1. What type of gas is produced by cyanobacteria?
   a. oxygen.   b. carbon dioxide.   c. nitrogen.   d. hydrogen.   e. water vapor.

2. Which group is considered to be microbes but not considered to be cells?
   a. bacteria.   b. archaea.   c. protists.   d. viruses.   e. prions.

3. Which century is known as the “First Golden Age of Microbiology”?
   a. 17th.   b. 18th.   c. 19th.   d. 20th.   e. 21st.

4. The first person to see bacteria as living creatures lived in:

5. The first person to see bacteria made magnifying glasses to be used in his job as a(n):
   a. draper.   b. jeweler.   c. teacher.   d. professor.   e. garbage man.

6. The sterilization technique most used in microbiology is:
   a. boiling.   b. pasteurization.   c. filter sterilization.   d. autoclaving.   e. irradiation.

7. The basis of the small pox vaccine is:
   a. chicken pox virus.   b. rabies virus.   c. small pox virus.   d. cow pox virus.   e. anthrax.

8. The development of the idea of the “RNA World” resulted from the discovery of:
   a. archaea.   b. prions.   c. bacteria.   d. ribozymes.   e. endosymbiosis.

9. The genetic expression machinery of archaea is most similar to:
   a. monera.   b. prokaryotes.   c. bacteria.   d. eukaryotes.   e. mitochondria.

10. Microbes classified today into domains and phyla by:
    a. comparative genomics.   b. microscopy.   c. X-ray diffraction.   d. DNA sequencing.   e. rRNA sequencing.

11. If an object and its surroundings absorb and reflect radiation equally then the object will be:
    a. undetectable.   b. reflected.   c. refracted.   d. radiated.   e. fluoresced.

12. Increasing the refractive index of the medium between an object and the objective lens increases:
    a. refraction.   b. reflection.   c. magnification.   d. resolution.   e. wavelength.

13. Gram positive bacteria retain the ___________ in the cells.
    a. crystal violet.   b. safranine.   c. iodine.   d. crystal violet-iodine complex.   e. carbolfuchsin.

14. In fluorescence microscopy, incident light is absorbed by the specimen and reemitted at a ___________ energy which results in a ___________.
    a. lower, longer wavelength.   b. lower, shorter wavelength.   c. higher, longer wavelength.
    d. higher, shorter wavelength.   e. higher, higher contrast.

15. Capsular polysaccharides forming a slippery layer can inhibit;
    a. diffusion.   b. phagocytosis.   c. attachment.   d. lysis.   e. osmosis.
16. Which of the following is true of TEM, but not of SEM?
   a. Specimen is fixed and embedded.    b. Specimen is cut into thin sections.   c. Specimen is stained with a heavy metal.    d. Specimen is viewed as three dimensional.   c. Specimen is seen in the living state.

17. The 70S prokaryotic ribosome is composed of a 30S subunit and a ______ subunit.
   a. 30S.    b. 40S.    c. 50S.    d. 60S.    e. 70S.

18. ____________ reinforce and stiffen bacterial membranes.

19. Cell membranes are composed of approximately equal parts of _______ and ________.
   a. polysaccharides, proteins.    b. sugars, amino acids.   c. phospholipids, proteins.
   d. lipopolysaccharides, sugars.   e. nucleotides, phospholipids.

20. All archaenal phospholipids have a(n) _______ link between the glycerol and the lipid component.
   a. ester.    b. ether.    c. ethanolamine.    d. unsaturated.    e. phosphatidyl.

21. All of the following are true statements about prokaryotic outer membrane Except:
   a. They are composed of only a phospholipid bilayer.     b. They are found only in Gram negative bacteria.
   c. They contain endotoxin.     d. The contain transport proteins.  e. The contain lipopolysaccharide.

22. All of the following represent components of eukaryotic organisms that help avoid osmotic shock Except:
   a. cellulose fibers.    b. chitin.    c. silicate exoskeleton.    d. contractile vacuole.    e. peptidoglycan.

23. The bacterial flagellum is a helical protein filament whose __________ motor moves the cell.
   a. shaking.    b. vibrating.    c. wavelike.    d. whiplike.    e. propeller-like.

24. The motor that seems to make the bacterial cytoskeleton, MreB, have dynamic motion is:
   a. Membrane ATPase.    d. DNA polymerase.    c. Peptidoglycan synthase.    e. FtsZ.

25. Fts proteins do which:

26. All of the following are used by bacteria to attach to a solid surface Except:
   a. endospore.    b. capsule.    c. pili.    d. fimbriae.    e. stalks.

27. The bacterial flagellum is a helical protein filament whose motor moves the cell using as a fuel:
   a. ATP.    b. NADH.    c. proton motive force.    d. MreB.    e. GTP.

28. To show positive chemotaxis, bacteria increase:
   a. runs.    b. tumble frequency.    c. length of the flagella.   d. clockwise rotation.    e. none of these.

29. By themselves, heterotrophs would deplete the world of ________ sources and starve to death.
   a. useable nitrogen.    b. organic carbon.    c. water.    d. energy.    e. oxygen.

30. Which form of transport does not occur in prokaryotes:
   a. facilitated diffusion.    b. ABC transport.    c. siderophores.    d. group translocation.    e. endocytosis.

31. Agar comes from:
   a. animal bones.    b. trees.    c. algae.    d. clay.    e. mud.

32. The transport system that represents coupled transport with molecules traveling in the same direction is:
a. aquaporin.  b. symport.  c. porin.  d. diffusion transporters.  e. antiport.

33. The cafeteria worked who failed to wash her/his hands and fails to wear gloves inoculates a room temperature flan with 4 *Escherichia coli* cells. By the time you purchased the flan it had 128 *E. coli* cells. How many generations of *E. coli* growth does this represent?
   a. 4.  b. 5.  c. 8.  d. 32.  e. 64.

34. If an organism produces seven offspring per generation, which of the following would express the rate of population increase where “n” corresponds to the number of generations.
   a. $2^n$.  b. $n^2$.  c. $7^n$.  d. $n^7$.  e. $2n^7$.

35. During which stage of bacterial growth is the culture growing most rapidly?
   a. log.  b. late log.  c. lag.  d. stationary.  e. early lag.

36. Human pathogens are:
   a. halophiles.  b. psychrophiles.  c. mesophiles.  d. thermophiles.  e. barophiles.

37. Which temperature could be quickly lethal to any mesophile?
   a. optimum growth temperature.  b. minimum growth temperature.  c. maximum growth temperature.
   d. refrigeration temperature.  e. autoclave temperature.

38. Which of the following are used to assess which genes are expressed to make RNA in a given organism at a given time or under a given condition?
   a. DNA microarrays.  b. PCR.  c. DNA sequencing.  d. fluorescence microscopy.  e. viable cell counts.

39. All of the following is true about penicillin Except: It was
   a. discovered by Alexander Fleming.  b. an accidental discovery.  c. produced by a bacterium.
   d. the first antibiotic used by humans.  e. purified by Florey and Chain.

40. The study of and cause of disease in humans, animals and plants is called:
   a. microbiology.  b. phylogeny.  c. genomics.  d. epidemiology.  e. forensics.

**Written Question**

1. You collected the following data from a culture of *Vibrio harveyi* growing in a Glycerol-Peptone-Yeast Extract medium at 25°C. Plot the data on the semilog graph paper here. Calculate the maximum growth rate, $\mu$, and the generation time. (20 points).

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