

1. *E. coli* can carry out three major types of energy metabolism. Which of the following represents those three types of metabolism ranked **in order** from the most energy yielding process to the one that yields the least energy (in terms of ATPs per glucose).
 - a. fermentation / aerobic respiration / methanogenesis
 - b. anaerobic respiration / methanogenesis / aerobic respiration
 - c. fermentation / aerobic respiration / anaerobic respiration
 - d. aerobic respiration / anaerobic respiration / fermentation
 - e. anaerobic respiration / aerobic respiration / fermentation

2. Vaccines for HIV have been unsuccessful because
 - a. the antigenic properties of the surface lipids are constantly changing.
 - b. reverse transcriptase is a sloppy enzyme.
 - c. of point mutations and genetic rearrangement among the 4 pieces of RNA the virus.
 - d. all of the above.

3. Probiotics refers to the inoculation of animals with good bacteria in order to
 - a. encourage the growth of beneficial bacteria such as *Listeria* and pathogenic *E. coli*.
 - b. allow pathogenic bacteria to colonize parts of the organism that could be susceptible to attack by antibiotic resistant bacteria.
 - c. give harmless bacteria a head start in colonizing mucosal surfaces in areas such as the colon and cecum.
 - d. give a nutritional boost to young animals, because it is well known that bacteria are nutritious and aid animals in their digestive processes.

4. If a population of bacteria has a generation time of 2 hours and the initial population (B_0) is 2×10^7 cells, after 8 hours what will the population size be? ($B_t = B_0 \times 2^n$)
 - a. 8×10^7 cells
 - b. 4×10^7 cells
 - c. 1.6×10^8 cells
 - d. 2×10^{32} cells
 - e. 3.2×10^8 cells

5. Siderophores are microbial compounds that
 - a. emulsify oil droplets
 - b. chelate iron and allow cells to take it up
 - c. hydrolyze proteins and polysaccharides
 - d. dissolve phosphorus granules and allow cells to take up phosphate
 - e. all of the above

6. Anaerobic Digestion:
 - a. Is performed on the liquid effluent of the primary and secondary treatments.
 - b. Produces a nutrient rich solid end-product that can be burned, put into landfills, or used as fertilizer
 - c. Produces methane as a gaseous end-product.
 - d. All of the above.
 - e. b and c only

7. "Mad Cow Disease" is related to Kuru and Creutzfeld-Jacob Syndrome in humans. Some English scientists believe that these sorts of diseases can be transmitted from cows to humans through ingestion of _____ contained in _____.
 - a. viruses / ground beef
 - b. viroids / ground beef
 - c. viroids / "sweet meats" (brains of cows)
 - d. prions / ground beef
 - e. *E. coli* / "sweet meats" (brains of cows)

8. Dental caries are caused by _____ which has an enzyme called dextransucrase. This enzyme catalyzes the production of _____ and fructose. The fructose then can be fermented to _____ which causes decalcification of tooth enamel.
- Streptomyces* / glucose / malic acid
 - Streptomyces* / dextran / lactic acid
 - Streptococcus* / glucose / lactic acid
 - Streptococcus* / dextran / lactic acid
 - Streptococcus* / glucose / malic acid
9. Which of the following bacteria produce both enterotoxin and endotoxin?
- Clostridium tetani*
 - Vibrio cholerae*
 - Streptococcus mutans*
 - Corynebacterium diphtheriae*
 - all of the above
10. Influenza (flu) is caused by an orthomyxovirus that infects the respiratory tract. The neuraminidase (NA) hydrolyzes the _____ allowing the hemagglutinin to bind to specific receptors on _____.
- cell wall / mucosal cells
 - mucous coating / viral envelope
 - mucous coating / mucosal cells
 - lung lining / bronchi
11. HIV can undergo a latent (provirus) stage after the _____ from the virus is converted to _____ which is then incorporated into the _____ of the host cell.
- RNA/DNA/RNA
 - DNA/RNA/DNA
 - RNA/DNA/DNA
 - RNA/RNA/DNA
12. Secondary metabolism refers to the production of
- simple metabolites like acetate or ethanol by growing cells.
 - complex metabolites like antibiotics by growing cells.
 - simple metabolites like antibiotics by growing cells.
 - complex metabolites like antibiotics by non-growing cells.
 - simple metabolites like acetate or ethanol by non-growing cells.
13. Chemoautotrophic microbes use _____ energy to make ATP, and fix _____ for all of their carbon needs. An example of a chemoautotroph would be a sulfur-oxidizing bacterium like _____.
- light / CO₂ / *Beggiatoa*
 - chemical / CO₂ / *Beggiatoa*
 - light / N₂ / *Nitrobacter*
 - chemical / CH₄ / *Metyhanococcus*
 - light / H₂S / *Beggiatoa*
14. Which of the following genera are Gram negative, fix N₂, and form nodules on the roots of some plants?
- Pseudomonas*
 - Rhizobium*
 - Frankia*
 - all of the above
 - none of the above
15. The most current theory for how prions function is that prions
- are inducers or repressors of gene expression.
 - cause a conformational change in brain proteins similar to themselves.
 - are lytic enzymes ("ribozymes") that make holes in individual brain cells.

16. Imagine there were organisms that lived in a lake and could naturally degrade DDT. Suddenly there was a massive DDT spill at a nearby industrial plant and the chemical seeped into the lake. The plant engineers added a fertilizer to the DDT so that these organisms would have enough nutrients to effectively degrade the DDT. This would be an example of:

- a. Bioaugmentation.
- b. Biostimulation.
- c. Biomagnification.
- d. All of the above.
- e. b and c only

17. More and more new diseases ("emerging infectious diseases") are being reported because

- a. the human population is growing exponentially
- b. humans are settling in areas that were not normally used for human habitation in the past
- c. diagnostic and reporting technologies have improved significantly in the last 50 years
- d. all of the above

18. The most recently discovered (and least studied) major group of Archaea is the

- a. Crenarchaeota
- b. Euryarchaeota
- c. Korarchaeota
- d. Haloarchaeota

19. Endotoxins are produced by Gram _____ Bacteria and are the same as Lipid A of the _____ layer.

- a. negative/peptidoglycan
- b. positive/peptidoglycan
- c. negative/lipopolysaccharide
- d. positive/ lipopolysaccharide

20. Methanogens (that carry out the reaction shown below) use _____ as their e- acceptor and _____ as their e- donor. $4 \text{H}_2 + \text{CO}_2 \rightarrow \text{CH}_4 + 2\text{H}_2\text{O}$

- a. $\text{H}_2\text{O} / \text{CO}_2$
- b. CO_2 / H_2
- c. $\text{O}_2 / \text{glucose}$
- d. H_2 / CO_2

21. Match the process with the name of the process (5 pts.)

- a. denitrification _____ $\text{N}_2 \rightarrow \text{NH}_4^+$
- b. nitrogen fixation _____ $\text{NO}_2^- \rightarrow \text{N}_2$
- c. decomposition _____ $\text{NH}_4^+ \rightarrow \text{NO}_2^- \rightarrow \text{NO}_3^-$
- d. nitrification _____ organic N $\rightarrow \text{NH}_4^+$
- e. immobilization _____ $\text{NH}_4^+ \rightarrow \text{organic N}$
- f. photosynthesis

22. A) Define eutrophication, B) list one possible cause, (2 pts.)

A)

B)

33. Draw the "Tree of Life" (label the 3 main branches) and place the following groups of organisms on it: (15 pts.)
 Fungi, Low GC Gram +, Proteobacteria, Enterobacteria, *Mycoplasma*, Crenarchaeota, Ascomycetes, *Streptococcus*, *Yersinia*, *Mycobacterium*, *Klebsiella*, High GC Gram +

35. List the three enzymes carried by an HIV virus particle and briefly describe the function of each enzyme (6 pts.).

36. Put the letter of the right answer in the blanks below (8 pts.)

A. Lipid A	D. M Protein	G. Plasma membrane
B. Lipid F	E. Ribosome	H. Hyaluronic acid capsule
C. LPS layer	F. Mycolic acid capsule	I. Peptidoglycan layer

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

