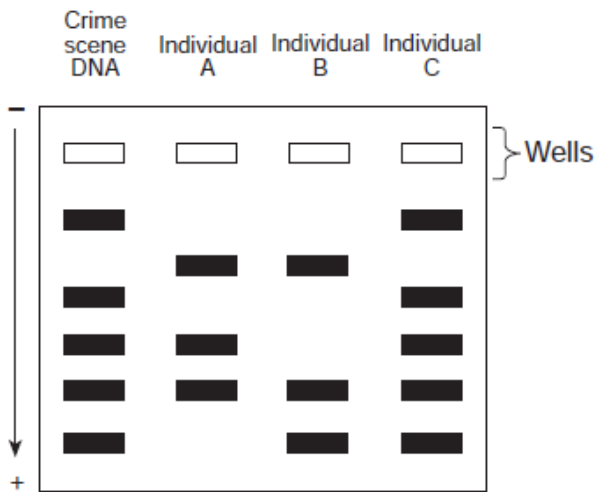


1. Base your answer to question on the information and diagram below and on your knowledge of biology.

An unknown sample of DNA found at a crime scene was compared to DNA samples taken from three individuals. The results of the technique used to compare the samples are represented below.



What factor causes the DNA fragments to move in this technique?

Base your answers to questions 2 through 4 on the information below and on your knowledge of biology.

### **Seriously, We're Poisonous: Coloration Is An Honest Signal Of Toxicity In Poison Frogs**

The conspicuous [noticeable] colors of poisonous frogs serve as a warning to predators: Don't eat me; I'm toxic. And a new study shows that in the case of at least one frog species, they aren't bluffing-the more conspicuous the color, the more poisonous the frog. Researchers Martine Maan (University of Groningen, the Netherlands) and Molly Cummings (University of Texas) studied strawberry poison dart frogs, which are native to Panama and come in more than a dozen different color patterns that vary from region to region....

.... Maan and Cummings tested the toxicity levels of 10 differently colored frog populations. Then using known properties of birds' visual systems, the researchers estimated how each color pattern would look to a bird, an important frog predator. The results show that frogs with more conspicuous color patterns-as seen by birds-tended to be more toxic. The findings suggest that "birds can predict the toxicity of frogs by looking at their colors, possibly better than the frogs can themselves," Maan said ....

Source: <http://www.ineffableisland.com/2012/01/seriously-were-poisonous-coloration-is.html>

- Frogs come in "more than a dozen different color patterns." State *one* method the scientists could have used to determine that they are all the same species.
- Researcher Austin Penner of the University of Alberta has noted that climate change and deforestation in the habitat of the strawberry poison dart frog could have "drastic effects" as the habitat required for them development of the tadpoles [young] of these frogs is extremely specific. Explain why it is important to protect these poisonous frog species and the habitat that supports them.

## Part D

4. If a sudden genetic mutation in the birds that feed on these frogs made them able to consume any amount of the poison with no harm to them, it is most likely that
- A) the frogs that are least poisonous and less conspicuous now would survive better than those that have more poison
  - B) the frogs that are most poisonous would continue to survive and be protected by the poison they contain
  - C) without the protection of the poison, all of the frogs would need to change color to become less conspicuous
  - D) the birds would find another source of food that does not contain any poison

Base your answers to questions 5 and 6 on the Universal Genetic Code Chart below and on your knowledge of biology.

**Universal Genetic Code Chart**  
**Messenger RNA Codons and the Amino Acids for Which They Code**

SECOND BASE					
	U	C	A	G	
FIRST BASE	U UUU } PHE UUC } UUA } LEU UUG }	UCU } UCC } SER UCA } UCG }	UAU } TYR UAC } UAA } STOP UAG }	UGU } CYS UGC } UGA } STOP UGG } TRP	U C A G
	C CUU } CUC } LEU CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A AUU } AUC } ILE AUA } AUG } MET or START	ACU } ACC } THR ACA } ACG }	AAU } ASN AAC } AAA } LYS AAG }	AGU } SER AGC } AGA } ARG AGG }	U C A G
	G GUU } GUC } VAL GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G

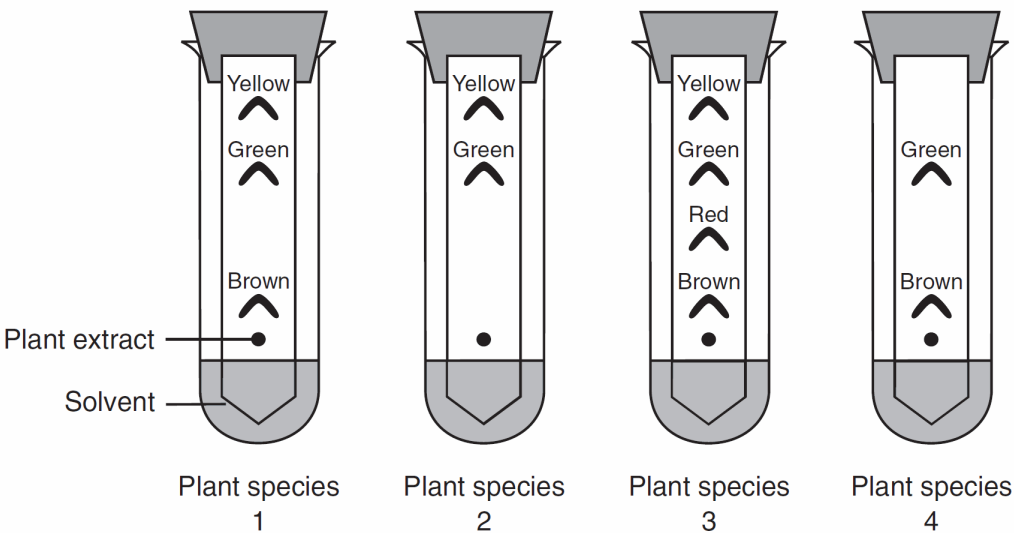
DNA Base Sequence	AAG	CCA	TGA	ACA
mRNA codons	_____	_____	_____	_____
Amino acid sequence	_____	_____	_____	_____

5. In the table below, record the mRNA codons coded for by the DNA base sequences.

Part D

6. Then, using the Universal Genetic Code Chart, record the amino acid sequence that is coded for by the mRNA codons you placed in the table.

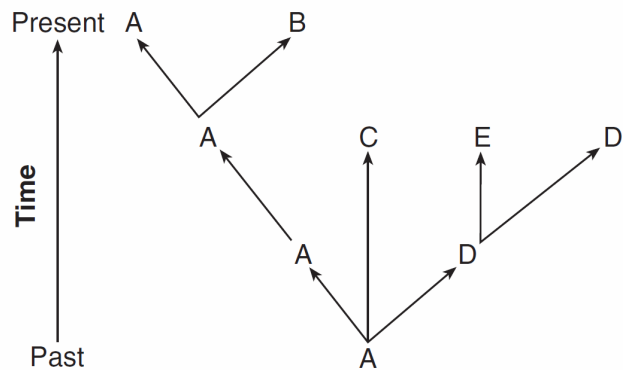
7. Base your answer to this question on the results of an experiment using plant pigments represented below and on your knowledge of biology.



Which phrase could be used to describe this technique?

- A) the use of chromatography to separate molecules in a mixture
- B) the use of cut leaves to observe certain colors
- C) using indicators to determine pH
- D) using dichotomous keys to identify plants

Base your answers to questions 8 through 10 on the diagram below and on your knowledge of biology. Letters A through E represent different species of organisms. The arrows represent long periods of geologic time.



8. Which species would most likely show the greatest similarities in their amino acid sequences?

- A) A and E
- B) A and B
- C) B and D
- D) C and E

## Part D

9. Which species is the common ancestor to all of the other species?
10. Identify *one* species that was *not* able to adapt to its environment. Support your answer.

Base your answers to questions **11** through **13** on the information below and on your knowledge of biology.

A student designed an experiment to investigate a claim that athletes would have lower heart rates than nonathletes during exercise. After the students classified themselves as an athlete or a nonathlete, their resting pulses were determined. Then all the students performed the same exercise for four minutes and their heart rates were determined by recording the pulse rate in beats per minute. The students continued to measure their pulse rates for an additional four minutes. The average heart rate per minute for each group was determined. The data were recorded, as shown on the table below.

**Average Heart Rate Response to Exercise (beats per minute)**

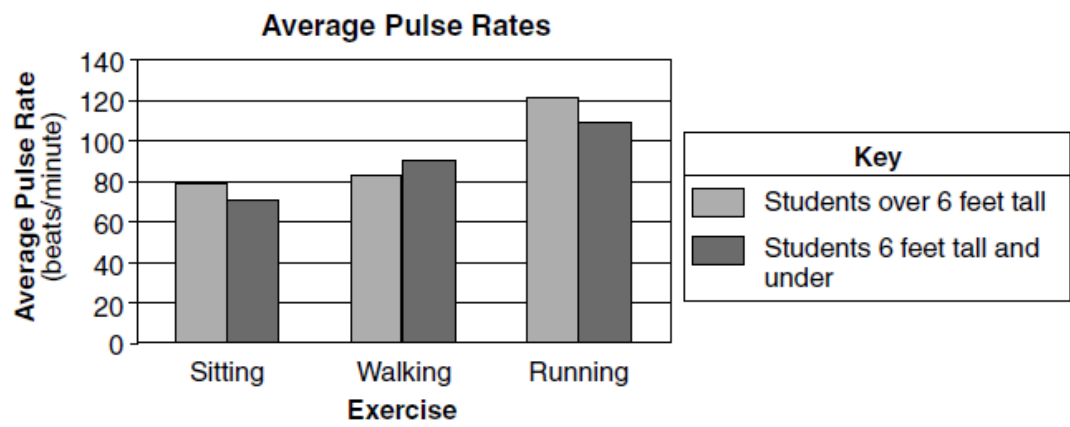
	Time (minutes)	Athlete Students	Nonathlete Students
Resting Pulse	0	68	72
Exercising Period	1	76	78
	2	82	90
	3	95	115
	4	110	130
After Exercise	5	100	125
	6	95	120
	7	85	100
	8	68	95

11. To improve the validity of the conclusion reached in this experiment, the students should repeat the experiment
  - A) disregarding any data that don't fit the hypothesis
  - B) with a larger number of athletes and nonathletes**
  - C) comparing the heart rates and breathing rates of males and females
  - D) with the athletes doing different exercises than the nonathletes
12. Which statement is best supported by the data in the chart?
  - A) After exercise, the nonathletic students had a lower heart rate than the athletic students.
  - B) After exercise, the heart rates of the athletic students returned to resting pulse in four minutes.**
  - C) During exercise, both groups of students had the same increase above their resting pulse.
  - D) During exercise, the athletic students had a higher heart rate than the nonathletic students.
13. State *one* appropriate hypothesis for this experiment.

Part D

Base your answers to questions 14 through 16 on the information below and on your knowledge of biology.

Students in a high school biology class conducted an investigation on pulse rates. The thirty students performed three different activities and determined their pulse rates. Each activity was done three times. The average is shown in the graph below.



14. State the relationship between intensity of physical activity and pulse rate.
15. Some biology students concluded that classmates over 6 feet tall always have higher pulse rates than shorter classmates. Does the information from the investigation support this conclusion? Support your answer.
16. The students want to improve the validity of their conclusion. The best way to accomplish this is to
- A) change the hypothesis
  - B) repeat the investigation several times**
  - C) increase the number of variables
  - D) increase the height of participants in each group

Base your answers to questions 17 and 18 on the information below and on your knowledge of biology.

An athlete bought a sport gel food and wanted to test it to see if it contained fats, starches, and glucose. The tests that the student used are shown in the table below.

	Test for Fat	Test for Starch	Test for Glucose
Positive Result	paper that is greasy	blue black color	brick red/orange color
Negative Result	paper that is not greasy	amber color	blue color

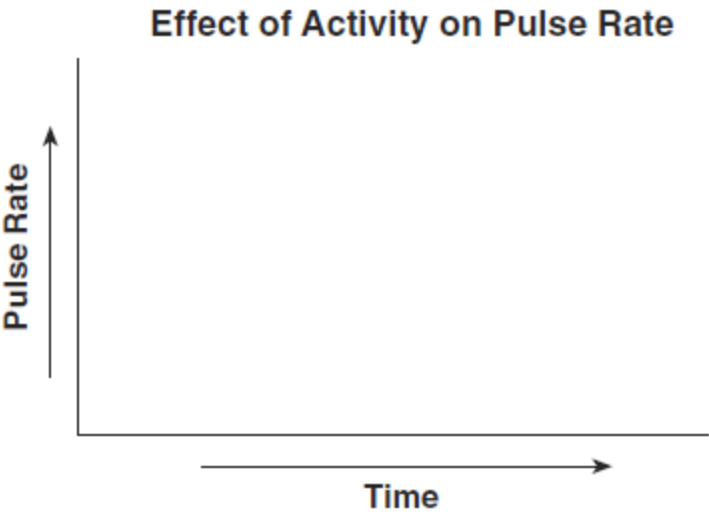
17. If a starch-digesting enzyme were added to a sports gel that lists starch as an ingredient, which substance would increase in concentration?
- A) fat
  - B) glucose**
  - C) amino acids
  - D) water

18. The athlete received the following results from the tests.

	Test for Fat	Test for Starch	Test for Glucose
Student's Result	paper not greasy	blue black color	brick red/orange color

Identify the contents of the sports gel.

19. A student went out to the school track and walked two laps, ran two laps, and then walked two more laps. On the grid below, draw a line that shows what most likely happened to the pulse rate of the student during these activities.

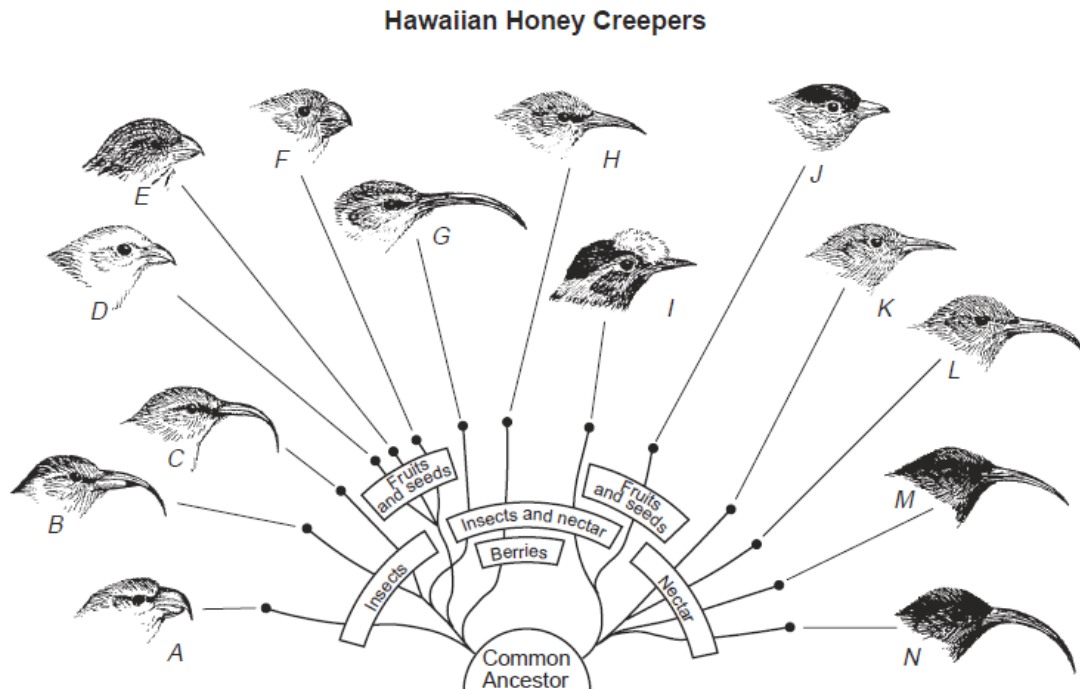


20. A student measured her pulse rate for a 15-second period, three separate times, and recorded the results. She then calculated her pulse rate for 1 minute. Complete the data table below by filling in the missing information.

Pulse Rates		
Trial Number	15 Second Pulse Rate	1 Minute Pulse Rate
1	19	76
2	18	
3	17	68
Average		72

## Part D

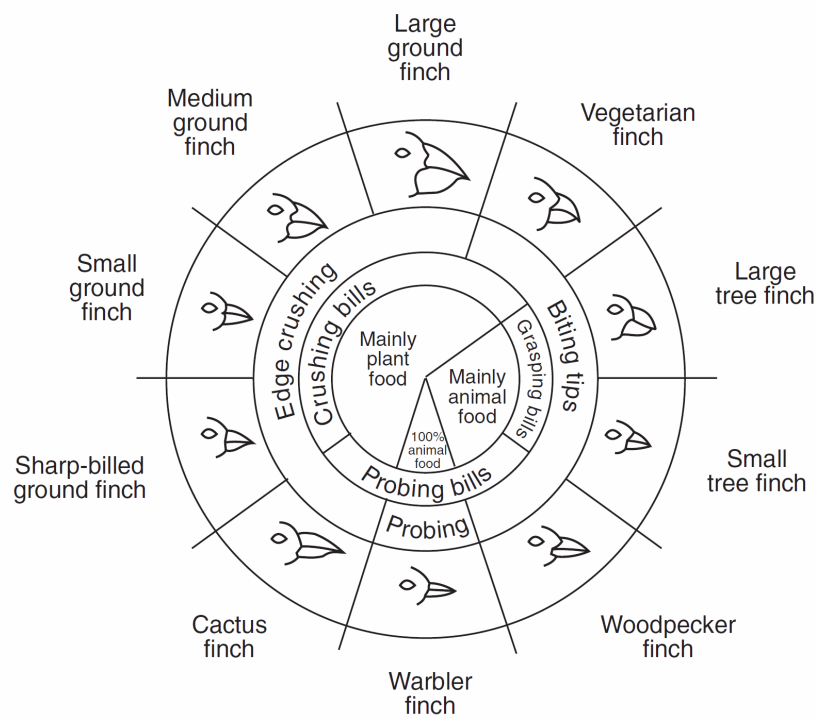
Base your answers to questions **21** through **23** on the diagram below, which shows the evolution of Hawaiian Honey Creepers from a common ancestor. As their ancestors spread to new islands, they found a variety of different food sources. Gradually, behaviors and beak structures evolved that took advantage of these different food sources, resulting in the formation of several new species.



21. Some of the birds that could not compete with the honey creepers were successful living on other islands. State *one* reason why this could be possible.
22. Other types of birds arrived at the islands, but they found it difficult to compete with the many forms of honey creepers. Explain why the honey creepers were able to compete so successfully against the new arrivals.
23. Describe how the beaks of the bird species *D*, *E*, *F*, and *J* that eat fruits and seeds differ from the beaks of the bird species that eat only nectar.

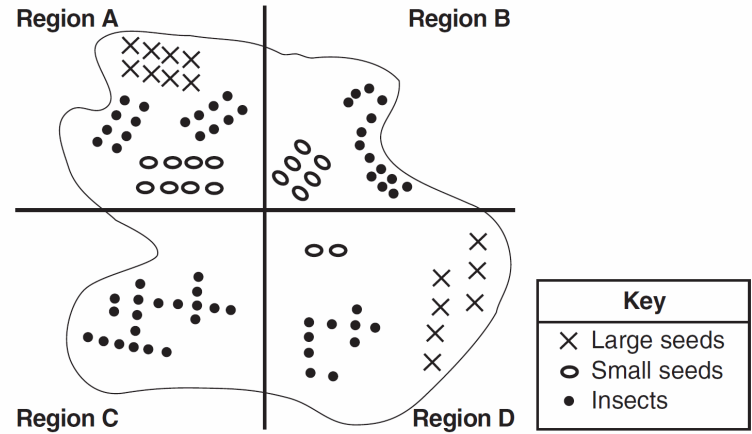
Base your answers to questions 24 through 27 on the diagrams below and on your knowledge of biology. The diagrams represent the variations in the beaks of finches in the Galapagos Islands and the relative abundance of food sources on a certain island.

Variations in Beaks of Galapagos Islands Finches



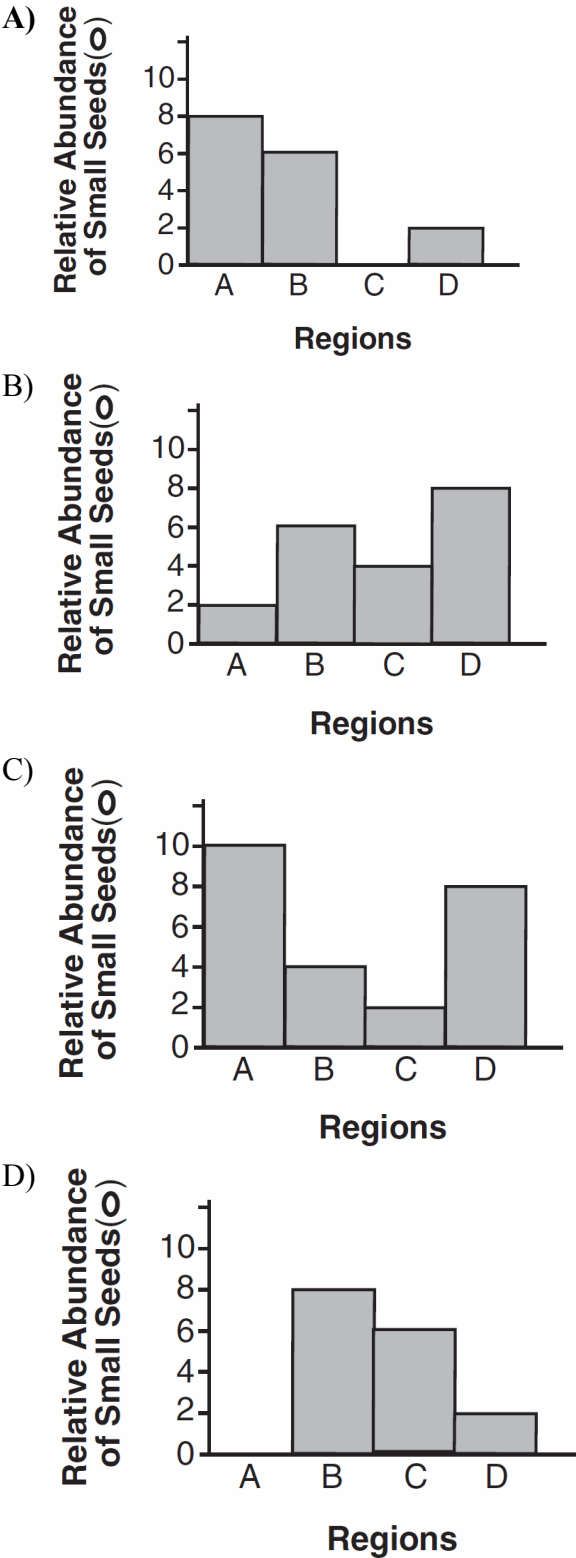
From: *Galapagos: A Natural History Guide*

Relative Abundance of Food Sources on a Certain Island





24. Which histogram displays the relative abundance of small seeds in regions *A*, *B*, *C*, and *D*?



## Part D

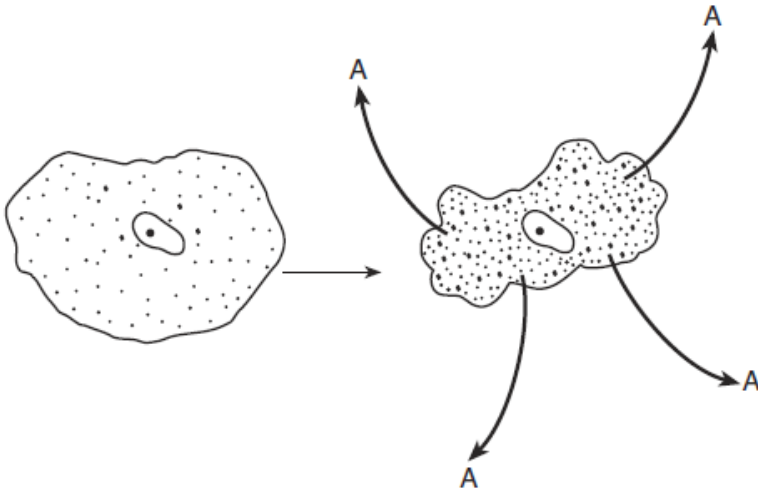
25. The diagram of the island suggests that in region *B* finches can feed on

- A) large seeds and insects
- B) small seeds, only
- C) a large variety of different-sized seeds
- D) insects and a limited number of small seeds**

26. Explain why researchers would most likely observe the large ground finch in regions *A* and *D* on the island and *not* in regions *B* and *C*.

27. A bird count was done on the island and the small tree finch was found in all regions. State *one* possible reason why the small tree finch is able to inhabit the entire island.

Base your answers to questions **28** and **29** on the diagram below, which represents the shrinking of a cell in response to an increase in the concentration of a substance outside of the cell.



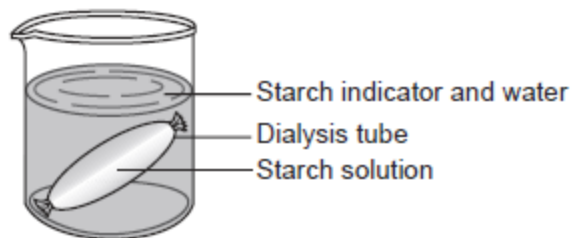
28. Identify *one* likely substance in the environment of the cell that caused this response.

29. Identify substance *A*.

## Part D

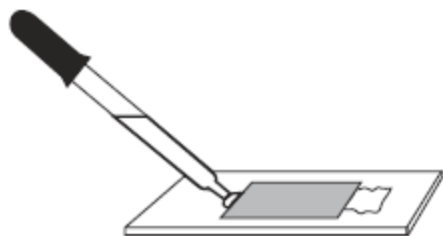
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30. Base your answer to the following question on the diagram below and on your knowledge of biology. The diagram represents an experimental setup.



Which statement best describes what would most likely be observed after 20 minutes?

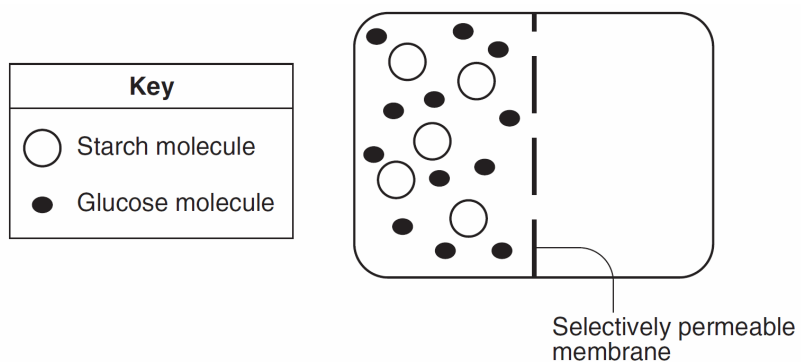
- A) **The contents of the dialysis tube would turn blue-black.**
  - B) The liquid in the beaker would turn blue-black.
  - C) The dialysis tube would burst.
  - D) There would be no change visible.
31. The diagram below represents a laboratory technique.



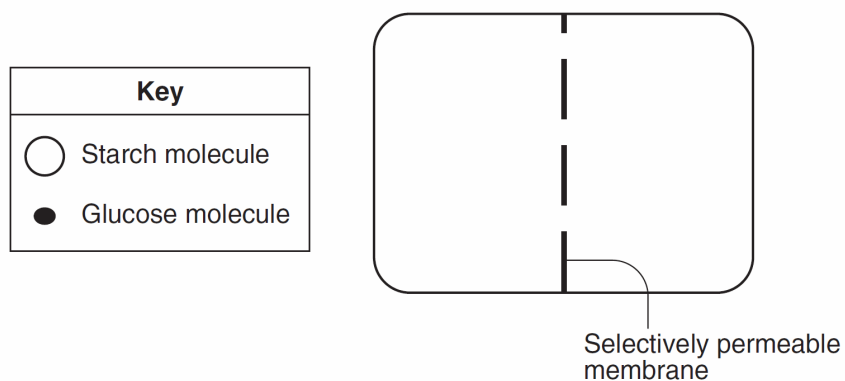
State *one* reason a student would use this technique during a scientific investigation.

## Part D

32. The diagram below represents a laboratory setup used to demonstrate the movement of molecules across a selectively permeable membrane.



In the diagram below, draw the 5 starch and the 12 glucose molecules to show where they would most likely be located after 15 minutes.



Part D

Base your answers to questions 33 and 34 on the information and data table below and on your knowledge of biology.

In an experiment, three plants of the same species were grown in each of six identical pots. The heights of the plants were measured when growth began. Each of the pots was watered every day with salt solutions of different concentrations. The data for the experiment are shown in the table below.

Effect of Salt Solution on the Height of Plants

Plant Group	Percent Salt Solution Used for Watering the Plants	Average Initial Height (centimeters)	Average Final Height (centimeters)
A	0	2	30
B	1	2	28
C	2	3	15
D	3	2	10
E	4	3	(died)
F	5	3	(died)

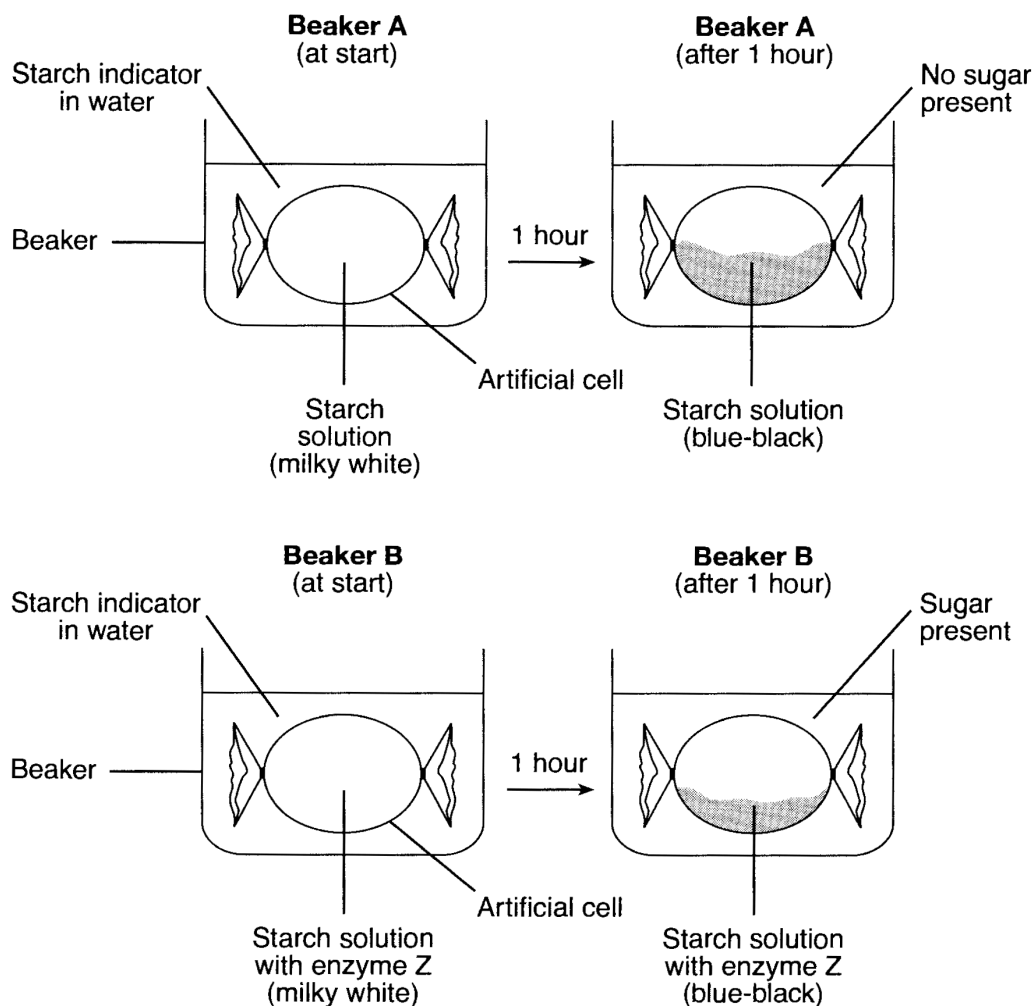
33. State the effect of increasing the percent of salt in the solution used to water the plants on the average final height of the plants in groups *A* through *D*.

34. State *one* way diffusion was involved in the cause of death of the plants in groups *E* and *F*.

## Part D

Base your answers to questions 35 and 36 on the information and diagram below and on your knowledge of biology.

Two models of a cell were made with dialysis tubing and placed in two beakers of fluid, *A* and *B*, each containing starch indicator solution, as represented in the diagram below. Enzyme Z was added to the artificial cell in beaker *B*. The solution outside each cell was tested for the presence of sugar. Initially, no sugar was present in the solution outside each cell. The results after one hour are represented below.



35. State *one* reason for the color change in beaker *A* after one hour.
36. How would the results have been different in beaker *B* if an enzyme that digests protein was used instead of enzyme Z?

# Answer Key

## Part D MigED

1. — electricity, — electrical charge, — attraction between opposite electrical charges
2. — gel electrophoresis — DNA analysis — protein/molecular/biochemical analysis — mate them to see if they can produce fertile offspring
3. — These frogs are important to maintaining biodiversity in the rain forest environment. — They are prey for the birds and consume other organisms for food. — The frogs could be a valuable source of medicines that might be developed from the toxins that they produce. — The destruction of the habitat could have unintended consequences that could disrupt the entire food web. — so the frog species does not become extinct
4. A
5.

DNA Base Sequence	AAG	CCA	TGA	ACA
mRNA codons	UUC	GGU	ACU	UGU
Amino acid sequence	PHE	GLY	THR	CYS
6.

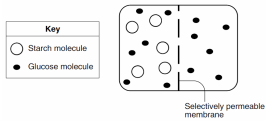
DNA Base Sequence	AAG	CCA	TGA	ACA
mRNA codons	UUC	GGU	ACU	UGU
Amino acid sequence	PHE	GLY	THR	CYS
7. A
8. B
9. — A
10. — Species C, because it became extinct. — D, because it is no longer alive. — Species E does not continue to the present.
11. B
12. B
13. — If athletes perform the same exercise as nonathletes, then the athletic students will have a lower heart rate during exercise. — Athletic students have a lower heart rate during similar exercise than nonathletic students. — Nonathletes have a higher heart rate than athletes when exercising.
14. — As intensity of physical activity increases, pulse rate increases. — It is a direct relationship. — If the activity decreases, the pulse rate will decrease.
15. — No, the results for shorter students were higher than for taller after walking. — No, the results in the graph are averages of all the students. Some taller students could have much lower rates or some shorter classmates could have much higher rates. — No, the sample size is too small to support this conclusion. — The data for walking do not support the conclusion.
16. B
17. B
18. starch and glucose
- 19.
20.

Trial Number	Pulse Rates	
	15 Second Pulse Rate	1 Minute Pulse Rate
1	19	76
2	18	72
3	17	68
Average	18	72
21. — There were not honey creepers to compete with. — There was enough food for them on the other island. — They were well adapted to the conditions on the other island.
22. — The honey creepers were well adapted to the conditions on the islands. — They had evolved specific skills/structures to find food on Hawaii. — They were better adapted than the new arrivals.
23. — Fruit and seed eaters have shorter, thicker beaks. — The nectar-eating birds have longer, thinner beaks. — Their beaks are shorter.
24. A
25. D
26. —Large ground finches prefer large seeds. —Region B and C lack the preferred food source of large ground finches, which is large seeds. —Large ground finches have large edge-crushing bills, which are best for eating the large seeds found only in regions A and D.
27. —The small tree finch eats mainly animal food (insects), and insects are found in all four regions on the island. —Insects are found in all regions.
28. — salt, — sugar, — seawater
29. — water
30. A
31. — to add a solution to a slide without removing the coverslip, — to add strain (or water) to a slide

## Answer Key

### Part D MigED

32.



33. – When more salt was used, the plants did not grow as tall.  
– Increasing the salt made the plants grow less.
34. – When more salt was used, more water diffused out of the plant cells. The plants in *E* and *F* dried out and died.  
– The cells lost too much water. – It caused the plants to dehydrate and die.
35. –The starch indicator diffused into the cell and reacted with the starch solution. –The starch indicator reacted with the starch. –The starch indicator diffused into the cell.
36. –Sugar would not be present. –The protein enzyme would not digest the starch to sugar.
-