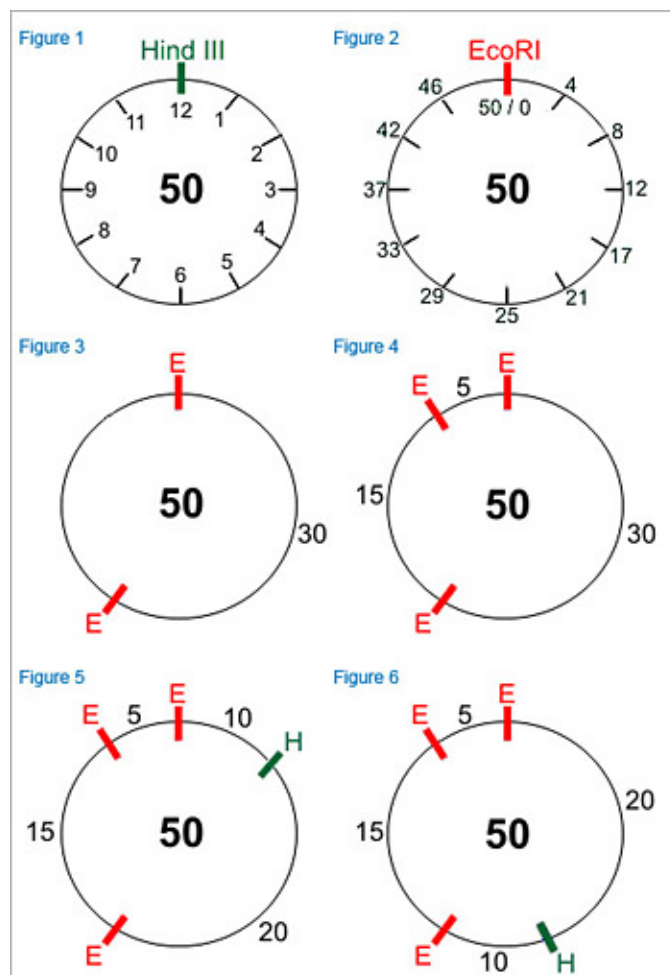
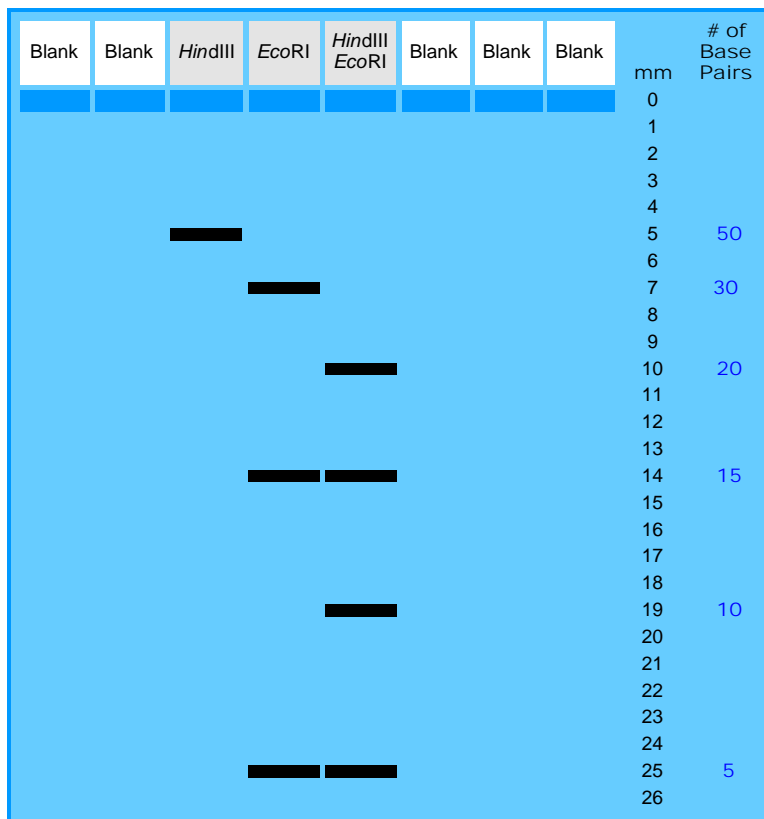


Sample Map Problem

Experimental data				
Number of base pairs per band				
<i>EcoRI</i>	30	15	5	
<i>HindIII</i>	50			
<i>HindIII / EcoRI</i>	20	15	10	5

Here's our approach to solving this plasmid map sample problem

- Determine the number of base pairs (bp) in the whole plasmid. Note that only one band results when the plasmid is cut by *HindIII*. This is a very good clue that *HindIII* has only one recognition site, and that when cut, the plasmid ring opens into a linear piece of DNA that is 50 bp long. This is confirmed by looking at the other combinations of restriction enzymes cutting the plasmid into pieces that, each time, add up to 50 bp.
 - Start drawing circles! (Note: Clock face references in the following instructions indicate cut sites or where lines are to be drawn.) The first circle should indicate one cut site for *HindIII* at 12:00. Label your circle with "*HindIII*" (or "H" for short) above a tick mark at 12:00 to indicate a single cut (a single digest) by this restriction enzyme. See figure 1. This accounts for your experimental data from the single digest with *HindIII*.
 - Place the number 50 in the center of the circle to indicate the total number of bp.
- Determine a scale for your circle. If the total number of bp going around the circle is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp. See figure 2.
 - Draw another circle to indicate where the *EcoRI* restriction sites are located. The data indicates 3 different-sized bands result when the plasmid is cut with just *EcoRI* (a single digest).
 - Start by placing a tick mark at 12:00, as in figure 2, to indicate the first *EcoRI* cut site.
 - Make another tick mark at about 7:00 to indicate a second *EcoRI* cut site 30 bp from the first site. See figure 3. This arrangement accounts for the 30 bp band in your experimental data. This leaves 20 bp between 7:00 and 12:00. The other 2 data results, 15 and 5, add up to 20 bp.
 - Go to approximately 11:00 or 7:00 (either option accounts for the experimental data and is therefore acceptable because plasmid maps show relative locations) and make a third tick mark. See figure 4. For example, if you go to approximately 11:00 (a distance of 5 bp), the remaining distance to 7:00 represents 15 bp (for a total of 20 bp), which accounts for your experimental data.
- Fit the 2 circles together to account for the experimental data from your double digest (*HindIII/EcoRI*). We recommend the use of 3-D plasmid models (loops) to help students visualize this process. You can make these loops out of inexpensive materials such as string, rubber tubing, paper strips, or Velcro strips.
 - Mark one loop to indicate the *HindIII* digest.
 - Mark another loop to indicate the *EcoRI* digests.
- Place the *HindIII* loop on top of the *EcoRI* loop and align the *HindIII* tick mark at about 2:30 on the *EcoRI* loop, which indicates a site 10 bp from the *EcoRI* site at 12:00 and 20 bp from the *EcoRI* site at 7:00. See figure 5.



- a. Bear in mind, it cannot be determined from the data if the *Hind*III tick mark should be located 10 bp from the 12:00 site or 10 bp from the 7:00 site. Both locations would account for the experimental data. See figure 6.
- b. Remember that these plasmid maps give relative positions. For more accuracy, you must perform additional digests.

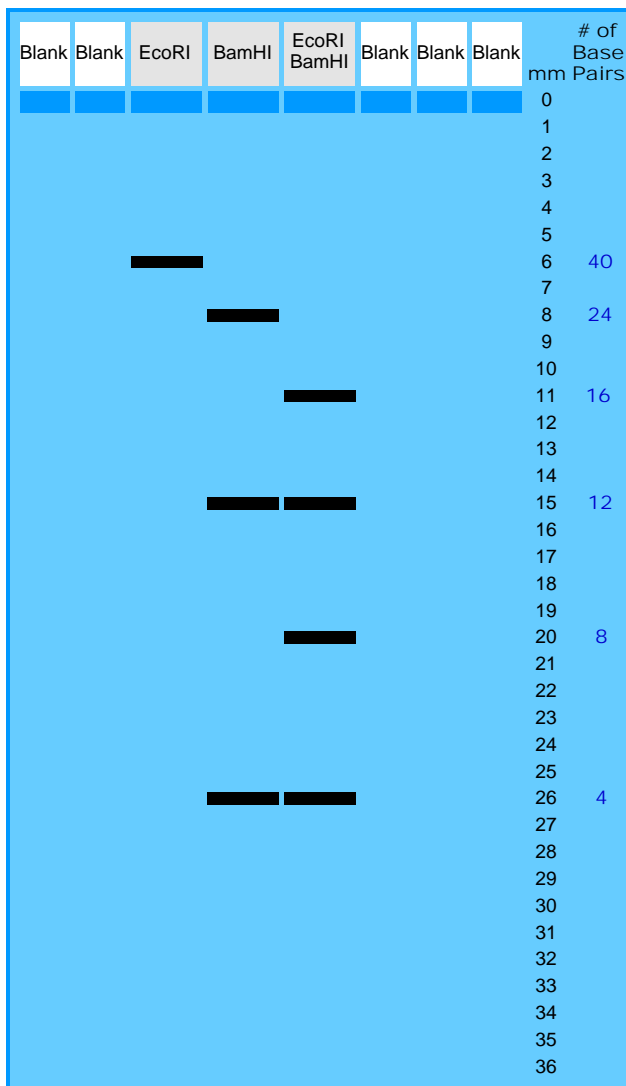


Plasmid mapping: Exercise # 1

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
Number of base pairs per band				
BamHI	24.0	12.0	4.0	
EcoRI	40.0			
EcoRI / BamHI	16.0	12.0	8.0	4.0





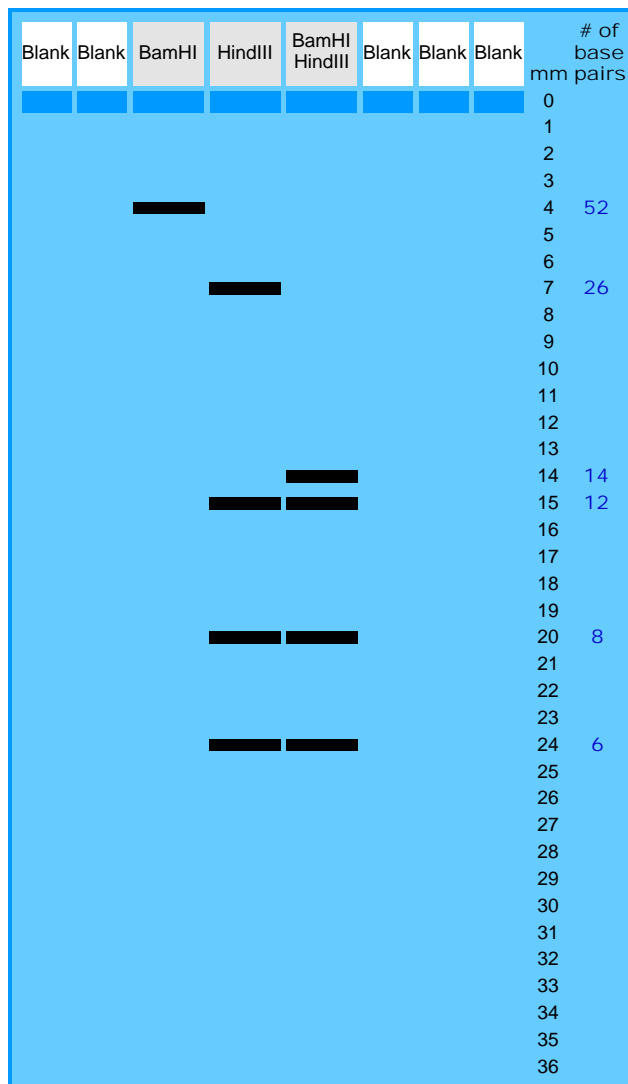
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Plasmid mapping: Exercise # 2

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
Number of base pairs per band				
BamHI	52.0			
HindIII	26.0	12.0	8.0	6.0
BamHI / HindIII	14.0	12.0	8.0	6.0





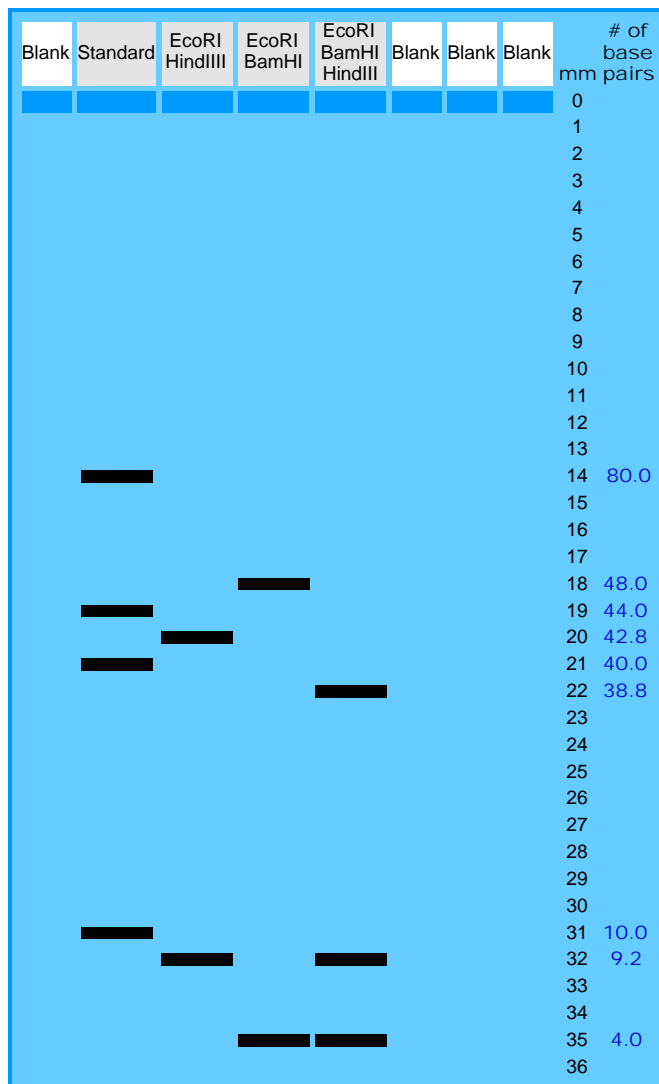
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Plasmid mapping: Exercise # 3

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
# of base pairs per band				
EcoRI / HindIII	42.8	9.2		
EcoRI / BamHI	48.0	4.0		
EcoRI / BamHI / HindIII	38.8	9.2	4.0	
Size Standard	80.0	44.0	40.0	10.0





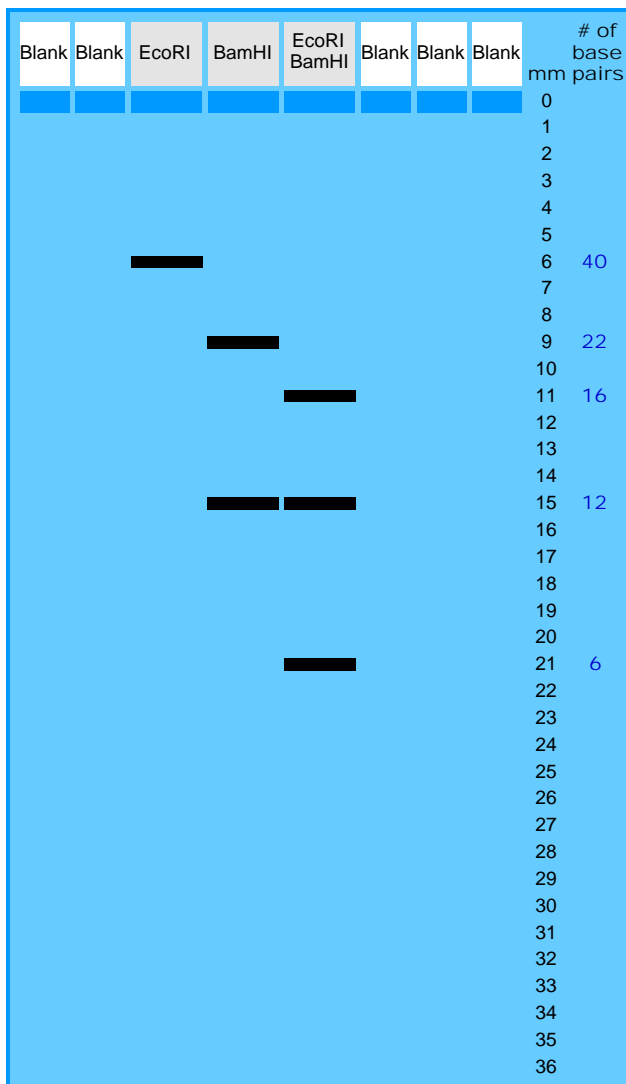
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Plasmid mapping: Exercise # 4

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
Number of base pairs per band				
EcoRI	40.0			
BamHI	22.0	12.0		
EcoRI / BamHI	16.0	12.0	6.0	



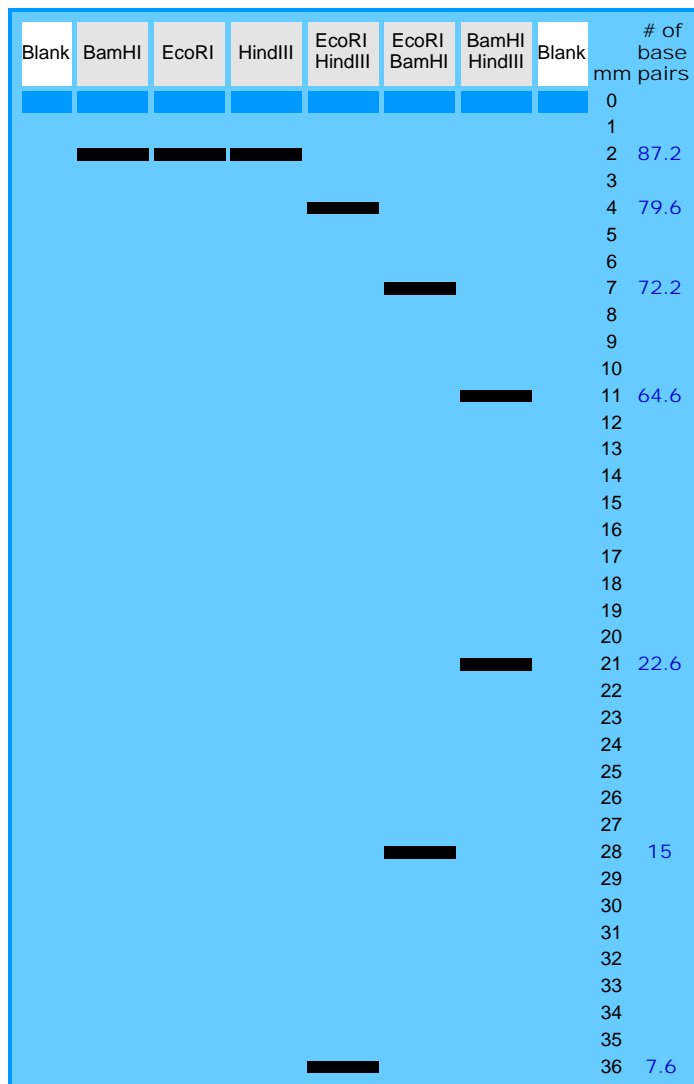


Plasmid mapping: Exercise # 5

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
Number of base pairs per band				
BamHI	87.2			
EcoRI	87.2			
HindIII	87.2			
EcoRI / HindIII	79.6	7.6		
EcoRI / BamHI	72.2	15.0		
BamHI / HindIII	64.6	22.6		





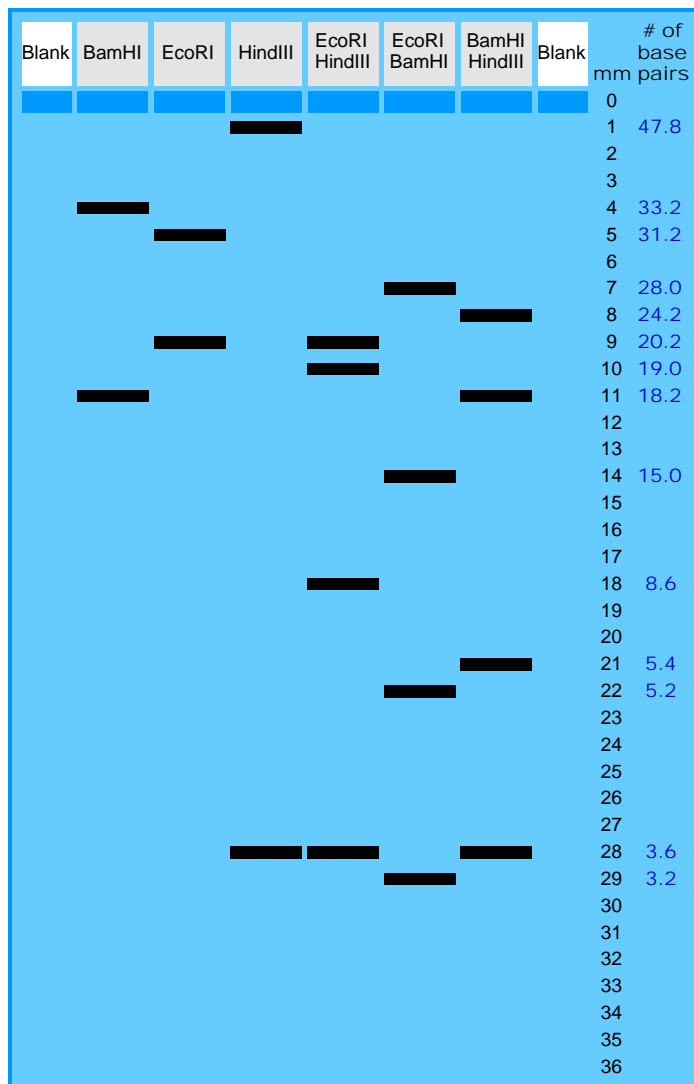
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Plasmid mapping: Exercise # 6

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data				
Number of base pairs per band				
BamHI	33.2	18.2		
EcoRI	31.2	20.2		
HindIII	47.8	3.6		
EcoRI / HindIII	20.2	19.0	8.6	3.6
EcoRI / BamHI	28.0	15.0	5.2	3.2
BamHI / HindIII	24.2	18.2	5.4	3.6





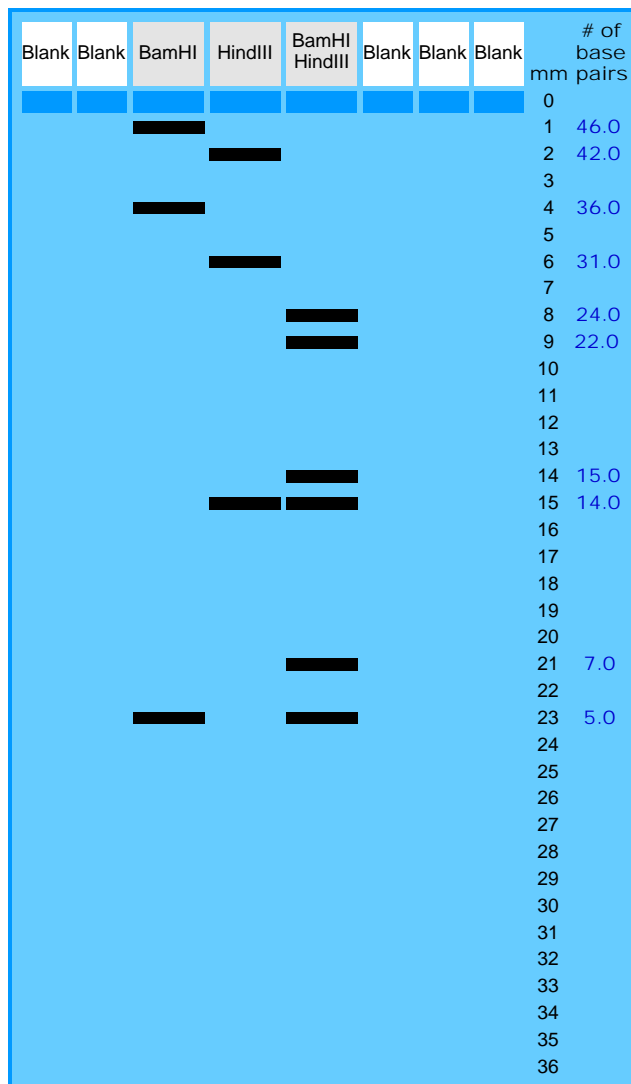
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Plasmid mapping: Exercise # 7

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data						
Number of base pairs per band						
HindIII	42.0	31.0	14.0			
BamHI	46.0	36.0	5.0			
BamHI / HindIII	24.0	22.0	15.0	14.0	7.0	5.0





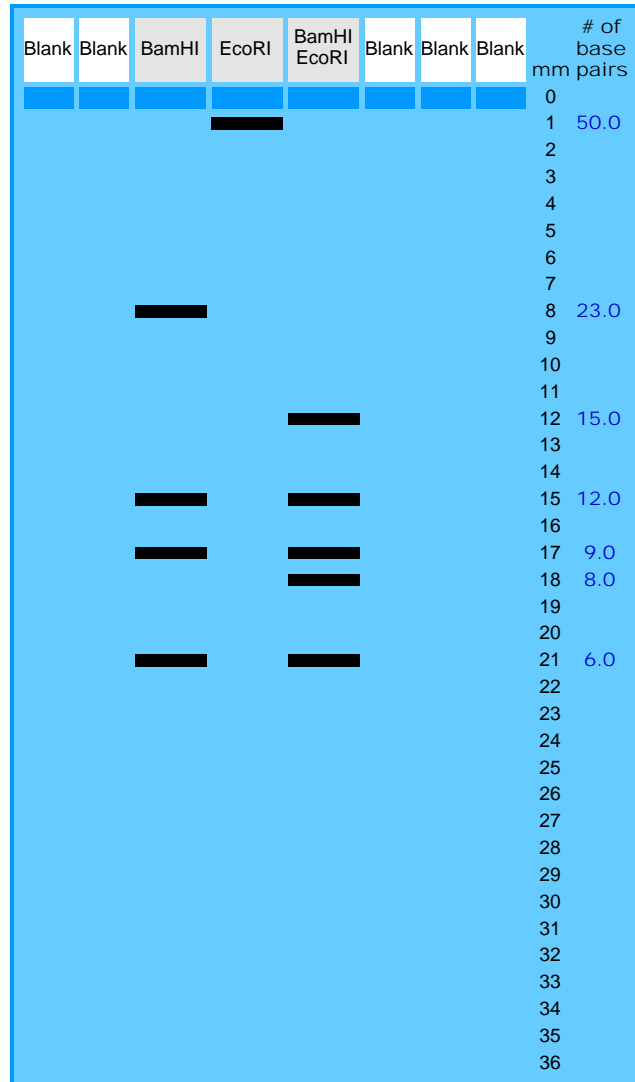
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Plasmid mapping: Exercise # 8

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data						
Number of base pairs per band						
BamHI	23.0	12.0	9.0	6.0		
EcoRI	50.0					
BamHI / EcoRI	15.0	12.0	9.0	8.0	6.0	





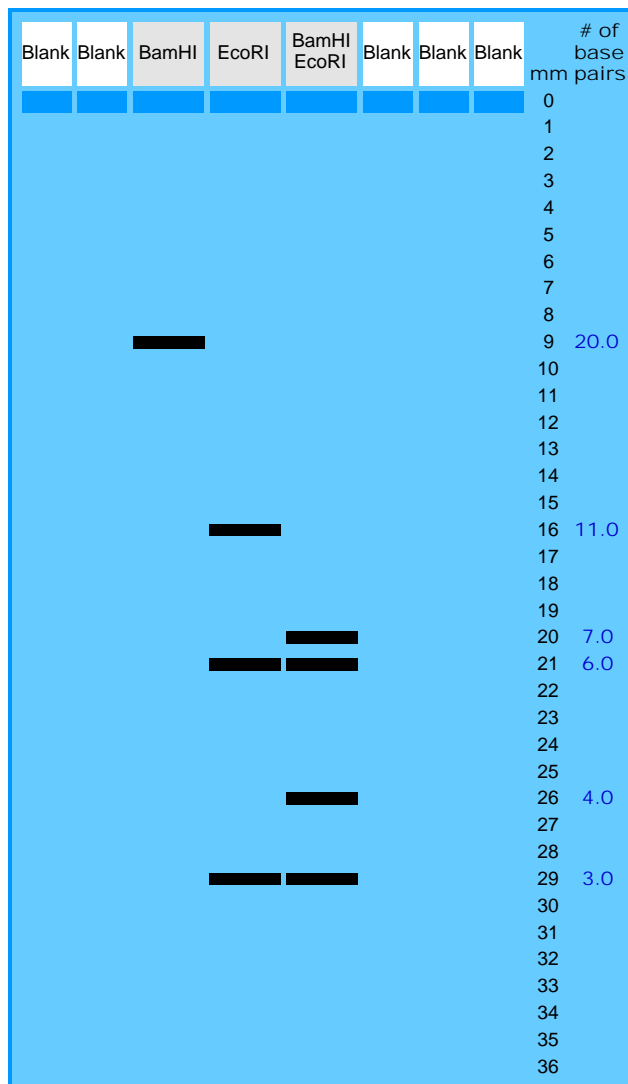
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Plasmid mapping: Exercise # 9

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data					
Number of base pairs per band					
BamHI	20.0				
EcoRI	11.0	6.0	3.0		
BamHI / EcoRI	7.0	6.0	4.0	3.0	





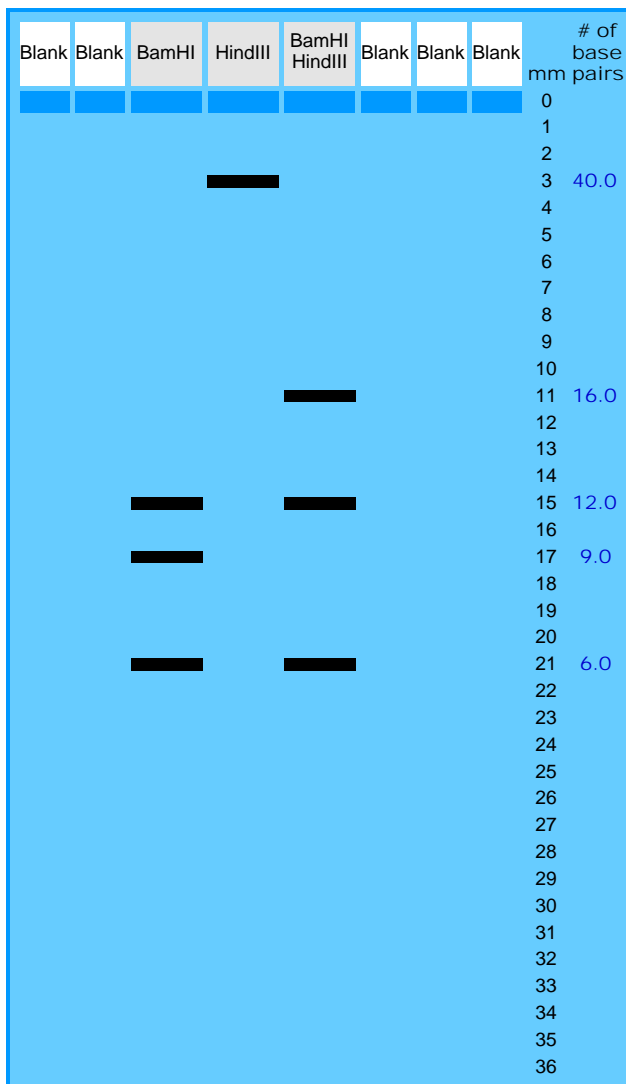
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Plasmid mapping: Exercise # 10

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data						
# of base pairs per band						
BamHI	12.0	9.0	6.0			
HindIII	40.0					
BamHI / HindIII	16.0	12.0	6.0			





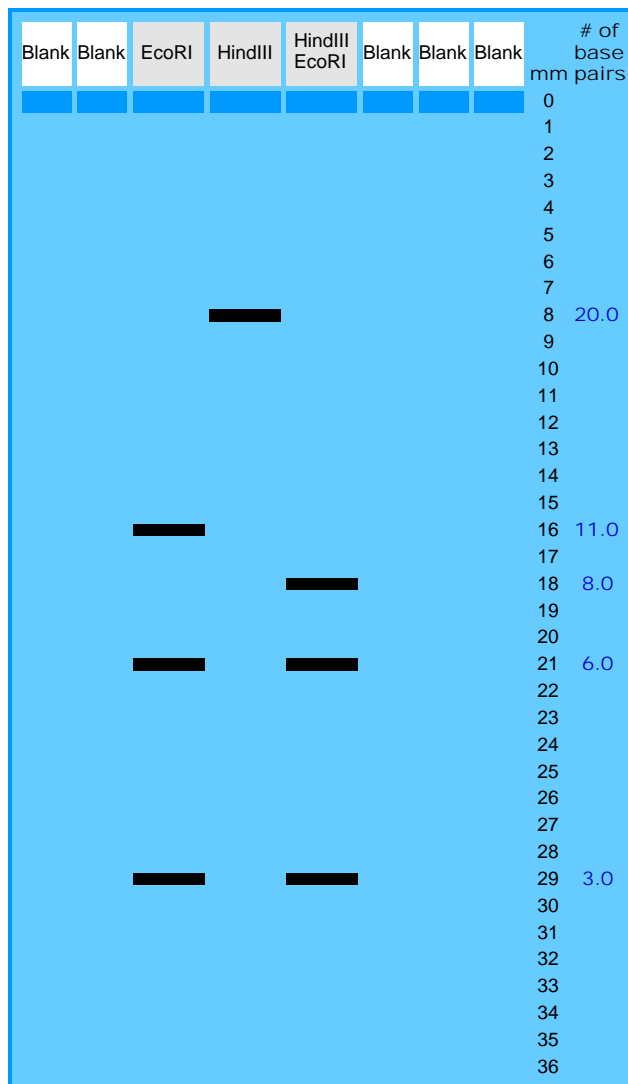
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Plasmid mapping: Exercise # 11

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data					
Number of base pairs per band					
EcoRI	11.0	6.0	3.0		
HindIII	20.0				
HindIII/ EcoRI	8.0	6.0	3.0		





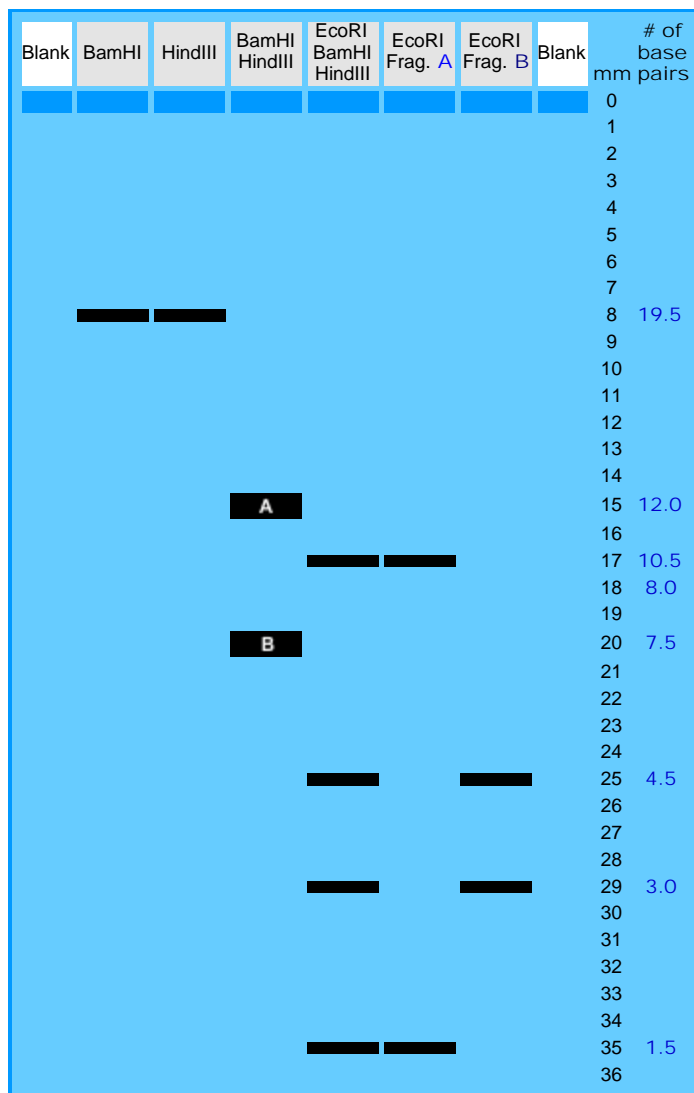
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Plasmid mapping: Exercise # 12

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data					
Number of base pairs per band					
BamHI	19.5				
HindIII	19.5				
BamHI / HindIII	12.0	7.5			
EcoRI / BamHI / HindIII	10.5	4.5	3.0	1.5	
EcoRI (Fragment A)	10.5	1.5			
EcoRI (Fragment B)	4.5	3.0			





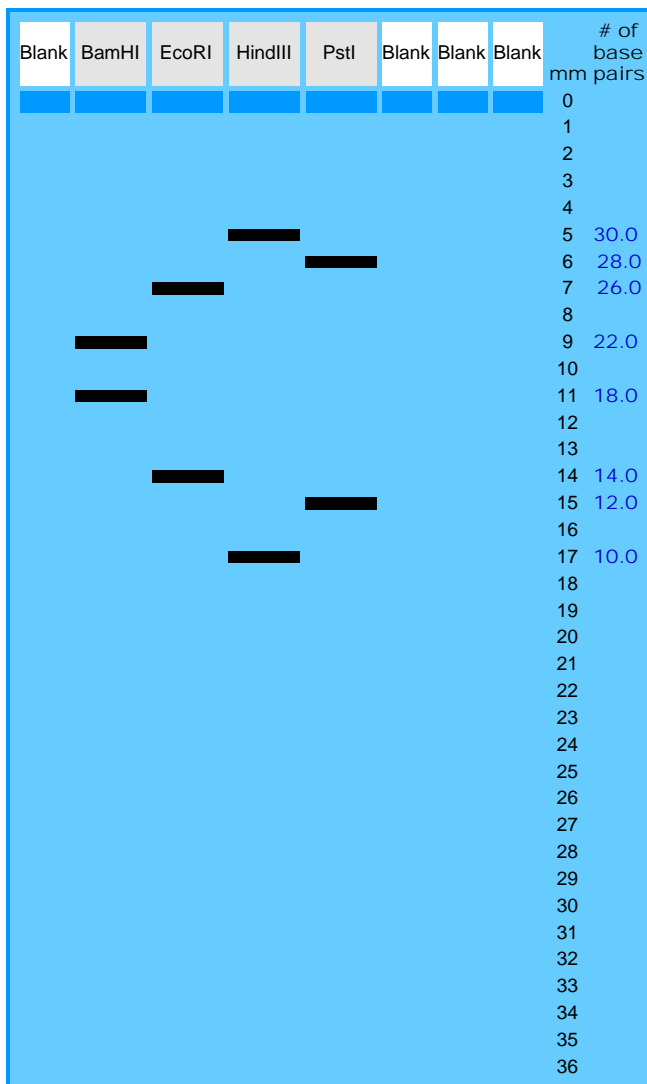
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Plasmid mapping: Exercise # 13-A

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data					
Number of base pairs per band					
BamHI	22.0	18.0			
EcoRI	26.0	14.0			
HindIII	30.0	10.0			
PstI	28.0	12.0			





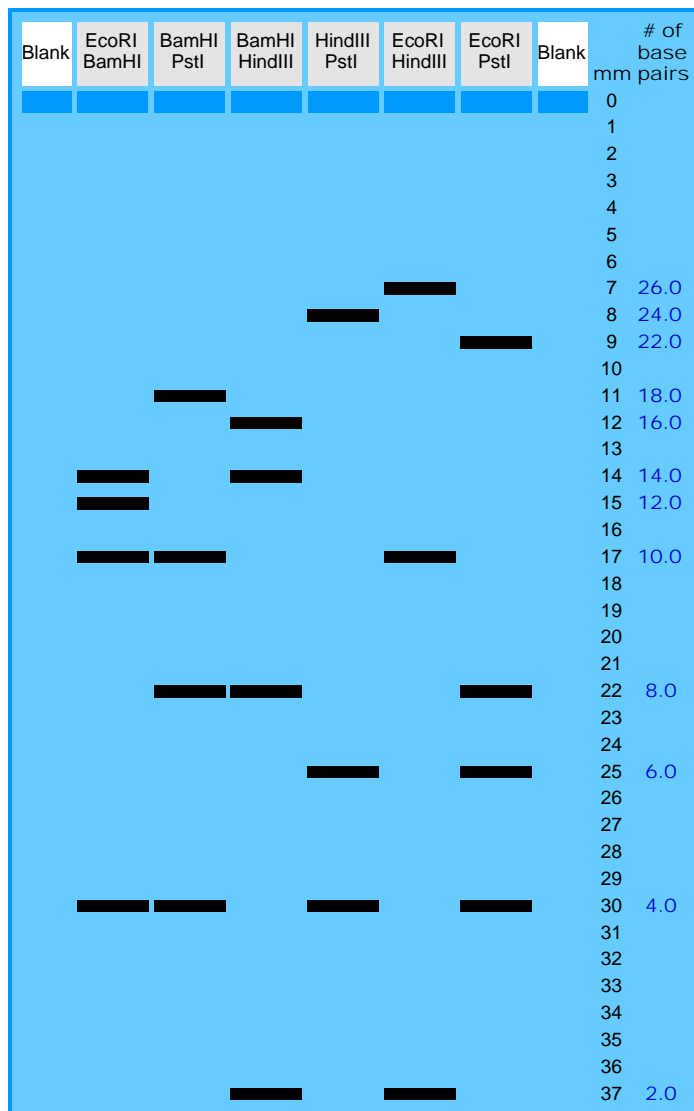
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Plasmid mapping: Exercise # 13-B

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data					
Number of base pairs per band					
EcoRI / BamHI	14.0	12.0	10.0	4.0	
BamHI / PstI	18.0	10.0	8.0	4.0	
BamHI / HindIII	16.0	14.0	8.0	2.0	
HindIII / PstI	24.0	6.0	4.0		
EcoRI / HindIII	26.0	10.0	2.0		
EcoRI / PstI	22.0	8.0	6.0	4.0	





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Plasmid mapping: Exercise # 13-C

Instructions

Determine the number of base pairs (bp) in the whole plasmid, and then determine a scale for your plasmid map. Visualizing the map as a clock face is helpful. For example, if the total number of base pairs going around the map is 50, then 6:00 represents 25 bp, 3:00 represents about 12–13 bp, and 9:00 represents about 37–38 bp.

Experimental data						
Number of base pairs per band						
BamHI / EcoRI / HindIII	14.0	12.0	8.0	2.0		
BamHI / EcoRI / PstI	12.0	10.0	6.0	4.0		
EcoRI / HindIII / PstI	22.0	6.0	4.0	2.0		
BamHI / HindIII / PstI	14.0	10.0	6.0	4.0	2.0	
BamHI / EcoRI / HindIII / PstI	12.0	10.0	4.0	2.0		

