Food Microbiology Question Bank

Q1/ Single-Choice Questions

1. Who is considered the "Father of Microbiology" for being the first to observe single-celled organisms?

a) Robert Hooke b) Louis Pasteur

c) **Antonie van Leeuwenhoek** d) Robert Koch

2. Which scientist disproved spontaneous generation using swan-neck flask experiments?

a) Leeuwenhoek b) **Louis Pasteur**

c) Koch d) Hooke

3. Koch's postulates are used to:

a) Classify bacteria by shape

b) **Prove that a specific microorganism causes a disease**

c) Preserve food by heat

d) Identify viruses

4. Which bacterial shape is described as spherical?

a) Bacillus b) Spirillum

c) **Coccus** d) Vibrio

5. The typical size range of most bacteria is:

a) 10–100 μm b) **1–10 μm**

c) 0.1–0.5 μm d) 100–500 μm

6. Which arrangement describes bacteria in chains?

a) Staphylococci b) Diplococci

c) **Streptococci** d) Tetrads

7. The lag phase of bacterial growth is characterized by:

a) Rapid cell division

b) **Cells adapting to the environment with no division**

c) Death exceeding division

d) Toxin production

8. During which growth phase are bacteria most metabolically active?

a) Lag phase b) **Log/exponential phase** c) Stationary phase d) Death phase

9. Prokaryotic DNA is:

a) Enclosed in a nuclear membrane b) **A single circular chromosome**

c) Linear and associated with histones d) Found in the mitochondria

10. Which structure is unique to prokaryotic cell walls?

a) Cellulose b) Chitin c) **Peptidoglycan** d) Phospholipids

11. Gram-positive bacteria have:

a) Thin peptidoglycan layer b) **Thick multilayered peptidoglycan**

c) No cell wall d) Outer membrane containing LPS

12. The function of pili includes:

a) Motility b) *Attachment and conjugation* c) Protein synthesis d) Endospore formation

13. Endospores are formed by:

a) **Bacillus and Clostridium** b) E. coli and Salmonella c) Yeast and molds d) Viruses

14. Which structure protects bacteria from phagocytosis and drying?

a) Flagella b) Ribosomes c) **Capsule (glycocalyx)** d) Plasmids

15. Plasmids often carry genes for:

a) Ribosome synthesis b) **Antibiotic resistance**

c) Cell wall formation d) Endospore germination

16. According to WHO, approximately how many annual foodborne illness cases occur globally?

a) 48 million b) **600 million** c) 1 billion d) 10 million

17. Most food poisoning cases (>90%) are caused by fewer than:

a) 100 species b) 50 species c) **20 species** d) 5 species

18. Which pathogen produces a heat-stable toxin not destroyed by cooking?

a) Salmonella b) **Staphylococcus aureus**

c) Listeria monocytogenes d) Campylobacter

19. Listeria monocytogenes is particularly dangerous because it can:

a) **Grow at refrigeration temperatures** b) Survive boiling

c) Form endospores d) Only infect animals

20. Soil typically contains how many microorganisms per gram?

a) Thousands b) Millions c) **Billions** d) Dozens

21. The primary habitat of E. coli O157:H7 is:

a) Human skin b) **Cattle intestines** c) Poultry feathers d) Soil fungi

22. Which of the following is NOT a primary source of food contamination?

a) Water b) Air c) **Refrigeration** d) Animal hides

23. The ideal refrigerator temperature for food preservation is:

a) 10°C b) **4.4°C (40°F)** c) 0°C d) -18°C

24. At freezer temperatures (≤-18°C), microbial growth is:

a) Accelerated b) **Prevented** c) Unaffected d) Optimal

25. Quick freezing produces:

a) Large extracellular ice crystals b) **Small intracellular ice crystals**

c) No ice crystals d) Gas bubbles

26. Slow freezing (home freezer) results in:

a) **Large extracellular ice crystals** b) Small intracellular crystals

c) Better texture retention d) Minimal drip loss

27. Approximately what percentage of microorganisms survive freezing in foods?

a) 0-10% b) 10-30% c) **40-90%** d) 100%

28. Gram-negative bacteria compared to Gram-positive are:

a) More resistant to freezing b) **More susceptible to freezing**

c) Equally susceptible d) Not affected

29. Which factor causes chilling injury during cooling?

a) **Cell membrane changes and metabolite leakage** b) Endospore formation

c) Rapid DNA replication d) Biofilm formation

30. Pasteurization is intended to:

a) **Kill pathogenic microorganisms** b) Kill all microorganisms (sterilization)

c) Only preserve color d) Add beneficial microbes

31. Louis Pasteur developed pasteurization originally for:

a) Milk only b) **Beer and wine** c) Canned vegetables d) Meat

32. HTST pasteurization of milk involves heating to:

a) 63°C for 30 min b) **71.7°C for 15 seconds**

c) 138°C for 2 seconds d) 140°C for 4 seconds

33. UHT treatment allows milk to be stored:

a) Only refrigerated for 1 week b) **Several months without refrigeration**

c) Frozen for 1 year d) At room temperature for 1 day

34. Which pasteurization method extends refrigerated shelf life to 60-90 days?

a) LTLT b) HTST c) **Ultra Pasteurization (UP)** d) Flash pasteurization

35. Steam pasteurization is used for:

a) Milk cartons b) **Beef carcasses to kill E. coli**

c) Fruit juice d) Powdered eggs

36. Normal flora are microorganisms that:

a) Always cause disease b) **Continuously inhabit the human body harmlessly**

c) Are only found in soil d) Cannot survive on skin

37. A fetus at birth:

a) Has full normal flora b) **Is sterile (no normal flora)**

c) Only has viruses d) Has gut flora only

38. Which body part contains the most bacteria?

a) Skin b) Mouth c) **Large intestine** d) Stomach

39. The predominant bacteria in the large intestine are:

a) E. coli (aerobic) b) **Anaerobic Bacteroides spp.**

c) Lactobacillus d) Streptococcus

40. Lactobacillus in the vagina helps protect against infection by:

a) Producing toxins b) **Keeping pH acidic**

c) Forming endospores d) Killing viruses

41. Opportunistic infections by normal flora can occur when:

a) The host is immunocompromised b) Normal flora are displaced

c) Antibiotics reduce competing flora d) **All of the above**

42. Which organism causes dental caries by colonizing teeth?

a) Staphylococcus aureus b) **Streptococcus mutans**

c) E. coli d) Pseudomonas

43. Milk is an excellent medium for bacterial growth because it is:

a) Acidic b) **Highly nutritious** c) Sterile d) Low in water

44. Psychrotrophs in milk can grow at:

a) 37°C b) **5°C or less** c) 60°C d) -20°C

45. Spoilage of refrigerated milk typically produces a:

a) Sour flavor b) **Bitter, rancid, fruity flavor**

c) Sweet taste d) No change

46. Which of the following is a milk-borne disease of primary importance?

a) Common cold b) **Tuberculosis** c) Malaria d) Athlete's foot

47. The term "symbiosis" means:

a) One organism harms another b) **Permanent association between two organisms**

c) No interaction d) Competition for nutrients

48. In mutualism:

a) One benefits, other unaffected b) **Both benefit**

c) One benefits, other harmed d) Both harmed

49. Which statement about viruses is true?

a) They are prokaryotic b) **They are acellular**

c) They divide by binary fission d) They have peptidoglycan

50. Ribosomes in prokaryotes are:

a) 80S b) **70S** c) 60S d) 90S

51. The nucleoid region contains:

a) Ribosomes b) **Bacterial DNA** c) Plasmids only d) Mitochondria

52. Which of the following is NOT a beneficial role of normal flora?

a) Producing vitamin K b) Stimulating immune system

c) Preventing pathogen colonization d) **Causing disease in healthy hosts**

53. The conjunctiva of the eye is protected by tears containing:

a) Antibiotics b) **Lysozyme enzyme** c) Acid d) Alcohol

54. The lower respiratory tract is usually sterile due to:

a) High temperature b) **Mucous membrane removal of microbes**

c) Presence of antibiotics d) Low oxygen

55. Which bacteria are highly resistant to freezing and virtually unaffected?

a) Gram-negative rods b) **Bacterial spores and viruses**

c) Lactobacillus d) Psychrotrophs

56. Fast freezing followed by fast thawing results in:

a) **Minimal additional damage** b) Maximum cell death

c) Large crystal formation d) No effect

57. Which food preservation method uses gamma rays?

a) Pasteurization b) **Irradiation pasteurization** c) Freezing d) LTLT

58. In parasitism, the organism that benefits is called the:

a) Host b) **Parasite** c) Commensal d) Symbiont

59. Synergism between microorganisms means they:

a) Compete for nutrients b) **Work together to cause disease neither could alone**

c) One kills the other d) Have no interaction

60. The majority of normal flora in the large intestine are:

a) Aerobic b) Facultative c) **Anaerobic** d) Photosynthetic

Q2/ Matching Questions

Match the term in Column A with its correct description in Column B.

| A | B |

| 1. Leeuwenhoek | A. Disproved spontaneous generation |

| 2. Pasteur | B. First to observe "animalcules" |

| 3. Koch | C. Identified Vibrio cholerae and TB |

| 4. Hooke | D. Coined term "cell" from cork observation |

| 5. Coccus | E. Spherical shape |

| 6. Bacillus | F. Rod-shaped |

| 7. Spirillum | G. Spiral shape |

| 8. Peptidoglycan | H. Unique molecule in bacterial cell walls |

| 9. Plasmid | I. Extrachromosomal DNA with antibiotic resistance |

| 10. Endospore | J. Dormant structure in Bacillus/Clostridium |

| 11. Psychrotroph | K. Grows at ≤5°C in milk |

| 12. HTST | L. 71.7°C for 15 seconds |

| 13. UHT | M. 140°C for 4 seconds |

| 14. LTLT | N. 63°C for 30 minutes |

| 15. Pasteurization | O. Reduces pathogens, not all microbes |

| 16. Mutualism | P. Both organisms benefit |

| 17. Commensalism | Q. One benefits, other unaffected |

| 18. Parasitism | R. One benefits, other harmed |

| 19. Synergism | S. Two microbes cause disease together |

| 20. Normal flora | T. Microbes living on/in human body harmlessly |

| 21. Lysozyme | U. Enzyme in tears that kills bacteria |

| 22. Streptococcus mutans | V. Causes dental caries |

| 23. Lactobacillus | W. Maintains acidic vaginal pH |

| 24. Bacteroides | X. Dominant anaerobic bacteria in large intestine |

| 25. Psychrotrophs | Y. Cause bitter/rancid spoilage in refrigerated milk |

| 26. Udder | Z. Primary source of milk microflora |

| 27. Campylobacter | AA. Major poultry-associated pathogen |

| 28. Salmonella | BB. Associated with eggs and poultry |

| 29. Staphylococcus aureus | CC. Produces heat-stable toxin |

| 30. Listeria | DD. Grows at refrigeration temperatures |

Answer Key:

1-B,2-A,3-C,4-D,5-E,6-F,7-G,8-H,9-I,10-J,11-K,12-L,13-M,14-N,15-O,16-P,17-Q,18-R,19-S,20-T,21-U,22-V,23-W,24-X,25-Y,26-Z,27-AA,28-BB,29-CC,30-DD

Q3/ Fill-in-the-Blank Questions

1. The Dutch scientist who first observed single-celled organisms under a simple microscope was **Antonie van Leeuwenhoek**.

2. The process of heating milk to kill pathogens without sterilizing is called **pasteurization**.

3. The rigid layer of bacterial cell walls composed of sugar and amino acid chains is **peptidoglycan**.

4. Bacteria with a spherical shape are called **cocci** (singular: coccus).

5. During the **log** phase, bacteria divide at a constant and rapid rate.

6. The **lag** phase is a period of adaptation with no cell division.

7. The **stationary** phase occurs when growth rate equals death rate.

8. Gram-positive bacteria have a **thick** peptidoglycan layer, while Gram-negative have a thin layer with an outer membrane.

9. **Pili** (or fimbriae) are hair-like appendages used for attachment and conjugation.

10. **Endospores** are highly resistant dormant structures formed by Bacillus and Clostridium.

11. The protective slimy layer on bacteria that prevents phagocytosis is the **capsule** (or glycocalyx).

12. **Plasmids** are small, circular extrachromosomal DNA molecules carrying accessory genes.

13. The ideal refrigerator temperature for food preservation is **4.4°C** (or 40°F).

14. Quick freezing produces **small** intracellular ice crystals, minimizing cell damage.

15. Approximately **40-90%** of microorganisms survive freezing in foods.

16. The HTST pasteurization method heats milk to **71.7°C** for 15 seconds.

17. UHT treatment heats milk to **140°C** for 4 seconds, allowing storage without refrigeration.

18. The study of microorganisms that inhabit, create, or contaminate food is **food microbiology**.

19. The lower respiratory tract is usually **sterile** due to mucous membrane defenses.

20. The large intestine contains more bacteria than any other body part, with 99% being **anaerobic** Bacteroides.

21. **Lysozyme** is an enzyme in tears that breaks down bacterial cell walls.

22. **Streptococcus mutans** is the primary bacterium causing dental caries.

23. **Lactobacillus** species maintain acidic pH in the vagina to prevent infections.

24. A newborn infant is **sterile** at birth and acquires normal flora from the mother and environment.

25. **Psychrotrophs** are bacteria that can grow at 5°C or less and spoil refrigerated milk.

26. Spoilage of milk at room temperature typically produces a **sour** flavor.

27. The udder and adjacent parts are **primary** sources of microorganisms in raw milk.

28. In **mutualism**, both organisms benefit from living together.

29. **Koch's postulates** are criteria used to prove a specific microorganism causes a disease.

30. The **glycocalyx** is a protective slimy layer on the bacterial cell surface.

Q4/ Short Answer Questions

1. **Explain why freezing does not sterilize food and what happens to microorganisms during freezing.**

Freezing prevents microbial growth but does not kill all microorganisms. Approximately 40-90% survive. Some cells die due to ice crystal formation (mechanical damage), solute concentration (plasmolysis), or pH changes. Survivors remain dormant and can become active again upon thawing.

2. **Compare and contrast the four phases of the bacterial growth curve.**

Lag phase: adaptation, no division. Log phase: rapid exponential division, highest metabolic activity. Stationary phase: growth rate equals death rate due to nutrient depletion/waste accumulation. Death phase: death exceeds division due to toxic conditions.

3. **Describe the differences between Gram-positive and Gram-negative bacterial cell walls.**

Gram-positive: thick multilayered peptidoglycan (10-20 layers), no outer membrane, retains crystal violet stain. Gram-negative: thin peptidoglycan (2-3 layers), outer membrane with LPS, does not retain crystal violet, stains pink/red.

4. **Explain how HTST, UHT, and LTLT pasteurization differ in time, temperature, and purpose.**

LTLT: 63°C for 30 min (home use). HTST: 71.7°C for 15 sec (commercial fresh milk). UHT: 140°C for 4 sec (shelf-stable milk, no refrigeration needed).

5. **What are the primary sources of microbial contamination in milk? Give four examples.**

Udder/teat (natural microflora), milking equipment (biofilms), milking environment (air, dust, feed), dairy workers (hands, clothing), transportation containers (improper cleaning).

6. **Explain why Listeria monocytogenes is particularly dangerous in refrigerated foods.**

Listeria is a psychrotroph—it can grow at refrigeration temperatures (0-7°C). Unlike most pathogens, refrigeration does not prevent its growth. It causes severe illness, especially in pregnant women, elderly, and immunocompromised.

7. **Describe three beneficial functions of normal flora in the human body.**

Protection against pathogens (competition, antimicrobial substances), stimulation of immune system development (especially in newborns), production of nutrients like vitamin K, aiding digestion and absorption.

8. **What factors determine the survival of microorganisms during freezing? List at least five.**

*Type of organism (Gram-negative more susceptible than Gram-positive; spores resistant), cell age (actively growing more susceptible), cooling/freezing rate, final storage temperature, food

composition (cryoprotectants vs. acid conditions), storage time, pre-freezing treatment, thawing rate.*

9. **Compare quick freezing and slow freezing in terms of ice crystal formation and food quality.**

Quick freezing (industrial, <30 min): small intracellular crystals → minimal cell damage, less drip loss, better texture. Slow freezing (home, 3-72 hours): large extracellular crystals → cell wall rupture, more drip loss, mushy texture upon thawing.

10. **Why does the large intestine contain the highest number of bacteria in the human body?**

The large intestine provides ideal conditions for microbial growth: neutral pH, slow transit time (allows bacterial multiplication), abundant nutrients from undigested food, anaerobic environment, and warm temperature. It harbors 99% anaerobic bacteria, primarily Bacteroides.

Q5/ True/False Questions

1. **True** – Antonie van Leeuwenhoek was the first to observe and describe single-celled organisms.

2. **True** – Louis Pasteur disproved spontaneous generation using swan-neck flasks.

3. **False** – Koch's postulates cannot be used to identify viruses (many viruses do not grow on artificial media).

4. **True** – Bacteria typically range from 1-10 μm in size.

5. **False** – The log phase is the period of most rapid cell division, not the lag phase.

6. **True** – During the stationary phase, growth rate equals death rate.

7. **True** – Peptidoglycan is unique to bacterial cell walls.

8. **False** – Gram-positive bacteria have thick peptidoglycan; Gram-negative have thin peptidoglycan with an outer membrane.

9. **True** – Endospores are formed by Bacillus and Clostridium species.

10. **True** – Capsules protect bacteria from phagocytosis and help with adhesion.

11. **False** – Plasmids are extrachromosomal, not part of the bacterial chromosome.

12. **True** – At freezer temperatures (≤-18°C), microbial growth is prevented.

13. **False** – Slow freezing produces large extracellular crystals, not small intracellular ones.

14. **True** – Approximately 40-90% of microorganisms survive freezing in foods.

15. **False** – UHT pasteurization allows milk to be stored without refrigeration for months.

16. **True** – HTST stands for High Temperature/Short Time (71.7°C, 15 seconds).

17. **False** – Pasteurization reduces pathogens but does NOT sterilize food.

18. **True** – The lower respiratory tract is normally sterile.

19. **True** – The large intestine contains more bacteria than any other body part.

20. **False** – Lactobacillus in the vagina protects by producing acid, not by killing viruses directly.

21. **True** – A newborn is sterile at birth.

22. **True** – Lysozyme is an antibacterial enzyme found in tears.

23. **False** – Streptococcus mutans causes dental caries, not E. coli.

24. **True** – Refrigeration significantly slows microbial growth.

25. **False** – Psychrotrophs grow at refrigeration temperatures (≤5°C), not thermophiles.

26. **True** – Spoilage of refrigerated milk typically produces bitter/rancid/fruity flavors.

27. **False** – Milk is not sterile; it has natural microflora and can be contaminated during milking.

28. **True** – In mutualism, both organisms benefit.

29. **True** – In commensalism, one organism benefits and the other is unaffected.

30. **True** – Parasitism benefits one organism (parasite) and harms the other (host).