogenase
B) Succinate dehydrogenase
C) Isocitrate dehydrogenase
D) α- ketoglutarate dehydrogenase

33. The amino acid not having 6 codons is

A) Leucine
B) Serine
C) Arginine
D) Glycine

34. A fatty acid $^{14}CH_3(CH_2)_9$ COOH in which the indicated carbon is labeled with ^{14}C, is fed to an animal and after allowing 30 minutes for fatty acid β oxidation, the label would most likely be recovered in:

A) Acetyl-CoA
B) Propionyl-CoA
C) Both acetyl-CoA and propionyl-CoA
D) Beta-hydroxy butyryl-CoA

35. Which one of the following is not true for Basal metabolic rate (BMR)

A) BMR is directly related to surface area
B) BMR is higher in males than their age matched females
C) BMR is increased in warm climate
D) BMR is inversely proportional to age

36. The normal p50 value of hemoglobin for a healthy adult is

A) 23.2 mm Hg
B) 26.6 mm Hg
C) 28.5 mm Hg
D) 20.2 mm Hg

37. Which of the following prenyl diphosphate requires initial isomerization to form terpenoid skeleton

A) GPP
B) FPP
C) GGPP
D) Squalene

38. Which of the following is the substrate for the enzyme chalcone synthase

A) *p*- coumaric acid
B) *p*- coumaroyl Co A
C) *p*- coumaroyl tyramine
D) *p*- coumaroyl alcohol

39. A carrier ampholyte for IEF should have

A) Large size
B) High buffering capacity at its pI
C) Strong interaction with protein
D) Low solubility at its pI

40. In sedimentation equilibrium experiment, the relative molecular mass can be calculated if one of the following values is known for the analyte

A) Frictional coefficient
B) Diffusion coefficient
C) Partial specific volume
D) Sedimentation rate

41. Discovery of human blood groups was done by

A) Karl Landsteiner
B) Susumu Tonegawa
C) Behring
D) R. Koch

42. A DNA molecule when digested with different restriction enzymes resulted in following fragments.

BamH1- 12 kb, 20 kb
Xho1 -18 kb, 14 kb
BamH1 + Xho1 - 12 kb, 14 kb, 6 kb

(i) DNA molecule is linear with one site each for BamHI and XhoI.
(ii) DNA molecule is circular with one site each for BamHI and XhoI.
(iii) Total length of DNA molecule is 32 kb
(iv) BamHI is blunt while XhoI is a sticky cutter enzyme

Which statement is true?

A) (i) and (iii) B) (ii) and (iii) C) (i) and (iv) D) (ii) and (iv)

43. Diet of an infant suffering from Maple syrup urine disease should be low in

A) Tryptophan
B) Glutamine
C) Branched chain amino acids
D) Tyrosine

44. Which one of the following lipid is a lung surfactant

A) Fatty acid esters
B) Phosphatidyl serine
C) Phosphatidyl choline
D) Phosphatidyl ethanolamine

45. Which molecule produces largest ATPs by aerobic metabolism?

A) Glucose B) Galactose C) Palmitic acid D) Amino acid

46. Antisense technology

A) Combines genetic material from different species
B) Specifically blocks expression of a gene
C) Transfers cells
D) Combines organelle

47. Growing of plants from a small tissue in culture is known as

A) Macroproduction
B) Micropropagation
C) Tissue culture
D) Mass production

48. Which isozyme of creatine kinase is used for diagnosis of myocardial infarction

A) CK-MM B) CK-MB C) CK-BB D) CK-MMB

49. Cystic fibrosis is diagnosed from sweat sample by measuring the concentration of

A) Magnesium B) Potassium C) Chloride D) Iodide

50. Consumption of avidin may lead to deficiency of

A) Ribofavin B) Nicotinamide C) Biotin D) Folic acid

x-x-x

Bio-Physics(Ph.D.)

1. The average size of a human gene is:

   A) 40,000 bp B) $2x10^6$bp C) $1.5x10^8$bp D) $3x10^9$ bp

2. The phenomenon of osmosis is opposite to that of:

   A) Diffusion b) B) Effusion C) Affusion D) Coagulation

3. Which of the following molecules; CO_2, CS_2, NO_2,COS are polar:

   A) NO_2 only B) CS_2, NO_2 and COS C) CO_2 only D) COS and NO_2

4. The concept that electron pair located in the valence shell of an atom bonded to other atoms tend to stay as far apart as possible so as to minimize the repulsions b/w them. This concept is incorporated in the:

   A) Pauli exclusion principle
   B) Heisenberg uncertainty principle
   C) Valance shell electron pair repulsion theory
   D) Electronegativity and polar bonds theory

5. Most of the water's unique properties result from the fact that water molecules:

   A) Are very small B) Tend to repel each other
   C) Are extremely large D) Tend to stick together

6. The surface tension in intestinal lumen b/w fat droplets and the aqueous medium is decreased by:

   A) Bile salts B) Bile acids C) conc. H_2SO_4 D) Acetic acid

7. The absorption of intact protein from the gut in the fetal and newborn animals takes place by:

   A) Pinocytosis B) Passive diffusion
   C) Simple diffusion D) Active transport

8. The pH of the blood is 7.4 when the ratio b/w H_2CO_3 and $NaHCO_3$ is:

   A)1:10 B) 1:20 C) 1:25 D) 1:30

9. Which one is the heaviest particulate component of the cell:

   A) Nucleus B) Mitochondria C) cytoplasm D) Golgi apparatus

10. Daily requirement of Ca^{2+} for normal adult human being is:

    A) 100 mg B) 800 mg C) 2g D) 4g

11. Infrared radiation spans which section of the electromagnetic spectrum:

    A) 0.25 to 0.78 μm λ B) 0.78 to 1000 μm λ C) 1000 to 3000 μm λ D) >3000 μm λ

12. IR spectroscopy cannot be used for:

A) Determination of functional groups in organic compounds
B) Determination of molecular conformation and stereochemistry
C) Determination of molecular orientation
D) Determination of the mass of the compounds precisely

13. X-ray diffraction is an analytical technique for examining:

A) Crystalline solid B) Liquid C) Powder D) Gases

14. Visible light wavelengths range from:

A) 0.39 to 0.77 B) 0.39 to 0.77 μm C) 0.39 to 0.77 nm D) 0.39 to 0.77 cm

15. The sky looks blue because the sun light is subjected to:

A) Rayleigh scattering B) Compton scattering
C) Tyndall effect D) photoelectric effect

16. The circular dichroism (CD) is observed only when the molecule is:

A) Optically active B) Planar C) In helix form D) In sheet form

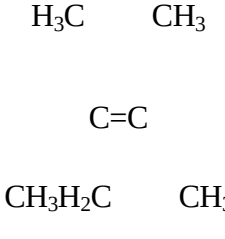
17. The Raman spectroscopy technique is based on which property of the monochromatic light:

A) Inelastic scattering B) Elastic scattering
C) Plastic scattering D) Neoelstic scattering

18. Which are the following would show the strongest absorption in the IR:

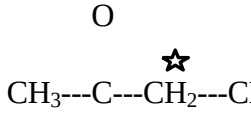
A) C-H B) O-H C) N-H D) S-H

19. How many absorption will the following compound have in its carbon-NMR spectrum:



A)3 B) 4 C)5 D) 6

20. What is the multiplicity expected in the hydrogen-NMR spectrum for the hydrogen atoms as marked by a star in the following compound:



A) Singlet B) Triplet C) Quartet D) Heptate

21. Isotopes are the atoms with the same no of:

A) Protons and varying no. of neutrons
B) Neutrons and varying no. of protons
C) Protons and varying no. of electrons
D) Electrons and varying no. of neutrons

22. Which of the following particle is the most commonly used isotopes, emitted by the most commonly important isotope and which are easiest to quantitate:

A) Alpha
B) Beta
C) Gamma
D) Delta

23. PET scan is done using the radioisotopes emitting:

A) α rays
B) Positrons
C) β-particles
D) Thermal neutrons

24. Non stochastic effects shortly after a high dose of radiation consist of:

A) Lymphopenia and hemopoietic syndrome
B) Cancer
C) Capillary occlusion and cardiac cell depletion
D) Pulmonary fibrosis and nephron loss

25. Which could be the preferred counter measure for the treatment of accidently administered p^{32} isotope:

A) ATP
B) Potassium phosphate
C) Organo phosphate
D) orthophosphoric acid

26. Double stranded DNA is made radioactive in both the chains. It is allowed to replicate twice in a non-radioactive medium and the result should be:

A) All the strands have radioactivity
B) Half the strands have radioactivity
C) Three strand have radioactivity
D) Radioactivity is absent in all the strands

27. In which type of microscope the field surrounding a specimen appears black, while the object itself is brightly illuminated:

A) Compound microscope
B) phase contrast microscope
C) Dark field microscope
D) fluorescence microscope

28. A three dimensional appearance with higher resolution than SCM can be obtained by TEM by:

A) Casting
B) Shadowing
C) Staining
D) using fluorescent dye

29. Magnification of a compound microscope does not depend upon:

A) Focal length of the objective
B) Focal length of the eye piece
C) Tube length of the microscope
D) Numerical aperture of the objective

30. Sucrose gradient centrifugation method can be used for estimation of the size of:

A) Proteins
B) Proteins, RNA and ribosomes
C) RNA, ribosomes and DNA
D) DNA

31. In patch-clamp set up the word patch represents:

A) The shape of glass micro pipette
B) The open tip of micro pipette
C) Open tip of micro pipette with a membrane surface
D) A glass electrode

32. A 58 yr man's ECG shows a combination of a prolonged QT interval with tall T waves. What does it suggest:

A) Uraemia
B) Hypocalcemia
C) Hypokalemia
D) Metabolic alkalosis

33. Levamisole used in electrophysiological experiments is an:

A) Acetyl choline antagonist
B) Acetyl choline agonist
C) Acetyl choline inhibitor
D) Acetyl cholineblocker

34. The application of hydropathy plot derived from the amino acid sequences of a protein involves:

A) Predicting interacting sites
B) Co-relating the profile with secondary structure
C) The transmembrane helices of a membrane bound protein
D) Predicting the subunit structure of the protein

35. Which of the following BLAST programme does not involve the comparing of protein /nucleotide queries from a nucleotide data base:

A) BLASTN B) BLASTX C) TBLASTN D) TBLASTX

36. FASTA programme is more sensitive for the comparison of:

A) DNA/RNA comparison sequence
B) DNA/Protein comparison sequence
C) DNA/DNA comparison sequence
D) Protein/Protein comparison sequence

37. What is the fundamental tool in immunofluorescence testing:

A) Specific antigen
B) Red blood cells
C) Fluorescent monoclonal antibody
D) Fluorescent polyclonal antibody

38. Which of the following detection counter is generally used for RIA:

A) Alpha counter B) Beta counter C) Gamma counter D) Delta counter

39. The common fixative used in histology is:

A) Formalin
B) Glyoxal
C) Bouin's fluid
D) Carnoy's fixative

40. Immunoprecipitation involves the purification of:

A) Antigen
B) Antibody
C) Both antigen and antibody
D) Antigen antibody complexes

41. Immunofluorescence is a technique used for:

A) Electron microscopy
B) Light microscopy
C) Confocal microscopy
D) Light microscopy with a fluorescent microscope

42. Which of the following stain is used for checking the transfer of protein after electrophoresis:

A) Comassie brilliant blue G250
B) Comassie brilliant blue R250
C) Amido black
D) Ponceau-S

43. Surface plasmon resonance (SPR) often measures the kinetics of a binding process and detects the binding of free molecules on:

A) The surface of a chip
B) The detector
C) On the coating tube
D) On a glass surface

44. Which of the following enzymes can be described as a DNA dependent RNA polymerase:

A) DNA ligase
B) Primase
C) DNA polymerase III
D) DNA polymerase I

45. Which of the following phospholipid is localized to a greater extent in the outer leaflet of the membrane lipid bilayer:

A) Choline phosphoglycerides
B) ethanolamine phosphoglycerides
C) Inositol phosphoglycerides
D) Serine phosphoglycerides

46. Structural feature that is common to all the prostaglandin molecules include:

A) 20- Carbon atom
B) An oxygen containing internal heterocyclic ring
C) A peroxide group at C-15
D) Two double bonds

47. In mammalian cells r-RNA is produced mainly in which organelle:

A) Endoplasmic reticulum B) Ribosome C) Nucleolus D) nucleus

48. Restriction fragment Length-polymorphism (RFLP) can only be used to follow the inheritance of a genetic disease if:

A) The disease causing mutation is at or closely linked to an altered restriction site
B) Proteins of mutated and normal genes migrate differently upon gel electrophoresis
C) Mutations are outside of restriction sites so that the cleaving still occurs
D) Restriction fragments remain the same size but their charge changes

49. Which one of the following is not considered a basic tissue of the body:

A) Epithelial tissue B) Connective tissue C) Muscle D) Hepatocyte

50. Human mitochondria are:

A) Inherited as an X-linked trait
B) inherited all from the father
C) Inherited all from the mother
D) Having linear DNA

x-x-x

Biotechnology(Ph.D.)

1. Chromatin consists of:

   A) Histories only
   B) DNA and histones only
   C) Histones and other proteins only
   D) DNA, histones, and other proteins

2. The pairing of homologous chromosomes is called:

   A) Synapsis
   B) Chiasma
   C) Crossing-over
   D) Recombination

3. HIV attacks:

   A) T helper cells
   B) T cytotoxic cells
   C) B cells
   D) Macrophages

4. The two most common processes that lead to production of multiple functional proteins from the same DNA sequence are

   A) RNA editing and alternative splicing
   B) Protein folding and posttranslational covalent modifications
   C) Alternative splicing and posttranslational covalent modifications
   D) Posttranslational covalent modification and transcriptional regulation

5. In yeasts, meiosis occurs within the:

   A) Antheridium
   B) Crozier
   C) Basidium
   D) Ascus

6. The Haber-Bosch process is important in the:

   A) Reduction of soil erosion
   B) Development of pesticides
   C) Manufacture of fertilizers
   D) Development of efficient irrigation systems

7. The inability to distinguish between self and non-self cells may lead to :

   A) Hypersensitivity
   B) Auto-immune diseases
   C) Immunodeficiency
   D) Tolerance

8. ____ is the principal source of nitrogen available to crop plants.

   A) Organic nitrogen
   B) Nitrate
   C) Ammonium
   D) Glutamine

9. The test that is done prior to transplantation surgery to detect the compatibility of MHC proteins between donor and recipient is called

   A) MHC matching
   B) MHC typing
   C) Tissue typing
   D) Blood HLA test

10. When tobacco pith callus is treated with higher concentrations of auxin than kinetin, ____ is (are) formed.

    A) More callus
    B) Roots
    C) Leaves
    D) Vascular tissue

11. Androgenesis is production of:

A) Triploids Plants
B) Virus free plants
C) Haploid Plants
D) VIGS

12. 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

13. Nitrogen fixing Anabaena is present in root pockets of

A) Calamaria
B) Salvia
C) Isoetes
D) Azolla

14. What unique characteristic of stem cells make them desirable for therapeutic use

A) They are the only cells that can undergo mutations
B) They are found in reproductive cells
C) They develop into organ needed for transplant
D) They can develop into many different tissues

15. Hydropathy plots are used to predict

A) Beta secondary structures
B) Transmembrane domain
C) Alpha secondary structures
D) Tertiary structures

16. What are the two faces of the Golgi body?

A) Positive face and negative face
B) Cis face and trans face
C) Coated face and non coated face
D) Tight face and loose face

17. DNA replication takes place in

A) Metaphase
B) Prophase
C) S Phase
D) G2 Phase

18. Which of the following can cross the placenta and provides passive immunity to new born

A) IgM
B) IgG
C) IgA
D) IgE

19. All are sequence alignment tools except

A) Rasmol
B) BLAST
C) FASTA
D) ClustalW

20. Sigma factor is a component of

A) DNA topoisomerase
B) DNA ligase
C) RNA polymerase
D) DNA polymerase

21. Which method is used for cell line authentication

A) STR profiling
B) Microscopic observation
C) Subculture
D) Flow cytometry

22. Which of the following is considered a transgenic animal

A) Animal which is a clone like dolly
B) Animal having foreign DNA in all their cells
C) Animal having an organ from another species
D) Animals with mutations

23. Crispr-Cas technique can be used for

A) Editing RNA
B) Editing DNA
C) Editing protein
D) Editing RNA and protein

24. What component helps in maintaining the pH of media in animal cell culture

A) Phenol red
B) Serum
C) Sodium bicarbonate
D) DMEM or RPMI

25. Which method is not used for inserting foreign DNA in animal cells

A) Heat shock method for transfection
B) Liposome mediated transfection
C) Electroporation
D) Virus mediated transfection

26. DNA fingerprint pattern of child is

A) 100% similar to mother's DNA fingerprint
B) 80% similar to father's DNA fingerprint
C) 100% similar to both parent's DNA fingerprint
D) 50% similar to father's and 50% similar to mother's DNA fingerprint

27. What is the minimum duration of copyright protection under the Berne Convention?

A) 50 years from the date of the author's death
B) 20 years from the date of the author's death
C) 10 years from the date of the author's death
D) 7 years from the date of the author's death

28. Slogan "Fly me" can be registered as

A) Design
B) Trademark
C) Copyright
D) Patent

29. A Single piece of information in a database is called as

A) File
B) Record
C) Field
D) Dataset

30. Database of current sequence map of human genome is called

A) OMIM
B) HGMD
C) Golden path
D) Genecards

31. PRINTS are used for

A) Detection of genes form genome
B) Detection of tRNA
C) Prediction of function of a new gene
D) Protein domains/motifs identification

32. Cholesterol is a/an

A) Saturated fat B) Unsaturated fat C) Steroid D) Essential oil

33. A peptide bond formation between 2 amino acids is accompanied by

A) Deamination B) Addition of water
C) Loss of water D) Decarboxylation

34. Which of the following is considered as the 21st amino acid

A) Hydroxylysine B) Ornithine C) Citrulline D) Selenocysteine

35. Watson and crick double helical DNA is a

A) A-DNA B) B-DNA C) Z-DNA D) D-DNA

36. An enzyme promotes a chemical reaction by

A) Lowering the energy of activation B) Increasing the energy of activation
C) Changing the free energy. D) Changing the direction of reaction

37. The word enzyme was coined by

A) Kunhe B) Koshland C) L Pasteur D) Fischer

38. Which of the enzyme is non-proteinaceous in nature

A) Urease B) Peptidase C) Ribozyme D) Phosphatase

39. CryII Ab and Cry I Ab produce toxins that control

A) Corn borer and tobacco budworms respectively
B) Nematodes and tobacco budworms respectively
C) Cotton bollworms and corn borer respectively
D) Corn borer and Cotton bollworms respectively

40. Which of the following is used as vector for gene therapy for SCID

A) Arbovirus B) Rotavirus C) Parovirus D) Retrovirus

41. The callus tissue can be regenerated into complete plant primarily by altering the concentration of

A) Sugars B) Vitamins C) Amino acids D) Hormones

42. DNA Fingerprinting was developed by

A) Watson and crick B) Yamanaka C) Alee Jefferey D) Paul Berg

43. The examples of constitute promoters are

A) Ubiquitin and actin B) TA29 and CaMV C) Zein and CaMV D) Rd22 and Zein

44. *Als* is a marker for..... .selection.

A) Kanamycin B) Chlorsulfuron C) Glyphosate D) Hygromycin

45. DICER proteins recognize only

A) ssRNA B) dsRNA C) gDNA D) rRNA

46. Binary vector generally has

A) Two reporter genes one each for bacteria and plants
B) Two selectable markers one each for bacteria and plants
C) One selectable markers used both in bacteria ans plants
D) One reporter gene common for bacteria and plants

47. If two genes are linked, then by definition they

A) Are alleles of the same gene
B) Occur on the same chromosome
C) Occur on different chromatids of the same chromosome
D) Will segregate independently

48. The most important requirement of evolution is

A) Mutation B) Natural selection
C) Variations D) Continuity of germplasm

49. Which of the following is involved in mediating allergic reactions

A) IgG B) IgM C) IgE D) IgA

50. Some defects or mutations in components if innate or adaptive immunity leads to

A) Hypersensitivity B) Auto-immune diseases
C) Immunodeficiency D) Tolerance

x-x-x

Botany(Ph.D. & M.Phil.)

1. The first organism to be studied for restriction enzymes was

   A) *Haemophilus influenza* B) *E.coli* K12
   C) *E.coli* K11 D) *Haemophilus influenzae* Rd

2. Which part of Ginseng is economically important?

   A) Leaf B) Stem C) Root D) Inflorescence

3. Which of the following fern is used for phytoremediation?

   A) *Sphagnum flexuosum* B) *Marchantia polymorpha*
   C) *Salvinia natans* D) *Pteris vittata*

4. Which of the following is called as the “Reindeer moss”

   A) *Cetraria islandica* B) *Cladonia rangiferina*
   C) *Peltigera canina* D) *Chryothrix chlorina*

5. DNA microarrays make it possible to monitor

   A) Gene synthesis B) Gene expression
   C) Gene cloning D) Gene amplification

6. The succulents in which leaves become fleshy are called

   A) Sclerophyllous B) Phyrophyllous
   C) Hygrophyllous D) Malacophyllous

7. The correct pattern in development of somatic embryos in dicotyledons is

   A) Globular-torpedo shaped-heart shaped
   B) Globular-heart shaped-torpedo shaped
   C) Torpedo shaped-heart shaped-globular
   D) Heart shaped-globular –torpedo shaped

8. What is the mobile genetic component in the Ti plasmid of *Agrobacterium tumefaciens*?

   A) T DNA B) Virulence region C) Opines D) Left Border

9. The genes for which plant was used in the development of golden rice?

   A) *Nicotiana tabaccum* B) *Narcissus pseudonarcissus*
   C) *Lycopersicon esculentum* D) *Solanum tuberosum*

10. Plant genetic transformation by electroporation mostly utilizes

    A) Callus B) Protoplasts C) Organs D) Anther culture

11. Mitotic chromosomes show a striking and reproducible banding pattern when stained with

    A) Fuelgen B) Giemsa C) Acetocarmine D) Acetoorcein

12. DNA fingerprinting refers to

A) Techniques used for identification of fingerprints of individuals
B) Molecular analyses of profiles of DNA samples
C) Analysis of DNA samples using imprinting devices
D) Techniques used for molecular analyses of cDNA samples

13. Nearly all the major classes of lipids required for production of cell membrane are synthesized in

A) Endoplasmic reticulum
B) Nucleus
C) Ribosomes
D) Golgi bodies

14. A catalytic subunit that transfers phosphate groups from ATP to amino acids during interphase is

A) MPF
B) Cdc2 kinase
C) Cyclin
D) Threonine

15. Of the subunits comprising RNA polymerase, the only factor that is involved in the initiation of transcription is

A) A
B) β
C) ∞
D) σ

16. The filamentous meshwork lining the inner surface of the nuclear envelope is called

A) Nuclear network
B) Nuclear lamina
C) Nuclear matrix
D) Nuclear kinesins

17. A regulatory mechanism for controlling gene expression involving premature termination of transcription is

A) Attenuation
B) Repression
C) Induction
D) Antitermination

18. Polymerization of gel in SDS-PAGE is initiated by

A) SDS
B) TEMED
C) Acrylamide
D) Bis-acylamide

19. A genetically engineered organism used successfully in bioremediation of oil spills is a species of

A) *Pseudomonas*
B) *Trichoderma*
C) *Xanthomonas*
D) *Baccilus*

20. Gram negative bacteria detect and respond to chemicals in their surroundings by

A) Volutin granules
B) Lipopolysaccharide
C) Muramic acid
D) Porins

21. Which part of the coconut produces coir?

A) Seed coat
B) Pericarp
C) Epicarp
D) Mesocarp

22. Which of the following is used for staining proteins?

A) Bromophenol blue
B) Methylene blue
C) Coomassie blue
D) Ethidium bromide

23. Drupe is recognized by

A) Fleshy seed coat B) Stony endocarp C) Thin seed coat D) Stony mesocarp

24. Dideoxynucleotides are used in which of the following techniques?

A) Cloning B) DNA sequencing
C) Polymerase chain reaction D) Southern Blotting

25. Porogamy is

A) Fertilization in which pollen tube enters the ovule through integument
B) Fertilization in which pollen tube enters the ovule through chalaza
C) Fertilization in which pollen tube enters the ovule through micropyle
D) Fertilization without pollen grain formation

26. An inflorescence in which flowers arise from different point but reach at same point

A) Catkin B) Spadix C) Umbel D) Cymose

27. In a PCR reaction, the primers move

A) Towards only the 3' end B) Towards only the 5'end
C) Parallel to each other D) Towards each other along opposite strands

28. During gel electrophoresis, the current in the solution between the electrodes is conducted mainly by

A) Polyacrylamide B) Sodium dodecyl sulphate
C) Buffer D) Ammonium persulphate

29. Which is an indirect method of gene transfer in plants?

A) Biolistics B) Electroporation C) Macroinjection D) *Agrobacterium*

30. Consumption of golden rice will help combating which deficiency?

A) Vitamin A B) Vitamin B C) Vitamin C D) Vitamin D

31. Which of the following are tools used to detect polymorphism in plants?

A) RFLP and QTL B) AFLP and PCR
C) RFLP and AFLP D) PCR and QTL

32. Which of the following is a predatory fungus?

A) *Puccinia* B) *Fusarium* C) *Arthrobotrys* D) *Alternaria*

33. The fruiting body of *Aspergillus* is called

A) Apothecium B) Cleistothecium C) Perithecium D) Hypanthodium

34. One of the major application of embryo culture is in

A) Clonal propagation
B) Production of alkaloids
C) Production of somaclonal variation
D) Overcoming hybridization barrier

35. Which of the following is not a plant derived elicitor?

A) Chitin
B) Pectin
C) Cellulose
D) Chitosan

36. Which of the following is not a type of signaling molecule?

A) Testosterone
B) Retinoic acid
C) Thyroxin
D) Adenylate cyclase

37. The enzyme that catalyzes the splitting of phosphatidylinositol biphosphate (PIP2) into two molecules of inositol triphosphate (IP3) and diacylglycerol in cell signaling, is

A) Phosphokinase C
B) Phospholipase C
C) Phosphodiesterase C
D) Lipokinase

38. Capping of the 5'end of RNA during RNA processing involves

A) Addition of carboxylic tail domain
B) Attachment of methylated guanine base
C) Methylated uridine base
D) Linking a string of phosphates

39. Which of the following bacteria is able to oxidize ammonia?

A) Nitrospina
B) Azotobacter
C) Nitrococcus
D) Nitrosobacter

40. The chief source of nitrogen for green plants is

A) Atmospheric nitrogen
B) Nitrates
C) Ammonium salts
D) Low molecular weight organic nitrogenous compounds

41. Vascular and cork cambium are examples of

A) Lateral meristems
B) Apical meristems
C) Intercalary meristems
D) Collenchyma

42. Which is the most advanced order in gymnosperms?

A) Cycadales
B) Coniferales
C) Gnetales
D) Taxales

43. Which is the most advanced group of algae?

A) Cyanophyta
B) Rhodophyta
C) Phaeophyta
D) Chlorophyta

44. Which of the following is absent in the xylem of gymnosperms?

A) Tracheae
B) Parenchyma
C) Fibers
D) Sieve cells

45. Pyrethrin is obtained from

A) *Azadiracta indica*
B) *Urtica dioca*
C) *Tagetes erecta*
D) *Chrysanthemum cinerarifolium*

46. Which of the following group of plants is the best indicator of sulfur dioxide pollution?

A) Bryophyte B) Pteridophyte C) Lichen D) Algae

47. *Azolla* is used as a biofertilizer as it has

A) Rhizobium
B) Micorhizza
C) Cyanobacteria
D) Large quantity of humus

48. Precursor of Indole acetic acid is

A) Glycine B) Methionine
C) Isopentynyl pyrophosphate D) Tryptophan

49. Auxin transport is

A) Polar B) Non-polar C) Symplast D) Apoplast

50. Pure line breed refers to

A) Heterozygosity only B) Homozygosity only
C) Homozygosity and self assortment D) Heterozygosity and linkage

x-x-x

Chemistry(Ph.D.)

1. The energy of a particle lying in its lowest quantum (1,1,1)state in a cubical box having dimension a=b=c is

   A) $h^2/8\ ma^2$ B) $3h^2/8\ ma^2$ C) $2h^216ma^4$ D) $h^2/2ma^3$

2. According to Rydbergs empirical relationship n_1 for Paschen series is

   A) 1 B) 2 C) 3 D) 4

3. In Raman Spectra the selection rule for transition between rotational energy levels is

   A) Δ J= +1 B) Δ J= +1 ± 1 C) Δ J= 0, ±2 D) Δ J= 0, ± 1

4. The electromagnetic radiation in the electromagnetic spectrum having frequency in the range of 10^{17} Hz to 10^{19} Hz is known as

   A) Radio B) Infra Red C) Ultra –Violet D) X-rays

5. A catalyst is defined as a substance that does following to a chemical reaction:

   A) Increase B) No effect C) Decrease D) Alter

6. The highest dipole moment amongst the following compounds is shown by

   i) CH_3Cl ii) CH_3Br iii) CH_3I iv) HI

   A) CH_3Cl B) CH_3I C) HI D) CH_3I

7. The theoretical dipole moment of a molecule “HX” is 5.10 D when completely ionic. The percent covalent character of “HX” if its dipole moment is observed as 1.02 D is

   A) 5.10 B) 1.02 C) 80 D) 20

8. When one mole of aqueous copper sulphate and zinc sulphate are used in Daniel Cell the electromotive force of such a cell at 298K in volts is

   A) 0.34 B) 0.0 C) 0.76 D) 1.10

9. Schottky defect can be classified as the following defect

   A) Line B) Point C) Plane D) Screw

10. The efficiency (η) of a Carnot cycle can be expressed by the following relation if T2 is source temperature and T1 is sink temperature

    A) $\frac{T1+T2}{T2}$ B) $\frac{T1-T2}{T2}$ C) $\frac{T2-T1}{T2}$ D) $\frac{T2-T1}{T1}$

11. The degree of dissociation of an electrolyte does not depend on

    A) Temperature B) Refractive index
    C) Presence of common ion D) Concentration

12. The energy generated in the stars is due to the following reaction

A) Chemical decomposition B) Nuclear fusion
C) Nuclear fission D) Chemical combustion

13. The following element does not have any stable isotope

A) Hydrogen B) Radium C) Oxygen D) Gold

14. The hydrolysis of an ester in aqueous solution in presence of mineral acid has the following order

A) First B) Second C) Zero D) Pseudo first

15. The number of Bravis Lattices associated with known crystal systems are

A) Six B) Two C) Seven D) Fourteen

16. The specific conductance of 0.2 M KCl solution at 298 K is 0.002780 ohm^{-1} cm^{-1}. The resistance of the cell containing the afore-stated solution is 500 ohm. The cell constant of the cell is

A) 0.002 B) 500 C) 1.39 D) 2.78

17. Given that when H_2O (liquid) $\rightarrow$ H_2 (gas)+ ½ O_2 (gas) ΔH is + 285.8 kJ/mol and when H_2 (gas)+ ½ O_2 (gas)$\rightarrow$ H_2O (gas) ΔH is -242.3 kJ/mol

The heat of conversion of 1 mol of H_2O (liquid) to H_2O (gas) at constant pressure and temperature in kJ/mol will be

A) + 285.8 B) -242.3 C) + 43.5 D) + 528.1

18. The self indicating silica gel (impregnated with cobalt chloride) turns pink on absorbing moisture and becomes blue on heating. The pink and blue colour are respectively due to

A) $[Co(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$ B) $[Co(H_2O)_6]^{2+}$ and Co_2O_3

C) $[Co(H_2O)_6]^{2+}$ and $[Co(H_2O)_6]^{3+}$ D) Co^{2+} and Co^{3+}

19. $KMnO_4$ is colored due to

A) d-d transitions
B) M$\rightarrow$L transitions or M$\rightarrow$L charge transfer
C) L$\rightarrow$M transitions or L$\rightarrow$M charge transfer
D) None of the above

20. Among the following the one which is EPR active

A) $Ni(CO)_4$ B) $[Cu(C_2O_4)]^{2-}$ C) $Mo(CO)_6$ D) $[Co(NH_3)_5Cl]^{2+}$

21. The structure of $Fe_3(CO)_{12}$ shows

A) No bridging and two terminal CO groups
B) One bridging and eleven terminal CO groups
C) Two bridging and ten terminal CO groups
D) Three bridging and nine terminal CO groups

22. Among the following, the strongest oxidizing agent is-

A) $[WO_4]^{2-}$ B) $[CrO_4]^{2-}$ C) $[MoO_4]^{2-}$ D) $[ReO_4]^{2-}$

23. Which of the following is a hard acid?

A) Li^+ B) Cu^+ (C)Ag^+ D) Au^+

24. In the reaction –
$4P + 3\ KOH + 3H_2O \rightarrow 3\ KH_2PO_2 + PH_3$

A) Phosphorus is reduced only
B) Phosphorus is oxidized only
C) Phosphorus is both oxidized and reduced
D) PH_3 is a solid precipitate

25. Identify the correct order of solubility of Na_2S, CuS and ZnS in aqueous solution-

A) $CuS > ZnS > Na_2S$ B) $ZnS > Na_2S > CuS$

C) $Na_2S > CuS > ZnS$ D) $Na_2S > ZnS > CuS$

26. Using the wade rules, the structure of $B_{10}C_2H_{12}$ can be predicted. The structure and number of isomers of $B_{10}C_2H_{12}$ respectively are-

A) *nido* and two B) *closo* and three C) *nido* and one D) *closo* and two

27. The number of manganese ions in tetrahedral and octahedral sites, respectively in Mn_3O_4 are-

A) One Mn^{2+} and two Mn^{3+} B) One Mn^{3+} and two Mn^{2+}

C)Two Mn^{3+} and one Mn^{2+} D) Two Mn^{2+} and one Mn^{3+}

28. The oxidation number of phosphorus in pyrophosphorus acid is –

A) +1 B) +4 C) +5 D) +3

29. In which of the following compounds, the oxidation state of Xe is not six-?

A) $XeOF_2$ and XeO_4 B) XeF_6 and XeO_3

C) $XeOF_4$ and XeO_2F_2 D) XeO_3 and $XeOF_4$

30. Mercury is best purified by-

A) Dry distillation B) Steam distillation

C) Distillation under high pressure D) Vacuum distillation

31. Determine the CFSE for the $[Cr(H_2O)_6]^{2+}$ having P = 23500 cm^{-1} and Δ = 13,900 cm^{-1} in more stable state –

A) +8340 cm^{-1} B) -1260 cm^{-1} C) +1260 cm^{-1} D) -8340 cm^{-1}

32. The number of P-O-P bonds in cyclic metaphosphoric acid is-

A) Zero B) Two C) Three D) Four

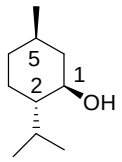
33. The number of 3-centre 2-electron bonds in tetraborane (10) is-

A) 4 B) 3 C) 5 D) 2

34. Jahn Teller effect affects the geometry of –

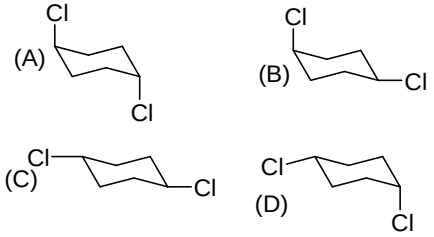
A) $[Ni(NH_3)_6]^{2+}$ B) $[Cu(NH_3)_4]^{2+}$
C) $[MnCl_4]^{2-}$ D) None of these

35. The configuration of the compound at C-1, C-2 and C-5 in the compound given below is:

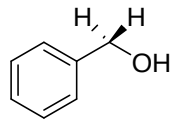


A) 1S, 2S, 5R B) 1R, 2S, 5R C) 1R, 2S, 5S D) 1R, 2R, 5R

36. The stable form of trans-1,4-dichlorocyclohexane is represented as:



37. In the compound given below, the hydrogen H_A and H_B are:



A) Enantiotpic B) Homotopic C) Distereotopic D) Isotopic

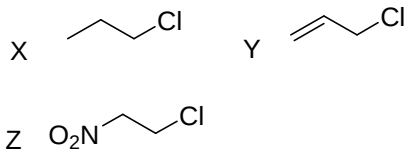
38. Benzyne can be trapped by reaction with:

A) Diene B) Electrophile C) Free radical D) Carbene

39. Singlet and triplet carbene can be identified by reaction with:

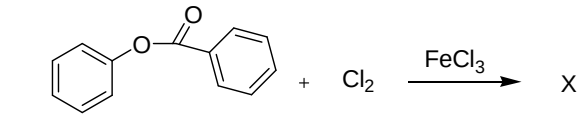
A) Alkene B) Electrophile
C) cis or trans Alkene D) Benzyne

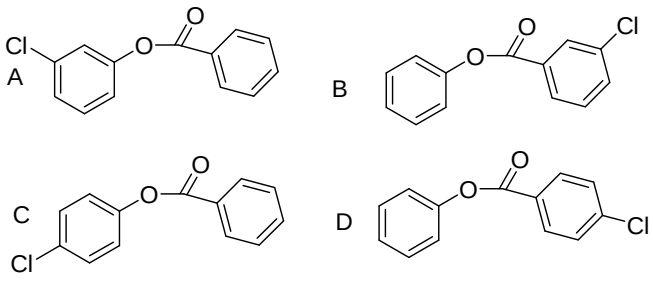
40. The decreasing order of reactivity of following alkyl halide toward solvolysis by S_N1 mechanism is:



A) X > Y >Z B) Z > Y >Z C) Y > X >Z D) Z > X >Y

41. Predict the major product X in the following reaction:





42. The best condition for generation of kinetically controlled enolate is:

A) LDA / THF , -78°C

B) NaOEt / EtOH

C) Na_2CO_3 / H_2O

D) KF / DMF

43. The selective oxidation of primary alcohols to aldehydes is achieved by:

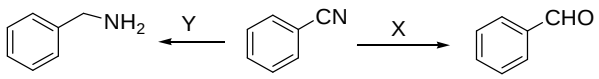
A) Jones reagent

B) Sarett's reagent

C) Lead tetraacetate

D) PCC

44. The reagent X & Y for the transformation given below are:



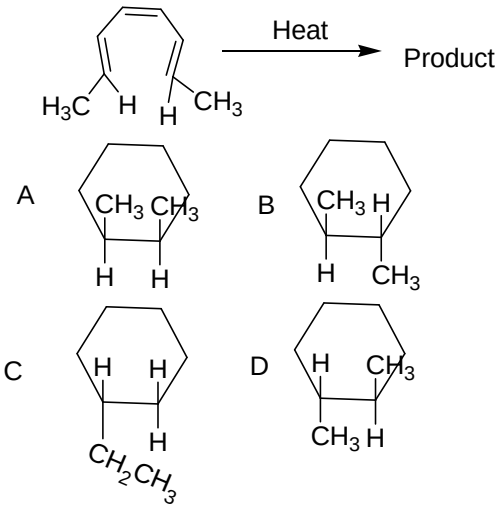
A) $NaBH_4$ & $LiAlH_4$

B) DIBAL-H & $LiAlH_4$

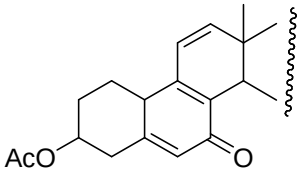
C) B_2H_6 & H_2 / Pd-C

D) Na / liq NH3 & $NaBH_4$

45. Predict the product of the following reaction:



46. Calculate λ_{max} for following enone:



A) 425 nm B) 340 nm C) 383 nm D) 329 nm

47. In the mass spectrum of 1,bromo-2-chloroethane, approximate ratio of peaks at m/z values 142, 144, 145 will be

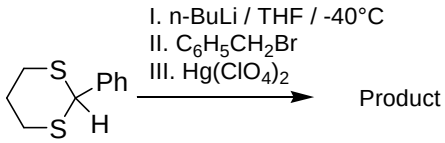
A) 6:1:4 B) 9:6:4 C) 3:4:1 D) 4:2:3

48. The number of N-Me group in an alkaloid can be estimated by:

A) Herzig-Meyers method B) Zeisel method

C) Hofmann's method D) Sanger's method

49. The major product in the reaction given below is:



A) Benzaldehyde B) Benzyl phenyl ketone

C) Benzoic acid D) Benzylalcohol

50. Carbobezyloxy i.e ($C_6H_5CH_2CO$-) Protected amine can be deprotected by:

A) 10% KOH solution B) HBr / AcOH

C) Lithium aluminum hydride D) $(C_4H_9)_4NOH$

x-x-x

Environment Science

1. 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

2. World Yoga day is celebrated on

   A) 14 November B) 21 June C) 2 October D) 15 October

3. The Dobson Unit (DU) is a measure of the

   A) Radioactivity B) UV index C) Ozone D) Oxygen molecule

4. Which one of the following is not a global issue?

   A) Global warming B) Climate change
   C) Acid rain D) Ozone depletion

5. Which gas was responsible for "Bhopal gas tragedy"
   A) Nitrogen B) Carbon dioxide
   C) Methyl isocyanate D) Sulphur dioxid

6. The concept of impact factor as an evaluation tool was given by

   A) Eugene Garfield B) Alex Eugene C) George Garfield D) S. Garfield

7. The index that attempts to measure both the scientific productivity and the apparent scientific impact of a scientist is termed as

   A) Citation index B) I-10 index C) h-index D) Impact factor

8. *Silent Spring* book written by Rachel Carson documented the detrimental effects on the environment particularly on birds due to

   A) Use of MIC B) Excess use of Fertiliser
   C) Contaminated water D) Indiscriminate use of pesticides

9. Radiatively active gases are called as green house gases that absorb wavelength

   A) Longer than 4 µm are B) Longer than 40 µm are
   B) Shorter than 4 µm are D) Longer than 10 µm are

10. The process which destroys all the microbial life including spores is known as

    A) Disinfection B) Antisepsis C) Deodorization D) Sterilization

11. As per MSW rules, Bins for storage of bio-degradable waste shall be painted

    A) Green B) White C) Black D) Red

12. United Nations Conference on the Human Environment was held at

    A) Brazil B) Stockhom C) Berlin D) Genewa

13. Nalgonda technique is used for the removal of

    A) Hg B) As C) F D) Iodine

14. The indoor pollutant from the furniture is

A) Ozone B) Formaldehyde C) Radon D) Carbon-dioxide

15. Which of the following public figure is not the ambassador of Swachh Bharat Mission campaign

A) Mridula Sinha B) Salman Khan
C) Shashi Tharoor D) Shah Rukh Khan

16. If pH of water is increased from 7 to 8

A) Hydrogen ion concentration is doubled
B) Hydrogen ion concentration is halved
C) Alkalinity is increased ten folds
D) Hydrogen ion concentration decreases 10 folds

17. The chloride content in treated water for public supplies should not exceed

A) 100 ppm B) 150 ppm C) 200 ppm D) 250 ppm

18. Methemoglobinemia (blue baby syndrome) is due to excess of the following in water:

A) Coliforms B) Nitrates C) Sulphates D) Iron

19. The apparatus in which the turbidity is measured as a function of intensity of light scattered as it passes through the water sample is called:

A) Spectrometer B) Nephelometer C) Tintometer D) Turbidimeter

20. Green marketing deals with

A) Ecologically sound Product B) Green products
C) Products packed in green paper D) Plants

21. Fly ash is the one kind of pollutant generated by

A) Thermal power plants B) Oil refinery
C) Fertilizer plants D) Mining operation

22. Which radioactive element is considered under Indoor pollutants category?

A) N –13 B) Carbon 14 C) Radon D) O–16

23. UASB stands for

A) Up flow anaerobic sludge bed reactor
B) Up flow aerobic sludge bed reactor
C) Up flow anaerobic sewage bed reactor
D) Upward anaerobic sewage bed reactor

24. Sulphate in water sample is analysed by

A) Flame photometry B) Titrimetry
C) Turbidimetry D) Reflux digestion

25. OSHA stands for

A) Occupational Standards and Health Administration
B) Occupational Standards and Health Assessment
C) Occupational Safety and Health Authority
D) Occupational Safety and Health Administration

26. In flame photometry undesirable wavelength is removed by using

A) Chopper B) Monochromator C) Filter D) Mirror

27. Flame photometer can be used to analyze

A) F B) Cr C) K D) Pb

28. 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

29. Which one of the following are useful in identifying gaps in research

A) Research paper B) Research article
C) Review paper D) Articles in magazine

30. Electronic documents have

A) Digital object identifier (DOI)
B) International Standard Book Number (ISBN)
C) Serial Item and Contribution Identifier (SICI)
D) PubMed Identifier

31. Love canal episode is related to

A) Hg poisoning B) Pb poisoning
C) Flooding D) Hazardous waste dumping

32. Which of the following is hazardous waste?

A) Paper waste B) Agricultural waste C) Battery D) Yard waste

33. Minimata disease is related to which one of the following element

A) Cd B) Cr C) Pb D) Hg

34. Vermicompost is the

A) Excreta of earthworm B) Culture of earthworms
C) Source of micro nutrient D) Colored liquid fertilizer

35. Every year world environment day is celebrated on

A) 28 Feb B) 14 March C) 22 May D) 5 June

36. What is Ecomark?

A) Label given to recycled products
B) Label given to an environment friendly products
C) Land mark indicating the boundaries of bioparks
D) Label given to non-recyclable products

37. World environment day theme for year 2016 is

A) Think Eat Save
B) Seven Billion Dreams; One Planet; Consume with Care
C) One World, One Environment
D) Join the race to make the world a better place

38. Partioning is also known as

A) Chemical extraction
B) Solvent extraction
C) Physical extraction
D) Solvent removal

39. Variability among replicates measurement is

A) Error
B) Precision
C) Accuracy
D) Deviation

40. Which one of the following is known as heart of the GC

A) Detector
B) Column
C) Oven
D) Carrier gas

41. Hazardous waste is dumped in which type of landfill?

A) Sanitary landfill
B) Secured landfill
C) Unlined landfill
D) open dumping site

42. Primary liner is used for

A) Leachate collection system
B) Leak detection system
C) To support the waste
C) None

43. Who among the following is Environment Minister

A) Menaka Gandhi
B) Prakash Javadekar
C) Samriti Irani
D) Rajnath Singh

44. Activated sludge is the:

A) Aerated sludge in the aeration unit
B) Sludge settled in the humus tank
C) Sludge in the secondary tank after aeration and rich in microbial mass
D) Sludge in the secondary tank after aeration and rich in nutrients

45. The appropriate percentage of water in the sewage is:

A) 90%
B) 99%
C) 99.9%
D) 99.99%

46. Biochemical Oxygen Demand (BOD) of sewage is the:

A) Oxygen require to oxidize biologically active organic matter
B) Oxygen required to oxidize biologically inactive organic matter
C) (A) and (B) both
D) None of these

47. Sherwood Rowland and Mario Molina were the first to report about

A) Climate change
B) CFC in atmosphere
C) Global warming
D) Ozone depletion

48. Which one of the following has maximum contribution towards green house effect

A) CFC
B) CO2
C) CH_4
D) N_2

49. A lake with high productivity is called

A) Oligotrophic
B) Mesotrophic
C) Eutrophic
D) Young lake

50. Discharge of heated effluent into aquatic water bodies leads to

A) Light pollution
B) Water Pollution
C) Biofouling
D) Thermal pollution

x-x-x

Forensic Science & Criminology

1. Which of the following individuals is known as the "Father of Forensic Toxicology"?

   A) R. A. Riess
   B) Edmond Locard
   C) Calvin Goddard
   D) Mathieu Orfila

2. Corpora-basal index is used to determine:

   A) Age
   B) Sex
   C) Race
   D) Stature

3. Tangential fracture lines have the following characteristics:

   A) Encircle the point of impact
   B) Radiate outward from the point of impact
   C) Form a crater or cone at the point of impact
   D) Form hackle marks at the point of impact

4. Medium velocity impact blood spatter stains are generally of what size?

   A) Smaller in size than high-velocity bloodstain patterns
   B) Smaller in size than low-velocity bloodstain patterns
   C) Greater in size than low-velocity bloodstain patterns
   D) Similar in size to those created by high-impact forces

5. A "V" shaped pattern is typically associated with:

   A) Hit and Run case with skid marks
   B) Drive-by shootings
   C) Assault cases with blood spatter evidence
   D) Arson cases

6. If the K and Q patterns match, what conclusion should be reported in the forensic lab report?

   A) Inclusion
   B) Inconclusive
   C) Insufficient
   D) Exclusion

7. A tire track impression in snow would be classified as:

   A) An indentation
   B) A positive impression mark
   C) An imprint
   D) A 2-dimensional mark

8. The chemical ninhydrin can be used to visualize latent fingerprints on porous surfaces. Ninhydrin turns violet when it reacts with which of the following fingerprint residues?

   A) Metal ions
   B) Lipids
   C) Carbohydrates
   D) Amino acids

9. Which of the following is an example of a physical method for developing latent fingerprints?

   A) Tape lift
   B) Small particle reagent
   C) Physical developer
   D) Super glue

10. What individualizing features may help to identify a particular copy machine?

    A) Accidental marks on the drum
    B) Toner formulations
    C) The font characteristics
    D) Ink composition

11. The fluid that is used to decolorize ink on a document is called:

    A) Surface coating
    B) "White-out"
    C) Toner
    D) Ink eradicator

12. Which of the following features reflect the skill level of the writer?

A) Smoothness and flow
B) Slant of letters
C) Spelling
D) Grammar

13. A computer database containing images of bullets and cartridge cases recovered from crime scenes or test fired from seized firearms is known by the acronym:

A) SWGGUN B) AFIS C) NIBIN D) GRC

14. The land-to-land diameter inside a rifle barrel is called the:

A) Broach B) Gauge C) Muzzle D) Caliber

15. The acid phosphatase screening test is used to detect which physiological fluid?

A) Sweat B) Semen C) Blood D) Saliva

16. SNPs are polymorphisms that are similar in composition to those found at:

A) Minisatellite loci
B) Microsatellite loci
C) VNTR loci.
D) mtDNA HV1 & HV2 regions

17. Which of the following items would be classified as a primary high explosive?

A) Nitroglycerine B) RDX C) TNT D) Dynamite

18. Which of the following best describes the products that are formed from a complete combustion reaction?

A) Water, heat and oxygen
B) Fuel, water, and heat
C) Heat, water, and carbon dioxide
D) Heat, water, and carbon monoxide

19. The Duquenois-Levine test is a screening test for which drug?

A) Heroin B) Psilocin C) Cocaine D) Marijuana

20. Making of false document is dealt in section:

A) 464 IPC B) 463 IPC C) 462 IPC D) 127 IEA

21. A scalp hair specimen with significant root sheath material would indicate that the hair originated from which phase of growth?

A) Anagen B) Collagen C) Catagen D) Telogen

22. Which of the following represents the best measure available for estimating the time of death (especially within the first 18 hours after death)?

A) The development of cloudiness in the eyes
B) Changes in body temperature
C) Hypostasis
D) Rigor mortis

23. In the case of skeletalised human remains, which of the following features is not of potential use in making a personal identification?

A) Surgical implants B) Dentition C) Tattoos D) Bone disorders

24. The post-mortem condition of hypostasis is also known as:

A) Cadaveric spasm B) Livor mortis C) Rigor mortis D) Putrefaction

25. With regard to skeletalised human remains, which of the following may be used to estimate the age of an individual at the time of his or her death?

A) Adipocere formation
B) Facial reconstruction
C) Epiphyseal union
D) Photosuperimposition

26. Which of the following methods used in the analysis of ink may be described as 'destructive'?

A) Infrared microscopy
B) Raman microscopy
C) Chromatography
D) Examination under specialist lighting conditions using, for example, the Video Spectral Comparator

27. Which of the following toxins comes from the castor oil plant?

A) Strychnine B) Digitalin C) Ricin D) Atropine

28. A particular SNP locus can be A, C or T. How many genotypes can be expected to be found in the population?

A) 12 B) 3 C) 9 D) 6

29. The latent fingerprint visualisation technique known as vacuum metal deposition involves the evaporation and subsequent deposition, under vacuum, of:

A) Copper and/or Gold
B) Gold and/or Silver
C) Zinc and/or Silver
D) Zinc and/or Gold

30. At a scene of a suspicious death in a domestic property, you find a powered-on computer. No specialist digital forensics expert is readily available. Other than recording the scene, do you:

A) Consider the computer no further
B) Pull the power cord from the rear of the computer and 'bag and tag' it
C) Review each of the running applications and user files to ascertain if there may be any pertinent evidence thereon
D) Wait until specialist advice does become available

31. Which of the following is not a feature of a “cookie”?

A) It is saved on the user’s hard drive
B) It tracks which sites a computer has visited
C) It may assist in an investigation. This is the correct answer
D) They are evil programs that scan the hard drive of a computer

32. Which of the following best describes the function of the atomic absorption spectrophotometer? This is the correct answer.

A) It determines the concentration of specific elements in a sample.
B) It is capable of identifying elements from the light that is produced during the test.
C) This is the primary tool used to identify organic and inorganic compounds.
D) It identifies and compares unknown crystalline substances.

33. Which of the following methods is best for identifying remains in a fire investigation?

A) Fingerprints
B) Dentition
C) Identification, jewellery, and clothing on the body
D) DNA printing

34. Which of the following describes a firewall?

A) A copy of data
B) Data that cannot be lost
C) Digital forensic analysis this is the correct answer.
D) Device or software that acts as a checkpoint between a network or stand-alone computer and the Internet

35. A PCR reaction that continues for 30 cycles will produce approximately how many PCR products from a single template DNA molecule?

A) 64
B) 128,000
C) Approximately 1 million
D) Approximately 1 billion

36. The determination of whether or not a substance is blood is best made by means of a preliminary color test such as the Kastle-Meyer color test, which uses the chemical:

A) p30 B) Benzidine C) Precipitin D) Phenolphthalein

37. A document examiner will typically generate how many samples to obtain a sufficient representation of a photocopier's characters?

A) 8 B) 10 C) 12 D) 4

38. The age of an ink may be determined by utilizing an ink library based on analysis by:

A) Gas chromatography
B) Thin-layer chromatography
C) Mass spectrometry
D) Infrared spectrophotometry

39. The area that begins at the end of the last sector that contains logical data and terminates at the end of the cluster is known as:

A) HDD slack B) File slack C) ROM slack D) RAM slack

40. A confession made to a police officer is inadmissible under

A) Section 24 of Evidence Act
B) Section 25 of Evidence Act
C) Section 26 of Evidence Act
D) Section 27 of Evidence Act

41. It is mandatory to produce the person arrested before the Magistrate, within 24 hours of his arrest, under

A) Section 56 of Cr PC
B) Section 57 of Cr PC
C) Section 58 of Cr PC
D) Section 59 of Cr PC

42. In a healthy middle-aged individual, a carbon monoxide blood saturation greater than _____ is considered fatal.

A) 5 percent B) 50-60 percent C) 10-20 percent D) 95-100 percent

43. Hair grows at the approximate monthly rate of:

A) 1 inch B) 1.5 inches C) 2 centimeters D) 1 centimeter

44. Forensic soil comparison includes the comparison of color because:

A) Soil color allows the examiner to determine the location of its origin
B) Color in soil is unique to a location
C) Color is an individual characteristic
D) There are nearly 1100 distinguishable soil colors so it offers a logical first step in soil comparison

45. A common screen test for the presumptive identification of an explosive is:

A) Gas chromatography-mass spectrometry B) X-ray diffraction
C) IR spectrophotometry D) Thin-layer chromatography

46. All of the following refer to ways that police officers try to enhance memory retrieval in eye witnesses except for _____.

A) Leading questions B) Change perspective
C) Context reinstatement D) Reverse order

47. The desire for notoriety, guilt feelings and the desire to protect someone else describe the psychology contributing to which forensic outcome?

A) Coerced confession B) Coerced compliance
C) Voluntary confession D) Voluntary compliance

48. Based on a mathematical calculation by Victor Balthazard, the probability of two individuals having the same fingerprints is one out of:

A) 1 x 10 to the 60th power B) 1 x 10 to the 90th power
C) 1 x 10 to the 100th power D) 1 x 10 to the 30th power

49. The analysis on the Kennedy assassination bullets were performed by the technique of:

A) Neutron activation analysis
B) Atomic absorption spetrophotometer
C) X-ray diffraction
D) Inductively coupled plasma emission spectrometry

50. Chat and instant messages can be typically located in a computer's:

A) RAM B) ROM
C) Web browser history D) Internet history

x-x-x

Geology

1. The localities Masinagudi and Ponmudi are related to

   A) Lamprophyres B) Kimberlite C) Carbonatite D) Charnockite

2. Cr occurs as a trace element in magnesite ($MgCO_3$) and ilmenite ($FeTiO_3$), but its abundance is much more in magnesite than in ilmenite because

   A) The ionic size of Mg is much smaller than that of Cr
   B) The charge of Mg is much larger than that of Cr
   C) The ionic size and charge of Mg is quite similar to those of Cr
   D) The ionic size and charge of Fe is quite similar to those of Cr

3. Which one of the following is the correct sequence of rocks from bottom to top in a partly preserved ophiolite suite?

   A) Pelagic sediments-sheeted dyke complex-layered gabbro-harzburgite
   B) Pelagic sediments- layered gabbro-sheeted dyke complex-harzburgite
   C) Harzburgite-layered gabbro-sheeted dyke complex-pelagic sediments
   D) Harzburgite- sheeted dyke complex-layered gabbro-pelagic sediments

4. Which one of the following is correct for the residual melt after the fractionation of olivine and garnet?

   A) Increase in Ni and La B) Decrease in Ni and Yb
   C) Increase in Ni and decrease in La D) Decrease in Ni and increase in Yb

5. Which of the following minerals are characteristic of A-type granites?

   A) Acmite-Riebeckite B) Acmite-Andalusite
   C) Muscovite-Garnet D) Muscovite-Cordierite

6. Anticlockwise P-T-t paths are characterised by

   A) Subduction-zone metamorphism
   B) Attainment of P_{max} and T_{max} at the same time
   C) Attainment of P_{max} before T_{max}
   D) Attainment of T_{max} before P_{max}

7. A spaced cleavage developed during micro folding of a pre-existing foliation is known as

   A) Slaty cleavage B) Crenulation cleavage
   C) Spaced foliation D) Microlithon foliation

8. A medium-temperature metasomatic rock characterised by quartz and white mica, commonly with topaz, fluorite and tourmaline is known as

   A) Tactite B) Greisen C) Propylite D)Rodingite

9. Which one of the following is the correct sequence of metamorphic facies with increasing grade of metamorphism?

A) Greenschist, Blueschist, Epidote-amphibolite, Prehnite-pumpellyite
B) Greenschist, Blueschist, Prehnite-pumpellyite, Epidote-amphibolite
C) Prehnite-pumpellyite, Greenschist, Epidote-amphibolite, Blueschist
D) Prehnite-pumpellyite, Blueschist, Greenschist, Epidote-amphibolite

10. In which of the following conditions a sandstone containing 25% feldspar, 70% quartz and 5% cement will form?

A) Slow burial without much transportation
B) Slow burial with great transportation
C) Quick burial with great transportation
D) Quick burial without much transportation

11. Which one of the following properties is NOT applicable to smectite?

A) Weathering product
B) Non expandable
C) High CEC
D) Cations adsorbed in interlayer space

12. Which one of the following is true regarding a multi-channel facies?

A) >11% bedload, and fan facies is abundant
B) 5-10% bedload, and delta facies is abundant
C) 2-5% bedload, and anastomosing facies is abundant
D) <2% bedload, and clay facies is abundant

13. The great thickness of sediments in a basin is due to

A) Accumulation of sediments in deep waters
B) Accumulation of sediments in deep inland troughs and rift valleys
C) Subsidence of the basin floor accompanying sedimentation
D) Sedimentation in foordeep of rising mountain chain

14. The stress ellipsoid of hydrostatic stress is defined by

A) $\sigma1 \neq \sigma2 \neq \sigma3$ B) $\sigma1 = \sigma2 = \sigma3$ C) $\sigma1 > \sigma2 = \sigma3$ D) $\sigma1 > \sigma2 \neq \sigma3$

15. If 10 planes are plotted in a Beta diagram then what would be the number of intersections in such a diagram?

A) 25 B) 35 C) 45 D) 55

16. According to dip isogons classification, a similar fold is labeled as

A) Class 1A B) Class 1B C) Class 1C D) Class 2

17. Which one of the following is the correct sequence of events in a Wilson cycle?

A) Rifting – Breakup of continents – Opening of ocean – Subduction
B) Breakup of continents – Rifting - Opening of ocean – Subduction
C) Opening of ocean - Subduction – Rifting – Breakup of continents
D) Opening of ocean – Subduction - Breakup of continents – Rifting

18. The structural manifestation of an extensional tectonic environment in an area is

A) Normal fault
B) Thrust fault
C) Strike-slip fault
D) Synform and antiform

19. Which one of the following salinity levels is indicated by the presence of *Liostrea* and *Mytilus*?

A) Euhaline B) Mesohaline C) Oligohaline D) Holohaline

20. *Hemicyclaspis* belongs to a

A) Primitive labyrinthodont
B) Permian pelycosaur
C) Bottom-dwelling ostracoderm with vertical scales
D) First jawed acanthodian

21. What types of pollen are produced by Gymnosperms?

A) Saccate B) Tricolpate C) Occulate D) Monolete

22. Which one of the following is the correct sequence of the evolution of horse?

A) Eohippus – Miohippus – Hipparion – Equus
B) Eohippus – Pliohippus – Meryhippus – Equus
C) Eohippus – Miohippus – Parahippus – Pliohippus – Equus
D) Equus – Eohippus – Parahippus – Miohippus

23. Corals will record a period

A) During a glacial maxima B) After a glacial maxima
C) During a thermal maxima D) After a thermal maxima

24. Which one of following demarcates the Maastrichtian-Danian boundary?

A) *Abthomathomphalus mayaroensis - Morozovella aragonensis*
B) *Abthomathomphalus mayaroensis - Globorotalia pseudobolloides*
C) *Abthomathomphalus mayaroensis - Acanthodiscus radiates*
D) *Abthomathomphalus mayaroensis - Placenticeras bidorsatum*

25. Which one of the following stratigraphic boundary is determined by Ediacaran fossils?

A) Permian-Triassic
B) Cretaceous-Tertiary
C) Archaean-Proterozoic
D) (Precambrian-Cambrian

26. Which one of the following phenomena is included in punctuated equilibrium?

A) New species are created by a gradual change of a lineage
B) New species are created by a long change of a lineage
C) Most evolutionary groups evolved in short, rapid spurts with little or no change
D) Most evolutionary groups evolved in long, gradual spurts with little or no change

27. Which one of the following is the incorrect statement?

A) The ideal season for taking aerial photograph for geological purpose is early spring
B) Scale of an aerial photograph is not related to the flight height
C) The ideal time for taking aerial photographs of sand dunes is early morning
D) Infra-red photographs can be taken during night

28. LIDAR and RADAR are examples of

A) Active remote sensing
B) Passive remote sensing
C) Massive remote sensing
D) Neutral remote sensing

29. In GIS data types, vectors can be classified into

A) Digital elevation model
B) Digital raster graphics
C) Digital ortho quarter quadrangle
D) Points, lines and polygons

30. In cold-cove cyclone

A) Temperature is lowest at centre and increases towards outer margin
B) Temperature is lowest at outer margin and increases towards centre
C) Temperature is highest at centre and decreases towards outer margin
D) Temperature is highest at outer margin and decreases towards centre

31. Streams commonly show a braided system because of the large amount of

A) Water erosion
B) Surface run off
C) Bed load
D) Suspended load

32. Sometimes synclinal structures can act as oil traps where water is

A) Very cold B) Less hot C) Very hot D) Absent

33. Which one of the following drilling fluids is used to drill a shale horizon?

A) Gypsum mud B) Calcite mud C) Fluorite mud D) Apatite mud

34. Mississippi Valley-type Pb-Zn deposits are characteristic of

A) Rift setting B) Extensional zones
C) Subduction zones D) Collisional setting

35. Which of the following physical properties are characteristic for a mineral to form a placer deposit?

A) High hardness and high density B) High density and low hardness
C) Low density and high hardness D) Low density and low hardness

36. Which one of the following minerals is classified as a "strategic mineral" in India?

A) Mica B) Coal C) Rare earths D) Chromite

37. The proportions of ^{40}K and ^{235}U have diminished much more through geological time than that of ^{238}U and ^{232}Th because

A) The volume percent of granite on the continental crust is much less as compared to basalt
B) The half-life of ^{238}U is much less as compared to ^{235}U
C) ^{40}K and ^{235}U started decaying much later as compared to ^{238}U and ^{232}Th
D) The half-lives of ^{40}K and ^{235}U are much shorter than those of ^{238}U and ^{232}Th

38. A granitic rock is found to have a $^{87}Sr/^{86}Sr$ ratio of 0.8958, and a $^{87}Rb/^{86}Sr$ ratio of 7.9398. If the initial $^{87}Sr/^{86}Sr$ value is 0.7052, what is the age of the rock? (assume $\lambda = 1.42 \times 10^{-11}$ year^{-1}).

A) 1671×10^6 years B) 167.1×10^6 years
C) 16.71×10^6 years D) 1.671×10^6 years

39. A radioactive parent isotope (P) decays into a radiogenic daughter isotope (D). What would be the ratio of number of atoms of D to the number of atoms of P after 3 half lives?

A) 6 B) 7 C) 3 D) 0.14

40. Which one of the following is the correct sequence in order of increasing unconfined compressive strength?

A) Wood-Concrete- Quartzite-Marble B) Wood-Concrete-Marble-Quartzite
C) Concrete-Wood- Marble-Quartzite D) Concrete-Wood-Quartzite-Marble

41. Which one of the following statements is correct?

A) A syncline provides a suitable location for a tunnel
B) In moderately dipping beds, the tunnel should be aligned along the dip
C) In steeply dipping beds, the tunnel should be aligned along the strike
D) Hard rocks are not suitable for a tunnel as the cutting work is costly

42. Most of the landslides take place during rainy season because

A) The water content of the rock increases
B) The salt content of the pore water reduces
C) The pore pressure at the potential rupture surface increases
D) The outer surface of the rock face becomes slippery

43. What does ground roll represents in seismic exploration?

A) Shear wave B) Surface wave C) Direct wave D) Indirect wave

44. Which one of the following subsurface formation will show maximum electrical resistivity?

A) Clay bed B) Fine sand aquifer C) Coarse sand aquifer D) Gravel bed

45. A gravity unit is equal to

A) 10^{-5} gal B) 10^{-3} gal C) 10^{-4} gal D) 10^{-2} gal

46. The drawdown in an aquifer caused by pumping at any point in the aquifer is inversely proportional to the

A) Transmissivity and storage coefficient
B) Storage coefficient and the square of the distance between the pumping well and the point
C) Transmissivity and square of the distance between the pumping well and the point
D) Transmissivity, storage coefficient, and the square of the distance between the pumping well and the point

47. What is the diameter range (in m) of a dug well?

A) 1-6 B) 6-10 C) 10-15 D) 15-20

48. Which one of the following natural inorganic constituent has a laxative effect when dissolved in ground water at higher concentrations (600-1000 mg/L)?

A) Sodium B) Manganese C) Sulphate D) Iron

49. If green house gases are absent, the atmosphere would be cooler by

A) 13°C B) 1.3°C C) 33°C D) 3.3°C

50. The main cause of the global warming is related to the absorption of terrestrial radiation by gases in

A) Stratosphere B) Troposphere C) Mesosphere D) Thermosphere

National Centre for Human Genomics and Research (1076)

1. DNA Pol γ: i) is involved in telomere maintenance; ii) is found in mitochondria; iii) is the main enzyme for replication of chromosomal DNA of the cell; iv) harbors 3'-5' exonuclease activity.

   A) i, ii and iii are correct
   B) ii and iv are correct
   C) Only ii is correct
   D) Only iv is correct

2. Apoptosis does not involve:

   A) Phagocytosis by macrophages
   B) Fragmentation of DNA
   C) Triggering of inflammation
   D) Formation of small membrane-bound vesicles

3. Methylation of DNA can be determined by bisulfite sequencing in which:

   A) Bisulphite converts methylated cytosine to uracil
   B) Bisulphite converts unmethylated cytosine to uracil
   C) Bisulphite converts methylated guanine to uracil
   D) Bisulphite converts unmethylated guanine to uracil

4. Which of the following statements is correct?

   A) 2',3'dideoxy nucleoside triphosphates are used in pyrosequencing
   B) Metagenomic analysis cannot be carried out by pyrosequencing because of its incompatibility with 16SrDNA sequencing
   C) Reversible terminators are used in pyrosequencing
   D) Deoxyadenosine alpha-thiotriphosphates, deoxyguanosine triphosphates, deoxycytidine triphosphate, deoxythymidine triphosphate are used in pyrosequencing

5. CAGE gives information about:

   A) Transcription start site
   B) Poly A site in the transcript
   C) All exons in a gene
   D) All introns in a gene

6. Xeroderma pigmentosum is characterized by an extreme sensitivity to ultraviolet (UV) rays from sunlight. The molecular basis of the disease is:

   A) Mutation in the transmembrane conductance regulator
   B) Induction of a provirus upon UV exposure
   C) Defect in nucleotide excision-repair system
   D) Defect in Mismatch repair

7. EF-Ts helps facilitate the regeneration of the EF-Tu.GTP complex by:

   A) Phosphorylation of the GDP in the EF-Tu.GDP complex
   B) Dissociation of tRNA from the EF-Tu.GDP complex
   C) Physical exchange of GTP for GDP in the EF-Tu.GDP complex
   D) The replacement of the EF-Tu/GDP complex with a new charged tRNA.GTP complex.

8. Messelson and Stahl experiment performed on a newly isolated organism shows 'conservative' DNA replication. What was observed on the CsCl-ethidium bromide gradient after growing the organism for one generation which led to this conclusion?

   A) Two DNA bands: one heavy and one light
   B) Two DNA bands: one heavy and one hybrid
   C) Three DNA bands: one heavy, one light and one hybrid
   D) One DNA band: hybrid

9. Glycosylation of proteins occurs in:

   A) Mitochondria
   B) Lysosome
   C) Peroxisome
   D) Endoplasmic Reticulum.

10. At a pH below its pI, a protein would have:

   A) Net positive charge
   B) Net negative charge
   C) No charge
   D) No net charge

11. Which of the following is a ribozyme?

   A) D,D-transpeptidase
   B) L,D-transpeptidase
   C) Peptidyl transferase
   D) Gamma-glutamyl transpeptidase

12. Which of the following has not been used in genome editing?

   A) CRISPR-cas9
   B) Zinc Finger Nucleases
   C) Transcription Activator Like Effector Nucleases
   D) PIN Domain Nucleases

13. Which of the following is not an epigenetic modification:

   A) Methylation of histone
   B) Methylation of DNA
   C) Propionylation of histone
   D) Crotonylation of DNA

14. Which of the following processes require two transesterification reactions:

   A) RNA editing
   B) mRNA splicing
   C) mRNA capping
   D) Polyadenylation

15. A core nucleosome is composed of:

A) Two copies each of histone H2A, H2B, H3 and H4 and ~146 bp of DNA.
B) Two copies each of histone H2A, H2B, H3 and H4 and ~1460 bp of DNA.
C) Four copies each of histone H2A, H2B, H3 and H4 and ~146 bp of DNA.
D) Two copies each of histone H2A, H2B, H3 and H4 and ~246 bp of DNA

16. RNA editing is:

A) Post-transcriptional alteration of sequences in mRNAs
B) Pre-transcriptional alteration of sequences in RNA
C) Post-transcriptional joining of two RNA molecules
D) Post-transcriptional splitting of one RNA molecule into two

17. which of the following is NOT true for transcriptome profiling by RNA seq:

A) It is limited to detecting transcripts that correspond to existing genomic sequence
B) It provides precise measurement of levels of transcripts and their isoforms
C) It can be used for non model organisms also
D) It has >5000 fold dynamic range to quantify gene expression level

18. Which cellular organelle is involved in the initiation of the intrinsic pathway of apoptosis?

A) Mitochondria B) Golgi C) Lysosome D) Peroxisome

19. What roles in regulating the intrinsic pathway of apoptosis are played by the Bcl-2 protein family members Bax and Bcl-2?

A) Bax inhibits apoptosis while Bcl-2 stimulates apoptosis
B) Both Bax and Bcl-2 inhibit apoptosis
C) Bax stimulates apoptosis while Bcl-2 inhibits apoptosis
D) Both Bax and Bcl-2 stimulate apoptosis

20. Which of the following is not true for Spectral Karyotyping (SKY):

A) It is a technique for chromosome analysis based on the approach of FISH technique
B) Interchromosome translocations can be detected by SKY
C) Inversion, deletion, insertion, and duplication in the same chromosome can be evaluated by SKY
D) PCR can be used to prepare probes for SKY

21. Which of the following sequences does not contain a 6 bp type II restriction endonuclease site:

A) CCCGGGTT
GGGCCCAA
B) TTTACTGCAG
AAATGACGTC
C) AAGCTTAAA
TTCGAATTT
D) ATCGGCA
TAGCCGA

22. Which of the following statements about the nuclear import is FALSE?

A) Gene regulatory proteins are frequently larger than the size exclusion for entry into the nucleus, and must have nuclear localisation signals to enter the nucleus
B) The nuclear localisation signals on eukaryotic gene regulatory proteins are have phenylalanine- glycine repeats
C) The hydrolysis of GTP to GDP is part of the cycle related to the transit of proteins to and from the nucleus
D) A small protein, Ran, is a component of the cycle related to the transit of proteins to and from the nucleus

23. Which of the following statements describes an advantage of the yeast two-hybrid method for analysis of protein interactions?

A) The assay can screen for interaction partners of a protein without the need for protein purification
B) The assay is suitable only for membrane proteins
C) The assay only detects direct association between two proteins
D) In this assay, proteins are secreted from the cells and therefore it works well with proteins with disulphide bonds

24. What is the pH of a 0.001M solution of HCl?

A) 1 B) 2 C) 3 D) 4

25. All the following are the attractive features of Scanning Electron Microscope (SEM) except:

A) Its ability to achieve high-resolution imaging of surfaces
B) Higher magnification over light microscope
C) Its great depth of focus
D) Its ability to polarize light

26. When cell components are separated by successive centrifugation (single or repeated steps) with increasing centrifugal force (*g*), the method is called:

A) Differential centrifugation B) Velocity centrifugation
C) Density-gradient centrifugation D) Equilibrium centrifugation

27. Which of the following statements is NOT correct?

A) Loss-of-function mutations in tumor suppressor genes are oncogenic
B) Gain-of-function mutations convert proto-oncogenes into oncogenes
C) Oncogenes of retroviruses are derived from normal cellular genes and they can activate proto-oncogenes
D) Oncogenes of DNA viruses are derived from normal cellular genes and they can activate proto-oncogenes

28. Drosha is involved in processing of :

A) mi RNA B) si RNA C) snoRNA D) snRNA

29. The heptad repeats of the sequence YSPTSPS are found in:

A) TFIID B) TFIIH C) TFIIE D) RNA Pol II

30. tBLASTn is used to search:

A) Protein database using a translated nucleotide query
B) Translated nucleotide database using a protein query
C) Translated nucleotide database using a translated nucleotide query
D) Nucleotide database using a nucleotide query

31. The C-value paradox refers to

A) Under-representation of nucleotide C is in some genomes
B) Poor correlation of the genome size of various eukaryotes with the number of protein-coding genes of the organism
C) Poor correlation of the genome size of various eukaryotes with the biological complexity of the organism
D) Poor correlation of the genome size of various eukaryotes with the evolutionary age of the organism

32. The approximate size of human genome is:

A) 3Mb B) 300Mb C) 3000Mb D) 30,000Mb

33. Online Mendelian Inheritance in Man (OMIM) includes entries on:

A) Particular diseases B) Particular genes
C) Genes and genetic disorders D) Complex chromosomal disorders

34. The term ‘whole-genome shotgun sequencing’ refers to:

A) A strategy to sequence an entire genome by breaking up DNA and sequencing using oligonucleotide primers that span the genomic DNA
B) A strategy to sequence an entire genome by breaking up DNA, cloning it into libraries, and sequencing using oligonucleotide primers that correspond to known chromosomal locations
C) A strategy to sequence an entire genome by breaking up DNA, cloning it into libraries, hybridizing small fragments, then reassembling the fragments into a complete map
D) A strategy to sequence an entire genome by breaking up DNA, cloning it into libraries, sequencing small fragments, then reassembling the fragments into a complete map

35. The purpose of the MIAME is to provide:

A) A unified system for the description of microarray manufacture
B) A unified system for the description of microarray experiments from design to hybridization to image analysis
C) A unified system for the description of microarray probe preparation including fluorescence- and radioactivity based approaches
D) A unified system for microarray databases including standards for data storage, analysis, and presentation

36. Klinefelter's syndrome is due to

A) XO B) XXO C) XXY D) XXX

37. Which of the following isotopes does not emit β-rays?

A) ^{32}P B) ^{14}C C) ^{125}I D) ^{3}H

38. An enzyme gave an absorbance of 1.0 at 275nm in a spectrophotometer using a 1cm cuvette. The molar extinction coefficient of the enzyme at 275nm is $10^2 M^{-1} cm^{-1}$, the concentration of the enzyme would be:

A) 1mM B) 10mM C) 100mM D) 20mM

39. Integration of phage lambda genome into E. coli genome occurs by:

A) Cos sites B) Random integration
C) Cro gene mediated recombination D) Site specific recombination

40. A protein sample should be in high salt concentration for binding to the column in _____ chromatography:

A) Hydrobhobic interaction chromatography
B) Preparative chromatography
C) Chromatofocusing
D) Gel permeation chromatography

41. QSAR (Quantitative structure activity relationship) is used for :

A) Drug designing B) Protein Modeling
C) Aligning two sequences D) Phylogenetic trees

42. Which of the following aminoacids would have the lowest propensity to occur in α-helix?

A) Arg B) Ala C) Pro D) Met

43. Which of the following is FALSE:

A) Human Microbiome Project (HMP) includes research on the relative number of different microbes present at different locations in the body
B) Only the microbes that can be cultivated in the lab are analyzed by HMP
C) The variation in particular species of gut microbes can affect digestive health
D) Metagenomic approaches are used in HMP to discover organismal and functional novelty

44. The primary cytotoxic target of the cancer drug etoposide is:

A) Topoisomerase I
B) DNA polymerase
C) RNA polymerase
D) Topoisomerase II

45. An infectious agent having no nucleic acid is:

A) Virus
B) Prion
C) Mycoplasma
D) Archaeon

46. Ebola virus has _____ as its genetic material.

A) Single stranded DNA
B) Double stranded RNA
C) Single stranded RNA
D) Double stranded DNA

47. 'Wobble hypothesis' refers to less stringent base pairing specificity of

A) 5' end of the codon
B) 5' end of the anticodon
C) 3' end of the anticodon
D) Middle base of the codon

48. Which of the following statements is NOT correct:

A) Homeobox genes are master developmental control genes
B) Homeobox genes code for a 30 aminoacid protein
C) Homeobox is evolutionary conserved throughout the three kingdoms of multicellular organisms
D) Homeobox containing genes encode DNA binding proteins that regulate gene expression

49. Select the correctly matched terms in the column below :

i. Bacteriophage lambda	A. a filamentous ssDNA phage
ii. Cosmid	B. vectors used to clone extremely large DNA molecules
iii. M13	C. a hybrid vector containing a cos site
iv. Shuttle vector	D. bacterial virus used as cloning vector
v. YAC	E. a plasmid capable of propagation in two different organisms

A) i-E; ii-D; iii-A; iv-C; v-B
B) i-D; ii-C; iii-A; iv-E; v-B
C) i-C; ii-E; iii-A; iv-B; v-D
D) i-B; ii-C; iii-D; iv-A; v-E

50. Whole-genome multiple displacement amplification from single cells can be carried out by:

A) Taq DNA polymerase
B) Pfu DNA polymerase
C) Vent DNA polymerase
D) Phi 29 polymerase

x-x-x

Medical Physics

1.	Which of the following is not a type of connective tissue A) Blood B) Bone C) Muscle D) Lymph
2.	The antibody class that can pass through the placenta to protect the fetus is A) IgA B) IgG C) IgM D) IgD
3.	^{89}Sr chloride is used to treat A) Malignant ascites B) Polycythemia vera C) Bone pain due to metastases D) Grave's disease
4.	Which endocrine gland slowly diminishes in its size with the advancement of age in humans? A) Pituitary B) Thymus C) Adrenal D) Pineal
5.	Which of the following is not a chemical radiosensitizer? A) Nucleotide analogues B) Electronic affinic compounds C) Nitroimidazoles D) Aminothiols
6.	A typical in vitro mammalian cell survival curve for low-LET radiations is characterised by A) Exponential curve B) Continuosly curving survival curve C) Initial shoulder followed by an exponential part D) Bell curve
7.	The most sensitive stage for the lethal in utero effects of radiation is A) Preimplantation B) Early organogenesis C) Late organogenesis D) The fetal period
8.	Which category of cells amongst the following is the most radiosensitive? A) Fixed postmitotic B) Reverteing postmiotic C) Vegetative intermitotic D) Differentiating intermitotic
9.	The most radiosensitive part of GI tract is A) Ileum B) Duodenum C) Colon D) Jejunum

10.	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
11.	For a *uniform* x-ray exposure, adjacent areas of the film (measured in mm^2) have photon counts that randomly differ from the mean value *N*. The distribution of the number of photons in each square millimeter is described by (A) Hypergeometric distribution (B) Chi-square distribution (C) Uniform distribution (D) Poisson distribution
12.	In radiography, which of the following is not true? (A) Object contrast refers to the attenuation characteristics of a lesion in comparison to those of the adjacent tissue that contains the lesion. (B) Increasing the lesion thickness decreases the object contrast. (C) Increasing the difference in density or atomic number between the lesion and the adjacent structure increases object contrast. (D) Object contrast is essential for any lesion to be visualized in an image.
13.	The number of 512 x 512 images (16 bit pixel) that can be stored on a 2 GB disk is about (A) 500 (B) 1,000 (C) 4,000 (D) 10,000
14.	Mammography image mottle is determined primarily by (A) Quantum mottle (B) Film grain size (C) Viewbox luminance (D) Variations in screen thickness
15.	Ten millicuries of source strength is equal to (A) 37 Bq (B) 370 Bq (C) 370 MBq (D) 37 mBq
16.	Soft-tissue contrast in chest radiographs performed at 140 kVp is due primarily to (A) Coherent interactions (B) Compton interactions (C) Photoelectric interactions (D) Pair production interactions

17.	If the half-value layer (HVL) for an absorber is 2 cm, the linear attenuation coefficient is (A) 0.50 cm^{-1} (B) 0.35 cm^{-1} (C) 2.9 cm^{-1} (D) 0.50 cm
18.	Film/screen mammography image quality would likely be degraded by all except (A) Use of grids (B) High kVp (C) Low mAs (D) Aluminum filtration
19.	The typical dose to the breast from a CT scan of the chest is (A) Approximately 0.02 mGy (20 mrad) (B) Approximately 0.2 mGy (200 mrad) (C) Approximately 2 mGy (0.2 rad) (D) Approximately 20 mGy (2 rad)
20.	Ultrasound attenuated by 3 dB means intensity of signal is lower than the original signal by (A) 3% (B) 30% (C) 50% (D) 70%
21.	In the case of interaction of water with x-rays, the photoelectric and Compton effects are equal at (A) 0.5 keV (B) 4 keV (C) 25 keV (D) 88 keV
22.	In X-ray imaging, the Subject contrast depends on (A) Tube voltage (kVp) (B) Tube current (mA) (C) Type of film (D) Film density
23.	Acoustical impedance is (A) Product of the velocity of sound in the medium and the medium density (B) Square root of the product of the velocity of sound in the medium and the medium density (C) Velocity divided by medium density (D) Transducer electrical resistance
24.	Ring artifacts in a third-generation CT scanner are caused by (A) Kilovolt peak drift (B) Tube arcing (C) Faulty detector elements (D) Patient motion

25.	Boron neutron capture therapy (BNCT), the selective therapeutic dose is delivered by the neutron capture reaction (A) $^{10}B(n,\alpha)^{7}Li$ (B) $^{11}B(n,p)^{11}Be$ (C) $^{10}B(n,p)^{10}Be$ (D) $^{11}B(n, \alpha)^{8}Li$
26.	Typical annual background radiation exposure values for a human are (A) Radon 2.0 mSv/yr, Cosmic rays 0.3 mSv/Yr, Internal souces (0.4 mSv/yr) and external gamma rays (0.3 mSv/Yr) (B) Radon 0.3 mSv/yr, Cosmic rays 2.0 mSv/Yr, Internal souces (1.4 mSv/yr) and external gamma rays (0.3 mSv/Yr) (C) Radon 4.0 mSv/yr, Cosmic rays 0.3 mSv/Yr, Internal souces (0.4 mSv/yr) and external gamma rays (0.3 mSv/Yr) (D) Radon 2.0 mSv/yr, Cosmic rays 1.3 mSv/Yr, Internal souces (0.4 mSv/yr) and external gamma rays (1.3 mSv/Yr)
27.	PET scanners detect (A) Positrons of the same energy in coincidence (B) Positrons and electrons in coincidence (C) Annihilation photons in coincidence (D) Annihilation photons in anticoincidence
28.	The cell division stage most sensitive to radiation is (A) Prophase (B) Metaphase (C) Anaphase (D) Telophase (E) Interphase
29.	The difference between exposure and dose is the difference between (A) The rad and the gray (B) Absorption and temperature increase (C) Photons and charged particles (D) Ionization in air and absorption in a medium
30.	A neutron will loose the most energy in backscattering from the nucleus of (A) ^{238}U (B) ^{1}H (C) ^{3}H (D) ^{106}Cd
31.	Which of the following nuclei will have a magnetic moment? (A) $^{2}D_{1}$ (B) $^{16}O_{8}$ (C) $^{12}C_{6}$ (D) $^{32}S_{16}$

32.	Two digits are selected at random from digits 1 to 9. The probability that their product is a perfect square is (A) 1/36 (B) 1/72 (C) 2/9 (D) 1/9
33.	The mean and standard deviation of a variable '*x*' are known to be 15 and 5, respectively. Then the mean and standard deviation of (100-2*x*) are (A) 15 and 5, respectively (B) 30 and 10, respectively (C) 70 and 5, respectively (D) 70 and 10, respectively
34.	Gaussian distribution is (A) Platykurtic ($\beta_2 < 3$) (B) Leptokurtic ($\beta_2 > 3$) (C) Mesokurtic ($\beta_2 = 3$) (D) Positively skewed
35.	The correlation coefficient between the variables '*x*' and '*y*' is +0.6. The correlation coefficient between the (-*x*/2) and (-*y*/2) will be (A) +0.6 (B) -0.6 (C) +0.3 (D) -0.3
36.	The shape of binomial distribution for p < 0.5 will be (A) Symmetrical (B) Mesokurtic (C) Positively skewed (D) Negatively skewed
37.	The mode value(s) in the set 2,2,3,3,3,5,9,10,11,10,12,10 is (A)12 (B)3 (C)10 (D)3 and 10
38.	Which of the following is the digital to analog converter? (A)Register-register D/A converter (B)2R-R ladder D/A converter (C)R-2R ladder D/A converter (D)Weighted- weighted D/A converter
39.	Relative dispersion is calculate by (A)$\overline{X}$ - Standard deviation (B)$\frac{X-\overline{X}}{n}$ (C)$\frac{\text{Standard deviation}}{\sqrt{n}}$ (D) $\frac{Standard\ deviaton}{\overline{X}} \times 100$

40.	Electron capture can result in emission of (A) High-LET radiation (B) Characteristic x-rays (C) Positrons (D) Neutrons
41.	A lead apron attenuates 95%; transmission through two lead aprons would be approximately (A) 0.25% (B) 0.5% (C) 1.0% (D) 1.25%
42.	If the dose rate is 250 cGy/min at 100 cm, at what distance will the dose rate be 100 cGy/min? (A) 40 cm (B) 158 cm (C) 200 cm (D) 250 cm
43.	A treatment using volumetric arc therapy (VMAT) usually requires fewer monitor units than does the same treatment with static gantry intensity modulation (i.e., IMRT). This is because (A) On average the MLC leaf openings are larger for VMAT than for IMRT (B) On average the dose rate is higher for VMAT than for IMRT (C) On average the treatment depth is less for VMAT than for IMRT (D) None of the above
44.	Continuous tracking of prostate motion during fixed-gantry IMRT delivery can be accomplished by (A) Cone-beam CT with MV treatment beam (B) Stereoscopic optical camera system (C) Stereoscopic infrared camera system (D) Implanted RF electromagnetic beacon localization
45.	When CT images are used for radiotherapy planning, Hounsfield numbers must be converted to electron densities for use by the dose calculation algorithms. The relationship between Hounsfield number and electron density is approximately linear for most tissues except (A) Bone (B) Lung (C) Air cavities (D) Muscle
46.	Which of the following is not refer to portal dosimetry using EPIDs (A) Dose profile measurement (B) IMRT QA (C) Patient position verification (D) MLC alignment verification

47.	A 50 keV x-ray has a photoelectric interaction with an atom. The emitted electron has a kinetic energy of 34 keV. Immediately, a 10 keV characteristic x-ray is emitted. What was the binding energy of the electron? (A) 6 keV (B) 16 keV (C) 22 keV (D) 28 keV
48.	The binary equivalent of 876 decimal is (A) 1001101100 (B) 1011110011 (C) 1101101100 (D) 1101000110
49.	One nibble equals to (A) 1 Bits (B) 2 Bits (C) 4 Bits (D) 8 Bits
50.	A potential prostate seed implant patient undergoes a transrectal ultrasound (TRUS) to determine prostate volume. The height, width, and length of the gland are measured. The volume of the gland can be computed approximately by assuming it has the shape of a/an (A) Cube (B) Brick (C) Cone (D) Ellipsoid

x-x-x

Microbial Biotechnology (1076)

1. Arrange the following forms of DNA in decreasing order of the number of base pairs per helical turn.

   A) A, B, Z B) B, A, Z C) Z, A, B D) Z, B, A

2. In DNA samples isolated from four unidentified bacterial species, W, X, Y and Z, adenine makes up 17%, 21%, 30% and 5%, respectively, of the total bases. Which of these species may be thermophilic?

   A) X B) W C) Y D) Z

3. The suffix “ximab” refers to monoclonal antibodies which are

   A) Chimeric B) Murine C) Human D) Humanized

4. Which of the following tests can be used to diagnose glandular fever?

   A) Rose-Waaler test B) Paul-Bunnell test
   C) Widal test D) Weil-Felix test

5. Which of the following is a pan B cell marker?

   A) CD1 B) CD56 C) CD19 D) CD4

6. In T cells, the T cell receptor (TCR) is found in close association with

   A) CD4 B) CD8 C) CD3 D) CD2

7. Molecular Koch’s postulates were given by

   A) Stanley Falkow B) Rober Koch
   C) Paul Ehrlich D) Barbara McClintock

8. In statistical hypothesis test, type I error corresponds to

   A) Incorrect rejection of the null hypothesis
   B) Incorrect acceptance of the null hypothesis
   C) Data clustering
   D) Peakedness

9. In flow cytometry, the side scatter is a measure of

   A) Relative cell size B) Relative cell complexity
   C) Relative fluorescence intensity D) Antigen-antibody reaction

10. The ligand that can be used for purification of glycoproteins is

   A) Concanavalin A B) Carboxymethyl
   C) DEAE D) Quaternary ammonium

11. If the base composition of a phage genome is A=28%, T=33%, G=21% and C=18%,

A) Single-stranded RNA B) Single-stranded DNA
C) Double-stranded DNA D) Double-stranded RNA

12. H3M form of the enzyme lactate dehydrogenase is predominantly found in the:

A) Heart and RBCs B) Brain and kidney
C) Liver D) Skeletal muscles

13. The side chain of which amino acid is ionized within the physiological pH range?

A) Phenylalanine B) Valine C) Glycine D) Histidine

14. A heat-stable exotoxin can be produced by

A) Enterotoxigenic *Escherichia coli* B) *Corynebacterium diphtheriae*
C) *Clostridium tetani* D) *Bacillus anthracis*

15. Nickel affinity chromatography can be used to purify

A) Fluorescently labelled proteins B) Glycine containing proteins
C) Radiolabelled proteins D) His-tagged proteins

16. Osmotic pressure of pure water is

A) 0 B) 1 C) 0.1 D) 10

17. Pantothenic acid is a precursor for

A) Coenzyme A B) Tetrahydrofolate
C) Pyridoxal phosphate D) FAD

18. Which of the following antibiotics inhibits the folic-acid pathway?

A) Chloramphenicol B) Sulfamethoxazole
C) Rifamycin D) Ciprofloxacin

19. Which of the following is a killed vaccine?

A) Salk vaccine B) Sabin vaccine C) BCG D) Mumps vaccine

20. Which of the following is a signal-amplification method?

A) Strand displacement B) NASBA
C) bDNA D) TMA

21. Toxoid-based vaccination is given for

A) Diphtheria B) Pertussis C) Measles D) Tuberculosis

22. Cetyltrimethylammonium bromide is a _____detergent

A) Zwitterionic B) Anionic C) Neutral D) Cationic

23. Which of the following enzymes can break the beta (1,4) linkage between N-acetylmuramic acid and N-acetylglucosamine?

A) Lysostaphin B) Lysozyme C) Glucosaminidase D) Glucanase

24. Ethidium bromide can detect as little as _____ of DNA.

A) 10 picogram B) 100 nanogram C) 10 nanogram D) 1 microgram

25. Cartagena protocol on biosafety with respect to living modified organisms was entered into force in the year

A) 1999 B) 2008 C) 2005 D) 2003

26. The wavelength of infrared rays is shorter than

A) Visible light B) X rays C) Gamma rays D) Microwaves

27. Paul Ehrlich is credited with discovering the concept of

A) Magic bullets B) Phagocytosis C) Blood groups D) Fermentation

28. Spastic paralysis is caused by

A) Diphtheria toxin B) Tetanus toxin C) Botulinum toxin D) Shiga toxin

29. The genome of Ebola virus is

A) ssRNA, negative sense B) ssRNA, positive sense
C) ssDNA D) dsDNA

30. Which of the following is the commonest cause of infantile diarrhoea?

A) *Salmonella* spp. B) Rotavirus
C) *Shigella* spp. D) *Clostridium* spp.

31. Sporangiospores are produced by

A) *Malassezia* spp. B) *Histoplasma* spp.
C) *Aspergillus* spp. D) *Rhizopus* spp.

32. Incomplete antibodies can be detected by

A) Coombs test B) Rose-Waaler test
C) Widal test D) VDRL test

33. Which of the following techniques cannot be used to study DNA-protein interactions?

A) Footprinting B) Electrophoretic mobility shift assay
C) Yeast two hybrid system D) Nitrocellulose filter binding assay

34. In *Streptococcus fecalis*, conjugation is mediated by

A) F factor
B) Aggregation and binding substances
C) Plasmid R68
D) C factor

35. The IMViC reaction for *Klebsiella* spp. is generally

A) + + - -
B) - - + +
C) + - + -
D) - + - +

36. Fullerenes nanotubes are a form of

A) Hydrogen
B) Silver
C) Carbon
D) Nitrogen

37. The T2*Candida* panel recently approved for diagnosis of candidemia is based on

A) Magnetic resonance imaging
B) Beta-glucan assay
C) Mannan assay
D) Multilocus sequence typing

38. Southern blotting is used for

A) Proteins
B) DNA
C) RNA
D) Lipids

39. Which of the following is not an ionization technique in mass spectrometry?

A) MALDI
B) ESI
C) APPI
D) TOF

40. Who sequenced the first bacterial genome?

A) Craig Venter
B) Stanley Falkow
C) Mario R. Capecchi
D) Ruth Sager

41. Mantoux test is based on _____ hypersensitivity reaction

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

42. 2-mercaptoethanol is used in SDS PAGE for reduction of

A) Disulfide linkages
B) Carbon-carbon linkage
C) Nitrogen-nitrogen linkage
D) Carbon-nitrogen linkage

43. The antibody which can cross placenta is

A) IgG
B) IgM
C) IgD
D) IgE

44. Which of the following is a selective culture medium?

A) Mueller Hinton agar
C) MacConkey agar
C) Blood agar
D) Nutrient agar

45. Blue cheese gets its name from the mould

A) *Rhizopus*
B) *Rhizomucor*
C) *Penicillium*
D) *Absidia*

46. Helmstetter-Cummings technique is used to prepare _____ culture of bacteria

A) Synchronous B) Continuous C) Batch D) Flow

47. The ability of a microscope to distinguish two adjacent points as separate is termed as its

A) Resolving power
B) Magnifying power
C) Numerical aperture
D) Optical thickness

48. Spheroplasts are obtained from

A) Gram-positive bacteria
B) Gram-negative bacteria
C) Chlamydia
D) Fungal spores

49. Growth rate is the reciprocal of

A) Generation time
B) Specific growth rate
C) Number of generations
D) Time period

50. Which of the following is not a member of the family Enterobacteriaceae?

A) *Yersinia pestis*
B) *Escherichia coli*
C) *Klebsiella pneumonia*
D) *Pseudomonas aeruginosa*

x-x-x

Microbiology (1076)

1. Proton motive force in bacteria is NOT utilized for

A) ATP synthesis
B) Flagellar locomotion
C) Transport of certain nutrients
D) Glucose metabolism

2. A bacterial population growing exponentially at a specific growth rate of 1.25/h will have a generation time of

A) 0.55 h B) 0.65 h C) 0.85 h D) 1.55 h

3. For beer fermentation, malt is prepared by

A) Roasting barley
B) Washing the barley with water and drying it in air
C) Soaking barley in water followed by germination and drying
D) Treating barley with bovine amylase followed by roasting

4. What is the raw material for the production of rum

A) Grapes B) Barley C) Cane molasses D) Apples

5. Which oil is used as immersion oil in light microscopy

A) Mineral oil
B) Glycolic acid
C) Cedar wood oil
D) Rosemary oil

6. Grapes are crushed to bring out juice for the production of wine. This is called

A) Wort B) Malt C) Whey D) Must

7. A carbonated drink, pH 3, is how many times more acid than distilled water

A) 3 B) 4 C) 3000 D) 10000

8. Which reaction produces most ATP molecules during aerobic metabolism

A) Glucose to glucose-6-phosphate
B) Phosphoenolpyruvate to pyruvate
C) Glucose to pyruvate
D) Acetyl CoA to $CO_2 + H_2O$

9. Which of the following processes does not generate ATP

A) Photophosphorylation
B) Calvin-Benson cycle
C) Oxidative phosphorylation
D) Substrate level phosphorylation

10. Which compound has the greatest energy for cell

A) ATP B) GTP C) Acetyl~CoA D) Glucose

11. Which is most effective in sterilizing plastic petri dishes

A) Chlorine
B) Autoclaving
C) Ethylene oxide
D) Non ionizing radiation

12. Feedback inhibition differs from catabolite repression in the way that feedback inhibition

A) Stops the synthesis of new enzymes
B) Is less accurate
C) Stops the action of preexisting enzymes
D) Has slower rate constant

13. Bergey's Manual of Systematic Bacteriology differs from Bergey's Manual of Determinative Bacteriology in that the former

A) Groups bacteria in to species
B) Groups bacteria according to phylogenetic relatedness
C) Groups bacteria according to pathogenic properties
D) Groups bacteria in to 19 species

14. Coliforms are used as indicator organisms of sewage pollution because

A) They are pathogens
B) They ferment lactose
C) They are abundant in human intestine
D) They grow within 48 hours

15. The term 12D treatment means

A) Heat treatment sufficient to kill 12000 bacteria
B) Use of 12 different treatments to kill all bacteria
C) 10^{12} reduction in bacterial count
D) 12 hours heat treatment to destroy thermophiles

16. Which reaction is undesirable in wine making

A) Sucrose to ethanol
B) Ethanol to acetic acid
C) Malate to lactate
D) Glucose to pyruvate

17. BamHI is a restriction enzyme belonging to the Type

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

18. Antibiotic that does not inhibit cell wall synthesis is

A) Cycloserine
B) Vancomycin
C) Nalidixic acid
D) Amoxycillin

19. The phylogenetic classification of bacteria is based on

A) Fatty acid analysis
B) DNA-DNA hybridization
C) 16S rDNA sequence analysis
D) G+C % content of DNA

20. In industrial mutations, which of the following mutagens causes oxidative deamination of cytosi

A) HNO_2
B) $HONH_2$
C) Methyl Nitro NitrosoGuanidine
D) Ethyl Methane Sulphonate

21. You have bought a 1L sealed bottle of mineral water. How will you check whether it is contaminated with *E.coli* or not

A) Dilution plate method
B) Pour plate method
C) Spread plate method
D) Membrane filter count method

22. *E. coli* DNA Polymerase III replicates ColEI plasmid DNA

A) Unidirectionaly at the rate of 50 kb per min
B) Bidirectionaly at the rate of 50 kb per min
C) Unidirectionaly at the rate of 40 bp per second
D) Bidirectionaly at the rate of 40 bp per second

23. Upon infection of *E. coli* with lambda phage, N and Cro proteins are produced during

A) Immediate early transcription B) Delayed early transcription
C) Late transcription D) DNA synthesis phase

24. pBR322 contains the origin of replication taken from

A) ColEI B) pSC101 C) R1 D) pMB1

25. XmaI, a restriction endonuclease recognizing hexameric sequence CCCGGG, will cut a genomic DNA, which has 50% GC content, after every

A) 4^2 bp B) 4^4 bp C) 4^6 bp D) 4^8 bp

26. Which of the following nucleic acid amplification techniques can be used for cDNA synthesis and cloning

A) TaqMan PCR B) Nested PCR C) RT – PCR D) Multiplex PCR

27. Yeast artificial chromosome can accommodate foreign DNA fragments of the size

A) 1-10 kb B) 120-300 kb C) 250-400 kb D) 10-100 Mb

28. For error prone PCR, the polymerase used is

A) *Taq* B) *Klenow* C) *Vent* D) *Pfu*

29. The gene responsible for septum formation in bacteria is

A) *mukA* B) *minC* C) *ftsZ* D) *lexA*

30. Which phage has terminally redundant, circularly permuted genome

A) P1 B) Lambda C) T2 D) M13

31. Which of the following viruses is NOT transmitted from animals to humans

A) Rabies B) Hanta C) Lassa Fever D) H5N1

32. Vaccination protects us from infectious disease by generating memory

A) Antigen B) Lymphocytes C) Macrophages D) PMNs

33. Alum is an effective adjuvant because it

A) Disaggregates the antigen B) Is immunogenic for stem cells
C) Is immunogenic for T cells D) Slows the release of antigen

34. Genes for immunoglobulins (antibodies) are unlike other human genes in that

A) Antibody genes are composed of introns and exons
B) DNA for antibody molecules is inherited from only one parent
C) Gene segments must be spliced together to make each unique antibody molecule
D) Several exons encode each antibody molecule

35. Which situation below describes an example of innate immunity?
A) Antibody production by plasma cells
B) Antigen removal by cilia in the respiratory tract
C) Memory response to influenza virus
D) Recognition and killing of virus-infected cells by cytotoxic T cells

36. What is NOT true about Measles:

A) Can be prevented through immunization with a live attenuated strains

B) Causes fetal abnormalities if the mother becomes infected during pregnancy

C) Is most infectious before the onset of symptoms

D) Is associated with secondary bacterial infection which is the main cause of mortality

37. What is wrong? Human immunodeficiency virus-1 (HIV-1):

A) Is a retrovirus containing RNA
B) Contains env gene which encodes the core nucleocapsid polypeptides
C) Causes an increase in CD8 lymphocytes during seroconversion
D) Can be detected in infected individuals by measuring the p24 antigen

38. Widal test is a serological test to detect

A) Specific agglutinins against O-Ag of *Samonella typhi*
B) Specific precipitins against H-Ag of *Samonella typhi*
C) Specific agglutinins against both O-Ag and H-Ag of *Samonella typhi*
D) Specific precipitins against both O-Ag and H-Ag of *Samonella typhi*

39. Which of the following is not positive for *Staphylococcus aureus*:

A) Lancefield group serology
B) Phosphatase positivity
C) Coagulase positivity
D) Fermentation of mannitol

40. Erythrogenic toxin is produced by

A) Group A lysogenic Streptococci
B) Beta- hemolytic Staphylococci
C) *Yersinia pestis*
D) Alpha- hemolytic Streptococci

41. Cholera toxin consists of

A) 5 A and 1 B chains
B) 1 A and 5 B chains
C) 1 A and 1 B chain
D) 5 A and 5 B chains

42. Which is not a member of the family Enterobacteriaceae

A) *Citrobacter* B) *Edwardsiella* C) *Providencia* D) *Pseudomonas*

43. Delayed hypersensitivity to PPD is measured by

A) Dick test B) Schick test C) Montoux test D) HPV test

44. Icosahedral capsid of viruses consists of

A) 12 corners, 20 faces
B) 12 corners, 12 faces
C) 20 corners, 12 faces
D) 20 corners, 20 faces

45. Which is not common flora of skin

A) *Staphylococcus* B) *Mycobacteria* C) *Corynebacteria* D) *Bacteroides*

46. The first bacterium whose genome was sequenced was

A) *E.coli*
B) *H. Influenzae*
C) *Mycoplasma genitalium*
D) *Methanococcus janaschii*

47. Prokaryotes that have cell walls without peptidoglycan fall in the division

A) Gracilicutes B) Firmicutes C) Tenericutes D) Mendosicutes

48. Rubella virus belongs to the family

A) Togaviridae B) Flaviviridae C) Rhabdoviridae D) Bunyaviridae

49. Which is an oxidation reaction carried out by *Thiobacillus ferrooxidans*

A) Fe^{2+} to Fe^{3+} B) Fe^{3+} to Fe^{2+} C) CuS to $CuSO_4$ D) Cu^0 to Fe^0

50. The commercial drink YAKULT contains the Lactic Acid Bacteia

A) *Lactobacillus casei*
B) *Lactobacillus plantarum*
C) *Leuconostoc mesenteroides*
D) *Streptococcus lactis*

x-x-x

Nanoscience & Nanotechnology (1076)

1. Crystal structure of GaAs is

   A) Body centred cubic
   B) Face centred cubic
   C) Cubic
   D) Trigonal

2. Quantum dots are useful for biotechnology applications in imaging. Property that is useful for the purpose is

   A) Absorption
   B) Luminescence
   C) Reflection
   D) Transmission

3. The reciprocal lattice of the face centred cubic lattice is

   A) Base centred cubic
   B) Face centred cubic
   C) Trigonal
   D) Orthorhombic

4. Bucky balls are made of

   A) C_{60} molecules
   B) A metallic glass
   C) A polymeric material
   D) Superconductors

5. In which of the following compounds are hydrogen bonds between molecules the strongest?

   A) HCl
   B) HF
   C) HBr
   D) HI

6. The distortion produced by the point defects in a lattice is classified as

   A) Local
   B) Global
   C) Surface
   D) None of these

7. Dislocations in metals are characterized by

   A) Etch pitting
   B) Transmission electron microscopy
   C) Both A and B
   D) None of these

8. As temperature increases, diffusivity of an atom in a solid material,

   A) Increases
   B) Decreases
   C) Remains constant
   D) Depends on the specific material

9. Which one of the following metals is commonly alloyed with iron to improve its corrosion resistance?

   A) Co
   B) Cr
   C) Ti
   D) Nb

10. In carbon fiber reinforced resin composites, for a given fiber volume content, Young's modulus depends on the orientation of the fiber with respect to the applied load. Which orientation of the fibers will give the maximum value of Young's modulus?

    A) Transverse
    B) Longitudinal
    C) Random
    D) Both transverse and longitudinal

11. Vulcanization is related to

    A) Strengthening of rubber
    B) Extrusion
    C) Injection moulding
    D) Addition polymerisation

12. Match the terminologies given in **Column I** with their relations listed in **Column II**

Column I	**Column II**
P. Domain wall	1. superconductors
Q. Fick's law	2. mechanical properties
R. Matthiessen's rule	3. ferromagnetic materials
S. Hall-Petch relation	4. resistivity of impure metal
T. Meissner effect	5. diffusion

A) P-1, Q-3, R-5, S-2, T-4
B) P-3, Q-5, R-2, S-4, T-1
C) P-3, Q- 5, R-4, S-2, T-1
D) P-3, Q-4, R-3, S-2, T-4

13. Match the microscopes listed in **Column I** with their principle of operation listed in **Column II**

Column – I	**Column – II**
P. Scanning Electron Microscope (SEM)	1. van der Waals forces between atoms
Q. Transmission Electron Microscope (TEM)	2. electrons to jump across a potential barrier
R. Scanning Tunnelling Microscope (STM)	3. diffraction of electrons
S. Atomic Force Microscope (AFM)	4. detection of secondary electrons
	5. photo emission of electrons

A) P-2, Q-5, R-3, S-1
B) P-3, Q-4, R-5, S-2
C) P-4, Q-3, R-2, S-1
D) P-4, Q-3, R-5, S-2

14. In free radical polymerization, one of the following techniques permits simultaneous increase in rate of polymerization and polymer molecular weight.

A) Solution polymerization
B) Suspension polymerization
C) Bulk polymerization
D) Emulsion polymerization

15. A reinforced polymer composite is made by the incorporation of

A) Elastomers into the polymer
B) Fibers into the polymer
C) Plasticizers into the polymer
D) Gaseous additives into the polymer

16. Match each of the following additives for plastics with its function

Additive	**Function**
P. α-Cellulose	1. Flame retarder
Q. Zinc chromate	2. Plasticizer extender
R. Alumina trihydrate	3. Organic fibrous filler
S. Chlorinated paraffin wax	4. Colorant

A) P-1; Q-2; R-3; S-4
B) P-2; Q-3; R-4; S-1
C) P-3; Q-4; R-1; S-2
D) P-4; Q-1; R-2; S-3

17. Which of the following carbohydrates is NOT classified as dietary fibre?

A) Agar
B) Pectin
C) Sodium alginate
D) Tapioca starch

18. Neoprene is rendered non-inflammable because

A) It has a highly cross-linked structure
B) It has a highly linear chain structure
C) Of the presence of chlorine atom in the structure
D) Of the absence of chlorine atom in the structure

19. Quantitative measurement of the roughness of a polysilicon wafer can be performed with

A) Scanning tunneling microscopy
B) Scanning electron microscopy
C) Transmission electron microscopy
D) Atomic force microscopy

20. The temperature of the antiferromagnetic-to-paramagnetic transition is called

A) Curie temperature
B) Curie-Weiss temperature
C) Neel temperature
D) Debye temperature

21. At low injection level, a forward biased p-n junction would have

A) No charge carriers
B) Minority carrier concentration much more than majority carrier concentration
C) Minority carrier concentration equal to majority carrier concentration
D) Minority carrier concentration much less than majority carrier concentration

22. The equilibrium concentration of vacancies in a pure metal

A) Increases exponentially with temperature
B) Decreases exponentially with temperature
C) Varies linearly with temperature
D) Is independent of temperature

23. The estimation of the molecular weight of a polymer by gel permeation chromatography (GPC) is based on its

A) Polarity
B) Size
C) Adsorption to stationary phase
D) Crystallinity

24. Elastomers are characterized by

A) High modulus and high elongation at break
B) High modulus and low elongation at break
C) Low modulus and high elongation at break
D) Low modulus and low elongation at break

25. In natural rubber compounding, a peptizer is added

A) At the beginning of the compounding cycle
B) After the addition of filler
C) At the end of the compounding cycle
D) After the addition of antioxidant

26. A non-hydrolyzable lipid is

A) Lecithin
B) Arachidic acid
C) Tocopherol
D) Tristearin

27. Arrange the following elements in order of increasing melting point:

(P) gallium Q) tungsten (R) aluminium (S) gold

A) P < R< Q < S B) S < P < R < Q C) P < R < S < Q D) R < S < Q < P

28. When the atoms in a solid are separated by their equilibrium distance

A) The potential energy of the solid is lowest
B) The force of attraction between the atoms is maximum
C) The force of repulsion between the atoms is zero
D) The potential energy of the solid is zero

29. Which of the following is NOT a soft magnetic material?

A) Iron-silicon steel B) Nickel zinc ferrite
C) Nickel iron alloy D) Alnico

30. Match the techniques listed in Column I with the characteristics of the materials measured in Column II.

Column I	**Column II**
P. DSC	1. Density of states
Q. XRD	2. Glass transition temperature
R. STM	3. Cathodoluminescence
S. SEM	4. Crystal structure
	5. Thermal expansion coefficient

A) P-2, Q-3, R-4, S-1 B) P-5, Q-4, R-5, S-1
C) P-2, Q-4, R-1, S-3 D) P-3, Q-5, R-4, S-2

31. The biodegradable polymer among the following polymers is

A) Poly(lactic acid) B) Poly(butylene terephthalate)
C) Polystyrene D) Polypropylene

32. Under alkaline conditions, DNA is more stable than RNA because

A) RNA forms secondary structures B) RNA is a single stranded molecule
C) RNA has uracil in place of thymidine D) RNA is susceptible to hydrolysis

33. Energy Dispersive Spectroscopy (EDS) in a typical scanning electron microscope enables elemental identification by collecting and examining which of the following:

A) Secondary electrons from the sample
B) Back scattered electrons from the sample
C) Characteristic X-rays from the sample
D) Diffraction pattern from the sample

34. Which of the following electronic configurations correspond to a noble gas

A) 2, 8, 4 B) 2, 8, 18 C) 2, 8, 18, 7 D) 2, 8, 3

35. The first humanized monoclonal antibody approved for the treatment of breast cancer is

A) Rituximab B) Cetuximab C) Bevacizumab D) Herceptin

36. Human genome sequencing project involved the construction of genomic library in

A) Bacterial artificial chromosome B) pBR322
C) Bacteriophage D) pcDNA3.1

37. In Bose-Einstein condensates, the particles

A) Have strong interparticle attraction
B) Condense in real space
C) Have overlapping wavefuntions
D) Have large and positive chemical potential

38. In a Hall effect experiment, the Hall voltage for an intrinsic semiconductor is negative. This is because (symbols carry usual meaning)

A) $n \approx p$ B) $n > p$ C) $m_e > m_n$ D) $m_e^* > m_h^*$

39. The Fourier series expansion is possible only if the function is

A) Periodic B) Non Periodic C) Discontinuous D) All of these

40. Smallest repeat entity of the crystal structure is known as

A) Lattice B) Unit cell C) Millar indices D) Phase

41. In heat treatment "quenching" refers to

A) Slow cooling B) Rapid cooling C) Rapid heating D) Slow hearting

42. For good photoemission, a semiconductor should have

A) Direct band gap B) Indirect band gap
C) Photonic band gap D) None of these

43. $(AB)^T$ = ?

A) $(AB)^{-1}$ B) $A^{-1}B^{-1}$ C) B^TA^T D) A^TB^T

44. Indium tin oxide is widely used in touch-screen displays due to

A) High adhesion property
B) Transparent and conductive properties
C) Microwave characteristics
D) Dust proof properties

45. Ion implantation is a process

A) To dope semiconductors B) In dental applications
C) To protect cytotoxicity D) In residual life assessment

46. The level of quantum confinement in quantum wires is

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

47. In a nanostructured material

A) The bandgap increases compared to bulk
B) The bandgap decreases compared to bulk
C) The bandgap is same as the bulk
D) None of the above

48. A liquid medium containing a colloidial suspension of ferromagnetic particles is known as

A) Magnetic resonance B) Plasmonic fluid C) Superconductor D) Ferrofluid

49. The stacking sequence ABCABCABC…. Belongs to the following crystal structure

A) FCC B) HCP C) Sperical D) Monolcinic

50. Among the following technique which is not useful for size characterization of nanomaterials

A) Transmission microscope B) Infra-red spectroscopy
C) X-ray diffraction D) Atomic force microscopy

x-x-x

Nuclear Medicine (1076)

1. Indicate which cell type is the most radiosensitive

   A) Lymphocytes
   B) Granulocytes
   C) Erythrocytes
   D) Mucosal cells lining the GI tract

2 Which of the following situations is a misadministration in nuclear medicine?

   A) Infiltration of an attempted intravenous injection
   B) Administration of 10 mCi I-131 instead of the prescribed 9 mCi
   C) Administration of 20 mCi Tc-99m pertechnetate instead of the prescribed 18 mCi
   D) Administration of 15 mCi I-131 sodium iodide oral solution intravenously

3. Which radionuclide is recommended for radiosynovectomy of small finger joints?

   A) ^{169}Er B) ^{188}Re C) ^{90}Y D) ^{198}Au

4. Bricks are used to attenuate a gamma ray beam. Two bricks reduce the intensity to half of the initial value (no brick shielding). Choose the correct statement

   A) Four bricks would reduce the intensity to 12.5% of the initial intensity
   B) Six bricks would reduce the intensity to 25% of the initial intensity
   C) Eight bricks would reduce the intensity to 6.25% of the initial intensity
   D) Three bricks would reduce the initial intensity to 25% of the initial intensity

5. Uniformity of a gamma camera depends on all of the following factors except one

   A) Variation of photomultiplier tube response
   B) X,Y positioning of pulses along the field of view
   C) Photon energy resolution
   D) Edge packing

6. Choose the correct statement: exposure of ^{99m}Tc MDP to air may result in

   A) Increased uptake in liver and spleen
   B) Increased renal excretion
   C) Increased uptake in stomach, thyroid and salivary glands
   D) Increased uptake in the bone marrow

7. Indicate which statement about radiolysis is false

   A) The longer half-life of the radionuclide, the more extensive is the radiolysis
   B) The higher the specific activity, the greater is the radiolysis
   C) The more energetic the radiation, the greater is the radiolysis
   D) Radiolysis is independent of temperature

8. Indicate which one of the following statements is not fulfilled by the Helsinki Declaration

A) Clinical research does not need the subject's consent if it is expected to be of benefit to the subject
B) Biomedical research cannot be carried out unless the importance of the objective is in proportion to the inherent risk to the subject
C) Each experimental procedure should be formulated in a protocol approved by an independent committee
D) For those who are unable to give consent this should be sought from a responsible relative

9. Indicate which one of the listed substances is normally used to explore the cerebral vasodilatory flow reserve by means of CBF SPECT

A) Adenosine B) Captopril C) Acetazolamide D) Dobutamine

10. Indicate which statement about diuresis renography is false

A) The diuretic may be administered before, at the same time, or after injection of the radiopharmaceutical
B) The renal function is a major determinant of the diuretic induced flow rate
C) An optimal response to the diuretic is dependent on adequate hydration
D) A full bladder will not influence the upper tract urodynamics

11. Which one of the following benign lesions does not normally show increased tracer uptake on bone scans?

A) Paget's disease B) Bone cyst
C) Englemann´s disease D) Osteoid osteoma

12. An HMPAO kit should generally be used within how many hours after preparation?

A) 2 hours B) 4 hours C) 0.5 hours D) 24 hours

13. Which of the following radionuclides is not a positron emitter?

A) ^{82}Rb B) ^{15}O C) ^{18}F D) ^{14}C

14. DOTATOC, DOTANOC and DOTATATE are

A) Somatostatin receptors B) Somatostatin analogues
C) Growth hormone D) Bi-functional chelators

15 Lu-177 is used in radionuclide therapy. Which of the following is true?

A) Only have βmax of 650 KeV B) βmax- 435 KeV and γ-208 KeV
C) βmax-2.1 MeV and γ-155 KeV D) βmax-1.7 MeV and γ-208 KeV

16. Normal FDG distribution would show the least activity in the:

A) Brain B) Bone C) Bladder D) Myocardium

17. Which of the following is the most effective means of measuring low levels of removable radiation?

A) By performing an area survey
B) By performing a wipe test
C) With a pocket dosimeter
D) With a TLD

18. The use of a nebulizer is required with which of the following radiopharmaceuticals during lung imaging?

A) ^{99m}Tc DTPA
B) ^{99m}Tc MAA
C) ^{127}Xe
D) ^{133}Xe

19. Radionuclides produced in a reactor are usually:

A) Neutron deficient
B) Long lived
C) Neutron excess
D) Short lived

20. Why is a small window used for peaking a scintillation detector?

A) It allows faster counting
B) It is less sensitive to count rate problems
C) It provides better sensitivity in detecting exact location of the peak
D) It provides a statistically better estimate of the counts

21 The role of the ACD solution in labeling RBCs :

A) Cell preservative
B) pH stabilizer
C) Oxidizing agent
D) Anticoagulant

22. At some point in time a source has an activity of 1,000 mCi. At a later point in time the activity is 62.5 mCi. The half-life is unknown. How many half-lives have elapsed?

A) Three
B) Four
C) Five
D) Can't be determined from the data provided

23 Indicate which one of the following drugs *may interfere* with the uptake of I-123 in the thyroid gland

A) Beta-blockers
B) Amiodarone
C) Calcium channel blockers
D) Calcitriol

24. Tumor uptake of 18F-FDG is influenced by all of the following *except*

A) Blood glucose level
B) Glut-1 expression (glucose transporter Glut-1)
C) Pgp expression (multidrug resistence p-glycoprotein)
D) Tumour growth rate

25. Indicate the *best statement* about the partial volume effect

A) Overestimation of activity in small volume because of scatter from surrounding activity
B) Underestimation of activity in a volume larger than the field of view
C) As the size of a radioactive structure decrease, the apparent activity concentration also decreases
D) Underestimation of activity in a volume because of too high count rate

26. Choose the cancer that normally shows the highest uptake of ^{67}Ga

A) Lung cancer
B) Colorectal cancers
C) Lymphoma
D) Malignant melanoma

27. Which is not true for radiolysis?

A) The higher the energy of radionuclide, higher is the radiolysis.
B) Higher the specific activity, higher is the radiolysis.
C) Increasing the temperature, the radiolysis rate remains same.
D) The longer the half life, the extensive is the radiolysis.

28. The crossfire effect provides greater irradiation of large tumors. Which of the following isotopes would have a crossfire effect?

A) I-123 B) At-211 C) Ga-67 D) Y-90

29. Which of the following is most commonly used as a solvent to extract Tc-99m from Mo-99?

A) di-isobutyl ketone
B) Methyl isobutyl ketone
C) Methyl Ethyl Ketone
D) Butanone

30. What of the following is the gene amplification method?

A) PCR B) SDS-PAGE C) Cell Culture D) Blotting

31. Which of the following immunoglobulin is a pentamer

A) IgG B) B) IgA C) IgD D) IgM

32. Which of the following is not associated with DNA replication?

A) Ligase B) Peroxidase C) Gyrase D) Polymerase

33. The site on antigen to which the antibody binds is termed as:

A) Paratope B) Epitope C) Agretope D) Affitope

34. Which best defines OLINDA

A) Organ Level International Dosimetry Assessment
B) Organ Level Internal Dose Assessment
C) Organ Linked International Dosimetry Assessment
D) Organ Level Internal Dosimetry Assessment

35. Which of the following is a central nervous system imaging agent

A) Tc-99m TRODAT
B) F-18 MISO
C) Tc-99m DTPA
D) Ga-68 DOTATOC

36. Retardation factor of $NaTcO_4$ and hydrolyzed activity in acetone are

A) 0 and 1
B) 0 and 0
C) 1 and 0
D) 1 and 1

37. Limit of endotoxins in injectables is

A) 170 EU
B) 175 EU
C) 200 EU
D) 150 EU

38. Mechanism of uptake for skeletal imaging is

A) Passive diffusion
B) Antigen-antibody interaction
C) Phagocytosis
D) Chemical bonding and adsorption

39. TRODAT is labeled with Tc-99m through

A) Direct labeling
B) Transchelation
C) Bifunctional Chelator
D) Nucleophilic reaction

40. Radionuclide purity is

A) Fraction of total radioactivity in desired chemical form
B) Fraction of total radioactivity in desired radionuclide form
C) Fraction of total pharmaceutical in desired chemical form
D) Fraction of wanted vs unwanted chemical in preparation

41. Half-life of C-11 is

A) 2 min
B) 20 min
C) 20 sec
D) 2 hr

42. Which of the following is a perfusion imaging agent

A) N-13
B) F-18
C) F-18 FDG
D) F-18 FDOPA

43. The main objective of radioprotection is

A) ALARA
B) To protect the radiation worker from exposure
C) To protect the patients from exposure
D) To keep the risk of stochastic effect as low as possible along with avoiding deterministic effects

44. F-18 FLT is a derivative substrate of

A) Thymidine Kinase-1
B) Glucose
C) Stomatostatin receptors
D) Estrogen

45. 1 Ci stands for how many DPS

A) 3.7×10^{1} B) 3.7×10^{10} C) 3.7×10^{12} D) 3.7

46. Which of the following nuclei will have magnetic moment

A) $_{1}$D-2 B) $_{6}$C-12 C) $_{2}$He-4 D) $_{8}$O-16

47. F-18 FMISO is used for imaging of

A) Neuroendocrine tumors B) Her2/neu receptors
C) Hypoxic tumors D) Glut receptors

48. Ga68 Exendin-4 is used for imaging of

A) Insulinomas B) Lung Ca C) Multiple myeloma D) Osteosarcomas

49. Which of the following is an unusual amino acid

A) Cystine B) Aspargine C) Taurine D) Anserine

50. Oxidation of which substance in the body yields the most calories

A) Glucose B) Lipids C) Glycogen D) Protein

x-x-x

Physics (1076)

1. A vector field which can be expressed as negative gradient of a scalar field is called

A) Conservative field
B) Non-Conservative field
C) Lamellar field
D) Lamellar field

2. An SCR has a circuit fusing rating of 50 A^2s. The device is being used in a circuit where it could be subjected to a 100 A surge. The maximum allowable duration of such a surge

A) 6 ms
B) 2 ms
C) 4 ms
D) 5 ms

3. At z = 0, tan (1/z) has

A) A simple pole
B) A double pole
C) An isolated singularity
D) A non isolated singularity

4. The electric field intensity on the surface of a charged conductor is

A) Directed along 60^o to the surface
B) Zero
C) Directed tangentially to the surface
D) Directed normally to the surface

5. The mean and standard deviation of a binomial distribution are 10 and 2 respectively. The value of P is

A) 0.6
B) 1.0
C) 0.8
D) 0.4

6. The path followed by a particle in sliding from one point to another in the absence of friction in the shortest time is a

A) Cycloid
B) Sphere
C) Sigmoid
D) Catenary of revolution

7. Assuming perfect conductor of a transmission line, pure TEM propagation is NOT possible in

A) Semi infinite parallel plate wave guide
B) Air filled cylindrical wave guide
C) Coaxial cable
D) Parallel thin wire line in air

8. An astronaut moves in a super spaceship travelling at a speed of 0.8c. The astronaut observes a photon approaching him from space. The speed of photon with respect to the astronaut is

A) 0.2c
B) 0.9c
C) 1.8c
D) c

9. The pointing theorem is a mathematical statement of the conservation of

A) States
B) Charge
C) Electromagnetic energy
D) Momentum

10. A gamma ray of energy 2.2 MeV produces an electron position pair. Then the energy imparted to each of the charge particles is nearly

A) 1.1 MeV
B) 0.59 MeV
C) 1.18 MeV
D) 0.31 MeV

11. In which of the following methods proper choice of initial value is very important?

A) False position B) Newton Raphson C) Bairsto method D) Bisection method

12. A radiowave has a maximum electric field intensity 10^{-4} V/m on arrival at a receiving antenna. The maximum magnetic flux density of such a wave is

A) 3.3×10^{-13} T B) 3.3×10^{-13} T C) 3.3×10^{-13} T D) zero

13. A particle of mass m moves in the logarithmic potential $V(r) = C \ln (r/r_o)$. The mean squared velocity is

A) mC B) m/C C) C/m D) zero

14. When a rigid body rotates about a given axis, the degrees of freedom it will have, is

A) 4 B) 1 C) 3 D) 2

15. In the case of elliptic orbits, energy is proportional to

A) a^{-3} B) a C) a^{-1} D) a^3

16. Davisson and Germer experiments relates to

A) Phosphorene B) Interference C) Polarisation D) Electron Diffraction

17. Suppose temperature of the sun goes down by a factor of two, then the total power emitted by the sun will go down by a factor of

A) 8 B) 4 C) 2 D) 16

18. The wave function of a particle in a classical forbidden region is

A) A negative exponential B) A positive exponential
C) A sine function D) A cosine function

19. Electrons have half integral spin and they obey

A) M-B statistics B) F-D statistics
C) B-E statistics D) Both F-D statistics and M-B statistics

20. The MOSFET switch in its on-state may be considered equivalent to

A) Battery B) Resistor C) Capacitor D) Inductor

21. When applied to solar radiation, Planck's law reduces to Wein's law in the

A) Ultraviolet region B) Visible region
C) Microwave region D) Infrared region

22. The internal energy of a perfect monoatomic gas at 27 ^{o}C is

A) Only potential
B) Only kinetic
C) Only vibrational
D) Partly potential and partly kinetic

23. Which of the following is an eigen function of L_z?

A) $\sin \varphi$ B) $\cos \varphi$ C) $e^{i\varphi}$ D) $\cos^2 \varphi$

24. In a classical microcanonical ensemble for a system of N interacting particles, the fundamental volume in phase space which is regarded as equivalent to one microstate is

A) h^N B) h^{2N} C) h^{3N} D) h
H is the Planck's constant.

25. In Joule-Thomson experiment, for an ideal gas

A) Enthalpy decreases
B) The internal energy remains constant
C) The entropy decreases
D) The entropy remains constant

26. If A satisfies the condition $AA^{+} = 1$, then A will be

A) Unitary B) Hermitian C) Skew Hermitian D) Symmetric

27. Phase shifts through an op-amp is caused by

A) The internal RC circuits
B) The external RC circuits
C) Negative feedback
D) The gain roll off

28. The orientational polarizability per molecule in a polyatomic gas is proportional to

A) T B) 1/T C) T^2 D) $1/T^2$

29. A single instruction to clear the lower four bits of the accumulator in 8025 assembly language is

A) XRI FOH B) ANI FOH C) XRI OHF D) ANI OFH

30. An analog voltage in the range of 0 to 8 V is divided in eight equal intervals for conversion of 3-bit digital output. The maximum quantization error will be

A) 1 V B) 2 V C) 0.5 V D) zero

31. The spectral term for the atom with 70% filled subshell and only S = 3/2 is

A) $^3F_{1/2}$ B) $^4F_{9/2}$ C) $^4P_{1/2}$ D) $^3P_0$

32. Which of the following instrument can be used for measuring the expansion of bodies by heat?

A) Differential air thermoscope
B) Thermoheater
C) Thermocouple
D) Pyrometer

33. In HCl molecule, the energy gap between the two vibrational levels is 0.36 V. Its zero point energy will be

A) 0.54 eV B) 0.36 eV C) zero D) 0.18 eV

34. Which one of the following types of noise gains importance at high frequency?

A) Random noise B) Transit-time noise
C) Shot noise D) Impulse noise

35. Capacitive transducers are normally used for

A) Dynamic measurements B) Static measurements
C) Transient measurements D) Both (A) & (B)

36. The ratio of frequencies of the first line of the Lyman series and the first line of the Balmer series is

A) 27/8 B) 4/27 C) 27/5 D) 8/27

37. In a Q-meter, the value of Shunt resistance connected across the oscillator is typically of the order of

A) kΩ B) mΩ C) μΩ D) Ω

38. The NMR spectrum of ethanol (CH_3CH_2OH) comprises to three bunches of spectral-lines in the bunch corresponding to CH_2 group is

A) 3 B) 4 C) 2 D) 1

39. For infrared spectrum of diatomic molecules is known as

A) Rotational spectrum B) Electronic band spectrum
C) Rotational vibrational spectrum D) Vibrational spectrum

40. The value of M, required to produce modulation index of 0.8 is

A) 0.26 B) 0.32 C) 0.16 D) 0.52

41. Metallic iron changes from bcc structure to fcc structure at 910 ^oC with an increase in the atomic radii. The density of iron in this structural change

A) Increases B) Decreases C) Becomes zero D) Remains constant

42. The quarks are supposed to exist in following numbers of flavours

A) Sixteen B) Four C) Six D) Two

43. If the band gap of an alloy semiconductor is 1.98 eV, then calculate the wavelength of radiation that is emitted when electrons and holes in the material recombine directly

A) 5750 ^{o}A B) 6000 ^{o}A C) 6250 ^{o}A D) 6500 ^{o}A

44. Superconductors are generally

A) Amorphous thin films of Be and Bi
B) Monovalent metals
C) Ferromagnetic and antiferromagnetic metals
D) Thin films of barium titanate

45. The Hall coefficient of a metal is low. It means that

A) The Hall field produced in that metal is low
B) The conductivity of that metal is zero
C) The charge carrier density in that metal is low
D) The charge carrier density in that metal is high

46. Superconducting electron density is

A) Zero at absolute zero B) Finite at absolute zero
C) Infinite at absolute zero D) Non-zero finite at critical temperature

47. The mean momentum of a nucleon in a nucleus with mass number A varies as

A) $A^{-2/3}$ B) $A^{-1/3}$ C) A^{2} D) A

48. A nucleus of medium mass with excess of neutrons may decay with the emission of

A) Electron B) Positron C) Neutron D) Proton

49. A crystal belongs to a fcc lattice with four atoms in the unit cell. The size of the crystal is 1 cm and its unit cell dimension is 1 nm. ‘f’ is the scattering factor of the atom. The number of atoms in the crystal is

A) 2×10^{23} B) 2×10^{21} C) 4×10^{24} D) 4×10^{21}

50. Suppose that a neutron at rest in free space decays into a proton and electron. This process would violate

A) Conservation of energy B) Conservation of angular momentum
C) Conservation of charge D) Conservation of linear momentum

x-x-x

Stem Cell Tissue (1076)

1. The genetically homogeneous colony of cultured animal cells selected by cloning in tissue culture conditions is called

   A) Cell Line
   B) Cell Strain
   C) Primary Culture
   D) Secondary Culture

2. When lysosomal enzyme (hydrolase) is released into the cytosol, it (enzyme) causes_____ of cytosolic components

   A) Complete Degradation
   B) Little Degradation
   C) Complete Denaturation.
   D) Little Denaturation

3. Oxidation of fatty acids in mitochondria produces CO_2 and ATP, whereas oxidation of fatty acids in peroxisomes yields acetyl groups and

   A) Produces ATP
   B) Produces toxic molecules
   C) Does not produce ATP
   D) Produces ATP and Heat

4. The intracellular Ca^{2+} ion concentration varies significantly during certain signal transduction events.These changes in intracellular Ca^{2+} ion can be measured with the help of fluorescent dye such as

   A) *fura-2* B) SNARF-1 C) SNARE D) GFP

5. Both Confocal microscopy and Cryoelectron tomography are used to study the live cells.The sample size for former is_____than the latter.

   A) 100 times thinner than
   B) 1000 times thicker than
   C) 1000 times thinner than
   D) Equal to

6. Most animal cells isolated from tissue/organ and cultured in tissue culture conditions, grow on a solid surface and not in suspension. This is attributed to the expression of_____ on the cell surface.

   A) Cadherins B) ECM C) Collagen D) Fibronectin

7. Skeletal muscle cells are multinucleated. Satellite cells are the cells found in skeletal muscles.These are

   A) Enucleated cells
   B) Multinucleated cells
   C) Syncytia
   D) Mononucleated cells

8. Cell strain has a _____life span

   A) Finite B) Infinite C) Indefinite D) Aneuploid

9. The activated satellite cells are

   A) $Pax7^{-ve}$
   B) $Pax7^{+ve}Myf5^{+ve}$
   C) $Pax7^{+ve}Myf5^{+ve}MyoD^{+ve}$
   D) $Pax7^{+}Myf5^{+ve}MyoD^{-ve}$

10. If the Km of a uniporter for a molecule "X" is much lower than Km for a relatively similar molecule "Y" then uniporter has

    A) Much higher affinity for "X" than for "Y".
    B) Much lower affinity for "X" than for "Y".
    C) Much lower affinity for both "X" and "Y".
    D) Much higher affinity for both "X" and "Y"

11. In animal cells cytosolic Ca^{2+} ion concentration increases during certain signal transduction events. This in turn produces various cellular responses. However, the low intracellular Ca^{2+} ion levels are restored back, by the activation of Ca^{2+} ATPase pump localized in _____ by exporting Ca^{2+} ions.

    A) Lysosomes
    B) Plasma membrane
    C) Sarcoplasmic reticulum
    D) Golgi complex

12. _____ technique is useful in measuring the movement of ions through single ion channel in the plasma membrane of a living cell.

    A) SDS-PAGE B) Western Blot C) FRAP D) Patch Clamp

13. The $G_{\alpha q}$ protein activated by a α_1-adrenergic receptor, activates the enzyme

    A) Adenylyl cyclase
    B) Phospholipase C
    C) c-GMP phosphodiesterase
    D) Protien kinase

14. The bacterium that causes whooping cough produces a toxin which locks _____ in inactive state

    A) $G_{\alpha i}$ B) $G_{\alpha s}$ C) $G_{\alpha q}$ D) $G_{\alpha t}$

15. Protein kinase C (PKC) is activated by increase in concentration of

    A) Both Ca^{2+} ions and DAG (diacylglycerol)
    B) Ca^{2+} / calmodulin
    C) Only Ca^{2+} ions
    D) OnlyDAG

16. The TGFβ Type II receptor has intrinsic protein kinase (serine/threonine kinase) activity which is

    A) Inactive sometimes
    B) Constitutively phosphorylated and inactive
    C) Constitutively phosphorylated and active
    D) Constitutively dephosphorylated and inactive

17. The ligand bound EGF (Epidermal Growth Factor) receptor directly binds

    A) Smads B) GRB2 C)Ras D) STATS

18. The protein kinase B (PKB) is partially activated by binding to

    A) c-AMP
    B) PI 3,4 bis phosphate or PI 3,4,5 tris phosphate
    C) PI (Phosphatidyl Inositol)
    D) PI-4, 5 bis phosphate

19. The Notch protein is expressed on the cell surface as two subunits namely extracellular subunit and a transmembrane cytosolic subunit joined noncovalently with each other. In which part of the cell do these two subunits arise from proteolytic cleavage of monomeric protein?

A) Golgi complex
B) Endoplasmic reticulum
C) Extracellular space
D) Lysosome

20. A small protein "X" binds G-actin and helps in exchange of ADP for ATP, finally forming "X"-ATP-actin complex. This protein "X" is

A) Cofilin
B) Formin
C) CapZ
D) Profilin

21. Cytochalasin D is a fungal alkaloid which causes _____of F-actin filaments.

A) Fragmentation
B) Branching
C) Polymerization
D) Depolymerization

22. Myosin-V is an actin associated motor protein,has two head domains and moves towards (+) end of actin filament. This motor protein is involved in

A) Vesicular trafficking
B) Muscle contraction
C) Bending of cilia
D) Bending of flagella

23. The fibroblasts were incubated in medium without growth factors for several hours followed by microinjection of plasmid expressing dominant active-Rac protein. Cells were subsequently stained with fluorescent phalloidin. It was observed that dominant active-Rac protein induced membrane _____

A) Contractile stress fibres
B) Ruffles
C) Filopodia
D) Depolarization

24. When a solution of microtubule protein is warmed from $4^{o}C$ to $37^{o}C$, it undergoes

A) Degradation
B) Breakage
C) Depolymerization
D) Polymerization

25. Cytoplasmic Dynein motor protein mediates _____ transport of organelles on microtubules.

A) Anterograde
B) Both anterograde and retrograde
C) Retrograde
D) (+) end directed

26. The movement of metaphase chromosomes to poles during Anaphase-A stage requires

A) Microfilament elongation
B) microtubule elongation
C) Microfilament shortening
D) Microtubule shortening

27. The basal lamina in kidney glomerular basement membrane is enriched in

A) Type I Collagen
B) Type II Collagen
C) Type IV Collagen
D) Type III Collagen

28. The peptide sequence RGD is characteristic of the protein called

A) Integrin B) Fibronectin C) Laminin D) Syndecan

29. The oval cells are the liver stem cells which are localized in

A) Hepatic cords B) Bile canaliculi
C) Portal vein D) Canal of Hering

30. Wnt/β – catenin signaling pathway regulates intestinal stem cell function. A mutation in APC (*adenomatous polyposis coli*) encoding gene leads to an increase in the levels of _____ in certain cancers.

A) Wnt B) Glycogen Synthase Kinase 3-β (GSK 3-β)
C) Disheveled D) β – catenin

31. The mouse embryonic stem cells are cultured in feeder free culture conditions, then the medium should be supplemented with _____in order to maintain their pluripotency.

A) LIF alone B) LIF and fetal calf serum
C) Fetal calf serum alone D) Feeder cells

32. One of the tissue culture methods, used for studying, one of the stem cell properties i.e. "clonality" of isolated Mammary Stem Cells is

A) SDS PAGE B) Immunoprecipitation
C) Mammosphere formation D) Western Blot

33. The trophectoderm of blastula does not allow the penetration of anti-human whole serum antibodies which can bind to any human cells. Although these antibodies bind trophectoderm but do not bind inner cell mass. Their entry is prevented due to

A) Presence of tight junctions B) Inhibition of endocytosis
C) Presence of desmosomes D) Presence of adherence junctions

34. The biodegradable material used for tissue engineering is

A) Ployethylene glycol B) Carbon nanotubes
C) Alumina D) Titanium

35. The peptides containing the _____ sequence incorporated into polymers would enable better anchorage for adherent cells while designing the scaffold for tissue engineering

A) AGD B) GGD C) RGD D) GDP

36. In order to induce vascularization_____ needs to be added to the scaffold seeded with stem cells in a bioreactor for tissue engineering.

A) EGF B) TGF
C) Insulin D) Angiogenic factor (VEGF)

37. The naïve B cells express on their surface

A) IgM alone.
B) Both IgM and IgD.
C) IgD alone.
D) IgG alone.

38. The mesangial cells of kidney of H-2 $^{k/d}$ mouse will express_____on their surface.

A) Both Class-I and Class-II MHC
B) Only Class-I MHC
C) Only Class-II MHC
D) Low levels of Class I-MHC

39. The peptides generated by endocytic- pathway of antigen processing are associated with

A) Class-I MHC
B) Both Class-I and Class-II MHC
C) Class-II MHC
D) Tc cells

40. The smaller fragment C3a produced during complement activation acts as an anaphylotoxin because it binds to receptor present on

A) Mast cells and basophils
B) Antigen
C) RBC
D) Phagocyte

41. In initial sensitization phase of delayed type hypersensitivity, which cells are activated?

A) T_H cells
B) T_C cells
C) B cells
D) Mast cells

42. Attenuated strain of *Mycobacterium bovis* transformed with a plasmid expressing major antigen of MTb virulent strain acts as a

A) Synthetic peptide vaccine
B) DNA vaccine
C) Inactivated vaccine
D) Recombinant vector vaccine

43. For the monolayer of animal cells cultured in a T-25 flask, the cell density is represented as

A) Cells per ml of culture medium
B) Cells per cm^2 of growth surface
C) Cells per gm weight of total cells
D) Mass per unit volume

44. In Retroviral infection method, which is one of the DNA transfer methods, the introduced foreign gene shows

A) Low efficiency
B) Low yield
C) Transient expression
D) Permanent expression

45. The IS element (one kind of transposon) has the following features

A) An inverted repeat at each end
B) An inverted repeat (≈ 50 base pairs) at each end and intervening region contains a gene which encodes transposase
C) Gene encoding transposase
D) An inverted repeat at one end followed by gene encoding transposase.

46. In DNA replication, the adjacent okazaki fragments separated by a nick are joined by

A) DNA ligase
B) DNA polymerase I
C) DNA polymerase III
D) DNA polymerase II

47. Different forms of a protein called isoforms are produced by different types of cells by a process called

A) 5’ Cap addition
B) Alternative RNA splicing
C) Polyadenylation
D) Chain elongation

48. The recruitment of histone deacetylase which promotes deacetylation of histones at a number of promoters, is promoted by its association with other proteins. This deacetylation of histones leads to _____ of target genes.

A) Transcription initiation
B) transcription repression
C) Transcription elongation
D) No effect on transcription

49. While generating Induced Pluripotent stem cells, one of the transcription factor _____ be replaced by Oct 1 or Oct 6

A) Oct ¾ can not
B) Oct 3/4 can
C) Oct 3/4 should
D) Oct 21 can

50. The ependymal cells are ciliated cells. These are present in the vicinity of

A) Neural stem cells
B) Epidermal stem cells
C) Keratinocyte stem cells
D) Lung stem cells

x-x-x

System Biology (1076)

1. In a reaction mix of chain termination sequencing reaction the concentration of dideoxynucleotides added was too high. What will be the consequences of the reaction?

   A) The reaction will yield very long products
   B) The reaction will yield very short products
   C) The reaction will yield very intense fluorescence products
   D) The reaction will not yield any products

2. To perform BLAST analysis of your data, you can input the query in all of the following Format, except

   A) PDB format
   B) FASTA format
   C) Ref Seq identifier
   D) Gene Bank Identifier

3. Which of the following is not the part of *lac* operon of *E.Coli*?

   A) A promoter site for RNA polymerase binding
   B) A gene for RNA polymerase enzyme
   C) A gene for repressor protein
   D) A set of inducible genes for enzymes of lactose metabolism

4. You have decided to identify a novel lead compound, which of the following needs to be established as the first step?

   A) Applying for patent
   B) Identification of pharmacophore
   C) To study structure activity relationship
   D) To establish the desirable biological activity

5. The eukaryotic cytoskeleton includes the following components, except.

   A) Intermediate filaments
   B) Spiral filaments
   C) Actin filaments
   D) Myosin filaments

6. The host cell does not survive shortly after the initial infection by which of the life cycle phases of bacteriophage?

   A) Prophage B) Lysogeny C) Lytic D) Prolytic

7. The genome mapping to understand the genome structure includes all of the following types of maps, except

   A) Cytological maps
   B) Genetic maps
   C) Physical maps
   D) Biochemical maps

8. Which of the following statements is not true for PAM matrix series?

   A) It is based on estimated mutation rates
   B) It is also called a log-odds matrix
   C) PAM matrices for less similar sequence are obtained by extrapolations
   D) PAM 100matrix corresponds to about 100% identities

9. An Operational Taxonomic Unit in a phylogenetic tree corresponds to which of the following

   A) Internal branch of two nodes
   B) External branch between node and leaf
   C) Terminal nodes or leaves
   D) Evolutionary distance between sequence

10. A PSI-BLAST search is most useful in which of the following query options.

    A) Find the remote sequence homologues.
    B) Extend a database search to find additional proteins in same species.
    C) Extend a database search to find additional DNA sequences in same species
    D) Use a pattern to extend a protein search

11. The gene prediction programs are based either on gene signals or gene content features. The following are the examples of gene signals, except

    A) Start and stop codons
    B) Ribosomal binding sites
    C) Transcription factor binding sites
    D)Statistical pattern of the coding region

12. The terminology used for small molecules that bind to different regions of a target binding site is.

    A) Epitopes B) Paratopes C) Epimers D) Isomers

13. Microarray data analysis can be performed with scatter plots, which provide the following information, except

    A) Whether the gene is expressed at relatively high or low level
    B) Whether the gene is up regulated or down regulated
    C) The gene copy number expressed in an organism
    D) Whether the gene is among the 5% most regulated genes in that experiment

14. PSIPRED is a program to predict protein secondary structures using a combination of which of these programs

    A) PSI-BLAST and GOR method
    B) PSI-BLAST and Jpred method
    C) PSI-BLAST and HMM method
    D) PSI-BLAST and Neural network method

15. Why microarray data must be normalized before inferences are drawn from the data?

A) Gene expression values are not uniformly distributed.
B) Some experiments have cDNAs labeled with radioactivity while others have cDNAs labeled with fluorescence.
C) The efficiency of the dye and radioactivity incorporation varies from sample to sample.
D) The efficiency of the dye and radioactivity incorporation varies between different tissues.

16. To define the features of a biochemical network, the main contributors to the dynamics of a biochemical system are

A) Metabolites, enzymes and parameters
B) Enzymes, substrate and product
C) Enzymes, substrate and parameters
D) Metabolites, substrate and product

17. All of the following computational tools help to predict the secondary structure features of protein, except?

A) Porter B) PSIPRED C) Predator D) Phred

18. Which of the following programs cannot be used for base calling and sequence assembly?

A) Phred B) Phrap C) PHD D) ARACHNE

19. The programs listed below are software for structure base drug designing and molecular docking, except

A) FRED B) FlexX C) LIGPLOT D) CHARMm

20. If you wish to draw the information for Cytochrome c oxidase from Gene Ontology project, you will be provided all of the following information, except

A) Biological process
B) Gene translocation
C) Cellular component
D) Molecular function

21. SBML is an abbreviation for the acronym

A) Systems Biology Markup Language
B) Systems Biology Metabolic Language
C) Systems Biology Markup Linker
D) Systems Biology Metabolic Linker

22. Which of the following set of databases constitute a part of KEGG database?

A) GENES, PATHWAY and BRENDA
B) GENES, LIGAND and BRENDA
C) PATHWAY, BRENDA and LIGAND
D) GENES, PATHWAY and BRITE

23. The following statements are true for QSAR technique in drug designing strategy, except

A) It provides qualitative models
B) It provides quantitative models
C) It represents chemical structures with mathematical descriptors
D) It represents correlation of structure descriptors with activity

24. Identify the true statement for the stable and active drug molecule

A) The most stable conformation is always the active one of the drug molecule
B) The stable conformation is the most reactive one of the drug molecule
C) The active and stable conformation can be easily predicted by conformational analysis of drug molecule
D) The conformation adopted by a drug when it binds to target site is the active one

25. The DNA replication in the mitochondrial DNA after incorporation of tritiated hydrogen Incorporation, when seen on the photographic emulsion revealed which of the following structure

A) Linearly separated two fragments
B) Theta structure
C) Separated terminal ends
D) Mitochondrial DNA do not replicate

26. The rolling circle replication is the method of DNA duplication in which of the following?

A) Bacterial chromosomes
B) Yeast chromosomes
C) Bacteriophage lambda genome
C) Mitochondrial genome

27. Which of the following can be cited as an example of a protein domain?

A) Alpha helix
B) Lysozyme
C) Exons
D) SH2

28. Which of the following statements define the metabolome of a cell?

A) All the metabolites in a cell in a particular metabolic pathway
B) All the metabolites in a cell in a particular reaction conditions
C) All the metabolites in a cell in a specific set of conditions
D) All the metabolites in a cell in a set of catabolic and anabolic reactions

29. A DNA underwent rolling circle mode of DNA replication. The formation of which of the following structure points to such type of replication

A) Concatamer
B) Adapters
C) Aptamers
D) Oligomers

30. The branching pattern of a phylogenetic tree constructed from DNA sequence data signify which of the following?

A) The divergence pattern of the organisms in terms of time
B) The number of synonymous changes in the genes
C) The degree of difference between the genes represented by the nodes
D) The degree of difference between the genes as well as the organisms

31. In order to study the absolute maternal inheritance pattern which of the following must be studied?

A) X chromosomes
B) Y chromosomes
C) Mitochondrial genome
D) Autosomes

32. All of the following listed enzymes participate in DNA repair except, one

A) DNA Polymerase I
B) DNA Ligase
C) DNA exconuclease
D) Polynucleotide kinase

33. Ligand mediated dimerization is a signature mode of activation in which type of receptors?

A) Steroid Receptor
B) Cytokine receptors
C) G-protein coupled receptors
D) Nitric Oxide receptors

34. Which of the following is a RefSeq accession number corresponding to an mRNA?

A) J01539
B) NM_15392
C) NP_15392
D) AAB15392

35. How many centrioles does a cell have at metaphase of mitosis?

A) One only
B) Two only
C) One pair
D) Two pairs

36. For *de novo* drug designing which of the following statements is true?

A) The design and synthesis of a compound is started from complex chemical structures.
B) The designing and synthesis of a novel range of structures.
C) The design of a novel drug based on molecular modeling studies of the binding site.
D) The modification of a drug based on molecular modeling studies of the binding site.

37. Which of the following databases is derived from mRNA information?

A) dbEST
B) PDB
C) OMIM
D) HTGS

38. Which of the following is the key cofactor for DNA Replication?

A) Mg^{2+}
B) BCa^{2+}
C) Co^{2+}
D) ATP

39. The amino-acid residue serine in a sequence for intermolecular bonding will form which of the following bonds as the strongest bond

A) Ionic bond
B) Hydrogen bond
C) Vanderwaals interactions
D) Hydrophobic interactions

40. All of the following neurotransmitters/hormones are derivatives of amino acids, except

A) Gamma amino butyric acid
B) Dopamine
C) Epinephrine
D) Acetyl chloline

41. Which of the following proteins is key to eukaryotic DNA replication?

A) Proliferating cell nuclear antigen
B) Proliferative nuclear dividing factor
C) Polymeric cell nuclear antigen
D) Polymeric nuclear dividing factor

42. All the following are ribozymes except, one

A) Aminoacyl tRNA synthetase
B) Peptidyl transferase
C) Ribonuclease P
D) Telomerase

43. The Ramachandran plot of a globular protein provides which of the following information

A) Sterically allowed conformations of a polypeptide back bone
B) The frequency of occurrence of amino acids in beta-sheet structure
C) The frequency of occurrence of amino acids in alpha helical structure
D) The NMR data pattern of the protein in query

44. The following is the list of DNA sequencing technologies, except

A) Sanger Method
B) Pyrosequencing
C) Solexa System
D) Shotgun sequencing

45. All of the following are Transposon derived repeats, except

A) LINEs
B) SINEs
C) LTR
D) STR

46. The central bioinformatics resource for human genetic disorders is

A) OMIM
B) MITOMAP
C) HapMap
D) GWAS

47. The Helices can be described by the notation $n_{m,.}$ What is the notation for the right handed alpha helix?

A) 3_{10}
B) 3.6_{13}
C) 2.2_{6}
D) 4.4_{16}

48. In a site directed mutagenesis test prediction you are targeting to study the role of Val at the active site. Which of the following substitution would you expect to disrupt protein function the most?

A) Val replaced by Ala
B) Val replaced by Leu
C) Val replaced by Gly
D) Val replaced by Phe

49. Isotope –coded affinity tag method can be used for which of the following applications

A) Quantitative proteome analysis
B) Qualitative proteome analysis
C) Quantitative protein analysis
D) Qualitative protein analysis

50. Which of the following function describes mode of action of the antibiotic Puromycin?

A) Inhibits A-site in ribosome
B) Inhibits peptidyl transfer
C) Inhibits chain termination
D) Induces premature chain termination

x-x-x

Zoology (1076)

1. The structure of deoxyhemoglobin is stabilized by each of the following except

   A) Coordination of the heme with the distil histidine
   B) Bisphosphoglycerate binding
   C) Hydrophobic interaction
   D) Salt bridges between acidic and basic side chains

2. Which amino acid does not help in producing bend inside the chain?

   A) Ser B) Gly C) Val D) Pro

3. Considering a glucose residue in glycogen, how many net ATP molecules will be formed in the glycolysis of the residue to pyruvate?

   A) 2 B) 3 C) 4 D) 6

4. Most common method used to study the interaction of two membrane proteins in a living mammalian cells is

   A) Fluorescence Recovery After Photobleaching (FRAP)
   B) Fluorescence Resonance Energy Transfer (FRET)
   C) Patch-clamp
   D) Freeze-fracture

5. The proteins in a mammalian cell account for 18% of its net weight. If the density of a typical mammalian cell is about 1.1g/ml and the volume of the cell is $4x10^{-9}$ ml, what is the concentration of protein in mg/ml?

   A) 200mg/ml B) 100mg/ml C) 400mg/ml D) 300mg/ml

6. Which phospholipid is present in very small quantity in the mammalian plasma membrane despite having an important role in cell signaling?

   A) Phosphatidylinositol B) Phosphatidyl choline
   C) Phosphatidyl serine D) Phosphatidylethanolamine

7. In a given area of cytoplasm in a non dividing cell

   A) All microtubules will be growing at the same time
   B) The growing ends of microtubules will have a GDP cap
   C) Some of the microtubules will be growing and some will be shortening
   D) All microtubules will be growing at one end and shortening at the other end

8. How are lysosomal enzymes stopped from being secreted?

   A) Are directed to lysosomes for degradation
   B) Bind to mannose 6 phosphate receptors
   C) Bind to KDEL receptors
   D) Interact with the signal recognition particle receptor

9. Generally high power objectives have

   A) High numerical aperture
   B) Low numerical aperture
   C) Low resolution
   D) Low numerical aperture with high resolution

10. To reduce blood glucose levels, insulin binds to the specific receptors on fat and muscle cells and activates the signaling pathway. Which event occur during the insulin signaling

    A) Insulin binds to a G protein coupled receptor and causes an increase in cytosolic Ca+2 levels
    B) GLUT 2 transporters are phosphorylated and activated
    C) Glycogen synthase kinase3 phosphorylates and activates glycogen synthase
    D) Intracellular vesicles containing GLUT4 fuse with the plasma membrane

11. Which method was used to sequence the human genome

    A) Cytogenetic mapping
    B) Shotgun sequencing
    C) Chromosome walking
    D) Radiation hybrid mapping

12. What is the melting temperature of the following PCR primer-
    5'AATCCAGGTATTCGCGAAG-3'

    A) 52^0C
    B) 60^0C
    C) 56^0C
    D) 65^0C

13. Knott concentration method is used for demonstration of

    A) Malarial parasites in peripheral blood film
    B) Microfilariae in peripheral blood film
    C) *Leishmania donovani* in bone marrow aspirate
    D) *Trypanosoma cruzi* in blood.

14. Bacteria prevent destruction of its own DNA

    A) By preventing foreign DNA from integrating into the bacterial genome
    B) By methylating bases in or near restriction enzyme recognition sites
    C) By masking restriction enzyme recognition sites as their DNA is circular
    D) By producing repressor proteins that block the enzyme recognition sites

15. Ziemann's dots in red blood cells are seen in infection with

A) *Plasmodium vivax* B) *Plasmodium falciparum*
C) *Plasmodium malariae* D) *Plasmodium ovale*

16. Peptide vaccines are desirable because

A) They don't expose pathogens to active pathogens
B) They are easier to manufacture than live pathogens
C) They always evoke a cell mediated immunity
D) They can be readily made to produce a cross reactive immunity

17. Transplanted tissue are rejected by

A) Cytotoxic T lymphocytes that recognize the MHC difference
B) Complement activation
C) Macrophages that display CD45 on their surface
D) Anti-cytokine antibodies

18. Contact dermatitis generally occurs against substances that are too small to induce an immune response. How do these substances induce an immune response?

A) By forming depots and are then slowly released into the blood.
B) These low molecular weight substances react with liver enzymes and are difficult to eliminate
C) By activating the complement cascade and cause neutrophils to accumulate and to serve an antigen presenting cells.
D) These substances bind to the tissues and cells resulting in larger total antigenic size which can then stimulate an immune response

19. Gynaecophoric canal is seen in case of male worm of

A) *Ascaris lumbricoides* B) *Trichinella spiralis*
C) *Schistosoma mansoni* D) *Clonorchis sinensis*

20. ' Highly differentiated cells become undifferentiated totipotent cells' is characteristic of

A) Dedifferentiation B) Totipotency
C) Differentiation D) Redifferentiation

21. An embryo lacking bicoid protein upon injection with bicoid protein will result in

A) Two heads and no thorax
B) Head in the middle and thorax at both ends
C) No head and thorax at both the ends
D) Normal phenotype

22. The ability of an amputated limb to regenerate is called

A) Morphollaxix B) Epimorphosis
C) Heteromorphosis D) Super regeneration

23. Cluster of cells with inductive properties surrounding a blastopore lip is called as

A) Spemann organizer B) Dorsal lip C) Notochord D) Neural plate

24. Which of the following hormone inhibits the release of prolactin?

A) Inhibin B) Somatostatin C) Dopamine D) Estrogen

25. The transport of glucose across epithelial layers in the gut involves

A) Primary active transport via a uniporter
B) Secondary active transport via a symporter
C) Primary active transport via a symporter
D) Primary active transport via an antiporter

26. In an organism with a diploid number of chromosomes equal to 52, how many bivalents are expected to form during meiosis?

A) 52 B) 13 C) 26 D) 104

27. Two parents with normal pigmentation have an albino child. What is the probability that their next child will be an albino girl?

A) 1/2 B) 1/4 C) 1/8 D) 1/16

28. If an X-linked dominant disorder affects 1/200 males in a population, what is the gene frequency of the disorder?

A) 0.05 B) 0.005 C) 0.75 D) 0.075

29. The evolutionary home of horse and camel is

A) North America B) South America C) Europe D) Africa

30. The variety of phenotype from a single genotype that can be observed in a population within a particular habitat

A) Ecophene B) Ecotype C) Race D) Diversity

31. A non name bearing specimen among syntypes after the lactotype is selected as

A) Syntype B) Holotype C) Neotype D) Paralectotype

32. Heavy rains and mud slides separate two deer groups and isolate them geographically. What will happen over a long period of time?

A) They become native species B) Allopatric speciation may occur
C) Peripatric speciation may occur D) Both groups emigrate

33. The evolution of long tails in all quadrupeds is an example of

A) Co-evolution
B) Divergent Evolution
C) Convergent Evolution
D) Parallel Evolution

34. Ecosystem with the highest biodiversity is

A) Fresh water marsh
B) Prairie grassland
C) Tundra
D) Boreal forest

35. Evolution in which animals of two different gene ecology show too much similarity with one another, is called

A) Parallel evolution
B) Convergent evolution
C) Retrogressive evolution
D) Progressive evolution

36. Chromosome walking

A) Will allow one to move from one chromosome to another
B) Will allow one to move from one clone to another
C) Require FISH
D) Will allow in the lateral transfer of gene.

37. Sequences in different species which perform the same or very similar functions are known as

A) Paralogues B) Homologues C) Orthologues D) Analogous

38. Biosensors involve linking of which of the following agents with electronic circuitry?

A) Microorganisms
B) Microbially derived enzymes
C) Either microorganisms or microbially derived enzymes
D) Neither microorganisms or microbially derived enzymes

39. How many rpm are needed to centrifuge a sample at 100,000 x g in a rotor with radius 7.2cm?

A) 30100 B) 35200 C) 43750 D) 50300

40. In rocket Immunodiffusion, the length of the rocket is

A) Proportional to the amount of antibody placed in each well
B) Inversely proportional to the amount of antibody placed in each well
C) Inversely proportional to the amount of antigen placed in each well
D) Proportional to the amount of antigen placed in each well

41. The chemical nature of slow reacting substance of anaphylaxis which constricts airways and arteries is

A) Histamine
B) Prostaglandin D2
C) Leukotrienes
D) Chondroitin sulphate

42. Production of sound due to grinding of hind limbs is seen in

A) Mouse B) Dragon fly C) Cricket D) Cockroach

43. Ventral nerve cord and tubular heart is present in

A) Annelida and arthropoda B) Annelida and Mollusca
C) Coelentrata and Mollusca D) Arthropoda and Mollusca

44. The difference in chromosome morphology between different species can be compared by

A) Fluroscence screening B) Tritium hydrogen labeling
C) Chromosome banding D) In-situ hybridization

45. High dose of antibiotics can destroy the bacterial flora of the large intestine. This can result in impaired

A) Absorption of protein B) Respiratory control
C) Bone resorption D) Blood coagulation

46. If communication between SA node and AV node becomes blocked, what will most likely occur?

A) Afterload will increase
B) The rate of atrial contraction will decrease
C) The rate of ventricular contraction will decrease
D) Stroke volume will increase to 5L/beat

47. Hydrolysis of an IgG molecule by pepsin will produce

A) One Fc fragment and two Fab fragments
B) One Fc fragment and one F(ab')2 fragment
C) One Fc fragment and one Fab fragment
D) One F(ab')2 fragment and one fab fragment

48. The ability of single B cell to express both IgM and IgD molecules on its surface at the same time is made possible by
A) Allelic exclusion
B) Isotype switching
C) Selective RNA splicing
D) Simultaneous recognition of two distinct antigens

49. Rhithron is characterized by

A) Low temperature, turbulence with substrate of rocks, stones and gravel
B) High temperature, no turbulence with substrate of mainly sand or mud
C) Low temperature, turbulence with substrate of sand or mud
D) High temperature, no turbulence with substrate of rocks and stones

50. The body of *Cyprinus carpio var. specularis* Lacepede (Mirror crap) is

A) Covered with regular arranged rows of scales
B) Covered with few large and bright scales randomly
C) Completely devoid of scale except a single few degenerate scales at the base of fins
D) With no scales at all

x-x-x

Question Booklet Series: **A** *Question Booklet Serial No.* 105437

Ph. D. Entrance Test – 2016

Subject: Mathematics

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. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. 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.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. 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.
13. 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.
14. **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.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

(1076)

1. If every element of a group G is its own inverse, then the group G is

(A) finite (B) infinite (C) cyclic (D) abelian

2. For a group G, let $F(G)$ denote the collection of all subgroups of G. Which of the following situation can occur?

(A) G is finite but $F(G)$ is infinite (B) G is infinite but $F(G)$ is finite

(C) G is countable but $F(G)$ is uncountable

(D) G is uncountable but $F(G)$ is countable

3. If N is a normal subgroup of G, then left and right cosets of N in G

(A) do not exist (B) are coincident

(C) exist but are different (D) none of these

4. Which of the following rings is an integral domain?

(A) $\mathbb{R}[x]/(x^2+x-1)$ (B) $\mathbb{R}[x]/(x^2+5x+6)$

(C) $\mathbb{R}[x]/(x^2-2)$ (D) $\mathbb{R}[x]/(x^2+1)$

5. Let $n \geq 1$ and let A be an $n \times n$ matrix with real entries such that $A^k = 0$, for some $k \geq 1$. Let I be the identity $n \times n$ matrix. Then

(A) $I + A$ need not be invertible (B) $Det(I + A)$ can be any non-zero real number

(C) $Det(I + A) = 1$ (D) A^n is a non-zero matrix

6. All the eigenvalues of the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ lie in the disc

(A) $|\lambda + 1| \leq 1$ (B) $|\lambda - 1| \leq 1$ (C) $|\lambda + 1| \leq 0$ (D) $|\lambda - 1| \leq 2$

7. The value of infinity-norm of $A = \begin{bmatrix} 5 & -4 & 2 \\ -1 & 2 & 3 \\ -2 & 1 & 0 \end{bmatrix}$ is

(A) 8 (B) 11 (C) 1 (D) 3

8. Let $A(\theta) = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$, where $\theta \in (0, 2\pi)$. Mark the correct statement below:

(A) $A(\theta)$ has eigenvectors in $\Re^2$ for any $\theta \in (0, 2\pi)$

(B) $A(\theta)$ does not have an eigenvector in $\Re^2$, for any $\theta \in (0, 2\pi)$

(C) $A(\theta)$ has eigenvectors in $\Re^2$, for exactly one value of $\theta \in (0, 2\pi)$

(D) $A(\theta)$ has eigenvectors in $\Re^2$, for exactly two values of $\theta \in (0, 2\pi)$

9. Let $T : l_2 \to l_2$ be defined by

$T(x_1, x_2, \cdots, x_n, \cdots) = (x_2 - x_1, x_3 - x_2, \cdots, x_{n+1} - x_n, \cdots)$. Then

(A) $\|T\| = 1$ (B) $\|T\| > 2$ but bounded

(C) $1 < \|T\| < 2$ (D) $\|T\|$ is unbounded

10. Set forming vector space over real numbers is given by

(A) all polynomials over $\Re$ with constant term 0

(B) all polynomials over $\Re$ with constant term 1

(C) the set of all rational numbers over $\Re$

(D) all members of the form $x + iy$, where x, y are integers.

11. Let K be a subspace of a finite dimensional vector space U and V. Then K will be the kernel of a linear map $T : U \to V$ if and only if

(A) $\dim K \leq \dim U - \dim V$ (B) $\dim K = \dim U - \dim V$

(C) $\dim K = \dim V - \dim U$ (D) $\dim K \geq \dim U - \dim V$

12. The dimension of a vector space formed by $n \times n$ matrices such that trace of each matrix is zero are

(A) $n(n-1)$ (B) n^2 (C) n^2-1 (D) $n(n+1)$

13. If W_1 and W_2 are subspaces of V, then

(A) W_1+W_2 is a subspace (B) $W_1 \cap W_2$ is not a subspace

(C) $W_1 \cup W_2$ is always a subspace (D) none of these

14. Let $f : \mathfrak{R} \to \mathfrak{R}$ be the function defined by $f(x)=\dfrac{\sin x}{|x|+\cos x}$. Then

(A) f is differentiable at all $x \in \mathfrak{R}$ (B) f is not differentiable at all $x=0$

(C) f is not differentiable at all $x=0$ but f' is not continuous at $x=0$

(D) f is not differentiable at all $x=\dfrac{\pi}{2}$.

15. The sequence $a_n=\dfrac{\left(\frac{10}{11}\right)^n}{\left(\frac{9}{10}\right)^n+\left(\frac{11}{12}\right)^n}$ converges to

(A) 0 (B) $\dfrac{1}{2}$ (C) 1 (D) 2

16. Let $\{a_n\}$ be a sequence of real numbers such that $|a_{n+1}-a_n| \le \dfrac{n^2}{2^n}$ for all $n \in N$. Then

(A) The sequence $\{a_n\}$ may be unbounded

(B) The sequence $\{a_n\}$ may be bounded but may not converge

(C) The sequence $\{a_n\}$ has exactly two limit points

(D) The sequence $\{a_n\}$ is convergent

17. Let Q denotes the set of rational in $\mathfrak{R}$. Let m denotes the Lebesgue measure in $\mathfrak{R}$. Then

(A) $m(Q)=1$ (B) $m(Q)=0$ (C) $m(Q)=\infty$ (D) $m(Q)=10^7$

18. Let $f:[0,1]\to\mathbb{R}$ be continuous such that $f(t)\geq 0$ for all t in $[0,1]$. Define $g(x)=\int_0^x f(t)dt$, then

(A) g is monotonic and bounded (B) g is monotonic but not bounded

(C) g is bounded but not monotone (D) g is neither monotonic nor bounded

19. Let X be a non-empty topological space such that every function $f:X\to\mathbb{R}$ is continuous. Then

(A) X has the indiscrete topology (B) X has the discrete topology

(C) X is compact (D) X is not connected

20. Which of the following is not true?

(A) Every sequentially compact metric space is compact

(B) Every sequentially compact metric space is totally bounded

(C) Every sequentially compact metric space has the Bolzano -Weierstrass property

(D) Every sequentially compact metric space is not seperable

21. Let (X,d) be a metric space. Which of the following is possible?

(A) X has exactly 6 dense subsets (B) X has exactly 5 dense subsets

(C) X has exactly 4 dense subsets (D) X has exactly 3 dense subsets

22. The function $f:C\to C$, where C denotes the set of complex numbers, defined by $f(z)=\bar{z}$ is

(A) differentiable at each z (B) differentiable at each $z=0$

(C) differentiable nowhere (D) analytic at $z=0$

23. The values of a, b and c such that the function $f(z)=x-2ay+i(bx-cy)$ is analytic are

(A) $b=a$ and $c=-1$ (B) $b=2a$ and $c=-1$

(C) $b=2a$ and $c=1$ (D) $b=a$ and $c=1$

24. If $f(z)=\frac{1}{z^2-3z+2}$, then coefficient of $\frac{1}{z^3}$ in the Laurent expansion for $|z|>2$ is

(A) 0 (B) 1 (C) 3 (D) 5

25. Let f be a bilinear transformation that maps $-i$ to -1, 1 to 0 and i to 1. Then $f(1)$ is equal to

(A) 0 (B) -2 (C) i (D) $-i$

26. The Euler-Lagrange equation is

(A) $\frac{\partial L}{\partial q}-\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}}\right)=0$ (B) $\frac{\partial L}{\partial q}-\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}}\right)=0$

(C) $\frac{\partial L}{\partial q}-\left(\frac{\partial L}{\partial \dot{q}}\right)=0$ (D) $\frac{\partial L}{\partial q}-\frac{d^2}{dt}\left(\frac{\partial L}{\partial \dot{q}}\right)=1$

27. On which curve, the functional $\int_0^1\left[(y')^2+12xy\right]dx$ with $y(0)=0$ and $y(1)=1$, be extremized?

(A) $y=x$ (B) $y=x^2$ (C) $y=x^3$ (D) $y=x^4$

28. The solution of Volterra integral equation: $y(x)=1+\int_0^x y(t)dt$ is

(A) $y=e^{-x}$ (B) $y=1+e^x$ (C) $y=\frac{e^x}{2}$ (D) $y=e^x$

29. For $n\in N$, we define: $S_n=1^3+2^3+3^3+\cdots\cdots+n^3$. Which of the following holds for all $n\in N$?

(A) S_n is an odd integer (B) $S_n=\frac{n^2(n+1)^2}{4}$

(C) $S_n=\frac{n(n+1)(2n+1)}{6}$ (D) none of the above

30. The number of multipliers of 16^{11} that divide 18^{12} is

(A) 11 (B) 12 (C) 121 (D) 144

31. The ordinary differential equation $(x^2+x-2)^2 y''+3(x+2)y'+(x-1)y=0$ has

(A) both $x=1$ and $x=-2$ are regular singular points

(B) both $x=1$ and $x=-2$ are irregular singular points

(C) $x=1$ is an irregular singular point and $x=-2$ is a regular singular points

(D) $x=1$ is a regular singular point and $x=-2$ is an irregular singular points

32. Non-trivial solution of $\frac{d^2y}{dx^2}+\lambda y=0,\ y(0)=y(\pi)=0$ exists for

(A) $\lambda>0$ (B) $\lambda<0$ (C) $\lambda=0$ (D) only for complex λ

33. The solution of PDE: $xp+yq=z$ is

(A) $f(x^2,y^2)=0$ (B) $f(xy,yz)=0$ (C) $f(x,y)=0$ (D) $f\left(\frac{x}{y},\frac{y}{z}\right)=0$

34. Let $u=u(x,y)$ be the complete integral of the PDE $\frac{\partial u}{\partial x}\frac{\partial u}{\partial y}=xy$ passing through the points $(0,0,1)$ and $\left(0,0,\frac{1}{2}\right)$ in the $x-y-u$ space. Then, the value of $u(x,y)$ evaluated at $(-1,1)$ is

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

35. Perfect fluids are the fluids which have

(A) viscosity (B) no viscosity (C) magnetic field (D) electric field

36. Let C be the boundary of the triangle framed by the points $(1,0,0)$, $(0,1,0)$ and $(0,0,1)$. Then the value of the line integral $\oint_C(-2y\,dx+(3x-4y^2)dy+(z^2+3y)dz)$ is

(A) 0 (B) 1 (C) 2 (D) 4

37. The stream function ψ is defined for a flow, which is

(A) incompressible and two-dimensional (B) compressible and two-dimensional

(C) incompressible and three-dimensional (D) compressible and three-dimensional

38. In a flow through a straight smooth pipe, the diameter Reynolds number transition to turbulence is generally taken to be

(A) 1500 (B) 1800 (C) 2300 (D) 250,000

39. Given the parameters, namely V, L, g, ρ and μ, which affect certain fluid flow problems, the ratio $\frac{V^2}{Lg}$ is usually known as

(A) Bernoulli head (B) Froude number

(C) velocity head (D) impact energy

40. Given the steady, incompressible velocity distribution $\vec{V} = 3x\hat{i} + cy\hat{k} + 0\hat{j}$, where c is a constant, the value of c required to satisfy the conservation of mass principle is

(A) 3 (B) 2 (C) -3 (D) -2

41. For a floating body, the buoyant force passes through the

(A) centre of gravity of the body (B) centre of gravity of the submerged part of the body

(C) metacentre of the body (D) centroid of the liquid displaced by the body

42. The velocity field $(u(x, y), 0)$ in the plane Poisuille flow is given by

(A) $u = 1 - y^2$ (B) $u = y$ (C) $u = \sin y$ (D) $u = \tanh y$

43. If $x = r$ is a root of order m of the equation $f(x) = 0$, then Newton method will converge

(A) linearly (B) quadratically (C) cubically (D) biquadratically

44. The efficiency index of an iterative method (p is the order of method and n is the number of functional evaluation per step) is defined by

(A) np (B) $p^{\frac{1}{n}}$ (C) p^n (D) p^{n^2}

45. The local discretization error in modified Euler's method is of the order of

(A) h (B) h^2 (C) h^3 (D) h^4

46. The highest order of polynomial integrand for which Simpson's $\frac{1}{3}rd$ rule of integration is exact is

(A) first (B) second (C) third (D) fourth

47. The delayed unit step function is defined as $u(t-a)=\begin{cases}0, t<a\\1, t\geq a\end{cases}$. Its Laplace transform is

(A) ae^{-as} (B) $\frac{e^{as}}{s}$ (C) $\frac{e^{-as}}{s}$ (D) se^{-as}

48. The set $S=\{(x_1,x_2): x_1+x_2=1\}$ has no vertex because it is

(A) not convex (B) not bounded (C) not closed (D) none of these

49. In a balanced transportation problem with m sources and n destinations, the number of dual constraints will be

(A) $m+n$ (B) $m+n+1$ (C) $m+n-1$ (D) mn

50. Which one of the following is not a deterministic model?

(A) linear programming problem (B) transportation problem

(C) PERT (D) CPM

Question Booklet Series: **A** *Question Booklet Serial No.* 104526

M. Phil./Ph. D. Entrance Test – 2016

Subject: Statistics

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**

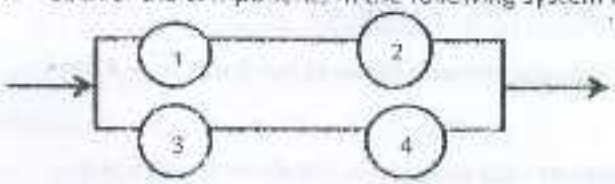
DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.

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. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. 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.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. 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.
13. 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.
14. **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.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

1. Let $X \geq 0$ almost surely. Suppose $E(X^{-1})$ and $E(X^{\alpha})$ exist, where $\alpha > 0$. Then $E(X^{\alpha})\,E(X^{-1})$ is:
   (A) $\leq E(X^{\alpha-1})$ (B) $\geq E(X^{\alpha-1})$ (C) $= E(X^{\alpha-1})$ (D) $= E(X^{\alpha})/E(X)$

2. Each of the components in the following system functions independently with probability .6.



   The probability that the system functions adequately is:
   (A) .72 (B) .1296 (C) .5904 (D) .28

3. Let X and Y be random variables. The inequality $(E(X+Y)^2)^{1/2} \leq (E(X^2))^{1/2} + (E(Y^2))^{1/2}$
   (A) Does not hold (B) Holds for any X and Y (C) Holds only if X and Y are non-negative
   (D) Holds only if X and Y are degenerate

4. The value of k for which the function $f(x, y) = kx(x-y)$, $0<x<1$, $-x<y<x$, is a joint density is:
   (A) 2 (B) 1 (C) 24 (D) 4

5. Three items drawn from a lot containing 5 items were found defective. The probability that all the items in the lot were defective is:

   (A) 4/5 (B) 1/2 (C) 2/5 (D) 2/3

6. The joint probability density function (pdf) of (X,Y) is $f(x,y) = 2$, $0<x$, $0<y$, $x+y<1$. The value of $P(X+Y>1/2)$ is:

   (A) 2/3 (B) 1/2 (C) 4/9 (D) 5/9

7. A simple random sample of size 6 was drawn with replacement from a lot containing 5 defective and 10 non-defective items. Let random variable X denote the number of non-defective items in the sample. The value of E(X) is:

   (A) 2 (B) 5 (C) 6 (D) 4

8. Let $X_1, \ldots, X_n$ be a random sample from uniform distribution over the interval (0, 1). Let random variable N_i denote the number of sample observations in the interval $(a_i, b_i]$, where $a_i = (i-1)/k$, $b_i = a_i + 1/k$, $i = 1, \ldots, n$, $k > 0$. Covariance between N_3 and N_8 is:

   (A) n/k^2 (B) $-1/k^2$ (C) $-n/k^2$ (D) nk^2

A single sampling plan with c=14 is used by taking a sample of size 225 items from a lot consisting of 2,000 items. The probability of accepting this lot is .83 when the lot quality is .05. Answer questions 9 and 10 using this information.

9. The average total inspection (ATI), rounded off to nearest whole number, is:

   (A) 110 (B) 1826 (C) 187 (D) 561

10. The value of average out going quality (AOQ) is:

    (A) .0415 (B) .558 (C) .110 (D) .05

11. A simple random sample of 4 items was drawn without replacement from a lot containing 4 defective and 6 non-defective items. Let random variable X denote the number of non-defective items in the sample. The value of E(X) is:

    (A) 3.6 (B) 2.4 (C) 1.6 (D) 2

12. Let random variable X follows Uniform distribution over the interval (0, 4). The value of P(X> 2| 1< X<3.5) is:

(A) 3/8 (B) 1 /2 (C) 3/5 (D) 2/5

13. Let $X_1, \ldots, X_n$ be iid Bernoulli variates with parameter p (0< p<1). Let $X = X_1 + \ldots + X_n$. An UMVUE of p + p(1-p) is:

(A) $X/n+X(X-n)/n^2$ (B) X(n-X)/n(n-1) (C) X(n-X)/n^2 (D) X/n + X(n-X)/n(n-1)

14. The basic purpose of bootstrap method of estimation is to:

(A) Decrease Bias (B) Decrease Variance (C) Decrease MSE (D) Increase ARE

15. Let X_1 and X_2 be iid standard exponential random variables. The value of P ($X_1 > X_2$) is:

(A) 3/4 (B) 1/4 (C) 2/3 (D) 1/ 2

16. In stratified simple random sampling the Variance of stratified sample mean is minimum for fixed total sample size n if $n_i \alpha$ N.S.. The value of constant of proportionality is:

(A) nS/N (B) $NS_i/\sum N_i$ (C) $N_iS_i/\sum S_i$ (D) $N_iS_i/\sum N_iS_i$

17. Let $T_{(r)}$ be the rth order statistic associated with a random sample of size n from an exponential distribution with mean θ. The value of $E(T_{(r)}/\theta)$ is:

(A) rθ (B) θ/n-r+1 (C) $\sum_{i=1}^{r} 1/(n-i+1)$ (D) $\theta\sum_{i=1}^{r} 1/(n-i+1)$

18. In cluster sampling, we take random sample:

(A) of clusters alone (B) from each cluster (C) of clusters and then take samples from selected clusters (D) from entire population

19. Let r be the number of components which fail before fixed time T out of n components under Type-1 censoring. Let T be the total life time observed and that the life times of components are iid exponential random variables with mean θ. The minimal sufficient statistic for θ is:

(A) (r, n) (B) (n, T) (C) (n, r, T) (D) (r, T)

20. Let Y and X , respectively, be the study and auxiliary variables. We prefer ratio estimator if Y is:

(A) Independent of X (B) non-linearly related to X (C) proportional to X (D) proportional to a linear function of X

21. Let $X_1, \ldots, X_n$ be a random sample from an exponential distribution with location parameter μ and scale parameter θ. Let T= min ($X_1, \ldots, X_n$) and $S = \sum_{i=1}^{n}(X_i - T)/(n-1)$. The distribution of 2n (T-μ)/S is:

(A) Chi-square (B) F (C) Gamma (D) Beta

22. Let X be a random variable such that $E(e^{aX})$ exists for a>0. Then P(X≥ c) is:

(A) ≤ $E(e^{aX})/ e^{ac}$ (B) ≥ $E(e^{ac})/e^{a}$ (C) ≥ $E(e^{aX})/ e^{ac}$ (D) ≤ e^{ac} $E(e^{aX})$

23. Let $\{X_i\}$ be a sequence of independent random variables such that $E(X_i)=\mu_i$ and $var(X_i)=\sigma_i$, $i=1, \ldots, n$. Define $Y_n = (X_1 + \ldots + X_n)/n$ and $\delta_n = (\mu_1 + \ldots + \mu_n)/n$. If $\sum_{i=1}^{n} \sigma_i / n^2 \to 0$ as $n \to \infty$ then Y_n converges to δ_n :

(A) in mean (B) in probability (C) in distribution (D) almost surely.

24. Let $\{T_n\}$ be a sequence of statistics such that $\sqrt{n}(T_n - \theta)$ follows normal distribution with mean zero and standard deviation $\sigma(\theta)$. Let g(x) be a function of single variable admitting first derivative $g'(x)$. The asymptotic distribution of $\sqrt{n}(g(T_n) - g(\theta)) / \sigma(\theta)$ is normal with variance

(A) 1 (B) $g'(\theta)$ (C) $\{g'(\theta)\}^2$ (D) $g'(\theta)/\{\sigma(\theta)\}^2$

25. Let A be the set of elements common to infinite number of events of the sequence of events $\{A_n\}$. Then $\sum P(A_n) < \infty$ implies that the value of P(A) is:

(A) 1 (B) 0 (C) in the interval (0, 1) (D) greater than 0

26. Let X be any random variable with $E(X) < \infty$. Then $E(X)$ is

(A) $\leq \log_e (E(e^X))$ (B) $\geq \log_e (E(e^X))$ (C) $e^{E(X)} \geq E(e^X)$ (D) $< \log_e (e^{E(X)})$

27. The probability mass function (pmf) of a discrete random variable X is $p(x) = 2^{-x}$, $x = 1, 2, \ldots$. The value of E(X) is:

(A) 1/2 (B) 2 (C) not defined (D) 4

28. The joint probability density function of (X,Y) is $f(x,y) = \frac{1}{4}$, $|x| < 1$, $|y| < 1$. The value of $P[X^2 + Y^2 \leq 9/16]$ is:

(A) 3/4 (B) 3/16 (C) 9/64 (D) 9/16

29. The joint pdf of (X,Y) is $f(x,y) = \{e^{-(x+y)} x^3 y^4\} / 144$, $x>0$, $y>0$. Define the random variables $U = X/(X+Y)$ and $V = X+Y$. The Jacobian of transformation to find the joint pdf of (U,V) is:

(A) u (B) 1 (C) v (D) uv

30. Let $N_1(t)$ and $N_2(t)$ be two independent Poisson processes with rates τ_1 and τ_2, respectively. The conditional distribution of $N_2(t)$ given $N_1(t) + N_2(t) = n$ is:

(A) Binomial (B) Geometric (C) Hypergeometric (D) Negative binomial

31. Let X and Y be two random variables with cdf $F_X(x) = F(x-\mu_X)$ and $G_Y(y) = F(y-\mu_Y)$, where F is any continuous distribution independent of parameters. If we write $G_Y(x) = F_X(x-\theta)$ then θ is equal to:

(A) $\mu_X \cdot \mu_Y$ (B) $\mu_Y - \mu_X$ (C) μ_X / μ_Y (D) μ_Y / μ_X

32. Let X and Y be two random variables with cdf $F_X(x) = F(x/\sigma_X)$ and $G_Y(y) = F(y/\sigma_Y)$, where F is any continuous distribution independent of parameters. If we write $G_Y(x) = F_X(x\theta)$ then θ is equal to:

(A) $\sigma_Y \cdot \sigma_X$ (B) $\sigma_Y - \sigma_X$ (C) σ_X / σ_Y (D) σ_Y / σ_X

33. Let $S \sim W(k, \Sigma)$. For fixed vector L the distribution of $(L'\Sigma^{-1}L)/(L'S^{-1}L)$ is:

(A) $W(k-p, \Sigma)$ (B) $\chi^2(k-p)$ (C) $\chi^2(k-p+1)$ (D) $W(k-p-1, \Sigma)$

34. Let $S \sim W(k, \Sigma)$ and consider the partition of S as $S = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$, where S, S_{11}, S_{12} and S_{22} are (pxp), (rxr), (rxs) and (sxs) matrices with r+s=p. Consider similar partition of Σ as Σ_{11}, Σ_{12} etc. The distribution of $S_{22} - S_{21} S_{11}^{-1} S_{21}$ is:

(A) Chi-square with s df (B) Gamma with shape p (C) Beta (r,s) (D) Wishart with s df

35. In constructing 1/6 fraction of $2^3 \times 3^3$ design suppose we take ½ fraction of a 2^3 experiment by confounding ABC and a 1/3 fraction from a 3^3 experiment by confounding DE^2F and D^2EF^2. The total number of confounded contrasts will be:

(A) 3 (B) 4 (C) 5 (D) 7

36. In a BIBD the number of experimental plots required is:

(A) vk (B) bk (C) vr (D) br

37. All contrasts of treatments effects are estimable in a design if and only if the design is :

(A) balanced (B) connected (C) orthogonal (D) complete.

38. The transition probability matrix (TPM) of a Markov Chain $\{X_n\}$, n = 1,2, ... with three states 1,2,3 is

$$P=\begin{vmatrix} .1 & .5 & .4 \\ .6 & .2 & .2 \\ .3 & .4 & .3 \end{vmatrix}$$

with initial probabilities as (.7 .2 .1). The value of $P(X_1 = 3, X_2 = 3, X_0 = 2)$ is:

(A) .2 (B) .04 (C) .012 (D) .09

39. Let μ_{ii} and d_i, respectively, be the mean recurrence time and period of state i of a Markov Chain. The state i is said to be ergodic if:

(A) $\mu_{ii} < \infty$ (B) $d_i > 1$ (C) $\mu_{ii} = \infty$, $d_i > 1$ (D) $\mu_{ii} < \infty$, $d_i = 1$

40. The value of k for which the function f(x) = k is a uniform density in the region bounded by curves $y = x$ and $y = x^2$ for $0 < x < 1$ is

(A) 2 (B) 6 (C) 4 (D) 1/6

41. Let $P = (p_{ij})$ be the TPM of a Markov Chain. This chain is said to be irreducible if:

(A) $p_{ij} > 0$ for all $\forall i, j$ (B) $p_{ij}^{(n)} > 0$ $\forall i, j$ and some n (C) $\sum_i p_{ij}^{(n)} = 1$ for some n

(D) $\sum_i p_{ij}^{(n)} < 1$ for $\forall j$ and some n.

42. The probability distribution of random variable N, denoting the number of items in the shipment, is:

n (value of N) :	10	15	20	25
P(N=n) :	.30	.20	.30	.20

The probability is .10 that any shipped item is defective. Let random variable X denote the number of defective items shipped each day. The expected value of X is

(A) 1.7 (B) 1.725 (C) .17 (D) 1.7

43. Let $U_1, \ldots, U_n$ be iid standard uniform random variables. Define $Y_i = U_i / \sum_{i=1}^{n} U_i$, i = 1, ..., n.

The random variables $Y_1, \ldots, Y_n$ are:

(A) Dependent (B) Linearly dependent (C) Independent (D) Undefined

44. Two stage sampling is a compromise between two sampling schemes, namely:

(A) Stratified and simple random (B) stratified and cluster (C) stratified and systematic (D) stratified and pps.

45. Let $Y_1, \ldots, Y_n$ be independent random variables such that $E(Y_i) = \mu_i$, $Var(Y_i) = \sigma^2$, i = 1, ..., n. Let tr(A) be the trace of matrix A, $Y' = (Y_1, \ldots, Y_n)$ and $\mu' = (\mu_1, \ldots, \mu_n)$. Then $E(Y'AY)$ is:

(A) $\sigma^2 tr(A) + \mu' A \mu$ (B) $\sigma^2 tr(A)$ (C) $\mu' A \mu$ (D) $\sigma^2 \mu' tr(A) \mu$

46. Let $X_1, \ldots, X_{20}$ be a random sample from a continuous distribution with median M and variance σ^2. Let random variable Y denote the number of sample observations greater than M. The variance of random variable Y is:

(A) 10 (B) 5 (C) 20 (D) 40

47. Let f(x) = x^2 and g(x) = e^x. The value of $\int_0^2 f(x)dg(x)$ is:

(A) -2 (B) 2 (C) 1 (D) 0dx

48. Let $F_n(x)$ be the empirical distribution function associated with a random sample $X_1, \ldots, X_n$ from a continuous distribution with cumulative distribution function (CDF) F(x). The variance of $F_n(x)$ is:

(A) F(x)(1-F(x))/2 (B) F(x)(1-F(x)) (C) nF(x)(1-F(x)) (D) nF(x)/4

49. Let $F^{-1}(u) = \theta_1 + \theta_2^{-1}(u^{\theta_3} - (1-u)^{\theta_4})$, 0<u<1, be the inverse of a CDF, where θs are all positive parameters. The distribution is symmetric if:

(A) $\theta_3 > \theta_4$ (B) $\theta_3 = \theta_4$ (C) $\theta_1 = \theta_2$ (D) $\theta_3 < \theta_4$

50. Let f(x) be the pdf associated with the cdf F(x) of a continuous non-negative random variable X. This distribution is IFR if $\log_e f(x)$ is:

(A) Convex (B) Linear (C) Concave (D) Non-ninear.