FRQ Friday – 4/23

AP Biology Insta-Review @apbiopenguins

2018 #3

2018 #7

2016 #5

FRQ 2018 #3

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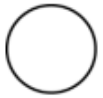
Seagrasses are aquatic plants that reproduce sexually. Male seagrass flowers produce sticky pollen that is carried by circulating water to female flowers, resulting in fertilization. A researcher claims that mobile aquatic invertebrates can also transfer pollen from male to female flowers in the absence of circulating water. To investigate this claim, the researcher set up aquariums to model the possible interactions between the invertebrates and seagrasses.

Male Flower	Female Flower	Invertebrates
		

FRQ 2018 #3

Claim: mobile aquatic invertebrates can also transfer pollen from male to female flowers in the absence of circulating water.

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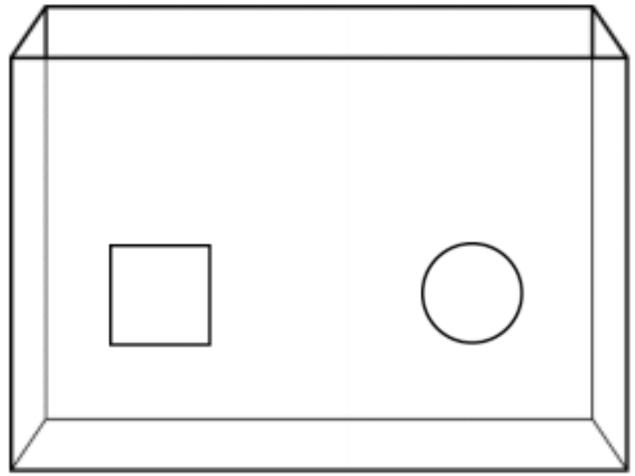
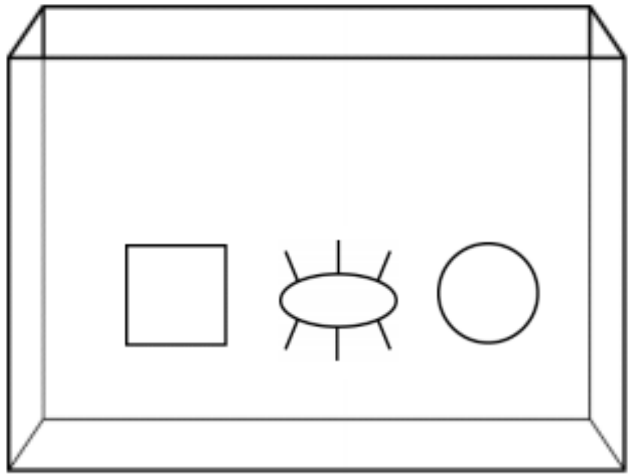
(a) Use the symbols below and the template aquariums to demonstrate the experimental design for testing the researcher's claim that mobile aquatic invertebrates can pollinate seagrass in the absence of circulating water. **Draw** the appropriate symbols in the negative control aquarium AND the experimental aquarium. Do not use any symbol more than once in the same aquarium.

Negative Control Aquarium	Experimental Aquarium
	

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(b) **Identify** the dependent variable in the experiment. **Predict** the experimental results that would support the researcher's claim that mobile aquatic invertebrates can also transfer pollen from male to female flowers in the absence of circulating water.

Identification (1 point maximum)	**Prediction (1 point maximum)**
Number/presence of pollen grains on female flowers OR pollination	More pollen grains transferred/pollination seen in experimental aquarium
Number/presence of fertilized plants/flowers OR fertilization	More fertilized plants/flowers/fertilization seen in experimental aquarium
Number/presence of seed/fruit/offspring produced OR reproduction	More seeds/fruits/offspring produced/reproduction in experimental aquarium

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In the tongue sole fish (*Cynoglossus semilaevis*), sex is determined by a combination of genetics and environmental temperature. Genetically male fish have two Z chromosomes (ZZ), and genetically female fish have one Z chromosome and one W chromosome (ZW). When fish are raised at 22°C, ZZ fish develop into phenotypic males and ZW fish develop into phenotypic females. However, when fish are raised at 28°C, the Z chromosome is modified (denoted as Z*). Z*W individuals develop as phenotypic males that are fertile and can pass on the Z* chromosome to their offspring even when the offspring are raised at 22°C. A cross between a ZW female and a Z*Z male is shown in the Punnett square below.

	Z	W
Z*	Z* Z	Z* W
Z	Z Z	Z W

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(a) **Predict** the percent of phenotypic males among the F_1 offspring of the cross shown in the Punnett square if the offspring are raised at 22°C.

@22°C

ZZ = male
ZW = female
Z*Z = male
Z*W = male

	Z	W
Z*	Z* Z (M)	Z* W (M)
Z	Z Z (M)	Z W (F)

@28°C

Z*Z = male
Z*W = male

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(b) At least one Z or Z* chromosome is necessary for survival of the fish. A researcher crossed two fish and observed a 2:1 ratio of males to females among the offspring. Based on the information, **identify** the genotype of the male parent in the cross. **Describe** ONE fitness cost to the female of mating with this particular male.

	Z*	W
Z	Male	Female
W	Male	WW Did Not Survive

@22°C

ZZ = male
ZW = female
Z*Z = male
Z*W = male

Identification (1 point)
Z* W

Description (1 point)

- Fewer offspring will develop/survive.
- 1/4 of the offspring are predicted to die.
- Some of her offspring will have the Z* chromosome/all of her male offspring will have a Z* chromosome.

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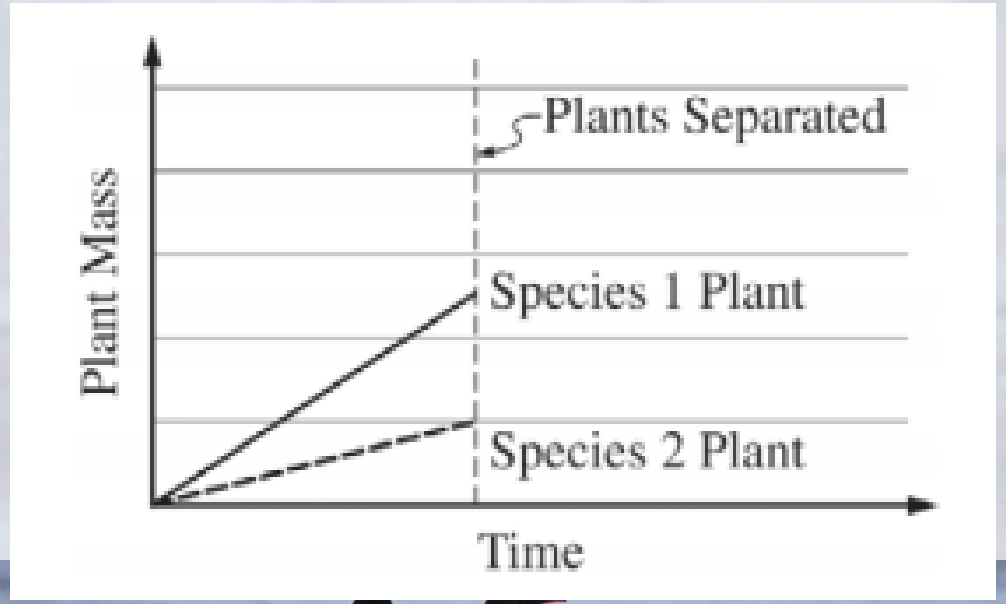
The graph above shows the mass of plants from two different species over time. The plants grew while attached to each other. The plants were separated at the time indicated by the vertical line in the graph.



FRQ 2016 #5

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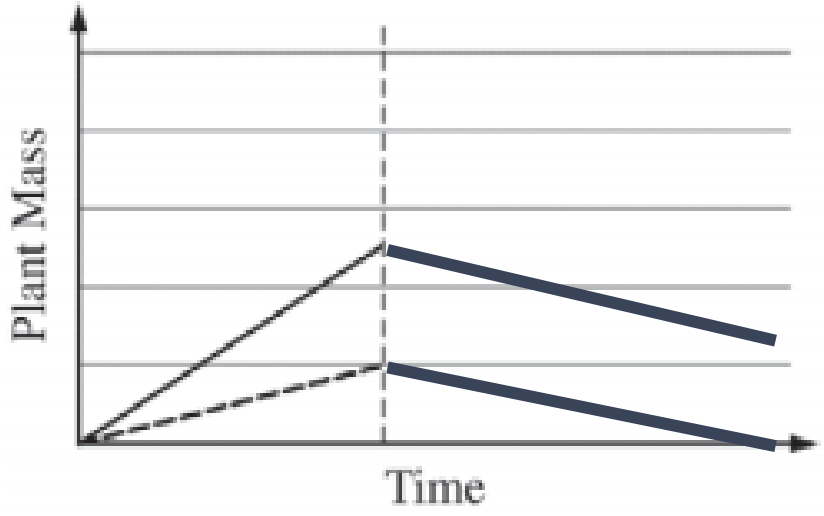
Using template 1, **graph** the predicted shape of the plant-mass lines after separation of the two plants if the plants were in an obligate mutualistic relationship. On template 2, **graph** the predicted shape of the plant-mass lines if the species 2 plant was a parasite of the species 1 plant. **Justify** each of your predictions.

TEMPLATE 1: OBLIGATE MUTUALISM



Graph characteristics (1 point each graph; 2 points maximum)
Both of the growth curves level off or decline.

Justification
(1 point each box; 2 points maximum)

- Each species depends on the other for survival.
- Without the relationship, both species are harmed.

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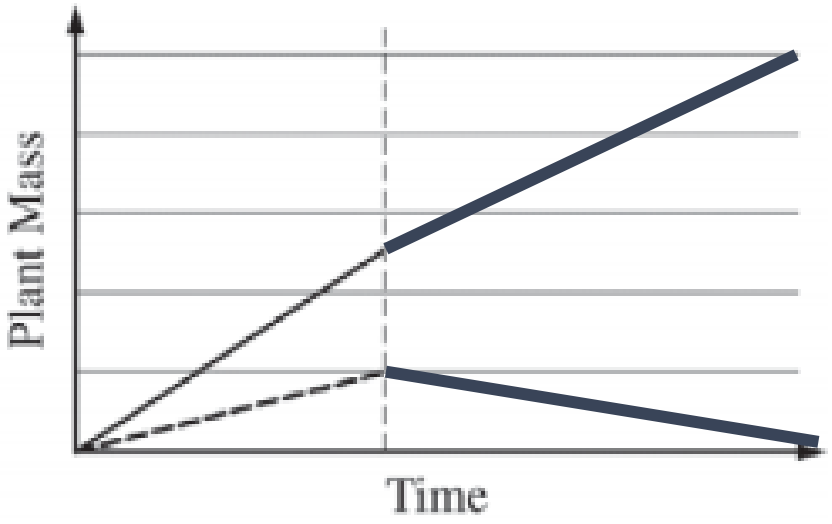
Using template 1, **graph** the predicted shape of the plant-mass lines after separation of the two plants if the plants were in an obligate mutualistic relationship. On template 2, **graph** the predicted shape of the plant-mass lines if the species 2 plant was a parasite of the species 1 plant. **Justify** each of your predictions.

TEMPLATE 2: PARASITISM



Graph characteristics (1 point each graph; 2 points maximum)
Species 1 continues to increase while species 2 levels off or declines.

Justification (1 point each box; 2 points maximum)
• The parasite requires an association with the host to survive but harms the host. • Without the relationship, the parasite cannot survive while the host continues to grow.

Next FRQ Friday (4/30)

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2018 #5

2017 #4

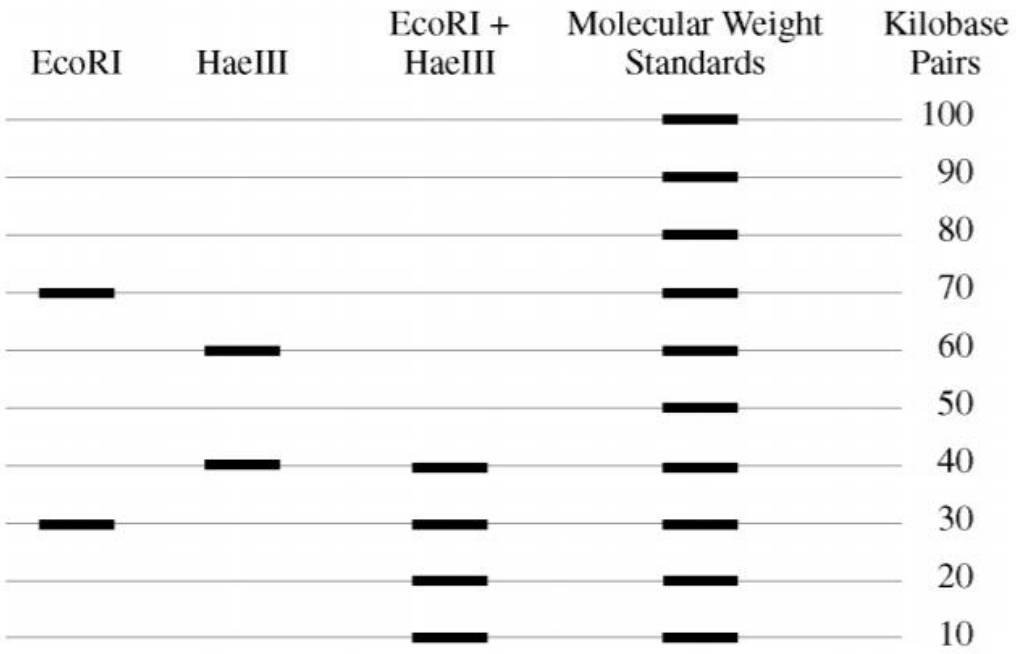
2016 #3

Plasmid Mapping Example

Question

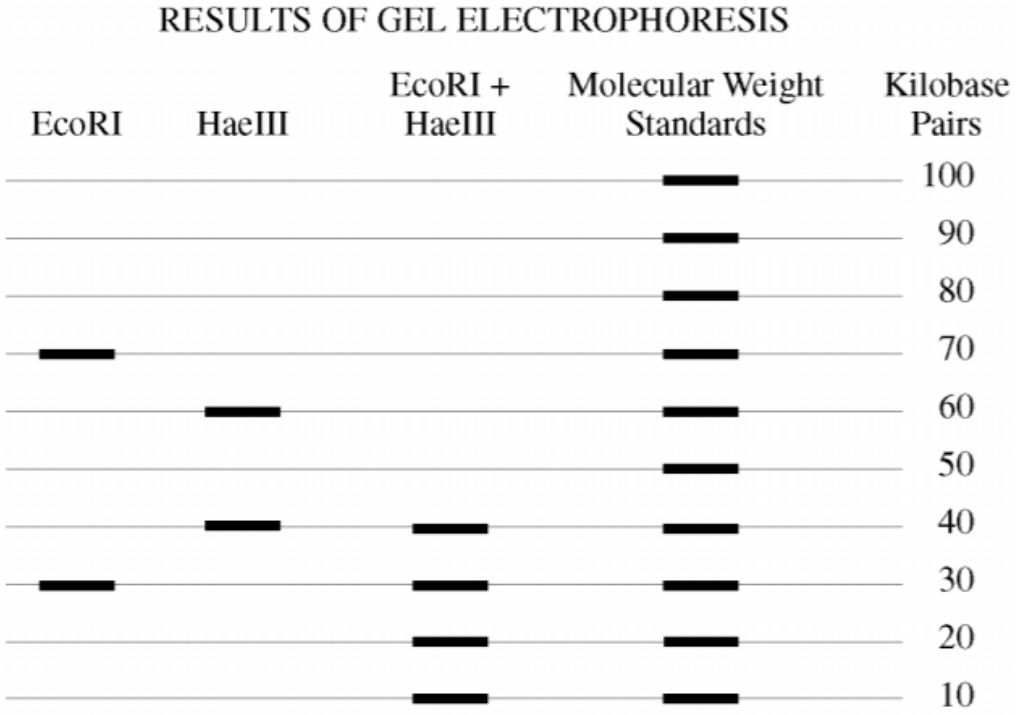
A bacterial plasmid is 100 kb in length. The plasmid DNA was digested to completion with two restriction enzymes in three separate treatments: EcoRI, HaeIII, and EcoRI + HaeIII (double digest). The fragments were then separated with electrophoresis, as shown.

RESULTS OF GEL ELECTROPHORESIS



(a) Using the circle provided, **construct** a labeled diagram of the restriction map of the plasmid. **Explain** how you developed your map.

Step 1: Determine lengths of fragments

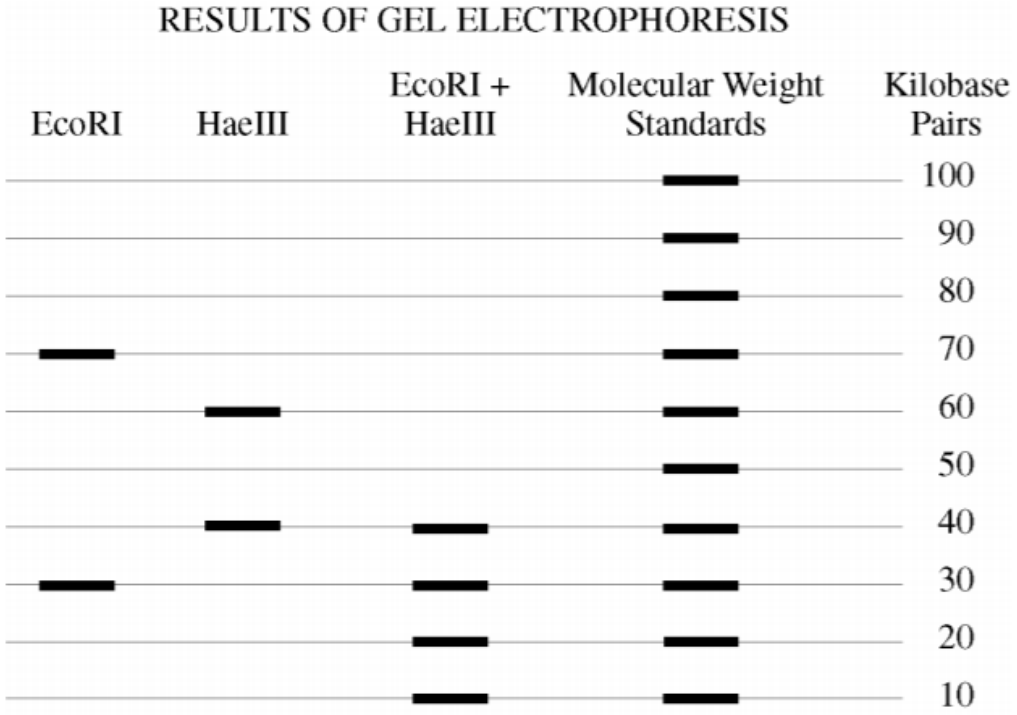


EcoRI: 70, 30

HaeIII: 60, 40

E+H: 40, 30, 20, 10

Step 2: Determine the number of cuts involved



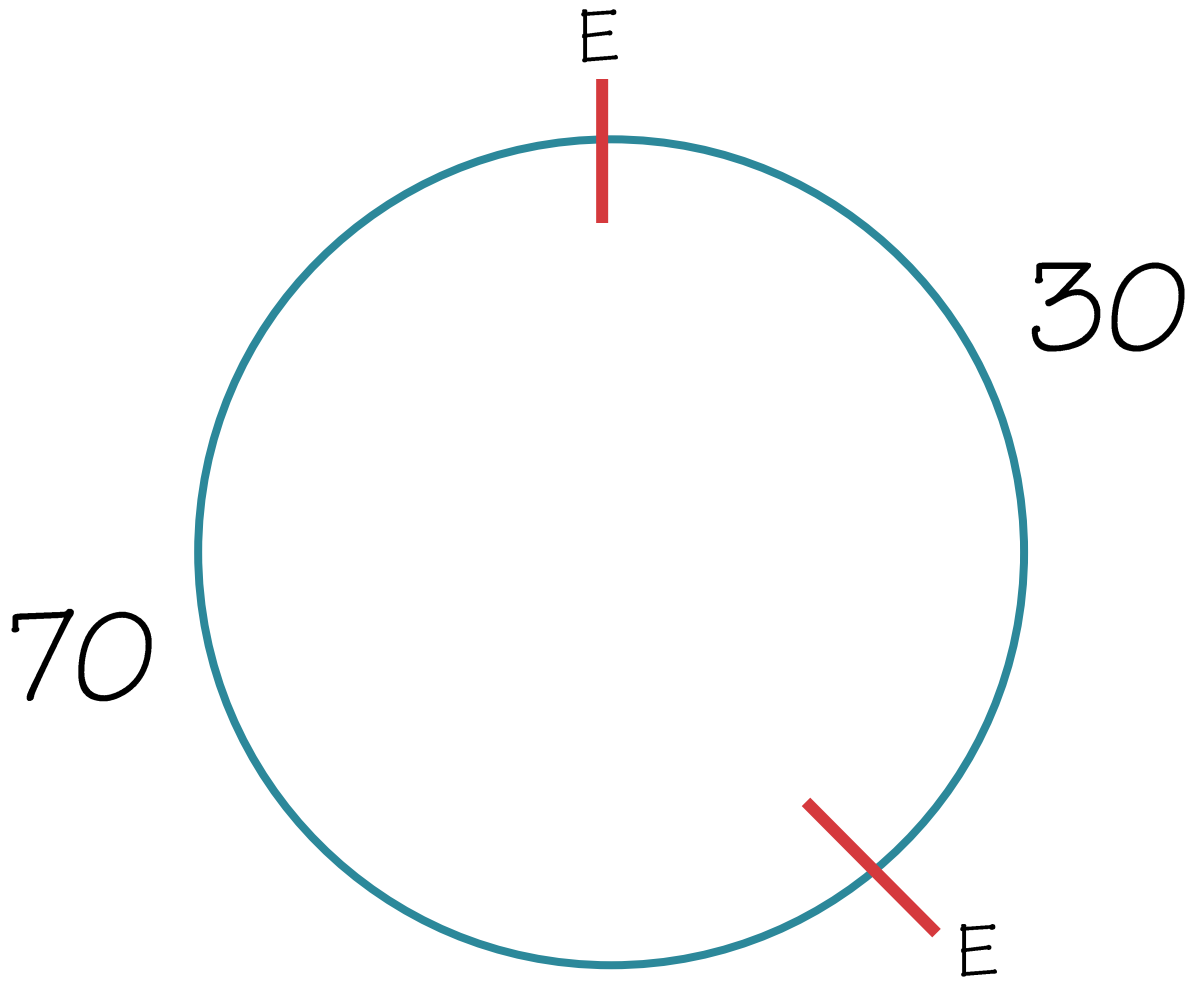
EcoRI: 70, 30 2 cuts

HaeIII: 60, 40 2 cuts

E+H: 40, 30, 20, 10 4 cuts

Step 3:
Place the cuts of ONE of the restriction enzymes on the plasmid circle

EcoRI:	~~70, 30~~	2 cuts
HaeIII:	60, 40	2 cuts
E+H:	40, 30, 20, 10	4 cuts

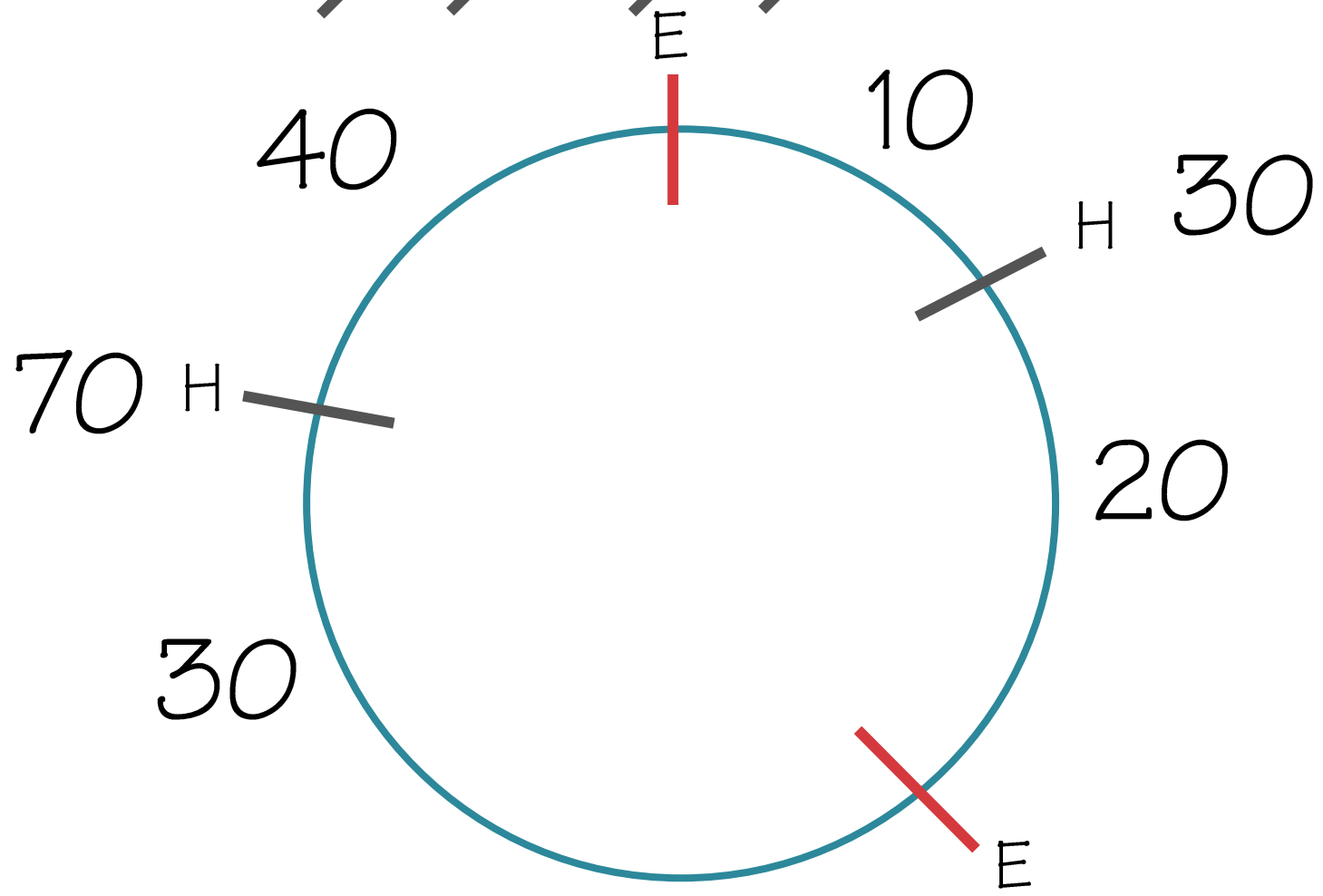


Step 4:
Place the cuts of the OTHER of the restriction enzyme on the plasmid circle
NOTE: Look at DOUBLE DIGEST

EcoRI: 70, 30 2 cuts

HaeIII: 60, 40 2 cuts

E+H: ~~40~~, ~~30~~, ~~20~~, ~~10~~ 4 cuts

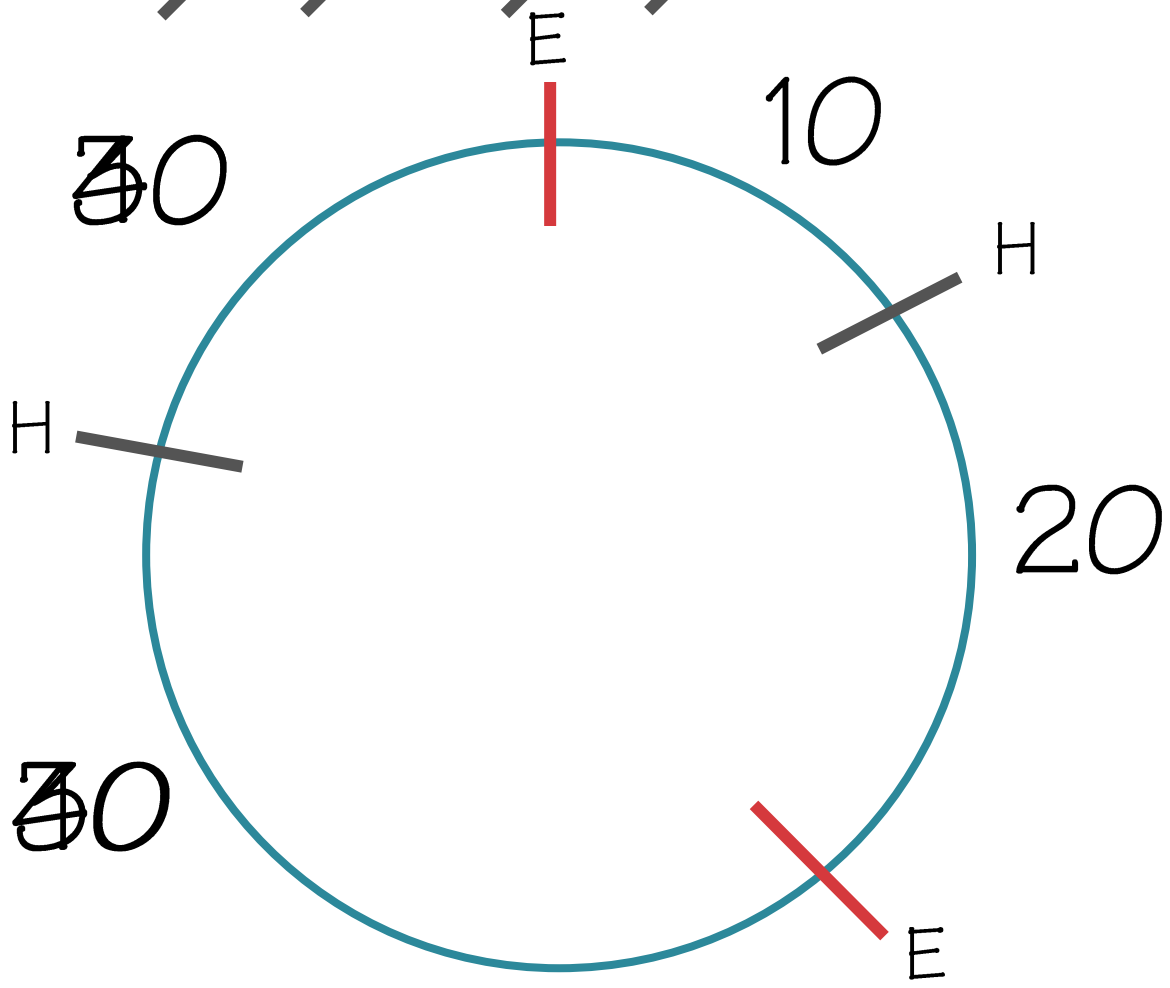


Step 5:
Verify ALL cuts
& lengths

EcoRI: 70, 30 2 cuts

HaeIII: 60, 40 2 cuts

E+H: ~~40~~, ~~30~~, ~~20~~, ~~10~~ 4 cuts



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