Multiple Choice Questions

Subject: Microbiology

1. For the examination of microbial cells we require the use of?
   a) High-power microscope
   b) Low-power microscope
   c) High-power microscope at a magnification of about 1,000 diameters
   d) Low-power microscope at a magnification of about 1,000 diameters

2. Lipopolysaccharide in cell walls is characteristic of?
   a) Gram-positive bacteria
   b) Gram-negative bacteria
   c) Fungi
   d) Algae

3. Which microorganism(s) among the following perform photosynthesis by utilizing light?
   a) Cyanobacteria
   b) Fungi
   c) Viruses
   d) Cyanobacteria, Fungi and Viruses

4. Growth of microbes in a solid media is identified by the formation of?
   a) pellicle at the top of media
   b) colonies
   c) sediment at the bottom
   d) turbidity

5. Which among the following are produced by microorganisms?
   a) Fermented dairy products
   b) Breads
   c) Alcoholic beverages
   d) Fermented dairy products, breads and alcoholic beverages

6. What are the blood serum proteins produced by animals called?
   a) Enzymes
   b) Antibodies
   c) Amino acids
   d) Toxins

7. The DNA molecule of microorganisms is made up of base pairs of _____
   a) guanine-cytosine
   b) adenine-thymine
   c) adenine-cytosine
   d) guanine-cytosine and adenine-thymine

8. Bdellovibrios come under which group of microorganisms?
   a) Viruses
   b) Bacteria

c) Fungi
d) Algae

9. Type strain is used for referring to?
   a) species
   b) genus
   c) family
   d) division

10. The correct order of taxonomic groups from higher to lower rank is?
    a) Kingdom—Order—Class—Family
    b) Order—Class—Division—Family—Genus—Species
    c) Kingdom—Order—Division—Family—Class—Genus—Species
    d) Kingdom—Division—Class—Order—Family—Genus—Species

11. % Similarity (%S) of each strain to every other strain is calculated by which method?
    a) Intuitive Method
    b) Numerical Taxonomy
    c) Genetic Relatedness
    d) DNA homology experiments

12. Two organisms which are very closely related to each other have which of the following property?
    a) similar mol% G+C values
    b) different mol% G+C values
    c) similar mol% G+C values and heteroduplexes are formed.
    d) different mol% G+C values and heteroduplexes are not formed.

13. What are ribosomes composed of?
    a) Proteins
    b) DNA
    c) RNA
    d) Proteins and RNA

14. If two organisms are distantly related and show no DNA homology there still may be similarity in their rRNA cistrons.
    a) True
    b) False

15. Which of the following are characteristics of archaebacterial different from eubacteria?
    a) methane-producers
    b) extreme halophiles
    c) thermoacidophiles
    d) methane-producers,extreme halophiles,and thermoacidophiles

16. Which among the following come under Gram-positive eubacteria?
    a) Clostridium
    b) Actinomyces
    c) Rhizobium

d) Clostridium,Actinomyces

17. Which among the following kingdoms were proposed by Whittaker?
    a) Monera
    b) Protista,Fungi
    c) Plantae,Animalia
    d) Monera,Protista,Fungi,Plantae,Animalia

18. According to Bergey's Manual of Systematic Bacteriology, prokaryotes that lack a cell wall belong to the group?
    a) Gracilicutes
    b) Firmicutes
    c) Tenericutes
    d) Mendosicutes

19. Which part of the compound microscope helps in gathering and focusing light rays on the specimen to be viewed?
    a) Eyepiece lens
    b) Objective lens
    c) Condenser lens
    d) Magnifying lens

20. What is the minimum distance for the eye to focus any object?
    a) 11 cm
    b) 25 cm
    c) 32 cm
    d) 4 2 cm

21. Resolving power of a microscope is a function of_____
    a) Wavelength of light used
    b) Numerical aperture of lens system
    c) Refractive index
    d) Wavelength of light used and numerical aperture of lens system

22. The greatest resolution in light microscopy can be obtained with _____
    a) Longest wavelength of visible light used
    b) An objective with minimum numerical aperture
    c) Shortest wavelength of visible light used
    d) Shortest wavelength of visible light used and an objective with the maximum numerical aperture

23. Oil immersion objective lens has an NA value of_____
    a) 0.65
    b) 0.85
    c) 1.33
    d) 1.00

24. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?
    a) Exciter filter
    b) Barrier filter
    c) Dichroic mirror
    d) Mercury arc lamp

25. Total Magnification is obtained by_____
    a) Magnifying power of the objective lens
    b) Magnifying power of eyepiece
    c) Magnifying power of condenser lens
    d) Magnifying power of both the objective lens and eyepiece

26. In light microscopy, which of the following is used as fixatives prior to staining technique?
    a) Osmic acid
    b) Glutaraldehyde
    c) Heat
    d) Osmic acid, glutaraldehyde, heat

27. In Phase contrast microscopy, the rate at which light enters through objects is_____
    a) Constant
    b) Inversely proportional to their refractive indices
    c) Directly proportional to their refractive indices
    d) Exponentially related to their refractive indices

28. Which part of the light microscope controls the intensity of light entering the viewing area?
    a) Coarse adjustment screw
    b) Fine adjustment screw
    c) Diaphragm
    d) Condenser lens

29. Which of the following is used in electron microscope?
    a) electron beams
    b) magnetic fields
    c) light waves
    d) electron beams and magnetic fields

30. Electron Microscope can give a magnification up to _____
    a) 400,000X
    b) 100,000X
    c) 15000X
    d) 100X

31. Which of the following are true for electron microscopy?
    a) specimen should be thin and dry
    b) image is obtained on a phosphorescent screen
    c) electron beam must pass through evacuated chamber
    d) specimen should be thin and dry, image is obtained on a phosphorescent screen and electron beam must pass through evacuated chamber

32. Degree of scattering in transmission electron microscope is a function of _____
    a) wavelength of electron beam used
    b) number of atoms that lie in the electron path
    c) number and mass of atoms that lie in the electron path
    d) mass of atoms that lie in the electron path
33. Negative Staining is used for examining _____
    a) virus particles

b) protein molecules
c) bacterial flagella
d) virus particles, protein molecules and bacterial flagella

34. Which among the following helps us in getting a three-dimensional picture of the specimen?
a) Transmission Electron Microscope
b) Scanning Electron Microscope
c) Compound Microscope
d) Simple Microscope

35. The secondary electrons radiated back in scanning microscope is collected by?
a) specimen
b) anode
c) vacuum chamber
d) cathode

36. On what factors do the intensity of secondary electrons depends upon?
a) shape of the irradiated object
b) chemical composition of the irradiated object
c) number of electrons ejected
d) size and chemical composition of the irradiated object, number of electrons ejected and on the number of electrons reabsorbed by surrounding

37. Where do we obtain the magnified image of the specimen in SEM?
a) cathode ray tube
b) phosphorescent screen
c) anode
d) scanning generator

38. Which of the following techniques are used in Transmission Electron Microscopy (TEM) for examining cellular structure?
a) Negative-Staining
b) Shadow Casting
c) Ultrathin Sectioning
d) Negative-Staining, Shadow Casting, Ultrathin Sectioning, Freeze-Etching

39. The dye eosinate of methylene blue belongs to which group?
a) Acidic dye
b) Basic dye
c) Neutral dye
d) Oxazine dye

40. What is the correct order of staining reagents in Gram-Staining?
a) Crystal violet, alcohol, iodine solution, safranin
b) Crystal violet, iodine solution, alcohol, safranin
c) Crystal violet, safranin, alcohol, iodine solution
d) Iodine solution, crystal violet, alcohol, safranin

41. Which bacteria appears purple-violet colour after staining?
a) Gram-positive
b) Gram-negative

c) Both Gram-positive and Gram-negative
d) Neither Gram-positive nor Gram-negative

42. Which of the following are true for Gram-negative bacteria?
a) upon alcohol treatment, the permeability of the cell wall increases
b) crystal violet-iodine (CV-I) complex is extracted
c) pore size decreases and the CV-I complex cannot be extracted
d) alcohol treatment increases the permeability of the cell wall and the CV-I complex can be extracted

43. Gram-positive bacteria are usually more susceptible to?
a) streptomycin
b) tetracyclin
c) penicillin
d) ampicillin

44. Which of the staining technique helps in demonstrating spore structure in bacteria as well as free spores?
a) Acid-fast stain
b) Endospore stain
c) Capsule stain
d) Flagella stain

45. In Gram-staining, iodine is used as a_____
a) fixative
b) mordant
c) solublizer
d) stain

46. Which of the following is the example of Gram-negative bacteria?
a) Lactobacillus
b) Eschericia coli
c) Staphylococcus aureus
d) Bacillus subtilis

47. In the classification of bacteria according to shape,which among the following refer to cuboidal arrangement of bacterial cells?
a) Tetrads
b) Staphylococci
c) Sarcinae
d) Streptococci

48. Which group of bacteria among the following have the largest area of contact?
a) Palisades
b) Trichomes
c) Streptobacilli
d) Diplobacilli

49. Which among the following are “Spirochetes”?
a) Spirillum volutans
b) Corynebacterium diphtheriae
c) Streptomyces sp.
d) Treponema pallidum

50. What is the approximate size of the bacterial cell?
a) 2mm in diameter
b) 1mm in diameter

c) 2 micrometer in diameter
d) 0.5 to 1.0 micrometer in diameter

Answer key with explanation

1. Answer: c
   Explanation: Microorganisms are very small and their size is usually expressed in micrometers. So for routine examination of microbial cells we require the use of a high-power microscope, usually at a magnification of about 1,000 diameters.

2. Answer: b
   Explanation: The occurrence of lipopolysaccharide in cell walls is characteristic of Gram-negative bacteria; whereas Gram-positive bacteria have cell walls that contain teichoic acid. Fungal and algal cell walls are very different in composition from those of bacteria.

3. Answer: a
   Explanation: Cyanobacteria require light as a source of energy to perform photosynthesis. Fungi and viruses are unable to perform photosynthesis and are heterotrophic.

4. Answer: b
   Explanation: On solid media, microbes grow as colonies – distinct, compact masses of cells that are macroscopically visible. When microbes grow in a liquid media, the media becomes turbid and growth may either occur only as sediment at the bottom or only as a thin film or pellicle at the top.

5. Answer: d
   Explanation: Microorganisms are used in many industries to produce food we eat, like fermented dairy products (sour cream, yogurt), as well as fermented foods as pickles, breads and alcoholic beverages.

6. Answer: b
   Explanation: Certain chemical compounds of microbial cells are called antigens. If microbial cells enter the animal body, the animal responds to these antigens by forming specific blood serum proteins called antibodies, which bind to the antigens.

7. Answer: d
   Explanation: The DNA molecule has a base composition of the following sequence as base pairs; guanine-cytosine and adenine-thymine. The ratio of A:T= the ratio of G:C.

8. Answer: b
   Explanation: Bdellovibrios are bacteria which are predatory on other bacteria. They have the ability to cause diseases or are pathogenic for other microorganisms.

9. Answer: a
   Explanation: Bacterial species consists of a special strain called type strain which have

similar characteristics. Bacterial genus is composed of a collection of similar species and is referred to as type species.

10. Answer: d
    Explanation: Taxonomists have made the classification based on two qualities—stability and predictability. The order of taxonomic groups from higher rank to lower rank is:Kingdom—Division—Class—Order—Family—Genus—Species.

11. Answer: b
    Explanation: %S = NS
    NS+ND
    where, %S is % similarity of each strain to every other strain,NS is the number of characteristics that are the same for the two strains, and ND is the number of characteristics that are different. Thus this is determined by numerical taxonomy.

12. Answer: c
    Explanation: Two organisms of the same species that are very closely related to each other will have very similar mol% G+C values and their single strands of DNA molecules combine to form heteroduplexes. Organisms which are not closely related have different mol% G+C values and hence do not form heteroduplexes.

13. Answer: d
    Explanation: Ribosomes, the small granular-appearing structures within the cell which manufacture proteins, are composed of proteins and RNA.The ribosomal RNA (rRNA) is coded for by only a small fraction of the DNA molecule, the rRNA cistrons.

14. Answer: a
    Explanation: The nucleotide sequence of rRNA genes has been found to be highly conserved. So even if two organisms are only distantly related and show no significant DNA homology, there still maybe similarity in the nucleotide sequences of their rRNA cistrons. The degree of similarity that exists can then be used as a measure of relatedness between organisms.

15. Answer: d
    Explanation: Eubacteria are the traditional, familiar ones that have received the most study.Archaebacteria the other group consists of methane producers, extreme halophiles and thermoacidophiles.

16. Answer: d
    Explanation: Based on rRNA oligonucleotiding, Clostridium and Actinomyces come under Gram-positive eubacteria. Rhizobium belongs to Purple eubacteria.

17. Answer: d
    Explanation: R.H.Whittaker classified microorganisms on the basis of nutritional requirements and formed Whittaker's Five Kingdom and they are Monera (bacteria and cyanobacteria),Protista (microalgae and protozoa),Fungi (yeasts and molds),Plantae (multicellular green plants and higher algae) and Animalia (multicellular animals).

18. Answer: c
    Explanation: Tenericutes are prokaryotes that lack a cell wall. Gracilicutes are prokaryotes with a complex cell-wall structure characteristic of Gram-negative bacteria.Firmicutes are prokaryotes with a cell wall structure characteristic of

Gram-positive bacteria and Mendosicutes are prokaryotes that show evidence of an earlier phylogenetic origin.

19. Answer: c
Explanation: Compound microscope contains three separate lens systems. The condenser lens is placed between the light source and the specimen and it gathers and focuses the light rays in the plane of the microscopic field to view the specimen.

20. Answer: b
Explanation: The eye cannot focus on objects brought closer to it less than 25 cm; this is, accordingly the distance of maximal effective magnification. An object must also subtend an angle at the eye of 1 degree or greater.

21. Answer: d
Explanation: The ability of a microscope to distinguish two adjacent points as distinct and separate is known as resolving power. Resolving power is a function of wavelength of light used and the numerical aperture (NA) of the lens system.NA refers to the refractive index of the medium multiplied with the sine value of the half-aperture angle.

22. Answer: d
Explanation: The relationship between numerical aperture (NA) and resolution is:-
Resolution (d) = wavelength / 2(NA)
Thus maximum resolution is obtained with the shortest wavelength of visible light and an objective with the maximum NA.

23. Answer: c
Explanation: NA = refractive index * sine (half-aperture angle).
The maximum NA for a dry objective is less than 1.0 as the refractive index of air is 1.The values of NA for oil immersion lens is slightly greater than 1.0 in the range of (1.2 to 1.4) as the refractive index of oil is 1.56.

24. Answer: a
Explanation: In fluorescence microscopy, the function of the exciter filter is to remove all but the blue light; the barrier filter blocks out blue light and allows any other light emitted by the fluorescing specimen to pass through and reach the eye.

25. Answer: d
Explanation: The total magnification is determined by multiplying the magnifying power of the objective by that of the eyepiece. Generally, an eyepiece having a magnification of 10X is used although eyepieces of higher or lower magnifications are available.

26. Answer: c
Explanation: Most staining techniques kill cells and so preliminary to staining, the cells are sometimes fixed. Commonly used chemical fixatives include osmic acid and mainly glutaraldehyde. But for light microscopy heat is the most commonly used fixative.

27. Answer: b
Explanation: Phase contrast microscopy is based on the fact that the rate at which light travels through objects is inversely related to their refractive indices. Since the frequency of light waves is independent of the medium through which they travel, the phase of a light ray passing through an object of higher refractive index than the surrounding medium will be relatively retarded.

28. Answer: c
Explanation: On the condenser is mounted a shutter like apparatus called the diaphragm which opens and closes to permit more or less light into the viewing area.

Condenser lens just helps in condensing the light rays. Coarse and fine adjustment screws are used for focusing under different power le

29. Answer: d
Explanation: Electron Microscope uses electron beams and magnetic fields to produce the image, whereas the light microscope uses light waves and glass lenses. In electron microscopy, a much higher resolution is obtained with extremely short wavelength of the electron beam.

30. Answer: a
Explanation: The resolving power of the electron microscope is more than 100 times that of the light microscope, and it produces useful magnification up to 400,000X. It is possible to resolve objects as small as 10 Angstrom.

31. Answer: d
Explanation: Since electrons can travel only in high vacuum, the entire electron path through the instrument must be evacuated; specimens must be completely dehydrated prior to examination. Only very thin specimens can be observed in the conventional electron microscope since the penetrating power of electrons through matter is weak. The magnified image may be viewed on a phosphorescent or fluorescent screen.

32. Answer: c
Explanation: In a transmission electron microscope, contrast results from the differential scattering of electrons by the specimen, the degree of scattering being a function of the number and mass of atoms that lie in the electron path.

33. Answer: d
Explanation: In negative-staining the electron opacity of the surrounding field is increased by using an electron-dense material such as phosphotungstic acid as a stain. Negative staining is particularly valuable for the examination of very small structures such as virus particles, protein molecules and bacterial flagella.

34. Answer: b
Explanation: The scanning electron microscope lacks the resolving power obtainable with the transmission electron microscope but has the advantage of revealing a striking three -dimensional picture. The surface topography of a specimen can be revealed with clarity and a depth of field not possible by any other method.

35. Answer: b
Explanation: In scanning electron microscope (SEM), the surface of the specimen is irradiated with a very narrow beam of electrons. Such irradiations causes low energy (secondary) electrons to be ejected from the specimen which can then be collected on a positively-charged plate or anode thereby generating an electric signal.

36. Answer: d
Explanation: The irradiations in SEM causes secondary electrons to be ejected from the specimen thereby generating a signal that is proportional to the number of electrons striking the anode. The intensity or the number of secondary electrons depends on the shape and the chemical composition of the irradiated object and also on the number of electrons ejected and the number of electrons reabsorbed by surrounding.

37. Answer: a
Explanation: In TEM, the image is obtained on a phosphorescent screen but in SEM the magnified image of the surface topography of the specimen is obtained on the cathode ray tube. The electronic signals generated scan the specimen in a raster pattern in the manner of a television system to produce an image on a cathode ray tube.

38. Answer: d
Explanation: Numerous techniques are available for use with electron microscopy which extends its usefulness in characterizing cellular structure. Some of them are: Negative-Staining (which increases the electron opacity of surrounding), Shadow Casting (helps in producing three-dimensional structure of the object), Ultrathin Sectioning and Freeze-Etching.

39. Answer: c
Explanation: A neutral dye is a complex salt of a dye acid with a dye base so eosinate of methylene blue is an example of a neutral dye. An acidic dye is one in which the charge on the dye ion is negative and a basic dye is one in which the charge carried by the dye ion is positive.

40. Answer: b
Explanation: Gram staining is a type of differential staining. In this process the fixed bacterial smear is subjected to the following staining reagents in the order listed: crystal violet, iodine solution, alcohol (decolorizing agent), and safranin.

41. Answer: a
Explanation: Gram-positive bacteria retain the crystal violet and hence appear deep purple-violet colour as it has a higher content of peptidoglycan layer. Gram-negative bacteria have lesser amount of peptidoglycan layer and on treatment with alcohol it loses the purple-violet colour, are counterstained by safranin and hence appears red.

42. Answer: d
Explanation: Experimental evidence suggests that during staining of Gram-negative bacteria the alcohol treatment extracts the lipid, which results in increased permeability of the cell wall. Thus the crystal violet-iodine (CV-I) complex can be extracted and the Gram-negative organism is decolorized. These cells subsequently take on the color of the safranin counterstain.

43. Answer: c
Explanation: Gram-positive bacteria are usually more susceptible to penicillin and less susceptible to disintegration by mechanical treatment or exposure to some enzymes than Gram-negative bacteria. Gram-negative bacteria are more susceptible to other antibiotics like streptomycin.

44. Answer: b
Explanation: There are numerous other staining techniques designed to identify some particular feature of cell structure or composition. Endospore staining demonstrates spore structure in bacteria as well as free spores.

45. Answer: b
Explanation: In Gram-staining, iodine acts as a mordant i.e. it combines with the dye or stain and thereby fixes it on the material. It increases the interaction between stain solution and the bacterial cell.

46. Answer: b
Explanation: Eschericia coli is an example of Gram-negative bacteria. Others are all examples of Gram-positive bacteria.

47. Answer: c
Explanation: In Sarcinae group of bacteria, the cells divide in three planes, in a regular pattern, producing a cuboidal arrangement of cells. In Staphylococci, cells divide in three planes, in an irregular pattern,producing bunches of cocci.

48. Answer: b
    Explanation: Trichomes are similar to chains but have a much larger area of contact between the adjacent cells whereas in palisade arrangement, the cells are ind side by side at angles to one another.

49. Answer: d
    Explanation: Spirochetes are flexible and can twist and contort their shape, whereas spirilla are relatively rigid. Treponema palldium belong to the spirochetes group and Spirillum volutans belong to the spirilla group.

50. Answer: d
    Explanation: Bacteria are very small, most being approximately 0.5 to 1.0 micrometer in diameter.This is the reason why they cannot be seen by naked eyes and can be observed under the microscope.

END