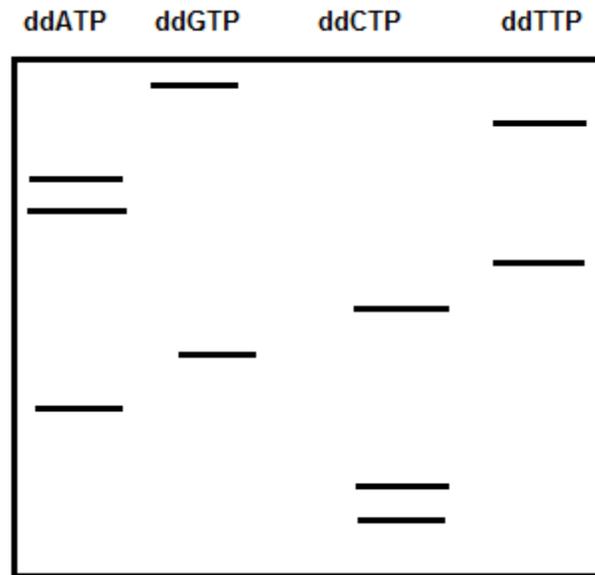


1. When using gel electrophoresis, where are the larger fragments of DNA most likely to be located?
  - a. Inside the well
  - b. Closer to the cathode
  - c. Closer to the anode
  - d. In between the cathode and anode
2. When sequencing DNA, what ratio of ddNTP:dNTP is required?
  - a. 3:1
  - b. 1:1
  - c. 1:3
  - d. 9:3:3:1
3. In a cycle of PCR, a student observes that the temperature required in order for a primer to attach to the sequence of interest is about 60°C. Based on this information, what should the student conclude about the primer?
  - a. The primer is an RNA primer
  - b. The primer is a DNA primer
  - c. The primer is relatively long
  - d. The primer is relatively short
4. If a scientist discovers a homologous gene between a chimpanzee and a human, how should the scientist describe the gene that they found?
  - a. Homolog
  - b. Ortholog
  - c. Paralog
  - d. All of the above
5. What are the units used for a physical map?
  - a. bp
  - b. ft
  - c. cM
  - d. cm
6. A recombination map is usually much more accurate than a physical map?
  - a. True
  - b. False
7. How many molecules of DNA will be present after 5 cycles of PCR?
  - a. 16
  - b. 10
  - c. 32
  - d. 64
8. What enzyme is not present in humans?
  - a. DNA Polymerase
  - b. RNA Polymerase
  - c. Gyrase
  - d. Reverse Transcriptase
9. At what temperature does elongation of the DNA chain take place in PCR?

- a. 50 °C
  - b. 72 °C
  - c. 65 °C
  - d. 95 °C
10. Where can cDNA be found?
- a. In a prokaryotic cell
  - b. In a eukaryotic cell
  - c. Both A and B
  - d. In a laboratory
11. You would like to clone a tiger. Tiger A donates a nucleus from a skin cell, Tiger B donates an enucleated egg cell, and Tiger C carries the tiger embryo in her uterus. When the baby tiger is born, she will be a clone of whom?
- a. Tiger A
  - b. Tiger B
  - c. Tiger C
  - d. None of the above
12. Molecular probes are only made of DNA.
- a. True
  - b. False
13. Since your beloved pet is getting older (and you fear the end is near), you decide that you would like to clone him/her. You also decide that you want to clone your pet in the same way that Dolly the sheep was cloned. Which cell of your pet's body should you extract a nucleus from?
- a. Germ cell
  - b. Egg cell
  - c. Heart cell
  - d. None of the above
14. When choosing a restriction enzyme, what type(s) of cut would be most useful?
- a. Blunt ends
  - b. Sticky ends
  - c. Palindrome ends
  - d. Both A and B
15. What type of polymerase is used during PCR?
- a. DNA polymerase
  - b. RNA polymerase
  - c. *Taq* polymerase
  - d. *Gaq* polymerase
16. What type of primer is typically used during PCR?
- a. DNA primer
  - b. RNA primer
  - c. Forward and Reverse primer
  - d. Both A and C
  - e. All of the above

17. 2D-PAGE typically separates what?
- DNA by their size only
  - Proteins by their pH only
  - Proteins by their size and pH
  - DNA fragments by their size and pH
18. Transcriptomics is best described as the study of
- All the genetic material in an organism
  - All the RNA found in an organism
  - All of the proteins found in an organism
  - All of the above
19. A person has two genes at a specific locus. One of the genes is mutated and the gene no longer creates a functional protein. What is this an example of?
- Robertsonian translocation
  - Pseudodominance
  - Haploinsufficient gene
  - Allopolyploidy
20. Determine the order of nucleotides in a sequence of DNA represented by the results of the gel electrophoresis below.



- 5'GTAATCGACC3'
  - 5'CATTAGCTGG3'
  - 5'CCAGCTAATG3'
  - 5'GGTCGATTAC3'
21. What laboratory technique is most likely illustrated in #32?
- Shotgun sequencing
  - Affinity capture
  - Sanger Sequencing

- d. 2D-PAGE
22. Whole-genome shotgun sequencing breaks the genome into short sequences reads that are approximately how many bps long?
- 600-700 bp
  - 200-300 bp
  - 6,000-7,000 bp
  - Unable to determine average fragment length
23. A person has Niemann-Pick disease, a condition in which results in an additional chromosome 18. What is this an example of?
- Monosomy
  - Trisomy
  - Polyploidy
  - Nullisomy
24. Which of the following lab techniques is used to isolate a specific protein using antibodies.
- Affinity capture
  - DNA microarray
  - Mass Spec
  - Protein microarray
25. Which of the following is a requirement for a vector?
- A cloning site
  - A drug resistance gene
  - Replication origin
  - All of the above
26. What types of chromosome mutations are required to change this chromosome (A.B.C.D.E•F.G) into each of the following chromosomes?

- A.B.E•F.G
- A.E.D.C.B•F.G
- A.B.A.B.C.D.E•F.G
- A.F•E.D.C.B.G
- A.B.C.D.E.E.D.C•F.G

27. A piece of DNA that is 14 kbp long is cut first by *EcoRI* alone, then by *SmaI* alone, and finally, by both *EcoRI* and *SmaI* together. The following results were obtained.

Digestion by <i>EcoRI</i> alone	Digestion by <i>SmaI</i> alone	Digestion by both
3-kbp fragment	5-kbp fragment	2-kbp fragment
4-kbp fragment	9-kbp fragment	3-kbp fragment
7-kbp fragment		4-kbp fragment
		5-kbp fragment

Draw a map of the *EcoRI* and *SmaI* restriction sites on this 14kbp piece of DNA, indicating the relative positions of the restriction sites and the distances between them.

28. Draw an illustration of Robertsonian translocation. Is this a reciprocal or nonreciprocal translocation? Describe the chromosomal morphology of the chromosome before the translocation and after the translocation.
29. Draw the structure of a ddNTP and explain why this allows for early termination of the fragment being sequenced.
30. Species I is diploid ( $2n=4$ ) with chromosomes AABB; related species II is diploid ( $2n=6$ ) with chromosomes RRSSTT. Give the chromosomes that would be found in individuals with the following chromosomal mutations.
- I. Autotriploidy in Species I
  - II. Allotetraploidy including species I and II
  - III. Monosomy in Species I
  - IV. Trisomy in Species II for chromosome R
  - V. Tetrasomy in Species I for chromosome A
  - VI. Allotriploidy including species I and II
  - VII. Nullisomy in species II for chromosome S