Anthropology (1068)

1. Mutation as a theory of evolution was proposed by:
A) Hugo de Vries B) Dobzhansky C) Darwin D) Mendel

2. Neo-Darwinism is also known as:
A) Mendelian theory B) Catastrophism
C) Synthetic theory of evolution D) None of these

3. In India, Dryopithecus fossil primate was discovered from:
A) Nasik B) SaraiNahar C) Bhimbetka D) Siwalik Hills

4. The strongest support to organic evolution comes from the study of
A) Fossils B) Comparative anatomy
C) Embryology D) Taxonomy

5. The theory of Lamarck is based on:
A) Inheritance of acquired characters B) Natural selection
C) Isolation D) Mutation

6. Who amongst the following has written the book *'The Descent of Man'*[7]
A) Charles Darwin B) Louis Dollo
C) Dr Robert Broom D) Raymond Dart

7. The driving force of natural selection is
A) Mutation B) Variation C) Genetic drift D) Natural selection

8. During mitosis the chromosomes begin to separate in_____stage.
A) Metaphase B) Anaphase C) Prophase D) Telophase

9. A gamete cell containing a single genome is known as_____;___.
A) Haploid B) Triploid C) Tetraploid D) Polyploid

10. A complete set of chromosomes and nuclear genes carried by an individual is called its_____.
A) Genome B) Gene amplification
C) Genetic code D) Gene

11. The ability of a gene to express itself phenotypically is called _____.
A) Expressivity B) Penetrance C) Reversion D) Lethality

12. The youngest phenomenon under the stratigraphy method is represented by
A) Lowest layer B) Topmost layer C) Middle layer D) None of these

13. The Pleistocene is an epoch which forms a part of the_____.
A) Tertiary period B) Quaternary period
C) Primary period D) None of these

14. Villafranchian flora and fauna on land include the ancestors of modern
A) Cow B) Elephant C) Horse D) All of these

15. The periods of high rainfall are called _____.
A) Glaciation B) Pluviation C) Interglaciation D) Interpluviation

16. Man started practicing agriculture in the _____ period.
A) Neolithic B) Chalcolithic C) Iron D) Mesolithic

17. Megaliths are:
A) Large stones B) Memorial stones or tomb
C) A special monument D) Artistic rock sculpture

18. The earliest cultural phase of Holocene is:
A) Mesolithic B) Neolithic C) Chalcolithic D) Iron age

19. Mesolithic Age succeeds:
A) Upper Palaeolithic B) Neolithic
C) Chalcolithic D) Iron Age

20. A genotype consisting of two identical genes for a given character is said to be:
A) Dominant B) Homozygous C) Recessive D) Heterozygous

21. Diastema is present on the;
A) Tooth B) Femur C) Fibula D) Dental arch

22. S.S- Sarkarin 1961 divided the Indian population into__ethnic elements.
A) 7 B) 6 C) 8 D) 5

23. The first well-preserved fossil of the Australopithecine group was first discovered by Raymond Dart from:
A) Taung, South Africa B) Kimber 197, South Africa
C) Tuscany, Italy D)Siwalik, India

24. The evolution of man from ape-like creature to *Homo sapiens* was large accomplished in:
A) Holocene B) Pleistocene C) Pliocene D) Miocene

25. In mammals red blood corpuscles are:
A) Not present B) Nucleated circular discs
C) Non-nucleated circular discs D) None of these

26. The term 'folk society' was first used by:
A) Malinowski B) Robert Redfield C)Tylor D) Milton Singer

27. The term 'part society' for peasant society was first stated by: -
A) Kroeber B) George Foster C) Robert Redfield D) None of these

28. Who among the following is associated with Neo-evolutionism?
A) Margaret Mead B) Leslie A. White C) R. Linton D) E. B.Tylor

29. Among the following, who has been associated with studies on culture and personality?

A) Robert Redfield B) Eric Wolf C) R. Linton D) A.L. Kroeber

30. A rule according to which a couple after marriage goes to reside with the family of the husband's maternal uncle is known as _____ residence.
A) Ambilocal B) Neolocal C) Amitalocal D) Avunculocal

31. _____ is a matrilineal society found in India.
A) Gonds of Madnya Pradesh B) Kadars of Malabar forest in South India
C) Khasis of Meghalaya D) Todas of South India

32. Marriage of one man with a woman and her several sisters is called;
A) Pratiloma B) Sororal polygyny C) Polyandry D) Levirate

33. Marriage within the caste is called:
A) Endogamy B) Incest rule C) Endogamy D) Hypergamy

34. Ego-centric groups are called:
A) Kindred B) Lineages C) Clans D) Phratries

35. Who gave the idea of classificatory and descriptive types of kinship terminology?
A) E.B. Tylor B) L.H. Morgan C) W.H.R. Rivers D) Frazer

36. Unilineal kin groups are characterized by:
A) Their size B) Their utility during emergency situations
C) Their amorphous character D) Their corporate character

37. Which amongst the following is considered as property in simple societies?
A) Land B) Tools and implements
C) Cattle D) All of these

38. Who amongst the following held the view that division of labour in modern societies is the principal source of social cohesion or social solidarity?
A) Auguste Comte B) Max Weber
C) Emile Durkheim D) Herbert Spencer

39. In the absence of law, defined in terms of central authority, courts and constables, which of the following help in maintaining social order in simple societies?
A) Folkways B) Customary Rules C) Mores D) All of these

40. A fundamental concept of social science, defined as the ability to make others act as per one's own will or desire, is known as:
A) Authority B) Dispute C) Power D) None of these

41. A very simple, least complex system, found among hunters and gatherers, with reciprocity as the dominant economic pattern, no concept of private ownership of resources, egalitarian with no differentiation of wealth or power, are termed as:
A) Bands B) Tribes C) Chiefdoms D) Peasants

42. Who amongst the following gave the theory of Animism?
A) Robertson Smith B) E. B. Tylor C) R.R. Marrett D) Emile Durkheim

43. _____ was picked from the Polynesian tribal usage carrying a similar meaning in them and is related to the theory known as Animalism.
A) Fetishism B) Mana C) Taboo D) Magic

44. Haimendorf did his major work in:
A) Central India B) South India C) North India D) North-East India

45. Which of the following refers to the movement of individuals or groups between different levels of the social hierarchy?
A) Social change B) Social gathering C) Social mixing D) Social mobility

46. Functionalism is:
A) A study of cause-and-effect relationships
B) A study of the inter-relatedness of the parts of a whole
C) A holistic study conceptualising the whole only
D) None of these

47. *Jajmani* system indicates a set of
A) Contractual relations B) Political relations
C) Marital relations D) Economic relations

48. Which amongst the following is a corporate group?
A) A youth organisation B) Members of a political party
C) A neighbourhood group D) Joint family

49. Who first differentiated between 'social structure' and 'social organisation'?
A) Raymond Firth B) A.R. Radeliffe-Brown
C) Claude Levi-Strauss D) E. Evans-Pritchard

50. Which of the following is not an essential characteristic of a social group?
A) Physical proximity B) Common interest
C) Group norms D) A sense of belongingness

x-x-x

Bio-Chemistry(1068)

1. Similarities in the structure and function of two proteins indicate that they are members of a family that share a common ancestor. If they are from different species, they are called-

A) Homologs
B) Paralogs
C) Orthologs
D) Proteologs

2. Which of the following statements about the active site of an enzyme is correct?

A) It binds the substrate of the reaction it catalyses more tightly than it does the transition state intermediate.
B) It binds the substrate of the reaction it catalyses less tightly than it does the transition state intermediate.
C) It binds the product of the reaction it catalyses more tightly than it does the transition state intermediate.
D) It is complementary to the substrate of the reaction it catalyses.

3. Which of the following statements about isoeletric focusing is correct?

A) Proteins separated by isoelectric focusing cannot be tested for biological activity.
B) Proteins separated by isoelectric focusing can be tested for biological activity
C) The separation of proteins by isoelectric focusing is only based on charge.
D) The separation of proteins by isoelectric focusing is only based on size.

4. Which of the following statements about membrane fluidity is correct?

A) Membrane fluidity is increased when there is a high proportion of *trans* unsaturated fatty acids in the glycerophosphate molecules that make up the bilayer.
B) Membrane fluidity is decreased when there is a high proportion of *cis* unsaturated fatty acids in the glycerophosphate molecules that make up the bilayer.
C) Membrane fluidity is increased when there is a high proportion of *cis* unsaturated fatty acids in the glycerophosphate molecules that make up the bilayer.
D) Membrane fluidity is increased when there is a high proportion of saturated fatty acids in the glycerophosphate molecules that make up the bilayer.

5. Insulin and glucagon are two major hormones that regulate carbohydrate metabolism. Which of the following statements correctly explains their action ?

A) During the post-absorptive phase, high insulin levels mediate glucose uptake in muscles.
B) During emergency situations muscle uses its glycogen stores to increase blood glucose levels.
C) During the post-absorptive phase, high glucagon levels mediate glucose uptake in muscles.
D) During the post-absorptive phase, high insulin levels mediate glucose uptake in the liver.

6. Which of the following statements about the enzyme lactate dehydrogenase is correct?

A) Lactate dehydrogenase catalyses the oxidation of pyruvate to lactate to regenerate NAD^+.
B) Lactate dehydrogenase ensures mitochondrial NADH is oxidised
C) Lactate dehydrogenase catalyses the reduction of pyruvate to lactate to regenerate NADH.
D) Lactate dehydrogenase catalyses the reduction of pyruvate to lactate to regenerate NAD^+.

7. During fatty acid synthesis, acetyl groups are transported from the mitochondrion to the cytosol as-

A) Citrate
B) Malonyl CoA.
C) Acetyl CoA
D) Acetylcarnitine

8. Which of the following reasons does not apply for conversion of proto-oncogene to oncogene ?

A) Mutation in coding sequence
B) Gene amplification
C) Mutation in non-coding sequence
D) chromosome rearrangement

9. Which of the following method is extensively used for obtaining pluripotent stem cells for somatic cell gene therapy?

A) Dispersal and culture of cells from morula
B) Collection of stem cells from adult tissues and their culture under specific conditions
C) Isolation and culture of inner cell mass of a blastocyst
D) Collection and culture of primordial germ cells from a fetus

10. In an α-helical polypeptide, the backbone Hydrogen bonds are between-

A) NH of n and CO of n+4 amino acid
B) NH of n and CO of n+3 amino acid
C) CO of n and NH of n+3 amino acid
D) CO of n and NH of n+4 amino acid

11. Proofreading activity of DNA polymerase III corrects errors during replication by recognizing incorrect bases at-

A) 3'end of growing chain and removing these by 3'-5' exonuclease activity
B) 5'end of growing chain and removing these by 3'-5' exonuclease activity
C) 3'end of growing chain and removing these by 5'-3' exonuclease activity
D) 5'end of growing chain and removing these by 5'-3' exonuclease activity

12. Cystic fibrosis is a disease which is caused by a mutation in cystic fibrosis transmembrane conductance regulator(CFTR). CFTR is involved in the transport of which of the following ions-

A) Calcium B) Bicarbonate
C) Chloride D) Phosphate

13. The regulation of transcription allows a bacterial cells to adapt to a changing environment. Which of the subunits of RNA polymerase is the regulatory subunit?

A) Alpha B) Sigma
C) Beta D) Both beta and sigma

14. Collagen, an important extracellular matrix protein, requires post translational hydroxylation for strengthening its triple helix structure. Which of the vitamin is required for this essential hydroxylation reaction ?

A) Vitamin C B) Thiamine C) Vitamin E D) Biotin

15. What is the smallest number of molecules of ATP and GTP consumed in the synthesis of a 50 residue peptide chain, starting from precursor amino acids. Assume that hydrolysis of PPi is equivalent to the hydrolysis of ATP for this calculation.

A) 50 ATPs, 100GTPs B) 100 ATPs, 99 GTPs
C) 100 ATPs, 100 GTPs D) 100 ATPs, 200 GTPs

16. Which one of the following methods is most suitable for monitoring the alterations in the levels of a serum protein using an antibody ?

A) Fluorescence activated cell sorting
B) Immunofluorescence microscopy
C) Western blotting
D) Enzyme linked Immunosorbent Assay

17. Lectins are used to identify the blood type in a clinical setting. Which motif does it recognize and bind?

A) Carbohydrates B) Proteins
C) Lipids D) Nucleic acids

18. Which one of the following combinations must be present in a steroid receptor that is located in the cytoplasm?

A) Nuclear export sequence, leucine zipper
B) Nuclear localisation sequence, leucine zipper
C) Nuclear export sequence, Zinc finger motif
D) Nuclear localization sequence, Zinc finger motif

19. What is the function of p53 which prevents the development of cancer?

A) It is a transcription factor.
B) It prevents the replication of cells with damaged DNA.
C) It helps in maintenance of telomere length.
D) It prevents cells from triggering apoptosis.

20. Which of the following signals is not coupled to G protein related signal transduction pathway ?

A) Insulin B) Glucagon
C) Epinephrine D) Oxytocin

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

A) 64 B) 1,28,000
C) Approximately 1 million D) Approximately 1 billion

22. In an experiment to identify the post-translational modification of a protein, following experimental data was obtained.

1. Protein move more slowly in an SDS PAGE.
2. Isoelectric focusing showed no change in pI.
3. Mass spectrometry analysis showed that the modification occurred on Serine residue. The modification that protein undergoes is likely to be-

A) Phosphorylation B) Glycosylation
C) Ubiquitination D) ADP- ribosylation

23. Which of the following class of antibodies is involved in Type I hypersensitivity reaction?

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

24. A deletion of three consecutive bases in the coding region of a gene cannot result in-

A) Deletion of a single amino acid without any change in the protein
B) Replacement of a single amino acid without any change in protein function
C) Replacement of a single amino acid by another without any other alteration in the sequence of a protein
D) Production of a truncated protein

25. Which of the following enzymes does not require a primer:

A) DNA dependent RNA polymerase B) RNA dependent DNA polymerase
C) DNA dependent DNA polymerase D) Taq DNA polymerase

26. Zn is an essential cofactor for :

A) Transaminases B) Superoxide dismutase
C) Pyruvate dehydrogenase D) Glutamate dehydrogenase

27. Citrate has a positive allostearic effect on which one of the following-

A) Pyruvate kinase B) Acetyl CoA carboxylase
C) Phosphofructokinase D) Fatty acid synthase

28. The human genome project began as researchers mapped ------ and sites of cytogenetic abnormalities-

A) RFLPs B) VNTRs
C) PCRs D) Lods

29. The catalytic efficiency of two enzymes can be compared by-

A) Molecular size of the enzymes B) Their optimum pH
C) Formation of product D) Km value

30. Which of the following statements about the competitive inhibition of an enzyme-catalyzed reaction is correct?

A) A competitive inhibitor and substrate can bind simultaneously to the enzyme.
B) The V_{max} and K_m (Michaelis constant) for a reaction are unchanged in the presence of a competitive inhibitor.
C) The V_{max} for a reaction remains unchanged in the presence of a competitive inhibitor.
D) The K_m for a reaction remains unchanged in the presence of a competitive inhibitor

31. Which of the following statements about Western Blotting is correct?

A) The detection of a particular protein by Western Blotting relies on the very specific interaction between the protein and its antibody.
B) The detection of a particular protein by Western Blotting relies on labelling the protein with a specific dye.
C) The detection of a particular protein by Western Blotting relies on labelling the antibody with a specific dye.
D) The detection of a particular protein by Western Blotting relies on the denaturation of the protein.

32. Which of the following statements about the mechanism of the Na^+/K^+ pump is correct?

A) The Na^+/K^+ ATPase uses energy to pump Na^+ outside the cell and K^+ inside.
B) The Na^+/K^+ ATPase uses energy to pump Na^+ inside the cell and K^+ outside.
C) The Na^+/K^+ ATPase uses energy to bind both Na^+ and K^+ in turn.
D) The phosphorylation of the Na^+/K^+ ATPase does not change its conformation.

33. Which of the following statements about food storage in the body is correct?

A) More glycogen is stored per unit mass in the muscles than in the liver.
B) Glycogen storage in the liver is unlimited.
C) Fat is a more efficient form of fuel storage than glycogen.
D) Proteins in muscle cells are a normal storage form of fuel.

34. Which of the following statements about prostaglandins is NOT correct?

A) Prostaglandins are eicosanoids made from unsaturated fatty acids.
B) Prostaglandins are eicosanoids made from saturated fatty acids.
C) Prostaglandins synthesized from arachidonic acid have a pain-relieving effect.
D) Prostaglandins synthesized from arachidonic acid have a fever-reducing effect.

35. A protein has one Tryptophan and two Tyrosine residues. What would be the molar concentration of the protein if its absorbance at 280nm is 1.6 { Extinction coefficient of Trp residue is $5000 M^{-1}cm^{-1}$ and for Tyr- $1500\ M^{-1}cm^{-1}$}.

A) 0.2mM B) 2mM C) 1.6mM D) 3.2mM

36. Koshland's theory of enzyme action is called-

A) Lock and key theory B) Enzyme coenzyme theory
C) Zymogen theory D) Induced fit theory

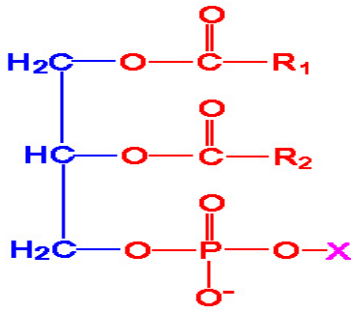
37. Following are the steps in DNA fingerprinting –

i) Hybridisation with probe
ii) Isolation of DNA
iii) Digestion of DNA with restriction endonucleases
iv) Detection by autoradiography
v) Separation of DNA fragments by electrophoresis
vi) Transferring the fragments to synthetic membrane

Which is the correct order of the steps-

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

38. Following is the general structure of a glycerophospholipid. What is the common name of the phospholipid if X is replaced by choline-



A) Cardiolipin B) Cephalins
C) Lecithin D) Plasmalogen

39. Phenylketonuria occurs due to deficiency of the enzyme:

A) Tyrosine hydroxylase B) Phenylalanine hydroxylase
C) Tyrosinase D) Homogentisate oxidase

40. Which of the following would have high content of triglycerides?

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

41. You have to determine the amino acid sequence of a peptide. You perform the following steps using enzyme cleavage of your peptide (see table below):

Step 1: Treatment with trypsin yields three fragments with the following sequences (in the order of their length): Trp-Gly-Ala , Ala-Gly-Thr-Lys, Tyr-Leu-Asp-Arg.

Step 2: Treatment with chymotrypsin gave the following three peptide fragments: Gly-Ala, Leu-Asp-Arg-Trp, Ala-Gly-Thr-Lys-Tyr. What is the sequence of your peptide?

A) Ala-Gly-Thr-Lys-Tyr- Leu-Asp-Arg-Trp- Gly-Ala

B) Gly-Ala- Leu-Asp-Arg-Trp- Ala-Gly-Thr-Lys-Tyr
C) Trp-Gly-Ala- Ala-Gly-Thr-Lys-Tyr-Leu-Asp-Arg
D) Tyr-Leu-Asp-Arg- Ala-Gly-Thr-Lys- Trp-Gly-Ala

42. Tumor cells have a higher requirement for glutamine. Which out of the following is NOT an appropriate reason for this metabolic pattern?
A) Serve as a precursor for urea synthesis
B) Serve as a source of energy production via conversion to Glutamate
C) Act as a source of N in purine and pyrimidine synthesis
D) Serve as a biosynthetic precursor for amino acids

43. The first reaction in the degradation of the majority of amino acids involves the participation of which of the following enzymes-
A) NAD+ B) Pyridoxal phosphate
C) Thiamine pyrophosphate D) FAD

44. A 25 year old man undertakes a prolonged fast for religious reasons. Which of the following metabolites will be elevated in his blood plasma after 24 hrs?
A) Glucose B) Glycogen
C) Ketone bodies D) Non esterified fatty acids

45. Allopurinol, a drug for the treatment of Gout, is a--------- inhibitor of xanthine oxidase.
A) Non-competitive B) Uncompetitive
C) Competitive D) Allostearic

46. Which of the following features of mature mRNA is thought to protect it against degradation?
A) 3' Poly C tail
B) Lariat structure
C) Special Post translational modifications
D) 5'-methyl Guanosine Cap

47. Select the one FALSE statement.
A) Chaperones often exhibit ATPase activity.
B) Protein disulfide isomerase anf peptidyl prolyl isomerase are involved in proper folding of proteins.
C) Ubiquitin is a small protein involved in protein degradation by lysosomes.
D) Mitochondria contain chaperones.

48. Phase II reaction of xenobiotic metabolism include all of the following except-
A) Hydroxylation B) Glucuronidation
C) Sulfation D) Methylation

49. Which of the following statements do not apply to Puromycin?
A) It is a structural analog of tyrosinyl tRNA.

B) It is incorporated via the A site on ribosome.
C) It inhibits both eukaryotic and prokaryotic translation.
D) It inhibits only prokaryotic translation.

50. Which of the following groups of enzymes are unique to the Calvin cycle?
A) Ribulose bisphosphate carboxylase, phosphoribulokinase, and sedoheptulose 1,7-bisphosphatase
B) Ribose 5-phosphate isomerase,epimerase, and aldolas
C) Pyruvate kinase, Pyruvate carboxylase, Phosphofructokinase
D) glyceraldehyde-3- phosphate dehydrogenase, Pyruvate kinase, Phosphoenolcarboxykinase

x-x-x

BioPhysics(1068)

1. Transition temperature of membrane bilayer is dependent on
- A) Presence of internal proteins
- B) Presence of transmembrane proteins
- C) Degree to which the fatty acyl chains of the phospholipids are unsaturated
- D) Protein to lipid ratio

2. How many signals does the aldehyde $(CH_3)_3CCH_2CHO$ have in ^1H NMR and ^{13}C NMR?
- A) Five ^1H signals and six ^{13}C signals.
- B) Three ^1H signals and four ^{13}C signals.
- C) Five ^1H signals and four ^{13}C signals.
- D) Three ^1H signals and six ^{13}C signals.

3. ELISA stands for
- A) Enzyme-Linked Immuno Sorbent Assay
- B) Enzyme Immunoassay
- C) Enzyme-Lagged Immuno Sorbent Assay
- D) Enzyme-Linked Immuno Solution Assay

4. Fluorescence recovery after photo bleaching in live cells is used to determine
- A) Co-localization of proteins.
- B) Distance between two organelles
- C) Diffusion of proteins
- D) Nucleic acid compactness

5. Circular Dichromism spectroscopy is primarily used for
- A) Primary structure determination in proteins
- B) Primary structure determination in DNA
- C) Secondary structure determination in proteins
- D) Primary structure determination in lipids

6. The absorption coefficient of 511 keV gamma rays depends on the :
- A) Nature of the medium only
- B) Density of the medium only
- C) Path travelled in the medium
- D) Intensity of the gamma rays

7. In the helium-neon laser, which of the following is not true?
- A) The laser transition occurs in helium atom
- B) The purpose of the helium atom is to help achieve a population inversion in the neon atoms
- C) There is stimulated emission as well as spontaneous emission in the Neon atoms
- D) The metastable state occur in both the Helium and Neon atoms.

8. A nanosecond is :
- A) 10^{-6} sec
- B) 10^{-3} sec
- C) 10^{-12} sec
- D) 10^{-9} sec

9. Device that converts one form of signal into another form is called:

A) Transformer B) Transducer C) Amplifier D) Condenser

10. Intrinsic rhythm of heart is maintained by
A) SA node B) AV node C) Internodal fibres D) Purkinje fibres

11. The bond between first phosphate group attached to sugar molecule in a nucleotide is
A) Phosphoester B) Phosphodiester
C) Glycosidic D) Phosphoanhydride

12. In a 3_{10} helical polypeptide, the backbone hydrogen bonds are between
A) NH of n and CO of n+4 amino acid
B) CO of n and NH of n+3 amino acid
C) CO of n and NH of n+4 amino acid
D) NH of n and CO of n+3 amino acid

13. In electron microscope, as compare to filament, the potential on shield is always
A) Positive B) Negative C) Zero D) Random

14. HEPES buffer is used in :
A) Animal tissue culture medium B) Plant tissue culture medium
C) Bacterial nutrient medium D) Yeast nutrient medium

15. Frequency range of alpha rhythm in normal EEG
A) 8-13 Hz B) 18-30 Hz C) 1-3.5 Hz D) 4-7 Hz

16. The sedimentation velocity of a protein in a centrifuge does not depend on the :
A) Density of solution B) Density of protein
C) Charge on protein D) Shape of protein

17. Which of the following amino acids is not the part of glutathione?
A) Glutamate B) Cysteine C) Glutamine D) Glycine

18. For macromolecules, a model refined to an R factor less than ……. indicates a good fit
A) 35% B) 25% C) 15% D) 20%

19. Which of the following facts will distinguish whether a cell is prokaryotic or eukaryotic?
A) The presence or absence of a rigid cell wall
B) The presence or absence of internal membranes partitioning the cells
C) The presence or absence of Ribosomes
D) The presence or absence of DNA as the Genetic material

20. The first protein to be sequenced is :
A) Insulin B) Myosin C) Myoglobin D) Haemoglobin

21. Lipids are synthesized in:
A) Smooth endoplasmic reticulum B) Rough endoplasmic reticulum

C) Golgi complex D) None of these

22. Antibodies are produced by:
A) T-cells B) NK-cells
C) Plasma cells D) B-cells

23. Genetically programmed cell death is called
A) Apoptosis B) Necrosis
C) Phagocytosis D) All of these

24. Which one of the following is not a type of connective tissue?
A) Blood B) Lymph C) Adipose tissue D) Muscle

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

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

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

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

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

30. Isoelectric focusing can be used to determine:
A) Molecular weight of a protein
B) The subunit conformation of a multimeric protein
C) The pH at which a protein is Zwitterion
D) The amino acid sequence of a protein

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

32. The first bioinformatics database was created by
A) Pearson B) Richard Durbin
C) Michael J. Dunn D) Dayhoff

33. Extraction of 99mTc-MAG3 is by:

A) Active transport B) Glomerular filtration
C) Tubular secretion D) Facilitated diffusion

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

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

36. Mucous, sweat, oil, and salivary glands are all ……..
A) Exocrine glands B) Endocrine glands
C) Paracrine glands D) Psedocrine glands

37. What is the rotational symmetry of a square
A) 360° B) 180° (C) 90° D) 45°

38. Name the snail shaped organ in the inner ear which is responsible for hearing
A) Vestibule B) Stapes C) Incus D) Cochlea

39. Which one of the following is a microwave generator
A) Cyclotron B) Magnetron C) DC Generator D) Alextron

40. ClustalW is a method that is used for:
A) Pairwise sequence alignment B) Homology Modeling
C) Multiple Sequence Alignment D) Introduction of gap penalty

41. In the 10-20 lead system in an EEG the number of electrodes applied are:
A) 19 B) 20 C) 21 D) 22

42. 50:50 mixture of L and D enantiomers rotate the plane of polarized light by:
A) 90° B) 180° C) 270° D) 0°

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

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

45. Nissl body originates from
A) Rough Endoplasmic Reticulum B) Cytoplasm
C) Plasma Membrane D) Vacuole

46. MHC stands for
A) Major Histocompatibility complex B) Minor Histocompatibility complex

C) Major Hypersensitivity complex D) Minor Hypersensitivity complex

47. Absorption of light in the ultraviolet region is because of the :

A) Electronic transitions only B) Vibrational level transitions only
C) Rotational level transitions only D) Rotational and the vibrational transitions.

48. The normal glomerular filtration rate is close to:

A) 25 ml/min B) 50 ml/min C) 100 ml/min D) 125 ml/min

49. The power supply is used to perform gel electrophoresis because it:

A) Converts AC to DC B) Converts DC to AC
C) Converts AC to high power AC D) Does not affect current

50. S phase of cell cycle deals with:

A) Cell division B) Cell arrest
C) Duplication of DNA D) DNA repair

x-x-x

BioTechnology(1068)

1. In intrinsic pathway of apoptosis

A) Bcl2 inhibits apoptosis while Bax simulates apoptosis
B) Bcl2 stimulates apoptosis while Bax inhibits apoptosis
C) Both Bcl2 and Bax inhibits apoptosis
D) Both Bcl2 and Bax stimulates apoptosis

2. The antagonistic action to adenylate cyclase is shown by

A) cAMP B) ATP
C) Protein kinase D) Phosphodiesterase

3. While creating a knockout mouse using homologous recombination, why a viral thymidine kinase gene is included in the vector outside of the region of homology between the targeted chromosome and vector? It allows

A) Negative selection of cells where target sequence got integrated by homologous recombination
B) Negative selection of cells where target sequence got integrated randomly
C) Positive selection of cells where target sequence got integrated by homologous recombination
D) Positive selection of cells where target sequence got integrated randomly

4. In PCR reaction one should not go for more than about 30 amplification cycles because

A) Taq polymerase has a half-life of 30 min at $95^{o}C$
B) dNTPs got denatured
C) dNTPs get exhausted
D) Primers get exhausted

5. Real time PCR is a method used for

A) Qualitative amplification of DNA
B) Qualitative amplification of RNA
C) Quantitative analysis of mRNA expression
D) Qualitative analysis of mRNA expression

6. Canning of vegetables and fruits is a

A) Heat process B) Cold process
C) Irradiation process D) Microwave process

7. The mother and father of Rajesh (male child) and Ritu (female child) have normal vision. Both maternal and paternal grand fathers of Rajesh were colour blind. What is the probability of getting colour blindness in case of Ritu?

A) 100% B) 50%

C) 25% D) 0%

8. Down syndrome is a diseases caused due to

A) Nondisjunction of chromosome B) Linkage

C) Crossing over D) Sex linked inheritance

9. The best wavelength associated with UV spectroscopy is

A) 1nm -400µm B) 190nm-1nm

C) 380nm-190nm D) 750nm-380nm

10. Proteins are separated by SDS page on the basis of

A) Change B) pI

C) Shape D) Size

11. Fluorosecnt spectroscopy utilizes the presence of intrinsic fluorescence by

A) Tyrosine B) Phenylalanine

C) Tryptophan D) Alanine

12. MTT assay is a colorimetric assay for assessing cell metabolic activity. It is based on the ability of cellular oxidoreductase enzymes

A) To oxidize the tetrazolium dye formazan to its insoluble form MTT

B) To reduce the tetrazolium dye formazan to its insoluble form MTT

C) To oxidize the tetrazolium dye MTT to its insoluble formazan

D) To reduce the tetrazolium dye MTT to its insoluble formazan

13. iTRAQ is

A) An isobaric labeling method used in quantitative proteomics

B) An isobaric labeling method used in quanlitative proteomics

C) Method for quantitative analysis of gene expression

D) Method for qualitative analysis of gene expression

14. Genomic imprinting is

A) Genes are incorrectly silenced due to DNA methylation, resulted in altered phenotypes

B) Only one of a pair of genes is expressed, the other being methylated and silenced

C) DNA methylation patterns in a genome are passed on to the next generation

D) DNA methylation is altered allowing for genes to be expressed that should be silenced

15. Which one is not a gene expression database

A) Bodymap B) GeneBank

C) SeedGenes D) Flyview

16. A unique small segment/cDNA of an active gene is known as

A) ESTs B) SNPs
C) Contigs D) hnRNA

17. Structural genomics is

A) DNA sequencing followed by gene annotation
B) DNA sequencing followed by genome annotation
C) DNA sequencing followed by protein annotation
D) RNA sequencing followed by gene annotation

18. The question that can be answered using subtractive hybridization?

A) What genes are required for basic cellular functions?
B) What genes are expressed by the tissue?
C) What genes are expressed in stem but not in root?
D) What genes are expressed in both stem and root ?

19. A protein is coded by 366 nucleotides including start and stop codons. What will be the length of peptide?

A) 120 B) 121 C) 122 D) 366

20. What is the complementary sequence of 5' ATGCCGTCGAAGC 3' ?

A) 5' ATGCCGTCGAAGC 3' B) 3' ATGCCGTCGAAGC 5'
C) 5' TACGGCAGCTTCG 3' D) 3' TACGGCAGCTTCG 5'

21. pUC plasmid has N-terminus 146 aminoacids of β-galactosidase.. What is the rationale behind this?

A) For replication of plasmid
B) For screening of *E. coli* having plasmid
C) For screening of *E. coli* having plasmid with insert
D) For proper ligation of gene

22. A continuous bioreactor in which only the flow rate is used to control the rate of cell or products productivity is called

A) Chemostat B) Physicostat
C) pH stat D) Temperature

23. In yeast two hybrid system a reporter gene is

A) Always GFP
B) Fused with activation domain of transcription factor
C) Expressed only when interaction of tested protein occurs

D) Expressed only when tested protein are not interacting

24. phred score is

A) Is a measure of the quality of the identification of the nucleobases generated by automated DNA sequencing
B) Is a measure of the quality of PCR product in real time PCR
C) Is a measure of the quantity of PCR product in real time PCR
D) Is a measure of the quantity of the identification of the nucleobases generated by automated DNA sequencing

25. Which one is not a remedy for property rights infringement?

A) Profit accounting B) Specific performance
C) Damages D) Injunction

26. Registration of certification mark can be done in

A) DBT B) Trademark Registry
C) Certification Board D) MHRD

27. A graft between members of different species is known as

A) Allograft B) Xenograft
C) Autograft D) Isograft

28. In monoclonal antibody production by hybridoma technology

A) B cell and myeloma cells is fused
B) B cell lacking HGPRT and myeloma cells is fused
C) B cell and myeloma cells lacking HGPRT is fused
D) B cell and myeloma cells lacking HGPRT and producing antibody is fused

29. QTL

A) Determines quality of a loci
B) Determines quantity of a loci
C) Is a section of DNA (the locus) which correlates with variation in a phenotype
D) Is a section of DNA (the locus) which correlates with variation in a genotype

30. Bromodomain recognizes

A) Methylated lysine residues
B) Acetylated lysine residues
C) Phosphorylated lysine residues
D) Ubiqutinated lysine residues

31. In Crysper-cas9 system, crisper sequence is recognized by

A) Messenger RNA B) Transfer RNA
C) Ribosomal RNA D) Guide RNA

32. A competitive inhibitor :

A) Increases both Km and Vmax
B) Decreases both Km and Vmax
C) Decreases Vmax
D) Increases Km without affecting Vmax

33. RNA interference (RNAi) or Post-Transcriptional Gene Silencing (PTGS) is a conserved biological response to

A) double-stranded RNA
B) DNA- RNA hybrid
C) Methylated double stranded DNA
D) Single stranded DNA

34. Reversed phase HPLC utilizes

A) A hydrophobic stationary phase and a polar mobile phase
B) A hydrophobic stationary phase and a non-polar mobile phase
C) A hydrophilic stationary phase and a non-polar mobile phase
D) A hydrophilic stationary phase and a polar mobile phase

35. The model organism widely used for genetic studies

A) *Neurospora*
B) *Drosophila melanogaster*
C) *Danio rerio*
D) *Bacillus subtilis*

36. A protein domain is

A) The α-helical portion of a protein
B) the β-pleated sheet portion of a protein
C) An independent region of polypeptide chain having self-contained three-dimensional structure
D) A globular proteins

37. BOD is a measure of :

A) Extent to which water is polluted with organic compounds
B) Carbon monoxide inseparably combined with haemoglobin
C) Wastes poured into water bodies
D) Amount of oxygen needed by green plants during day

38. Artificial seeds are

A) Seeds produced in lab conditions
B) Seeds encapsulated in a gel
C) Somatic embryos encapsulated in a gel
D) Zygotic embryos encapsulated in a gel

39. An esterase has been purified from inclusion bodies in the presence of urea. The protein has been refolded by serial dilution method. Which technique can be used to determine if protein has been refolded properly?

A) NMR
B) Spectrophotometric analysis
C) SDS-PAGE
D) CD spectroscopy

40. High levels of mRNA for the enzymes of the *E. coli* lac operon will be synthesized in presence of

A) High glucose, high lactose
B) No glucose, high lactose
C) Low glucose, low lactose
D) High glucose, low lactose

41. The heat inactivation of serum in animal cell culture is carried out?

A) To inactivate complement system
B) To activate growth hormones
C) To inactivate any bacteria present
D) To remove unwanted proteins

42. The hnRNA of a gene is 8800 ribonucleotide long. The mature mRNA is 2172 ribonucleotide long. This size difference is due to the

A) Splicing
B) Deletion
C) Cleavage of RNA
D) Removal of tail

43. A gene for protein X was cloned in pET28a vector followed by transformation in DH5α *E. coli* strain. Upon induction with IPTG, expression of gene was not observed. The problem in expression is due to the

A) Codon biasing
B) Very Strong promoter
C) Degradation of expressed protein
D) Host selection

44. The resonance in protein structure is responsible for:

A) The partial double bond character of the side chain-alpha carbon bond
B) The prevention of rotation about the alpha carbon
C) The planar nature of the peptide bond
D) The ability of cochlear cells to detect sound waves by mechanotransduction

45. Assuming Hardy-Weinberg equilibrium, the genoypte frequency of heterozygotes, if the frequency of the two alleles at the gene being studied are 0.6 and 0.4, will be:

A) 0.80
B) 0.64
C) 0.48
D) 0.32

46. GRAIL algorithm is used for searching genes in DNA sequence

A) Neural network
B) Wide network

C) Rule based system D) Hidden markov model

47. Very long DNA can be separated by
A) Acrylamide gel electrophoresis
B) Agarose gel electrophoresis
C) Paper chromatography
D) Pulse field gel electrophoresis

48. One of the first reports of transgenic animals involved in transfer of growth hormone gene fused to the promoter for the
A) T7 B) T5
C) Mettalothionine D) GST

49. The term "prey" is associated with
A) AD hybrid B) DBD hybrid
C) Yeast hybrid D) Reverse two hybrid

50. Which type of biosafety facility is required to work with HIV?
A) BSL0 B) BSL1
C) BSL2 D) BSL3

x-x-x

Botany (1068)

1. Which of the following is not an extinct member of pteridophytes?

A) *Lepidodendron* B) *Sphenophyllum*
C) *Phylloglossum* D) *Calamites*

2. Which of the following terms is used for the harvestable growth of ecosystem?

A) Biomass B) Primary productivity
C) Ecological yield D) Standing crop

3. Which of the following is commonly known as "Skeleton fern"?

A) *Tmesipteris elongate* B) *Pteris pedatum*
C) *Psilotum nudum* D) *Hymenophyllum denticulatum*

4. Spores of the fern plants germinate to form…….

A) Embryo B) Prothallus C) Protonema D) Zygospore

5. Category III of IUCN Protected Area pertains to the……..

A) Natural Monument B) National Park
C) Wilderness Area D) Strict Nature Reserve

6. Which of the following best describes the concept of a metapopulation?

A) A population in an urban area
B) A population of different species living in the same geographic area at the same time
C) A population that has become spatially subdivided
D) A network of distinct and non-interacting species

7. Which of the following terms is used for the populations showing reversible phenotypic variations induced upon environmental gradient?

A) Ecotype B) Ecophene C) Ecotope D) Ecotone

8. Leaves are involved in the vegetative reproduction in which of the following plants?

A) *Solanum nigrum* B) *Brassica campestris*
C) *Bryophyllum daigremontianum* D) *Opuntia articulata*

9. The only natural habitat of the endangered Manipur Brow-Antlered deer is……..

A) Keibul Lamjao National Park B) Keoladeo National Park
C) Great Himalayan National Park D) Kudremukh National Park

10. Golden rice is a genetically modified variety of rice that contains a gene from …….
A) Sunflower B) Lotus C) Daffodil D) Marigold

11. Recombinant DNA was first developed in the year…….
A) 1974 B) 1973 C) 1972 D) 1971

12. Caryopsis is the fruit in family……
A) Asteraceae B) Chenopodicaeae C) Poaceae D) Apiaceae

13. Which of the following is an example of drupe?
A) Avocado B) Buttercup C) Olive D) Pear

14. Which of the following was the theme of the International Day of Forests 2018?
A) Forests and Sustainable Cities B) Forests and Energy
C) Forests and Water D) Forests | Climate | Change

15. Chemically, ephedrine is a/an…….
A) Saponin B) Polyphenol C) Alkaloid D) Diterpene

16. Rattans are the type of ……..
A) Climbing Pines B) Climbing Palms
C) Climbing Ferns D) Woody Ferns

17. Which of the following is true about bird-pollinated plants?
A) Plants tend to have red flowers and are rarely scented
B) Plants tend to have red flowers and are always scented
C) Plants tend to have blue flowers and are always scented
D) Plants tend to have blue flowers and are rarely scented

18. The change in allele frequency from one generation to the next is known as……

A) Gene flow B) Genetic drift C) Gene transfer D) Gene migration

19. The term *gene* was coined by

A) C.H. Morgan B) Hugo de Vries
C) William Bateson D) Wilhelm Johannsen

20. Which of the following terms is used for the hard and porous cell wall of diatoms?

A) Frustule B) Lorica
C) Extra cellular matrix D) Coccolith

21. India's seed vault for protecting the seeds especially of crops is located at……

A) Kaza (Lahaul and Spiti) B) Kalpa (Kinnaur)
C) Chang La (Ladakh) D) Kargil (Ladakh)

22. Bull Kelp is the common name of ……..

A) *Laminaria hyperborean* B) *Durvillaea antarctica*
C) *Ascophyllum nodosum* D) *Macrocystis pyrifera*

23. Which of the following is not a C4 plant?

A) Maize B) Barley C) Sugarcane D) Sorghum

24. Drooping junipers are the characteristic trees of ……..

A) Littoral and Swamp forests B) Moist tropical forests
C) Alpine forests D) Sub-tropical forests

25. Which of the following members of oomycetes is used as a biocontrol agent?

A) *Pythium oligandrum* B) *Saprolegnia mixta*
C) *Aphanomyces euteiches* D) *Plasmopara viticola*

26. Which of the following green algae is responsible for causing the phenomenon of watermelon snow?

A) *Chlorella vulgaris* B) *Chlamydomonas nivalis*
C) *Volvox aureus* D) *Chara elegans*

27. *Die natürlichen Pflanzenfamilien* is related to…….

A) Bentham and Hooker B) Engler and Prantl

C) Takhtajan D) Hutchinson

28. Which of the following is an example of leafy liverwort?

A) *Porella* B) *Riccia* C) *Nothoceros* D) *Marchantia*

29. Which of the following contains inverted cortical vascular bundles?

A) Sunflower B) *Nyctanthes* C) *Boerhavia* D) *Bougainvillea*

30. Replum is found in the ovary of……..

A) Mustard B) Sunflower C) Petunia D) Pea

31. Which of the following species of *Amanita* is commonly known as "Death Cap"?

A) *Amanita bisporigera* B) *Amanita ocreata*

C) *Amanita phalloides* D) *Amanita verna*

32. Which of the following diseases of potato is associated with the famines that occurred in Europe in 1840s?

A) Potato Scab B) Late Blight of Potato

C) Early Blight of Potato D) Brown Rot of Potato

33. Which of the following viroids was the first to be identified?

A) Avocado Sun Blotch Viroid B) Eggplant Latent Viroid

C) Potato Spindle Tuber Viroid D) Peach Latent Mosaic Viroid

34. Who among the following is known as the father of taxonomy?

A) de Candolle B) Linnaeus C) Mayr D) Theophrastus

35. Which of the following is the botanical name of Ajwain?

A) *Cuminum cyminum* B) *Ferula communis*

C) *Foeniculum vulgare* D) *Trachyspermum ammi*

36. Amber is a type of ……

A) Fossilized tree resin B) Inflorescence

C) Fruit D) Woody climber

37. Which of the following parts of clove is used as flavouring material?

A) Dried leaves B) Dried seeds C) Floral buds D) Young fruits

38. A mutation that changes a codon specifying a different amino acid to one of the stop codons is known as…..

A) Leaky mutation B) Nonsense mutation

C) Missense mutation D) Null mutation

39. Fuelgen reaction is a specific test to check the presence of……..

A) RNA B) Proteins C) Fats D) DNA

40. Which of the following refers to the recognition site in promoter region of a *lac* operon?

A) Pribnow box B) TATA box C) CRP box D) Cga box

41. Which of the following amino acids is aromatic in nature?

A) Tryptophan B) Glycine C) Glutamic acid D) Alanine

42. Cyclic photophosphorylation involves

A) Both PS I and PS II B) Either PS I or PS II

C) PS II only D) PS I only

43. Which of the following is true about Nastic movements?

A) Non-directional only

B) Reversible only

C) Both reversible and non-directional

D) Neither reversible nor non-directional

44. Which of the following is the symbol for net reproductive rate?

A) R_0 B) l_x C) λ D) m_x

45. Type I error in statistical hypothesis testing is also known as……

A) Standard error B) False neutral

C) False negative D) False positive

46. Which of the following is the full form of DOI – a serial code for electronic documents?

A) Digital Object Index B) Digital Object Identifier

C) Data Operating Indicator D) Data object Identifier

47. Sulphur shower relates to……

A) *Pinus* B) *Picea* C) *Abies* D) *Ginkgo*

48. Fern *Acrostichum aureum* is well adapted to .....

A) Salt marshes B) Heathlands

C) Open exposed areas D) Xerophytic conditions

49. Long fibre of cotton seed is known as…….

A) Coir B) Fuzz C) Flax D) Lint

50. Medicinally important Ginseng, a slow growing perennial plant belongs to which of the following genera?

A) *Panicum* B) *Pandanus* C) *Panax* D) *Papaver*

x-x-x

Chemistry(1068)

1. The rotational spectrum of a rigid diatomic rotor consists of equally spaced lines with spacing equal to:
A) 2B B) 3B/2 C)B/2 D)B

2. Consider an endothermic reaction A ⟶ B with E_b and E_f as activation energies for the backward and forward reactions respectively, then:
A) $E_b > E_f$
B) $E_b < E_f$
C) $E_b = E_f$
D) There is no definite relation between E_b and E_f

3. For a cyclic process:
A) Both $\Delta U=0$ and $\Delta H=0$ B) $\Delta H=0$
C) $\Delta U=0$ D) $\Delta U=0$ and $\Delta H\neq 0$

4. 'It is only the radiation actually absorbed by the reacting system that is effective in producing a chemical reaction'.
A) Lambert law B) Grothus-Draper Law
C) Lambert-Beer law D) Einstein-Stark Law

5. The temperature at which the average speed of H_2 equal that of O_2 at 320 K:
A) 10K B) 20K C) 30K D)40K

6. The second lower state of particle in a cubic box is:
A) Non-degenerate B) Doubly degenerate
C) Six fold degenerate D) Triply degenerate

7. In polarography:
A) $E_{1/2}$ varies with concentration B) $E_{1/2}$ is always zero
C) Migration current is not suppressed D) Diffusion current varies with concentration

8. The correct point group for SF_6 is:
A) O_h B)T_d C) D_{6h} D) C_{2h}

9. The crystal system of a compound with unit cell dimensions a=0.387, b=0.387, c= 0.504 nm and $\alpha=\beta= 90^0$ and $\gamma=120^0$ is:
A) Cubic B) Orthorhombic C) Rhombohedral D) Hexagonal

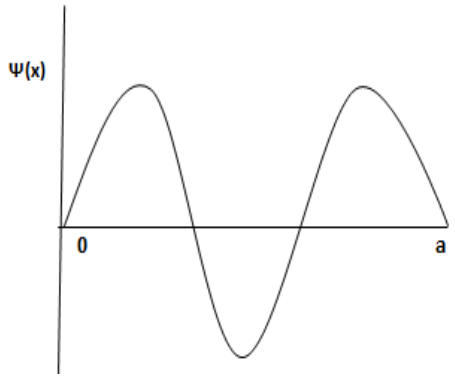
10. For an aqueous solution at 25°C, the Debye-Huckel limiting law is given by:
A) $\log\gamma_{\pm} = 0.509|Z_+Z_-|\sqrt{\mu}$ B) $\log\gamma_{\pm} = 0.509|Z_+Z_-|\mu^2$
C) $\log\gamma_{\pm} = -0.509|Z_+Z_-|\sqrt{\mu}$ D) $\log\gamma_{\pm} = 0.509|Z_+Z_-|\mu^{\pm}$

11. The standard electrode potential E^0 at a fixed temperature and in a given medium is dependent on

A) Only the electrode composition
B) The electrode composition and the extent of the reaction
C) The extent of the electrode reaction only
D) The electrode reaction and the electrode composition

12. A wave function (ψ) is not acceptable when:
A) When first derivative of ψ is continuous B) When ψ is single valued
C) When ψ is infinite D) When ψ vanish at infinite

13.



The given wave function graph in one-dimensional box of length, a, corresponds to energy equal to (where, m is mass of particle):
A) $3h^2/8ma^2$ B) $2h^2/8ma$ C) $9h^2/8ma^2$ D) $2h/8ma^2$

14. Soap essentially form a colloidal solution in water and remove the greasy matter by:
A) Coagulation B) Emulsification C) Adsorption D) Absorption

15. The lowest allowed energy is equal to zero for
A) The hydrogen atom B) A rigid rotor
C) A harmonic oscillator D) A particle in a 3-dimentional box

16. At high altitudes, the boiling point of water gets lowered because
A) Temperature is low B) Atmospheric pressure is low
C) Atmospheric pressure is high D) High vapour pressure

17. The cell constant of a conductivity cell:
A) Changes with change of electrolyte
B) Changes with temperature of electrolyte
C) Remains constant for a cell
D) Changes with change of concentration of electrolyte

18. Among the following the one which is EPR active is:
A) $Ni(CO)_4$ B) $[Cu(C_2O_4)]^{2-}$ C) $Mo(CO)_6$ D) $[Co(NH_3)_5Cl]^{2+}$

19. Generally octahedral clusters are formed by:

A) Se, Y, La B) Zn, Cd, Hg C) Mo, Nb, Ta D) Mo, Nb, Tl

20. Cerium oxide containing special variety glass, which cuts off ultraviolet rays, is known as:
A) Crookes glass B) Jena glass C) Flint glass D) Pyrex glass

21. The ion that gets readily hydrolysed is:
A) Dy B) Nd C) Eu D) Er

22. Which is thermodynamically unstable and also kinetically labile?
A) $[Co(H_2O)_6]^{3+}$ B) $[Co(H_2O)_6]^{2+}$ C) $[Co(NH_3)_6]^{3+}$ D) $[Co(NH_3)_6]^{2+}$

23. d-p mixing occurs in:
A) Tetrahedral complexes only B) Octahedral complexes only
C) Complexes with no centre of symmetry D) Complexes with centre of symmetry

24. Which transition metal is present in carbonic anhydrase?
A) Cobalt B) Nickel C) Zinc D) Manganese

25. Magnetic moment of Cr (Z=24), Mn^+ (Z=25) and Fe^{2+} (Z=26) are x, y, z. They are in the order
A) $x < y < z$ B) $z < x = y$ C) $x = y = z$ D) $x = y < z$

26. Which of the following is the first chemical compound of the noble gases?
A) $Xe[PtF_6]$ B) $Rn[PtF_6]$ C) $Ar[PtF_6]$ D) $Kr[PtF_6]$

27. Cold solution of barium nitrite on mixing with sulphuric acid produces:
A) $BaSO_4 + NO_2$ B) $BaSO_4 + HNO_3$
C) $BaSO_4 + HNO_2$ D) $BaSO_4 + N_2 + O_2$

28. Nitric oxide is paramagnetic in:
A) Gaseous state B) Liquid state C) Solid state D) Polymeric state

29. The styx code for diborane is:
A) 2020 B) 2200 C) 2002 D) 0220

30. Microcosmic salt when heated strongly, a transparent bead is formed which is used in identification of:
A) ZnO B) Al_2O_3 C) Fe_2O_3 D) SiO_2

31. Which has the least molar solubility in H_2O?
A) LiCl B) NaCl C) KCl D) CsCl

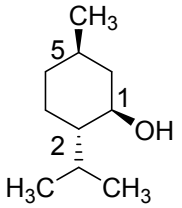
32. The shape of $XeOF_5^-$ ion is:
A) Octahedral B) Distorted octahedral
C) Pentagonal pyramidal D) Pentagonal bipyramidal

33. From molecular orbital configuration of CO and NO^+, we would predict:
A) Both have a Bond order of 3
B) Both are paramagnetic
C) Both will readily lose an electron to form CO^+ or NO^{2+}
D) Both CO and NO^+ should not exist

34. Among the following diatomic molecules, which one will show EPR signal?
A) Li_2 B) B_2 C) C_2 D) N_2

35. What is the main factor on which chemical shift depends in Mossbauer spectra?
A) Electron density B) Transition energy
C) Intensity of light D) All of these

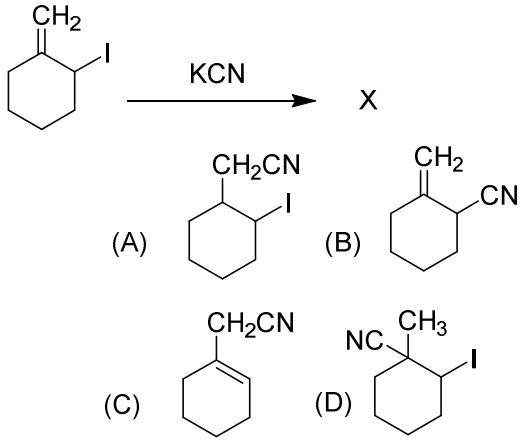
36. Assign R / S configuration at C-1, C-2 and C-5 in the following compounds.



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

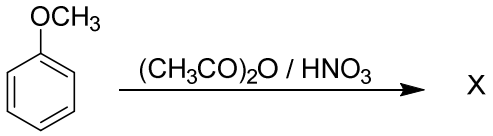
37. Singlet and triplet carbene can be distinguish by reaction with :
A) Cyclobutane B) cis-Butene C) iso-Butane D) n-Butane

38. Predict the product X of the following reaction:



39. The major product formed by reaction of benzene withy isobutyl alcohol in presence of con.H_2SO_4 is:
A) *sec*.-Butyl benzene B) *n*-Butyl benzene
C) *iso*-Butyl benzene D) *tert*.-Butyl benzene

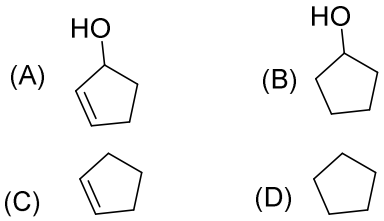
40. The major product X in the following reaction is:



A) o-Nitro anisole
B) p-Nitroanisole
C) m-Nitroanisole
D) p-Nitro phenyl acetate

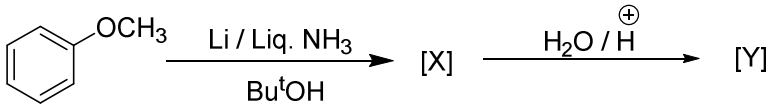
41. Elimination addition mechanism of aromatic nucleophilic substitution involves the intermediacy of:
A) Carbanion B) Carbocation C) Free radical D) Benzyne

42. Reduction of cyclopene-2-ene-1-one with sodium borohydride in methanol and $CeCl_3$ results in formation of:



43. The best reagent for conversion of 1-butene to 1-butanol is:
A) H_2O / H_2SO_4
B) H_2O_2
C) $Hg(OAc)_2$ / $NaBH_4$
D) B_2H_6 / H_2O_2 -NaOH

44. Product Y in the following sequence of reaction is:



A) Cyclohexanol
B) Cyclohexanone
C) Cyclohex-2-ene-1-one
D) Cyclohex-3-ene-1-one

45. Which of aldehyde will not response to Cannizarro reaction:

A) Bezaldehyde
B) Fomaldehyde
C) Trimethyl acetaldehydel
D) Phenyl acetaldehyde

46. Base catalyzed condensation of two molecules of ester result in formation of:
A) α-Keto ester
B) β-Keto ester
C) γ-Keto ester
D) α-diketone

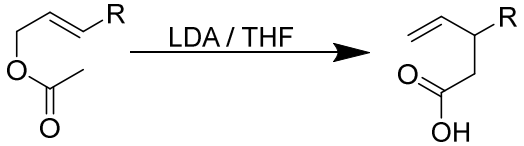
47. The selective reagent for selective oxidation of primary alcohol to aldehyde is:
A) CrO_3 /H_2SO_4
B) CrO_3 /Pyridine
C) MnO_2
D) DMSO-$(COCl)_2$ / Et_3N

48. How many products are possible in case of free radical bromination of 1-butene ?
A) 1 B) 3 C) 2 D) 4

49. Relative intensity of M^+, M^++2 and M^++4 peaks in mass spectra of 1,3-dibromopropane is:

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

50. The following reaction is an example of:



A) [1,3]sigmatropic shift B) [4,3]sigmatropic shift

C) [2,3]sigmatropic shift D) [3,3]sigmatropic shift

x-x-x

Environment Studies (1068)

1. With reference to organic farming, which of the following has become India's first fully organic state?
A) Assam B) Arunachal C) Gujarat D) Sikkim

2. Noise level of 50 dB corresponds to sound intensity of
A) 10^{-5} Wm^{-2} B) 10^{-7} Wm^{-2} C) 10^{-3} Wm^{-2} D) 10^{-9} Wm^{-2}

3. Which of the following is an eco-friendly food preservative, acts as a disinfectant and is a tropical grass which is considered as a sacred material in Vedic scriptures?
A) Bamboo B) Darbha C) Lemon D) Bermuda

4. Consider the following statements:

1. Thermal power plants are major contributors of fly ash.

2. ESP's are used to capture fly ash.

3. Flyash bricks are low in strength but eco-friendly.

Which of the statements given above is/are correct?

A) Only 1 B) Only 2 C) 1 & 2 D) 1, 2 &3

5. The local people, in a particular region in India, train the roots of living trees into robust bridges across the streams. As These unique 'living root bridges' are found in
A) Himachal Pradesh B) Jharkhand C) Meghalaya D) Tamil Nadu

6. 'Bio Carbon Fund Initiative for Sustainable Forest Landscapes' is managed by the
A) World Bank
B) Asian Development Bank
C) International Monetary Fund
D) United Nations Environment Programme

7. Which one of the following is the best description of the term 'ecosystem'?
A) A community of organisms interacting with one another.
B) A community of organisms together with the environment in which they live
C) That part of the Earth which is inhabited by living organisms.
D) The flora and fauna of a geographical area

8. With reference to bio-toilets used by the Indian Railways, consider the following statements:

1. The decomposition of human waste in the bio-toilets is initiated by fungal inoculums.

2. Ammonia and water vapour are the only end products in this decomposition which are released into the atmosphere.

Which of the statements given above is/are correct?

A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

9. The Genetic Engineering Appraisal Committee is constituted under the
A) Wildlife (Protection) Act, 1972
B) Environment (Protection) Act, 1986
C) Geographical Indications of Goods (Registration and Protection) Act, 1999
D) Food Safety and Standards Act, 2006

10. Consider the following States:

1. Arunachal Pradesh

2. Himachal Pradesh

3. Mizoram

In which of the above States do 'Tropical Wet Evergreen Forests' occur?

A) 1 only B) 1 and 3 only C) 2 and 3 only D) 1, 2 and 3

11. In the Mekong-Ganga Cooperation, an initiative of six countries, which of the following is/are not a participant/ participants?

1. Bangladesh
2. Cambodia
3. China
4. Myanmar
5. Thailand

Select the correct answer using the code given below.

A) 1 only B) 1 and 3 only C) 2, 3 and 4 D) 1, 2 and 5

12. Consider the following statements

1. The winds which blow between 30^{o} N and 60^{o} S latitudes throughout the year are known as Westerlies.

2. The moist air masses that cause winter rains in North-Western region of India are part of westerlies.

Which of the statements given above is/are correct?

A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

13. Tides occur in the oceans and seas due to which among the following?
1. Gravitational force of the Sun

2. Gravitational force of the Moon

3. Centrifugal force of the Earth

Select the correct answer using the code given below.

A) 1 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3

14. "Each day is more or less the same, the morning is clear and bright with a sea breeze; as the Sun climbs high in the sky, heat mounts up, dark clouds form, then rain comes with thunder and lightning. But rain is soon over." Which of the following regions is described in the above passage?

A) Savannah B) Equatorial C) Frigid D) Mediterranean

15. Which one of the following best describes the main objective of 'Seed Village Concept'?

A) Encouraging the farmers to use their own farm seeds and discouraging them to buy the seeds from others
B) Involving the farmers for training in quality seed production and thereby to make available quality seeds to others at appropriate time and affordable cost
C) Earmarking some villages exclusively for the production of certified seeds
D) Identifying the entrepreneurs in village and providing them technology and finance to set up seed companies

16. Which of the following has/have been accorded 'Geographical Indication' status?

1. Banaras Brocades and Sarees

2. Rajasthani Daal-Bati-Churma

3. Tirupathi Laddu

Select the correct answer using the code given below.

A) 1 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3

17. Siderite is an ore of

A) Nickel B) Chromium C) Molybdenum D) Iron

18. Which one of the following pair of States of India indicates the easternmost and westernmost State?

A) Assam and Rajasthan B) Assam and Gujarat
C) Arunachal Pradesh and Rajasthan D) Arunachal Pradesh and Gujarat

19. The primitive atmosphere of earth consisted of

A) CO_2, NO_2, NH_3, SO_2 B) H_2, NH_3, CH_4, H_2O
C) CO, N_2O_3, SO_3, H_3N D) He, Ne, Ar, Kr

20. The sound power from a voice shouting is 0.001 Watt. The sound level in dB is

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

21. Consider the following pairs:

Place of Pilgrimage: Location

1. Srisailam : Nallamalai Hills

2. Omkareshwar : Satmala Hills

3. Pushkar : Mahadeo Hills

Which of the above pairs is/are correctly matched?

A) 1 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3

22. With reference to 'dugong', a mammal found in India, which of the following statements is/are correct?

1. It is herbivorous marine animal.

2. It is found along the entire coast of India.

3. It is given legal protection under Schedule I of the Wildlife (Protection) Act, 1972.

Select the correct answer using the code given below.

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

23. With reference to the use of nano-technology in health sector, which of the following statements is/ are correct?

1. Targeted drug delivery is made possible by nanotechnology.

2. Nanotechnology can largely contribute to gene therapy.

Select the correct answer using the code given below.

A) 1 only B) 2 Only C) Both 1 and 2 D) Neither 1 nor 2

24. Which one of the following is the national aquatic animal of India?

A) Saltwater crocodile B) Olive ridley turtle
C) Gangetic dolphin D) Gharial

25. Which one of the following regions of India has a combination of mangrove forest, evergreen forest and deciduous forest?

A) North Coastal Andhra Pradesh B) South-West Bengal
C) Southern Saurashtra D) Andaman and Nicobar Islands

26. Which one of the following is associated with the issue of control and phasing out of the use of ozone-depleting substances?

A) Montreal Protocol B) Kyoto Protocol

C) Nagoya Protocol D) Bermuda Protocol

27. What is Rio+20 Conference, often mentioned in the news?

A) It is a Conference of the Inter-governmental Panel on Climate Change
B) It is a Conference of the Member Countries of the Convention on Biological Diversity
C) It is the United Nations Conference on Sustainable Development
D) It is a Ministerial Meeting of the World Trade Organization

28. Which of the following statements regarding 'Green Climate Fund' is/are correct?

1. It is intended to assist the developing countries in adaptation and mitigation practices to counter climate change.

2. It is founded under the aegis of UNEP, OECD, Asian Development Bank and World Bank.

Select the correct answer using the code given below.

A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

29. A small amount of UV B radiation is essential for

1. Synthesis of Vitamin D

2. Acts as a germicide

3. Can cause cancer

4. Inhibit metabolism

Which of the statements given above is/are correct?

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

30. Why is a plant called Prosopis juliflora often mentioned in news?

A) Its extract is widely used in cosmetics
B) It tends to reduce the biodiversity in the area in which it grows
C) Its extract is used in the synthesis of pesticides
D) It is used for phyto- remediation

31. Which of the following are the key features of 'National Ganga River Basin Authority (NGRBA)'?

1. River basin is the unit of planning and management.

2. It spearheads the river conservation efforts at the national level.

3. One of the Chief Ministers of the States through which the Ganga flows becomes the Chairman of NGRBA on rotation basis.

Select the correct Answer using the code given below.

A) 1 and 2 only B) 2 and 3 only C) 1 and 3 only D) 1,2 and 3

32. Puga valley, one of the most promising geothermal fields in India is situated in which of the following?

A) Himachal Pradesh B) Jammu & Kashmir
C) Sikkim D) Arunachal Pradesh

33. The Himalayan mountain range is a classic example of which type of plate boundary?

A) Divergent B) Convergent C) Transform D) Translucent

34. Formation of sedimentary chalcopyrite requires

A) High pH High Eh B) High pH Low Eh
C) Low pH Low Eh D) Low pH High Eh

35. What test statistic is used for a global test of significance?

A) F-test B) Z-test C) t- Test D) Chi-Square Test

36. The quantity of water that can be withdrawn annually and also the rate at which this withdrawal could be made without adversely affecting the inventory of the aquifer is called

A) Annual yield B) Percent yield C) Operational yield D) Monthly yield

37. Which of the following is a **false statement regarding the Environment Impact Assessment is?**

A) Schedule I - List of projects requiring EIA
B) Schedule II - Application Forms
C) Schedule III - Procedure for public hearing
D) All of the above

38. The environmental planning is:

A) The analysis of how we can prevent the poaching of environment

B) The analysis of how people impact natural resources
C) The analysis of how we can preserve our biodiversity
D) The supply of management tool to conserve our environment

39. Which of the following best describes/ describe the aim of 'Green India Mission' of the Government of India?

1. Incorporating environment al benefits and costs into the Union and State Budgets thereby implementing the `green accounting'
2. Launching the second green revolution to enhance agricultural output so as to ensure food security to one and all in the future
3. Restoring and enhancing forest cover and responding to climate change by a combination of adaptation and mitigation measures

Select the correct answer using the code given below.

A) 1 only B) 2 and 3 only C) 3 only D) 1, 2 and 3

40. Human activities in the recent past have caused the increased concentration of carbon dioxide in the atmosphere, but a lot of it does not remain in the lower atmosphere because of:

1. Its escape into the outer stratosphere.
2. The photosynthesis by phyto-plankton in the oceans.
3. The trapping of air in the polar ice caps.

Which of the statements given above is/are correct?

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

41. Biomass gasification is considered to be one of the sustainable solutions to the power crisis in India. In this context, which of the following statements is/are correct?

1. Coconut shells, groundnut shells and rice husk can be used in biomass gasification.

2. The combustible gases generated from biomass gasification consist of hydrogen and carbon dioxide only.

3. The combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.

Select the correct answer using the codes given below:

A) 1 only B) 2 and 3 only C) 1 and 3 only D) 1, 2 and 3

42. What is the theme of World Environment day, 2018?

A) Beat Plastic Pollution B) Connecting people to nature
C) Conserve natural resources D) Recycle aluminium

43. Which of the following is 1^0 discontinuity between mantle and core?

A) Mohorovicic B) Gutenberg- Weichert
C) NiFe D) Conrad

44. Red soil is rich in which of the following mineral
A) Magnesium B) Iron C) Phosphorus D) Aluminium

45. The largest ocean on earth is
A) Pacific Ocean B) Atlantic Ocean C) Antarctic Ocean D) Arctic Ocean

46. X ray films are a source of which of the following gas?
A) SO_2 B) CO_2 C) NO_2 D) SO_3

47. Which one of the following is responsible for broncho spasm?
A) SO_3 B) SO_4 C) CO_2 D) SO_2

48. Maximum biological damage is caused by
A) X-Rays B) Gamma – Rays C) Beta- Rays D) Alpha-Rays

49. Green Blocks refers to
A) Bio-bricks B) Pro-biotic curd C) Green Ministry D) Green Cover

50. The noble gas used for the treatment of cancer
A) Argon B) Radon C) Krypton D) Helium

x-x-x

Geology(1068)

1. Liquefaction commonly occurs in an area of
   A) Abandoned mines
   B) Sand and silts
   C) Carbonates
   D) Evaporites

2. Grouting is carried out to
   A) Improve rock strength
   B) Improve building strength
   C) Fill in the reservoir
   D) Empty the reservoir

3. Which one of the following faults is more common in the Himalaya?
   A) Normal
   B) Transform
   C) Strike-slip
   D) Thrust

4. Listric fault is a type of
   A) Strike-slip fault
   B) Normal dip-slip fault
   C) Reverse dip-slip fault
   D) Overthrust fault

5. A dipping formation has a true dip of 70° due North. What will be the amount of apparent dip due N45°W?
   A) 20°
   B) 25°
   C) 30°
   D) 35°

6. Which one of the following cannot be measured using only a clinometers compass?
   A) Strike of a plane
   B) Amount of plunge of a line
   C) Direction of plunge of a line
   D) Pitch of a line

7. Which one of the following stratigraphic units is NOT part of Gondwana formations?
   A) Maleri
   B) Panchmarhi
   C) Patcham
   D) Panchet

8. Which one of the following stratigraphic formations is Eocene in age?
   A) Subathu
   B) Chingi
   C) Nagri
   D) Kasauli

9. Eparchean unconformity divides the geological units of
   A) Archaean from Proterozoic
   B) Proterozoic from Palaeozoic
   C) Late Palaeozoic from Mesozoic
   D) Late Archaean from Early Archaean

10. Which one of the following granites are characterised by riebeckite and arfvedsonite?
   A) Peraluminous
   B) Strongly peraluminous
   C) Strongly peralkaline
   D) Metaluminous

11. Which one of the following is not a lamprophyre?
   A) Polzenite
   B) Vogsite
   C) Spessartine
   D) Minette

12. Name the rock of the upper primitive mantle that undergoes partial melting to generate basaltic rocks.

A) Dunite B) Lherzolite C) Harzburgite D) Wherlite

13. The rare earth elements (REE) pattern of an igneous rock that largely constitutes cumulus plagioclase will show a

A) Positive Eu anomaly B) Negative Eu anomaly

C) Positive Gd anomaly D) Negative Gd anomaly

14. A cohesive and foliated fault rock containing 50-90% matrix is called

A) Protomylonite B) Protocataclasite

C) Mesomylonite D) Mesocataclasite

15. Which one of the following pairs is NOT correctly matched?

A) Hornblende-plagioclase-garnet : Amphibolite facies

B) Hornblende-plagioclase-clinopyroxene : Hornblende-hornfels facies

C) Orthopyroxene-clinopyroxene-plagioclase : Pyroxene-hornfelds facies

D) Pyrope-omphacite-rutile : Eclogite facies

16. The rock in which the calc-silicates are formed as a result of reaction of carbonates and hot, silica-rich waters from the pluton is called

A) Bastite B) Tactite C) Tectonite D) Coronate

17. The fauna *Gigantopithecus-Hystrix-Coelodonta-Tragocerus* characterises

A) Lower Siwaliks B) Upper Siwaliks C) Lower Murrees D) Upper Murrees

18. First land plants appeared in

A) Carboniferous B) Cretaceous C) Devonian D) Silurian

19. Which one of the following depositional environments is indicated by a brachiopod-bearing sandstone?

A) Deep brackish water B) Shallow brackish water

C) Shallow marine D) Deep marine

20. Which one of the following minerals is an oxide in the Mohs scale of hardness?

A) Gypsum B) Topaz C) Corundum D) Apatite

21. When the colour of a mineral is due its chemical composition, it is known as

A) Idiochromatic B) Allochromatic C) Pseudochromatic D) isochromatic

22. Which one of the following pairs is NOT correctly matched?

A) X_2SiO_4 : Olivine

B) $X_3Y_2Si_3O_{12}$: Garnet

C) $X(Al,Si)_2O_8$: Feldspar
D) $X_2Y_3Si_3O_{12}(OH)$: Epidote

23. Which one of the following statements related to uniaxial minerals is NOT correct?
A) They crystallise with monoclinic, orthorhombic or triclinic symmetry
B) The optical indicatrix of an uniaxial mineral is an ellipsoid of rotation
C) If the extraordinary ray is slower, the mineral is said to be optically positive
D) If the extraordinary ray is faster, the mineral is said to be optically negative

24. Change in refractive index with wave length is called
A) Retardation B) Birefringence C) Dispersion D) Optic orientation

25. Prod marks are formed due to
A) Erosion B) Sediment recycling
C) Gravitational settling D) Slumping

26. Which one of the following processes will form chert?
A) Erosion of olivine grains B) Erosion of mica grains
C) Precipitation of dissolved silica D) Precipitation of dissolved clays

27. Sedimentary clasts of the grain size between 0.004 mm and 0.062 mm, are termed as
A) Clay B) Sand C) Silt D) Granule

28. A mud-supported carbonate rock that contains greater than 10% grains is known as
A) Wackestone B) Grainstone C) Packstone D) Mudstone

29. The oldest rock in world is located at
A) Jack Hills B) Itsaq Gneiss Complex
C) Acasta Gneiss Complex D) Nuvvuagittuq Greenstone Complex

30. Dolins are formed in
A) Karst B) Desert C) River D) Playa

31. The age of rocks of ocean floor is usually < 200 Ma because of
A) Ocean-floor metamorphism B) Hydrothermal alteration of oceanic basalts
C) Continuous subduction of oceanic crust D) Occurrence of ophiolites

32. The Eastern Ghat mobile belt is characterised by
A) Backarc sediments B) Forearc sediments
C) Granulites and khondalites D) Tidal to fluvial successions

33. Which one of the following folds can be used to deduce larger structures?
A) Chevron B) Drag C) Piercing D) Supratenous

34. The carbonated-hosted Pb-Zn deposits are associated with

A) Collisional tectonics
B) Back-arc basins
C) Fore-arc basins
D) Rift-related sedimentary basins

35. The Agnigundala lead deposits occur in the rocks of

A) Cuddapah Supergroup
B) Vindhyan Supergroup
C) Dharwar Supergroup
D) Marwar Supergroup

36. Which one of the following mineral deposits is located at Bhavnagar?

A) Dolomite
B) Bentonite
C) China clay
D) Vermiculite

37. Noamundi iron mines are located in

A) Maharashtra
B) Madhya Pradesh
C) Jharkhand
D) Bihar

38. Which one of the following conditions is favourable for the formation of bauxite deposits?

A) There should be maximum rainfall in the area
B) The rocks should be with low permeability
C) The parent rocks should contain K-bearing minerals
D) The area should have short period of tectonic stability

39. Mineral deposit occurring at an alteration of pinches and swells is called

A) Reef
B) Lode
C) Stock
D) Pocket

40. $^{12}_{7}N$ decays to $^{12}_{6}C$ by

A) Alpha decay
B) Negatron decay
C) Positron decay
D) Electron capture

41. Which of the following isotopic methods is best suited to date biotite?

A) Rb-Sr & Sm-Nd
B) K-Ar & Rb-Sr
C) Ar-Ar & Sm-Nd
D) U-Pb and Sm-Nd

42. Which of the following isotopes are radioactive?

A) ^{147}Sm & ^{148}Sm
B) ^{147}Sm & ^{150}Sm
C) ^{148}Sm & ^{150}Sm
D) ^{147}Sm & ^{152}Sm

43. Eötvös correction is necessary if gravity is measured

A) In a moving vehicle
B) In a stationary vehicle
C) Below sea level
D) Above sea level

44. For an oceanic profile, the Bouger anomaly is more strongly

A) Positive at the axis of ridge
B) Positive at distances beyond 1000 km from the ridge
C) Negative at the axis of ridge
D) Negative at distances beyond 1000 km from the ridge

45. What percentage of water on Earth is potable?
A) 20 % B) 78 % C) 8 % D) Less than 1 %

46. What are the three components of hydraulic head?
A) **G**ravitational energy+ Static energy+ Elevation energy
B) Thermal energy + Static energy+ Elevation energy
C) Kinetic energy + Pressure energy + Elevation energy
D) Elastic potential energy+ Pressure energy + Elevation energy

47. The change in the head per unit distance is called
A) Hydraulic gradient B) Hydraulic conductivity
C) Specific yield D) Specific storage

48. What is the maximum permissible level for nitrates in drinking water?
A) 45 ppm B) 45 ppb C) 10 ppm D) 10 ppb

49. The interaction of the electromagnetic radiation produced with a specific wave length to illuminate a target on the terrain for studying its scattered radiance, is called
A) Passive remote sensing B) Active remote sensing
C) Neutral remote sensing D) Normal remote sensing

50. The changes in the reflectivity/emissivity with time, is called
A) Temporal variation B) Temporary variation
C) Spectral variation D) Spatial variation

x-x-x

Home Science(1068)

1. Vegetables are blanched
A) To sterilise them
B) To prevent spoilage
C) To store them
D) To inactivate the enzymes

2. Which one of the following is not a traditional Japanesecostume
A) Tatami B) Kimono C) Zanshi D) Yukata

3. Which is the first order of the development of play amongst children
A) Solitary play B) Dual play C) Parental play D) Peer play

4. Which of the following foods is rich in omega 3 fatty acids
A) Olive oil B) Rice bran oil C) Almonds D) Walnuts

5. The bobbin in a sewing machine is fixed on the
A) Oscillating hook B) Pressure foot C) Feed dog D) Thread lever

6. A gluten free diet is given to patients with
A) Crohn's disease
B) Celiac disease
C) Irritable bowel syndrome
D) Liver disease

7. A kantha embroidery ceremonial bedspread is known as
A) Sujani B) Suber C) Sangli D) Sainchi

8. A situation in which all the participants are involved in the discussion of a problem is known as
A) Symposium B) Debate C) Public speaking D) Brainstorming

9. Releasing pent up emotional energy is
A) Emotional catharsis
B) Emotional breakdown
C) Emotional control
D) Emotional security

10. Sociometry is a tool which measures a child's
A) Knowledge about society
B) Knowledge about sociology

C) Intelligence quotient D) Relationship with peers

11. The addition of black colour to any colour is known as
A) Chroma B) Shade C) Tint D) Colour intensity

12. The limiting amino acid in pulses is
A) Lysine B) Tryptophan C) Methionine D) Arginine

13. Which of the following is a neutral colour
A) Beige B) Red C) Green D) White

14. The human developmental pattern is
A) Non specific B) Predictive C) Haphazard D) Indefinite

15. The Act which governs the consumer disputes redressal forum is
A) Consumer Redressal Act B) Consumer Protection Act
C) Consumer Merchandise Act D) BIS Act

16. Several garments can be finished together by which of the following finishes
A) Firm press B) Buck press C) Die press D) Tunnel press

17. Inner time clock changes refer to
A) Digestion B) Growth C) Maturation D) Learning

18. Concept of Family Resource Management is
A) Attaining goals by optimum use of resources
B) Attaining goals by fulfilling responsibilities
C) Attaining goals by hard work
D) Attaining goals by delegating responsibilities

19. Enuresis is associated with
A) Spitting B) Bed wetting C) Biting D) Mental retardation

20. Lesions at the corners of the mouth occur in deficiency of
A) Vitamin E B) Iron C) Vitamin C D) Vitamin B

21. Right to survival of children is

A) Right to express
B) Right to education
C) Right to entertainment
D) Right to health and nutrition

22. Which of the following is not a principle of textile design
A) Light B) Harmony C) Rhythm D) Balance

23. Which of the following comes under the three tier system of Panchayati Raj
A) Self Help Groups
B) Mahila Mandals
C) Village Panchayats
D) Anganwadis

24. Which of the following principles mean that development takes place from head to toe
A) Proximodistal B) Continuous C) Linear D) Cephalocaudal

25. Tube feeding is also known as
A) Oral nutrition B) Nasal nutrition C) Enteral nutrition D) Parenteral nutrition

26. A bland diet easy to chew and digest is
A) Soft diet B) Semi solid diet C) Fluid diet D) Full fluid diet

27. Which of the following is not a correct layout for garment cutting of unidirectional fabrics
A) Double fold B) Lengthwise fold C) Cross fold D) Open

28. International Literacy day is observed on
A) 8^{th} October B) 8^{th} September C) 7^{th} October D) 7^{th} September

29. The term Golden Rectangle refers to
A) Lines B) Geometric pattern C) Proportion D) Form

30. All chemical reactions occurring in the body are termed as
A) Oxidation B) Catabolism C) Anabolism D) Metabolism

31. The function of EGO is based on
A) Reality principle B) Pleasure principle C) Reflex action D) Dreams

32. Design repeat does not happen in
A) Mirror B) Drop C) Satin D) Rotary

33. HDL is synthesised and secreted from

A) Muscle B) Heart C) Pancreas D) Liver

34. Chi square is applied

A) When the data is in frequencies
B) To check accuracy of data
C) When there are several groups for comparison
D) When the data is qualitative

35. Which is the lowest scale of measurement

A) Interval scale B) Ordinal scale C) Nominal scale D) Ratio scale

36. Food borne intoxication is caused by

A) E. Coli B) Lactobacillus
C) Clostridium botulinum D) Salmonella

37. Which of the following does not promote language development in children

A) Solitary play B) Story telling C) Social interaction D) Peer play

38. The quality of any research can be assessed by

A) The duration of research B) The objectives of research
C) The total expenditure on research D) The title of the research

39. A mentally challenged child who can be educated has an IQ of

A) 0-25 B) 25-50 C) 50-75 D) 75-100

40. Vanaspati is an adulterant in

A) Biscuits B) Milk C) Dhesi Ghee D) Samosas

41. Organisation chart is also known as

A) Management Tree Chart B) Flow Chart
C) Power Chart D) Action Chart

42. Which is the chemical used for ripening of fruits

A) Benzene B) Gun Powder
C) Potassium Bisulphite D) Calcium Carbide

43. Which of these is not a symptom of kidney failure

A) Polyuria
B) GFR 20ml or less / minute
C) Oliguria
D) Oedema

44. PEM in early stages in children can be assessed by

A) Biochemical Tests
B) Anthropometry
C) Pathological Tests
D) Clinical Examination

45. Anemia caused by Vitamin B12 deficiency is

A) Megaloblastic
B) Sickle Cell
C) Pernicious
D) Microblastic

46. Reading disability is called

A) ADD
B) Dysgraphia
C) Dyslexia
D) Aphasia

47. Under National Mission for Empowerment for Women the centres created at village level are called

A) Mahila Vigyaan Kendra
B) Poorna Shakti Kendra
C) Rashtriya Mahila Kendra
D) Mahila Vikas Kendra

48. Which of the following is not a cool colour

A) Bluish Green
B) Yellow Orange
C) Blue
D) Green

49. The method of research used for conducting census every ten years is

A) Case Study
B) Headcount
C) Interview
D) Survey

50. Which of the following does not reflect the use of knowledge and abilities acquired through non formal education

A) Personal Development
B) Involvement in community activities
C) Competency in doing similar work
D) Increased self employment opportunities

x-x-x

Human Genomics(1068)

1. DNA contains information in form of bases, A, T, G, C. Proportion of G=C, A=T. Which of the following strand of the DNA will have maximum information content?
A) Length 1000 bases with 10% G content
B) Length 2000 bases with 10% A content
C) Length 2000 bases with 40% T content
D) Length 1000 bases with 25% C content

2. Beating of cilia is regulated by
A) Actin B) Myosin C) Cofilin D) Nexin

3. The main difference between normal and transformed cells are
A) Immortality and contact inhibition
B) Shorter generation time and cell mobility
C) Apoptosis and tumor suppressor gene hyperfunction
D) Inactivation of oncogenes and shorter cell cycle duration

4. When bacteria are grown at 20 C and warmed at 37 C, they are most likely to synthesize membrane lipids with
A) Short chain saturated fatty acids B) Short chain unsaturated fatty acids
C) Long chain saturated fatty acids D) Long chain unsaturated fatty acids

5. Which of the following combinations must be present in a steroid receptor located in cytoplasm?
A) Nuclear export sequence (NES) and leucine zipper
B) NES and zinc finger motif
C) Nuclear localization sequence (NLS), zince finger motif
D) NLS and leucine zipper

6. The most commonly tool used for phylogenetic analysis involves sequencing of
A) Mitochondrial DNA B) Mitochondrial RNA
C) Ribosomal RNA D) Ribosomal DNA

7. A researcher wants to monitor changes in the level of a serum protein for which an antibody is available. which technique he will use

A) Immunofluorescence microscopy B) Fluorescence *in situ* hybridization
C) ELISA D) FACS

8. A cell line deficient in salvage pathway for nucleotide biosynthesis was fed with medium containing 15N labelled amino acids. Purines were then extracted. Treatment with which one of the following amino acids is likely to produce 15N labelled purines?
A) Aspartic acid B) Proline
C) Tryptophan D) Histidine

9. Enzymes accelerate a reaction by which one of the following strategies?

A) Decreasing energy required to form the transition state
B) Increasing kinetic energy of the substrate
C) Increasing the free energy difference between substrate and the product
D) Increasing the turn over number of enzymes

10. A film projector and microscope give equal magnification. But a film projector is not used to see living cells because
A) A living cell cannot be placed in a film projector
B) The viewer's eye is close to a microscope whereas it is far away from the projector's screen.
C) A microscope produces a virtual image whereas a projector produces a real image.
D) A microscope has greater resolving power than a projector

11. The ionic strength of a 0.2 M Na2HPO4 solution will be
A) 0.2 M B) 0.4 M C) 0.6 M D) 0.8 M

12. The genome of a bacterium is composed of a single DNA molecule which is 10^9bp long. How many moles of genomic DNA is present in the bacterium? [Consider Avogadro No.=6×10^{23}]
A) $1/6 \times 10^{-23}$ B) $1/6 \times 10^{-14}$ C) 6×10^{14} D) 6×10^{23}

13. It takes 40 minutes for a typical E. coli cell to completely replicate its chromosome. Simultaneous to the ongoing replication, 20 minutes of a fresh round of replication is completed before the cell divides. What would be the generation time of E. Coli growing at 37°C in complex medium?
A) 20 minutes B) 40 minutes C) 60 minutes D) 30 minutes

14. Which one of the following chemicals is a DNA intercalator?
A) 5-bromouracil B) Ethyl methane sulfonate
C) Acridine orange D) UV

15. An antibiotic that resembles the 3'end of a charged tRNA molecule is:
A) Streptomycin B) Puromycin C) Sparsomycin D) Tetracycline

16. In a heterozygous individual for a given gene, if a crossing over has occurred between the gene locus and the centromere of the chromosome, the segregation of the two alleles of the given gene will occur during meiosis at
A) Either anaphase-I or anaphase-II B) Anaphase-I only
C) Anaphase-II only D) Both anaphase-I and II

17. 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) pH measurement
C) Gas chromatography D) Viscosity measurement

18. A gene expressing a 50 kDa protein from an eukaryote was cloned in an E. coli plasmid under the lac promoter and operator . Upon addition of IPTG, the 50 kDa protein was not detected. Which one of the following explains the above observation?
A) The cloned sequence lacked the Kozak sequence
B) E. Coli does not make proteins larger than 40 kDa
C) Differences in codon preference
D) 50 kDa protein contains a nuclear localization signal

19. For identification of three proteins moving together (as a single band) upon loading in a single lane of a SDS-PAGE gel, the best method is:
A) One step western blotting
B) NMR spectroscopy
C) Western blott followed by stripping and reprobing
D) UV spectroscopy

20. Which one of the following techniques will you use to identify more than 1000 differentially expressed genes in normal and tumor tissues in one single experiment?
A) RAPD
B) Genome sequencing
C) ChIP assay
D) Transcriptome analysis

21. Which one of the following statements is correct?
A) In all L-amino acids, only the Cα carbon atom is chiral
B) Deoxyribose is optically inactive
C) The specific rotation of sucrose will be the sum of the specific rotations of D- glucose and D-fructose
D) Phosphatidyl choline isolated from biological membranes is optically active

22. You have labelled DNA in a bacterium by growing cells in medium containing either 14 N nitrogen or the heavier isotope, 15 N. Furthermore, you have isolated pure DNA from these organisms, and subjected it to CsCl density gradient centrifugation leading to their separation of light (14N) and heavy (15N) forms of DNA to different locations in the centrifuge tube. In the next experiment, bacteria were grown first in medium containing 15N, so that all the DNA made by cells will be in heavy form. Then these cells were transferred to medium containing only 14N and allowed the cells to divide for one generation. DNAs were extracted and centrifuged as above in the CsCl gradient. A hybrid DNA band was observed at a position located between and equidistant from the 15N and 14N DNA bands. Based on the above observation, which one of the following conclusions is correct?
A) Replication of DNA is conservative
B) Replication of DNA is semi conservative
C) Replication of DNA is dispersive
D) Replication of DNA is by rolling circle method

23. Two siblings who inherit 50% of the genome from the mother and 50% from the father show lot of phenotypic differences. Which one of the following events during gametogenesis of the parents will maximally contribute to this difference?

A) Mutation B) Recombination
C) Independent assortment D) Environment

24. Of the following, which one of the individuals will NOT necessarily carry the allele responsible for the mentioned trait?
A) A woman in a family where an autosomal dominant trait is segregating and her mother and son are affected
B) A daughter of a man who is affected by an X-linked dominant trait
C) A father of a child who is affected with an autosomal recessive trait
D) A father of a boy affected with X-linked recessive trait

25. If the probability of being blood type A is 1/8 and the probability of blood type O is ½, what is the probability of being either blood type A or O?
A) 5/8 B) 1/8 C) 1/2 D) 1/16

26. If two proteins have overall sequence identity of 50%, then the overall similarity will be
A) Less than 50% B) More than 50%
C) Cannot be more than 50% D) Can be less or more than 50%

27. 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) Histidine C) Aspargine D) Glutamate

28. The effective strength of hydrogen bonds will be
A) Unaffected by water molecules B) Strengthened by water molecules
C) Weakened by water molecules D) Totally destroyed by water molecules

29. Which one of the following statements is INCORRECT?
A) Quantitative inheritance results in a range of measurable phenotypes for a polygenic trait
B) Polygenic traits often demonstrate continuous variation.
C) Certain alleles of quantitative trait loci (QTL) have an additive effect on the character/trait
D) Alleles governing quantitative traits do not segregate and assort independently

30. Which of the following is not a unit of structure found in proteins?
A) β sheets B) α helices C) Loop regions D) γ loops

31. A mouse carrying two alleles of insulin –like growth factor II (IgF2) is normal in size; whereas a mouse that carries two mutant alleles lacking the growth factor is dwarf. The size of a heterozygous mouse carrying one normal and one mutant allele depends on the parental origin of the wild type allele. Such pattern of inheritance is known as
A) Sex- linked inheritance B) Genome imprinting
C) Gene environment interaction D) Cytoplasm inheritance

32. Which one of the following statements is INCORRECT?

A) Loss of genetic variation occurs within a small population due to genetic drift.
B) The number of deleterious alleles present in the gene pool of a population is called the genetic load.
C) Genetic erosion is a reduction in levels of homozygosity
D) Inbreeding depression results from increased homozygosity for deleterious alleles.

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

34. Telomerase, a RNA- protein complex which completes the replication of telomeres during DNA synthesis ,is a specialised
A) RNA dependent DNA polymerase B) DNA dependent DNA polymerase
C) DNA dependent RNA polymerase D) RNA dependent RNA polymerase

35. One amino acid among following usually breaks an alpha helix
A) Proline B) Glycine C) Leucine D) Valine

36. Which of the following mutagens is most likely to result in a single amino acid change in a gene product?
A) Acridine orange B) X-rays C) EMS D) Ethidium bromide

37. Which one of the following analytical techniques does NOT involve an optical measurement?
A) ELISA B) Microarray
C) Flow cytometry D) Differential scanning calorimetry

38. Which of the following is NOT an assumption of the Hardy-Weinberg model?
A) Population mates at random with respect to the locus in question
B) Selection is not acting on the locus in question
C) One allele is dominant and the other is recessive at this locus
D) The population is effectively infinite in size

39. If one has to think of conducting a charge, which molecule is useful in principle?
A) Proteins only B) DNA only
C) RNA only D) DNA and RNA both

40. Coomassie brilliant blue binds to
A) Proteins specifically B) Nucleic acids non specifically
C) Proteins nonspecifically D) Nucleic acids specifically

41. DNA mehtylation is involved in

A) Replication B) Transcription C) Imprinting D) Recombination

42. Evolution is NOT a:

A) Process directed to a goal
B) Process which is ongoing
C) Random process
D) Process which involves natural selection

43. Biological membranes are associated with all of the following except:

A) Free movement of proteins and nucleic acids across the membrane
B) Sites for biochemical reactions
C) Release of protons when damaged
D) Prevention of free diffusion of ionic solutes

44. Side chain of serine can act as

A) An electrophile
B) A nucleophile
C) Both as a nucleophile and electrophile
D) Neither as a electrophile or nucleophile

45. The van der Waals radius of an atom is

A) A measure of the size of an atom
B) A measure of the bond that atom forms
C) A measure of its charge
D) A measure of its electric filed

46. The only genetically encoded amino acid without a stereoisomer is:

A) Glycine B) Glutamate C) Glucose D) Galactose

47. Binomial distribution gives

A) The probability of events with binary outcomes
B) The measurement of event in binary digits
C) Precision of the measurement in binary digits
D) Accuracy of the measurement in binary digits

48. Which of the following is not a process governed by molecular recognition?

A) Active transport
B) Passive diffusion
C) Translation by the ribosome
D) Transcription by RNA polymerase

49. Palindromes are

A) Inverted repeat sequences
B) Triplet repeats
C) Nucleosomes
D) Double repeats

50. Which of the following is involved in the process of translation?

A) EF-Mu B) EF-C C) EF-D D) RF-3

x-x-x

Medical Physics

1. Which of the following is not an example of compressed data

A) Data array

B) Frequency distribution

C) Histogram

D) Ogive

2. The relationship between A.M., G.M. and H.M. is

A) G.M. = (A.M.) × (H.M.)

B) $(G.M.)^2 = (A.M.) \times (H.M.)$

C) $G.M. = (A.M. \times H.M.)^2$

D) $(G.M.)^2 = (A.M.)^2 \times (H.M.)^2$

3. Sampling distribution is usually the distribution of

A) Parameter

B) Variance

C) Mean

D) Statistics

4. The interval estimate of a population mean with large sample size and known standard deviation is given by

A) $\bar{x} \pm z_{\alpha/2}\, \sigma_{\bar{x}}$

B) $\bar{x} \pm z_{\alpha/2}\, s_{\bar{x}}$

C) $\bar{x} \pm t_{\alpha/2}\, \sigma_{\bar{x}}$

D) $\bar{x} \pm t_{\alpha/2}\, s_{\bar{x}}$

5. If two regression lines are x + 3y + 7 = 0 and 2x + 5y = 12, then $\bar{x}$ and $\bar{y}$ are, respectively

A) 2, 1

B) 1, 2

C) 2, 3

D) 2, 4

6. Which of the following statements regarding electromagnetic radiation is false?

A) Travel at the speed of light (3×10^8 m/second).

B) Have a photon energy proportional to frequency.

C) Travel at a speed proportional to frequency.

D) The product of frequency and wavelength is constant.

7. X-ray tube output is increased most strongly by increasing the

A) Voltage across the tube (kVp)

B) Anode diameter

C) Atomic number (Z) of the target

D) Tube current (mA)

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. Which interaction dominates for 45 keV photons in water?

A) Photoelectric effect

B) Coherent scatter

C) Photodisintegration

D) Pair production

10. The attenuation coefficient for diagnostic x-ray photons in soft tissue

A) decreases to about 25 keV, then rises again

B) increases continuously with increasing energy

C) exhibits discontinuities at 69.5 keV

D) decreases continuously with increasing energy

11. The reason 12:1 grids are seldom used with portable radiography is because

A) low voltage used is unable to penetrate grids

B) accurate grid alignment is too difficult

C) scatter is not important in portable x-rays

D) air gaps are preferred to eliminate scatter

12. How many 5 MeV alpha particles are required to deposit total energy of 1 J?

A) 1.25×10^{12} alpha particles

B) 1.25×10^{-13} alpha particles

C) 6.5×10^{-13} alpha particles

D) 6.25×10^{12} alpha particles

13. The alpha particles with energy of 5.5 MeV are fully stopped in a gas with W-value of 30 eV/ion pair and a Fano factor of 0.15. The expected average number of ion pairs n_o produced in the gas is

A) $1.6 \times l0^{34}$ ion pairs

B) $6.1 \times l0^{34}$ ion pairs

C) $1.83 \times l0^{5}$ ion pairs

D) $3.81 \times l0^{5}$ ion pairs

14. The scintillation efficiency of anthracene if 1 MeV of particle energy loss creates 20300 photons with average wavelength of 447 nm are

A) 7.65 %

B) 5.63 %

C) 3.65 %

D) 5.68 %

15. Which scintillation material is most efficient at converting the energy of a 2 MeV electron into light?

A) BaF_2

B) HPGe

C) NaI(Tl)

D) $LaBr_3$(Ce)

16. The long-wavelength limit of the sensitivity of a photocathode layer with work function of 1.5 eV is

A) 2250 Angstroms

B) 1250 Angstroms

C) 8270 Angstroms

D) 7250 Angstroms

17. The acceleration voltage required for a hybrid photomultiplier tube using a silicon diode to have a charge gain of 5000 is about

A) 27.3 keV

B) 17.9 keV

C) 12.6 keV

D) 13.0 keV

18. If the energy resolution of a particular NaI(Tl) scintillation detector is 7% for ^{137}Cs gamma rays (0.662 MeV), estimate its energy resolution for the 1.28 MeV gamma rays from ^{22}Na

A) 0.0503

B) 0.0305

C) 0.5032

D) 0.2035

19. If the energy resolution of a scintillator is 8.5% at 662 KeV, the standard deviation (in energy units) of the Gaussian curve that would be a fit to the photopeak at that energy is

A) 39.2 keV

B) 29.3 keV

C) 33.9 keV

D) 23.9 keV

20. The typical energy resolution for surface barrier detectors worsen as the surface area of the detector increases because of

A) Resistance

B) Capacitance

C) Magnetic field

D) Electric field

21. Assume that the Fano factor in germanium were half the currently assumed value. Both the FWHM and energy resolution are

A) increased by $\sqrt{2}$

B) increased by 2

C) decreased by $\sqrt{2}$

D) decreased by 2

22. An incident fast neutron is moderated and then diffuses total path length of 10 cm before being captured in the BF_3 tube of a long counter. The time delay between the time of neutron incidence and the leading edge of the output pulse is

A) 55.5 micro seconds

B) 45.5 micro seconds

C) 25.5 micro seconds

D) 15.5 micro seconds

23. The stages required in a successive approximation ADC to achieve a conversion gain of 4096 channels is

A) 8 ADC steps

B) 24 ADC steps

C) 12 ADC steps

D) 96 ADC steps

24. A Wilkinson type ADC has a conversion gain of 2048 channels and a maximum conversion time of 25μs. The oscillator must operate at frequency is

A) 98.1 MHz

B) 81.9 MHz

C) 48.0 MHz.

D) 25.9 MHz.

25. The modulation transfer function (MTF) is not:

A) A description of any imaging system resolution performance

B) The ratio of image to subject contrast at each spatial frequency

C) Equal to the unity when the spatial resolution is perfect

D) Fifty percent at half the limiting spatial resolution

26. The DICOM standard does not specify the image's

A) Reimbursement rate

B) Matrix size

C) Bit depth

D) Display settings

27. Breast imaging using MRI would not use

A) Fat-suppression techniques

B) Special breast coils

C) Iodine contrast

D) Three-dimensional imaging techniques

28. Which of the following is not a radiopharmaceutical localization mechanism?

(A) Diffusion

(B) Phagocytosis

(C) Capillary blockage

(D) Elution

29. An x-ray exposure of 1 mGy (100 mR) results in all of the following except

A) equivalent dose of 1 mSv (100 mrem) in bone

B) absorbed dose of 4 mGy (400 mrad) in bone

C) equivalent dose of 1 mSv (100 mrem) in tissue

D) absorbed dose of 1 mGy (100 mrad) in tissue

30. Positron emission tomography (PET) scanners generally make use of all of the following except

A) Short-lived radionuclides such as ^{15}O

B) Cyclotrons

C) Directly detected positrons

D) Filtered-back projection reconstruction algorithms

31. The chronic x-ray threshold dose for radiation-induced cataracts is about

A) 5 mGy (0.5 rad)

B) 50 mGy (5 rad)

C) 1 Gy (100 rad)

D) 5 Gy (500 rad)

32. Which of the following artifacts does not appear in CT images?

A) Motion artifacts

B) Phase-encoding artifacts

C) Streak artifacts

D) Ring artifacts

33. Absorption of a 30 keV photon by a screen with a 10% conversion efficiency will emit how many blue 3 eV light photons?

A) 10

B) 1

C) 100

D) 1000

34. An ultrasound beam travelling through tissue cannot be

A) Absorbed

B) Amplified

C) Scattered

D) Refracted

35. Blastoma is a cancer involving which tissue

A) Bone

B) Connective tissue

C) Epithelial tissue

D) Embryonic tissue

36. Which enzyme is produced by kidney when blood pressure falls?

A) Secretin

B) Relaxin

C) Renin

D) Melanin

37. Which is the correct order of cellular radiosenstivity

A) Eyrthroblasts > Intestinal crypt cells > Spermatids > Chondrocytes

B) Intestinal crypt cells > Spermatids > Eyrthroblasts > Chondrocytes

C) Spermatids > Eyrthroblasts > Chondrocytes > Intestinal crypt cells

D) Spermatids > Eyrthroblasts > Intestinal crypt cells > Cchondrocytes

38. A typical in vitro mammalian cell survival curve for low-LET radiations is characterised by

A) Exponential curve

B) Continuosly curving survival curve

C) Initial shoulder followed by an exponential part

D) Bell curve

39. Lateral resolution in ultrasound imaging would most likely be improved by

A) Increasing transducer focusing

B) Imaging in the Fraunhofer zone

C) Reducing the pulse length

D) Increasing the frequency

40. For most tissues, which of the following is false?

A) T1 and T2 often increase with malignancy.

B) T2 is relatively independent of field strength.

C) T1 increases as field strength increases.

D) T1 is of the order of a few seconds

41. Electron capture does not

A) result in the emission of a neutrino

B) can compete with positron emission

C) Result in internal conversion electron emission

D) result in characteristic x-ray emission

42. The largest ultrasound reflections occur between

A) Kidney and Water

B) Fat and Kidney

C) Brain and Water

D) Water and Muscle

43. How long will it take to receive the ultrasound echo from an object 10 cm away?

A) 1.3 μs

B) 13 μs

C) 130 μs

D) 13 ms

44. 13. Which of the following does not concern itself with radiation risk estimates?

A) ICRP

B) UNSCEAR

C) BEIR

D) ICRU

45. If an ultrasound beam is attenuated by 99%, the attenuation is

(A) 3 dB

(B) 1 dB

(C) 20 dB

(D) 10 dB

46. What fraction of ultrasound is reflected from a liver (Z = 1.55) and soft tissue (Z = 1.65) interface?

A) 1/1000

B) 1/100

C) 1/10

D) 1/2

47. Increasing the width of the computed tomography (CT) image display window will reduce

A) quantum mottle

B) displayed contrast

C) section thickness

D) image brightness

48. Chemical shift artifacts are caused by differences in the

A) T1 relaxation time

B) T2 relaxation time

C) Spin density

D) Larmor frequency

49. The continuous spectrum obtained from X-ray tubes is due to

A) Transitions of atomic electrons from higher to lower energy levels

B) Deceleration of electrons when they hit the target

C) Conversion of electrons to electromagnetic energy

D) Thermionic emission

50. Which of the following is not a unit of energy?

A) Erg

B) Joule

C) Watt

D) British thermal unit (BTU)

x-x-x

Microbial Biotechnology (1068)

1. The Cartagena Protocol on Biosafety was adopted in 2000 and entered into force by

A) August, 2002 B) August, 2000

C) September, 2001 D) September, 2003

2. A diagnosis of diptheria is confirmed by

A) Isolation of typical organisms from materials such as blood agar

B) Isolation of a typical colony on Tinsdale's agar

C) Demonstration of toxin production by suspicious isolate

D) Microscopic appearance of organisms stained with methylene blue

3. The kingdom Protista contains

A) Prokaryotic unicellular autotrophic organisms

B) Eukaryotic unicellular photosynthetic/non-photosynthetic organisms

C) Prokaryotic multicellular heterotrophic organisms

D) Eukaryotic multicellular heterotrophic organisms

4. Which of the following statements about a plot of V versus substrate concentration for an enzyme that follows Michaelis-Menten kinetics is false

A) K_m is the substrate concentration at which $V=1/2\ V_{max}$

B) The shape of the curve is a hyperbola

C) As substrate concentration increases, the initial velocity of the reaction, V also increases

D) At very high substrate concentration, the velocity curve becomes a horizontal line that intersects the y-axis at K_m

5. Evidence indicating the chloroplasts were originally free-living prokaryotes that subsequently evolved a symbiotic relationship with a eukaryotic host includes all of the following except

A) Similarities of rRNA sequences between chloroplasts and free-living prokaryotes.

B) Similarities of structures between chloroplasts and some contemporary free-living prokaryotes

C) Presence of circular DNA in chloroplasts and in free-living prokaryotes

D) Ability of chloroplasts to synthesize all their own proteins.

6. Electron acceptor in anaerobic conditions in prokaryotes is

A) Fatty acids B) Glucose, fructose, maltose

C) SO_4, NO_{3-}, CO_2 D) Antioxidants such as vitamin K

7. The wavelengths of visible light are shorter than the wavelength of

A) Infrared B) Ultraviolet C) x-rays D) Gamma rays

8. 2,4-dinitrophenol uncouples electron transport from ATP synthesis in mitochondria by
A) Causing dissipation of the proton gradient generated by the electron transport
B) Allowing the proton translocating function of ATP synthase while inhibiting its ATP synthesizing activity
C) Activating a second proton pump that sends back the protons into the mitochondrial matrix
D) Neutralizing the proton gradient by absorbing the protons generated during the electron transport

9. What do you mean by "NA" in mass transfer?
A) Rate of oxygen transfer per unit volume of fluid
B) Rate of oxygen transfer per unit volume of gas
C) Avogadro number
D) Rate of oxygen transfer per unit mass of solid

10. Which type of forces stretch and distort the bubbles?
A) Shear forces
B) Strain forces
C) Surface tension
D) Frictional forces

11. Which of the following statements about meiosis is not true?
A) Kinetochores of sister chromatids attach to opposite poles in Meiosis I
B) Kinetochores of sister chromatids attach to opposite poles in Meiosis II
C) Chiasma is formed in Prophase I
D) Homologous chromosomes are segregated in Meiosis I

12. If a proteasome inhibitor is added to synchronously cycling human cells in G2 phase, which one of the following events is likely to happen?
A) Induce re-replication of DNA
B) Arrest cells in G2 phase
C) Arrest cells in anaphase
D) Block chromatin condensation

13. Which of the following is a correct hierarchial sequence for classifying a living organism?
A) Domain-Kingdom-Phylum-Class-Order-Family-Genus-Species
B) Kingdom-Domain-Phylum-Class-Order-Family-Genus-Species
C) Domain-Kingdom-Phylum- Order -Class -Family-Genus-Species
D) Kingdom -Domain -Phylum-Order- Class -Family-Genus-Species

14. After activation of a promoter by the DNA binding activity of a transcription factor, a co-activator is recruited at the region targeted for transcription which in turn creates a

binding site for a chromatin remodeling complex. Which one of the following activities of the co-activator is responsible for the recruitment of chromatin remodeling complex?

A) Histone deacetylase activity
B) Histone methyl transferase activity
C) Histone acetyl transferase activity
D) DNA methyl transferase activity

15. The S wave 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

16. What phenotype would you predict for a mutant mouse lacking one of the genes required for site-specific recombination in lymphocytes?

A) Decrease in T cell count
B) Immunodeficient
C) Increase in T cell count
D) Increase in B cell count

17. Cystic fibrosis transmembrane conductance regulator (CFTR) is known to regulate the transport of which ion?

A) Ca^{2+}
B) Mg^{2+}
C) HCO_3^-
D) Cl^-

18. Assuming Hardy-Weinberg equilibrium, the genotype frequency of heterozygotes, if the frequency of the two alleles of the gene being studied are 0.6 and 0.4, will be

A) 0.80
B) 0.64
C) 0.48
D) 0.32

19. Major stimulus for spore formation in bacteria is

A) Nutrition limitation
B) Heat stress
C) Cold stress
D) pH stress

20. Which one of the following combinations of secondary metabolite biosynthetic pathways result in the biosynthesis of terpenes?

A) Mevalonic acid and MEP pathways
B) Malonic acid and MEP pathways
C) Shikimic acid and Malonic acid pathways
D) Shikimic acid and Mevalonic acid pathways

21. Insulin increases facilitated diffusion of glucose in muscle cells by

A) Phosphorylation of glucose transporters
B) Translocation of glucose transporter containing endosomes into the cell membrane
C) Inhibition of the synthesis of mRNA for glucose transporters
D) Dephosphorylation of glucose transporters

22. A culture medium contains two carbon sources, one is preferred carbon source (glucose) and the second is a non-preferred source (lactose). Which one of below is correct regarding the nature of growth curve of *E. coli* cultured in this medium?

A) Growth curve will be same as when grown in presence of only glucose
B) Growth curve will be same as when grown in presence of only lactose
C) A lag phase will be observed between the two exponential phases
D) Two lag phases will be observed between the two exponential phases

23. The major disadvantage of using liposome as a targeted drug delivery vehicle is that

A) It gets internalized by phagocytosis inside lysosomes
B) It is very unstable and has low shelf-life
C) It gets intercalated in cell membranes
D) Its drug entrapment efficiency is very low

24. Phosphatidyl serine, an important component of biological membrane, is located in

A) The outer leaflet but flip flops to inner leaflet under specific conditions
B) Both the leaflets
C) The middle of the bilayer
D) The inner leaflet but flip flops to outer leaflet under specific conditions

25. If the core body temperature of a human rises above normal, which of the following processes would be initiated sequentially for thermo-regulation?

A) Peripheral vasodilation, increased rate of respiration, tachycardia
B) Peripheral vasodilation, increased rate of respiration, bradycardia
C) Peripheral vasodilation, decreased rate of respiration, tachycardia
D) Peripheral vasodilation, decreased rate of respiration, bradycardia

26. Which of the following is not a characteristic of phylum chordata?

A) Pharyngeal slits
B) Amniotic egg
C) Postanal tail
D) Notochord

27. After isolating and purifying to homogeneity a small enzyme (110 amino acids long) from a culture of bacteria, you are confused as to whether you grew wild-type bacteria or mutant strain that produced the enzyme with a valine residue at position 66 instead of the glycine found in the wild-type strain. For quick determination of nature of protein you will use

A) Mass spectroscopy
B) Ion exchange chromatography
C) SDS-PAGE
D) HPLC

28. Sequence tagged sites have which of the following properties?

A) They are present only once within a genome and possess an RFLP site
B) They are present only once within a genome and their sequence is known

C) Their sequence is known and they must contain repetitive DNA sequences

D) They must contain the sequences of a gene and no repetitive DNA sequences can be present

29. Life-history characteristics associated with k-selected organisms include

A) Rapid reproduction rates, short generation times and large body size

B) Repeated reproduction, few progeny and large body size

C) Inhabiting early successional state communities, rapid mutation rates and numerous large offsprings

D) Inhabiting climax communities, many small offsprings and short life span

30. An X-linked recessive gene produces red-green color blindness in humans. A woman with normal color vision whose father was colorblind marries a colorblind man. What is the probability that their son will be colorblind?

A) 0 B) 1/ 4 C) ½ D) 3/ 4

31. Which of these descriptions could be associated with the luteal phase of the uterine cycle?

A) Decrease in LH, increase in progesterone, corpus luteum present, secretory uterine lining

B) Decrease in LH, decrease in progesterone, corpus luteum present, secretory uterine lining

C) Increase in LH, increase in progesterone, corpus luteum present, endometrium released

D) Low FSH, high estrogen, developing follicle, increase in endometrium

32. Which of the following statement provides a true example of both photomorphogenesis and phototropism?

A) Phototropism is a growth towards blue light, and photomorphogenesis is a growth towards red light

B) Phototropism is a growth towards blue light, and photomorphogenesis is a developmental process triggered by near-red light

C) Phototropism is a growth towards red light, and photomorphogenesis is a germination triggered by blue light

D) Phototropism is a movement towards blue light that does not involve growth and photomorphogenesis is a movement towards red light that does involve growth

33. Some viruses can undergo latency, the ability to remain inactive for some period of time. Which of the following is an example?

A) Influenza, a particular strain of which returns every 10-20 years

B) Herpes simplex viruses whose reproduction is triggered by physiological or emotional stress in the host

C) Koposi's sarcoma, which causes a skin cancer in people with AIDS, but rarely in those not infected by HIV

D) The virus that causes a form of the common cold, which recurs in patients many times in their lives

34. Advantages of the oral polio vaccine compared with the killed polio vaccine are all of the following except that it

A) Elicits IgA as well as IgG synthesis

B) Induces cellular as well as humoral immunity

C) Induces secretion of protective mucosal neutralizing antobodies

D) Is safer to give to immunosuppressed children

35. What accounts for antibody switching (i.e. the switch of one B-cell from producing one class of antibody to another antibody class that is responsive to the same antigen)?

A) Mutation in the genes of that B-cell, induced by exposure to the antigen

B) The rearrangement of V region genes in that clone of responsive B-cells

C) A switch in the kind of antigen-presenting cell that is involved in the immune response

D) The shuffling of exons for one C region type to another attached to the V-J transcript

36. Cholera is an infectious disease caused by the bacterium *Vibrio cholera*. How does the cholera toxin (CTX) dysregulate the G-protein coupled receptor signaling in the host cells?

A) CTX modifies the Gsα-subunit which is unable to hydrolyze the bound GTP resulting in increased cAMP level

B) CTX modifies the Gsα-subunit which is unable to hydrolyze the bound GTP resulting in decreased cAMP level

C) CTX modifies the Giα-subunit which is unable to hydrolyze the bound GTP resulting in increased cAMP level

D) CTX modifies the Giα-subunit which is unable to exchange GDP resulting in increased cAMP level

37. Assuming that the level of glucose is low, a mutation in the repressor associated with the *lac* operon of *E. coli* which prevents binding of the repressor to allolactose should result in

A) Constitutive expression of the lac operon genes

B) Lack of expression or reduced expression of the lac operon genes under all circumstances

C) Expression of the genes only when lactose is present

D) Expression of the genes only when lactose is absent

38. A bacterial culture was diluted 1000 fold and 0.1 ml of this diluted sample was spread per plate on nutrient agar. In a triplicate run, the number of colonies formed is 121, 93 and 86. The number of colony forming units/ ml in the original bacterial culture is

A) 10^6 B) 10^5 C) 10^3 D) 10^2

39. Which of the following statements about the Rb (retinoblastoma) tumor suppressor protein is correct?

A) Rb is activated when phosphorylated by Cdk

B) Rb binds the transcription factor E2F and thus prevents the cell from entering S-phase until a mitogenic signal is received

C) Rb is a transcription factor

D) A mitogenic signal is received, Rb binds the transcription factor E2F and thus stimulates the cell to enter S-phase

40. In which of the following situations would cells die by necrosis, not apoptosis?

A) Removal of cells with damaged DNA that cannot be repaired

B) Removal of developing neurons that fail to make profitable connections with other cells

C) Removal of heart muscle cells damaged by oxygen depletion following cardiac infarction

D) Removal of virus infected cells

41. Which of the following statement about ribozymes is false?

A) Ribozymes are capable of self-replication but cannot catalyze other types of reactions

B) Manfred Eigen found that RNAs could replicate themselves in solution without the aid of proteins

C) In *Tetrahymena thermophila*, an intron was found that carried out its own excision and splicing

D) A tRNA-processing enzyme containing RNA was found in which the RNA portion provided the catalysis

42. An example of competitive inhibition of enzyme is the inhibition of

A) Succinic dehydrogenase by malonate

B) Cytochrome oxidase by cyanide

C) Hexokinase by glucose-6-phosphate

D) Carbonic anhydrase by carbon dioxide

43. A set of microfuge tubes containing DNA, RNA and protein samples have lost their labels. Which of the following strategies will you adopt to distinguish and relabel them?

A) Measuring their absorption at 260 nm and 280 nm
B) Measuring their absorption at 240 nm, 260 nm and 280 nm
C) Measuring their absorption at 260 nm and 280 nm at $30^{o}C$ and $80^{o}C$
D) Measuring their absorption at 240 nm, 260 nm and 280 nm at $30^{o}C$ and $80^{o}C$

44. When hemoglobin is converted from the deoxy form to oxyhemoglobin?
A) It becomes more acidic and releases protons
B) Carbamino formation is promoted
C) Binding of BPG is favored
D) Bound NO is transferred to glutathione

45. Which of the following virus is not used in gene therapy?
A) Papillomavirus
B) Retrovirus
C) Adenovirus
D) Herpes simplex virus

46. What is an MPR rating on air filters?
A) Magnitude performance rating
B) Micro-particle performance rating
C) Macro-particle performance rating
D) Moles per rate

47. What do you mean by the low Ks value?
A) Low affinity for the limiting substrate
B) Medium affinity for the limiting substrate
C) High affinity for the limiting substrate
D) No affinity for the limiting substrate

48. What do you mean by "Idiophase"?
A) Production of waste materials
B) Production of topical products
C) Production of primary metabolites
D) Production of secondary metabolites

49. Which of the following condition is of reverse phase chromatography?
A) The mobile phase is non-polar and stationary phase is polar
B) The mobile phase is polar and stationary phase is non-polar
C) Both the mobile phase and stationary phase are organic
D) Both the mobile phase and stationary phase are inorganic

50. What is the function of microcarrier beads?
A) To give the cells the shape of beads
B) It provides non-buoyancy condition
C) It helps in the lysis of cells
D) It provides protection and surface area

x-x-x

Microbiology (1068)

1. Who demonstrated that open tubes of broth remained free of bacteria when air was free of dust

A) Francesco Redi
B) Louis Pasteur
C) John Tyndall
D) Lazzaro Spallanzani

2. The term bacteriophage was coined by

A) De'Herelle
B) *F.W. Twort*
C) Beijernick
D) D. Iwanosky

3. Several flagella at one end of the organ is called as

A) Monotrichate
B) Amphitrichate
C) Lophotrichate
D) Peritrichate

4. The interval period between HIV infection and appearance of antibodies in serum is called

A) Intrinsic period
B) Incubation period
C) Window period
D) None of these

5. The surgical asepsis was first demonstrated by

A) Louis Pasteur
B) Robert Koch
C) Joseph Lister
D) Edward Jenner

6. The famous experiment using goose neck flasks to disapprove the theory of spontaneous generation of microorganisms was demonstrated by

A) Robert Koch
B) John Needham
C) H. Schroeder
D) Louis Pasteur

7. L-form bacteria were isolated by

A) Emmy Klieneberger-Nobel
B) Louis Pasteur
C) Joseph Lister
D) Robert Koch

8. The pigment present in red algae is

A) Rhodochrome
B) Fucoxanthin
C) Chlorophyll only
D) Chlorophyll + phycoerythrin

9. Rancidity of stored foods is due to the activity of

A) Toxigenic microbes
B) Proteolytic microbes
C) *Saccharolytic* microbes
D) Lipolytic microbes

10. Alginic acids and its salts are obtained from the wall of

A) Red algae
B) Brown algae
C) Green algae
D) Red and brown algae

11. Which is the largest bacterium

A) *Thiomargarita namibiensis*
B) *Bacillus licheniformis*
C) *Mycoplasma genitalium*
D) *Bacteroides thetaiotaomicron*

12. Which is the largest virus by size

A) Mamavirus
B) Mimivirus
C) *Megavirus chilensis*
D) *Pithovirus sibericum*

13. For acetic acid production the methods followed are

A) *Orleans process* B) Rapid process

C) *Submerged process* D) All of these

14. The process of enhancement of virulence of a microorganism is called

A) Activation B) Hyper-activation

C) Exaltation D) Attenuation

15. Which of the following is absent in gm+ bacteria

A) Cell wall B) Teichoic acid

C) Murein D) Outer membrane

16. Which of the following processes is not exhibited by eukaryotic microorganisms

A) Decomposition B) Fermentation

C) Nitrogen Fixation D) Causing disease

17. The transfer of plasmid from one bacterium to a different strain/ species is called as

A) Horizontal gene transfer B) Vertical gene transfer

C) Homozygous gene transfer D) Heterozygous gene trasfer

18. The utilization of elemental carbon by microorganisms during geochemical cycling is known as

A) Immobilization B) Mineralization

C) Decomposition D) Dissimilation

19. Which scientist first disproved spontaneous generation of microorganisms by boiling the meat infusions and using the hermetical sealing

A) Francesco Redi B) Theodor Schwann

C) Louis Pasteur D) Lazzaro Spallanzani

20. Which scientist disproved spontaneous generation of microorganisms by supplying the air to boiled meat infusion after passing through a coiled tube heated to a very high temperature

A) Francesco Redi
B) Lazzaro Spallanzani
C) Theodor Schwann
D) Louis Pasteur

21. In anaerobic respiration by microorganisms the terminal electron acceptor is

A) Oxygen
B) Hydrogen
C) Nitrate
D) Nitrogen

22. The acquisition of energy as a result of glucose fermentation requires

A) Substrate level phosphorylation
B) Electron transport chain
C) The enzyme glucose oxidase
D) Oxidative phosphorylation

23. Which of the following groups of the microorganisms contain unique coenzymes such as coenzyme M and coenzyme F420

A) Methanogens
B) Methanotrophs
C) Acetogens
D) Sulphate reducing bacteria

24. When acetate is used as the sole source of carbon for some microorganisms the pathway used is

A) Glycolytic pathway
B) Pentose phosphate pathway
C) Glyoxalate pathway
D) Oxaloacetate pathway

25. On which day the World Intellectual property Day is celebrated

A) April 26
B) May 22
C) June 5
D) December 1

26. Which immunoglobulin class is the most efficient to produce agglutination reaction?

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

27. Which of the Following is selective medium for *Streptococcus pyogenes*?
A) Blood agar
B) Crystal Violet blood agar
C) Potassium tellurite blood agar
D) Chocolate agar

28. Draughtsman colony is a characteristic feature of:
A) *Streptococcus pyogenes*
B) *Streptococcus pneumoniae*
C) *Enterococcus facecalis*
D) *Viridans streptococci*

29. Which is the selective medium used for isolation of *C. diphtheriae*?
A) Tellurite blood agar
B) Loeffler's serum slope
C) Lowenstein-Jensen medium
D) Chocolate agar

30. Which of the following toxins is the most toxic?
A) Botulinum toxin
B) Tetanus toxin
C) Diphtheria toxin
D) Cholera toxin

31. Sereny test is used for the identification of :
A) EPEC
B) ETEC
C) IEC
D) EHEC

32. The most important specimen for isolation of *Salmonella typhi* in first week of enteric fever is:
A) Blood
B) Faeces
C) Urine
D) Pus

33. Accessory growth factor/s required by *Haemophilus influenzae* is/are:
A) X factor
B) V factor
C) Both X and V factors
D) Neither X nor V factor

34. Culture of *Mycobacterium tuberculosis* may be positive even if number of bacteria in the specimen is:
A) As few as 1-2 per ml
B) As few as 6-10 per ml
C) As few as 10-100 per ml
D) As few as 3-5 per ml

35. Extensively drug resistant tuberculosis (XDR-TB) due to *Mycobacterium tuberculosis* strains are resistant to all the following except
A) Any fluoroquinolone
B) Isoniazid and rifampicin
C) At least one of three injectable second line (capreomycin,kanamycin and amikacin)
D) Beta-lactams

36. The following characteristics are true for viruses except:
A) Obligate intracellular infective agents
B) Contain either DNA or RNA
C) Do not multiply by binary fission
D) Both DNA and RNA

37. Which of the following is a diploid cell line ?
A) Hela
B) WI-38

C) McCoy D) BHK-21

38. In which of the following processes, bacteriophage may act as carrier of genes from one bacterium to another ?
A) Transformation B) Transduction
C) Conjugation D) Transposition

39. On which day, the WHO announced the global eradication of small pox?
A) May 8, 1970 B) May 8, 1975
C) May 8, 1980 D) May 8, 1985

40. Which vaccine is employed in pulse polio immunisation programme?
A) Salk vaccine B) Sabin vaccine
C) BCG D) Variola vaccine

41. Which of the following drugs may be given for chemoprophylaxis during epidemic of influenza virus A?
A) Amantadine B) Acyclovir
C) Ribavirin D) Ganciclovir

42. The transgenic crops rich in vitamin A are:
A) Golden rice B) Pink rice
C) Yellow rice D) Orange rice

43. All of the following antirabies vaccine are inactivated vaccines except:
A) Human diploid cell strain vaccine B) Purified chick embryo cell culture vaccine
C) Purified vero cell vaccine D) Chick embryo vaccine

44. Which of the following markers when positive indicate high infectivity of hepatitis B virus?
A) HBsAg B) HBeAg
C) HBcAg D) HBAg

45. The following may cause teratogenic infections except?
A) Toxoplasma B) Cytomegalovirus
C) Rubella virus D) Trypanosoma

46. Lepromin test is an example of :
A) Type I hypersensitivity reaction B) Type II hypersensitivity reaction
C) Type III hypersensitivity reaction D) Type IV hypersensitivity reaction

47. DTH reaction may be demonstrated in the following except
A) Tuberculosis B) Salmonellosis

C) Gas gangrene D) Contact dermatitis

48. During PAGE gel formation, acrylamide is activated by free radicals formed by
A) Ammonium persulphate B) TEMED
C) Oxygen D) SDS

49. The difference between a simple tandem array and a compound tandem array is :
A) The frequency of different sequences B) The direction of sequences face (left or right)
C) The number of different sequences involved D) The number of repetitions of sequences

50. Protein secondary structures such as a-helices and B-sheets are stabilized mainly by:
A) Dipole moment B) Disulfide bond formation
C) Vander Waals force D) Hydrogen bond formation

x-x-x

Nuclear Medicine (1068)

1. When the half life increases

A) Decay constant remains unchanged
B) Decay constant increases
C) Decay constant decreases
D) Decay constant changes

2. A Cyclotron is used to

A) cause heavy nuclei to fission spontaneously
B) cause isomeric transitions exclusively
C) cause charged particles to collide into a target material
D) cause heavy nuclei to fission spontaneously

3. What is the mass equivalent of 70keV photon?

A) 1.25×10^{-31} Kg
B) 11.2×10^{-15} Kg
C) 1.25×10^{-27} Kg
D) 11.2×10^{-31} Kg

4. Which of the following is not a processing artifact in the reporting film?

A) Dirty rollers
B) Roller marks
C) Kink marks
D) Chemical fog

5. What is the dynamic range of the nuclear medicine digital imaging system?

A) 2^8
B) 2^{10}
C) 2^{12}
D) 2^{14}

6. During which phase radiation induced chromosome damage is analyzed

A) Prophase
B) Metaphase
C) Anaphase
D) Telophase

7. LET and RBE of 1MeV beta particles is

A) 0.3 and 0.9
B) 3.0 and 1.0
C) 30 and 10
D) 300 and 20

8. Which of the following is not a radiation cytogenetic effect

A) Single hit chromosome aberration
B) Multihit chromosome aberration
C) Reciprocal translocations
D) Thrombocytopenia

9. What does a low D37 value indicates

A) Radio-resistance cell
B) Radio-sensitive cell
C) Highly radio-resistant cell
D) Highly radio-sensitive cell

10. Which factors will you least consider in calculating a shielding barrier thickness?

A) Workload
B) Corridor Distance
C) Patient position
D) Controlled area

11. Which of the following is present on the label of a transport package.
A) Name of the consignee
B) Name of the consigner
C) Name of the institute
D) Name of the radionuclide

12. Which number should be present on a poisonous, flammable solid radioactive material.
A) 4
B) 7
C) 6
D) Both 6 and 7

13. Which is a mock standard?
A) I-125
B) Co-57
C) Cs-137
D) I-129

14. Random errors affects
A) Accuracy
B) Variance
C) Precision
D) Reproducibility

15. Which process solves the impurity problem in detectors.
A) Pure sampling process
B) Energy-selective counting process
C) Lithium doping process
D) Thallium doping process

16. TVT in lead (mm) of I-131
A) 1.7
B) 3.1
C) 6.3
D) 7.7

17. Townsend avalanche process occurs in
A) Charged particle spectroscopy
B) Pocket dosimetry
C) Survey meter
D) Mass spectroscopy

18. Baseline shift occurs in which electronic instrument
A) Resistor and capacitor
B) Amplifier
C) ADC
D) Coincidence circuit

19. As per the guidelines, ALI is calculated assuming how much of air is breathed per minute?
A) $1x\ 10^4$ ml
B) 2×10^4 ml
C) 3×10^4 ml
D) 4×10^4 ml

20. How much sewer concentration is allowed for 99mTc.
A) 0.01 µCi/mL
B) 0.1 µCi/mL
C) 1.0 µCi/mL
D) 1.1 µCi/mL

21. Sequential Steps to follow in dealing with a radioactive spill

A) Contain, inform and decontaminate
B) Inform, decontaminate and contain
C) Closure, inform and decontaminate
D) Inform, contain and decontaminate

22. Laboratory monitors are
A) Regularly operated
B) Contamination monitors
C) Used to detect all types of radiations
D) Placed at fixed locations.

23. A positron is an antiparticle of
A) Ordinary proton
B) Ordinary electron
C) Negative electron
D) Ordinary neutron

24. Which process does not transform an "odd-odd" nucleus to "even-even" nucleus.
A) Beta decay
B) Positron decay
C) Alpha decay
D) EC

25. Pick the renal cortical agent?
A) DTPA
B) DMSA
C) EC
D) MAG3

26. Pseudolesions are result of
A) Patient movement
B) Respiration motion
C) Mis-registered PET to CT
D) Inaccurate SUV

27. Leiomyosarcomas doesn't occur in
A) Pancreas
B) Bladder
C) Uterus
D) Prostate

28. In MDCT the numer of x-ray projections available for interpolation decreases with increasing pitches because
A) Z window filter is decreasing
B) Z window filter is increasing
C) Z window filter is absent
D) Z window filter is fixed

29. Dose calibrator readings are not affected by
A) Volume of the dose
B) Location of dose in well
C) Radionuclide half life
D) Shape of the dose container

30. In which condition the PHA window will not count the 140 keV gamma photons
A) In increased HV setting
B) In increased amplifier gain
C) In decreased either HV or amplifier gain setting
D) In increased either HV or amplifier gain setting

31. What could be the reason for the variation less than expected in a chi-square test performed on a scintillation counter?

A) RF interference
B) Random electrical noise
C) Temperature changes
D) Drifting power supply

32. What could not be the reason for a cold spot in the gamma image?
A) Coins/buckles
B) PMT failure
C) Cotton swab
D) Collimator damage

33. If Rg represents collimator resolution, then its large value means
A) Good resolution
B) Worse resolution
C) Better resolution
D) High resolution

34. How can you prevent temporary crystal damage in a gamma camera
A) Avoid temperature fluctuations
B) Avoid hitting the crystal
C) Avoid contamination of the crystal
D) Avoid cleaning the crystal

35. Radiotracer used to measure cerebral dynamics
A) 99mTc-DTPA B) 99mTc-DMSA C) 18F-FDG D) 18F-Choline

36. During labeling of RBC's by 99mTc, the valency of the 99mTc should change to
A) +7 B) +5 C) +1 D) -1

37. How does smoothing affects the image
A) Reduces noise in static image
B) Increases imaging time
C) Reduces pixel values
D) Increases injecting dose

38. Angina pectoris is the pain cause by ……. and treated by……..
A) Myocardial infarct and calcium antagonists
B) Myocardial infarct and adenosine
C) Myocardial ischemia and adenosine
D) Myocardial ischemia and calcium antagonists

39. What does "track" means on disk drive
A) Pie shaped centers
B) Discrete positions
C) Data blocks
D) Concentric rings

40. Plummers disease is same as
A) TMG B) GD C) Toxic adenoma D) Hyperthyroidism

41. In dual gastric scintigraphy which combination of the radionuclides is preferred.
A) 99mTc and 201 Tl
B) 99mTc and 67Ga
C) 99mTc and 131 I
D) 99mTc and 18F

42. Opiod drug morphine causes constriction of

A) Gall bladder
B) Spinter of oddi
C) Pancreatic duct
D) Common bile duct

43. During 14C-carbon breath tests, 1mmol of CO2 will be trapped by

A) 0.1 mmol of hyamine hydroxide
B) 0.5 mmol of hyamine hydroxide
C) 1.0 mmol of hyamine hydroxide
D) 5.0 mmol of hyamine hydroxide

44. Which statement is not true for perchlorate salt studies

A) It is rapidly absorbed and metabolized by the body
B) It is rapidly taken up by the thyroid gland
C) It is rapidly eliminated by the body in urine
D) It is used to prevent technetium uptake in the body

45. What would be the transmission factor for a weekly dose equivalent of 59.7 μSv and occupancy factor of 1, in a PET-CT room.

A) 59.7
B) 0.017
C) 0.34
D) 1.0

46. Which of the following tests should be performed to evaluate quantitative accuracy of SPET syatem?

A) Tomographic uniformity
B) Tomographic resolution
C) Tomographic contrast
D) Tomograpphic linearity

47. What is the meaning of "historical waste"

A) Are raw or partially treated
B) Have incomplete traceability
C) Mixed with waste stream
D) Have complete history

48. Two complementary approaches for the nano-particles are

A) Top and bottom approach
B) Top-up and bottom-up approach
C) Top-down and bottom-down approach
D) Top-down and bottom-up approach

49. Select the correct sequence of time needed by the radiopharmaceutical for stopping breast feed

A) 67Ga-citrate>201TlCl>99mTc-TCo4>99mTc-MAA
B) 201TlCl>67Ga-citrate >99mTc-TCo4>99mTc-MAA
C) 67Ga-citrate>201TlCl>99mTc-MAA >99mTc-TCo4
D) 201TlCl >67Ga-citrate >99mTc-MAA >99mTc-TCo4

50. Select the correct sequence of radiopharmaceuticals providing highest organ absorbed radiation dose to lower one.

A) MAA(lungs), HIDA(GB), MIBI(GB)
B) MAA(lungs),MIBI(GB), HIDA(GB)

C) MIBI(GB), MAA(lungs), HIDA(GB) D) HIDA(GB), MIBI(GB), MAA(lungs)

x-x-x

Optometry (1068)

1. Endothelial cell density is
- A) 1000 cells/mm2 at birth
- B) 2000-3000 cells/mm2 at birth
- C) 3000-4000 cells /mm2 at birth
- D) 6000-7000 cells/mm2 at birth

2. True about cornea is
- A) Refractive index is 1.376
- B) Maximum refraction occurs at cornea –aqueous interface
- C) Central cornea is 3D flatter than the periphery
- D) Central corneal thickness is 420-480 micron

3. Corneal topography can be useful in detecting which of these conditions?
- A) Dry eye
- B) Staphylococcal marginal keratitis
- C) Fuch's corneal dystrophy
- D) Megalocornea

4. Which of the following statements regarding acanthemoeba is false?
- A) Two potentially infectious forms of acanthoameba exist: the motile trphozoite and the dormant cyst.
- B) Acanthamoeba can be grown on buffered charcoal yeast extract agar.
- C) Acanthamoeba can be visualized with chalcofluor white, acridine orange, or the giemsa stain.
- D) Acanthamoeba keratitis can appear as a pseudodendriteinits course.

5. Patients who complain of increased symptoms first thing in the morning could have any of the following conditions except?
- A) Anterior basement membrane dystrophy
- B) Fuch's endothelial dystrophy
- C) Floppy lid syndrome
- D) Keratoconjunctivitissicca

6. All of the following conditions commonly cause glare except:
- A) Iritis
- B) Corneal scarring
- C) Posterior subcapsular cataract
- D) Albinism

7. All are risk factors for cataract formation except –
- A) Age
- B) Genetic propensity
- C) Type A personality
- D) Smoking

8. Callisto eye for Toric IOL is in ?
- A) Lenstar
- B) I trace
- C) IOL master
- D) Verion

9. What direction of gaze is included in the 6 cardinal positions?
- A) Upgaze
- B) Primary gaze
- C) Downgaze
- D) Right gaze

10. False about Femtosecond lasers is?

A) Involves Photodisruption
B) Wavelength is 1043 nm
C) Pulse is in nanoseconds
D) Infrared laser

11. For a trifocal glasses, if the lensometer reads
-1.00/-1.00X180 in the distance portion
+0.50/-1.00X180 in the intermediate portion
+1.50/-1.00X180 in the near portion
What is the near add?

A) +1.50 D
B) +0.50 D
C) +2.00 D
D) +2.50 D

12. All the following pairs are matched correctly *except:*

A) Diopter-reciprocal meter
B) Prism diopter- centimeters per meter
C) Wavelength – nanometers
D) Frequency-cycles per degree

13. When a lens material has a higher index of refraction, all of the following are true *except:*

A) The velocity of light is increased in this material
B) The spectacle lens made from this material can be thinner
C) Its value of *n* is higher
D) It has a greater ability to refract light

14. The Airy disk image on the retina is larger when

A) The wavelength of light is shortened
B) The focal length of the eye is shorter
C) The pupil size decreases
D) Macular degeneration is present

15. Corneal haze secondary to corneal edema is primarily caused by

A) Reflection
B) Light scattering
C) Refraction
D) Diffraction

16. *Candela* is a unit of measure for which of the following?

A) Luminous intensity
B) Luminous flux
C) Illuminance
D) Luminance

17. The far point of the non-accommodated myopic eye

A) And the fovea are corresponding points

B) Is posterior to the eye, optically speaking

C) Is nearer to the eye than the point of focus of the fully accommodated eye

D) Cannot be moved by placing a lens in front of the eye

18. In which type of astigmatism do the focal lines straddle the retina?

A) Mixed astigmatism

B) Compound myopic astigmatism

C) Compound hyperopic astigmatism

D) Simple myopic astigmatism

19. 19 An angle of 45 degrees corresponds to how many prism diopters

A) 45 B) 22.5 C) 90 D) 100

20. You fit a toric soft contact lens on a patient with a refractive error of - 2.50 D -1.50 x 175.The trial lens centers well, but the lens mark at the 6 o'clock position appears to rest at the4 o'clock position when the lens is placed on the patient's eye. What power contact lensshould you order?

A) -2.50 D - 1.50 x 175 B) -2.50 D - 1.50 x 115

C) - 2.50 D - 1.50 x 55 D) -2.50 D - 1.00 x 175

21. Compared with spectacles, contact lenses

A) Increase the accommodative requirements of myopic eyes

B) Increase the accommodative requirements of hyperopic eyes

C) Increase the convergence demands of hyperopic eyes

D) Decrease the convergence requirements of myopic eyes

22. The power of an in traocular lens (IOL) should be increased

A) As the power of the cornea increases and the axial length increases

B) As the power of the cornea decreases and the axial length increases

C) As the power of the cornea increases and the axial length decreases

D) As the power of the cornea decreases and the axial length decreases

23. In bifocal design, image jump may be minimized by

A) Placing the optical center of the segment as close as possible to the top of the segment

B) Placing the top of the segment as close as possible to the distance optical center

C) Using a smaller bifocal segment

D) Using a blended bifocal segment having no visible line of separation

24. The interface at the surface of the cornea is responsible for approximately what percentage of the refractive power of the human eye?

A) 25% B) 33% C) 50% D) 66%

25. Which of the rectus muscles inserts closest to the limbus?

A) Lateral rectus B) Medial rectus C) Superior rectus D) Inferior rectus

26. Which of the following localregional anesthetic agents has the longest duration ofeffect?

A) Lidocaine B) Procaine C) Bupivacaine D) Mepivacaine

27. Factors that influence drug penetration of the cornea include all of the following *except:*

A) Concentration B) Drop volume C) pH D) Vehicle

28. Which of the following series correctly depicts the relative duration of drug action?

A) Atropine>homatropine>scopolamine>cyclopentolate>tropicamide

B) Atropine>scopoiamine>homatropine>cydopentolate>tropicamid*e*

C) Cyclopentolate>tropicamide>scopolamine>homatropine>atropine

D) Homatropine>cyclopentolate>tropicamide>scopolamine>atropine

29. Which of the following best characterizes a person with "low vision"?

A) A bitemporal hemianopia

B) Best-corrected visual acuity of *20/70* or worse

C) Myopia greater than - 20 D

D) A disability related to visual dysfunction

30. Proper distance visual acuity testing for a low vision patient includes all of the following *except:*

A) Testing chart with an equal number of symbols on each line

B) Non-standardized room illumination

C) A Snellen visual acuity chart at 20 ft

D) A test distance of 10 ft

31. The color of fluorescein staining in corneal ulcer is:

A) Yellow B) Blue C) Green D) Royal blue

32. Schirmer's test is used for diagnosing:

A) Dry eye B) Infective keratitis C) Watering eyes D) Horner's syndrome

33. All the following are extraocular muscle of eye except:

A) Superior rectus B) Ciliary muscle C) Inferior oblique D) Superior oblique

34. In concomitant squint:

A) Primary deviation > Secondary deviation
B) Primary deviation < Secondary deviation
C) Primary deviation = Secondary deviation
D) Primary and secondary deviation are variable

35. In paralytic squint, the difference between primary and secondary deviation in the gaze of direction of the paralytic muscle:

A) Increases B) Decreases
C) Remains the same D) Depends on the muscle involved

36. Dense scar of cornea with incarceration of iris is known as:

A) Adherent Leucoma B) Dense leucoma
C) Ciliary staphyloma D) Iris bombe

37. Which one of the following is the gas mixer used in modern excimer lasers?

A) CO_2 B) N_2O C) ArF D) XeF

38. A polarizing ophthalmic lens should be oriented so as to eliminate:

A) A vertical vibrating wave B) Horizontal vibrating wave
C) Oblique vibrating wave D) All vibrating wave

39. An aphake is refracted at a distance of 13 mm and is found to require a +10.00 D lens. Assuming again, that the contact lens does not change the refraction of the eye, what is the final contact lens power:

A) +11.00 D B) +11.50 D C) +12.00 D D) +12.50 D

40. Velocity of sound in Silicon Oil

A) 980 m/s B) 1280 m/s C) 1530 m/s D) 1632 m/s

41. Post keratoplasty keratometery shows vertically oval (elongated) mires. Which meridian sutures should be removed to reduce astigmatism?

A) 90 B) 180 C) 45 D) No suture removal

42. You fit a patient who has - 3.50 D of myopia with an RGP contact lens that is steeper than K. If the patient's average K reading is 7.80 mm and you fit a lens with a base curve of 7.60 mm, what is the shape of the tear lens?

A) Plano B) No tear lens C) Concave D) Convex

43. What is the power of a prism that displaces an image 10 cm at a distance of 50 cm?

A) 10 Δ B) 20 Δ C) 25 Δ D) 40 Δ

44. When a +/- 0.50 JCC is placed on a lensometer with red axis at 0 and 180 degree, the lensometer will read the power as:

A) -0.50/+1.00x90 B) -0.50/+1.00x180 C) 0 D) +0.50

45. Which one of the following is true regarding accommodative esotropia (strabismus) and amblyopia in children?

A) Strabismus is caused by dysfunction of the ocular muscles, which pull the eye out of alignment.

B) Treatment for accommodative esotropia usually consists of miotic eye drops.

C) The earlier amblyopia is detected and treated, the better the outcome.

D) Stereopsis and binocularity develop independently of eye alignment.

46. Protanomaly referred as:

A) Green weakness B) Red weakness

C) Yellow weakness D) Blue weakness

47. In corneal topography Q value signifies

A) Corneal hyteresis B) Corneal asphericity

C) Corneal aberration D) Corneal thickness progression

48. In wave front analysis Z^0_4 stands for:

A) Coma B) Spherical aberrations

C) Trefoil D) Tetrafoil

49. Kappa angle is the angle between:

A) Visual axis and optical axis

B) Papillary axis and optical axis

C) Optical axis and fixation point at the centre of rotation of the eye ball

D) Visual axis and pupillary axis

50. Satellite nodule on corneal ulcer is seen due to :

A) Bacterial B) Viral C) Fungal D) Mycoplasma

x-x-x

Physics

1. In the N dimensional space, the number of different components in a skew-symmetric tensor A^{ij} of second-order are

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

2. The value of $\int_0^\infty \frac{Sin\, t}{t}\, dt$ is
   (A) $\frac{\pi}{4}$
   (B) $\frac{\pi}{2}$
   (C) Zero
   (D) π

3. If $\phi = x^3 + y^3 + z^3 - 3xyz$, then expression for Div (grad ϕ) is
   (A) $(x + y + 3yz)$
   (B) $3(x + y + xz)$
   (C) $3(x + y + z)$
   (D) $6(x + y + z)$

4. At the transition temperature in a first order phase transition, the specific heat of the system
   (A) Diverges and its entropy has finite discontinuity
   (B) Remains unchanged and its entropy exhibits finite discontinuity
   (C) Has finite discontinuity and its entropy diverges
   (D) Diverges and its entropy remains the same

5. A particle moves along the curve $x = 2t^2;\ y = t^2 - 4t,\ z = 3t - 5$; where t is time. The component of its acceleration at time t=1 in the direction of ($\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$) is
   (A) $-\frac{2}{\sqrt{14}}$
   (B) $-\frac{1}{\sqrt{14}}$
   (C) $-\frac{2}{\sqrt{7}}$
   (D) $-\frac{2}{\sqrt{5}}$

6. Fourier transform of $e^{-x^2/2}$ is
   (A) $log_e (k^2)$
   (B) e^{-2k^2}

(C) $e^{-k^2/2}$

(D) e^{-k^2}

7. Compton shift in wavelength of a photon scattered at angle, θ, from the electron (mass m) is given by

(A) $\frac{h}{mc^2}(1+cos\,\theta)$

(B) $\frac{h}{mc}(1+cos\,\theta)$

(C) $\frac{h}{mc}(1-cos\,\theta)$

(D) $\frac{h}{mc^2}(1-cos\,\theta)$

8. The capacitance of two concentric spherical metal shells with radii a and b is

(A) $4\pi\varepsilon_o\frac{ab}{(a+b)}$

(B) $4\pi\varepsilon_o\frac{ab}{(b-a)}$

(C) $8\pi\varepsilon_o\frac{ab}{(b-a)}$

(D) $8\pi\varepsilon_o\frac{ab}{(a+b)}$

9. The electrostatic energy of a uniformly charged spherical shell of total charge q and radius R is

(A) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{R}$

(B) $\frac{1}{4\pi\varepsilon_o}\frac{q}{R}$

(C) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{R^2}$

(D) $\frac{1}{8\pi\varepsilon_o}\frac{q^2}{R}$

10. Transition temperature T_c and critical field H_c for a superconductor are related as

(A) $H_c = H_o\left[1+\left(\frac{T}{T_c}\right)^2\right]$

(B) $H_c = H_o\left[1 - \left(\frac{T}{T_c}\right)^2\right]$

(C) $H_c = H_o\left[1 - \left(\frac{T}{T_c}\right)^3\right]$

(D) $H_c = H_o\left[1 - \frac{T^2}{T_c}\right]$

11. The eigenvalues of $\begin{bmatrix} 2 & 4 \\ 3 & 3 \end{bmatrix}$ are
    (A) -1, 6
    (B) 1, 6
    (C) 2, 8
    (D) 3, 4

12. The Fourier series expansion of function $f(x) = \frac{\pi^2}{24} - \frac{x^2}{8}$ in the interval (-π,π).
    (A) $\frac{1}{2}\left[\sin x - \frac{\sin 2x}{2^2} + \frac{\sin 3x}{3^2} - \cdots ...\right]$
    (B) $\frac{1}{2}\left[\cos x - \frac{\cos 2x}{2^2} + \frac{\cos 3x}{3^2} - \cdots ...\right]$
    (C) $\frac{1}{2}\left[1 + \sin x - \frac{\sin 2x}{2^2} + \frac{\sin 3x}{3^2} - \cdots ...\right]$
    (D) $\sum_{n=1}^{\infty} 1 + \frac{(-1)^{n+1}}{2n^2} Cos\ nx$

13. The ratio of electrical conductivity σ to thermal conductivity κ is proportional to temperature T. According to Wiedemann – Franz law, the ratio σ/ κT
    (A) Is a constant called the Landau ratio
    (B) Varies from metal to metal.
    (C) Changes slowly with temperature and is called Debye constant.
    (D) Is the same for all metals, and is called the Lorentz number.

14. An electron in classical electrodynamics is best described as
    (A) A point charge particle.
    (B) A particle with a radius comparable to its Compton wavelength.
    (C) A particle of radius e^2/mc^2
    (D) A wave.

15. The paramagnetic susceptibility of a solid varies with temperature (t) as
    (A) T^2

(B) T^0
(C) T
(D) T^{-1}

16. The form of the internal time-base signal in a common oscilloscope (CRO) is
(A) Square wave
(B) Sine wave
(C) Saw-tooth wave
(D) Piece-wise sine wave.

17. The simplified form of the Boolean expression $\overline{\overline{\bar{A}(\overline{AB})}}.\overline{\bar{B}(\overline{AB})}$ is
(A) $\overline{AB}$
(B) $A.B$
(C) $A + B$
(D) $\overline{A + B}$

18. Which of the following is a pseudoscalar
(A) $\vec{r}.\vec{p}$
(B) $|\vec{r} \times \vec{p}|$
(C) $(\vec{r} \times \vec{p}).\vec{r}$
(D) $\left(\vec{A} \times \vec{B}\right).\vec{C}$

19. A plane travelling wave has a peak electric field E_o of 15V/m. The medium is lossless with $\mu_r = 1\ and\ \epsilon_r = 12$, the impedance of the medium is
(A) ~ 109 Ω
(B) ~ 377Ω
(C) ~34 Ω
(D) ~ 4524 Ω

20. According to Nilsson model, the shell model $h_{11/2}$ neutron orbital in a weakly oblate nucleus ($\varepsilon_2 \sim 0.04$) splits into orbitals having
(A) Ω = 9/2, 7/2, 5/2, 3/2, 1/2 with decreasing order of energy.
(B) Ω = 9/2, 5/2, 1/2 with decreasing order of energy.
(C) Ω = 7/2, 3/2 with decreasing order of energy.
(D) Ω = 1/2, 3/2, 5/2, 7/2, 9/2 with decreasing order of energy.

21. The oblate nuclear shapes are defined as spheroid with
(A) two axes equal which are smaller ones, and negative quadrupole moment
(B) two axes equal which are larger ones, and negative quadrupole moment
(C) two axes equal which are smaller ones, and positive quadrupole moment
(D) two axes equal which are larger ones, and positive quadrupole moment

22. The spin magnetic moment of neutron and its spin angular momentum are
(A) at right angles to each other

(B) cannot be defined as spin magnetic moment of neutron is zero
(C) opposite to each other
(D) in same direction

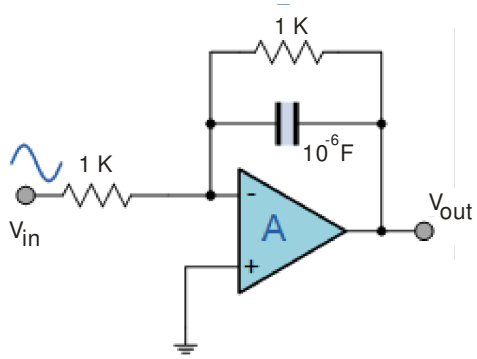
23. Shell model predicated spin-parity of $_{16}S^{33}$ nucleus is
(A) $5/2^+$
(B) $3/2^+$
(C) $3/2^-$
(D) $1/2^+$

24. The Lagrangian of a particle moving in one dimension is given by $L = \frac{\dot{x}^2}{2x} - V(x)$. *V(x)* is static one. The Hamiltonian is given by
(A) $\frac{1}{2}xp + V(x)$
(B) $xp + V(x)$
(C) $\frac{1}{2}xp^2 + V(x)$
(D) $\frac{1}{2}x^2p + V(x)$

25. The potential of a diatomic molecule as a function of the distance r between the atoms is given by $V(r) = -\frac{a}{r^6} + \frac{b}{r^{12}}$. The values of the equilibrium separation and the potential at equilibrium separation between the atoms, respectively, are
(A) $\left(\frac{2b}{a}\right)^{1/2}$; $\frac{-a^2}{4b}$
(B) $\left(\frac{2b}{a}\right)^{1/6}$; $\frac{-a^2}{4b}$
(C) $\left(\frac{2b}{a}\right)^{1/6}$; $\frac{-a^2}{b}$
(D) $\left(\frac{2b}{a}\right)^{1/6}$; $\frac{-a}{4b}$

26. Given $u(x,y) = x + \frac{1}{2}(x^2 - y^2)$ is the real part of an analytical function $f(z)$ of complex variable $z = x + iy$, then imaginary part of $f(z)$ will be
(A) $x(y+1)$
(B) $y(x+1)$
(C) $y(x^2+1)$
(D) $y^2(x+1)$

27. If the input to the following circuit is sinusoidal signal of amplitude 5 V and frequency (1000/2π) Hz , then amplitude of the output in volts will be



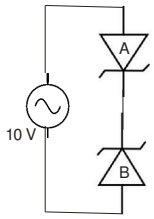
(A) $5\sqrt{2}$

(B) $\frac{5}{2\sqrt{2}}$

(C) $\frac{5}{\sqrt{2}}$

(D) 5

28. Two zener diodes, A and B, are connected to a 10 V a.c power supply. Diode A is has Zener voltage (Vz) = 3 V and Diode B has Vz = 5 V. The cut-in voltage (Vγ) for diodes A is 0.7 V and that for diode B is 0.3 V. The peak-to-peak voltage across the zener diode combination will be



(A) +5.3 V and -3.7 V

(B) -5.7 V and +3.3 V

(C) +5.7 V and -3.3 V

(D) -5.3 V and +3.7 V

29. Asymmetry energy correction in liquid-drop model formula for nuclear binding energy is

(A) Negative and proportional to $\frac{(A-2Z)^2}{A}$

(B) Positive and proportional to $\frac{(A-2Z)^2}{A}$

(C) Negative and proportional to $\frac{(A+Z)^2}{A}$

(D) Negative and proportional to $\frac{(A-Z)^2}{A}$

30. The energy E_n of 'n' level of an atom consisting of positron and electron that orbit each other will be given by (R is Rydberg constant for hydrogen atom)

(A) $\frac{R}{n^2}$

(B) $\frac{2R}{n^2}$

(C) $\frac{3R}{2n^2}$

(D) $\frac{R}{2n^2}$

31. The commutator $[x^2, p^2]$ is

(A) $i\hbar(xp + px)$

(B) $2i\hbar(xp + px)$

(C) $2i\hbar(x + p)$

(D) $4i\hbar xp$

32. Which of the following is Lorentz invariant

(A) $\left|\vec{E}.\vec{B}\right|^2$

(B) $\left|\vec{E}\right|^2\left|\vec{B}\right|^2 - \left|\vec{E}\right|^2$

(C) $\left|\vec{E}\right|^2 - \left|\vec{B}\right|^2$

(D) $\left|\vec{E}\right|^2\left|\vec{B}\right|^2$

33. Consider a system having three energy levels with energies 0, 2ε and 3ε, with respective degeneracies of 2, 2 and 3. Four bosons of spin zero have to be accommodated in these levels such that the total energy of the system is 10ε. The number of ways it can be done is

(A) 12

(B) 8

(C) 24

(D) 18

34. The possible values of the resultant angular momentum for two electrons; one with $j_1 = \frac{3}{2}$

and other with $j_2 = \frac{5}{2}$ are

(A) 4, 3, 2, 1
(B) 4ħ, 3ħ, 2ħ, 1ħ
(C) $\sqrt{20}$ħ, $\sqrt{12}$ħ, $\sqrt{6}$ħ, $\sqrt{2}$ħ
(D) 1, 4

35. The atom with configuration (*ns*) (*n'p*); *n* and *n'* represent principal quantum numbers, *s* and *p* are subshells. The possible ground state terms for (*ns*) (*n'p*) configuration are

(A) $^1S_0$, $^1P_1$, $^3P_1$, $^3P_2$
(B) $^3S_1$, $^1P_1$, $^3P_1$, $^3P_2$
(C) $^3P_0$, $^3P_1$, $^3P_2$, $^1P_1$
(D) $^3P_0$, $^3P_1$, $^3P_2$, $^1D_2$

36. Consider a system of 3 Fermions which can occupy 4 available energy states with equal probability. The entropy of the system is

(A) k_B *Ln* 8
(B) k_B *Ln* 12
(C) $2k_B$ *Ln* 2
(D) k_B *Ln* 16

37. For two electron system, possible electronic state is $^3P_2$. Angle between $\vec{S}$ and $\vec{L}$ in this state is

(A) 0^o
(B) 60^o
(C) 30^o
(D) 90^o

38. Lande's g factor and total magnetic moment for $^2P_{3/2}$ state are

(A) $g_j = \frac{2}{3};\ \mu_j = -\frac{2}{3}\sqrt{15}\,\mu_B$
(B) $g_j = \frac{4}{3};\ \mu_j = -\frac{2}{3}\sqrt{15}\,\mu_B$
(C) $g_j = \frac{4}{3};\ \mu_j = -\sqrt{15}\,\mu_B$
(D) $g_j = \frac{1}{3};\ \mu_j = \sqrt{15}\,\mu_B$

39. The Λ value of $^3\Sigma_u^+$ state is

(A) 0
(B) 3
(C) -1
(D) +1

40. One can study rotational structure of O_2 molecule using

(A) Infrared spectroscopy
(B) Raman spectroscopy
(C) Visible absorption spectroscopy
(D) Microwave absorption spectroscopy

41. Total degeneracy of n=3 state of H atoms is
(A) 9
(B) 3
(C) 14
(D) 18

42. The field carriers in the weak interactions that are responsible for ordinary beta decays
(A) $W^{\pm}$ bosons
(B) Gluons
(C) Z^0 boson
(D) electrons

43. The field carriers in the strong interactions between quarks are
(A) Gluons, which are massless and travel with speed of light
(B) Z^0 bosons, which a have 97 times mass of proton
(C) $W^{\pm}$ bosons, which have 85 times mass of proton
(D) Gluons, which are have 85 times mass of Au nucleus

44. Maximum, energy that can be transferred from a charged particle of mass *m* with kinetic energy *E* to an electron of mass m_o in a single collision is
(A) Em_o/m
(B) $4Em_o/m$
(C) $2Em_o/m$
(D) $8Em_o/m$

45. A 12 bit ADC is used to convert analog voltage of 0 to 10 V into digital. The resolution is
(A) 24.4 mV
(B) 24.4 μV
(C) 2.44 mV
(D) 1.22 mV

46. In GM counter experiment, the measured data is 4900, the statistical error quoted with 68 % confidence level will be will be
(A) 50
(B) 70
(C) 140
(D) 210

47. The vacuum of the order of 10^{-6} torr can be produced and measured using

(A) rotary pump and pirani gauge, respectively.
(B) diffusion pump and pirani gauge, respectively.
(C) adsorption pump and thermocouple gauge, respective
(D) diffusion pump and penning gauge, respectively.

48. Phonons propagate in a solid with
(A) Velocity of light
(B) Velocity of sound
(C) Root mean square velocity of the atoms in the solid
(D) Fermi velocity

49. In a degenerate n type semiconductor material, the Fermi level is
(A) very near valence band
(B) at the centre in between valence and conduction bands
(C) in conduction band
(D) In valence band

50. The maximum proportion of volume available in face-centered cubic lattice of spheres is
(A) 52%
(B) 26%
(C) 32%
(D) 68%

x-x-x

Statistics (1068)

1. Two unbiased dice are tossed simultaneously. The probability that the sum of the numbers on the upper faces of both is either a multiple of three or a multiple of 4 is

A) 1/3 B) ¼ C) 7/12 D) 5/9

2. Let $A_1, \ldots, A_n$ be n events in the sample space. Let $\overline{A_t}$ be compliment of A_t, t= 1, …,n. Then

A) $P(A_1 \cap \ldots \cap A_n) \geq 1 - \sum_{i=1}^{n} P(A_i)$ B) $P(A_1 \cap \ldots \cap A_n) \geq 1 - \sum_{i=1}^{n} P(A_i)$

C) $P(\overline{A_1} \cap \ldots \cap \overline{A_n}) \geq 1 - \sum_{i=1}^{n} P(A_i)$ D) $P(\overline{A_1} \cap \ldots \cap \overline{A_n}) \leq 1 - \sum_{i=1}^{n} P(A_i)$

3. Graphic method to check the normality assumption of error in a linear model is to draw the graph of:

A) Residuals versus predicted values B) Residuals versus observed values

C) Q-Q plot of predicted values D) Q-Q plot of residuals

4. Let $\hat{\beta}$ be the estimate of β in the Gauss Markov linear model Y =Xβ +ε, where X is a nxk matrix with rank k and n>k. Then the distribution of $Y^tY - \hat{\beta}^t X^tY$ is

A) F(n, n-k) B) Chi-square with n-k df

C) Chi-square with k df D) F(n-k, n).

5. Let Y = ($Y_1, \ldots, Y_n$), where Y_is are independent and normally distributed. Then for the matrix A, the distribution of Y^tAY is chi square if and only if

A) $|A| \neq 0$ B) $|A| \neq 0$ C) $AA^t = I$ D) $A = A^2$

6. The set of all feasible solutions to a linear programming problem forms a :

A) Concave set B) Convex set C) Orthogonal set D) Optimal set

7. The value of k for which the function f(x.y) = k on the support R_{XY} = {(x,y): 0<x<y, 0<y<1} and zero otherwise is the joint probability density function will be:

A) 2 B) ½ C) 1 D) ¼

8. The characteristic function of a discrete random variable X is $(.25+ .75\, e^t)^4$. The value of P[X≥1] is:

A) .0468 B) .0156 C) .9532 D) .9844

9. Let the square matrix A be partitioned as $A=\begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}$. Then |A| is equal to

A) $|A_{11}||A_{11} - A_{12}A_{22}^{-1} A_{21}|$ B) $|A_{22}||A_{11} - A_{12}A_{22}^{-1} A_{21}|$

C) $|A_{22}||A_{22} - A_{12}A_{11}^{-1} A_{21}|$ D) $|A_{22}||A_{11} - A_{21}A_{22}^{-1} A_{12}|$

10. The test statistic obtained from likelihood ratio criterion to test the hypothetical value of mean vector of a multivariate normal distribution, on the basis of a random sample of size N, is :
A) Mahalanobis D^2 B) Hotelling T^2

C) F D) Multivariate t- distribution

11. Let the p-dimensional random vector X follow multivariate distribution $N_p(\mu, T)$. Let Y = AX , where A is a qxp matrix of rank q (q<p). Then the distribution of Y is:
A) $N_p(A\mu, ATA^t)$ B) $N_p(A\mu, ATA^t)$

C) $N_q(A\mu, T)$ D) $N_q(A\mu, ATA^t)$

12. Let the p-dimensional random vector X follow multivariate distribution $N_p(\mu, \Sigma)$. Let X and Σ be partitioned as $X = (X^{(1)}, X^{(2)})^t$ and $\Sigma=\begin{bmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{bmatrix}$ respectively, where $X^{(1)}$ has first q components of X. Then $X^{(1)}$ and $X^{(2)} – W X^{(1)}$ are uncorrelated if W is equal to:
A) Σ_{22}^{-1} B) $\Sigma_{12}\Sigma_{11}^{-1}$ C) $\Sigma_{21}\Sigma_{11}^{-1}$ D) $\Sigma_{21}\Sigma_{22}^{-1}$

13. A random variable X may assume four values with probabilities (1+3x)/4, (1-x)/4, (1+2x)/4 and (1-4x)/4. The value(s) of x for which this is a probability distribution is:
A) x<1 B) -1/3≤x≤1/4 C) 0≥ x≥ -1/2 D) ¼ ≤x ≤0

14. A random variable X is uniformly distributed over the interval [$1-1/\sqrt{3}$, $1+1/\sqrt{3}$]. The exact value of P[$|X-E(X)| \geq 3/2\sqrt{Var(X)}$] is :
A) .44 B) .64 C) .134 D) $\sqrt{3}/2$

15. Let $\bar{X}$ be the mean of a random sample of size n from a continuous distribution with mean μ and variance σ^2 . Suppose the asymptotic distribution of $\bar{X}$ is normal with mean μ and variance σ^2 /n . Then the variance of the asymptotic distribution of a continuous function $H(\bar{X})$ is:
A) $H(\mu)\ \sigma^2/n$ B) $H'(\mu)\sigma/n$ C) $[H'(\mu)\sigma]^2$ D) $[H'(\mu)\sigma]^2/n$

Here H́(.) denotes the derivative.

16. Let f(x) and F(x) be the pdf and cdf, respectively, of a continuous random variable X. Let the interval [a, b] be in the support of X . For any t ε [a, b] , the pdf when truncated to left at a and to the right b, will be:
A) f(t)/[F(b)-F(a)] B) f(t)/[1- F(b)] C) f(t)/[1-F(a)] D) f(t)

17. Let random variable X follows binomial distribution with parameters n and p. Then the distribution of random variable Y= n-X is:

A) Geometric B) Binomial with parameters n and p

C) Binomial with parameters n and 1-p D) Poisson with parameter np.

18. Let f(x,y) be the joint pdf of a continuous random vector (X,Y). Define the random variables U = $(X^2+Y^2)^{1/2}$ and V =X. The Jacobean of this transformation is:

A) xy B) $y(x^2+y^2)^{-1/2}$ C) $-y(x^2+y^2)^{-1/2}$ D) $xy(x^2+y^2)^{-1/2}$

19. Let X_1, …, X_n be a random sample from a two parameter exponential distribution with location parameter μ and scale parameter θ. The MLEs of μ and θ respectively are $X_{(1)}$= min (X_1, …, X_n) and S = $\sum_{i=1}^{n}(X_i - X_{(1)})$/n. An unbiased estimator of θis:

A) $X_{(1)}$–S/n B) $X_{(1)}$ C) S D) nS/(n-1)

20. The interval of the real line on which the function f(x) = $1/(1+x^2)$ will be concave is:

A) (0, ∞) B) $(0, 1/\sqrt{3})$ C) $(-1/\sqrt{3}, 0)$ D) $(-1/\sqrt{3}, 1/\sqrt{3})$.

21. 25% of the values of a data set are less than 30 and 25% are more than 60. The coefficient of quartile deviation is:

A) 15 B) 30 C) 1/3 D) 1/15

22. Let random variable X follow binomial distribution with parameters n and p (0<p<1). An upper bound on P[X>nα], using Markov's inequality for p=.5 and α=.75 is:

A) 3/8 B) ¾ C) ½ D) 2/3

23. The most appropriate non-parametric test for testing the stochastic dominance between two distribution functions is:

A) Median test B) Mann-Whiteny U-test

C) Run test D) Mood's test

24. A system of 5 identical units consists of two parts A and B which are connected in series. Part A has 2 units connected in parallel and Part B has 3 units connected in parallel. All the five units function independently with probability of failure ½. The probability that the system functions is:

A) 31/32 B) 11/32 C) 1/32 D) 21/3244

25. The radius of a circle is measured with an error of measurement which is normally distributed with mean 0 and variance σ^2. Let X_1,…,X_n be n measurements on the radius. Let $\overline{x}$ and $s^2 = \frac{1}{n-1}\sum(x_i - \overline{x})^2$be the sample mean and sample variance respectively. Then an unbiased estimate of the area of the circle is:

A) $\pi\overline{x}^2$ B) $\pi\left[\frac{1}{n}\sum x_1^2 - s^2\right]$ C) $\frac{\pi}{n}\sum x_i^2$ D) $\pi\left(\overline{x}^2 - s^2\right)$

26. For which of the following set of values will a balanced incomplete block design with parameters v, b, r, k, λ exists:

A) v=11, b=7, r=4, k= 4, λ=2 B) v=21, b=4, r=4, k= 21, λ=4

C) v=7, b=7, r=4, k= 4, λ=2 D) v=11, b=7, r=3, k= 4, λ=4

27. To examine whether two different skin creams, A and B, have different effect on human body, n randomly chosen persons were enrolled in a clinical trial. Then cream A was applied to one of the randomly chosen arms of each person, cream B to the other arm. The design used is:

A) CRD B) LSD C) Youden Square D) RBD

28. A random variable X takes values-3, -2, -1, 0, 1, 2 with probability .1, .2, .2, .1, .3, .1 respectively. Let Y = | X|. Then E(Y) is:

A) .5 B) 1.3 C) 1.4 D) 0

29. Let random variable X denote the number of tosses before the first appearance of a 6 when a balanced die is tossed repeatedly and independently. Then for k= 0,1,2,… the value of P[X= k] is:

A) $(1/6)^k$ B) ½ C) $(5/6)^k$ D) $5^k/6^{k+1}$

30. If P(B) = 1/3 and $P(A/B^c)$=1/4. The value of P(AUB) is:

A) 1/2 B) 2/3 C) 3/4 D) 5/6

31. Let X and Y be iid $N(0,\sigma^2)$. Define V = X + Y and S = X – Y. Then the conditional distribution of V given S = s is:

A) Uniform$\left(\mu - \frac{s}{2}, \mu + \frac{s}{2}\right)$ B) $N(0,2\sigma^2)$

C) $N(0,\sigma^2)$ D) $N(s,\sigma^2)$

32. Let X be a binomial random variable with parameters n = 11, p = 1/3. The value(s) of k at which P[X = k] maximized is:

A) k = 1, 2 B) k = 3, 4 C) k=5 D) k=6

33. Let $X_1,\ldots,X_n$ be a random sample from a distribution with probability density function $f(x) = \frac{1}{\theta}, 0 < 0 < x < \theta$. An unbiased estimator of θ is:

A) $\overline{x}$ (sample mean) B) max($X_1,\ldots,X_n$) /(n+1)

C) min (X_1,…,X_n)/n D) $\frac{n+1}{n}[max(X_1, \dots, X_n)]$

34. Suppose persons A and B draw random samples of sizes 18 and 24 respectively from $N(\mu, \sigma^2), \sigma > 0$ for testing $H_0: \mu = 5$ against $H_1: \mu > 5$ In both the cases the observed sample means and sample standard deviations are same with values $\overline{x}_1 = \overline{x}_2 = 1.8$, $s_1 = s_2 = s$. Both of them use usual t-test and state p-values as p_A and p_B respectively. Then

A) $p_A > p_B$ B) $p_A = p_B$ C) $p_A < p_B$ D) $p_A + p_B = 1$

35. Suppose X_1, X_2 … is an iid sequence of random variables with common variance $\sigma^2 > 0$. Let $Y_n = \frac{1}{n}\sum_{i=1}^{n} X_{2i-1}$, $Z_n = \frac{1}{n}\sum_{i=1}^{n} X_{2i}$. Then the asymptotic distribution (as n →∞) of $\sqrt{n}(Y_n - Z_n)$ is:

A) N(0,1) B) $N(0, \sigma^2)$ C) $N(0, 2\sigma^2)$ D) Degenerate at 0

36. In a CRD the four treatments A,B, C, D are repeated 6,9,11, 8 times respectively. The error degrees of freedom (df)will be:

A) 3 B) 25 C) 33 D) 30

37. In an RBD there are four treatments A,B,C and D each is to be repeated 5 times. The number of blocks required is:

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

38. Let $X_1, \dots, X_n$ be iid random variables from uniform distribution over the interval $(0, \theta)$, $\theta > 1$. Define $Y_i = 1$ if $X_i > 1$ and zero otherwise. Let $\overline{Y} = \frac{1}{n}\sum Y_i$. The method of moments estimator of θ is:

A) $\overline{Y}$ B) $1 - \overline{Y}$ C) $\frac{1}{\overline{Y}}$ D) $\frac{1}{1-\overline{Y}}$

39. A person selects a simple random sample with replacement of size 3 from a lot containing 5 good and 3 bad items. The probability of getting 2 good and 1 bad item in the sample is:

A) 75/512 B) 15/28 C) 225/512 D) 15/64

40. Let f(x)=1 if x = c and zero otherwise, where c is a positive constant. The value of $\int_{-\infty}^{\infty} e^{-x} f(x) dx$ is :

A) 0 B) e^{-c} C) ∞ D) 1

41. Let $X_1, \dots, X_n$ be iid gamma random variables. Define $Y_i = \frac{X_i}{\sum_{i=1}^{n} X_i}$, i=1,…,n. The distribution of Y_i is:

A) Uniform B) Beta (first kind) C) Exponential D) Pareto

42. Let $Y_{ij} = \mu_i + \varepsilon_{ij}, j = 1, \dots, n_i, i = 1, \dots, k$, where $\varepsilon_{ij} \sim NI(0, \sigma^2) \forall i, j$. Let $\overline{Y}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} Y_{ij}, i = 1, \dots, k$. For any sets of constants $a_1, \dots, a_k$ and $b_1, \dots, b_k$ the covariance between $\sum a_i \overline{Y}_i$ and $\sum b_i \overline{Y}_i$ is zero if:

A) $\sum a_i b_i = 0$ B) $\sum n_i a_i b_i = 0$ C) $\sum a_i = 0$ D) $\sum \frac{a_i b_i}{n_i} = 0$

43. Let the error degrees of freedom in the ANOVA table of an RBD is 63 and degrees of freedom for the between sum of squares is 7. Then the block size is:

A) 8 B) 9 C) 10 D) 7

44. Let random variable X follows uniform distribution over the interval (0, 2).The value of E[X|X>.5] is:

A) .9375 B) 1.25 C) 1.875 D) 1.5

45. Let $X_1, \dots, X_n$ be independent Poisson random variables such that the mean of X_i is μ_i , i = 1, …, n. The joint distribution of $X_1, \dots, X_n$ given $X_1 + \dots X_n$ is :

A) Beta (first kind) B) Binomial C) Hyper Geometric D) Multinomial

46. If A_1 and A_2 are two events such that $P(A_1 \cup A_2) = P(A_1) + P(A_2) = 1$.Then events A_1 and A_2 are:

A) Independent B) Mutually exclusive

C) Mutually exclusive and independent D) Mutually exclusive and exhaustive.

47. Let x = 10 be an observation on the hyper geometric random variable X with probability mass function $P[X = x] = \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}}, x = 0,1, \dots, \min(M, n)$ and n-x<N-M. Let M = 40, n = 30 and N is an unknown. The maximum likelihood estimate of N is:

A) 120 B) 75 C) 60 D) Not unique

48. Let $X_1, \dots, X_n$ be independent and identically distributed (iid) Bernoulli (p) random variables, 0<p<1. The distribution of $Y = \sum X_i^2$ is:

A) Chi-square with n degrees of freedom B) N(np, np (1-p))

C) Binomial (n, p) D) Poisson (np)

49. Let $X \sim N(0,1)$, $Y \sim N(1,2)$. Then

A) $P[X > 0] = P[Y > 1]$ B) $P[X > 0] = P\left[\frac{Y}{2} > 1\right]$

C) $P[X > 0] = P\left[Y > \frac{1}{\sqrt{2}}\right]$ D) $P[X > 0] = P[Y > 0]$

50. The time interval between arrivals of two buses at a bus stop is exponentially distributed with mean 5 minutes. Then the probability that no bus arrives in 5 minutes is:

A) e B) 1/2 C) 1/5 D) 1/e

x-x-x

System Biology & Bioinformatics (1068)

1. All the molecules listed below are used as spin label probes for studying biomolecules by electron paramagnetic resonance spectroscopy technique, except one;

A) 1-piperidinyloxy 2,2,6,6-tetramethyl (TEMPO)
B) 5-nitroxyl oxazolidine
C) 4-isothiocyanato-TEMPO
D) 2 ,2 ,6 ,6 -nitroxyl oxazolidine

2. During electrophoretic mobility shift assay specific protein binding to DNA could be identified by which of the following result;

A) Appearance of supershifted band upon addition of antibody
B) Appearance of fast moving band upon addition of antibody
C) Disappearance of all types of bands upon addition of antibody
D) Appearance of thick band on bottom of gel upon addition of antibody

3. Following mentioned is the list of tools used for quality assessment of Protein secondary and tertiary structure prediction, except one;

A) PROCHECK B) VERIFY 3D C) WHAT IF D) VMD

4. All of the following are examples of transposons, identify which one of the following does not possess reverse transcriptase activity;

A) LINEs (long interspersed nuclear elements)
B) SINEs (short interspersed nuclear element)
C) LTR (Long terminal repeats)
D) DNA transposons

5. A gene that will be expressed only if there are two identical copies of it is called as;

A) Psuedogene B) Syngenic C) Recessive gene D) Dominant gene

6. A typical BLAST output shows all of the following important properties, except;

A) Value of E decreases exponentially with increasing S value.
B) The size of database searched can influence the likelihood of particular alignment output
C) The size of query can be detrimental to the alignment outputs
D) The expected score for alignment of a pair of amino acids cannot be determined

7. The Laser beams are used in image analysis, DNA sequencing and so many other techniques. The abbreviation Laser stands for;

A) Light amplification by stimulated emission of radiation
B) Light amplification by stimulated excitation of radiation
C) Light absorption by stimulated emission of radiation
D) Light absorption by stimulated excitation of radiation

8. Identify which of the following metacharacters match to the descriptions for the beginning of a line, the end of a line and any non digit descriptions in the Perl Programs;

A) ^, $ and \ d respectively
B) ^, $ and \ D respectively
C) >, $ and \ d respectively
D) >, $ and \ D respectively

9. Urea is a protein denaturant. All of the following statements are true for it, except;

A) It is a net uncharged molecule
B) It is polar in nature
C) It can interrupt hydrogen bonding between amide and carbonyl groups.
D) It can disrupt disulfide linkages in proteins10.

10. A Bioinformatics program used to convert raw DNA sequences input to an ordered list of base identities and quality scores is called;

A) Chromatogram B) Reads C) Contigs D) Base caller

11. The yeast *Saccharomyces cerevisiae* is an attractive model organism for many reasons. Which one of the following is not true about it;

A) It contains about 13Mb of DNA in 16 chromosomes.
B) Its genome has high gene density.
C) Its genome has been completely sequenced.
D) Its physical and genetic maps have not been unified.

12. The simplest and best way to navigate Entrez search space is mentioned below. Identify the correct answer;

A) Use of individual search terms
B) Use of individual search terms coupled together by special characters
C) Use of individual search terms coupled together by Boolean operators
D) Use of individual search terms coupled together by special characters and Boolean operators

13. To evaluate the phylogenetic analysis data and robustness of trees, all of the following methods, except one, are used for tree evaluation;

A) Randomised trees
B) Boot strapping
C) Likelihood ratio test
D) Star decomposition

14. The homology modeling approach consists of steps i-iv, listed as below. Identify the correct order of steps followed;

i. Identification of homologous sequences in a protein structure database
ii. Optimization of side chains, atoms and loops
iii. Build a framework structure
iv. Refinement of entire model

A) i, ii, iii followed by iv
B) i, iii, ii followed by iv
C) i, iv, iii followed by iii
D) i, ii, iv followed by iii

15. To get the DNA sequencing data using Sanger dideoxynucleotide technique which of the following vector systems is used to obtain large amounts of single stranded DNA;

A) Bacteriophage lambda
B) Bacteriophage P
C) M13 Bacteriophage
D) L13 Bacteriophage

16. The mapping of protein – protein interaction can be done by all of the following mentioned experimental approaches, except one, identify;

A) Yeast two hybrid
B) GST pull Down
C) Immunoprecipitation
D) BIOGRID

17. To perform gel electrophoresis Acryl amide is polymerized to form polyacrylamide gel. Which of the following statement represents correct polymerization reaction;

A) Polymerization is initiated by TEMED and catalysed by persulfate radicals
B) Polymerization is initiated by persulfate radicals and catalysed by TEMED
C) Polymerization is initiated and catalysed by per sulfate radicals
D) Polymerization is initiated and catalysed by TEMED

18. In addition to autosomes and sex chromosomes, humans have a mitochondrial genome also. Following mentioned are properties of mitochondrial genome, except;

A) They are in high copy number
B) The mutation rate is higher than in nuclear DNA
C) They have paternal lineage
D) They are mostly followed in molecular phylogeny studies to find earliest human ancestor

19. The X-rays are high energy radiations, which of the following statements is true about these rays;

A) These have long wavelengths and low frequency
B) These have long wavelengths and high frequency
C) These have short wavelengths and high frequency
D) These have short wavelengths and low frequency

20. The relationship between sedimentation coefficient and molecular mass is represented by; which of the following notations;

A) Snedberg
B) Sredberg
C) Svedberg
D) Sledberg

21. Which one of the following statement is not true for two-dimensional gel electrophoresis;

A) Several thousand proteins can be resolved simultaneously
B) It can detect less than one nanogram protein per spot on the gel
C) Only the most abundant proteins are usually detected
D) It is possible to process many samples in parallel on same gel

22. In oligonucleotide based arrays and cDNA based arrays how many samples can be processed on a single chip;

A) 1 and 2, respectively
B) 2 and 1, respectively
C) 1 in both types of chips
D) 2 in both types of chips

23. Cholera toxin stimulates Adenylate cyclase in signal transduction cascade by activating which type of G proteins;

A) $G_{s\alpha}$ B) $G_{i\alpha}$ C) $G_{t\alpha}$ D) $G_{o\alpha}$

24. In the nucleotide polymerization process catalyzed by DNA polymerases all of the following are true, except;

A) Leading strand is synthesized continuously
B) Lagging strand is not synthesized continuously
C) Short RNA primers are required for lagging strand initiation
D) Short RNA primers are not required for lagging strand initiation

25. In the mitotic division of a somatic cell, during telophase stage which of the following process will take place;

A) Nuclear process reassembly
B) Contractile rings form cleavage furrow
C) Chromosomes are aligned in a equatorial plate
D) Kinetochore assembly takes place

26. Majority of soluble ER resident proteins carry a signature sequence, what is this signature and where is it located on the protein;

A) KDEL sequence at N-terminal
B) KDEL sequence at C-terminal
C) KDEGL sequence at N-terminal
D) KDEGL sequence at C-terminal

27. One of the following mentioned enzymes is not a serine protease enzymes, identify the one;

A) Trypsin B) Cocoonase C) Subtilisin D) Lysozyme

28. Radioactive isotopes emitting β-type of radiations have been listed below. Identify which one of the following isotope has been listed incorrectly;

A) ^{3}H B) ^{32}P C) ^{35}S D) ^{125}I

29. Hexokinase enzyme catalyzes the first reaction of glycolytic pathway. The substrates for this enzyme are Mg^{2+}-ATP and_____;

A) D-Glucose , D-Mannose and D-Fructose
B) D-Glucose , L-Glucose and D-Fructose
C) L-Glucose , L-Mannose and L-Fructose
D) L-Glucose , D-Mannose and D-Fructose

30. In a protein sequencing reaction by Edman degradation the terminal amino acid reacts with a chemical to generate its derivative, identify the correct answer;

A) First amino acid on N-terminal reacts with phenylthiocyanate
B) First amino acid on C-terminal reacts with phenylthiocyanate
C) First amino acid on N-terminal reacts with phenylisothiocyanate
D) First amino acid on C-terminal reacts with phenylisothiocyanate

31. Metabolic flux by glycolysis in muscles is controlled primarily by which of thefollowing enzyme;

A) Phosphofructokinase
B) Glucokinase
C) Enolase
D) Glyceraldehyde 3-phosphate dehydrogenase

32. Lipinski's rule states that a probable drug candidate should not violate the following criteria, except;

A) It should have molecular mass less than 500 daltons
B) It should not have more than 10 hydrogen bond donors
C) It should not have more than 10 hydrogen bond acceptors
D) The octanol –water partition coefficient log P should not exceed 5

33. Which of the statements is not true for suicide inhibitors;

A) They are activated by enzyme catalyzed reactions
B) They react irreversibly with the enzyme
C) They form a covalent bond with the enzyme active site once activated
D) They self destruct as result of enzyme catalysis

34. An agonist molecule stays bound to a receptor for a long period, this results in Phosphorylation of the receptor molecule. This effect will lead to a phenomenon termed as;

A) Tolerance of the receptor B) Sensitization of the receptor
C) Desensitization of the receptor D) Destruction of the recptor

35. Which of the following statistical approaches is not used for clustering of high throughput techniques generated datas?

A) K-means clustering
B) Self organizing maps
C) Multivariate analysis
D) Principal component analysis

36. Which of the following statements is not true for effective drug – target interactions;

A) Desolvation is an energy requiring step to remove water molecules from polar functional groups prior to a drug binding to its active site.
B) Water molecules surround a hydrophobic region to generate an ordered layer with reduction in entropy
C) Water molecules removal for nonpolar regions of drug and target interaction lead to a lowering the value of ΔG
D) An increase in entropy at any point of drug target interaction resulting in a higher value of ΔG leads to greater chance of drug-target binding

37. You were asked to perform polymerase chain reaction (PCR). The outcome of this experiment showed multiple bands upon electrophoresis inspite of very specific primer sequences used for amplification. What could be the probable reason for such an effect;

A) Annealing temperature 3-5 degree less than Tm of primers
B) Very high concentration of magnesium ion in the reaction
C) Very high annealing temperature
D) Low concentration of Magnesium ion used in the reaction

38. In both protein and DNA sequences there may be regions that contain highly repetitive sequences. These regions are known as;

A) High density regions
B) Low density regions
C) High complexity regions
D) Low complexity regions

39. A bioinformatics analytical tool may yield false positive results, which will be the best definition of false positive values;

A) A false positive result is when analysis indicated negative but true status is positive
B) A false positive result is when analysis indicated positive but true status is negative
C) A false positive result is when analysis indicated positive but true status is also positive
D) A false positive result is when analysis indicated negative but true status is also negative

40. In the events of excessive exercise, muscles undergoing high rates of glycolysis, tissues are insufficiently aerobic to oxidize all of the NADH generated, hence to maintain overall electron balance these tissue will do which of the following activities;

A) Stop the glycolytic cycle
B) Stop generation of NADH selectively
C) Start alcoholic fermentation
D) Start lactic acid fermentation

41. Which of the following is not a measure of central tendency;

A) Percentile
B) Quartile
C) Standard deviation
D) Mode

42. A number of inhibitors of prokaryotic translation are also effective in eukaryotes. Some of the example of such inhibitors are listed below, except one, identify ;

A) Puromycin
B) Tetracycline
C) Pactamycin
D) Diphtheria toxin

43. Heparin is a natural anticoagulant , which binds strongly to blood proteins to inhibit clotting process. Heparin itself is a____.

A) Highly sulfated Protein molecule
B) Highly sulfated glycoprotein molecule
C) Highly sulfated glycosyl amino acid molecule
D) Highly sulfated glyosylaminoglycan molecule

44. A family tree diagram that shows how a particular genetic trait or diseases has been inherited is called as;

A) Phylogenetic tree
B) Pedigree
C) Cladogram
D) Dendrogram

45. In R language for the input statement **>1:6** the correct output would be;

A) [1] 1 2 3 4 5 6
B) [1] 1 1 1 1 1 1
C) [6] 1 2 3 4 5 6
D) [6] 1 1 1 1 1 1

46. The Structural parameters of few of the polypeptide structures are represented as

Structure Type ----------Residue/turn----------phi and psi angles (^{0})

from below identify the incorrect dataset out here;

A) 3_{10} Helix……3.0……..-49 and -26
B) 3.6_{13} Helix…… 3.6……..-57 and +47
C) 4.4_{16} Helix…… 4.4……..-57 and -70
D) Parallel β sheet…….. 2.0……..-119 and +113

47. Which of the following is not basic data type in programming in C?

A) Char
B) Long
C) Float
D) Double

48. The metabolically activated form of glucose for glycogen synthesis is;

A) UDP-glucose
B) Glucose -1-phosphate
C) Glucose -6-phosphate
D) Glucose -1,6-phosphate

49. Out of the six major classes of enzymes, four have been mentioned here, but one data is erroneous, identify which one;

A) Isomerases B) Oxidoreductases C) Ribozymes D) Lyases

50. What is the fundamental unit of execution in C;

A) Expression B) Subexpression C) Statement D) Function

x-x-x

Zoology (1068)

1. In an experiment it was observed that if the eye of shrimp, *Palinurus*, was removed it developed not an eye but an antenna like structure. This phenomenon is known as

A) Autotomy
B) Super regeneration
C) Morphallaxis
D) Heteromorphosis

2. Which of the following acts as DNA scissors

A) UV light
B) DNA ligases
C) Restriction enzymes
D) Lasers

3. In regeneration of salamander limb the cells beneath the wound surface undergo extensive de- differentiation so that a zone of indistinguishable cells is formed. This is called

A) Apical ectodermal cap
B) Wound epidermis
C) Regeneration Blastema
D) Progress Zone

4. Cell adhesion molecules that require calcium ions for their functioning are

A) Cadherins
B) Immunoglobulin super family
C) Gap junctions
D) Laminin

5. The cortical granule reaction is a mechanism involved in

A) Fast block to polyspermy
B) Slow block to polyspermy
C) Activation of sperm
D) Activation of egg

6. An interesting feature of the cleavage pattern in annelids is that the cleavage furrows are oblique and give rise to a blastula that

A) Has a normal blastocoel and is called stereoblastula.
B) Has no blastocoel and is called stereoblastula.
C) Has a normal blastocoel and is called morula.
D) Has no blastocoel and is called morula.

7. Polar lobe is formed during cleavage in

A) Echinoderms and contains a prominent nucleus
B) Molluscs and contains morphogenetic determinants
C) Amphibians and contains a multilobed nucleus.
D) Birds and contains yolk.

8. The chromatin seen on the nuclear envelope of a normal XX female is

A) Euchromatin called Barr body
B) Heterochromatin called Barr body
C) Glycoprotein called Barr body
D) Nucleoprotein called Barr body

9. The organism of choice for studies in developmental biology is

A) *Paleomon*
B) *Drosophila*
C) *Caenorhabditis elegans*
D) *Rhodinius prolixus*

10. P granules in *Caenorhabditis elegans* are associated with

A) Founder cells B) Somatic cells
C) Germ cells D) Polar lobe

11. Which of the following is not associated with insect metamorphosis

A) Corpus cardiacum B) Corpus allatum
C) Corpus striatum D) Ring gland

12. A population pyramid with a narrow base and broad top is characteristic of

A) Population with more percentage of individuals of older age
B) Population with zero growth rate
C) Population with more percentage of individuals of younger age
D) Population with more percentage of females

13. Trisomy of chromosome 21 causes

A) Cri du chat syndrome B) Downs syndrome
C) Marfan syndrome D) ABCD syndrome

14. In which phase is heat period experienced by mammals exhibiting estrous cycle

A) Proestrous B) Metastrous C) Diestrous D) Anestrous

15. A piece of nucleic acid used to find a gene by forming a hybrid with it is called

A) Probe B) Vector
C) Restriction sequence D) Retrovirus

16. A type of muscle contraction during which the muscledoes not shorten in length during contraction. This is called

A) Isotonic contraction B) Isometric contraction
C) Tetanization D) Stair case effect

17. Sugars that differ with respect to configuration around one specific carbon atom are

A) Enantiomers B) Epimers C) Anomers D) Amphoteric

18. Which of the following is a protein

A) Cellulose B) Chitin C) Keratin D) Inulin

19. The repeat unit of telomere is

A) TTATTC B) TGATTG C) TTAGGG D) TTAGCG

20. What does ping pong mechanism refer to ?

A) Hydrolysis of carbohydrates in the gut
B) Mechanism of breakdown of fats by bacteria
C) Enzymatic activity in which enzyme is temporarily modified
D) Feedback inhibition.

21. Deficiency of which vitamin causes Xerophthalmia

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

22. Which hormone is released into the AC usually in response to acidity

A) Epinephrin B) Norepinephrin C) Secretin D) Insulin

23. The blood sample of an individual contains agglutinins anti A and anti B in the plasma. His blood group will be

A) O B) AB C) A D) B

24. Which of the following factors does not influence cardiac output

A) Calcium ions B) Venous return

C) Temperature D) Metabolism

25. Which organ is referred to as thermostat of the body

A) Liver B) Hypothalamus C) Thyroid D) Pineal

26. Cyanosis refers to

A) Poisoning due to potassium cyanide

B) Fumigation of stored products with HCN to kill insect pest

C) Bluing of nails and lips

D) Colour of blood due to haemocyanin

27. The first heart sound appears during which of the following phases of the cardiac cycle:

A) Isovolumic relaxation B) Isovolumic contraction

C) Ejection D) Rapid ventricular filling

28. Number of ganglia present in the ventral nerve cord of *Musca* is

A) Ten B) Eight C) Five D) One

29. The Johnstons organ in insects is related to which of the following senses

A) Touch B) Taste C) Hearing D) Smell

30. In the respiratory system of an insect only the last pair of abdominal spiracles are open. This type of respiratory system is called

A) Apneustic B) Perineustic C) Metapneustic D) Propneustic

31. Philadelphia chromosome is found in patients suffering from

A) Hepatitis B) Myelocytic leukaemia

C) Albinism D) Muscular dystrophy

32. In the pupae of some insects the mandibles are powerful, sclerotized and used by the pharate adult to escape from the cocoon. This type of pupa is

A) Decticous B) Adectious C) Coarctate D) Obtectadecticous

33. Which of the following is not an organo phosphate insecticide

A) Quinalophos B) Phorate C) Malathion D) Endosulphan

34. Which of the following is not a coleopteran pest of stored grains
A) *Tribolium* B) *Rhizopertha* C) *Corcyra* D) *Bruchus*

35. *Trypanosoma* is vectored by which of the following
A) Tsetse fly B) Sand fly C) Horse fly D) Flea

36. Which of the following is not produced by honey bees
A) Royal jelly B) Wax C) Venom D) Pollen

37. Which of the following characteristics is used to identify Cobra:
A) Flat tail B) Enlarged ventral shields
C) 3rd supra labial shield D) Hexagonal mid-dorsal vertebral scales

38. Which of the following helps in digestion of cellulose in termites
A) *Giardia* B) *Monocystis* C) *Trichonympha* D) *Balantidium*

39. Which of the following lake is originated by wind action
A) Sambhar lake B) Wular lake C) Anchar lake D) Nainital lake

40. The condition in which maximum organisms a habitat can have under least favourable, yet tolerable conditions is known as
A) Biotic Potential B) Standing crop
C) Carrying Capacity D) Yield

41. Eutrophication is caused by addition of …… in a water body
A) Heavy metals B) Detergents
C) Fertilizers D) Detergents and fertilizers

42. According to Hutchinsons classification, the lake with water temperature above 4^0 C and with rare periods of turnover at irregular intervals is known as
A) Cold Monomictic B) Oligomictic
C) Polymictic D) Warm monomictic

43. Labyrinthine organ is present in which of the following
A) *Notopterus notopterus* *B) Synbranchus marmoratus*
C) Anabas testudineus *D) Monopterus cuchia*

44. Complement is a part of
A) Innate immune system B) Adaptive immune response
C) Hypersensitivity D) CMI

45. Farmers lung disease is
A) Type1 hypersensitivity B) Type 2 hypersensitivity
C) Type 3 hypersensitivity D) Type 4 hypersensitivity

46. Which of the following is passive immunisation

A) Vaccine for snake venom B) Polio vaccine
C) Tetanus vaccine D) Hepatitis vaccine

47. Silver carp primarily feeds on
A) Benthos B) Phytoplankton C) Small fish D) Small insects

48. Homologous genes in different organisms that encode proteins with same function and have evolved by direct vertical descent are called
A) Paralogs B) Orthologs C) Analogs D) Homologs

49. LOD scores are used to predict
A) Cross over frequencies B) Gene sequencing
C) Gene linkage D) Number of genes in genome

50. Antibodies in the blood can be detected by
A) TEM B) SEM C) ELISA D) RT-PCR

x-x-x