Bio-Chemistry(Ph.D.)

1. What is the isoelectric point for phenylalanine given the pK_a for the COOH group is 1.83 and the NH_3^+ group is 9.13?

(A) 5.48 (B) 4.83 (C) 2.43 (D) 9.13

2. A sequence of amino acids in a certain protein is found to be –Ser-Gly-Pro-Gly-. The sequence is most probably part of a (n):

(A) Alpha helix (B) Beta turn

(C) Parallel beta sheet (D) Anti-parallel beta sheet

3. D-Glucose is called as a reducing sugar because it undergoes an oxidation-reduction reaction at the anomeric carbon. One of the products of this reaction is:

(A) D-galactose (B) D-D-glucurinate

(C) D-gluconate (D) D-ribose

4. Side chains of tryptophan residues in proteins can interact with lectins. This is surprising because:

(A) The side chain of tryptophan is hydrophilic and lectins are hydrophobic
(B) The side chain of tryptophan is negatively charged and lectins are generally positively charged or are neutral
(C) The side chain of tryptophan can make hydrogen bonds and lectins cannot
(D) The side chain of tryptophan is hydrophobic and lectins are generally hydrophilic

5. The uncommon amino acid selenocysteine has an R group with the structure $–CH_2—SeH$ with a pKa of approximately 5. In an aqueous solution, pH=7.0, selenocysteine would:

(A) Be fully ionized zwitterion with no net charge
(B) Be nonionic
(C) Never be found in a protein
(D) Not be optically active

6. Prosthetic groups in proteins known as Glycoproteins are composed of:

(A) Carbohydrate (B) Lipids (C) Metals (D) Phosphates

7. A major advance in the application of mass spectrometry to macromolecule came with the development of techniques to overcome which One of the following problems:

(A) Macromolecules were insoluble in solvents used in mass spectrometry
(B) Mass spectrometric analyses were too complex
(C) Mass spectrometric analysis involved molecules in gas phase
(D) Most macromolecules could not be purified to the degree needed for this technique

8. An individual molecular structure within an antigen to which an individual antibody binds is :

(A) Antigen (B) Epitope (C) Fab region (D) Fc region

9. The biological role of restriction enzymes is:

(A) Restrict the damage to DNA by ultraviolet light

(B) Make bacteria resistant to antibiotics

(C) Degrade foreign DNA that enters a bacterium

(D) Restrict the size of DNA in certain bacterium

10. While in laboratory, you will introduce recombinant plasmids into bacterial cells by:

(A) Transformation- heat shock of the cells incubated with plasmid DNA in presence of $CaCl_2$

(B) Mixing plasmids with an extract of broken cells

(C) Electrophoresis- a gentle low voltage gradient draws DNA into the cell

(D) Microinjection

11. Which one of the following analytical techniques does NOT help illuminate a gene's cellular function?

(A) DNA microarray analysis (B) Protein chip analysis

(C) Southern blotting (D) Two-hybrid analysis

12. Tay-Sachs disease is the result of a genetic defect in the metabolism of

(A) Sterols (B) Gangliosides

(C) Triacylglycerols (D) Vitamin D

13. Non steroidal anti-inflammatory drugs (NSAIDS) like aspirin act by blocking production of:

(A) Sphingolipids (B) Ceramides

(C) Prostaglandins (D) Waxes

14. Phosphatidylglycerol, bees wax and cholesterol were dissolved in chloroform and subjected to thin layer chromatography on silica gel using chloroform/methanol/water as developing solvent. Which statement is true for the given conditions:

(A) Bees wax will move fastest, followed by cholesterol; phophatidylglycerol will be slowest

(B) Cholesterol will move fastest, followed by Bees wax; phophatidylglycerol will be slowest

(C) Phophatidylglycerol will move fastest, followed by cholesterol; Bees wax will be slowest

(D) Bees wax will move fastest, followed by phophatidylglycerol; cholesterol will be slowest

15. Triple helical DNA structures can result from Hoogsteen (non Watson-Crick) interactions. These interactions are primarily:

(A) Covalent bonds involving deoxyribose
(B) Covalent bonds involving bases
(C) Hydrogen bonds involving the bases
(D) Hydrophobic interactions involving the bases

16. Which of the following statements about a plot of V_o vs. [S] for an enzyme that follows Michelis Menten kinetics is false?

(A) At very high [S], initial velocity curve becomes a horizontal line that intersects the y-axis at Km

(B) As [S] increases, initial velocity of reaction Vo also increases

(C) Km is the [S] at which Vo=1/2 Vmax

(D) The shape of the curve is a hyperbola

17. Penicillin and related drugs inhibit the enzyme_____this enzyme is produced by_____.

(A) Beta lactamase, bacteria (B) Transpeptidase, human cells

(C) Transpeptidase, bacteria (D) Lysozyme, human cells

18. Enzyme X exhibits maximum activity at pH=6.9. X shows a fairly sharp decrease in its activity when the pH goes much lower than 6.4. One likely interpretation of this pH activity is that:

(A) A Glu residue on the enzyme is involved in the reaction
(B) A His residue on the enzyme is involved in the reaction
(C) The enzyme has a metallic cofactor
(D) The enzyme is found in gastric secretions

19. Which of the following is a common compound shared by TCA cycle and Urea cycle?

(A) Alpha ketoglutarate (B) Argino succinic acid
(C) Arginine (D) Fumarate

20. A patient reports with polyuria, polydipsia, polyphagia and blood glucose levels of 320 mg/dl; characteristic of Diabetes mellitus. Which of the following would occur in this patient?

(A) Increased conversion of fatty acids to acetyl CoA
(B) Decreased synthesis of cholesterol in liver
(C) Increased fatty acid synthesis from glucose in liver
(D) Increased stores of triacylglycerol in adipose tissue

21. Which of the following is a compound formed from both: a hydroxylation with an enzyme requiring Vitamin C and a subsequent methylation:

(A) Histamine (B) Creatinine (C) Epinephrine (D) Serotonin

22. Which of the following dairy products could be recommended to an individual with Lactose intolerance:

(A) Condensed milk (B) Yogurt

(C) Cheese (D) Ice cream

23. Catabolism of 1 mol of glucose to lactate in the glycolytic pathway is accompanied by the reduction of how many moles of O_2?

(A) 2 (B) 0 (C) 4 (D) 8

24. As electrons are received and passed down the transport chain, the electron carriers are first reduced with the acceptance of the electron and then oxidized with loss of the electron. An individual poisoned by which of the following compounds has the most highly reduced state of most of the respiratory chain carriers?

(A) Puromycin (B) Rotenone

(C) Carbon monoxide (D) Chloramphenicol

25. Which of the following nutrients is rich in short and medium chain fatty acids:

(A) Milk (B) Peanut oil (C) Sunflower oil (D) Almond oil

26. The pH of the body fluids is stabilized by buffer systems. Which of the following buffers is the most effective buffer system at physiological pH?

(A) Phosphate buffer (B) Protein buffer

(C) Deoxyhemoglobin (D) Bicarbonate buffer

27. Replication of DNA genome in human cells occurs only at a specified time during its life span and this period is referred to as:

(A) S phase (B) M phase (C) G1 (D) G2

28. The derepression of lac operon in the presence of lactose is an example of:

(A) Double negative regulation (B) Double positive regulation

(C) Positive regulation (D) Negative regulation

29. Which of the following is NOT a stop codon in prokaryotes?
(A) UAA (B) UAG (C) UGG (D) UGA

30. DNA is assembled into nucleosomes with the help of special proteins called
(A) Prolamines (B) Histones (C) Chaperones (D) Protamines

31. Pasteur effect is due to inhibition of glycolysis by high concentration of :
(A) ATP (B) ADP
(C) AMP (D) Creatine phosphate

32. Which of the following tests is undertaken to differentiate between Glucose and Fructose:
(A) Benedict's test (B) Seliwanoff's test
(C) Molisch test (D) Starch test

33. Sphingosine is not present in:
(A) Gangliosides (B) Cerebrosides
(C) Sphingomyelin (D) Plasmalogen

34. Which essential nutrient participates as a coenzyme in the transport of high energy electrons and H+ ions during oxidative phosphorylation in the mitochondria?
(A) Folic acid (B) Thiamine (C) Niacin (D) Ascorbic acid

35. Cholesterol is a precursor of all except:
(A) Bile salts (B) Bilirubin (C) Steroids (D) Vitamin D

36. All amino acids except one, participate in phase 2 reactions of detoxification
(A) Serine (B) Glycine (C) Glutamine (D) Cysteine

37. Hill reaction is concerned with the production of
(A) Reducing agents like $TPNH_2$ or $NADPH_2$ and ATP in mitochondria
(B) Oxygen due to photolysis in chloroplasts
(C) Reducing agent like $NADPH_2$ and O_2 from H_2O in chloroplasts
(D) Reducing agents like $TPNH_2$ and ATP in chloroplasts

38. The C4 plants are photosynthetically more efficient than C3 plants because
(A) They have more chloroplasts
(B) CO_2 compensation point is high
(C) CO_2 efflux is not prevented
(D) CO_2 generated during photorespiration is trapped through PEP carboxylase

39. Artificial ripening of fruits is accomplished by treatment with
(A) IAA (B) Ethylene gas
(C) Kinetin (D) Sodium Chloride

40. Majority of Nitrogen fixation occurs by

(A) Lightening (B) Volcanic reuptions

(C) Haber Bosch process (D) Biological nitrogen fixing organisms

41. The major enzymes involved in Nitrogen fixation are

(A) Nitorgenase and hexokinase (B) Nitrogenase and hydrogenase

(C) Nitrogenase and hydrolyase (D) Nitrogenase and peptidase

42. Which part of the brain controls eating, drinking, body temperature & provides a link between brain and endocrine system?

(A) Parietal lobes (B) Temporal lobes

(C) Amygdala (D) Hypothalamus

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

(A) In situ hybridisation (B) Colony hybridisation

(C) Dot blot technique (D) Western blotting

44. Reverse transcriptase PCR uses

(A) DNA as a template to form ssDNA
(B) RNA as a template to form DNA
(C) mRNA as a template to form cDNA
(D) DNA as a template to form dsDNA

45. Minisatellites are

(A) Short coding repetitive regions on the eukaryotic genome
(B) Short non coding repetitive sequences present throughout the chromosome
(C) 10-40 bp sized short sequences within the genes
(D) Regions of chromosomes after secondary constriction

46. The use of living microorganisms to degrade environmental pollutants is called

(A) Microremediation (B) Nanoremediation

(C) Bioremediation (D) Georemediation

47. Which of the following chelating agents is recommended for acute Lead poisoning with signs of encephalopathy?

(A) Dimercaprol and Calcium EDTA (B) Succimer

(C) Penicillamine (D) Calcium EDTA

48. Which of the following Mast cell products is not preformed and therefore has to be newly synthesized?

(A) Eosinophil chemotactic factor (B) Heparin

(C) Histamine (D) Prostaglandin

49. The circulation of a two month old breast fed baby will contain maternal:
(A) IgA (B) IgG (C) IgM (D) IgD

50. For vaccination against mycobacterial diseases such as tuberculosis, the most important facet of the immune response to be stimulated is:
(A) High titer of antibody

(B) Cytotoxic T cells

(C) Macrophage activating cell mediated immunity

(D) Neutrophils

x-x-x

(BIOPHYSICS)

1. The most significant drawback in electron microscope is that
(A) It is very costly
(B) It requires high technical skill
(C) It is to be lodged in vacuum
(D) Living cells cannot be observed under it

2. Mycobacterium tuberculosis is an intra-cellular bacterium. It prefers to infect
(A) Macrophages (B) B-cells
(C) T-cells (D) Neutrophils

3. What does θ signifies in Brags equation: $2d \sin \theta = n\lambda$
(A) Angle between incident x-ray and diffracted x-ray
(B) Angle between incident x-ray and plane of crystal
(C) Angle between incident x-ray and protein molecule
(D) Angle between incident x-ray and x-ray grid

4. Which gene transfer technique involves the use of a fatty bubble to carry a gene into a somatic cell?
(A) Electroporation (B) Liposome transfer
(C) Microinjection (D) Particle bombardment

5. What reagent is quantified when performing an indirect ELISA?
(A) Antibodies in patient's serum (B) Fluorescent antibody
(C) Chromagen (D) Complement

6. The vector for T-DNA is:
(A) Thermusaquaticus (B) Agrobacterium tumefaciens
(C) Bacillus thuringiensis (D) Salmonella typhimurium

7. Asprin, used as a common analgesic, antipyretic and anti-inflammatory agent, inhibits the synthesis of which one of the following?
(A) Arachidonic acid (B) Prostaglandins
(C) Glucocorticoids (D) Histamine

8. The S wave form of normal human ECG originates due to:
(A) Septal and left ventricular depolarization
(B) Late depolarization of the ventricular walls moving back towards the AV junction
(C) Left to right septal depolarization
(D) Repolarization of atrium

9. Which one of the methods listed below is the most sensitive label free quantification methods for proteins?
(A) UV spectroscopy (B) Infra-red spectroscopy
(C) Raman spectroscopy (D) Southern blotting

10. Which of the following proteins acts as an energy transducer?
(A) G-protein (B) Bacteriorhodopsin
(C) Haemoglobin (D) Heat shock protein

11. Which of the following is unfavorable for protein folding?

(A) Hydrophobic Interaction (B) Van DER Waals Interaction
(C) Conformational Entropy (D) Hydrogen Bonding

12. Recombinant proteins are
(A) Proteins synthesized in animals
(B) Proteins synthesized by transgene in host cell by rDNA technology
(C) Proteinssynthesised in cells that are produced by protoplast fusion
(D) Proteins synthesized in mutated cell lines

13. Immunoprecipitation involve the purification of
(A) Antigen (B) Antibody
(C) Antigen and antibodies (D) Antigen-antibody complex

14. Bouguer's law relates
(A) Light reflection (B) Light refraction (C) Light transmission (D) Light absorption

15. Which among the following is the simplest method to estimate the concentration of glycerol in an aqueous solution of glycerol?
(A) UV absorption spectroscopy (B) Gas chromatography
(C) pH measurement (D) Viscosity measurement

16. Choose the correct statement about peptides in Ramchandran plot.
(A) Peptides that are unstructured will have all the backbone dihedral angles in the disallowed regions
(B) It is not possible to conclude whether a peptide adopts entirely helix or entirely beta sheet conformation
(C) The occurrence of beta turn conformation in a peptide can be deduced
(D) The sequence of a peptide can be deduced

17. An optical measurement of protein is taken both before and after digestion of the protein by a protease. In which of the following spectroscopic measurement the signal change, i.e., before v/s after protease treatment, could be the maximum?
(A) Absorbance at 280 nm (B) Circular dichromism
(C) Absorbance at 340nm (D) Fluorescence value

18. The presence and distribution of specific mRNAs within a cell can be detected by
(A) Northern blot analysis (B) RNase protection assay
(C) In situ hybridization (D) Real-time PCR

19. Which one of the following analytical techniques does NOT involve an optical measurement?
(A) ELISA (B) Microarray
(C) Flow cytometry (D) Differential Scanning Calorimetry

20. The secondary antibodies routinely used for the detection of primary antibodies in western blotting experiment are
(A) Anti-allotypic (B) Anti-idiotypic (C) Anti-isotypic (D) Anti-paratypic

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

22. Where are CD-45 cells responsible for signal transduction in the body located?

(A) B-cells (B) T-cells

(C) All leukocytes except T-cells (D) Haemopoietic cells

23. Which of the following antibiotics work by inhibiting protein synthesis in the target organism?

(A) Quinolones and Bacitracin (B) Streptomycin and Tetracycline

(C) Rifampicin and Cephalosporin (D) Tetracycline and Ampicillin

24. Which one of the following chemicals is a DNA intercalator?

(A) 5-Bromouracil (B) Ethyl methane sulfonate

(C) UV (D) Acridine orange

25. The appropriate match in Column 1 and 2 is

	COLUMN 1		**COLUMN 2**
a	Ferritin	i	Carboplatin
b	Chemotheraphy	ii	Iron storage
c	Metallothioneins	iii	Cystein rich protein

(A) a-i, b-ii, c-iii (B) a- ii, b-i, c-iii

(C) a-i, b-iii, c-ii (D) a- iii, b-i, c-ii

26. Which of the following groups contain only aromatic Aminoacids?

(A) Histidine, Serine, Tryptophan (B) Phenylalanine, Tyrosine, Valine

(C) Tryptophan, Tyrosine, Histidine (D) Alanine, Tyrosine, Valine

27. Immediate hypersentivity reactions are associated with?

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

28. The Biological role of Cytochrome P-450 is

(A) Nitrogen Fixation (B) Oxidation of RH to ROH

(C) Amide hydrolysis (D) Oxidation of aminoacids

29. If half-life of 100 g iodine (I131) is 8 days, how many grams will remain in 32 days

(A) 50 g (B) 75 g (C) 6.25 g (D) 25 g

30. Which of the following statements is/are correct?

(A) Temperature coefficient of thermistors is more than the thermoresistors

(B) Temperature coefficient of thermoresistors is more than the thermistor

(C) The resistance-temperature relationship of thermistors is exponential and thermoresistor is linear

(D) The resistance-temperature relationship of thermoresistor is exponential and thermistor is linear

31. A neoplasm is

(A) A population of cells growing out of control

(B) A cell organelle that begins the process of turning a cell cancerous

(C) The nucleus of a cancer cell

(D) Pain caused by cancer cells putting pressure on neurons

32. "A single ring-shaped DNA molecule" is a description of

(A) The only genetic material in a cancer cell

(B) The bacterial chromosome
(C) The viral chromosome
(D) A transposon

33. The tumor suppressor gene that shows up in approximately half of all U.S. cancers is called
(A) u2 (B) p51 (C) 6pac (D) p53

34. Increased blood flow to a cancerous tumor is called
(A) Anaplasia (B) Metastasis (C) Malignancy (D) Vascularization

35. A mutation that removes a base pair and thus offsets the reading frame of the genetic sequence by one letter is called
(A) A basal disruption (B) A frameshift mutation
(C) A bump-and-run mutation (D) A sliding sequence mutation

36. Lack of thymus leads to increased infection in humans such a condition called
(A) Thymectomy (B) Nude mice
(C) DiGeorge's syndrome (D) None of above

37. The proofreading of newly synthesized DNA, to excise incorrect nucleotides which have been inserted, is done by:
(A) A restriction endonucleases (B) DNA gyrase
(C) DNA ligase (D) DNA polymerase III

38. The codon is found in :
(A) DNA (B) rRNA (C) tRNA (D) mRNA

39. The size of the E.coli genome is
(A) 4640 bp (B) 4.64 Kbp
(C) 4.64 Mbp (D) Not known with certainty

40. An enzyme that recognizes a specific (palindromic) sequence and cuts within a DNA molecule is called a(n):
(A) Exonuclease (B) Methylase
(C) Modification enzyme (D) Restriction endonuclease

41. Which polymerase made widespread use of PCR possible:
(A) DNA polymerase I (B) Thermus aquaticus (Taq) polymerase
(C) DNA polymerase III (D) None of the above

42. G-proteins are involved in relying signals through G-protein linked receptors. Which of the following forms of G-proteins considered in to be active state?
(A) G-protein –ADP (B) G-protein-ATP
(C) G-protein-GDP (D) G-protein-GTP

43. Which one of the following compounds does not act as second messenger during signaling process?
(A) cAMP (B) Calcium ions
(C) Ionositol-3,4,5-trisphosphate (D) Triacylglycerol

44. Which of the following biochemical reactions is most commonly utilized by living cells to propagate intracellular signals?

(A) Acylation (B) Phosphorylation

(C) Methylation (D) Decarboxylation

45. Tight junctions:

(A) Are essential for metabolic coupling

(B) Donot occur in vertebrates

(C) Have the closest approach of two plasma membranes of any junction

(D) Surround connexons

46. Which of the following is the component in the signaling pathway stimulated by receptor tyrosine kinases?

(A) Adenylate cyclase (B) Adaptor proteins

(C) Autophosphorylating receptor (D) Ras activating protein

47. Which of the following wavelength ranges is associated with UV spectroscopy?

(A) 0.8-500µm (B) 400-100nm (C) 380-750nm (D) 0.01-10nm

48. Electron microscopes have higher resolution than any type of light microscope because of their:

(A) Higher magnification (B) Lenses used are of high quality

(C) Very short wavelength of electrons (D) Bulky structure of microscope

49. Lycopene (λ_{max} = 469 nm) is present in tomatoes. What colour of light does lycopene absorb?

(A) Green (B) Red (C) Blue (D) Orange

50. Which of the following is not a limitation of Beer Lambert's law, which gives the relation between absorption, thickness, and concentration?

(A) Concentration must be lower

(B) Radiation must have higher bandwidth

(C) Radiation source must be monochromatic

(D) Does not consider factors other than thickness and concentration that affect absorbance

x-x-x

(BOTANY)

1) Basal elaterphore present in the capsule of *Pellia* develops from:

(A) Elater mother cells (B) Sterile sporogenous cells

(C) Fertile sporogenous cells (D) Amphithecium

2) Which of the following pair is an example of saprophytic liverwort and moss respectively?

(A) *Cryptothallus mirabilis* and *Buxbaumia aphylla*

(B) *Buxbamia aphylla* and *Cryptothallus mirabilis*

(C) *Cryptothallus* and *Zoopsis*

(D) *Zoopsis* and *Cryptothallus*

3) Setae are absent in the sporangium of:

(A) *Anthoceros* and *Corsinia* (B) *Corsinia* and *Tortula*

(C) *Tortula* and *Antoceros* (D) *Sphagnum and Corsinia*

4) Name the earliest land vascular plant discovered from Mid Silurian of Ireland.

(A) *Cooksonia* (B) *Rhynia* (C) *Aglaophyton* (D) *Psilophyton*

5) Which of the following statement is not true about stele system of pteridophytes?

(A) Primitive type of stele is found in *Lycopodium*

(B) Stele in which centre is occupied by pith is called siphonostele

(C) A siphonostele perforated by several overlapping leaf gap is called Solenostele

(D) Amphiphloic siphonostele is the condition in which xylem is surrounded on both sides by phloem, pericycle and endodermis

6) In transverse sections of a young stem, if vallecular canals and cranial canals are present, then the plant belongs to:

(A) Lycopodiales (B) Isoetales (C) Selaginellales (D) Equisetales

7) Which of the following families of the gymnosperms has 1 ovule per scale?

(A) Pinaceae (B) Araucariaceae (C) Cupressaceae (D) Ginkgoaceae

8) Sago is a starch mostly obtained from pith and cortex of the stem of Cycas species:

(A) *Cycas cercinalis* (B) *Cycas revoluta*

(C) *Cycas pectinata* (D) *Cycas rumphi*

9) A demulcent is a drug that:

(A) Calms the nerves and induces sleep

(B) Enhances appetite and digestion

(C) Soothes skin and mucous membrane

(D) Increases the discharges of urine

10) Which of the following plant extract has property to cure rheumatism?

(A) *Azadirachta indica* (B) *Cassia augustifolia*

(C) *Withania somniferum* (D) *Aegle marmelos*

11) In which of the following types, the embryo sac has 16 nuclei, with a 3-celled egg apparatus and two polar nuclei?

(A) *Peperomia* (B) *Penaea* (C) *Drusa* (D) *Fritillaria*

12) *Amborella trichopoda* is now widely considered as:

(A) Oldest known fossils of an angiosperm
(B) Most primitive living angiosperm
(C) Most primitive living vascular plant
(D) Oldest known fossil of a seed plant

13) Which of the following algae have nonflagellate coenobia?

(A) Eudorina (B) Pandorina (C) Pediastrum (D) Volvox

14) Formation of statospores is a characteristic feature of:

(A) Chlorophyta Division (B) Chrysophyta Division
(C) Phaeophyta Division (D) Pyrrophyta Division

15) The most important alga used as food in Japan is:

(A) *Furcellaria fastiagata* (B) *Gleopeltis furcata*
(C) *Microcystis aeruginosa* (D) *Porphyra tenera*

16) Which of the following shows secondary growth by successive cambia?

(A) *Boerhaavia diffusa* (B) *Aristolochia triangularis*
(C) *Thunbergia coceinea* (D) *Serjania corrugate*

17) Bicollateral vascular bundles are characteristic feature of which of the following genera:

(A) *Cucurbita* (B) *Helianthus* (C) *Althaea* (D) *Salvia*

18) The type specimen is collected from the original material to serve as nomenclature type, when holotype is missing:

(A) Isotype (B) Lectotype (C) Neotype (D) Topotype

19) ICN stands for:

(A) International code of nomenclature for plants
(B) International code of nomenclature for algae, fungi and plants
(C) International code of nomenclature for algae and fungi
(D) International code of nomenclature for angiosperm only

20) Which of the following is a bionomial in which genus and species names are identical in spelling?

(A) Autonym (B) Tautonym (C) Homonym (D) Synonym

21) The Genome D present in bread wheat is supposed to have been derived from:

(A) *Aegilops Squarrosa* (B) *Aegilops Speltoides*
(C) *Triticum Monococcum* (D) *Triticum vulgare*

22) The process involving inspection, fumigation and growing the introduced plant material in isolation is known as

(A) Acclimatization (B) Quarantine
(C) Adaptation (D) Tolerance

23) Heterosis is:

(A) Superiority of hybrids over their parents
(B) Induction of mutation
(C) Mixture of two or more traits
(D) Spontaneous mutation

24) A type 1 survivorship curve is characteristic of the species with a rapid increase in mortality in old age. This type of curve is:

(A) Typical of many invertebrates that produce a large number of offspring
(B) Typical of humans and other large mammals
(C) Almost never found in nature
(D) Typical of all species of birds

25) According to McArthur and Wilson's equilibrium theory, which of the following is true?

(A) Larger islands and islands closer to continent are expected to have more species than smaller and isolated islands
(B) Smaller islands and islands far from the continent are expected to have more species than larger and isolated islands
(C) Smaller islands and islands closer to the continent are expected to have more species than far away and isolated islands
(D) More species are expected on all islands irrespective of their size and distance from continent

26) Wetlands are conserved internationally through an effort called:

(A) Basei convention (B) Rio convention
(C) Montreal convention (D) Ramsar convention

27) Which of the following fungal group belongs to phylum Straminopila?

(A) Ascomycota (B) Basidiomycota
(C) Zygomycota (D) Oomycota

28) Which of the following zoosporic fungi has nuclear cap in its zoospores?

(A) *Blastocladiella emersonii* (B) *Apodachlya brachynema*
(C) *Plasmodiophora brassicae* (D) *Phytophthora infestans*

29) Unicellular stalked teleutospores with papillar thickening is a characteristic feature of the following rust genera?

(A) Uromyces (B) Puccinia (C) Phragmidium (D) Ravenelia

30) Phenylalanine, a precursor of most of the phenolics in higher plants is a product of which one of the following pathways?

(A) Shikimic acid pathway (B) Malonic acid pathway
(C) Mevalonic acid pathway (D) Methylerythritol pathway

31) Gibberellic acid (GA) controls seed germination by directing breakdown of the stored starch. In which one of the following tissues of the barley seed, α-amylase gene is induced in response to GA?

(A) Endosperm (B) Coleoptile (C) Aleurone layer (D) Embryo

32) How many ATP and $NADPH_2$ are used in C_3 cycle for net production of one molecule of 3-phosphoglyceraldehyde?

(A) 3ATP and 2 $NADPH_2$ (B) 9ATP and 6 $NADPH_2$

(C) 6ATP and 6 $NADPH_2$ (D) 6ATP and 9 $NADPH_2$

33) Magnesium, iron and Molybdenum metals are present in enzymes as activators, which are:

(A) Cytochrome, Peptidases and Phosphotases respectively

(B) Phosphatases, Cytochromes and Nitrogenase respectively

(C) Fructokinase, Cytochromes and Nitrate reductase respectively

(D) Dehydrogenase, Kinase and Nitrate reductase respectively

34) If the free energy change (ΔG) in a reaction is a negative value, it indicates that the:

(A) Reaction releases energy (B) Reaction absorbs energy

(C) Reaction is in positive direction (D) Reaction is in negative direction

35) Enzyme acts as biological catalyst by increasing rate of reaction by:

(A) Increasing activation energy (B) Decreasing activation energy

(C) Increasing free energy change (D) Increasing entropy

36) During protein synthesis in prokaryotes, the peptidyl transferase activity required for pepetide bond formation is due to:

(A) Ribosomal proteins (B) 16S ribosomal RNA

(C) 23S ribosomal RNA (D) Aminoacyl t-RNA

37) Major function of σ-Subunit of *E. coli* RNA polymerase during transcription is to:

(A) Initiate transcription and does not fall off during elongation

(B) Decreases affinity of core enzyme to promoter

(C) Binds to DNA independent of core enzyme

(D) Ensure recognition of promoter region by interacting with core enzyme

38) During replication, the RNA primer is degraded by the 5'-3' exonuclease activity of:

(A) RNase H1 (ribonuclease H1) (B) FEN-1 (flap endonuclease 1)

(C) TopoisomeraseII B (D) DNA polymerase Ɛ

39) Species richness is much pronounced in which type of forests:

(A) Tropical rain forest (B) Tropical deciduous forest

(C) Temperate forest (D) Alpine forest

40) Average annual precipitation and temperature of temperate forest are respectively:

(A) 255 cm precipitation and 25°C temperature

(B) 300 cm precipitation and 15°C temperature

(C) 100 cm precipitation and 15°C temperature

(D) 300 cm precipitation and 25°C temperature

41) Subalpine forest and tropical thorn forest are dominated with following plant species:

(A) *Dichanthium* and *Abies* (B) *Ilex* and *Pinus*

(C) *Abies* and *Acacia* (D) *Dipterocarpus* and *Acacia*

42) The apple scab disease is caused by:

(A) *Xanthomonas citri* (B) *Venturia inaequalis*

(C) *Colletotrichum* falcatum (D) *Curvularia prasadii*

43) The 'Tundu' disease of wheat is caused by:

(A) *Anguina triticia* and *Corynebacterium tritici*

(B) *Anguina tritici*

(C) *Anguina tritici* and *Erwinia dissolvens*

(D) *Globodera tritici*

44) The "Great Bengal Famine" in 1943 was the result of which of the following:

(A) Bunt of wheat caused by *Telletia*

(B) *Helmithosporium* blight of rice

(C) Blast of rice caused by *Pyricularia*

(D) Late blight of potato caused by *Phytophthora*

45) Standard deviation of a sample is 240 and number of individuals of the sample are 64. Find out the Standard error of mean (SEM)?

(A) 30 (B) 50 (C) 20 (D) 60

46) Choose the correct relation among arithmetic mean (AM), geometric mean (GM) and harmonic mean (HM):

(A) GM> AM>HM (B) HM>AM<GM

(C) AM>GM>HM (D) HM>AM>GM

47) Which of the following is a non parametric test?

(A) Chi square test (B) F-test

(C) T-test (D) ANOVA test

48) The genetically modified tomato 'Flavr Savr' with delayed ripening was the result of:

(A) Over expression of Antisense gene for *polygalacturonase*

(B) Gene silencing by antisense RNA

(C) Over expression of gene for ethylene biosynthesis

(D) Over expression of gene for ACC synthase

49) Glyphosate-based herbicides, such as Roundup, target which pathway of the plants?

(A) Mevalonic acid pathway

(B) Shikimate pathway enzyme 5-enolpyruvylshikimate 3-phosphate (EPSP) synthase

(C) Methyl erythritol pathway

(D) Malonic acid pathway

50) Which of the following genetic engineering method is best suited for addition of gene into plants?

(A) Plasmid method (B) Vector method

(C) Biolistic (gene gun) method (D) Microinjection

x-x-x

(CHEMISTRY)

1. The variable that is kept constant in an isobaric process is

(A) Volume (B) Temperature (C) Molarity (D) Pressure

2. The following isotope is radioactive

(A) ^{3}H (B) ^{12}C (C) ^{2}H (D) ^{16}O

3. The drag on the central ion as discussed by Debye Huckel is known as

(A) Viscous effect (B) Electrophoretic effect

(C) Asymmetry effect (D) Wien effect

4. The well known radioisotope ^{14}C decays by emitting the following particle

(A) Alpha (B) Negatron (C) Positron (D) Neutron

5. The volume occupied in Litres by 18.0 g of Oxygen gas made up of Oxygen atoms having 10 neutrons at normal temperature and pressure is

(A) 5.6 (B) 11.2 (C) 2.24 (D) 22.4

6. An experimenter tries to melt ice at 265 K as well as at 300 K. The sign of ΔG for the melting of ice experiment at 265 K and 300 K respectively can be expressed as follows:

(A) + - (B) + + (C) - + (D) - -

7. It was observed that in a chemical reaction A proceeding to B the increase in the concentration of A by 3 times increases the reaction rate by 9 times the order of the reaction would be

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

8. In Raman Spectroscopy the scattered radiation having energy more than the incident radiation is called

(A) Stokes (B) Anti-Stokes (C) Rayleigh (D) Thermal

9. Given that $g_N = 5.585$ and $\mu_N = 5.05 \times 10^{-27}$ J T^{-1} the NMR frequency of a proton in a magnetic field of intensity 2.82 Tesla would in MHz be

(A) 60 (B) 120 (C) 90 (D) 30

10. Debye Falkenhegen Effect describes the conductance of an electrolyte of interest under the following condition

(A) High AC frequency (B) High Voltage

(C) Low Concentration (D) High Viscosity

11. The de Broglie wavelength of an electron moving with a velocity of 4.8×10^{5} m sec^{-1} is about

(A) 1.5×10^{-9} m (B) 3.0×10^{-10}m (C) 4.8×10^{-5} m (D) 4.8×10^{5} m

12. The pair ^{13}C and ^{13}N is an example of

(A) Isobar (B) Isotone (C) Isomer (D) Isotope

13. The number of elements depicted in the most recent periodic table is

(A) 103 (B) 92 (C) 109 (D) 118

14. The unit cell parameter a=b=c and $\alpha=\beta=\gamma=90^0$ represents crystal system

(A) Tetragonal (B) Cubic (C) Monoclinic (D) Hexagonal

15. The lowest bond energy is depicted by the bond between following pair of atoms

(A) H-F (B) H-Br (C) H-H (D) C=C

16. If the number of ways of a molecular arrangement can be expressed by term X then the relationship between entropy S and the term X can be represented by

(A) S=X (B) S=kX (C) S=Q/T (D) S=klnX

17. The neutron to proton ratio in the isotope of the element Boron having mass number 13 is

(A) 1.6 (B) 1.0 (C) 13 (D) 5

18. A compound X on heating gives a colourless gas. The residue is dissolved in water to obtain Y. Excess CO_2 is bubbled through aqueous solution of Y which result in the formation of Z. Z on gentle heating gives back X. The compound X is:

(A) $CaCO_3$ (B) Na2CO_3 (C) $Ca(HCO_3)_2$ (D) K_2CO_3

19. When orthoboric acid (H_3BO_3) is heated, the residue left is:

(A) Boron (B) Metaboric acid

(C) Boric anhydride (D) Borax

20. Which of the following trihalides of nitrogen is least basic:

(A) NF_3 (B) NCl_3 (C) NBr_3 (D) NI_3

21. The number of P-O-P and P-O-H bonds present respectively in pyrophosphoric acid molecule are:

(A) 1,2 (B) 2,2 (C) 1,4 (D) 1,8

22. Which of the following does not form clatherates:

(A) Helium (B) Argon (C) Krypton (D) Xenon

23. The aqueous solution containing which one of the following ions will be colourless:

(A) Mn^{2+} (B) Fe^{2+} (C) Ti^{3+} (D) Sc^{3+}

24. Which of the following belongs to C_{3v} point group:

(A) SO_3 (B) BBr_3 (C) NH_3 (D) $AlCl_3$

25. Which structures for XeO_3 and XeF_4 are consistent with the VSEPR model?

(A) Trigonal pyramidal, Square planar (B) Trigonal planar, Square planar

(C) Trigonal pyramidal, Tetrahedral (D) Trigonal planar, Tetrahedral

26. The compound which exhibits Jahn-Teller distortion is:

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

(C) $[Cr(H_2O)_6]^{3+}$ (D) $[Fe(CN)_6]^{4-}$

27. The total no. of isomers in $Co(en)_2Cl_2$ is

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

28. The no. of lines that appear in the EPR spectra of $[C_6H_6]^-$ is:

(A) 5 (B) 7 (C) 11 (D) 13

29. The hardness of water is measured by:

(A) Distillation (B) Conductivity

(C) EDTA method (D) Sublimation

30. Cyanide process is used to obtain:

(A) Cr (B) Ag (C) Cu (D) Zn

31. Which of the following has largest bond angle:

(A) NH_3 (B) PH_3 (C) AsH_3 (D) SbH_3

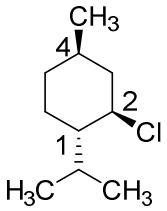
32. Peroxo linkage is present in:

(A) H_2SO_3 (B) H_2SO_5 (C) H_2SO_4 (D) $H_2S_2O_7$

33. WOC complex present in photosynthesis process contain

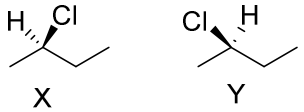
(A) Zn (B) Fe (C) Pu (D) Mn

34. Assign R / S configuration at C-1, C-2 and C-5 in the following compounds.



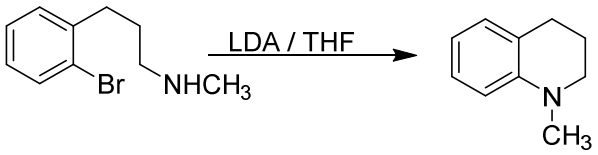
(A) 1R,2S,4R (B) 1R,2R,4R (C) 1S,2S,4R (D) 1S,2R,4R

35. Mark the relationship ship between following structures X and Y:



(A) Enantiomers (B) Diastereomers (C) Meso (D) Same

36. Which reactive intermediate is involved in the following reaction?



(A) Carbene (B) Nitrene (C) Benzyne (D) Free radical

37. Reaction of 2-buten-1-ol with thionyl chloride results in formation of:

(A) 3-Chloro-1-butene (B) 1-Chloro-2-butene

(C) 1,2-Dichlorobutane (D) 1,3-Dichlorobutane

38. Solvolysis of neopentyl bromide result in formation of:

(A) 2-Methyl-2-butene (B) 3-Methyl-1-butene

(C) 2-Butene (D) 1-Butene

39. Nitration of N,N-dimethylaniline results in formation of:

(A) *m*-Nitro-N,N-dimethylaniline (B) *o*-Nitro-N,N-dimethylaniline

(C) *p*-Nitro-N,N-dimethylaniline (D) N-Nitro-N,N-dimethylaniline

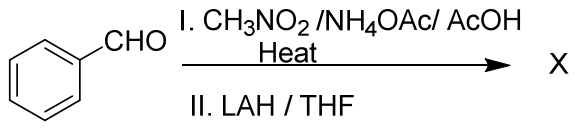
40. In sulphonation of benzene attacking species is:

(A) SO_2 (B) SO (C) SO_3 (D) S_2O

41. Addition elimination mechanism of aromatic nucleophilic substitution involves the intermediary of:

(A) Carbocation (B) Carbanion (C) Carbene (D) Benzyne

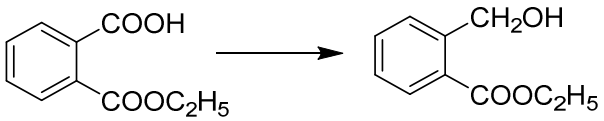
42. Predict the product X in the following reaction:



(A) 2-Phenyl ethyl amine (B) 1-Phenyl ethyl amine

(C) Benzyl amine (D) Ethyl benzene

43. The best reagent to achieve the following transformation is:



(A) BH_3.THF (B) $LiAlH_4$ (C) $NaBH_4$ (D) $NaBH_3CN$

44. Selective reduction of ketone in presence of aldehyde can be achieved by use of:

(A) $NaBH_4$ / CH_3OH

(B) $NaBH_3CN$ / CH_3OH

(C) [I. $NaBH_4$ / CH_3OH / $CeCl_3$]
[II. H_2O / H^+]

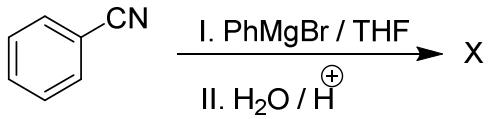
(D) $NaBH(OOCCH_3)_2$

45. The best reagent for trans hydroxylation of alkenes is:

(A) Jones reagent (B) Sarett reagent

(C) Collins reagent (D) Prevost reagent

46. Predict the product X in the following reaction:



(A) Benzoic acid (B) Benzophenone

(C) Diphenyl amine (D) Benzaldehyde

47. Oxidation of styrene to phenyl acetaldehyde can be achieved by use of:

(A) alk. $KMnO_4$ (B) MnO_2

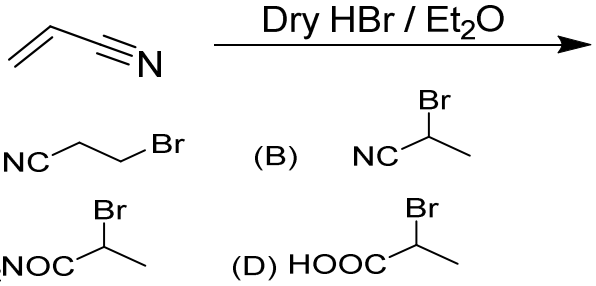
(C) $Tl(NO_3)_3$ / dil. HNO_3 (D) HIO_4

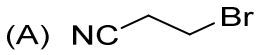
48. Which intermediate is involved in Favorskii rearrangement?

(A) Cypclopropane (B) Cyclopropene

(C) Cyclopropanol (D) Cyclopropanone

49. Predict the product of the following reaction:





50. Acid catalysed hydration of propyne results in formation of:

(A) Propane oxide (B) Propinoaldehyde

(C) Acetone (D) Propane-1,2-diol

x-x-x

(PHYSICS)

1) **Let $u(x,y) = x + \frac{1}{2}(x^2 - y^2)$ be the real part of analytic function $f(z)$ of the complex variable $Z = x + iy$, the Imaginary part of $f(z)$ is**

(A) $y + xy$ (B) xy (C) y (D) $y^2 - x^2$

2) **If the fourth colour band of a given resistor is missing, what is the tolerance of a resistor**

(A) 10% (B) 20% (C) 30% (D) 40%

3) **The value of the integral $I = \int_0^\infty \frac{sinx}{x} dx$ is**

(A) 0 (B) π (C) $\frac{\pi}{2}$ (D) $2\pi i$

4) **In which of the following detector *p-n* junction diode is used**

(A) Surface barrier detector (B) GM Counter

(C) Scintillation Counter (D) Proportional Counter

5) **Consider an anti-symmetric tensor P_{ij} with indices i and j running from 1 to 5. The number of independent components of the tensor is**

(A) 3 (B) 10 (C) 9 (D) 6

6) **The source of emission of electrons in a CRT is**

(A) *p-n* junction diode

(B) Accelerating anode

(C) A barium and strontium oxide coated cathode

(D) Post-accelerating anode

7) **Consider the linear differential equation $\frac{dy}{dx} = xy$, if $y = 2$ at $x = 0$, then the value of y at $x = 2$ is given by**

(A) e^{-2} (B) $2e^{-2}$ (C) e^2 (D) $2e^2$

8) **At the input an amplifier has a signal voltage level of $3\mu V$ and noise voltage level of $1\mu V$. If the voltage gain of the amplifier is 20, the ratio of signal to noise $\left(\frac{S}{N}\right)$ at the out -put is**

(A) 4 (B) 9 (C) 8 (D) 6

9) **Laplac transform of $\{e^{-2t} - e^{-3t}\}$ is**

(A) $\frac{1}{s^2+3s+6}$ (B) $\frac{1}{s^2+5s+6}$ (C) $\frac{1}{s-2}$ (D) $\frac{1}{s+2}$

10) **The lifetime of an atomic state is 1 nanosecond. The natural line width of the spectral line in the emission spectrum of this state is of the order of**

(A) $10^{-10}eV$ (B) $10^{-9}eV$ (C) $10^{-6}eV$ (D) $10^{-4}eV$

11) **A Ge semiconductor is doped with acceptor impurity concentration of $10^{15}\ atoms/cm^3$. For the given hole mobility of $1800\ cm^2$ / V. s , The resistivity of the material is**

(A) $0.288\ \Omega\ cm$ (B) $0.694\ \Omega\ cm$ (C) $3.472\ \Omega\ cm$ (D) $6.944\ \Omega\ cm$

12) A gate with only one input and one output is

(A) an OR gate (B) a NOT gate (C) a NAND gate (D) an AND gate

13) In a microprocessor, the resistor which holds the address of the next instruction to be fetched is

(A) Accumulator (B) Program counter

(C) Stak counter (D) Instructor register

14) The voltage resolution of a 12 bit digital to analog converter (DAC) whose out-put varies from -10V to +10V, is approximately

(A) 1 mV (B) 5 mV (C) 20 mV (D) 100 mV

15) If the memory chip size is $256 \times 1\ bits$, what is the number of chips required to make up $1\ Kbyte$ of memory?

(A) 32 chips (B) 64 chips (C) 128 chips (D) 256 chips

16) The energy of the first excited quantum state of a particle in the two dimensional potential $V(x, y) = \frac{1}{2}\, m\omega^2(x^2 + 4y^2)$ is

(A) $2\ \omega$ (B) $3\ \omega$ (C) $\frac{3}{2}\ \omega$ (D) $\frac{5}{2}\ \omega$

17) The quantum mechanical operator for the momentum of a particle moving in one dimension is given by

(A) $i\ \frac{d}{dx}$ (B) $-i\ \frac{d}{dx}$ (C) $i\ \frac{d}{dt}$ (D) $-\frac{^2}{2m}\frac{d^2}{dx^2}$

18) The energy eigen values of a particle in the potential $V(x) = \frac{1}{2}m\omega^2x^2 - ax$ are

(A) $E_n = \left(n + \frac{1}{2}\right)\ \omega - \frac{a^2}{2m\omega^2}$ (B) $E_n = \left(n + \frac{1}{2}\right)\ \omega + \frac{a^2}{2m\omega^2}$

(C) $E_n = \left(n + \frac{1}{2}\right)\ \omega - \frac{a^2}{m\omega^2}$ (D) $E_n = \left(n + \frac{1}{2}\right)\ \omega$

19) If $f(\theta, \varphi)$ is the scattering amplitude, the differential cross section $\sigma(\theta, \varphi)$ will be equal to

(A) $|f(\theta, \varphi)|$ (B) $\frac{|f(\theta,\varphi)|^2}{2}$ (C) $|f(\theta, \varphi)|^2$ (D) $f(\theta, \varphi)$

20) Value of $\overrightarrow{s_1}\ .\ \overrightarrow{s_2}$ for two spin half particle is

(A) $\frac{1}{4}$ for singlet (B) $-\frac{3}{4}$ for triplet (C) $\frac{1}{4}$ for triplet (D) $-\frac{3}{2}$ for singlet

21) The acceleration due to gravity (g) on the surface of earth is approximately 2.6 times that on the surface of Mars. Given that the radium of Mars is about one half the radius of Earth, the ratio of the escape velocity on Earth to that on Mars is approximately

(A) 1.1 (B) 1.3 (C) 2.3 (D) 5.2

22) If the Lagrangian of a particle moving in one dimension is given by $L = \frac{\dot{x}^2}{2x} - V(x)$, then the Hamiltonian is

(A) $\frac{1}{2}xp^2 + V(x)$ (B) $\frac{\dot{x}^2}{2x} + V(x)$

(C) $\frac{\dot{x}^2}{2} + V(x)$ (D) $\frac{p^2}{2x} + V(x)$

23) A particle is moving under the action of a generalized potential $V(q, \dot{q}) = \frac{1+\dot{q}}{q^2}$. The magnitude of the generalized force is

(A) $\frac{2(1+\dot{q})}{q^3}$ (B) $\frac{2(1-\dot{q})}{q^3}$ (C) $\frac{2}{q^3}$ (D) $\frac{\dot{q}}{q^3}$

24) The speed of a particle whose kinetic energy is equal to its rest mass energy is given by (c is the speed of light in vacuum)

(A) $\frac{c}{3}$ (B) $\frac{\sqrt{2}}{3}$c (C) $\frac{c}{2}$ (D) $\frac{\sqrt{3}}{2}c$

25) A particle is constrained to move along the inner surface of a hemisphere. The number of degrees if freedom of the particle is

(A) One (B) Two (C) Three (D) Four

26) Four equal point charges are kept fixed at the four vertices of a square. How many neutral points (i.e points where the electric field vanishes) will be found inside the surface

(A) 1 (B) 4 (C) 0 (D) 7

27) The magnetic field corresponding to the vector potential $\vec{A} = \frac{1}{2}\vec{F} \times \vec{r} + \frac{10}{r^3}\vec{r}$ (where $\vec{F}$ is a constant vector) is

(A) $\vec{F}$ (B) $-\vec{F}$ (C) $\vec{F}+\frac{30}{r^4}\vec{r}$ (D) $\vec{F}-\frac{30}{r^4}\vec{r}$

28) A plane electromagnetic wave travelling in free space is incident normally on a glass plate of refractive index $\frac{3}{2}$. If there is no absorption by the glass, its reflectivity is

(A) 04% (B) 16% (C) 20% (D) 50%

29) The field of magnetic vector $\vec{B}$ is always

(A) Solenoidal (B) Irrotational

(C) Non-solenoidal (D) Sometime Irrotational

30) An infinitely long closely wound solenoid carries a sinusoidally varying current. The induced electric field is

(A) Zero inside and non-zero outside the solenoid

(B) Zero everywhere

(C) Non-zero inside and zero outside solenoid

(D) Non-zero inside as well as outside the solenoid

31) A metal with body centred cubic (bcc) show the first (i.e smallest angle) diffraction peak at a Bragg angle of $\theta = 30^0$. The wavelength of X-ray used is 2.1 A^0 . The volume of the Primitive unit cell of the metal is

(A) $26.2\ (A^0)^3$ (B) $13.1\ (A^0)^3$ (C) $9.3\ (A^0)^3$ (D) $4.6\ (A^0)^3$

32) In the Debye model for a three dimensional crystal the internal energy U at low temperature is represented by

(A) $U \alpha T$ (B) $U \alpha T^2$ (C) $U \alpha T^3$ (D) $U \alpha T^4$

33) Sodium atoms crystallic in BCC metal. The atomic radius of sodium is $1.86\, A^0$. The Fermi energy of sodium at $0\ K$ is

(A) 5.11 eV (B) 6.01 eV (C) 3.11 eV (D) 4.21 eV

34) For an ideal Fermi gas in three dimensions, the electron velocity V_F at the Fermi surface is related to electron concentration 'n' as

(A) $V_F \alpha n^{\frac{2}{3}}$ (B) $V_F \alpha n$ (C) $V_F \alpha n^{\frac{1}{2}}$ (D) $V_F \alpha n^{\frac{1}{3}}$

35) Given that the ground state energy of the hydrogen atom is -13.6 eV. The ground state energy of the positronium (which is a bound state of an electron and positron) is

(A) +6.8 eV (B) -6.8 Ev (C) -13.6 Ev(D) -27.2 eV

36) An electron collides with a hydrogen atom in its ground state and excites it to a state of $n = 3$. How much energy was given to the hydrogen atom in this inelastic collision?

(A) 13.6 eV (B) 6.8 eV (C) 12.1 eV (D) 1.51 eV

37) In deep inelastic scattering electrons are scattered off protons to determine if a proton has any internal structure. The energy of the electron for this must be at least

(A) $1.25 \times 10^9\ eV$ (B) $1.25 \times 10^{12}\ eV$

(C) $1.25 \times 10^6\ eV$ (D) $1.25 \times 10^8\ eV$

38) The reaction $^2_1D + {}^2_1D \rightarrow {}^4_2He + \pi^0$ cannot proceed via strong interaction, because it violates the conservation of

(A) Angular momentum (B) Electric charge

(C) Baryon no (D) Isospin

39) The reaction $e^+ + e^- \rightarrow \mu^+ + \pi^-$ is forbidden because of

(A) Law of baryon number conservation

(B) Law of momentum energy conservation

(C) Law of muon number conservation

(D) Law of energy conservation

40) If the mass of a particle is three times of its rest mass, then the speed at which the particle is moving is (where c is the velocity of light)

(A) $\frac{\sqrt{8}}{3}c$ (B) $\frac{\sqrt{8}}{9}c$ (C) $\frac{8}{9}c$ (D) $3c$

41) What is the approximate Fermi Kinetic energy of the nucleons (either proton or neutron) in case of a self-conjugate nuclei with N=Z=A/2 ?

(A) 33 MeV (B) 150 MeV (C) 0.5 MeV (D) 200 MeV

42) According to the shell model, the ground state spin of the $^{13}_{6}C$ nucleus is

(A) $\frac{1}{2}$ (B) $\frac{3}{2}$ (C) $\frac{5}{2}$ (D) $\frac{7}{2}$

43) Which of the following statement is not correct for a compound nuclear reaction.

(A) Compound nuclear reaction is symmetric around 90 degree

(B) Mass distribution obtained in case of compound nuclear reaction is symmetric

(C) The reaction products peak around the grazing angle

(D) Light ion induced compound nuclear reaction follow Bohr's independence hypothesis

44) The neutron and proton form a deuteron bound state which is stable, while there is no bound state for two neutrons because

(A) Nuclear forces are saturated

(B) Nuclear forces are spin dependent

(C) Nuclear forces are charge dependent

(D) Nuclear forces depend upon magnetic moment

45) Let E_s denotes the contribution of the surface energy per nucleon in the Liquid drop model. The ratio $E_s\left(^{27}_{13}Al\right)$: $E_s\left(^{64}_{30}Zn\right)$ is

(A) 2 : 3 (B) 4 : 3 (C) 5 : 3 (D) 3 : 1

46) A system of N non-interacting classical point particles is constrained to move on the two dimensional surface of a sphere. The internal energy of the system is

(A) $\frac{3}{2}\,NK_BT$ (B) $\frac{1}{2}\,NK_BT$ (C) NK_BT (D) $\frac{5}{2}\,NK_BT$

47) Consider a system of 3 fermions which can occupy any of the four available energy states with equal probability. The entropy of the system is

(A) $K_B\,ln2$ (B) $2K_B\,ln2$ (C) $2K_B\,ln4$ (D) $3K_B\,ln4$

48) Curie temperature of Iron is that temperature below which it is

(A) Ferromagnetic (B) Electrically conducting

(C) Superconducting (D) Radioactive

49) The number of ways in which N identical bosons can be distributed in two energy level is

(A) N+1 (B) $\frac{N(N-1)^2}{2}$ (C) $\frac{N(N+1)}{2}$ (D) N

50) Which one of the following is a first order phase transition

(A) Vaporization of a liquid at its boiling point

(B) Ferromagnetic to paramagnetic

(C) Normal liquid He to super-fluid He

(D) Superconducting to normal state

(GEOLOGY)

1. As per the Rule of V's the outcropping strata that intersects the contours in general will show a V pointing upstream when the.....

(A) Strata dips upstream (B) Strata is horizontal

(C) Strata is Vertical (D) Strata dips downstream

2. One limb of a fold dips 45^0 due $N45^0E$ and the other dips 45^0 due $N45^0W$. What would be the approximate direction of plunge of the fold?

(A) East (B) West (C) South (D) North

3. .....is a strike slip fault with a vertical fault surface

(A) Pivotal Fault (B) Detachment Fault

(C) Wrench Fault (D) Gravity Fault

4. The absence of hydrous minerals and presence of pyroxenes characterises.....

(A) Greenschist facies (B) Blueshist facies

(C) Amphibolite facies (D) Granulite facies

5. Bouguer anomaly (mgal) along oceanic ridges ranges between.....

(A) -20 and -30 (B) -200 and -300

(C) +200 and +250 (D) -10 and -50

6. Diamond bearing kimberlites are found in the tectonic setting of.....

(A) Continental rift (B) Foreland Basin

(C) Oceanic ridges (D) Cratons and Passive margins

7. Sensitive High Resolution Ion Micropobe (SHRIMP) is used for

(A) U-Pb Dating (B) REE Geochemistry

(C) Isotope Geochemistry (D) Fission Track Dating

8. Which among the following contains Thorium?

(A) Glauconite (B) Perthite (C) Monazite (D) Coffinite

9. ……is an ultramafic intrusive rock similar to peridotite

(A) Eurite (B) Picrite (C) Troctolite (D) Allivalite

10. ……is a melanocritic picritic basalt.

(A) Oceanite (B) Saxonite (C) Lherizolite (D) Izolite

11. The stratigraphic Law of faunal succession was developed by.....

(A) Niels Steno (B) William Smith

(C) James Hutton (D) Charles Lyell

12. Biotite is

(A) Uniaxial positive (B) Biaxial positive

(C) Uniaxial negative (D) Biaxial negative

13. Olivine shows

(A) 1^{st} order interference colours (B) 2^{nd} order interference colours

(C) 3^{rd} order interference colours (D) 4^{th} order interference colours

14. Which among the following contains Arsenic?

(A) Chalcopyrite (B) Chalcocite

(C) Realgar (D) Covelite

15. Khondalite rock contains which of the following assemblage

(A) Quartz-Orthoclase-Hypersthene

(B) Plagioclase-Orthoclase-Hypersthene

(C) Quartz-Garnet-Rhodonite

(D) Quartz-Haematite-Hypersthene

16. Which one is a metamorphic texture

(A) Lepidoblastic (B) Graphic (C) Clastic (D) Aphinitic

17. Which among the following orders survived the K-T boundary?

(A) Ceratitids (B) Nautilids

(C) Goniatitids (D) Ammonitids

18. Which one of the following belongs to the oldest trilobite order Redlichiida.

(A) *Asaphus* (B) *Olenellus* (C) *Agnostus* (D) *Phacops*

19. .....is a air breathing freshwater gastropod.

(A) *Turbo* (B) *Natica* (C) *Physa* (D) *Crepidula*

20. .....marks the beginning of Cambrian

(A) *Agnostus* (B) *Asaphus* (C) *Treptichnus* (D) *Olenus*

21. .....is a cosmogenic isotope

(A) ^{18}O (B) ^{26}Al (C) ^{12}C (D) ^{13}C

22. Earths obliquity cycle (axial tilt) occurs every

(A) 10,000 years (B) 21,000 years

(C) 41,000 years (D) 100,000 years

23. .....is considered one the first chordates.

(A) *Lingula* (B) *Pikaia*

(C) *Redlichia* (D) *Terebratula*

24. ..... is a biostratigraphic zone that deals with high abundance of a taxa

(A) Lineage Zone (B) Concurrent Zone

(C) Acme Zone (D) Assemblage Zone

25. A marked lack of coal deposits all over the world is related to.....

(A) End Ordovician Extinctions (B) End Devonian Extinctions

(C) Permian-Triassic Extinctions (D) Cretaceous-Tertiary Extinctions

26. The Paleocene–Eocene Thermal Maximum (PETM) occurred around

(A) 35 Ma (B) 45 Ma (C) 55 Ma (D) 65 Ma

27. Ediacara Biota found in India occur in the.....

(A) Aravalis (B) Dharwas (C) Gondwanas (D) Vindhyans

28. Age of the Deccan Traps is…….

(A) 100 Ma (B) 66 Ma (C) 45 Ma (D) 150 Ma

29. As per Conodont Alteration Index the colour dark grey denotes temperature between

(A) 50-80^{0}C (B) 60-140^{0}C (C) 110-300^{0}C (D) 190-300^{0}C

30. Spectral logging comes under

(A) Density Logging

(B) Gamma Ray Logging

(C) Resistivity Logging

(D) Nuclear Magnetic Resonance Logging

31. In a typical Bouma Sequence, the Bouma D layer is deposited under.....

(A) Very slight turbidity current (B) No turbidity current

(C) High energy turbidity current (D) Moderate energy turbidity current

32. The oldest oceanic crust found on the ocean floor today is around

(A) 100 Ma (B) 450 Ma (C) 180 Ma (D) 55 Ma

33. The Galapagos Tripple Junction is an example of .....tripple junction

(A) Fault-Fault- Ridge (B) Fault-Fault-Trench

(C) Ridge-Ridge-Ridge (D) Ridge-Trench-Fault

34. Kerguelen Hotspot is the source of.....

(A) Deccan Traps (B) Panjal Traps

(C) Malani Igneous Suite (D) Rajmahal Traps

35. The hyper-impact Lonar Crater is formed in.....

(A) Granitic Rock (B) Basaltic Rock

(C) Rhyolic Rock (D) Gneissic Rock

36. .....is a supercontinent that existed from ~550 Ma to ~180 Ma.

(A) Laurasia (B) Gondwanaland

(C) Columbia (D) Rodinia

37. Evidence of Iridium anomaly related to K-T boundary has been recorded from the Indian state of.....

(A) Madhya Pradesh (B) Meghalaya

(C) Karnataka (D) Andhra Pradesh

38. .....are the joints that are approximately perpendicular to the fold axis.

(A) Pinnate joints (B) Conjugate joints

(C) Cross joints (D) Sigmoidal joints

39. The first appearance of the horse *Equus* in the Siwaliks is at.....

(A) 5.5 Ma (B) 2.6 Ma (C) 8.4 Ma (D) 3.5 Ma

40. The Global Stratotype Section and Point of Neogene-Quaternary Boundary is located in.....

(A) Guryul Ravine, Kashmir Valley, India

(B) Chicxulub, Mexico

(C) El-Kef, Tunisia

(D) Monte San Nicola Section, Italy

41. .....single celled algae with cell wall made up of silica.

(A) Acritarchs (B) Dinocysts

(C) Diatoms (D) Chitinozoans

42. .....materials are non-magnetic when a magnetic field is absent and magnetic when a magnetic field is applied.

(A) Ferromagnetic (B) Paramagnetic

(C) Ferrimagnetic (D) Antiferrimagnetic

43. Dharamsala Formation underlies.....

(A) Subathu Formation (B) Dagshai Formation

(C) Kasauli Formation (D) Siwalik Group

44. The oldest dates that can be reliably measured using Radiocarbon method is.....

(A) 100,000 yrs (B) 500,000 yrs (C) 50,000 yrs (D) 500 yrs

45. Base and precious metal deposits are usually associated with.....

(A) Divergent Plate boundaries (B) Convergent Plate boundaries

(C) Transform faults (D) Transcurrent Faults

46. Calcium, Magnesium, Iron, Manganese and Aluminium silicates are commonly associated with

(A) Skarn deposits (B) Gossan deposits

(C) Placer deposits (D) Evaporite deposits

47. Pterosaurs were flying.....

(A) Birds (B) Mammals (C) Reptiles (D) Dinosaurs

48. The southernmost Fault that runs along the Himalayas is called.....

(A) Main Boundary Thrust (B) Main central Thrust

(C) Himalayan Frontal Thrust (D) Nahan Thrust

49. .....is bounded by maximum flooding surface at the top and maximum regressive surface at the base.

(A) High Stand System Tract (B) Low Stand System Tract

(C) Transgressive System Tract (D) Regressive System Tract

50. The collision of India with Asia took place sometime between.....

(A) 20-15 Ma (B) 85-75 Ma

(C) 65-35 Ma (D) 200-100 Ma

x-x-x

Home Science(Ph.D.)

1. Which of the following statements is not true?

(A) Growth is a biological process
(B) Development is a quantitative process
(C) Education is a goal-oriented process
(D) Learning is a process of behavioural changes

2. Identify the term related to flower arrangement.

(A) Feng Shui (B) Ying-Yang (C) Ikebana (D) Alpana

3. Researcher wants to test the association of female literacy on infant feeding practices. Which of the following test of significance is the most appropriate for this?

(A) F-test (B) Chi-square test
(C) 't' test (D) Mann-Whitney test

4. Which of the following is not an Embroidery Stitch?

(A) Dabka (B) Menthi (C) Phanda (D) Murri

5. _____is claimed to be father of modern management

(A) Henry Fayol (B) Frederick Taylor
(C) Gross & Crandall (D) Nickel & Dorsey

6. Recommended dietary allowances for Indians are given by --------.

(A) ICAR (B) ICSSR (C) CSIR (D) ICMR

7. The greatest resource in extension work is

(A) Money (B) Local material
(C) Local people (D) Contacts with high officials

8. Mean, Median and Mode are:

(A) Deviation (B) Ways of sampling
(C) Measures of Central tendency (D) Hypothesis

9. Which of the following is a double pointed dart?

(A) Flange (B) French (C) Fish (D) Dressmakers

10. Rhythm is created through

(A) Proportion (B) Repetition (C) Harmony (D) Balance

11. A young child's inability to distinguish her own cognitive perspective from others' perspectives is

(A) Egocentrism (B) Centration
(C) Irreversibility of thought (D) Identity constancy

12. Which of the following does not represent Kasuti Embroidery?

(A) Menthe (B) Aari (C) Ganti (D) Murgi

13. NCPCR is an autonomous body which stands for

(A) National Commission for Protection of Child Rights
(B) National Council for Prevention and Control of Reproduction
(C) National Commission for Poverty control and Relief
(D) National Council for Preschool, Creche and Research

14. If a researcher wants to predict with 99% accuracy he would set the level of significance at

(A) .05 (B) .95 (C) .01 (D) .10

15. A reasoning where we start with certain particular statements and conclude with a universal statement is called

(A) Deductive Reasoning (B) Inductive Reasoning
(C) Abnormal Reasoning (D) Transcendental Reasoning

16. Sociometry is a tool to measure child's

(A) Intelligence level (B) Behaviour problems
(C) Relationship with peers (D) Relationship with parents

17. Live microorganisms similar to beneficial microorganisms found in the human gut are called as ---------.

(A) Prebiotics (B) Probiotics (C) Antibiotics (D) Symbiotics

18. 'AGMARK is a certificate mark employed on_____

(A) Poultry & fisheries products (B) Agriculture Products
(C) Vegetables (D) Fruits

19. Which of the following is not a plain weave?

(A) Percale (B) Calico (C) Drill (D) Chintz

20. Compared with mail questionnaires the principal advantage of the personal interview is that it is

(A) Low cost
(B) Depth of information collected
(C) Objectivity
(D) High reliability of information collected

21. A child with average intelligence has an IQ of

(A) 70-79 (B) 80-89 (C) 90-109 (D) 110-119

22. Extension Education is the education for the betterment of people for changing their

(A) Behaviour (B) Status (C) Income (D) Values

23. Which of the following is not a hand printing technique?

(A) Duplex (B) Screen (C) Block (D) Stencil

24. Gluten free diet is given to patients with

(A) Crohn's Disease (B) Celiac Disease
(C) Irritable Bowel Disease (D) Liver Disease

25. The period of human embryo is

(A) 2 – 4 weeks (B) 1 – 8 weeks
(C) 2 – 8 weeks (D) 2 – 6 weeks

26. Material used for insulation, radio cabinets and handles etc. is _____

(A) Bakelite (B) Plastic (C) Rubber (D) Fiber

27. Which of the following garment finishers is used for finishing number of garments together?

(A) Form Press (B) Tunnel (C) Buck Press (D) Die Press

28. One of the most effective methods of imparting skill is

(A) Field Visit (B) Group Discussion
(C) Demonstration (D) Project

29. 'Allin' is a compound found in

(A) Garlic (B) Turmeric (C) Cinnamon (D) Cloves

30. A representative sample is used so that the results of a study are

(A) Reliable (B) Generalized (C) Convenient (D) Limited

31. The fact that motor control of the arms precedes control of the legs is an example of

(A) Secular trend (B) Cephalo-caudal trend

(C) Proximal-distal trend (D) Evocative trend

32. Which of the following is not a cool colour?

(A) Bluish green (B) Yellow orange (C) Blue (D) Green

33. Area, line, pictoral, pie are the types of -

(A) Charts (B) Posters (C) Graphs (D) Diagrams

34. Following fat is the richest source of MUFA:

(A) Sunflower Oil (B) Soyabean Oil (C) Coconut Oil (D) Olive Oil

35. Qualitative Research is used in the situations

(A) Where all sample units of study are homogenous

(B) Where phenomenon under study is cardinal

(C) Where phenomenon under study is nominal

(D) Where it is not possible to measure the phenomenon and responses are subjective

36. _____ is an intense educational activity for motivating and mobilizing a community to action.

(A) Brainstorming (B) Colloquium (C) Campaign (D) Symposium

37. Anti-ageing vitamin is

(A) Vitamin E (B) Vitamin K (C) Vitamin B_{12} (D) Vitamin A

38. DRDA is functioning at

(A) District level (B) Block level (C) Village level (D) State level

39. Urie Bronfenbrenner's theory is

(A) Humanistic perspective (B) Sociobiology

(C) Ecological Systems Theory (D) Socio-cultural Theory

40. Type-I Error occurs if

(A) Null hypothesis is rejected even though it is true

(B) Null hypothesis is accepted even though it is false

(C) Both the null hypothesis as well as alternative hypothesis are rejected

(D) Both the null hypothesis as well as alternative hypothesis are accepted

41. The occurrence of the first menstrual period is known as

(A) Menopause (B) Menogenesis (C) Puberty (D) Menarche

42. Hallmark is a standardized certification of

(A) Jewellery (B) Eco friendly products

(C) Electrical appliances (D) Canned Food

43. This nutrient is needed for a healthy immune system and strong connective tissue-----

(A) Fiber (B) Vitamin K (C) Vitamin C (D) Fluoride

44. While washing cotton fabrics, colour can be prevented from bleaching by using

(A) Vinegar (B) Common Salt

(C) Sodium Carbonate (D) Lissapol

45. Bread,vinegar,wine and beer are produced with the help of

(A) Mould (B) Bacteria (C) Yeast (D) Enzymes

46. _____is a traditional luxury ornamental handicraft of Kashmir

(A) Madhubani (B) Papier-mache (C) Modak (D) Alpana

47. The Act which governs Consumer Disputes Redressal Forum is

(A) The Bureau of indian Standard Act (B) The consumer Protection Act

(C) The Trade Merchandise Mark Act (D) Restrictive Trade Practises Act

48. 8th March is celebrated as

(A) International Environment Day (B) International Sanitation Day

(C) International Women's Day (D) International Energy Day

49. Which of the following is not a stretch fiber?

(A) Neoprene (B) Spandex (C) Elastane (D) Viscose

50. In a normally distributed population, Mean + 1.96 S.D. will cover _____ of population.

(A) 90% (B) 95% (C) 98% (D) 99%

x-x-x

Human Genomics(Ph.D.)

1. Which of the following is the correct reason why liquid media is favoured for culturing thermophilicarchaea?

(A) Liquid media can be heated to higher temperatures
(B) Liquid media is easier to store
(C) Solid media is usually unstable at optimum growing temperatures
(D) Solid media becomes glass-like at high temperatures

2. Which of the following microscopy techniques relies on the specimen interfering with the wavelength of light to produce a high contrast image without the need for dyes or any damage to the sample?

(A) Conventional bright field light microscopy
(B) Phase contrast microscopy
(C) Electron microscopy
(D) Fluorescence microscopy

3. With respect to their surrounding membrane system, which is the odd one out?

(A) Nucleus (B) Endoplasmic reticulum
(C) Mitochondria (D) Chloroplasts

4. Within the nucleus, individual chromosomes are thought to occupy discrete territories. Which of the following is most likely to promote this segregation?

(A) Nuclear lamina (B) Nuclear pore complexes
(C) Nuclear matrix/scaffold (D) Intermediate fibres

5. The base adenine (A. of the DNA of the fungus Neurosporacrassa forms 23.3 % of its composition. Which of the following is the most likely base composition of the genome, given C is cytosine, G guanine and T thymine?

(A) A = T = 23.3 % and G = C = 23.3 % (B) A = C = 26.7 % and G = T = 26.7 %
(C) A = T = 23.3 % and G = C = 26.7 % (D) A = T = 26.7 % and G = C = 23.3 %

6. A population of cells grown in adherent culture contains 0.4 mg protein per 106 cells. Actin comprizes 4.5 % of the total protein. Given the Mr of actin is 42 000 and Avogadro's number is 6.02 x 1023, which of the following equals the mean number of actin molecules per cell?

(A) 2.58 x 1014 actin molecules (B) 2.58 x 1011 actin molecules
(C) 2.58 x 108 actin molecules (D) 2.58 x 1010 actin molecules

7. What would the generally expected effect on the PCR reaction be of adjustments that increase the temperature of the annealing phase and the length of the elongation phase?

(A) Precision and yield will be reduced
(B) Precision will be reduced, but yield will be increased
(C) Precision will be increased, but yield will be reduced
(D) Precision and yield will be increased

8. In principle, what outcome would be least expected in a failure to separate pre-PCR and post-PCR activities?

(A) False positive reactions (B) False negative reactions
(C) Mixed or non-specific PCR products (D) Increased reliability of PCR results

9. What would the expected effect be on a PCR reaction if the primers used were slightly shorter and more variable than the intended oligonucleotide sequences?

(A) The PCR reaction would not commence
(B) The PCR reaction would end after one cycle
(C) The reaction would generate a single short PCR product
(D) The reaction would yield a mixture of non-specific products

10. You need to use a first generation sequencing method for de novo sequencing, which template should give optimum results for this project?

(A) Genomic DNA (B) PCR product
(C) Bacterial artificial chromosome (D) Plasmid DNA

11. Once the sequences are obtained from your Next Generation Sequencing experiment what is the first thing you should do?

(A) Perform a bioinformatics analysis of your data
(B) Check your data using a different method
(C) Publish your results
(D) Further investigate the sequences of interest

12. Which of the following DNA binding proteins interacts with DNA in a sequence specific manner?

(A) Histone H3 (B) DNA polymerase
(C) NF-kB (D) RNA polymerase

13. Which of the following is an equilibrium method that can be used to accurately determine DNA-protein dissociation constants?

(A) Site directed mutagenesis (B) Chromatin Immunoprecipitation
(C) ELISA (D) Footprinting

14. In an EMSA experiment free DNA is separated from protein-DNA complexes in a native gel by which following principle?

(A) Charge (B) Molecular weight
(C) DNA digestion with DNAse (D) Antibody immunoprecipitation

15. Which statement best describes the main distinction between the origin of the two classes of small regulatory RNAs: siRNA and miRNA?

(A) siRNAs originate within the cell cytoplasm; miRNAs originate from the cell genome

(B) siRNAs originate from predominantly exogenous dsRNA; miRNAs originate from
the cell genome
(C) miRNAs are expressed whenever siRNAs are unable to appropriately degrade RNA
sequences
(D) miRNAs are processed from dsRNA viruses, siRNAs are processed from ssRNA viruses

16. For an application where you require a sample of your target protein at high purity, what would be a good purification strategy? Assume that your starting point is E. coli cells in which the target protein fused to an affinity tag has been over-expressed.
(A) Affinity chromatography (AC. followed by size exclusion chromatography (SEC.
(B) AC only
(C) AC followed by ion-exchange (IEX) followed by SEC
(D) AC followed by IEX, followed by hydrophobic interaction (HIC. and then SEC

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

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

19. In the yeast two-hybrid system, which of the following statements is accurate: A reporter gene
(A) Is fused to the activation domain of a transcription factor
(B) Is fused to the DNA binding domain of a transcription factor
(C) Requires the presence of Histidine in the growth medium for its expression
(D) Is expressed only if the tested protein interaction occurs

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

21. Which one of the following elements is least likely to participate in a hydrogen bond?
(A) O (B) F (C) S (D) N

22. Which one of the following terms describes a positive and negative charge, which are separated in space within a molecule?

(A) Salt bridge (B) Polar bond
(C) Dipole (D) Van der Waals interaction

23. The molar mass of an element is equal to which of the following?

(A) Avogadro's number (B) Atomic number
(C) Mass number (D) Relative atomic mass

24. If we begin with 8 mL of a glucose solution with a concentration of 0.25 mol L-1 and dilute it to a volume of 0.5 L, what is the concentration of the final, diluted solution?

(A) 250 mol L-1 (B) 4 mol L-1 (C) 0.004 mol L-1 (D) 0.0025 mol L-1

25. Only one amino acid has two identical groups attached to its central carbon atom. Which of the following amino acids is it?

(A) Alanine (B) Valine (C) Glycine (D) Cysteine

26. A beta-barrel is an example of what level of structure?

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

27. Zinc finger motifs are a particular characteristic of proteins with which one of the following functions?

(A) Biochemical catalysis (The proteins are enzymes)
(B) Formation of the cell cytoskeleton (The proteins are structural proteins)
(C) Gene regulation (The proteins are DNA-binding proteins)
(D) Signal transduction across the cell membrane (The proteins are transmembrane proteins)

28. NAD+ associates with the enzyme lactate dehydrogenase to catalyse the oxidation of malate. What term is used to describe NAD+ in this context?

(A) Prosthetic group (B) Coenzyme
(C) Functional group (D) Intermediate

29. Which of the following statements regarding the Gibbs free energy change for a reaction is false?

(A) The Gibbs free energy change is the proportion of the enthalpy change of a reaction that is used to increase the entropy
(B) If the Gibbs free energy change for a reaction is negative, the reaction happens spontaneously
(C) The Gibbs free energy is represented by the symbol G
(D) A reaction with a negative Gibbs free energy change of reaction is called an exergonic reaction

30. Consider the binding of a protein and its ligand, represented by the expression P + L⇆PL. Which of the following statements in relation to this binding process is true?

(A) The expression for the dissociation constant, Kd, is $K_d = \frac{[PL]}{[P][L]}$

(B) A small value of Kd tells us that the protein and ligand bind tightly

(C) If binding is strong, the association reaction lies to the left

(D) If binding is weak, the dissociation reaction lies to the left

31. Which of the following statements regarding enzymes is false?

(A) A given enzyme catalyses just one type of reaction

(B) While most enzymes are proteins, some are composed of RNA

(C) The activity of enzymes is typically impaired at high temperatures

(D) Enzymes act to lower the activation energy of a reaction by stabilising the transition state, but do not participate chemically in the reaction

32. Which one of the following statements regarding Vmax and K_M is false?

(A) Vmax is the maximum rate at which a particular enzyme-catalysed reaction can proceed

(B) K_M is the concentration of substrate at which the rate of the reaction reaches Vmax

(C) A small value of K_M tells us that an enzyme binds strongly to its substrate

(D) A large value of K_M tells us that an enzyme shows little specificity for a given substrate

33. Which of the following techniques is used to study the three-dimensional structure of a molecule?

(A) Infra-red spectroscopy (B) Mass spectrometry

(C) UV-visible spectroscopy (D) X-ray crystallography

34. A mouse, true breeding for normal gait, was crossed with a mouse, true breeding for an odd gait called 'dancing'. The F1 animals all showed normal gait. What is the most likely proportion of dancing mice in the F2 generation?

(A) 1/3 (B) 1/4 (C) 3/4 (D) 0

35. In goats, being polled (hornless) is dominant to being horned. What are the genotypes of polled parents that give birth to a kid which subsequently grows horns?

(A) Homozygous dominant for polled allele

(B) Homozygous recessive for polled allele

(C) Heterozygous for polled allele

(D) Impossible to know

36. What would be the probability that the five children in a family are all boys?

(A) 1/32 (B) 1/64 (C) 1/25 (D) 1/16

37. The association of histone H1 with a nucleosome indicates which of the following?

(A) Transcription is occurring

(B) DNA replication is occurring
(C) The DNA is condensed into a 30nm fibre
(D) The DNA double helix is exposed

38. When calculating a LOD score why do the values vary?
(A) They vary according to both the level of recombination and the level of independent assortment used in the calculation
(B) They vary according to the level of independent assortment used in the calculation
(C) They vary according to the level of recombination used in the calculation
(D) The values never vary

39. Which of the following is the main base methylated in mammalian DNA by the action of DNA methylase?
(A) 7-methyl guanine
(B) 5-methyl cytosine
(C) Methyl adenine
(D) Thymine

40. To which of the following types of sequence does most of the human genome belong?
(A) Pseudogenes
(B) Genes
(C) Tandem repeat sequences
(D) Interspersed repeat sequences

41. Which inherited human disorder results from mutations in the nucleotide excision repair system?
(A) Huntingdon disease
(B) Myotonic dystrophy
(C) Hypermutability syndrome
(D) Xerodermapigmentosum

42. What is the basis of the mutagenic action of the base analogue bromouracil?
(A) It replaces T and binds with G
(B) It replaces G and binds with T
(C) It replaces T and binds with C
(D) It replaces A and binds with C

43. In tropical areas where malaria is prevalent, people who have one allele for beta thalassemia have a selective advantage over people who have no or two alleles for beta thalassemia. What is this an example of?
(A) Frequency dependent selection
(B) Diversifying selection
(C) Hybrid vigour
(D) Heterozygous advantage

44. On what does natural selection act?
(A) Phenotype
(B) Genotype
(C) A population's gene pool
(D) Homozygous dominant and heterozygous individuals

45. Which of the following strategies can ensure production of a cloned human gene in a bacterium?
(A) Use of a fusion plasmid/human viral vector
(B) Additional insertion of a human origin of replication
(C) Cloning into a RNA phage
(D) Insertion of the cDNA sequence

46. Why do molecular biologists sometimes compare cytochrome oxidase I sequences from different sources?

(A) To investigate gene function
(B) To identify stem cells
(C) To investigate evolutionary relationships
(D) To map genes

47. Which of the following occurs during pyrosequencing?

(A) Dideoxynucleotides release fluorescent bases
(B) Dideoxynucleotides are incorporated and terminate DNA synthesis
(C) A released dideoxynucletode generates a fluorescent signal
(D) A released pyrophosphate generates a fluorescent signal

48. Which of the following occurs when a knockout mouse is produced?

(A) A mutant gene is replaced by a functional allele
(B) A functional gene is replace by a mutant allele
(C) A functional gene is inserted in addition to the mutant allele
(D) A mutant gene is inserted in addition to the functional allele

49. For which of the following is PCR not used?

(A) Site specific mutagenesis
(B) To generate double stranded DNA for DNA sequencing
(C) To generate copies of microsatellites for DNA fingerprinting
(D) To generate cDNA from mRNA

50. Which mode of natural selection is most important in maintaining genetic variation at single loci?

(A) Overdominance
(B) Positive frequency-dependent selection
(C) Negative frequency-dependent selection
(D) Underdominance

x-x-x

Medical Physics(Ph.D.)

1. **Which characteristic increases with increasing photon energy?**
   (A) Wavelength
   (B) Frequency
   (C) Mass
   (D) Charge

2. **Electron capture can result in emission of**
   (A) Antineutrinos
   (B) High-LET radiation
   (C) Characteristic x-rays
   (D) Positrons

3. **If the distance from a radiation source is halved, the radiation intensity will**
   (A) Increase by 2%
   (B) Increase by 50%
   (C) Double
   (D) Quadruple

4. **After 24 hours, the activity of a 100 MBq ^{123}I ($T_{1/2}$ = 13 hours) source will be about**
   (A) 50 MBq
   (B) 25 MBq
   (C) 10 MBq
   (D) 5 MBq

5. **Which of the following is measured in newtons**?
   (A) Electrons flowing through a medium
   (B) Attraction or repulsion between two bodies
   (C) Mass
   (D) Electric resistance

6. **Which of the following decay modes changes the mass number (A) of an unstable nucleus?**
   (A) Electron capture
   (B) Beta positive Decay
   (C) Alpha decay
   (D) Isomeric transition

7. **The maximum photon energy in a x-ray beam is determined by**
   (A) Voltage across the x-ray tube
   (B) Atomic number of the x-ray beam filter
   (C) Current flowing through the x-ray tube
   (D) Total exposure time (seconds)

8. **The heel effect is more pronounced**
   (A) At larger distances from the focal spot
   (B) With a larger target (anode) angle
   (C) With a smaller anode angle
   (D) At the cathode edge of the x-ray field

9. **Targets for production of x-rays have**
   (A) Low atomic numbers (Z)
   (B) Air cooling
   (C) Beryllium covering
   (D) High heat capacities

10. **The ratio of heat to x-rays produced in a x-ray tube is about**
   (A) 1:99
   (B) 99:1
   (C) 50:50
   (D) 90:10

11. **All of the following could affect the HVL of an x-ray beam except**
   (A) Tube voltage
   (B) Voltage ripple
   (C) Tube current
   (D) Anode angle

12. **Which of the following is not a component of an image intensifier**?
   (A) Anode
   (B) Input phosphor
   (C) Photocathode
   (D) Photomultiplier tube

13. **High ratio grids increase all the following except**
   (A) Screen/film speed
   (B) Image contrast
   (C) Patient dose
   (D) Removal of scatter

14. **Which of the following factors would have the least effect on image sharpness?**
   (A) Film type
   (B) Focal spot size
   (C) Screen/film contact
   (D) Screen thickness

15. **The patient integral dose does not depend on the**
    (A) Skin dose
    (B) Beam area
    (C) Organ sensitivity
    (D) Patient thickness

16. **Which of the following is not true for Poisson distributions?**
    (A) They are used to describe radioactive decay
    (B) They are used to describe quantum mottle
    (C) The variance is equal to the mean
    (D) They are always symmetrical

17. **A ROC curve is used to measure diagnostic imaging**
    (A) Performance
    (B) Accuracy
    (C) Specificity
    (D) Sensitivity

18. **How many bits are required to store 512 shades of gray?**
    (A) 6
    (B) 8
    (C) 9
    (D) 10

19. **Input devices for a computer do not include**
    (A) Keyboard
    (B) Trackball
    (C) Touch screen
    (D) Array processor

20. **The Nyquist frequency for a 1 k digital photospot image (25 cm image intensifier size) is**
    (A) 1 lp/mm
    (B) 2 lp/mm
    (C) 4 lp/mm
    (D) 8 lp/mm

21. **Breast compression in mammography**
    (A) Improves image contrast
    (B) Eliminates the need for a grid
    (C) Requires the use of a wide-latitude film
    (D) Increases radiation dose

22. Breast imaging using MRI would not use

(A) Fat-suppression techniques
(B) Special breast coils
(C) Iodine contrast
(D) Three-dimensional imaging techniques

23. The use of thermography to detect breast cancer

(A) Involves ionizing radiation
(B) Uses thermoluminescent dosimeters
(C) Is most effective near the chest wall
(D) Is deemed by the ACR to be ineffective

24. The fundamental measurement made by a CT scanner is the

(A) Sorting of CT numbers
(B) Determination of gray scale
(C) Pixel density
(D) Relative x-ray attenuation

25. Which of the following is not a source of CT artifacts?

(A) Patient motion
(B) Metal implants
(C) Beam hardening
(D) Low tube current

26. CT scanner spatial resolution could improve with an increase of

(A) Reconstruction matrix
(B) Detector elements size
(C) Focal spot size
(D) Scan time

27. The pulse height analyzer in NM imaging increases

(A) Detector efficiency
(B) Scattered photons
(C) Contrast-to-noise ratio
(D) Count rate

28. Following administration of ^{131}I to a patient, the dose rate near the patient does not depend on

(A) Administered activity
(B) Patient age
(C) Effective half-life
(D) Distance to patient

29. The variance of a NM image pixel with a 100 count would be

(A) 10
(B) 20

(C) 50
(D) 100

30. Which of the following does not concern itself with radiation risk estimates?
(A) ICRP
(B) UNSCEAR
(C) BEIR
(D) ICRU

31. An ultrasound beam traveling through tissue cannot be
(A) Absorbed
(B) Amplified
(C) Scattered
(D) Reflected

32. Contrast in MR can be due to all the following differences except
(A) Presence of flow
(B) Proton density
(C) T1
(D) Atomic number

33. MR spectroscopy is used to detect all the following except:
(A) ^{31}P
(B) ^{32}P
(C) Inorganic phosphate
(D) Phosphocreatinine

34. The semi-interquartile range is most closely related to the
(A) Median
(B) Mean
(C) Mode
(D) None of the above

35. Parity is not conserved in
(A) Alpha-decay
(B) Beta-decay
(C) Gamma-decay
(D) None of the above

36. Which of the following factors would be most appropriate to produce a T1-weighted image in MRI?
(A) TR = 500, TE = 20
(B) TR = 2,000, TE = 20
(C) TR = 2,000, TE = 100
(D) TR = 500, TE = 100

37. Which enzyme is activated during double stranded break in DNA?

(A) DNA polymerase
(B) Klenow fragment
(C) RNA polymerase
(D) Translesional polymerase

38. The main source of solar energy is

(A) Nuclear fission
(B) Nuclear fusion
(C) Gravitational contraction
(D) Combination of coal and hydrogen

39. Transverse electric (TE) waves have

(A) Magnetic field component H in the direction of propagation
(B) Electric field component E in the direction of propagation
(C) Magnetic field component H in the direction of propagation and no component of electric field E in this direction
(D) Electric field component E in the direction of propagation and no component of magnetic field H in this direction

40. In GM counter experiment the measured data is 3600, the statistical error quoted with 95 % confidence level will be will be

(A) 180
(B) 60
(C) 120
(D) 104

41. $\overline{\overline{AB} + \overline{AC}}$ is equivalent to

(A) A + B + C
(B) ABC
(C) $A\overline{BC}$
(D) $AB\overline{C}$

42. The correct order of increasing wavelength is

(A) X-rays, IR, Microwave, Visible
(B) UV, IR, Microwave, X-rays
(C) Microwave, X-rays, UV, IR
(D) X-rays, UV, IR, Microwave

43. In an n-p-n transistor biased for operation in forward active region

(A) emitter is positive with respect to base
(B) collector is positive with respect to base
(C) base is positive with respect to emitter and collector is positive with respect to base
(D) none of the above

44. A uniform plane wave is one in which

(A) $\vec{E} \times \vec{H} = 0$
(B) $\vec{E}.\vec{H} = 0$
(C) $\vec{E}$ and $\vec{H}$ are perpendicular
(D) $\vec{E}$ and $\vec{H}$ lie in a plane and are perpendicular to each other

45. Which of the following is true as regards photo emission?

(A) Rate of photo emission is inversely proportional to light intensity
(B) Maximum velocity of electron increases with decreasing wave length
(C) Both holes and electrons are produced
(D) Velocity of emitted electrons is dependent on light intensity

46. Given $\vec{A}$, $\vec{B}$ and $\vec{C}$ are the translational vectors in case of unit cell of a lattice in solid.The volume of the unit cell is

(A) $\left|(\vec{A} \times \vec{B}).\vec{C}\right|$
(B) $\left|\vec{A}.\vec{B}.\vec{C}\right|$
(C) $\left|(\vec{A} \times \vec{B})\right|$
(D) $\left|(\vec{A} \times \vec{B}) \times \vec{C}\right|$

47. A Zener diode

(A) has a constant current in the breakdown region
(B) has a constant voltage in the breakdown region
(C) has a constant current in the forward region
(D) has a constant voltage and constant current in the breakdown region

48. The parent radionuclide of the A = 4n + 2 radioactive series is

(A) ^{238}U
(B) ^{232}Th
(C) ^{232}U
(D) ^{238}Th

49. In common-base configuration, the output resistance is given by

(A) $\left[\frac{\Delta V_{BE}}{\Delta I_E}\right]_{I_C=\text{constant}}$

(B) $\left[\frac{\Delta V_{BE}}{\Delta I_E}\right]_{V_{CE}=\text{constant}}$

(C) $\left[\frac{\Delta V_{CE}}{\Delta I_C}\right]_{I_B=\text{constant}}$

(D) $\left[\frac{\Delta V_{CB}}{\Delta I_C}\right]_{I_E=\text{constant}}$

50. The unit of magnetic flux in SI system is

(A) Maxwell
(B) Tesla
(C) Weber
(D) Gauss

Nuclear Medicine(Ph.D.)

1. 1 terabecquerel is equal to

(A) 10^9 disintegrations/Second (B) 10^{12} disintegrations/Second

(C) 10^{15} disintegrations/Second (D) 10^{18} disintegrations/Second

2. Radiation weighting factor (Wr) for fast neutrons

(A) 5 (B) 20 (C) 1-20 (D) 5-20

3. The artificial radioactivity was discovered by

(A) Henri Becquerel (B) Irene Curie and F. Joliot

(C) Blumgart (D) Rutherford

4. The ejection fraction of the gall bladder can be evaluated using

(A) Cimitidine (B) Dipyridamole

(C) Cholecystokinin (D) Dobutamine

5. Radiocolloids are cleared from the circulation by

(A) Liver parenchymal cells (B) Kupffer cells

(C) Hepatocytes (D) Hemangiomas

6. Colloid shift refers to

(A) Small colloid particles clumped together to form large particles which localizes in the lungs

(B) 99mTc sulphur colloid changing into albumin colloid

(C) Increased uptake of the colloid in the spleen and bone marrow relative to liver

(D) The redistribution of colloid within the liver over time

7. *The energy of beta particle for strontium-90 is*

(A) 346.2 Kev *(B) 546.2 Kev*

(C) 746.2 Kev *(D) 946 Kev*

8. *The energy of gamma photon from samarium-153 is*

(A) 73.2Kev(B) 932Kev (C) 103.2Kev (D) 113.2Kev

9. The P wave of electrocardiogram is associated with

(A) Contraction of Atria

(B) Depolarisation of atrial muscular tissue

(C) Contraction of ventricles

(D) Repolarisation of SA node

10. What is the usual particle size of sulphur colloid?

(A) 0.3-1.0 µm (B) 0.03-0.1 µm (C) 2.0-10 µm (D) 4.0-15 µm

11. How many MBq will correspond to 50µci of activity?

(A) 1.85MBq (B) 0.85MBq (C) 18.5MBq (D) 0.185MBq

12. Which of the following cannot be evaluated by a MUGA scan?

(A) Wall motion (B) Aneurismal flow

(C) Vessel patency (D) Wall thickness

13. The normal half-time of gastric emptying of a a labelled solid meal is

(A) 45-60 minutes (B) 75-90 minutes

(C) 90-120 minutes (D) 120-180 minutes

14. What is the mechanism of ^{201}Tl decay?

(A) Electron capture (B) Internal conversion

(C) Positron decay (D) Isomeric transition

15. If a radiation worker has to spend a full 40-hrs working week in a particular area, what is the maximum dose rate which can be allowed?

(A) 5 µSv/hr (B) 10 µSv/hr (C) 12 µSv/hr (D) 15 µSv/hr

16. The dose rate at 2 m from a particular gamma source is 400 µSv/hr. At what distance will it give a dose rate of 25 µSv/hr?

(A) 6 m (B) 7 m (C) 8 m (D) 10 m

17. What is the biological half life of 99mTc-MAA in lungs?

(A) 30 minutes (B) 1-1.5 hrs (C) 2-3 hrs (D) 3-4 hrs

18. Normal gallium scan findings at 72 hours may include uptake in all of the following except

(A) Salivary glands (B) Lacrimal glands

(C) Liver (D) Kidney

19. What fraction of an intravenous dose of 99mTc-sulphur colloid localise in the liver, spleen and bone marrow, respectively?

(A) 85%; 10%, 5% (B) 75%; 15%, 10%

(C) 50%; 40%, 10% (D) 45%; 50%, 5%

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

(A) Lung uptake (B) Liver uptake

(C) Thyroid uptake (D) Gastric uptake

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

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

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

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

23. The tissue weighing factor for brain is

(A) 0.12 (B) 0.08 (C) 0.04 (D) 0.01

24. Proteins are separated by SDS-electrophoresis on the basis of their

(A) Size (B) Charge

(C) Amino acid composition (D) Charge and shape

25. In Scanning Electron Microscope (SEM), to form an image of the specimen

(A) Electron should pass through the specimen

(B) Electrons are scattered from the surface

(C) A thin film of heavy metal is evaporated

(D) Specimens are stained

26. The tertiary structure of protein is detected by

(A) X-ray crystallography (B) Spectrophotometry

(C) Electrophoresis (D) Chromatography

27. ELISA assay uses

(A) An enzyme which can react with a secondary antibody

(B) An enzyme which can react with the antigen

(C) A substrate which gets converted to a colored product

(D) A radiolabelled secondary antibody

28. Which spectroscopy is used to detect –SH group and disulphide linkages in proteins

(A) CD spectroscopy (B) Fluorescence spectroscopy

(C) NMR spectroscopy (D) FTIR spectroscopy

29. Maximum limit on total discharge per day in sanitary sewage system for ^{125}I is

(A) 0.37 MBq (B) 3.7MBq (C) 0.037MBq (D) 37MBq

30. The exposure rate at the surface of a package to be shipped is 50 mrem/hr.What label is required?

(A) DOT Radioactive White I (B) DOT Radioactive Yellow II

(C) DOT Radioactive Yellow III (D) no radioactive label is required

31. *The most sensitive stage for the lethal effects of radiation is:*

(A) Preimplantation (B) Early organogenesis

(C) Late organogenesis (D) The fetal period

32. **The enzyme responsible for continuing DNA replication in prokaryotes, once it is initiated is**

(A) DNA polymerase I (B) DNA polymerase III

(C) Polymerase beta (D) DNA Gyrase

33. **Northern blotting is used for separation of**

(A) DNA (B) Mrna (C) Protein (D) Plasmids

34. In isoelectric focusing, proteins are separated

(A) In a pH gradient (B) In a salt gradient

(C) In a density gradient (D) In a temperature gradient

35. The enzyme used to form a phosphodiester bond in a nick between a 3'end of one DNA chain and a 5 end of another is

(A) DNA polymerase (B) Restriction Endonuclease

(C) S1 nuclease (D) DNA ligase

36. Which of the following techniques is primarily undertaken to amplify DNA?

(A) Polymerase chain reaction (B) Microarrays

(C) Northern Blotting (D) Southern Blotting

37. Electrodessication is used to destroy tissue by

(A) High frequency positrons (B) Low frequency positrons

(C) High frequency photoelectrons (D) High frequency electric current

38. Malondialdehyde is a degradation product of

(A) Peroxidised lipids (B) Peroxidised proteins

(C) Glucose metabolism (D) Carbohydrate metabolism

39. *Which of the following statement is not true for X-rays*

(A) *X-rays are electromagnetic radiations*

(B) *X-rays have a speed of sound*

(C) *Produced by stopping high energy electrons in a tungsten target*

(D) *Intensity falls of in accordance with the inverse square law*

40. Which of the following heals the quickest after injury:

(A) Bone (B) Epithelium (C) Cartilage (D) Muscle

41. Which of the following suffixes implies "growth" or "formation":

(A) -blast (B) -lemma (C) -stasis (D) -cyte

42. If the concentration of glucose in the water outside of a cell is higher than the concentration inside,

(A) Water will tend to enter the cell by osmosis

(B) Water will tend to leave the cell by osmosis

(C) Glucose will tend to enter the cell by osmosis

(D) Glucose will tend to leave the cell by osmosis

43. Times a proton is heavier than an electron is

(A) 1827 (B) 1876 (C) 1836 (D) 1789

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

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

45. Which of the following is not a chemical radiosensitizer?

(A) Nucleotide analogues (B) Electronic affinic compounds

(C) Nitroimidazoles (D) Aminothiols

46. The material used for absorbing excess neutrons in a nuclear reactor is

(A) Cadmium (B) Neodymium (C) Vanadium (D) Indium

47. Energy of thermal neutrons is

(A) 0.50 ev (B) 0.05 ev (C) 0.25 ev (D) 0.025 ev

48. In β^+ decay, nucleon number is

(A) Conserved (B) Not conserved (C) Unstable (D) Stable

49. Phenomena of radioactivity was discovered in

(A) 1893 (B) 1894 (C) 1895 (D) 1896

50. Heavy nuclei have

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

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

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

1. Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ be a matrix such that $A^3 = O_{2\times 2}$, but $A \neq O_{2\times 2}$, then

(A) $A^2 = O_{2\times 2}$ (B) $A^2 = A$

(C) $A^2 = I - A$ (D) $A^2 = I + A$

2. The inverse of a skew symmetric matrix of odd order is

(A) A symmetric matrix (B) A skew symmetric matrix

(C) Diagonal matrix (D) Does not exist

3. If $A = \begin{pmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{pmatrix}$ and $|A| \neq 0$, then the system of equations

$a_1x + b_1y + c_1z = 0$, $a_2x + b_2y + c_2z = 0$ and $a_3x + b_3y + c_3z = 0$ has

(A) Only one solution

(B) Infinite number of solutions

(C) No solution

(D) More than one but finite number of solutions

4. One hundred identical coins, each with probability p of showing heads are tossed once. If $0 < p < 1$ and the probability of heads showing on 50 coins is equal to that of heads showing on 51 coins, the value of p is

(A) 1/2 (B) 51/101 (C) 49/101 (D) 3/101

5. Let A, B and C be three mutually independent events. Consider the two statements S_1 and S_2:

S_1: A *and* $B \cup C$ are independent

S_2: A *and* $B \cap C$ are independent

Then

(A) Both S_1 and S_2 are true (B) Only S_1 is true

(C) Only S_2 is true (D) Neither S_1 nor S_2 is true

6. A letter is taken at random from the letters of the word 'STATISTICS' and another letter is taken at random from the letters of the word 'ASSISTANT'. The probability that they are the same letter is

(A) 1/45 (B) 5/18 (C) 13/90 (D) 19/90

7. Each of two persons *A* and *B* toss three fair coins. The probability that both get the same number of heads is

(A) 3/8 (B) 1/9 (C) 5/16 (D) 7/16

8. A letter is known to have come from either TATANAGAR or CALCUTTA. On the envelope, just two consecutive letters, TA, are visible. The probability that the letter has come from CALCUTTA is

(A) 4/11 (B) 1/3 (C) 5/12 (D) 1/7

9. If the regression line of *Y* on *X* is $Y + 0.8X = 25$ and the standard deviations of *X* and *Y* are respectively 3 and 8, then the value of correlation coefficient *r* is

(A) -0.3 (B) -0.4 (C) 0.3 (D) 0.4

10. Suppose *r* is the correlation coefficient between two variables *X* and *Y* where standard deviation of *X* and *Y*are equal. If θ is the angle between the regression lines, then

(A) $tan\theta = \frac{1+r^2}{2r}$ (B) $tan\theta = \frac{1-r^2}{2r}$

(C) $tan\theta = \frac{1+r^2}{r}$ (D) $tan\theta = \frac{1-r^2}{r}$

11. The joint probability density function of (X, Y) is $f(x, y) = exp\{-(x + y)\}$, for $0 < x < \infty$ and $0 < y < \infty$.

Assertion(A): $P(X < Y/X < 2Y) = P(X < Y)$

Reason (R): X and Y are independently exponentially distributed which possesses 'lack of memory property'

Select your answer from the following codes:

(A) Both *(A)* and *(R)* are true and *(R)* is correct explanation of *(A)*
(B) Both *(A)*and *(R)* are true but *(R)* is not correct explanation of *(A)*
(C) *(A)*is true but *(R)* is false
(D) *(A)*is false but *(R)* is true

12. The joint probability mass function of random variables X and Y is

$$f(x,y) = \frac{\lambda^x e^{-\lambda} p^y (1-p)^{x-y}}{y!\,(x-y)!}, y = 0,1,\dots,x; x = 0,1,\dots.$$

The marginal distribution of

(A) X and Y both are Poisson
(B) X and Y are binomial
(C) X is binomial and that of Y is Poisson
(D) X is Poisson and that of Y is binomial

13. Let X be a random variable

Assertion (A): $E(X^2) \geq \big(E(X)\big)^2$

Reason (R): X^2 is convex function of X

Select your answer from the following codes:

(A) (A) is true but (R) is false

(B) (A) is false but (R) is true

(C) Both (A) and (R) are true and (R) is correct explanation of (A)

(D) Both (A) and (R) are true but (R) is not correct explanation of (A)

14. For normal distribution, quartile deviation, the mean deviation and standard deviation are approximately

(A) 1:2:3 (B) $\frac{1}{2}:3:5$ (C) 10:12:15 (D) 1:1:1

15. The hypergeometric distribution with parameters N, M and n, for

$N \to \infty, \frac{M}{N} \to p, 0 < p < 1$, reduces to the following distribution

(A) Gamma (B) Geometric (C) Binomial (D) Normal

16. If X and Y are two independent Poisson variates such that $X \sim P(1)$ and $Y \sim P(2)$, the probability, $P(X + Y < 3)$ is

(A) $8.5e^{-3}$ (B) $4e^{-3}$ (C) e^{-3} (D) $3e^{-3}$

17. If $\phi(t)$ is characteristic function, which of the following is incorrect?

(A) $|\phi(t)| \leq 1$

(B) $\phi(t)$ is continuous everywhere on real line

(C) $\phi(0) = 1$

(D) $|\phi(t)| > 1$

18. If X and Y are independent exponential random variable with the same mean λ, then the distribution of $min(X, Y)$ is

(A) Exponential with mean $\lambda/2$ (B) Exponential with mean 2λ

(C) Exponential with mean λ (D) Laplace distribution with mean λ

19. Mean and variance of standard Logistic distribution are

(A) Mean = 0, Variance = $\frac{\pi^2}{3}$ (B) Mean = 0, Variance = $\frac{\pi^2}{4}$

(C) Mean = 0, Variance = $\frac{2\pi^2}{3}$ (D) Mean = 0, Variance = $\frac{3\pi^2}{2}$

20. If the coefficient of the study variable Y and auxiliary variable X in a population are 18 and 32 respectively, then for what range of the coefficient of correlation (ρ)between X and Y, the ratio method of estimation will be preferable over sample mean (assuming that R>0)?

(A) $\rho < 0.63$ (B) $0.33 < \rho < 0.80$

(C) $\rho > 0.88$ (D) $0.63 < \rho < 0.85$

21. Let X be a geometric distribution with parameter θ and the experimenter is to decide between $H_0: \theta = \theta_0 = 0.5$ against $\theta = \theta_1 = 0.1$. We accept H_0 if $\{X \leq 2\}$ and reject it if $\{X > 2\}$. Then, the probability of Type-II error is

(A) 0.81 (B) 0.19 (C) 0.25 (D) 0.75

22. Let X_n be a sequence of random variables and X is a random variable. Further let k be a constant.

Assertion (A): X_n converges in probability to $X \Rightarrow X_n$ converges in distribution to X

Assertion (B): X_n converges in distribution to $k \Rightarrow X_n$ converges in probability to k

Then

(A) Both *A* and *B* are true (B) Only *A* is true

(C) Only *B* is true (D) Neither *A* nor *B* is true

23. If the population standard deviation is known to be 5 for a population containing 80 units, then the standard error of sample mean for a simple random sample of size 25 without replacement is

(A) 0.55 (B) 0.20 (C) 0.35 (D) 0.85

24. In a railway-marshaling yard, goods trains arrive at a rate of 30 trains per day. Assume that the inter-arrival time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average of 36 minute. Then the average number of trains in the queue is

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

25. The error degrees of freedom for 4×4 Graeco-Latin square design is

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

26. Let $X_1, \ldots, X_n$ be a random sample of size n from $Uniform\ (0, \theta)$ distribution, where θ is unknown.The maximum likelihood estimator of θ based on this sample is

(A) $min(X_1, \ldots, X_n)$ (B) $max(X_1, \ldots, X_n)$

(C) $\frac{min(X_1,\ldots,X_n)+max(X_1,\ldots,X_n)}{2}$ (D) $\frac{max(X_1,\ldots,X_n)-min(X_1,\ldots,X_n)}{2}$

27. Let $X_1, \ldots, X_n$ be independent and identically distributed as Poisson distribution with parameter θ. Let $(\theta) = \frac{e^{-\theta}\theta^3}{3!}$, $T = \sum_{i=1}^{n} X_i$ and $\binom{T}{3} < 0$ for $T < 3$. Then, the unique minimum variance unbiased estimator of $\tau(\theta)$ is

(A) $\phi(T) = \binom{T}{3}\left(\frac{1}{n}\right)^3\left(1-\frac{1}{n}\right)^{T-3}$ (B) $\phi(T) = \binom{T}{2}\left(\frac{1}{n}\right)^2\left(1-\frac{1}{n}\right)^{T-2}$

(C) $\phi(T) = \binom{T}{1}\left(\frac{1}{n}\right)^1\left(1-\frac{1}{n}\right)^{T-1}$ (D) $\phi(T) = \binom{T}{0}\left(\frac{1}{n}\right)^0\left(1-\frac{1}{n}\right)^{T-0}$

28. Consider the linear programming (LP) problem – maximize $x_1 + x_2$ subject to

$$x_1 - 2x_2 \leq 10$$

$$x_2 - 2x_1 \leq 10$$

$$x_1 \geq 0, x_2 \geq 0$$

Then

(A) The LP problem admits an optimal solution
(B) The LP problem is unbounded
(C) The LP problem admits no feasible solution
(D) The LP problem admits a unique feasible solution

29. Which of the following relations is incorrect in the context of *Cost of Living Index Number (CLIN)*

(A) $Real\ Wages = \frac{Money\ Wages}{CLIN} \times 100$

(B) $Purchasing\ Power\ of\ Money = \frac{1}{CLIN}$

(C) Real Wages = $\frac{CLIN}{Money\ Wages} \times 100$

(D) $CLIN = \frac{Total\ Expenditure\ in\ current\ year\ with\ base\ year\ quantities\ as\ weights}{Total\ expenditure\ in\ base\ year} \times 100$

30. Suppose $X_1, X_2, \ldots$ is a sequence of $i.i.d.$ random variables with common variance $\sigma^2 > 0$. Let $Y_n = \frac{1}{n}\sum_{i=1}^{n} X_{2i-1}$ and$Z_n = \frac{1}{n}\sum_{i=1}^{n} X_{2i}$. Then, the asymptotic distribution of $\sqrt{n}(Y_n - Z_n)$ as $n \to \infty$ is

(A) $N(0,1)$ (B) $N(0, \sigma^2)$ (C) $N(0, 2\sigma^2)$ (D) $N(0, 3\sigma^2)$

31. Let X be a discrete random variable taking non-negative integer values in a set E. Let $P(X > a + b/X > a) = P(X > b)$ for any two positive integers$a, b \in E$. Then, which of the following is a possible distribution of X?

(A) Negative Binomial (B) Geometric

(C) Binomial (D) Possion

32. Let Y_1, Y_2, Y_3 and Y_4 be four random variables such that $E(Y_1) = \theta_1 - \theta_3; E(Y_2) = \theta_1 + \theta_2 - \theta_3; E(Y_3) = \theta_1 - \theta_3; E(Y_4) = \theta_1 - \theta_2 - \theta_3$, where $\theta_1, \theta_2, \theta_3$ are unknown parameters. Also assume that $Var(Y_i) = \sigma^2, i = 1,2,3,4$. Then

(A) $\theta_1$is estimable (B) θ_2 is estimable

(C) $\theta_3$is estimable (D) $\theta_1, \theta_2 \; and \; \theta_3$are estimable

33. The hazard rates of two life time random variables T_1 and T_2 with respective cumulative distribution functions $F_1(t)$ and $F_2(t)$ and probability density functions $f_1(t)$ and $f_2(t)$, are $\square_1(t) = 3t^2$and $\square_2(t) = 4t^3, t > 0$, respectively. Then,

(A) $E(T_1) < E(T_2)$ (B) $f_1(t) < f_2(t) \forall\, t > 0$

(C) $F_1(t) \geq F_2(t) \forall\, t > 0$ (D) $F_1(t) < F_2(t) \forall t > 1$

34. Let $(X_1, Y_1), \ldots, (X_n, Y_n)$ be a bivariate set of n independent observations from $(X, Y) \sim BVN(\zeta, \eta, \sigma_1^2, \sigma_2^2, \rho)$, then the distribution of $(\bar{X}, \bar{Y})$ is

(A) $BVN(\zeta, \eta, \sigma_1^2, \sigma_2^2, \rho)$ (B) $BVN\left(\zeta, \eta, \frac{\sigma_1^2}{n}, \frac{\sigma_2^2}{n}, \rho\right)$

(C) $BVN\left(\frac{\zeta}{n}, \frac{\eta}{n}, \frac{\sigma_1^2}{n}, \frac{\sigma_2^2}{n}, \rho\right)$ (D) $BVN\left(\frac{\zeta}{n}, \frac{\eta}{n}, \frac{\sigma_1^2}{n}, \frac{\sigma_2^2}{n}, \frac{\rho}{n}\right)$

35. Let $g(F)$ be an estimable parameter of degree m, and let $X_1, \dots, X_n$ be a sample of size $n, n \geq m$. Corresponding to any symmetric kernel $T(X_{i_1}, \dots, X_{i_m})$of $g(F)$, the one sample U-statistic for the sample is given by $U(X_1, \dots, X_n) = \binom{n}{m}^{-1} \sum_C T(X_{i_1}, \dots, X_{i_m})$, where summation$C$ is over all $\binom{n}{m}$ combinations of m integers $(i_1, i_2, \dots, i_m)$ chosen from $(1,2, \dots, n)$. The variance of $U(X_1, \dots, X_n)$ is

(A) $\frac{1}{\binom{n}{m}} \sum_{c=1}^{m} \binom{m}{n} \binom{n-m}{m-c} \zeta_c$ (B) $\frac{1}{\binom{n}{m}} \sum_{c=1}^{n} \binom{m}{n} \binom{n-m}{m-c} \zeta_c$

(C) $\binom{n}{m} \sum_{c=1}^{m} \binom{m}{n} \binom{n-m}{m-c} \zeta_c$ (D) $\binom{n}{m} \sum_{c=1}^{n} \binom{m}{n} \binom{n-m}{m-c} \zeta_c$

Here$\zeta_c = cov_F \left(T(X_{i_1}, \dots, X_{i_m}), T(X_{j_1}, \dots, X_{j_m}) \right)$

36. For the bivariate normally distributed random variable (X, Y), Kendall's tau measure of association between X and Y is zero

(A) If and only if X and Y are independent

(B) If and only if X and Y are perfectly positive correlated.

(C) If and only if X and Y are perfectly negative correlated

(D) If and only if X and Y are perfectly correlated

37. A persistent state (say k) is said to be null, if its mean recurrence time is

(A) Finite (B) Unity (C) Infinite (D) Zero

38. Let X_1, X_2, X_3 be three random variables such that $\rho_{12} = \rho_{13} = \rho_{23} = \rho \neq 1$, then the square of multiple correlation coefficient $R^2_{1.23}$ is

(A) $\frac{\rho^2}{1+\rho}$ (B) $\frac{1+2\rho^2}{1+\rho}$ (C) $\frac{2\rho^2}{1+\rho^2}$ (D) $\frac{2\rho^2}{1+\rho}$

39. Let X be a continuous random variable with mean 2 and variance 9. Then

$P\{|X-2| \geq 6\}$ is

(A) Bounded above by 1/4 (B) Bounded below by 1/4

(C) Bounded above by 1/2 (D) Bounded below by 1/2

40. The minimum number of equal length subintervals needed to approximate $\int_1^2 xe^{-x}dx$ to an accuracy of at least $\frac{1}{3} \times 10^{-6}$ using the trapezoidal rule is

(A) 100 (B) $100e$ (C) 1000 (D) $1000e$

41. Relative efficiency of cluster sampling with cluster of equal size *M* with simple random sampling without replacement, assuming that number of clusters *N* is sufficiently large, is

(A) $1 + \rho(M-1)$ (B) $1 + 2\rho(M-1)$

(C) $\big(1 + \rho(M-1)\big)^{-1}$ (D) $\big(1 + 2\rho(M-1)\big)^{-1}$

42. In one classification model, consider the following analysis of variance table

Sources of variation	d.f.	Sum of squares	F-statistic
Treatments	2	250	F = 7.5
Error	12	200	
Total	14	450	

The coefficient of determination R^2 is

(A) 5/2 (B) 5/9 (C) 9/5 (D) 2/5

43. Let *f* be a measurable function defined over a measurable set *E*. Then the function $-f$ (the negative of *f*) is

(A) Measurable

(B) May or may not be measurable

(C) Measurable if function *f* vanishes no where on *E*

(D) Outer measurable

44. For normal underlying distribution, the asymptotic relative efficiency of Mann-Whitney U-test relative to two-sample t-test is

(A) 0.655 (B) 0.755 (C) 0.855 (D) 0.955

45. In a 3^3 design, the error degress of freedom with 5 replicates are

(A) 108 (B) 106 (C) 104 (D) 102

46. The study state control limits for exponentially weighted moving average control chart with parameters, $\mu_0 = 0, L = 3, \sigma = 1 \; and \; \lambda = 1$, are in the interval

(A) -4 to 4 (B) -3 to 3 (C) -2 to 2 (D) -1 to 1

47. A necessary condition for a symmetrical BIBD, assuming the treatments as even, is that $(r - \lambda)$ must be

(A) Positive integer (B) Negative integer

(C) Either positive or negative integer (D) Perfect square

48. If $A \sim W_m(n, \Sigma), n > 0$ is a positive integer and $\underline{Y}$ is an $m \times 1$ random vector independently distributed of A with $P(\underline{Y} = \underline{0}) = 0$, then

(A) $\frac{\underline{Y}'A\underline{Y}}{\underline{Y}'\Sigma\underline{Y}} \sim \chi^2_n$ and is independent of $\underline{Y}$

(B) $\frac{\underline{Y}'A\underline{Y}}{\underline{Y}'\Sigma\underline{Y}} \sim \chi^2_{2n}$ and is independent of $\underline{Y}$

(C) $\frac{\underline{Y}'A\underline{Y}}{\underline{Y}'\Sigma\underline{Y}} \sim \chi^2_{\frac{n}{2}}$ and is independent of $\underline{Y}$

(D) $\frac{\underline{Y}'A\underline{Y}}{\underline{Y}'\Sigma\underline{Y}} \sim \chi^2_{3n}$ and is independent of $\underline{Y}$

49. For the Gauss Markoff model $(\underline{Y}, A\theta, \sigma^2 I)$, with $A = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$ and $\underline{\theta} = \begin{pmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \end{pmatrix}$, $l_1\theta_1 + l_2\theta_2 + l_3\theta_3$ is estimable if

(A) $l_1 = 0, l_2 = 1, l_3 = 0$ (B) $l_1 = 0, l_2 = 0, l_3 = 1$

(C) $l_1 = 1, l_2 = 0, l_3 = 0$ (D) $l_1 = 1, l_2 = 1, l_3 = 0$

50. The ability of a sampling plan to discriminate between lots of high quality and lots of low quality is described as

(A) An average outgoing quality curve (B) A process control chart

(C) An operating characteristic curve (D) A range chart

x-x-x

Stem Cell Tissue Engineering & Biomedical Excellence(Ph.D.)

1. Downregulation of different G-Protein receptor signalling by β-adrenergic receptor kinase represents which one of the following process:

(A) Homologous Desensitization (B) Homologous Sensitization

(C) Heterologous Desensitization (D) Heterologous Sensitization

2. Which one of the following does not represent as a growth medium?

(A) Leibovitz (B) RPMI 1640

(C) Histopac (D) DMEM

3. In order to perform cell line authentication which of the following methods is not used:

(A) DNA barcoding (B) in situ hybridization

(C) Isoenzyme analysis (D) Cytogenetic analysis

4. One of the following does not represent second messenger:

(A) cAMP (B) cGMP

(C) cCMP (D) Diacylglycerol

5. Surface immunoglobulin (Ig) is stripped from the surface of B-lymphocytes by all the proteolytic enzymes, except one of the following:

(A) Collagenase (B) Pronase

(C) Chymotrypsin (D) Trypsin

6. Overexpressing the niche milieu will produce which of the following:

(A) No effect in the local environment (B) Apoptosis of the cells

(C) Cancer cell phenotype (D) Differentiation of cells

7. Differentiation of one differentiated cell to other differentiated cell type is known as:

(A) Primitive cell differentiation (B) Ontogeny

(C) Metaplasia (D) Dysplasia

8. During drosophila development, number of nuclei bathing in the common cytoplasm is represented by which of the following:

(A) Cap cell (B) Syntial blastoderm

(C) Follicle cell (D) Trophoblast cell

9. Richest reservoir of mesenchymal stem cells is represented by which of the following:

(A) Bone Marrow (B) Cord blood cells

(C) Adipose Tissue (D) Wharton Jelly

10. One of the following can be used to generate the whole organism:

(A) Blastomere (B) Dental pulp stem cells

(C) Blastocyst cells (D) Bone marrow cells

11. The embryoid bodies can be generated from which type of the cells:

(A) Induced Pluripotent Stem Cells (B) Mesenchymal stem cells

(C) Hemangioblast (D) Niche support cells

12. All the following, except one is not related to feeder cells used during stem cell culture:

(A) Provide Extracellular Secretions for Growth

(B) Source of antitrypsin

(C) Layer of cells unable to divide

(D) Irradiated cell types

13. Pancreatic cell progenitor can be identified from the pool of population of stem cells by which of the following master regulator:

(A) PAX 1 (B) PDX (C) GPCR (D) RxR

14. When studying the antibody reaction on the cells grown on matrix which of the following is exercised:

(A) Use blocking reagent after addition of specific antibody

(B) Use blocking reagent before addition of specific antibody

(C) A combination of specific and non-specific antibody

(D) Only single antibody specific protein in question

15. Which one of the following can be exploited to trace the stem cells and separate them from rest of the nucleated cells?

(A) Fluorescent cell sorting analysis (B) BrdU labeling studies

(C) ^{14}C labeling studies (D) ^{35}S labeling studies

16. One of the following characteristics that both mouse Embryonic stem cells (ES) and Embryonic germ cells (EG) possess is:

(A) High Alkaline phosphatase activity

(B) Low Alkaline phosphatase activity

(C) High Acid phosphatase activity

(D) Low Acid phosphatase activity

17. Addition of leukaemia inhibitory factor to the embryonic cell culture performs which of the following function:

(A) Augmentation of Apoptosis (B) Augmentation of Differentiation
(C) Inhibition of differentiation (D) Inhibition of Apoptosis

18. In order to find the interacting partner of Sox 2 protein for stem cell pluripotency, Sox2 vector was tagged with sequence coding for His-2 tag, its expression in stem cell was used to identify the interacting protein. Pinpoint the methodology that you would use to achieve it:

(A) Immuno-hybridization followed by southern blotting
(B) Immuno-precipitation and followed by Northern blotting
(C) South-Western blotting
(D) Immuo-pulldown followed by immuo-blotting

19. The deliberate creation of embryo for production of stem cells line that will not provoke any immune response and rejection is termed as:

(A) Positional cloning (B) Genetic cloning
(C) Reproduction cloning (D) Therapeutic cloning

20. Matrigel is a commonly used material for growing cell. Which of the following is not the component of Matrigel:

(A) Heparan sulfate (B) Laminin (C) Collagen (D) β-Catenin

21. Scaffold or materials that are permissive to bone formation but do not attract the osteo-progenitors that initiate bone formation is termed as:

(A) Osteo-conduction (B) Osteo-induction
(C) Osteo-inhibition (D) Osteo-porosis

22. Mesangioblasts are the stem cells associated with differentiation into:

(A) Mesothelial cells (B) Vessel forming cells
(C) Bone forming cells (D) Neural cell

23. One of the following process is used to generate all female derived embryonic stem cells by tricking the non-fertilized egg into duplication of DNA:

(A) Artificial insemination (B) in vitro fertilization
(C) Fertilization (D) Parthenogenesis

24. Which of the following biological assay was used first to detect hematopoietic stem cells:

(A) Cell migration assay
(B) Clonal subtraction assay
(C) Soft agar colony forming assay
(D) Spleen colony forming assay

25. Which one of the following best explains the progenitor cells**:**

(A) An immature cell committed to a particular differentiation lineage with limited proliferation

(B) A cell that is terminally differentiated with very low proliferation

(C) Cell isolated from inner cell mass of the embryo with very high proliferation rate

(D) Totipotent cell isolated at morula stage having very high proliferation

26. The term epigenetic is commonly used during stem cell imprinting, this term is best explained as:

(A) Mitotically /meiotically heritable change involving covalent modification of existing protein

(B) Mitotically /meiotically heritable change not involving changes in DNA sequence

(C) Mitotically /meiotically heritable change involving events at 5' upstream region of a gene

(D) Mitotically /meiotically heritable change due to mutation in promoter region

27. Method of removing trophectoderm of a blastocyst, using antibodies bound to surface antigen of trophectoderm and complement is represented as:

(A) Immuno-surgery
(B) Immuno-precipitation assay
(C) Immuno-rejection
(D) Immuno-sorbent assay

28. The Stem cells isolated from bone marrow were differentiated into myogenic lineage. The cells were then washed and loaded with fresh medium with no serum for a period of 8 hrs. When this medium was added on the fresh stem cells these cells also got differentiated to myogenic lineage. Such a medium is termed as:

(A) Condition medium of pluripotency
(B) Condition medium of myogenic cells

(C) Condition medium of stem cells
(D) Condition medium of bone marrow

29. Which of the following represents cocktail for generating induced pluripotent stem cell and are named as original Yamanaka factors:

(A) Oct4, Sox2, cMyc, and Klf4 (B) Oct4, Sox2, cMyc, and nanog
(C) Oct4, Sox2, nanog, and Klf4 (D) Oct4, nanog, cMyc, and Klf4

30. Which one of the following stem cell marker can be exploited to differentiate mouse embryonic stem cells from human embryonic stem cells:

(A) Nanog. (B) SSEA-1 (C) Oct 3/4 (D) Sox2

31. All the following except one, represent progenitor cells:

(A) Alveolar type 2 cells for lungs
(B) Blast cells for T & B lymphocytes
(C) Satellite cells for muscle
(D) Oval Cells for liver

32. All the following differentiated cells could be derived from embryonic stem cells except one of the following:

(A) Adipocytic Cells (B) Chondrocytic Cells
(C) Myocytic Cells (D) Trophoectodermal Cells

33. The Stem cell sorting and identification required use of CD markers during FACS analysis, what does CD stands for:

(A) Combinatorial differentiation (B) Cluster of differentiation
(C) Combined designation (D) Chemotactic designation

34. During Flowcytometry, commonly used cell types called side population cell is named due to which of the following character:

(A) Cells lying on the side of Hoechst dye retaining cells
(B) Cells lying on the side of differentiated cell lacking Hoechst dye
(C) Cells displaced on the side of a culture plate before addition of Hoechst dye
(D) Cells positive for Hoechst dye obtained after trypsinization

35. Which of the following event occurs following mammalian fertilization:

(A) Inhibition of heterokaryon formation
(B) Loss of follicular cells

(C) Exit from the meiosis

(D) Entry to the meiosis

36. In newt, following amputation of forelimb the cells around the amputated area undergo mitosis, trans-differentiation and de-differentiation. Which of the following event precedes all these:

(A) Formation of blastema (B) Formation of embryoid body

(C) Formation of trophoectoderm (D) Formation of teratoma

37. One of the major difference between osteoblast and osteoclast cells is:

(A) Differentiation to osteocytes by osteoblast and chondrocytes differentiation by osteoclast cell

(B) Differentiation to myocytes by osteoblast and chondrocytes differentiation by osteoclast cell

(C) Bone resorption by osteoblast and bone formation by osteoclast cell

(D) Bone formation by osteoblast and bone resorption by osteoclast cell

38. The concentration of magnesium sulfate higher than its optimum, during PCR amplification, can lead to which of the following outcome:

(A) Increase in nonspecific amplification

(B) Increase in the specific amplification

(C) Increases the DNA denaturation and hasten the speed of amplification

(D) Increases the DNA denaturation and slowing down speed of amplification

39. For the identification of sequence that a transcription factor binds for the gene regulatory activity can be ascertained by which of the following technique:

(A) Mutagenic assay (B) DNA finger printing assay

(C) Gel retardation assay (D) Gene silencing assay

40. The procedure for selecting hybridoma cells requires HAT medium containing aminopterin. This is included in the medium because:

(A) It provides a precursor for purine metabolism

(B) It inhibits purine metabolism

(C) It provides a precursor for dihydrofolate reductase activity

(D) It inhibits dihydrofolate reductase activity

41. The location of Hematopoiesis during development in mouse is:

(A) Mesonephric to Metanephric axis

(B) Neural tube site

(C) Extraembryonic yolk sac

(D) Extraembryonic aorta-gonad-metanephric

42. Abzyme, is an important molecule designated as:

(A) RNA with catalytic activity

(B) Catalytical antibody

(C) Catalytic carbohydrate

(D) Nano-based Fe with catalytic activity

43. All except one of the following cannot be used to differentiate the cancer cell out of mixed cell population:

(A) Loss of telomerase function (B) Loss of contact inhibition

(C) High nuclear to cytosol ratio (D) Polyploidy in cells

44. Dideoxy nucleotides are used to achieve which of the following outcome:

(A) Sequencing of DNA (B) Mapping of DNA

(C) Generation of clone contigs (D) Amplification of DNA

45. The major source of the collagen synthesizing cells used in the tissue engineering studies is:

(A) Neural cells (B) Endothelial cells

(C) Fibroblast cell (D) Epithelial cells

46. Bisulfite sequencing methodology is used to ascertain which of the following:

(A) Methylation of CpG islands (B) Acetylation of histones

(C) Phosphorylation of serine/threonine (D) Deacetylation of histones

47. The inactivation of complement system of serum to be used during cell culture is achieved by which of the following method:

(A) Filtration through 0.2 micron filter (B) Heat inactivation

(C) Charcoal treatment (D) Autoclaving

48. The action of the antibody involves its specificity towards a particular antigen, which of the following contributes to antibody specificity:

(A) The variable region of the heavy and light chain
(B) The constant region of antibody
(C) The heavy chain of the antibody
(D) Hinge region of antibody

49. Non-adherent clusters of neural progenitor cells grown under *in vitro* and used for propagation of neural stem cells is represented by which of the following:

(A) Glial cell clusters
(B) Axonic cell clusters
(C) Neurosphere
(D) Neural tube

50. Which one of the following stem cell type escapes immunological barrier during transplantation in mouse:

(A) Mesenchymal stem cell
(B) Embryonic stem cell
(C) Hematopoietic stem cells
(D) Neural stem cells

x-x-x

System Biology & Bioinformatics(Ph.D.)

1. What is full form of RCSB?
(A) Research collaborator for structural bioinformatics
(B) Research collaboration for structural bioinformatics
(C) Research contributory for structural bioinformatics
(D) Research contribution for structural bioinformatics

2. What makes BLAST faster than FASTA?
(A) Processor speed of the computer (B) Hash table lookup
(C) Database size (D) E value

3. Gen bank file format is DNA centric report because of
(A) Coding region (B) Decoded region
(C) Qualifier (D) CDS

4. What is the difference between RefSeq and GenBank?
(A) RefSeq includes publicly available DNA sequences
(B) GenBank includes non redundant curated data
(C) GenBank sequences are derived from RefSeq
(D) RefSeq sequences are derived from GenBank

5. ASN.1 is computer language which is?
(A) Cross-platform dependent
(B) Machine-readable only
(C) Human-readable and machine-readable
(D) Human-readable only

6. GI number in NCBI is
(A) Gen Info Identifier (B) Gene Info Indent
(C) Gene information Identity (D) Genome Identifier

7. The Pitch/turn of helix observed generally in B-DNA structures is
(A) 33.3 (B) 33.2 (C) 33.1 (D) 33.4

8. The major groove of B-DNA structures is
(A) Narrow (B) Shallow (C) Deep, narrow (D) Wide, shallow

9. What is VRML
(A) Visual Real Modeling Language (B) Visual Reality Model Language
(C) Virtual Real Modeling Language (D) Virtual Reality Modeling Language

10. Which of the following most accurately determined using molecular modeling?
(A) Molecular orbital energies (B) Minimum energy conformation

(C) Electrostatic potentials (D) Energy

11. The Phi-Psi scatter diagram is a
(A) Ramachandran plot (B) Chi plot
(C) Scatter plot (D) Prediction plot

12. Which factor distinguish between sensitivity in BLAST
(A) P value only (B) E value only
(C) P & E value (D) P or E value

13. GENSCAN developed by
(A) Christopher Burge (B) Christopher rode Samuel
(C) Christopher rode (D) Christopher karlin

14. How Sequence filtering in BLAST help in fast database searching
(A) Searches for LCR (B) Searches for Repeats
(C) Both A & B (D) None of the above

15. Using SEG and PSEG in BLAST increase
(A) Sensitivity (B) Specificity (C) Search result (D) E value

16. Many genes involved in pathogenicity are located in defined continuous regions ("islands") of the genome and have different GC content from other portions of the genome, suggesting that they have arisen through
(A) Horizontal gene transfer
(B) Gene duplication and subsequent mutation
(C) Protection from methylation
(D) Increase in the rate of mutation of successive GC pairs

17. Parametric bootstrap differ from non parametric because
(A) It uses simulated replicate rather than pseudo replicate
(B) It uses simulated pseudo replicate rather than replicate
(C) It uses simulation parameter for search
(D) It do not uses simulation parameter for search

18. Mention the type of the following reaction

$$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$$

(A) Synthesis (B) Hydrolysis (C) Dehydration (D) Hydrogenation

19. Value of coefficient of kurtosis for a Normal distribution is
(A) Positive (B) Negative (C) Equal to one (D) Equal to three

20. The Northern blotting technique depends on
(A) Similarities between the sequences of probe DNA and experimental DNA

(B) Similarities between the sequences of probe RNA and experimental RNA
(C) Similarities between the sequences of probe protein and experimental protein
(D) The molecular mass of proteins

21. In an airline reservation system, the entities are date, flight number, place of departure, destination, type of plane and seats available. The primary key is
(A) Flight number
(B) Flight number + place of departure
(C) Flight number + date
(D) Flight number + destination

22. MEGA phylogenetic software uses
(A) Comupute synonymous and not nonsynonymous sites
(B) Comupute both synonymous and nonsynonymous sites
(C) Comupute only synonymous and nonsynonymous sites
(D) Comupute only nonsynonymous sites

23. PSI-BLAST & BLAST?
(A) Different
(B) Same
(C) Search engine
(D) Certain Difference

24. What are the advantages of computer in CADD?
(A) Simple & fast
(B) Simple, short & fast
(C) Complex & slow
(D) A & B

25. Kyte-Doolittle hydropathy plot are?
(A) Used by TGREASE
(B) Short Prediction
(C) Signaling
(D) 1 dimension plot

26. Which one is correct?
(A) 8 bit = 10 byte
(B) 1024 KB = 1MB
(C) 1024GB = 10 Terabyte
(D) 1024GB = 1 Mega Byte

27. Starch content of potatoes can be increased by using a bacterial gene, known as
(A) Sucrose phosphate synthase gene
(B) ADP glucose pyrophosphorylase gene
(C) Polygalactouranase gene
(D) None of the above

28. Kimura 2-parameter for Mutational models for DNA determine:
(A) Transversions more likely than transitions
(B) Transitions more likely than transversions
(C) Transversions vs. transitions
(D) Identify all transitions

29. DOT PLOT uses

(A) Low window and high stringencies (B) Low stringencies and high window
(C) Low window and low stringencies (D) High window and high stringencies

30. Repeat and inverted repeats in DNA sequences are significantly identify by DOT PLOT
(A) Agree (B) May be
(C) Strongly agree (D) Not possible

31. Normal distribution require for statistically signification?
(A) 1572 change amino acid changes in PAM
(B) 71 groups of PAM
(C) Entropy of PAM
(D) None of the above

32. Full form of SAGE
(A) Serial analysis of gene expression
(B) Series analysis of gene expression
(C) Sorted analysis of gene expression
(D) Segregated analysis of gene expression

33. Significant of pair sequence alignment is not possible without scoring matrix.
(A) Statement is correct (B) Statement is incomplete
(C) Statement is no universal (D) Statement is justified

34. In prokaryotes, just before the cell divides, the two daughter genomes are attached side by side to the
(A) Cell membrane (B) Replication origin
(C) Centromeres (D) Equatorial plate

35. Charge–charge relationship of noncovalent interactions to the distance separating the interaction molecules is
(A) $1/r$ (B) $1/r^2$ (C) $1/r^3$ (D) $1/r^4$

36. LOD score
(A) Statistical estimation (B) Establish linkage between two loci
(C) None (D) A & B

37. What is the range of sample size used in SDS-PAGE methods.
(A) Micrograms (B) Naonograms (C) Picograms (D) Milligrams

38. Who coined the term mitosis
(A) Strasburger (B) Flemming
(C) Strasburger & Flemming (D) Clamming

39. Rotameric structures are?
(A) Different phi & psi but differ in side chain
(B) Same psi but differ in side chain

(C) Same phi & psi but differ in side chain
(D) Same phi but differ in side chain

40. Beta Globin fold consist of
(A) All alpha helices (B) Eight alpha helices
(C) Four alpha & four beta helices (D) Four alpha & three beta helices

41. Macro molecular thermodynamics do not deals with
(A) Pressure (B) Entropy (C) Free energy (D) Surface

42. DH5 alpha Plasmid DNA is
(A) Positively supercoiled (B) Negatively supercoiled
(C) Early supercoiled (D) Supercoiled

43. Linking number of DNA describe
(A) Topology (B) Conformation (C) Model (D) Flexibility

44. Phylogenetics analysis are not based on
(A) Homology (B) Para logy (C) Orthology (D) Xenology

45. Which of these amino acids is highly conserved & abounded in nature?
(A) Glycine (B) Alanine (C) Both (D) None

46. Triad tools in molecular modeling consist of
(A) Force field, Parameter sets, molecular mechanism
(B) Force field, Minimization algorithm, Parameter sets
(C) Force field, molecular dynamics, parameter sets
(D) All of the above

47. Which is second generation force field
(A) MMFF (B) MM Family (C) AMBER (D) AMBER 2.0

48. How many copies of mitochondria is present in an eukaryotic cell
(A) 10^3 - 10^4 (B) 10^2 - 10^3 (C) 1000 (D) 10^6- 10^7

49. Minimum energy conformation is always an active conformation of the model
(A) Statement is correct (B) State is incomplete
(C) Statement is not justify (D) None of the above

50. Which of them are rare amino acid
(A) Citrulune (B) Selenoacedities
(C) 3,4-dihydroxy-phenylalanine (D) 3,8-dihydroxy-phenylalanine

x-x-x

(ZOOLOGY)

1. Which of the following is not part of the triad of epidemiology?
(A) Host (B) Agent (C) Environment (D) Time

2. Cydippid larva is a notable feature of phylum
(A) Echinodermata (B) Mollusca
(C) Porifera (D) Ctenophora

3. Which tracheal system is present in dipteran pupae?
(A) Propneuistic (B) Metapneuistic
(C) Holopneuistic (D) Hemipneuistic

4. Which of the following nucleotide bases is never present in genetic code?
(A) Adenine (B) Uracil
(C) Thymine (D) Cytosine

5. Grass carp is
(A) *Ctenopharyngodon idellus* (B) *Cyprinus carpio*
(C) *Hypophthalmichthys molitrix* (D) *Oreochromis mossambicus*

6. In which sequence the following proteins are activated as prerequisite for ventralisation in *Drosophila*
(A) Snake, Spätzle, Easter (B) Snake, Easter, Spätzle
(C) Spätzle, Snake , Easter (D) Easter, Snake, Spatzle

7. Which of the following is not a G-Protein coupled receptor?
(A) Rhodopsin (B) Muscarinic acetylcholine receptor
(C) Nicotinic acetylcholine receptor (D) Thyrotropin receptor

8. The honey bee drones
(A) Have a mother and a father
(B) Have sisters but no brother
(C) Have no father but have a grandfather
(D) Have only grandmother and grandfather

9. In *C. elegans*, pharynx is generated by two sets of cells derived from
(A) ABp and E cells (B) ABa and E cells
(C) ABa and EMS cells (D) ABp and EMSs

10. The median dorsal arm of epicranial suture is termed
(A) Metopic suture (B) Epistomal suture
(C) Fulturae (D) Gula

11. Which of the following isoenzymes is the first indicator of myocardial infarction?

(A) CPK_1 (B) CPK_2 (C) CPK_3 (D) CPK_4

12. Which of the following provides exact distance between two loci on a chromosome?
(A) Genetic map
(B) Physical map
(C) Linkage analysis between two loci
(D) Results of crossing over between two loci

13. Which of the following technique is used for determining the molecular weight of the biomolecules?
(A) High Pressure Liquid Chromatography
(B) Affinity Chromatography
(C) Size Exclusion Chromatography
(D) Ion Exchange Chromatography

14. Which of the following are all game fish?
(A) *Salmo trutta fario, Schizothorax richardsonii* and *Tor putitora*
(B) *Salmo trutta fario, Schizothorax richardsonii* and *Cyprinus carpio*
(C) *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*
(D) *Ctenopharyngodon idellus*, *Cyprinus carpio* and *Barilus barila*

15. Who is considered as the father of epidemiology?
(A) John Wisnar (B) Louis Pasteur (C) John Snow (D) John Smith

16. In vertebrate visual receptors which of the following secondary messengers plays a key role
(A) AMP (B) Ca++ (C) cGMP (D) Phospholipids

17. Which of the following is a temporary endocrine gland in human body?
(A) Corpus cardiacum (B) Corpus luteum
(C) Corpus striatum (D) Corpus albicans

18. The naive B cell contains which type of antibodies
(A) IgE and IgA (B) IgM and IgE
(C) IgM (D) IgG1 and IgG2

19. What is thought to be the origin of the Alu RNA transposon
(A) It is thought to be derived from a retrovirus
(B) It is thought to be derived from a protein coding gene
(C) It is thought to be derived from a cellular non coding RNA molecule
(D) It is thought to be derived from a DNA virus

20. Gill nets are mostly used in
(A) In rivers where the water current is very fast
(B) In shallow waters where depth is not more than a feet

(C) In reservoirs and lakes where the water is stationary
(D) In torrential streams

21. Which of the following is an example of constitutive heterochromatin?
(A) Barr body
(B) Hox genes of insects
(C) rRNA transcribing region of genome
(D) Centromeric region of chromosome

22. Foetus belong to which type of transplant
(A) Xenograft (B) Isograft (C) Autograft (D) Allograft

23. Edman degradation is used for the
(A) Determination of amino acid sequence from the N-terminal of a protein
(B) Determination of nucleotide sequence of the DNA
(C) Determination of amino acid sequence from the C-terminal of a protein
(D) Determination of nucleotide sequence of the RNA

24. The volume of blood left in the ventricle after ventricular systole is called
(A) Stroke's volume (B) End systolic volume
(C) Cardiac volume (D) End diastolic volume

25. In which of the following animals germ cells are not determined by material in egg cytoplasm?
(A) Nematodes (B) Frogs (C) Mammals (D) Insects

26. In an analytical procedure, a mixture of proteins is subjected to electrophoresis, transferred to nitrocellulose and then probed by using a labeled antibody probe. This technique is
(A) Southern blotting (B) Northern blotting
(C) Western blotting (D) RT-PCR

27. The syndrome in humans in which an individual's somatic cells contain the XXX chromosomes is called
(A) Klinefelter's (B) Turner's (C) Down's (D) Superfemale

28. Best site for taking biopsy for diagnosis of Trichinellosis is
(A) Deltoid muscle (B) Diaphragm (C) Pectoralis major (D) Liver

29. Contraction of the external intercostals results in:
(A) Downward movement of the ribs and sternum
(B) Elevation of the ribs and sternum
(C) Downward movement of diaphragm
(D) Abdominal contraction

30. In humans major cause of Burkitt's lymphoma is:
(A) Translocation of part of chromosome 8 to chromosome 14

(B) Translocation of part of chromosome 9 to chromosome 22
(C) Reciprocal translocation of parts of chromosome 15 and 17
(D) Translocation of part of chromosome 18 to chromosome 14

31. Berlese filter chamber in the midgut of insects is a modification for
(A) Conserving water
(B) Rapidly removing water
(C) Sieving solid food particles
(D) Separating digestible and non-digestible materials

32. In new born infants, haemolytic disease can be limited by
(A) Administration of specific allergens
(B) Allergens of specific shots
(C) Administration of antihistamines
(D) Administration of anti-Rh antibodies

33. In vertebrate genes, transcription regulatory regions that contain CpG islands are inactivated by which CpG modification?
(A) Methylation (B) Myristylation
(C) Phosphorylation (D) Acetylation

34. Pad-like structures on ventral surface of the tarsal subsegments are
(A) Euplantulae (B) Basitarsus (C) Empodium (D) Basicoxite

35. The presence of the pharyngeal teeth is a key character of
(A) Catfishes (B) Carps
(C) Eels (D) Snakehead fish

36. A high concentration of fructose is present in the secretion of
(A) Prostate (B) Seminal vesicle
(C) Epididymis (D) Vas deferens

37. Karnovsky's fixative used in electron microscopy is
(A) Glutaraldehyde
(B) Paraformaldehyde
(C) Glutaraldehyde and Paraformaldehyde
(D) Osmium Tetraoxide and Uranyl acetate

38. In Epidemiology "Quarantine" refers to:
(A) Separation of the diseased individual
(B) Separation of the individual exposed to a disease
(C) Separation of the diseased individual and its family
(D) Treatment of the diseased individual

39. Which of the following gene is required for SOS DNA repair in prokaryotes?
(A) *MutS* (B) *UvrA* (C) *UmuD* (D) *MutH*

40. Detection of odour is mediated by

(A) Ungated Na channels (B) Gated Na- channels
(C) Gated cation channels (D) G-protein coupled receptors

41. *Notopterus notopterus* and *Chitala chitala* are commonly referred as

(A) Eels (B) Carps (C) Featherbacks (D) Catfishes

42. Which of the following is not an actin binding protein?

(A) Formin (B) Filamin (C) Profilin (D) Laminin

43. All of the following characteristics are seen in the stools in amoebic dysentery of

(A) RBCs in clumps (B) Charcot-Leyden crystals
(C) Pyknotic bodies (D) Ghost Cells

44. The best way to demonstrate whether nuclear DNA is being replicated in cell is by:

(A) Phase contrast microscopy (B) Thin layer chromatography
(C) Autoradiography (D) Gel electrophoresis

45. The situation in which the RBC infection with *Plasmodium* species is not eliminated by immune system or by therapy and their numbers in the RBCs begin to increase again with subsequent clinical symptoms is called

(A) Gametogony
(B) Secondary exoerythrocytic schizogony
(C) Replase
(D) Recrudescence

46. A type of egg tube in insects in which vitellarium contains eggs only

(A) Acrotropic (B) Polytropic (C) Meroistic (D) Panoistic

47. Basic Keratins are type of:

(A) Type II intermediate filaments (B) Type III intermediate filaments
(C) Type IV intermediate filaments (D) Type V intermediate filaments

48. The Mitosis Promoting Factor (MPF), which propels an animal cell into division stage, has two essential sub units: one is catalytic and the other is regulatory sub unit of MPF. Which one of the following is the regulatory sub unit of MPF:

(A) Cyclin (B) Cdk (C) Proline (D) Ubiquitin

49. What are cryptic splice sites?

(A) These are splice sites that are used in some cells but not in others
(B) These are splice sites that are always used
(C) These are splice sites that are involved in alternative splicing resulting in removal of exons from some RNA molecules
(D) These are the sequences within exons or introns that resemble consensus splicing signals, but are not true splice sites

50. Trochophore larva is present in both these classes

(A) Amphineura & Cephalopoda (B) Pelecypoda & Scaphopoda
(C) Pelecypoda & Amphineura (D) Amphineura & Scaphopoda

Public Health(Ph.D)

1. What is Gini Index:
(A) Measure of distribution of Income among households between countries
(B) Measure of distribution of Income among households within a country
(C) Measure of distribution of Income among households between States
(D) Measure of distribution of Income among households within States

2. Corpulence index means
(A) Measurement of Obesity
(B) Measurement of BP
(C) Measurement of Cholesterol
(D) Measurement of Depression

3. AIDS-causing HIV identifies its target cell by recognizing
(A) Gated Channels in the membranes
(B) Carbohydrates of Glycocalyx
(C) Apoproteins in the coated pits of membranes
(D) Low density lipoproteins in cell membranes

4. What is the use of Johari Window
(A) Studying health effects due to pollutants
(B) Studying the interpersonal relations
(C) Studying epidemiology
(D) Studying common health problems

5. Salutogenesis is
(A) Is a type of disease
(B) Is a term used in Health System
(C) Is related with immunization
(D) Is a process of improvement in health

6. Which of the following would usually require the smallest sample size because of its efficiency?
(A) One stage cluster sampling
(B) Simple random sampling
(C) Two stage cluster sampling
(D) Quota sampling

7. Who introduced the term 'stateless society'?
(A) Paul Bohannan (B) E. Evans-Pritchard
(C) A. Powell (D) A. Giddens

8. What is the marriage of a widow to her deceased husband's brother termed as?
(A) Widow marriage (B) Sororate
(C) Polyandry (D) Levirate

9. What are the minimum number of newborns should be examined for calculating percentage of LBW babies:
(A) 500 babies (B) 1000 babies
(C) 10000 babies (D) 100000 babies

10. The term 'family size' refers to:
(A) Total number of female children born to a woman
(B) Total number of persons in a family
(C) Total number of children a woman has born at a point in time
(D) Average No of children a woman has born at a point in time in a community

11. Which of the following method is used for contraceptive efficacy:
(A) PERT Analysis (B) Life Table Analysis
(C) NPP (D) PPV

12. Which one is incorrect regarding, angle of the needle to the injection site in different route of injection during immunization:
(A) Intra-dermal injection:15^{o} (BCG)
(B) Sub-cutaneous: 45^{o} (Measles, MMR)
(C) Sub- cutaneous: 45^{o} (DPT, DT, TT, Hepatitis)
(D) Intra-muscular: 90^{o} (DPT, DT, TT, Hepatitis

13. Which of the following is correct explanation of Gestational Age (SGA):
(A) As the 5% of Birth Weight at any given Gestational age
(B) As the 10% of Birth Weight at any given Gestational age
(C) As the 15% of Birth Weight at any given Gestational age
(D) As the 20% of Birth Weight at any given Gestational age

14. What is Cycle Beads?
(A) Emergency Contraceptive Pills (ECP)
(B) Statistical Method used in MCH
(C) Hormonal Contraceptive
(D) Natural family planning method

15. Pomeroy Technique is widely used in?
(A) Mini Pills (B) IUD
(C) Tubal ligation (D) Coitus interrupts

16. What is Catch-Up Growth?
(A) Under growth, according to WHO growth curve
(B) Higher than normal growth to recover in previous growth curve
(C) Onset of growth in a growth curve
(D) Birth injury

17. What are the recommendations of school health services for a school?
(A) 1 Privy for 50 Children and 1 Urinal/40 Children
(B) 1 Privy for 100 Children and 1 Urinal/60 Children
(C) 1 Privy for 50 Children and 1 Urinal/100 Children
(D) 1 Privy for 150 Children and 1 Urinal/80 Children

18. What is meant by 'Ring Vaccination'?
(A) Vaccine given around 100 meters of a detected case

(B) Vaccine given around 100 yards of a detected case
(C) Vaccine given around 200 meters of a detected case
(D) Vaccine given around 200 yards of a detected case

19. Which is the major principle of medical ethics that states that physicians and other medical professionals must act in the best interest of the patient?

(A) Justice (B) Autonomy
(C) Non-malfeasance (D) Beneficence

20. Xenograft is

(A) Transplant across species barriers
(B) A transplant of tissue from one to oneself
(C) Transplant between genetically identical (monozygotic) twins
(D) Transplant from one individual to another with a different genetic make-up

21. According to COTPA-2003 (Cigarette or any other tobacco product) no person shall sell, offer for sale, or permit the sale of Cigarette or any other tobacco product in any educational institution in an area within a radius of

(A) One hundred yards (B) One hundred meters
(C) One hundred feet (D) One hundredth of a mile

22. Which of the following is a nominal variable?

(A) Blood sugar level (B) Blood Type (A, B, AB & O)
(C) Hemoglobin level (D) Severity (mild, moderate and severe)

23. Whenever the median is reported as the measure of central tendency of a continuous variable, the associated appropriate measure of dispersion is

(A) Range (B) Variance
(C) Interquartile Range (D) Standard Deviation

24. Which of the following properties is characteristic of a variable following normal distribution?

(A) High Skewness (B) Small variance
(C) Large mean (D) Symmetry about mean

25. An investigator wants to draw samples from a group of men and women separately at random. What sampling method would he choose?

(A) Stratified random sampling (B) Simple random sampling
(C) Systematic Sampling (D) Quota sampling

26. One way ANOVA is used

(A) To compare the means of more than two groups
(B) To compare several proportions
(C) To test for linear trend
(D) To compare ratio of two variances

27. The association between two categorical variables is best shown in a

(A) Scatter plot (B) Bar chart
(C) Dot plot (D) Cross – tabulation of two factors

28. The equivalent nonparametric test for paired 't' test is

(A) Kruskal-Wallis test (B) Wilcoxon-signed rank test
(C) Median test (D) Sign test

29. The correlation between two continuous variables (r, pearson's correlation coefficient measures:
(A) The nonlinear relationship
(B) How mutually exclusive
(C) The strength of linear relationship
(D) The extent to which they are clustered

30. The aim of simple linear regression analysis is to
(A) Investigate a non linear relationship between two continuous variables
(B) Replace dots in scatter diagram by a straight line
(C) Measure extent of relationship between two variables
(D) Describe the relationship in straight line form that best describe it and enables prediction of one variable from the other

31. Which among the following study designs is effective, when the frequency of disease is low?
(A) Cohort (B) Case control (C) Ecological (D) Descriptive

32. Which of the following sets of four numbers has the smallest possible standard deviation?
(A) 7,8,9,10 (B) 5,5,5,5 (C) 0,0,10,10 (D) 0,1,2,3

33. If your grade on a recent test was 72th percentile. If 90 students write the test then approximately how many students received a higher grade than you?
(A) 18 (B) 65 (C) 5 (D) 72

34. Which of the following statement is NOT true about random sampling?
(A) It is reasonably accurate
(B) Free from personal biases
(C) Economical method of sampling
(D) Can be applied for all types of data collection

35. The best sampling method for sampling a population finite size:
(A) Area sampling (B) Systematic sampling
(C) Purposive sampling (D) Quota sampling

36. Which of the following best suit for 'Action Research'?
(A) It is an applied research (B) It is a quantity research
(C) It is a survey research (D) It is a population research

37. The 'write once read many' concept in the article is synonymous to which of James Martins concepts?
(A) Subject centered systems (B) Database centered systems
(C) Task centered systems (D) Multimedia centered systems

38. Which scale measures the psychological meanings of an attitude object using bipolar objectives?
(A) Likert (B) Summated rating
(C) Semantic differential (D) Constant sums

39. The research study carried out with the help of data points (either primary or secondary) is termed as:
(A) Conceptual (B) Observational (C) Empirical (D) Action

40. The primary objective of _____ is to provide insights into, and an understanding of, the problem confronting the researcher.
(A) Exploratory research (B) Conclusive research
(C) Causal research (D) Descriptive research

41. Population value is called _____.
(A) Statistic (B) Parameter (C) Variable (D) Core value

42. The report submitted when there is a time lag between data collection and presentation of result is called _____.
(A) Thesis (B) Interim report
(C) Summary report (D) Article

43. The goal for universal EHR adoption is _____.
(A) 2011 (B) 2020 (C) 2015 (D) 2014

44. What are interactive computer programs designed to assist physicians and other health professionals with decision making tasks?
(A) Electronic health records (B) Clinical decision support systems
(C) Computerized provider order entry (D) Telemedicine

45. Health information management standards began with the establishment of the:
(A) HMMS (B) AHIMA (C) CAHIIM (D) ASHIM

46. _____ is defined as the mobilization of healthcare information electronically across organizations within a region, community or hospital system?
(A) Health informatics (B) Health information exchange
(C) Health information technology (D) Health information management

47. _____ is a health information organization that brings together health care stakeholders within a defined geographic area and governs health information exchange among them for the purpose of improving health and care in that community?
(A) HIE (B) NORC (C) RHIO (D) HIT

48. What does SNOMED-CT stand for?
(A) Systemic nomenclature of medicine and coding terms
(B) Systematised nomenclature of medicine and coding terms
(C) System novel of medicine and clinical terms
(D) Systematised nomenclature of medicine and clinical terms

49. To achieve effective integration of various electronic patient records in the NHS requires?
(A) Unique patient identification system
(B) Patient identification system
(C) Radical change to the way the NHS runs
(D) Unique patient billing system

50. Human metabonomics is the study of?

(A) Study of human metabolic responses to environmental changes
(B) Study of metabolic responses to drugs and diseases
(C) Study of metabolic responses to drugs, environmental changes and diseases
(D) Study of human metabolic responses to aging

Biotechnology(Ph.D.))

1. Which activity defines Bioaugmentation

(A) Addition of nutrients at the site of pollution
(B) Degradation of toxic waste by resident microflora
(C) Sequestration of heavy metal ions by bacteria
(D) Introduction of specific bacterial species at the pollution site

2. Which of the following is not present in the cell wall of Gram negative bacteria

(A) Peptidoglycan (B) Teichoic acid (C) Lipid A (D) Porins

3. Mark the incorrect combination

(A) Biosafety level 1 *Bacillus subtilis*
(B) Biosafety level 2 *Mycobacterium tuberculosis*
(C) Biosafety level 3 *Bacillus anthracis*
(D) Biosafety level 4 Ebola virus

4. Which of the following statements is incorrect

(A) Milk is pasteurized at 62.8^0C for 30 minutes
(B) Pasteurization kills C*oxiella burnetii*
(C) Pasteurization temperature depends on the heat resistance of *M.tuberculosis*
(D) Pasteurisation increases the shelf life of milk

5. A polypeptide of 90kDa will be coded by a gene of the size

(A) 0.245 kb (B) 2.454 kb (C) 24.54 kb (D) 1.5 kb

6. Which of the following form the apoptosome complex

(A) Cytochrome c, Apaf-1 and procaspase-8
(B) Cytochrome c, Bcl-2 and procaspase-9
(C) Cytochrome c, FasL and procaspase-9
(D) Cytochrome c Apaf-1, and procaspase-9

7. What does not hold true for *Cre/loxP* system used in generating transgenic animals

(A) It causes large scale deletions in the chromosomes
(B) It activates the transgene by removing DNA sequences flanked by *loxP* sites
(C) It can remove the selectable marker that is no longer needed
(D) It creates a more efficient way to integrate useful transgene into the chromosomes

8. Genetically modified papaya exhibits

(A) Herbicide tolerance (B) Insect protection
(C) Virus resistance (D) Early ripening

9. Bt brinjal cultivation has been banned in

(A) Canada (B) Bangladesh (C) India (D) Philippines

10. Which of the following genetically modified crop is cultivated in maximum countries?

(A) Cotton (B) Maize (C) Rice (D) Soyabean

11. National Green Tribunal has banned the use of plastic bag below the thickness of

(A) 40 micron (B) 50 micron (C) 60 micron (D) 80 micron

12. 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

13. The promoter for heterologous gene hyperexpression in pET28a plasmid vector is

(A) P_L promoter of lambda phage (B) *trp* promoter

(C) T7 phage promoter (D) *lac* promoter

14. In DH5alpha strain of *E.coli* which mutations allow better yields and stability of the recombinant plasmid

(A) *end*A1 and *rec* A1 (B) *gyr*A and *dna*J

(C) *rec* A and *dam* (D) *supF* 44 and *rel* E

15. Treatment of bacterial culture with Trizol and chloroform leads to separation of

(A) RNA and DNA in aqueous phase and proteins in organic phase

(B) RNA in aqueous phase,DNA in interphase and proteins and lipids in organic phase

(C) RNA in aqueous phase,DNA and proteins in interphase and lipids in organic phase

(D) RNA in the organic phase,DNA in interphase and proteins in aqueous phase

16. Craig Venter has not been associated with which of the following

(A) Sequencing of *H.influenza* genome

(B) Sequencing of *C.elegans* genome

(C) Developing Expressed Sequence Tags (ESTs)

(D) Synthesis of the minimal bacterial genome

17. In which of the following situations NGS would be most useful

(A) To genotype 100 DNA samples for a known SNP

(B) To study the differential gene expression of a tumor sample

(C) To detect common missense mutation in Sickle cell disease

(D) To detect gene for resistance to rifamycin in *M.tuberculosis*

18. Which pair of aminoacids has highest and lowest isoelectric point

(A) Glycine, serine (B) Serine, glutamine

(C) Serine, lysine (D) Lysine,glutamine

19. Which of the following pair is wrongly matched

(A) IFN α Leucocytes

(B) IFN ß Fibroblasts

(C) TNF α Activated T cells

(D) CEA Liver cells

20. What is not true for peroxisomes

(A) In plants and animal it is involved in converting fatty acids to sugars

(B) In liver cells it detoxifies toxic molecules

(C) It is self replicating membrane bound organelle

(D) It imports proteins and lipids from cytosol

21. Which of the following oncogenes is not involved in signal transduction

(A) *src* (B) *ki –ras* (C) *n - ras* (D) *jun*

22. Mark the correct statement

(A) Only helices are involved in DNA –protein interactions

(B) The many types of leucine zipper proteins can all form heterodimers with one another

(C) The strength and specificity of DNA protein interaction can be adjusted by changing the number of zinc fingers repeats

(D) Helix turn helix motif of bacterial gene regulatory proteins is often embedded in same structural context

23. Which of the following does not affect the stability of mRNA

(A) Reduction of polyA tail to 100 residues

(B) Removal of 3' tail leading to decapping at 5'end

(C) Nucleotide sequence at 5'UTR

(D) Pyrimidine rich residues at 3' UTR

24. Which technique would be suitable to determine the transcription binding sites on global scale

(A) Deletion mapping (B) DNA foot printing

(C) Whole genome sequencing (D) ChIP- seq

25. In *E.coli* errors left after proof reading are removed by

(A) MutS,MutL,MutH and DNA polymerase I

(B) MutS,MutL,MutH and DNA polymerase III

(C) MSH,MLH and DNA polymerase I

(D) Rec A,Rec BCD,UMC and DNA polymerase III

26. Puromycin which is commonly used in the studies of protein translation, causes

(A) Nonspecific binding of aminoacyl tRNA to A site

(B) Release of EF-G-GDP from ribosome

(C) Inhibition of peptidyl tranferase activity

(D) Exit of growing polypeptide chain from ribosome

27. Which statement is true for X Chromosome

(A) Paternally derived X Chromosome is heterochromatized
(B) Maternally derived X Chromosome is heterochromatized
(C) Heterochromatized X Chromosome is reactivated during oogenesis
(D) Genes responsible for pigmentation are located on X Chromosome

28. If a set of four mice is immunized with high dose of an antigen,in the secondary response they will produce

(A) Low affinity,heterogenous antibodies mainly IgG
(B) Low affinity,heterogenous antibodies mainly IgM
(C) High affinity,homoogenous antibodies mainly IgG
(D) High affinity,homogenous antibodies mainly IgM

29. Which of the following can activate classical complement cascade

(A) A single molecule of IgM bound to RBC
(B) IgM molecules circulating in the serum
(C) A single molecules of IgG bound to the surface of RBC
(D) Two molecules of IgG bound at a distance on the surface of RBC

30. In 2019, the UN climate summit is scheduled to be held in

(A) Germany (B) India (C) Brazil (D) Chile

31. Kagali Amendment of the Montreal protocol relates to the regulation of global warming by phasing out

(A) CFCs (B) HCFCs
(C) HFCs (D) Methyl bromide

32. Highly acid frits are canned in which type of steel cans

(A) Type L (B) Type M (C) Type MC (D) Type MR

33. Bacterial spores can be inactivated by all except

(A) Ethanol (B) Steam under pressure
(C) Formaldehyde (D) Glutaraldehyde

34. Which type of microbial contamination is difficult to detect in continuous cell line

(A) Bacterial (B) Fungal (C) Yeast (D) Mycoplasma

35. Serum in cell culture medium provides hormones which stimulate proliferation except one which inhibits growth and promotes differentiation

(A) VEGF (B) FGF (C) TGFß (D) IGF II

36. In sauerkraut production, the sequence in which different bacteria do desirable fermentation is

(A) *Leuconostoc mesenteroides* followed by *Lactobacillus curcumeris* and then *Lactobacillus pentoaceticus*
(B) *Lactobacillus curcumeris* followed by *Lactobacillus pentoaceticus* and then *Leuconostoc mesenteroides*
(C) *Lactobacillus lactis* followed by *Lactobacillus curcumeris* and then *Leuconostoc mesenteroides*

(D) *Leuconostoc mesenteroides* followed by *Lactobacillus pentoaceticus* and then *Lactobacillus curcumeris*

37. Patients with celiac disease should not eat

(A) Peanuts (B) Corn (C) Rice (D) Wheat

38. Which of the following food pathogens can survive at cold temperature

(A) *Clostridium botulinum* (B) *Campylobacter jejuni*

(C) *Listeria monocytogenes* (D) *Bacillus cereus*

39. Mark the incorrect statement

(A) Corn syrups add viscosity to confection due to its dextrin content
(B) Invert sugar retards crystallization of sucrose
(C) Sorbitol is less sweet than sucrose and adds no calories
(D) Aspartame is sweeter then sucrose and adds no calories

40. Diphtheria toxin which is tagged to monoclonal antibody for targeted cancer therapy acts by

(A) ADP-ribosylation of eEF2

(B) Adenylate cyclase cleavage

(C) Uncoupling of electron transport chain

(D) Blocking of transmission in peripheral nerves

41. Mark the incorrect statement

(A) Tandem mass spectroscopy is used to determine peptide sequence
(B) Glycosylation or phosphorylation of protein can be identified by MALDI
(C) Mass spectroscopy cannot analyze metabolome
(D) The time of flight (TOF) for ions is directly correlated with mass to charge ratio

42. Mark the incorrect statement

(A) Pyrosequencing involves sequencing by synthesis
(B) Next generation sequencing can be used for quantification of gene expression
(C) Deep sequencing of bisulfite treated DNA can be used to study global methylation in cancer
(D) Exome-sequencing is not suitable to detect mutations associated with tumor progression

43. Most proteins have net positive charge at

(A) High Ph
(B) Low pH
(C) In the presence of SDS
(D) In the presence of mercaptoethanol

44. Which statement regarding yeast replicative plasmid is not true

(A) It is a high copy number plasmid

(B) It does not contains 2 μ plasmid origin of replication

(C) It does not show mendelian segregation

(D) It gives the most stable maintenance of cloned gene

45. What is best option to express heterologous proteins efficiently in *E.coli* when codon bias can be a limitation

(A) Using genetically modified host strain that expresses rare tRNAs

(B) Genetically engineer the foreign gene to incorporate codons for more abundant tRNAs

(C) Genetically engineer the gene to remove the codons for rare tRNAs

(D) Grow the genetically modified host cells for longer time to make protein with rare codons

46. Which of the following techniques is based on Forster Resonance Energy transfer (FRET)

(A) Multiplex PCR

(B) Taq man PCR

(C) Surface Plasmon Resonance

(D) Fourier transform infrared spectroscopy

47. Which statement is not true for CRISPR Technology

(A) It is a kind of adaptive immunity in bacteria

(B) It works exclusively in bacteria

(C) It is based on RNA guided sequence specific DNA cleavage

(D) It is a powerful tool for making knock outs

48. In reverse phase HPLC sample is purified by using _____stationary phase and _____mobile phase

(A) Hydrophilic, non polar (B) Hydrophilic, polar

(C) Hydrophobic, non polar (D) Hydrophobic, polar

49. All the statements given below are correct except

(A) Sec pathway transports proteins from the cytoplasm to outside cell in two steps

(B) Transportation of inner membrane proteins require sequences specific for signal recognition particle (SRP)

(C) Only unfolded protein containing two arginines in their signal peptide go through TAT pathway

(D) TAT pathway is important for virulence in pathogens

50. Yeast two hybrid system cannot be used to study

(A) Protein - Protein interaction (B) Protein - RNA interaction

(C) Loss of Protein - Protein interaction (D) Loss of DNA- protein interaction

x-x-x

Forensic Science(Ph.D.)

1. In forensic science the most reliable form of evidence is

(A) Blood (B) Weapon (C) Clothes (D) Eye witness

2. 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

3. Who was first to advocate the application of science to criminal investigation?

(A) Hans Gross (B) Alphonse Bertillon

(C) Paul Kirk (D) August Vollmer

4. In India the first State Forensic Science laboratory was established at

(A) Calcutta, 1952 (B) Mumbai, 1955

(C) Delhi, 1952 (D) Hyderbabad, 1955

5. Which of the following is the preferred way to identify a deceased person?

(A) Visual inspection

(B) Tattoos

(C) Examination of teeth, surgical records

(D) Surgical scars

6. The state forensic science laboratory was established in Shimla in year

(A) 1986 (B) 1987 (C) 1988 (D) 1989

7. The term 'self-loading pistol' is strictly synonymous with which one of the following?

(A) Semi-automatic pistol (B) Double-action revolver

(C) Single-action revolver (D) Automatic pistol

8. Which one of the following is used to analyse for the presence of gunshot residues? (A) Microspectrophotometry

(B) Refractive index measurements

(C) Polarized light microscopy

(D) Scanning electron microscopy used in conjunction with energy dispersive X-ray analysis

9. Which of the following is characteristic of genuine signatures (as opposed to forged signatures)?

(A) Pen strokes with blunt ends (B) Pen strokes with tapering ends

(C) Evidence of retouching (D) Unnatural pen lifts

10. If the probability of being blood type A is 1/8 and the probability of blood type O is what is the probability of being either blood type A or O?

(A) 5/8 (B) 1/8 (C) 1/2 (D) 1/16

11. The phase in the growth cycle of an individual hair in which the hair is actively growing is known as the:

(A) Anaphase (B) Catagen phase
(C) Telogen phase (D) Anagen phase

12. The final breakthrough for the fingerprint method of personal identification was made by:

(A) Sir Francis Galton (B) Joseph Faurot
(C) William Herschel (D) Edward Henry

13. For most fingerprint examiners, the chemical method of choice for visualizing latent prints is:

(A) Silver nitrate (B) Iodine
(C) Chlorate (D) Ninhydrin

14. The three basic types of fingerprint pattern are:

(A) Aarches, loops and rings (B) Loops, arches and whorls
(C) Whorls, arches and accidentals (D) Whorls, accidentals and loops

15. Quadrant zone method of crime scene investigation is suitable for:

(A) Indoor crime scene (B) Outdoor crime scene
(C) Automobile crime scene (D) Blast site

16. Blood or buccal swabs for DNA analysis are to be taken from any consensual partner having sex with the victim within _____ hours following intercourse.

(A) 24 hours (B) 36 hours (C) 48 hours (D) 72 hours

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

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

18. Which of the following best defines rigor mortis?

(A) This is the body cooling after death (B) Livor mortis
(C) Postmortem rigidity (D) Postmortem medical examination

19. Which of the following physiological fluids would be expected to have a high concentration of the enzyme amylase?

(A) Urine (B) Sweat (C) Semen (D) Saliva

20. Which of the following is not a presumptive test for blood?

(A) Acid phosphatase test (B) Luminol test
(C) Kastle-Meyer test (D) Leuco-malachite green test

21. Luminol reagent reacts with blood in the presence of peroxide to emit light by a chemical process known as:

(A) Fluorescence (B) Chemiluminescence
(C) Coagulation (D) Illumination

22. The condition characterised by the absence of sperm cells in the seminal fluid is known as:

(A) Hypospermia (B) Hyperspermia
(C) Oligospermia (D) Azoospermia

23. 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

24. Corpora-basal index is used to determine:
(A) Age (B) Sex (C) Race (D) Stature

25. Properties of evidence that can be attributed to a common source with an extremely high degree of certainty is/are:
(A) Individual characteristics (B) Referent characteristics
(C) Comparison characteristics (D) Class characteristics

26. How much seminal fluid does the normal male release during an ejaculation?
(A) 2.5 ounces (B) 6 pints
(C) 1 milliliter (D) 2.5 to 6 milliliters

27. Cheiloscopy is the study of
(A) Lips (B) Eyes (C) Ears (D) Nose

28. In the ABO system, blood group 'O' is characterised by the:
(A) Presence of antigen A and the absence of antigen B
(B) Presence of both antigen A and antigen B
(C) Presence of antigen O
(D) Absence of both antigen A and antigen B

29. The ideal place to record the temperature of dead body is
(A) Rectum (B) Axilla (C) Mouth (D) Groin

30. Diatoms in bone barrow are seen in death due to:
(A) Strangulation (B) Drowning
(C) Electrocution (D) Asphyxia

31. Specimens for toxicological evaluation should be preserved in
(A) 10 % Formaldehyde (B) Alcohol
(C) Normal Saline (D) Saturated solution of common salt

32. All of the following are items to be collected from a deceased's body and sent to the forensic laboratory except:
(A) Head and pubic hairs (B) Ocular fluid
(C) Blood (D) Fingernail scrapings

33. 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 30th power (B) 1 x 10 to the 60th power

(C) 1 x 10 to the 100th power (D) 1 x 10 to the 90th power

34. The common habit forming drug is

(A) Nicotine (B) Alcohol (C) Opium (D) Heroin

35. Huffing is common in:

(A) Psychedelic abuse (B) Solvent abuse

(C) Ether abuse (D) Smack dependence

36. Horizontal ligature mark in the neck is seen in

(A) Throttling (B) Hanging

(C) Choking (D) Strangulation by ligature

37. Adipocere is formed due to:

(A) Putrefaction of soft tissues

(B) Dehydration of muscles and subcutaneous fat

(C) Hydrogenation of subcutaneous tissues

(D) Saponification of subcutaneous fat

38. The child would have _____ number of teeth at the age of 3:

(A) 20 (B) 16 (C) 24 (D) 12

39. The following bones are useful in determination of stature:

(A) Fibula and Pisiform (B) Radius and Talus

(C) Femur and Ulna (D) Humerus and Hyoid

40. The technique commonly used for comparison of ink sample is:

(A) Gas chromatography (B) Thin layer chromatography

(C) X-ray diffraction (D) Infra red spectroscopy

41. The report of fake currency note is admissible as evidence in court under:

(A) IPC292 (B) IEA-292 (C) CrPC-292 (D) CPC-292

42. A file placed on a computer's hard disk drive by Websites the user has visited are called:

(A) Firewall (B) Bookmarks (C) Caches (D) Cookies

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

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

44. Who propounded the 'principle of exchange'?

(A) Francis Galton (B) Edmond Locard

(C) Hans Gross (D) Alphonse Bertillon

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

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

46. 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

47. The Y-STR's utility in the forensic sciences is that:
(A) The frequency of occurrence in the general population is very small
(B) It is shorter by six bases on the Y chromosome then the X chromosome
(C) Replication of the DNA takes less then one hour
(D) It originates only from a male donor of DNA

48. A genetic locus that is analyzed in many forensic and paternity testing laboratories is the human leukocyte antigen locus known as HLA-DQ alpha. There are four major alleles at this locus known as 1, 2, 3, and 4. How many different genotypes are possible for these four alleles?
(A) 8 (B) 10 (C) 12 (D) 16

49. Using the equation given below,

$$W \approx \frac{d^3}{16}$$

calculate the approximate diameter of the crater that would be expected to be produced by a bomb containing 210 kg of explosive. where W is the weight of the charge in kilograms and d is the diameter of the crater in meters. Which is the correct answer?
(A) 5 m (B) 20 m (C) 15 m (D) 10 m

50. The main technique used to analyse samples suspected of containing liquid fire accelerants is:
(A) Atomic absorption spectroscopy (B) Gas chromatography
(C) X-ray diffraction (D) Ultraviolet-visible spectroscopy

x-x-x

Microbial Biotechnology(Ph.D.)

1. A bacterium weighs one femtogram and has a doubling time of 20 min. If this organism grows continuously for 24 hrs, with same doubling time, its biomass will be
A) 1.00 kg
B) 100.00kg
C) 1000.00 Tons
D) More than the weight of the earth

2. Use of agar as a solidifying agent for nutrient media was given by
A) F. E.Hesse B) R. Koch C) L. Pasteur D) J. Lister

3. In *S.aureus* cell wall, penta-glycine joins two adjacent tetra peptides. This joining is between
A) D-Ala of one peptide and D-Lys of second peptide
B) D-Ala of one peptide and L-Lys of second peptide
C) L-Ala of one peptide and L-Lys of second peptide
D) D-Ala of one peptide and meso-DAP of second peptide

4. One of the components involved in flagellar movement is called Rotor. It is made up of
A) MS and C rings
B) MS and L rings
C) MS and P rings
D) P,L and C rings

5. Most microbes die if the internal pH drops/rises
A) Below 5.0-5.5 B) 6.0-6.20
C) Above 7.5-.8.0 D) Above 7.6 -8.3

6. Approximate conditions for moist heat killing of yeasts and molds are
A) 10 minutes at 80^oC
B) 30 minutes at 80^oC minutes
C) 10 minutes at 70^oC
D) 30 minutes at 70^oC.

7. Using glyoxylate cycle, bacteria converts acetylCoA into an end product known as
A) Oxaloacetate B) Succinate
C) Malate D) Pyruvate

8. Pasteurization is a process of killing
A) Pathogenic microbes in milk
B) Undesirable microbes in milk
C) All vegetative forms of microbes in a given sample
D) Undesirable microbes in a given sample

9. The starting material for biosynthesis of Penicillin by *Penicilliumchrysogenum* is

A) D-alpha-Aminoadipic acid, L-Cysteine, L-Valine
B) D-alpha-Aminoadipic acid, L-Cysteine, D-Valine
C) L-alpha-Aminoadipic acid, D-Cysteine, L-Valine
D) L-alpha-Aminoadipic acid, L-Cysteine, L-Valine

10. Which of the product is synthesized with the simultaneous involvement of two microbial strains (Plus and Minus)

A) Monosodium glutamate
B) Glutamic acid
C) Beta-Carotene
D) Vitamin B_{12}

11. Coagulation of milk is an important step in the production of Cheese. Coagulum is formed by the degradation of which type of casein.

A) Kappa
B) Beta
C) Alpha
D) Epsilon

12. One of the important SCPs is *Spirulina maxima*. For its biomass production, the source of Carbon as nutrient is

A) CO_2
B) Whey
C) Molasses
D) Rice straw

13. Which of the following molecule does not have enzymatic activity

A) Streptokinase
B) Urokinase
C) Tissue plasminogen activator
D) Nonase

14. For the synthesis of Riboflavin from GTP as the staring material, the sequence of enzymes is

A) Cyclohydrolase, Reductase, Deaminase, and Synthase
B) Cyclohydrolase, Deaminase, Reductase and Synthase
C) Oxidase, Deaminase, Reductase and Synthase
D) Oxygenase, Deaminase, Reductase and Synthase

15. What type of bonds in Starch are cleaved by Glucoamylase (EC 3.2.1.3)

A) Alpha 1,4 and alpha 1,6
B) Beta 1,4 and beta 1,6
C) Alpha 1,4 and beta 1,6
D) Beta 1,4 and alpha 1,6

16. Vanillin can be synthesized from Capsaicin using following enzymes

A) Pen G Acylase and Vanillyl alcohol oxidase
B) Pen G Acylase and Vanillyl alcohol reductase
C) Capinase and Vanillyl alcohol oxidase
D) Capinase and Vanillyl alcohol reducatse

17. Tick the most appropriate statement

A) Secondary Metabolites arise from majority of precursors from Primary Metabolites

B) Secondary Metabolites arise from limited number of precursors from Primary Metabolites
C) Secondary Metabolites arise from only 2-Carbon Primary Metabolites
D) Secondary Metabolites arise from only 6-Carbon Primary Metabolites

18. Indigo dye used for coloring jeans can be synthesized from Tryptophan using following enzymes:
A) Glycinase and Xylene oxidase
B) Tryptophanase and Phenol oxidase
C) Glycinase and Indi oxidase
D) Tryptophanase and Xylene oxidase

19. Which of the following bacteria is the most crucial for sustenance of life on Earth
A) Nitrogen fixing bacteria B) Carbon fixing bacteria,
C) Phosphorus fixing bacteria D) ATP generating bacteria

20. Which of the following organism has fastest speed of movement.
A) *Mycobacterium tuberculosis* B) *Escherichia coli*
C) Man D) Leopard

21. Shine-Dalgarno sequence is
A) Found in 23S rRNA, that binds to purine rich sequence in mRNA
B) Found in 16S rRNA, that binds to pyrimidine rich sequence in mRNA
C) Found in 5SrRNA, that binds to pyrimidine rich sequence in mRNA
D) Found in 28S rRNA, that binds to purine rich sequence in mRNA

22. Type II Restriction endonucleases are enzymes that
A) Recognize specific sequences, cleave DNA within or near recognized DNA sequence and require Mg^{2+} as a cofactor
B) Restrict/destroy the endonucleases present in cytoplasm
C) Remove the bases from the ends of a linear DNA molecule to produce blunt ends; means to allow ligation of two DNA molecules
D) Degrade ssRNA genome of retroviruses

23. A 1500bp DNA can code for _____ amino acid long polypeptide chain.
A) 300 B) 333 C) 500 D) 433

24. Most common modification found in nucleotide bases of DNA
A) O-glycosylation B) Methylation
C) Sulfation D) Nitrosylation

25. RNA is chemically _____reactive as compared to DNA due to_____
A) More, presence of extra hydroxyl group
B) Less, presence of extra hydrogen atom
C) More, presence of extra nitrosyl
D) Less, presence of benzene ring

26. β_2 microglobulin is associated with

A) MHC I B) MHC II C) TCR D) IgG

27. *Clostridium difficile*is often associated with

A) Antibiotic-associated diarrhoea B) Tetanus
C) Endocarditis D) Catheterinfections

28. If a microbial pathogen inhibits the expression of MHC-I on the surface of infected cells, the binding of which of the following receptors will be inhibited?

A) CD 4 B) CD 8 C) CD 16 D) CD 32

29. Which of the following diseases is an intoxication and not infection?

A) Staphylococcal food poisoning B) Tetanus
C) Shigellosis D) Diphtheria

30. A germline B lymphocyte possesses 250 distinct V region genes, 4 J region genes and 2 isotypic options for assortment of its light chain. How many distinct idiotypes can be produced when this sequence combines with one heavy chain?

A) 2000 B) 500 C) 8 D) 1000

31. Bacillary dysentery is commonly caused by

A) *Clostridium* spp. B) *Salmonella* spp.
C) *Entamoeba histolytica* D) *Shigella* spp.

32. Phagocytosis involves all these steps except

A) Cytoskeletal rearrangements B) Binding of TCR-CD3
C) Oxidative killing D) Recognition of PAMPs

33. Which of the following cells does not exhibit antibody-dependent cell-mediated cytotoxicity?

A) B cells B) NK cells C) Macrophages D) Neutrophils

34. Administration of anti-tetanus serum is an example of _____ immunity

A) Natural, passive B) Natural, active
C) Artificial, passive D) Artificial, active

35. Rheumatic fever is an autoimmune disease associated with _____ antigens

A) Staphylococcal cell wall B) Mycobacterial cell wall
C) Fungal cell wall D) Streptococcal cell wall

36. Which of the following microbes is an obligate intracellular parasite?

A) *Mycobacteriumleprae* B) *Mycobacterium tuberculosis*
C) *Shigellaflexneri* D) *Clostridiumperfringens*

37. The only carbohydrate which is not having any chiral carbon atom is

A) Glyceraldehyde B) Erythose

C) Dihydroxyacetone D) Erythrulose

38. Histones are rich in
A) Lysine B) Alanine
C) Histidine D) Lysine and Arginine

39. Which of the following methods would be most appropriate for sterilizing an antibiotics solution?
A) Dry heat sterilization B) Microfiltration
C) Autoclaving D) Desiccation

40. The reserved food materials of green algae is
A) Laminaria B) Chrysolaminaria
C) Floridian starch D) Starch

41. The magnitude of BOD of wastewater is related to
A) Bacterial count B) Amount of organic materials
C) Amount of inorganic materials D) Fungal count

42. Which were the investigators live at the same times
A) Koch and Pasteur B) Darwin and Woese
C) Van Leeuwenhoek and Ricketts D) Berg and Hooke

43. Yeasts cells are good source of
A) Vitamins A and B B) Vitamins A and D
C) Vitamins B and D D) Vitamins A and C

44. The floating and drifting microbes are called
A) Zooplanktons B) Benthos
C) Planktons D) Limnos

45. The major carrier of Salmonellosis are
A) Meat and eggs B) Meat and fish
C) Eggs and fruits D) Eggs and fruits

46. In which year "The Biological Diversity Act" was enacted in India
A) 2004 B) 2002 C) 2005 D) 2016

47. Which of the following is not a type of copyright work?
A) Engine Design B) Musical Work
C) Literary D) Art

48. The term for patent protection under Indian Patent Act is:
A) 15 Years B) 60 Years C) 20 Years D) 35 Years

49. What prominent amendment was made in The Patent Act, in 2005
A) Parallel importation
B) Establishment of appellate board
C) Simplification of procedures
D) Product patent for inventions in all fields of technology

50. Which of the following category does not fall under industrial property rights
A) Patents B) Trademarks
C) Trade secrets D) Copyrights

Microbiology

1. Histozoic are the organisms residing in

A) Colon
B) Blood
C) Tissues
D) Small Intestine

2. India was declared polio free country in

A) 2013
B) 2015
C) 2011
D) 2014

3. Microparasites are

A) Algae
B) Fungi
C) Protozoa
D) Insects

4. Protozoa belong to kingdom

A) Animalia
B) Protista
C) Monera
D) Plantae

5. The parasite eradicated from India is

A) Medinaworm
B) Hookworm
C) Threadworm
D) Pinworm

6. GRAS stands for

A) Generally regarded as safe
B) Generally required safe
C) Generally registered as safe
D) Generally recognized as safe

7. Probiotics are generally

A) Yeast
B) Streptococci
C) Enterobacter
D) Lactic acid bacteria

8. HSC represents

A) Human stem cells
B) Haemopoietic stem cells
C) Haem stem cells
D) Human secretory cells

9. Class I MHC molecules are expressed in

A) Antigen presenting cells
B) Nucleated cells
C) B cells
D) T cells

10. Respiratory bursts is a

A) Biochemical mechanism
B) Microbicidal mechanism
C) Physiological mechanism
D) Pathogenic mechanism

11. Emil Von Behring got nobel prize for his research work in

A) Anaphylaxis C) Antitoxins

B) Toxins D) Antibodies

12. Multiple Sclerosis occurs due to

A) Hypersensitivity C) Autoimmune disorder

B) Sedentary life D) Malnutrition

13. Urease is the potent enzyme produced by

A) Campylobacter C) Helicobacter

B) Escherichia D) Enterobacter

14. Late lactose fermenters are deficient in enzyme

A) β galactosidase C) β galactopermease

B) β galactosidase permease D) β galactoglucopermease

15. Toxoid is a

A) Polysaccharide C) Proteinaceous compound

B) Glycoprotein D) Glycolipid

16. ISCOM is a

A) Protein antigen + Quil A C) Protein antigen + detergent

B) Protein antigen + Quil A + detergent D) Protein antigen + detergent + MF 59

17. Cider Vinegar is produced from

A) Molasses C) Apple juice

B) Wheat D) Barley

18. Enzyme saccharase acts on

A) Saccharin C) Sucrose

B) Maltose D) Fructose

19. Kefir is produced by

A) Lactic acid bacteria (LAB) C) LAB + yeast

B) Yeast D) Bifidobacteria

20. Curing is the process of preservation of meat by

A) Refrigeration C) Salts

B) Lyophilization D) Salts + refrigeration

21. Eukaryotic mRNAs are

A) Polycistronic C) Monocistronic

B) Tricistronic D) Bicistronic

22. In homofermentative process, the end product is always

A) Lactic acid + ethanol
B) Lactic acid + water + carbon dioxide
C) Lactic acid alone
D) Lactic acid + traces of other products

23. Genetic material in viruses may be

A) RNA
B) DNA
C) RNA and DNA
D) RNA or DNA

24. Ribosome 55s is found in

A) Eukaryotes
B) Prokaryotes
C) Mitochondria of vertebrates
D) Mitochondria in golgi bodies of eukaryotes

25. mRNA of prokaryotes are

A) Stable and long shelf life
B) Stable and polycistronic
C) Unstable and polycistronic
D) Stable and short shelf life

26. RNA polymerase I is located in

A) Nucleoplasm
B) Cytoplasm
C) Nucleolus
D) Nuclear membrane

27. Autoclave and porcelain filters were discovered by

A) Robert Koch
B) Charles Chamberlain
C) T Needham
D) Elie Metchnikoff

28. Importance of microorganisms in carbon and nitrogen cycle was discussed by

A) Louis Pasteur
B) Lister
C) Beijerinck
D) S N Winogradsky

29. In bioterrorism, the most lethal organism is

A) Yersinia
B) Vibrio
C) Bacillus
D) Varicella

30. World Health Day is celebrated every year in the month of

A) 7^{th} January
B) 7^{th} June
C) 7^{th} March
D) 7^{th} April

31. 16s rRNA has classified microbes into three domain and is given by

A) Carl Woese
B) Olsen
C) Holben
D) Car Louis

32. Second edition of Bergey's Manual of systematic bacteriology has

A) Four volumes
C) Three volumes
B) Five volumes
D) Six volumes

33. Genetic material in TMV is

A) ssDNA
C) dsRNA
B) dsDNA
D) ssRNA

34. Intermediate host for filaria is

A) Rat
C) Human
B) Culex
D) Anopheles

35. Fastest moving parasite is

A) Giardia
C) Trichomonas
B) Paramaecium
D) Trypanosome

36. Malaria is caused by

A) Tachyzoites
C) Sporozoites
B) Gametocytes
D) Merozoites

37. Saprozoic microorganism takes

A) Solid foods
C) Semi solid foods
B) Soluble foods
D) Solid and liquid foods

38. Amoebic cyst are formed in

A) Tissues
C) Soil
B) Colon
D) Ileum

39. The antibodies that crosses placental barriers is

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

40. IgM is most effective antibody in neutralizing viruses because of its

A) High valency
C) Half life
B) High amount
D) Avidity

41. CDC stands for

A) Centre for Disease Control & prevention
B) Centre for Disease Control & protection
C) Centre for Disease control & Progress
D) Centre for Disease control & Program

42. Smallpox is eradicated even then virus is preserved in

A) Baltimore, USA
C) Rockfellar Institute, USA
B) Atlanta, USA
D) Texas University, USA

43. Peritrichous flagella is present in

A) *E. coli*
C) *Pseudomonas*
B) *Vibrio cholera*
D) *Clostridium*

44. Dienes phenomena is exhibited by

A) *Klebsiella*
C) *Proteus*
B) *Escherichia*
D) *Serratia*

45. Among different species of *Klebsiella* , which species is indole producing

A) *K. pneumonae*
C) *K. oxytoca*
B) *K. aerogenes*
D) *K. ozaenae*

46. Capsule of *Klebsiella* can be seen with

A) Simple staining
C) Zeil Neilson staining
B) Gram staining
D) Negative staining

47. Red/pink colonies are seen due to production of pigment by

A) *E. coli*
C) *Salmonella*
B) *Shigella*
D) *Serratia*

48. Pure culture concept was introduced by

A) Lister
C) Louis Pasteur
B) Robert Koch
D) John Tyndall

49. Black centered colonies are observed on DCA by

A) *Shigella*
C) *Salmonella*
B) *Proteus*
D) *Serratia*

50. Mission Indradhanush was launched on

A) 25th December 2014
C) 25th December 2013
B) 25th December 2016
D) 25th December 2012

x-x-x