

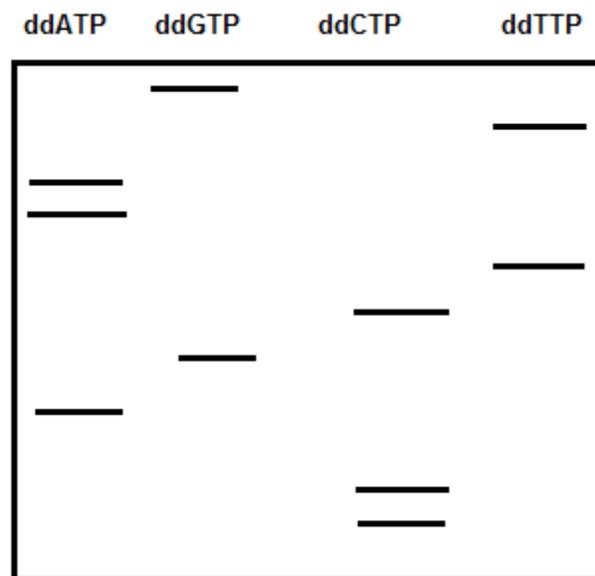
1. When using gel electrophoresis, where are the larger fragments of DNA most likely to be located?
 - a. Inside the well
 - b. Closer to the cathode
 - c. Closer to the anode
 - d. In between the cathode and anode
2. When sequencing DNA, what ratio of ddNTP:dNTP is required?
 - a. 3:1
 - b. 1:1
 - c. 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

Because it's a higher temperature range, it takes less energy for a small DNA to move than a large.
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 (gene that has been conserved)
 - b. Ortholog (conserved among different species)
 - c. Paralog (conserved among the same species – duplication of a gene)
 - d. All of the above
5. What are the units used for a physical map?
 - a. bp
 - b. ft
 - c. cM (recombination map)
 - 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

2^n and $n = \#$ molecules

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? (BAD EXAMPLE: temps will be more extreme on the actual test)
 - a. 50 °C –end point for primers
 - b. 72 °C –usually temp for Taq polymerase
 - c. 65 °C –end point for primers
 - d. 95 °C –denature DNA
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 1n
 - b. Egg cell 1n
 - c. Heart cell 2n
 - 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 **–never use RNA primer**
 - c. Forward and Reverse primer
 - d. **Both A and C**
 - e. All of the above
17. 2D-PAGE typically separates what?
- a. DNA by their size only
 - b. Proteins by their pH only
 - c. **Proteins by their size and pH**
 - d. DNA fragments by their size and pH
18. Transcriptomics is best described as the study of
- a. All the genetic material in an organism
 - b. **All the RNA found in an organism**
 - c. All of the proteins found in an organism
 - d. 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?
- a. Robertsonian translocation
 - b. Pseudodominance
 - c. **Haploinsufficient gene**
 - d. Allopolyploidy
20. Determine the order of nucleotides in a sequence of DNA represented by the results of the gel electrophoresis below (the actual sequence not the complementary sequence).



- a. 5'GTAATCGACC3'

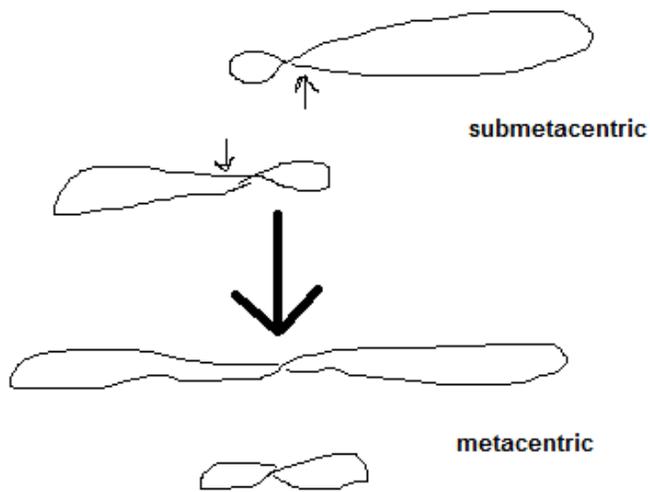
- b. 5'CATTAGCTGG3'
c. 5'CCAGCTAATG3'
d. 5'GGTCGATTAC3'
21. What laboratory technique is most likely illustrated in #20?
a. Shotgun sequencing
b. Affinity capture
c. Sanger Sequencing
d. 2D-PAGE
22. Whole-genome shotgun sequencing breaks the genome into short sequences reads that are approximately how many bps long?
a. 600-700 bp
b. 200-300 bp
c. 6,000-7,000 bp
d. 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?
a. Monosomy
b. Trisomy a type of Aneuploidy
c. Polyploidy
d. Nullisomy
24. Which of the following lab techniques is used to isolate a specific protein using antibodies.
a. Affinity capture
b. DNA microarray
c. Mass Spec
d. Protein microarray
25. Which of the following are a requirement for a vector?
a. A cloning site
b. A drug resistance gene
c. Replication origin
d. 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?
I. A.B.E•F.G Deletion
II. A.E.D.C.B•F.G Paracentric Inversion
III. A.B.A.B.C.D.E•F.G Tandem duplication
IV. A.F•E.D.C.B.G Pericentric Inversion
V. A.B.C.D.E.E.D.C•F.G Duplication & Paracentric inversion
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

Reciprocal translocation.



29. Draw the structure of a ddNTP and explain why this allows for early termination of the fragment being sequenced.

Lack of -OH on 3' C which prevents further binding of nucleotides to the 3' end of the chain.

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
 1. $3n=6$; AAABBB
 2. $2n$ Species I + $2n$ Species II (AABBRRSSTT); $3n$ species I + $1n$ Species II (AAABBBRST); or $1n$ species I + $3n$ species II (ABRRRSSTTT)
 3. $2n-1= (4-1)=3$; ABB or AAB

4. $2n+1 = (6+1)=7$; RRRSSTT
5. $2n+2 = (4+2)= 6$; AAAABB
6. AABBRST or ABRRSSTT
7. RRTT