Midterm 1 Practice Questions

For MC Questions, correct answers are highlighted in Green in the Answer Key.
For T/F Questions, ones that are True are highlighted in Green in the Answer Key.

Lectures 1-4.
Practice T/F Questions.

1. For a given number of taxa, there are more unrooted trees than rooted trees.
2. Unrooted trees lack a root branch and do not convey the timing of speciation events.
3. The presence or absence of ribosomes can be used to infer relationships on the tree of life.
4. A grouping of taxa that excludes some, but not all, descendants of a MRCA is paraphyletic.
5. Polytomies show areas of uncertainty on phylogenies.
6. Unrooted trees completely specify relationships among a set of taxa.
7. Flight is a homoplasy among animals.
8. If clades A and B are sister groups, then together they form a monophyletic group.
9. In a cladogram, the branch lengths are proportional to the amount of character change.
10. Cladograms allow us to identify which of the study species are primitive or advanced.
11. On a given phylogeny, sister taxa split from a common ancestor at the same time

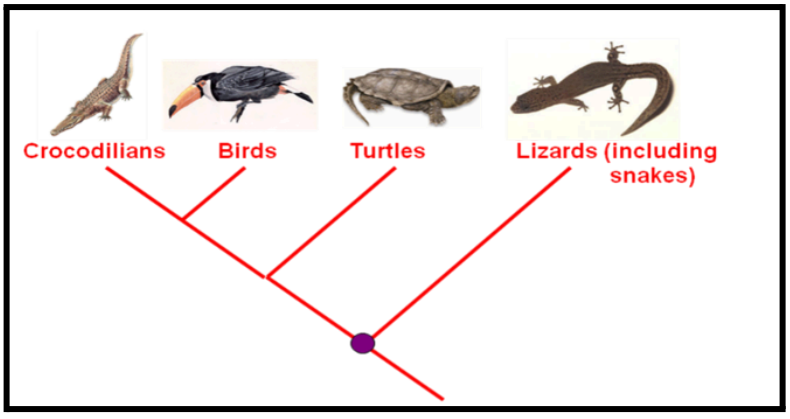
Lecture 1-4.
Practice Multiple Choice Questions

1. What is a function of outgroup species in phylogeny estimation?
   a. It indicate which character state is primitive/derived
   b. It allows one to root a unrooted tree
   c. It indicate which character state is ancestral/advanced
   d. It resembles the MRCA of the ingroup
   e. It indicates the ancestral condition of the ingroup

2. Comparing rooted and unrooted trees:
   a. unrooted trees are less informative about relationships than rooted trees
   b. for a given character/taxon matrix, unrooted trees require fewer steps than rooted trees
   c. unrooted trees depict sister group relationships, while rooted trees do not
   d. phylogeny estimation is easier when working with rooted trees
   e. all of the above

3. In addition to showing relationships among taxa, all phylogenies include the:
   a. proportion of genetic change represented by branch lengths
   b. number of extinction events across the tree
   c. interactions among populations within a species
   d. order of splitting events among lineages
   e. absolute dates of splitting events on the tree

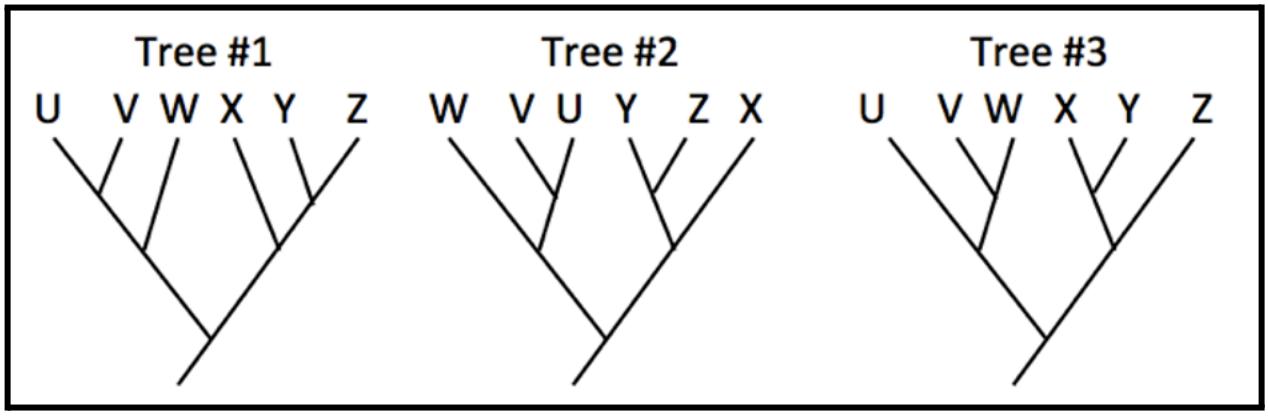
4. Given the cladogram shown below Reptiles, which of the following statements is true?



   a. turtles are more closely related to crocodilians than to lizards
   b. exclusion of birds would make Reptiles monophyletic
   c. lizards share a more recent common ancestor with turtles than with birds
   d. the sister group of (crocodilians + birds) is (turtles + lizards)
   e. birds could be a useful outgroup for studies of reptile phylogeny

Lectures 1-4.
Practice Tree Interpreting Questions

Tree Interpretation 1



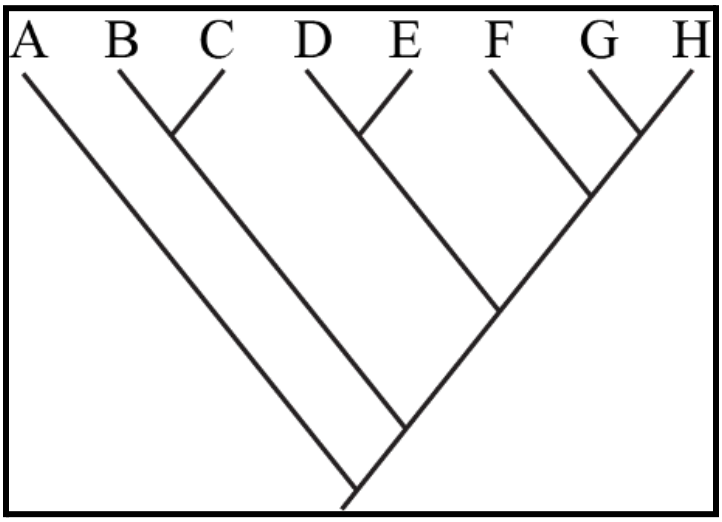
1. Considering the trees above, which of these statements is **true**?
   a. tree #1 = tree #2
   b. tree #1 = tree #3
   c. tree #2 =tree #3
   d. all three trees are equivalent
   e. all three trees are different

2. Considering the trees above, which of these statements is **true**?
   a. Z and Y form a monophyletic group in all trees
   b. X, Y and Z form a monophyletic group in all trees
   c. V and W form a monophyletic group in all trees
   d. U and V form a monophyletic group in all trees
   e. Z and Y are sister taxa in all trees

T/F questions about these trees (True highlighted in Green in Answer Key)

1. In Tree #1, the group of UVW is sister to the group of XYZ.
2. In Tree #3, Z is more closely related to Y than it is to X.
3. In Tree #2, W is more closely related to Y than it is to X.
4. In Tree #1, there are 5 monophyletic groups.
5. In Tree #3, Z is more closely related to U than it is to V.

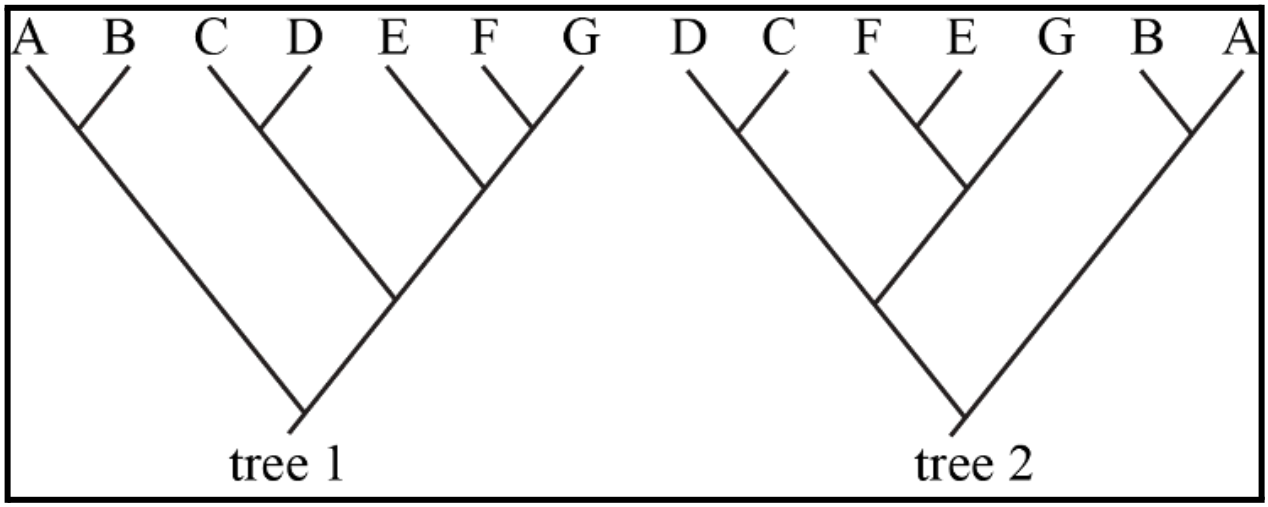
Tree Interpretation 2



T/F Questions About This Tree

1. A group including D, E and F and their most recent common ancestor is a clade
2. A group including G and H and their most recent common ancestor is a clade
3. A group including D, E, F, G, and H and their most recent common ancestor is paraphyletic
4. A group including F, and G and their most recent common ancestor is paraphyletic
5. A group including B and F is polyphyletic
6. D is more closely related to F than it is to G.
7. There are 7 monophyletic groups in this tree
8. A group including F, G and H and their most recent common ancestor is a natural group

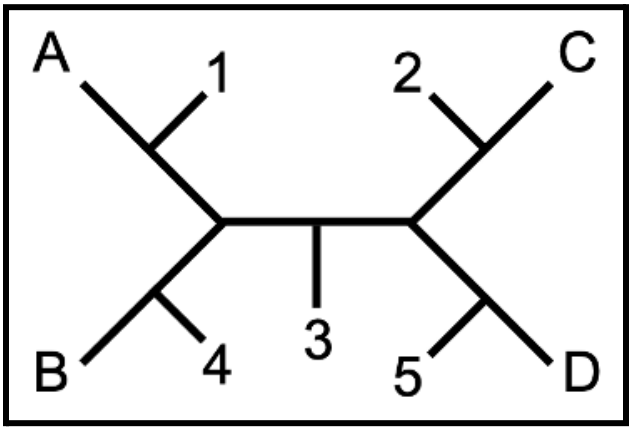
Tree Interpretation 3.



T/F Questions About This Tree

1. Trees 1 and 2 specify identical relationships among species A–G
2. Trees 1 and 2 do not specify identical relationships among species A–G
3. The branch lengths in cladograms are arbitrary, so we cannot infer species relationships in these two trees,

Tree Interpretation 4



On this tree, the taxa are represented by A, B, C, D and 1-5 represent alternate rooting options. More than one answer may be possible for some questions - **mark all choices that apply.**

1. At which point(s) could we root this tree so that taxon C is sister to taxon D?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
   f. not possible on this tree

2. At which point(s) would we root this tree so that taxa B, C, and D form a monophyletic group?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
   f. not possible on this tree

3. If taxon D is the outgroup relative to the other taxa, where would you place the root?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
   f. not possible on this tree

4. At which point(s) would we root this tree so that taxon A is sister to taxon D?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5
   f. not possible on this tree

5. If **taxon C** is the outgroup relative to the other taxa, where would you place the root?

a. 1
b. 2
c. 3
d. 4
e. 5
f. not possible on this tree

6. At which point would you root this tree, so that taxa A, C, and D form a **monophyletic group**?

a. 1
b. 2
c. 3
d. 4
e. 5
f. not possible on this tree

7. At which point would you root this tree, so that taxon B is sister to taxon D?

a. 1
b. 2
c. 3
d. 4
e. 5
f. not possible on this tree

8. At which point would you root this tree, so that taxon A is sister to taxon B AND taxon C is sister to taxon D?

a. 1
b. 2
c. 3
d. 4
e. 5
f. not possible on this tree

9. At which point would you root this tree, so that taxon B is sister to taxon C?

a. 1
b. 2
c. 3
d. 4
e. 5
f. not possible on this tree

Lecture 5-8 Practice Questions

Practice T/F Questions

1. The Last Universal Common Ancestor probably had a nucleus, but not ribosomes.
2. The use of ribosomes for translation is an example of a universal homology.
3. The use of water by cells is an example of a universal trait.
4. Universal homologies are traits shared by all organisms that could not have arisen in separate origins of life and thus are evidence for common ancestry.
5. LUCA most likely used RNA to encode its genetic information.
6. The use of ribosomes and DNA as the genetic material are universal homologies.
7. All organisms can trace their origins to two separate origins of life.
8. Universal homologies support the fact that all life evolved from a single, common ancestor.
9. The use of ribosomes for translation in different organisms is an example of homoplasy.
10. “The Central Dogma” can be represented as “DNA -> RNA -> protein”.
11. Universal traits are traits shared by all organisms that could not have arisen in separate origins of life and thus are evidence for common ancestry.
12. If you discovered a living organism on Mars and showed it had ribosomes this would mean that that life on Mars must share a common ancestry with life on Earth.
13. The closest relatives of Eukaryotes are Asgard Archaea.
14. Bacteria and Archaea lack ribosomes.
15. Asgard Archaea have a nucleus.
16. Prokaryotes are monophyletic in the Two Domain Tree of Life.
17. The unrooted tree of life from Woese’s work showed that Archaea and Eukaryotes are sister taxa.
18. More microbes are present in an environment than can be grown in lab cultures.
19. There are colonial examples of Bacteria, "prokaryotic Archaea" and Eukaryotes.
20. Many Bacteria and "Prokaryotic Archaea" are multicellular.
21. The placement of the root of the tree of life has been determined by analyzing fossils.
22. Some “prokaryotic Archaea” have a nucleus.
23. In the Two Domain Tree of Life, Asgard Archaea are more closely related to other “prokaryotic Archaea” than they are to Eukaryotes.
24. Lokiarchaea could not be studied until they could be cultured in the lab.
25. Asgard Archaea have traits that were previously thought to only be present in Eukaryotes.
26. In the Two Domain Tree of Life, Bacteria are more closely related to “prokaryotic Archaea” than they are to Eukaryotes.
27. The Tree of Life cannot be rooted using a normal outgroup species.
28. The cell wall is made out of peptidoglycan only in Gram negative bacteria.
29. Gram positive bacteria are distinguished from Gram negative bacteria by the presence of peptidoglycan.
30. Gram negative bacteria are called “negative” because they are missing cell membranes.
31. The cell wall is thicker in Gram positive bacteria than in Gram negative bacteria.
32. The cell wall is a target for antibiotics in Gram negative but not Gram positive bacteria.
33. Gram negative bacterial cells are surrounded by two membranes.
34. Peptidoglycan is a synapomorphy of prokaryotes.
35. Gram negative bacteria have two cell walls while Gram positive bacteria have only one.
36. Gram positive bacteria have thin peptidoglycan cell walls.
37. Peptidoglycan is found in both Gram positive bacteria and Gram negative bacteria.
38. Peptidoglycan is not a target for antibiotics because bacteria do not need it.

39. Colonial organisms do not have division of labor.
40. In colonial organisms and multicellular organisms cells are usually all the same genotype.
41. Most archaea are multicellular.
42. Most bacteria are colonial.
43. Most archaea are unicellular.
44. Most bacteria are unicellular.
45. Many bacteria are multicellular.
46. All eukaryotes are colonial or multicellular.

Practice Multiple Choice Qustions

1. In the Two Domain Tree of Life, which group is the sister group to Asgard Archaea
    a. “prokaryotic Archaea”
    b. Bacteria
    c. Eukaryotes
    d. Archaea
    e. None of the above

2. The Three Domain Tree of Life and “Modern” Two Domain Tree of Life differ in:
    a. Whether or not Prokaryotes are monophyletic
    b. Whether or not Eukaryotes are polyphyletic
    c. Whether or not Bacteria are monophyletic
    d. Whether or not prokaryotic Archaea are monophyletic
    e. Whether or not Eukaryotes are monophyletic

3. Which of the following is NOT a universal trait of all of life?
    a. Made up of cells
    b. Carries out transcription and translation
    c. Extracts energy from the environment
    d. Uses a universal molecular code to make proteins
    e. Possesses cell walls

4. Of the following universal traits, which would be the best evidence that life shares a common ancestry?
    a. Made up of cells
    b. Uses DNA as a genetic material
    c. Live on Earth
    d. Store energy in chemicals
    e. Acquires energy from environment

5. Of the following universal traits, which would be the least useful in showing that life shares a common ancestry?
    a. Uses a three letter genetic code
    b. Uses DNA as a genetic material
    c. Uses ribosome for translation
    d. Stores energy in chemicals
    e. Uses the bases ACTG in DNA

6. Suppose you discovered three different living organisms on Mars. What is the maximum number of “Trees of Life” you would need to show their evolutionary history?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 6

7. Which of the following is a trait found in eukaryotes but not “prokaryotes”
    a. Binary fission
    b. RNA genome
    c. Circular genome
    d. Haploid genome
    e. Meiosis

8. Which of the following is a trait found in “prokaryotes” but not eukaryotes
    a. DNA genome
    b. RNA genome
    c. Circular genome
    d. Cell wall
    e. Mitosis

9. The Three Domain Tree of Life shows which of the following patterns:
    a. Archaea are monophyletic
    b. Eukaryotes are not monophyletic
    c. Prokaryotes are monophyletic
    d. A and C
    e. None of the above

10. The Two Domain Tree of Life shows which of the following patterns:
    a. Prokaryotic archaea are monophyletic
    b. Eukaryotes are not monophyletic
    c. Prokaryotes are monophyletic
    d. A and C
    e. None of the above

11. Which of the following is NOT seen in the Two Domain Tree of Life?
    a. Bacteria are monophyletic
    b. Prokaryotic Archaea are more closely related to Eukarya than they are to bacteria
    c. Eukarya are monophyletic
    d. “Prokaryotic Archaea” are monophyletic
    e. Prokaryotic organisms are not monophyletic

12. Which of the following is NOT true of Asgard Archaea
    a. They are more closely related to Animals than they are to Bacteria
    b. They have traits that were previously thought to only be present in Eukaryotes.
    c. They are prokaryotic
    d. They are a sister group to other “Prokaryotic Archaea”
    e. They have circular genomes

13. Which of the following is thought to have evolved after the existence of the common ancestor of eukaryotes and the Asgard Archaea?
    a. DNA genomes
    b. The nucleus
    c. Binary fission
    d. Circular chromosomes
    e. Chromatin

14. Of the following traits, which of the following is the best evidence for the common ancestry of all life on Earth?
    a. Use of cells
    b. Use of DNA as the genetic material
    c. Use of DNA with A, C, G, T bases as the genetic material
    d. Use of peptidoglycan in cells
    e. All of the above are equally strong evidence

15. Which of the following is not seen in the Two Domain Tree of Life?
    a. Bacteria are monophyletic
    b. Eukaryotes are monophyletic
    c. Prokaryotic organisms are not monophyletic
    d. Bacteria are more closely related to “Prokaryotic Archaea” than to Eukarya
    e. All “Prokaryotic Archaea” are more closely related to eukaryotes than they are to Bacteria

16. Which of the following distinguishes the cell wall in Gram positive versus Gram negative bacteria?
    a. The cell wall is missing in Gram negative bacteria
    b. The cell wall is made out of peptidoglycan in Gram positive but not Gram negative bacteria
    c. The cell wall is thicker in Gram positive bacteria than in Gram negative bacteria
    d. Gram positive bacteria have two cell walls while Gram negative bacteria have only one
    e. Some antibiotics work better at targeting the cell wall in Gram positive negative than in Gram negative bacteria

17. Why is “uses water as a solvent” NOT considered a universal homology?
    a. It is not universal
    b. It could potentially have evolved easily in separate origins of life
    c. It is a form of homoplasy
    d. There is water on other planets
    e. Organisms use different types of water

18. Which is NOT an example of a universal homology?
    a. The use of a three-letter genetic code.
    b. The use of A,C, T and G bases in DNA.
    c. The use of ribosomes for translation.
    d. The use of ribosomal RNA in the ribosome.
    e. The use of ether linkages in membranes.

19. Which of the following methods is used for determining the optimal growth temperature of organisms?
    a. Culturing
    b. DNA sequencing
    c. Microscopy
    d. Plate counting
    e. PCR

20. Which of the following distinguishes cells of Gram positive and Gram negative bacteria?
    a. The cell membrane is missing in Gram negative bacteria
    b. The cell wall is made of chitin in Gram positive but not Gram negative bacteria

c. The cell wall is thicker in Gram positive bacteria than in Gram negative bacteria
d. Gram positive bacteria have a thick cell membrane while Gram negative bacteria have a thin cell membrane
e. Most antibiotics are equally effective at targeting cells of both

21. Which of the following groups is most closely related to the Asgard Archaea?
    a. Proteobacteria
    b. Crenarchaeota
    c. Spirochetes
    d. Fungi
    e. Firmicutes

22. Which of the following is a trait found in eukaryotes but not commonly found in “prokaryotes”?
    a. DNA genome
    b. RNA genome
    c. Peptidoglycan
    d. Pathogenicity
    e. Linear genome

23. Which of the following is a trait found in eukaryotes but not found in “prokaryotes”?
    a. DNA genome
    b. Diploid genome
    c. RNA genome
    d. Peptidoglycan
    e. Pathogenicity

24. Which of the following is **FALSE** regarding peptidoglycan?
    a. It is not found in "prokaryotic Archaea"
    b. It likely was present in the Bacterial Common Ancestor
    c. It is missing from Gram negative bacteria
    d. It is present in a thick layer in Gram positive bacteria
    e. It is a target for antibiotics in Gram positive and Gram negative bacteria

25. Which of the following groups is most closely related to the Asgard Archaea?
    a. Actinobacteria
    b. Euryarchaeota
    c. Animals
    d. Chlamydia
    e. Korarchaeota

Practice Questions Lectures 9-12

Practice T/F Questions

1. The bacteria in tubeworms could not be studied until they could be grown in the lab.
2. Chemolithoautotrophs get their electrons from inorganic sources.
3. Chemolithoheterotrophs get their electrons from organic sources.
4. All parasitisms are symbioses.
5. All symbioses are mutualisms.
6. Most microbes in the human microbiome are parasitic.
7. Most microbes in the human microbiome are mutualistic.
8. Commensalism is a class of interaction in which both organisms will benefit from the relationship.
9. There are no known prokaryotic Archaea that cause disease.
10. One hypothesis for the origin of viruses is that they are escaped portions of cells.
11. Thermophily has only evolved once in the history of life.
12. Thermophiles are monophyletic.
13. Extreme halophiles are monophyletic.
14. All parasites are pathogens.
15. Bacteria can evolve resistance to phage but not antibiotics.
16. Lateral gene transfer can help bacteria become resistant to antibiotics.
17. The genomes of viruses are always made up of RNA.
18. Viruses do not evolve.
19. Viruses do not have their own genomes.
20. Lateral gene transfer is unidirectional.
21. Lateral gene transfer is only seen in bacteria.
22. Lateral gene transfer only occurs over small evolutionary distances.
23. Some viruses may have originated as highly reduced parasites.
24. One reason some people think viruses are alive is that they have metabolism.
25. Most viruses today can be described as ancient.
26. Some viruses may have evolved from cellular organisms.
27. One reason some scientists think viruses are alive is that they mutate and evolve.
28. The interaction between tubeworms and chemosynthetic bacteria can be described as commensalism.
29. The human microbiome is thought to include many commensalisms.

Practice Multiple Choice Questions
Lecture 9-12

1. An organism obtains energy from inorganic compounds like H2S and carbon from carbon dioxide (CO2). This organism would be best described as a:
    a. Chemoheterotroph
    b. Chemoautotroph
    c. Photoheterotroph
    d. Photoautotroph
    e. Chemolithotroph

2. Which of the following is TRUE regarding extremophiles?
    a. They are only seen in Archaea
    b. They cannot be grown in the laboratory
    c. They never undergo convergent evolution
    d. Thermophily has evolved more times than halophily
    e. No bacteria are thermophiles

3. Current COVID19 infections can be detected using which of the following:
    a. Test for the presence of antibodies in blood
    b. Test for the presence of DNA from the virus
    c. Test for the presence of RNA from the virus
    d. A and C
    e. B and C

4. Which of the following is thought to have evolved after the existence of the common ancestor of eukaryotes and the Asgard Archaea?
    a. DNA genomes
    b. The nucleus
    c. Binary fission
    d. Circular chromosomes
    e. Chromatin

5. What is the difference between photolithoautotrophy and chemolithoheterotrophy?
    a. The source of electrons
    b. The source of energy
    c. The source of carbon
    d. A and C
    e. B and C

6. What is the difference between photolithoheterotrophy and chemolithoheterotrophy?
    a. The source of electrons
    b. The source of energy
    c. The source of carbon
    d. A and B
    e. B and C

7. What is the difference between chemolithoautotrophy and photolithoautotrophy?
    a. The source of electrons
    b. The source of energy
    c. The source of carbon
    d. A and C
    e. B and C

8. What is the difference between photolithoheterotrophy and chemoorganoheterotrophy?
    a. The source of electrons
    b. The source of energy
    c. The source of carbon
    d. A and B
    e. B and C

9. An antibiotic that targets those organisms that are surrounded by a single membrane and a thick peptidoglycan cell wall would be useful in targeting which of the following diseases
    a. Malaria
    b. Chlamydia
    c. Lyme disease
    d. The plague
    e. Anthrax

10. Which of the following diseases is caused by a eukaryotic pathogen?
    a. Anthrax
    b. The plague
    c. Malaria
    d. The flu
    e. Tuberculosis

11. Which of the following is most closely related to the cause of tuberculosis?
    a. The cause of anthrax
    b. The cause of flu
    c. The cause of lck
    d. The cause of HIV
    e. The cause of sudden oak death

12. Which of the models of virus origins is most similar to the model “Viruses are escaped portions of cells?”
    a. Viruses are the outgroup to cellular life
    b. Viruses have a separate origin from cellular life
    c. Viruses are reduced versions of parasitic cells
    d. Viruses are cellular symbionts
    e. Viruses are replicative elements

13. Which of the following viruses or kinds of viruses have DNA genomes?
    a. Coronaviruses
    b. Influenza virus
    c. HIV virus
    d. Phage
    e. Polio virus

14. The symbionts of giant tubeworms allow the worms to function as which of the following:
    a. Chemolithoheterotrophs
    b. Chemolithoautotrophs
    c. Chemoorganoheterotrophs
    d. Photolithoautotrophs
    e. Photoorganoheterotrophs

15. Fecal transplants are used to treat an infection caused by
    a. A Gram positive bacterium
    b. A Gram negative bacterium
    c. An RNA virus
    d. A DNA virus
    e. A eukaryote

16. Which of the following is a eukaryotic group for which members look like fungi but for which this similarity is not due to homology?
    a. Actinomycetes
    b. Opisthokonts
    c. Ooymetes
    d. Diplomonads
    e. Firmicutes

    Oomycetes form a distinct phylogenetic lineage of fungus-like eukaryotic microorganisms within the Stramenopiles.
    They are filamentous and heterotrophic, similar to fungi, but this similarity is not due to homology as they are not actually fungi

17. Which of the following is most closely related to the cause of anthrax?
    a. Cyanobacteria
    b. Lokiarchaea
    c. Fungi
    d. Flu virus
    e. Ooymcete

    Anthrax is a bacterium called Bacillus anthracis. Among the given choices, Cyanobacteria is the only one that is also a type of bacteria

    Lokiarchaea is a type of archaea, Fungi is a kingdom of eukaryotes, Flu virus is a virus, and Oomycete is a type of eukaryotic microorganism

18. If you find a new pathogen, what type of organism is it NOT likely to be?
    a. Virus
    b. Eukaryote
    c. Bacteria
    d. Prokaryotic Archaea
    e. Parasite

    Prokaryotic Archaea because while they are prokaryotes like bacteria, they are not typically associated with diseases in humans. Most known pathogens fall into the categories of viruses, bacteria, eukaryotes (such as fungi and protists), and parasites

19. Which of the following is true about multicellularity?
    a. It is seen in many bacteria
    b. It is seen only in plants and animals
    c. It is seen in most Archaea
    d. It involves cells of different genotypes living together
    e. It involves cells of different functions living together

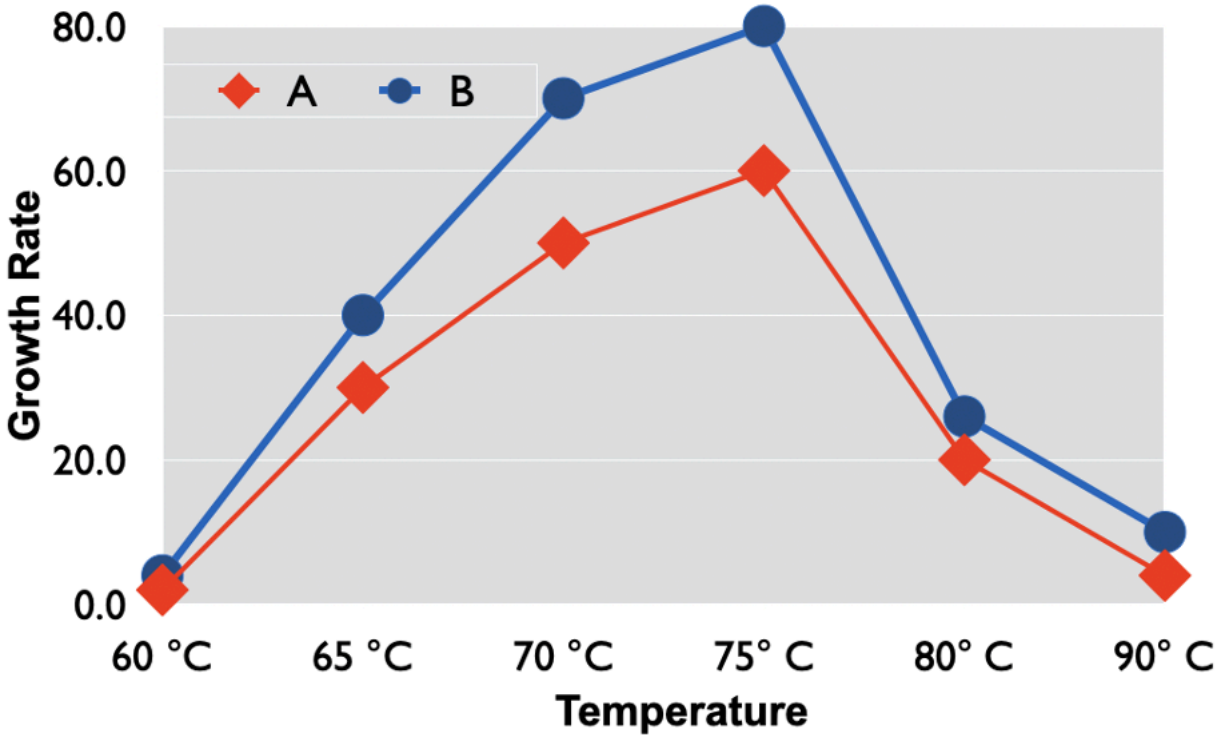
20. Which of the following is thought to represent the evolutionary process that led to the origin of retroviruses?
    a. They have a separate origin from cellular life
    b. They are an escaped cellular component
    c. They are an outgroup to cellular organisms
    d. They arose via an anciently duplicated gene
    e. They are a reduced cellular parasite

21. Which of the following is not one of the mechanisms discussed as a possible way that bacteria can limit the effectiveness of antibiotics?
    a. Biofilm formation
    b. Formation of endospores
    c. Mutations
    d. Growing faster
    e. Lateral gene transfer

22. Which of the following diseases is NOT caused by a bacterial pathogen?
    a. Anthrax
    b. The plague
    c. Giardia
    d. Chlamydia
    e. Tuberculosis

23. Which of the following diseases is caused by a bacterial pathogen?
    a. Flu
    b. Tuberculosis
    c. Malaria
    d. Giardia
    e. Measles

24. Given the chart below, which organism has the higher optimal growth temperature?



a. A
b. B
c. Cannot determine
d. A and B have the same optimal growth temperature
e. A but only if it is an Archaea