Microbiology Semester Review Guide

Name KEY Period 7

Chapter 1 The Microbial World and You

1. What is the proper way to write the scientific name of a microbe? Genus species
2. What are the terms for the 2 parts of the scientific name?
3. Fill out the table below for each of the following groups.

Organism Type	Multicellular, Unicellular, or not made of cells	Sexual vs Asexual Reproduction	Absence or Presence of Cell Wall	If applicable, composition of cell wall	Genetic Material RNA or DNA	Pro or EuKaryotic	Misc Facts
Bacteria	UNicellular	Asexual Binary fission	cell wall present	peptidoglycan	DNA	Pro -	no nucleus no membrane bound organelles most treatable with antibiotics
Archaea	UNicellular	Asexual Binary Fission	NO absent		DNA	Pro -	Halophiles - high salt Thermophiles - high temp gens Methanophiles - CH4
Fungus	can be BOTH Multi (molds + mushrooms) + UNI (yeasts)	BOTH sexual + asexual	cell wall present	CHITIN cell walls	DNA	EUkaryote	• Heterotrophs • Mycology = study of Fungi
Protozoa	UNI -	Both sexual & Asexual	NO absent		Both DNA + RNA		• Hard to treat • contact with contaminated reservoir • Giardia, Malaria,
Virus	Not a cell (non-living).	Both sexual & asexual	absent		Both DNA + RNA		Made of protein coat + nucleic acid genome. • No treatment/time • can manage tumors • HPV, HIV, FIU
Prion	Not made of cells (infectious proteins)						No treatment - cause Mad Cow disease (beef-spinal cord) or Creutzfeldt Jacobs (contaminated surgical eq).
Parasite (Worm Helminth)	MULTI -	sexual reproduction			DNA	Eukaryote	• parasites • complex reproduction

trapped bacteria in the bend so the broth inside stayed clear. Without life having access, there was no life in the tube.

4. Who is credited with proving the theory of spontaneous generation false? Pasteur

5. Describe the experiment that disproved the theory of spontaneous generation.
Biogenesis - life comes from life. He created the "goose-neck" flask that let air in but

6. What did the following scientists contribute to Microbiology?
   A. Pasteur - Pasteurization / Fermentation / Biogenesis
   B. Koch - postulates - ID cause of disease to a specific microbe
   C. Fleming - Discovered 1st antibiotic (penicillin).
   D. Jenner - created 1st vaccine against smallpox by using cowpox to protect against smallpox

7. Fill out the table below regarding Koch's postulates.

Postulate	Description of Postulate	Exception
1	Is the same pathogen present in every case?	One disease is caused by a large number of microbes.
2	Can you isolate the pathogen and grow it in a pure culture?	Too fastidious (can't be grown on artificial media).
3	Does the isolated pathogen cause the disease when (re-)injected?	Some microbes cause various diseases
4	Can you reisolate the pathogen after infection?	Ethical issues - human hosts.

8. For what 2 diseases did Koch find the causative microbe by using these postulates?
   A. Anthrax
   B. TB

9. Fill out the table below regarding *E.coli O157* vs. Mad Cow.

Disease	Original Source of Organism	Usual Food Contaminated and How it becomes Contaminated	Prevention Methods (If applicable)	Severity of the Disease if contracted (Symptoms and Prognosis)
E.coli O157	Bacteria from contaminated intestinal matter.	ground meat (grinding) with intestines	fully cook to internal temp of well done.	• Food Poisoning • wait it out.
Mad Cow	spinal cord material	beef contaminated with spinal cord	Don't eat it.	• Death • No treatment

10. Fill out the table below by providing a definition and an example for each of the following.

Term	Definition	Scenario/Example
Emerging Disease	"New"/Relatively New among humanys	•AIDS •Legionnare •CJD •LYME
Remerging Disease	Diseases that were a problem, then they declined dramatically, but are again becoming health problems.	•TB •Schisto
Endemic	Disease constantly present in a specific geographic area never significantly decline	• pneumonia • strep • polio • guinea worm • plague
Epidemic	sudden increase in a disease in a specific location	• Depends - 60 cases a week/normally 1 or 2.
Pandemic	worldwide epidemic	• Influenza 1918-1919

11. Define the following miscellaneous vocabulary terms:

A. Pathogen - Disease causing agent

B. Normal microbiota - bacteria that are commonly found/serve a benneficial purpose.

C. Antibiotic - Drug used to treat bacterial infections.

D. Pasteurization - Heating material up to a safe temperature to kill microbial life.

E. Passive vaccine - you are given antibodies (short term: placenta + breast milk).

F. Active vaccine - you make antibodies post disease/vaccination.

G. Natural immunity - you make antibodies (had the disease).

H. Artificial immunity - you are given antibodies (shot/nose spray).

I. Halophile - A microbe that can/needs higher salt conditions to grow.

J. Thermophile - A microbe that needs higher temps (extremes) to grow.

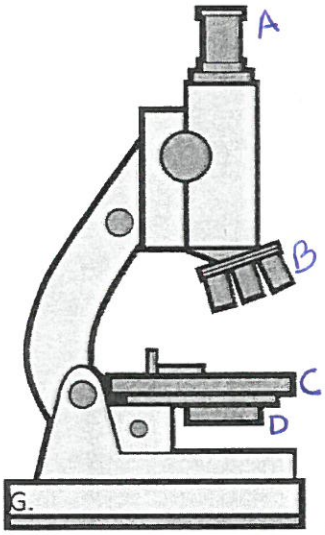
K. Vector - An arthropod/insect that carries organism between hosts but does NOT get disease.

L. Reservoir
- A site where infectious agents survive.

Chapter 3 & 4

12. Microscopy. Types of scopes: Fluorescence, transmission electron, light, scanning electron, darkfield.
    A. Which has the best resolution? Transmission
    B. Which has the best magnification? Transmission

Type of Microscope	Does it use light or something else?	Unique Characteristics	What do specimens look like under the scope?
Fluorescent	light	can rapidly ID No culture needed can detect small #'s	shine / fluoresce green, red
Transmission	electrons	need thin slices so e⁻ penetrate. internal cell structures	detailed internal views.
Scanning	electrons	view surface structures	3D
Light	light	LIVE / unstained ~~can rapidly ID specimen~~ stained	alive -depends on stain
Dark-field	light	Easier to see unstained Can see distinct borders Can see smaller microbes	black background and microbes start out.



C. Label the following parts of a scope on the picture to the left:
    A. Ocular lens
    B. Objective lens
    C. Stage
    D. Diaphragm

D. What is the equation to calculate total magnification?
Objective Lens • Occular Lens

E. Calculate the total magnification of a scope with a 40 objective lens.
40X • 10 = 400X

F. What is resolution? The minimum distance at which a microscope lens can distinguish two points as separate.

G. List two ways to improve the resolution of a microscope.
(1) decrease wavelength (2) use oil (3) adjust condenser.

13. Fill in the table below regarding types of stains:

Stain Type	Uses of this Stain	Appearance of the Stain	Example Reagents
Positive/~~Acidic~~ Basic	morphology (shape, size, arrangement)	stains bacteria	Methylene Blue, Safranin, Malachite Green, Crystal Violet
Negative/ ~~Basic~~ Acidic	Detect capsules, cell size, cell shape	stains the background	Acid Fuchsin Nigrosin
Differential	uses more than one stain.	different microbes appear different color	- Gram stain

14. Endospore staining –
    A. How are they stained? Apply heat (differential stain)

    B. When is an endospore stain appropriate (based on gram stain)?
    Use endospore stain if clear spots appear in gram positive bacteria.

15. Acid Fast staining.

A. When appropriate to use (based on gram stain)?
when looking for Mycobacterium - gram stain/simple stains do not yield results.

B. What does a positive result mean?
TB

16. Fill out the table below regarding Gram staining:

Gram Stain Steps	Description of Step	Reagent Used	Appearance of GN Cells	Appearance of GP Cells
Step 1	Initial Stain	Crystal violet	Purple	Purple
Step 2	Mordant - locks in color	Iodine	Purple	Purple
Step 3	Decolorizes - removes initial stain from negative cells.	Alcohol	Clear	Purple
Step 4	Counterstain - stains negative cells so they are visible for analysis	Saffranin	PINK/RED	Purple

17. List two or more reasons why gram stain results may be inaccurate?
(1) ONLY USED FOR YOUNG CULTURES (TOO OLD = destruction of cell wall).
(2) Decoloring timing is critical.

18. Prokaryotes vs Eukaryotes:

Type of Cell	DNA Structure/Location	Ribosomes Size	Cell Wall Differences	Other Internal Cell Structures that Differ
Prokaryote	no nucleus Free DNA	70S	peptidoglycan in bacteria.	• Chromatophores • plasmids • inclusions
Eukaryote	nucleus	80S	no cell walls (besides fungi - chitin)	nucleus membrane bound organelles.

19. Fill in the table below regarding special cell walls.

Type of Cell	Structure of Cell Wall
Archaea	no peptidoglycan
Bacteria	peptidoglycan cell walls. - Amount depends on GP/GN
Mycobacteria	cell walls with GP peptidoglycan thick layer

20. What is the purpose of endospores in a cell? A resistant dormant/resting structure remenant of bacteria used to protect microbes in adverse conditions

21. What types of cells possess endospores? GP

22. Chromatophores:

A. What are chromatophores? pigment absorbing molecules in prokaryotes

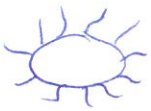
B. What is the function of chromatophores in cells?
perform photosynthesis

23. Inclusions:

A. What are inclusions? Reserve deposits that prevent internal increases in osmotic pressure.

B. What is the function of an inclusion?
prevent osmotic lysis

24. Fill in the table below regarding structures external to the cell wall.

External Structure	Function	Miscellaneous Facts
Glycocalyx/Capsule	Adherence	Prevents Phagocytosis
Flagella	Movement	Types/Placement Options
	peritrichous - flagella cover the whole surface	Lophotrichous - group of flagella at one end 
	monotrichous - one flagella	Amphitrichous - flagella on opposite ends
Axial Filament	Movement	
Fimbrae	Adherence	
Sex Pilus	Transfer DNA	GN only

25. How do bacteria reproduce? binary fission

26. What's the difference between archea & bacteria Cell wall make-up

27. What are the three shapes/morphologies of bacteria?

a. Rod / Bacillus
b. Circle / Cocci
c. Spiral / Spirrelum

28. What are plasmids? Extrachromosomal DNA

a. Clinical significance: Specific concerns & how we use them for our benefit.

- Drug resistance → used to produce products + pass on resistence to environmental factors.

29. Fill out the table below regarding types of cell walls (GN vs. GP).

Type of Cell Wall	Composition Differences	Diagram
GN	Little peptidoglycan underneath a thick outer wall layer.	← porins ← outer wall layer ← peptidoglycan ← cell membrane
GP	Lots of peptidoglycan connected by teichoic acids.	← teichoic acids. ← peptidoglycan ← cell membrane

30. What type of cell, GP or GN, possess...

a. Endotoxins? GN

b. Protection from osmotic lysis? GP

c. Penicillin sensitivity? GP

d. Lysozymes? GP

e. Teichoic acids? GP

f. Porins? GN

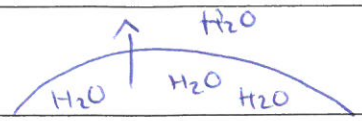
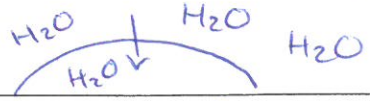
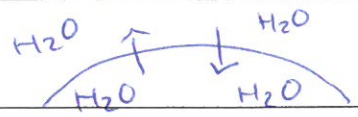
31. Fill out the table below regarding molecule movement through cell wall.

Type of Membrane Transfer	How do molecules move?	Is energy used?
Passive – balances	~~Lo~~ From High to Low concentration	NO
Active – unbalanced	From Low to HIGH concentration	yes

32. Fill out the table below regarding types of passive transport.

Type of Passive Transport	Definition	Diagram	Examples of molecules that require this type of transfer
Osmosis	Movement of water from High → Low concentrations	H_2O H_2O H_2O H_2O H_2O H_2O	WATER
Diffusion	Movement of small molecules, elements, compounds from High → Low concentrations	O_2 O_2 O_2 O_2 O_2 O_2	• Elements (CO_2) • Compounds • molecules (O_2)
Facilitated Diffusion	Movement of large molecules (sugars) through protein channels in the membrane from High → Low Concentration	$C_6H_{12}O_6$ $C_6H_{12}O_6$ $C_6H_{12}O_6$ $C_6H_{12}O_6$	Macromolecules – sugars

33. Fill out the table below regarding types of solutions created.

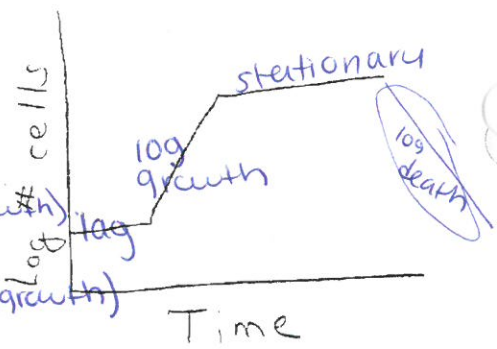
Term	Definition	Diagram
Hypertonic	movement of substances out of cells.	
Hypotonic	Movement of substances into cells	
Isotonic	movement of substances in + out of cells.	

34. Endosymbiotic theory. List multiple SPECIFIC pieces of evidence supporting it. - Eukaryotes evolved from prokaryotes living inside other prokaryotes
- chloroplasts are similar to photosynthetic prokaryotes
- mitochondria & chloroplasts reproduce by binary fission.

Chapter 6: Growth

35. Label the phases of growth on the graph to the right.
36. When are antibiotics/radiation most effective? log (growth)

37. Graph shows growth in room temperature air. How would it change if it's a/an



A. Aerotolerant anaerobe grown in:

A. Candle jar instead? lower slope of log (growth)

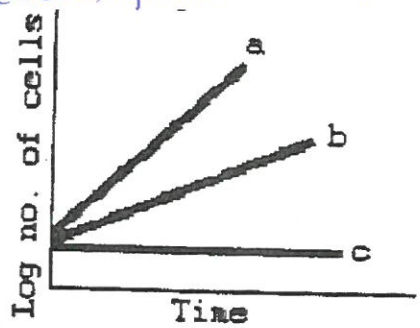
B. Anaerobic conditions? higher slope of log (growth) (steeper)

B. Facultative anaerobe grown in:

A. Candle jar? lower/more gradual slope for log (growth)

B. Anaerobic conditions? even further reduced/gradual slope for log(grad

38. Use the graph to the right to answer the following questions.



a. Which line is a thermophile grown at 4C? C

b. Which line is a thermophile grown at 55C? A

c. Which line is a psychrotroph grown at 4C? B

39. Write the equation that the following enzymes catalyze:

A. Catalase $2H_2O_2 \rightarrow 2H_2O + O_2$

B. Superoxide dismutase $\cdot O_2^- + \cdot O_2^- + 2H^+ \rightarrow H_2O_2 + O_2$

40. What is the equation used to calculate number of organisms present after a given number of generations?

organisms = n(original #) • 2^{x}(# of generations)

a. If there are 6 cells to begin with, how many are there after 2 generations?

24 = $6 \cdot 2^2$

a. After 6 generations?

384 = $6 \cdot 2^6$

b. If there are 4 cells to begin with, how many are there after 3 generations?

32 = $4 \cdot 2^3$

41. Archea: Define each organism below and list the specific locations where they can be found.

a. Acidophile - Grows in lower pH - volcano vents.

b. Extreme Halophile - 20-30% salt / Archaea - Dead Sea, Great Lake.

c. Facultative Halophile - can grow in above avg. salt concentrations but prefers NOT to.

42. Define the following miscellaneous terms:

a. Anabolism - the synthesis, making, of complex molecules from simpler ones.

b. Catabolism - the breakdown of complex components into simpler ones.

c. Halophile - An organism that grows best in higher amounts of salt.

d. Amylase - An enzyme that digests starch.

43. Fill out the table below regarding oxygen requirements for microbes.

Microbe	Optimal Conditions	Presence of SOD	Presence of Catalase	Growth in Candle Jar	Location of growth in Thioglycolate broth	End Product (Alcohol/Acid)
Obligate aerobe	can only grow in O_2	X	X		Only at top in pink layer Growth ← pink	CO_2
Microaerophile	grows in small quantities of O_2	X	X	X	Growth in center (suspended) ← pink	CO_2
Facultative anaerobe	an aerobe that can grow w/out O_2 but prefers not to.	X	X		Growth All through but more at top ← pink	alcohol/acid CO_2 in O_2
Aerotolerant anaerobe	Anaerobes that can grow in O_2 but prefer not to.	X			Growth all over but more at bottom pink	alcohol/acid
Obligate anaerobe	can only grow w/out O_2				ONLY Growth at the bottom (not pink areas) pink	alcohol/acid

14. For 5 classifications based on oxygen requirements/survival:

a. Generation time/amount ATP produced in different environments

shorter generation time & ↑ rates of ATP if grown in conditions closer to optimal.

45. Fill out the table below regarding temperature requirements

Type of Microbe	Optimal Temp	Miscellaneous Facts
Psychrophile	15°C	Cold Loving
Psycrotroph	25°C	Refrigerater Spoilage
Mesophile	25-40°C	Most common / Human pathogens
Thermophile	40°+	Hotter than normal
Extreme Thermophile	40°+	Archaea: Producers use Sulfure to make energy without light.

46. Fill in the table regarding media types.

Type of Media	Ingredients	What types of plates have we used?
Complex (contains Extract)	Exact composition Unknown	NUT EMB Blood Agar LB PEA TSI
Defined	Exact Composition known	

47. Fill in the table regarding media types.

Type of Media	How does it work?	What types of plates have we used?	Explain the mechanism of the plate(s).
Selective	only certain groups grow	EMB + PEA	contains alcohol that dissolves GN outer membrane & dehydrates cell.
Differential	appearance differences btw different bacteria	EMB	contains lactose & a pH indicater that changes color due to acid production if lactose is used

48. Starch plate:

A. What does it test for?

presence of amylase / exoenzyme to digest starch.

B. Describe the appearance of both a positive test vs. a negative test.

halo | no-halo / darker around bacteria

49. Fill in the table regarding CHONPS.

Element	Molecules it Creates
C	All organic molecules. All compounds in living things.
H	Satisfies all compounds in living things.
O	Cellular respiration (energy production)
N	Amino Acids (proteins) & Nitrogen Bases (RNA/DNA)
P	ATP, membrane phospholipids, + DNA
S	Amino Acids (proteins).

EMB: dyes methylene blue & eosin inhibit GP

50. Fill out the table below regarding media types.

Media	Mechanism	Diagrams/Pictures with possible interpretations			What types of organisms are found on this media?
OF-G	Can the organism digest glucose with/without the presence of O_2.	(open) yellow	(oil) green	oxidizer	can digest glucose with use of O_2 only (only aerobic respiration)
		(open) yellow	(oil) yellow	fermenter	can digest glucose with AND without O_2. uses aerobic [oxidative] & fermentation to break down lactose
		(open) green	(oil) green	non-utilizer	Anaerobe → uses peptones
TSI	Glucose when fermented produces acid turning the tube yellow. If lactose and sucrose ferment, it stays yellow. If peptones are used tube turns red (no acid).	(slant) yellow (10hrs) red (24)	(butt) yellow - stays yellow	glucose utilizer	Glucose is the only sugar oxidized & will be used up quickly (After glucose, peptones are used → returns to red).
		(slant) yellow - stays yellow	(Butt) yellow - stays yellow	glucose & lactose/sucrose	As glucose is oxidized, the tube turns yellow & will stay yellow due to high acid production during lactose/sucrose use.
		(slant) darker red	(Butt) darker red	peptone utilizer	No sugar is used only peptones are oxidized.
EMB	Selective – methylene blue & eosin inhibits GP growth Differential – contains lactose & a pH indicator that changes color due to acid production if lactose is used.				GN
PEA	Selective - contains alcohol that dissolves GN cells outer membrane				GP

Chap 7 & 20: Control

51. Define the following words:
    a. Broad Spectrum
    b. Narrow Spectrum
    c. Synergism

52. What is an example of synergism?

53. Fill out the table below regarding targets of antibiotics.

Target	How is this structure different from Eukaryotic cells?	How does this disrupt bacteria function?	What danger is there to Eukaryotic cells?
Cell Wall			
Folic Acid Synthesis			
Ribosomes			
Outer Membranes			
DNA synthesis /transcription			

54. Compare and Contrast MIC and MBC.

55. Use the table below to fill out the MIC and MBC for the drugs Cf and NB.

		Staph		*E. coli*	
Drug	Dilution	Growth	Subculture	Growth	Subculture
Cf	1:2	-	-	-	-
"	1:10	-	+	+	+
"	1:20	+	+	+	+
"	1:100	+	+	+	+
NB	1:4	-	-	-	-
"	1:60	-	_	-	-
"	1:80	+	+	-	+

	Staph	Ecoli
MIC Cf		
MBC Cf		
MIC NB		
MBC NB		
Which drug most effective? Explain.		

56. What is different about reading the results of disk diffusion testing for antibiotic vs. disinfectants?