

4. Draw a bacterial growth curve indicating the four phases of growth. At which phase of growth would exposure to antibiotics cause the most adverse effects on the bacterial population? Why?
5. Complete the following table, indicating where the microorganisms will grow in a tube of a solid medium on the basis of their relationship to oxygen.

Relation to oxygen	Where in the tube does growth occur?	Why?
Obligate aerobe		
Facultative anaerobe		
Obligate anaerobe		
Aerotolerant anaerobe		
Microaerophile		

ANSWERS

Matching

- I. 1. g 2. d 3. c 4. a 5. f 6. e 7. j 8. i 9. k
 II. 1. e 2. a 3. b 4. f 5. d 6. c 7. g
 III. 1. b 2. a 3. f 4. d 5. g 6. d
 IV. 1. b 2. c 3. f 4. g 5. j 6. i
 V. 1. a 2. d 3. c
 VI. 1. d 2. b 3. a
 VII. 1. d 2. a 3. d 4. c

Fill in the Blanks

1. polysaccharide 2. *cyanobacteria* 3. mesophiles 4. number 5. broth 6. deep-freezing
 7. binary 8. absorbance (also optical density) 9. dry weight measurement 10. Facultative
 11. Facultative 12. phosphate; amino acids 13. culture medium 14. 40°C 15. pour plate method
 16. peptones 17. living host cells 18. reduction 19. optimum 20. colony-forming units

Critical Thinking

1. a. Fruit jelly is acidic and also has a relatively high osmotic pressure from added sugars.
 b. Pickles are acidic.
 c. Salted fish have high osmotic pressures.
 d. Hard cheeses are acidic and have relatively low moisture.

2. a. Molds; they are relatively tolerant of acidity, high osmotic pressure, and low moisture. (Yeasts have similar characteristics but are much less common in the environment. Acidophilic bacteria will grow in acidic foods but are usually not considered spoilage organisms—in fact, they very likely were used to make the food acidic, for example, cheese and pickles.)
 - b. Molds
 - c. Molds
 - d. Molds
3. a. Milk is highly perishable, and the delay required for incubation of plates would often be too lengthy for practical use.
 - b. Molds are filamentous, and plate counts would often arise from mold spores or fragments of mold filaments, which would not indicate the mold growth very well.

4. See figure below.

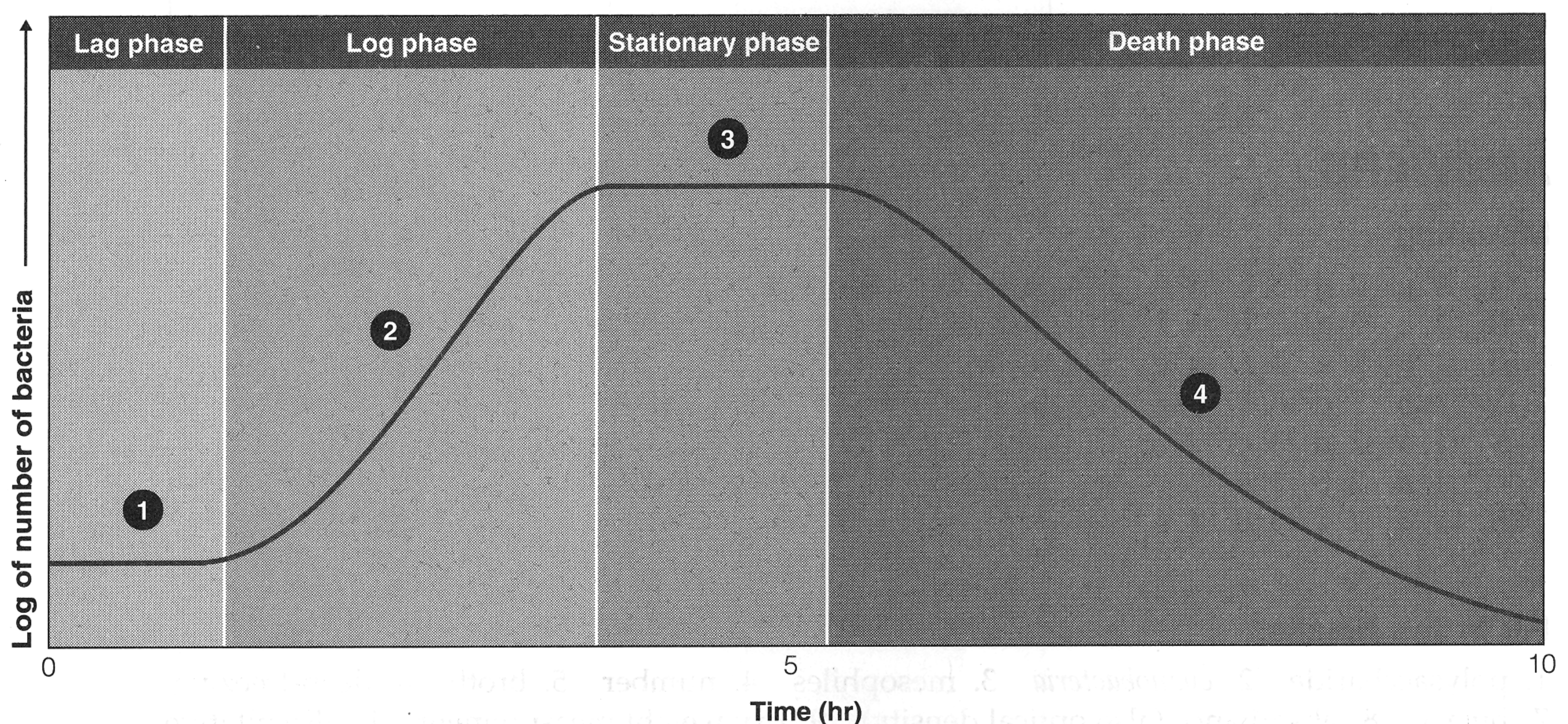
Lag phase—The period immediately following inoculation to fresh media in which little or no growth occurs. A time of intense metabolic activity as the cells gear up for reproduction.

Log or exponential phase—The period of growth in which cellular reproduction is most active. Generation time is at a minimum.

Stationary phase—The number of new cells being produced equals the number of cell deaths; the period of equilibrium.

Death phase—The number of dead cells exceeds the number of living cells until only a small portion of the population exists or the population dies out completely.

Exposure to antibiotics during log or exponential phase would cause the most adverse effects on the bacterial population. This is because antibiotics are most effective against growing cells.



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| <p>1 Intense activity preparing for population growth, but no increase in population.</p> | <p>2 Logarithmic, or exponential, increase in population.</p> | <p>3 Period of equilibrium; microbial deaths balance production of new cells.</p> | <p>4 Population is decreasing at a logarithmic rate.</p> |
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Key Concept

Bacterial populations follow a sequential series of growth phases: the lag, log, stationary, and death phases.

5.

Relation to oxygen	Where in the tube does growth occur?	Why?
Obligate aerobe	Near the top of the medium	Dissolved oxygen diffuses only a short distance in the medium.
Facultative anaerobe	Best near surface but throughout tube	They can survive without oxygen but grow better in the presence of oxygen.
Obligate anaerobe	At the bottom	Oxygen is poisonous to these organisms.
Aerotolerant anaerobe	Evenly throughout tube	These organisms don't use oxygen.
Microaerophile	In a narrow band of the medium	They will grow at the depth having the optimum oxygen concentration.