

LIVING ENVIRONMENT

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Tuesday, June 19, 2012 — 9:15 a.m. to 12:15 p.m., only

Student Name _____

School Name _____

Print your name and the name of your school on the lines above.

A separate answer sheet for multiple-choice questions in Parts A, B-1, B-2, and D has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

You are to answer all questions in all parts of this examination. Record your answers for all multiple-choice questions, including those in Parts B-2 and D, on the separate answer sheet. Record your answers for all open-ended questions directly in this examination booklet. All answers in this examination booklet should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on the answer sheet or in this examination booklet as directed.

When you have completed the examination, you must sign the declaration printed on your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice...

A four-function or scientific calculator must be made available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

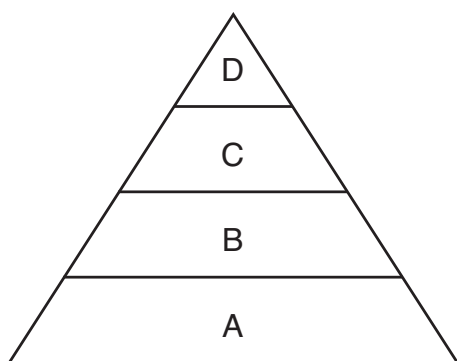
Answer all questions in this part. [30]

Directions (1–30): For *each* statement or question, record on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

1 One characteristic of all living things is that they

- (1) develop organ systems
- (2) produce identical offspring
- (3) maintain internal stability
- (4) synthesize only inorganic matter

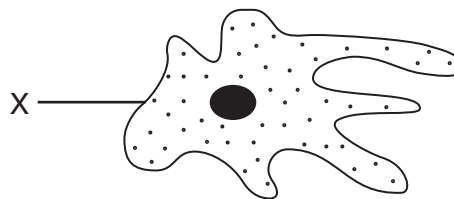
2 The diagram below represents interactions between organisms in a stable ecosystem.



Which statement correctly describes organisms in this ecosystem?

- (1) Organisms in level *B* obtain their energy directly from the Sun.
 - (2) Organisms in level *C* obtain their nutrients directly from organisms in level *D*.
 - (3) Organisms in level *A* are herbivores.
 - (4) Organisms in level *D* are heterotrophic.
- 3 Due to overfishing, the number of fish in the ocean could drastically decrease. This will cause
- (1) an increase in the stability of the oceans
 - (2) an increase in the salt content of the oceans
 - (3) a decrease in the stability of the oceans
 - (4) a decrease in the oxygen available in the oceans
- 4 Which substance can enter a cell by diffusion without having to be digested?
- (1) water
 - (2) protein
 - (3) starch
 - (4) fat

5 A single-celled organism is represented below.



Structure *X* carries out a function most similar to which structure in a human?

- (1) lung
 - (2) brain
 - (3) ovary
 - (4) heart
- 6 Parrots are tropical birds. However, in some areas of New York City, some parrots have been able to survive outdoors year-round. These parrots survive, while most others cannot, due to
- (1) overproduction of offspring
 - (2) extinction of previous species
 - (3) asexual reproduction of parrots with a mutation
 - (4) a variation that allows these parrots to live in colder climates
- 7 Changing one base in a gene could have the most direct effect on the
- (1) function of the membrane of a cell
 - (2) sequence of building blocks of a protein found in a cell
 - (3) number of mitochondria in a cell
 - (4) type of carbohydrates synthesized by a cell
- 8 An alteration of genetic information is shown below.



This type of alteration of the genetic information is an example of

- (1) deletion
- (2) insertion
- (3) substitution
- (4) recombination

9 The table below shows adaptations in two organisms.

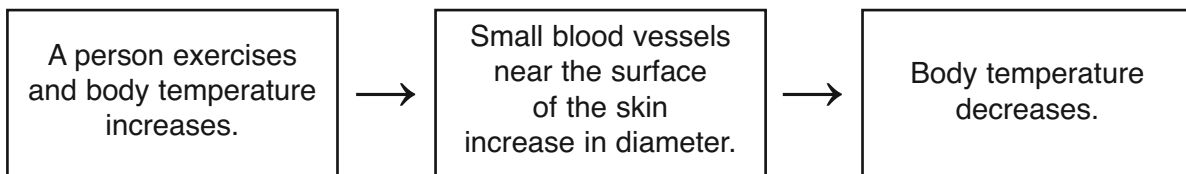
Environmental Adaptations

Organism	Environment	Adaptation
desert rat	hot and dry	comes out of burrow only at night
Arctic poppy plant	cold and windy	grows low to ground next to rocks

The presence of these adaptations is most likely the result of

- (1) reproductive technology
- (2) natural selection
- (3) asexual reproduction
- (4) human interference

10 The diagram below represents an activity that occurs in the human body.



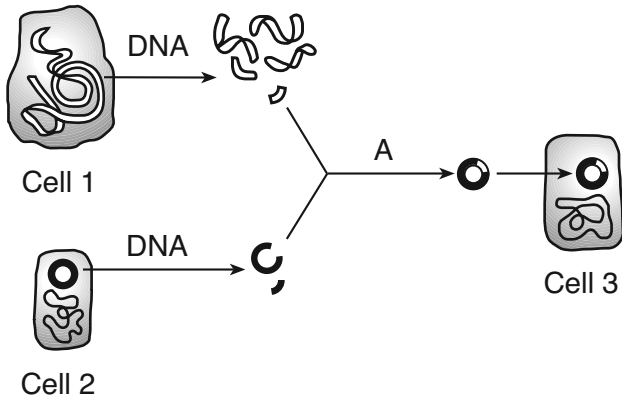
This diagram best illustrates

- (1) active transport
- (2) maintenance of homeostasis
- (3) synthesis of nutrients
- (4) differentiation

11 In which row in the chart below is a human action correctly paired with its environmental impact?

Row	Human Action	Environmental Impact
(1)	deforestation	increased biodiversity
(2)	population growth	increased number of species
(3)	industrialization	increased global temperature
(4)	overharvesting	increased mineral resources

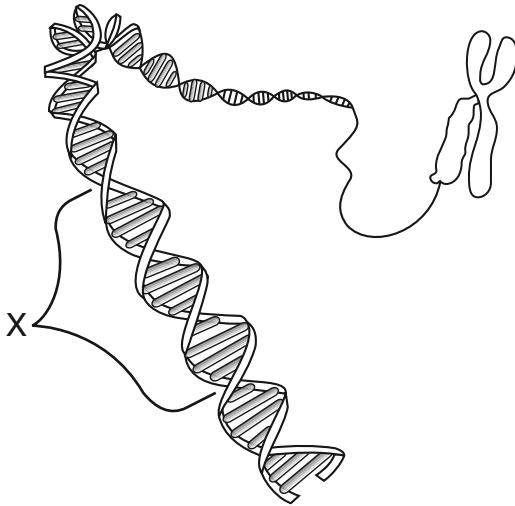
12 A laboratory technique is represented in the diagram below. Letter A represents a process.



Which specific chemicals are needed to successfully carry out the process shown at A?

- (1) receptor molecules
- (2) carbohydrates
- (3) enzymes
- (4) starch molecules

13 The diagram below represents genetic material.



The expression of the section labeled X may be modified by

- (1) temperature, only
- (2) asexual reproduction
- (3) the environment
- (4) pH, only

14 Characteristics that are harmful to a species tend to decrease in frequency from generation to generation because these characteristics usually

- (1) have a high survival value for the species
- (2) have a low survival value for the species
- (3) are inherited by more individuals
- (4) affect only the older members of the population

15 Which situation results in a characteristic that is inheritable?

- (1) A limb is lost when two marine organisms fight.
- (2) A puppy learns to beg for food by watching an older dog perform tricks.
- (3) A gene is inserted into a bacterium, allowing the organism to produce insulin.
- (4) A random mutation causes the immediate death of a microbe.

16 Which statement best describes bat populations in a stable ecosystem?

- (1) They are held in check by environmental factors.
- (2) They are producers that rely indirectly on other producers.
- (3) They are not limited by natural predators.
- (4) They are not dependent on other species.

17 Which characteristic of a geographic region would have the greatest influence on the type of ecosystem that forms in that region?

- (1) ratio of autotrophs to heterotrophs
- (2) concentration of atmospheric oxygen
- (3) number of food chains
- (4) climatic conditions

18 A scientist claimed that he had cloned a guinea pig to produce two offspring, a male and a female. The claim is *not* valid because

- (1) guinea pigs can reproduce both sexually and asexually
- (2) the two offspring are not identical copies of the original guinea pig
- (3) each of the offspring had half the genetic information of the original guinea pig
- (4) none of the genetic information came from the original guinea pig

19 The major function of the placenta is to

- (1) cushion the fetus so it won't be hurt when the mother moves
- (2) exchange food, oxygen, and waste between mother and fetus
- (3) store food for the fetus
- (4) support the egg for the process of fertilization

20 During the process of photosynthesis, energy from the Sun is converted into

- (1) chemical energy in the bonds of inorganic molecules
- (2) chemical energy in the bonds of organic molecules
- (3) enzymes used to produce inorganic molecules
- (4) enzymes used to produce organic molecules

21 A pesticide that kills an insect by interfering with the production of proteins in the insect would most directly affect the activity of

- (1) ribosomes
- (2) minerals
- (3) chloroplasts
- (4) mitochondria

22 When two different bird species temporarily occupy the same niche, they would most likely

- (1) change their nesting behaviors
- (2) not affect one another
- (3) interbreed to form a new species
- (4) compete with one another

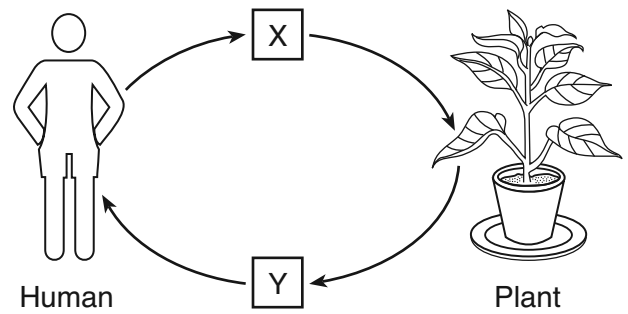
23 Which group would most likely be represented in a food chain?

- (1) biotic factors
- (2) abiotic factors
- (3) inorganic compounds
- (4) finite resources

24 Which statement describes a similarity between all enzymes, antibodies, and hormones?

- (1) Their chemical structure is critical to their ability to function.
- (2) Their ability to replicate identical copies ensures continuation of the species.
- (3) They work better at 100°C than 37°C.
- (4) They are made by and carried by the blood.

25 The diagram below represents a cycling of materials.



Which row in the chart below shows the substances represented by X and Y?

Row	X	Y
(1)	oxygen	carbon dioxide
(2)	glucose	oxygen
(3)	carbon dioxide	oxygen
(4)	amino acids	carbon dioxide

26 Over a long period of time, the stages represented in the diagram below were each present in a particular ecosystem.

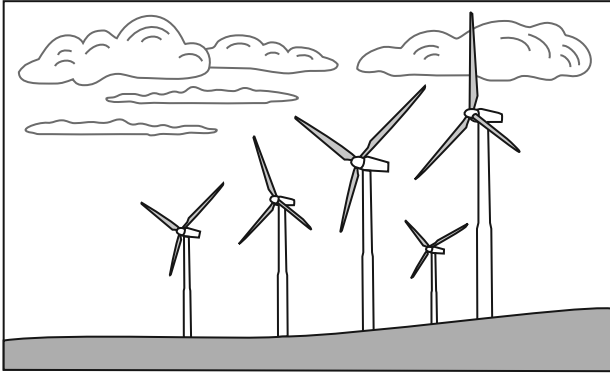
Stages in an Ecosystem

A Forest	B Charred stumps	C Young evergreens and shrubs	D Grasses and shrubs

After a forest fire, what is the most likely order in which these stages appeared?

- (1) $D \rightarrow C \rightarrow A \rightarrow B$
- (2) $B \rightarrow D \rightarrow C \rightarrow A$
- (3) $A \rightarrow B \rightarrow C \rightarrow D$
- (4) $B \rightarrow C \rightarrow D \rightarrow A$

- 27 A ski resort installed a wind turbine similar to those represented below to supply some of its energy needs.



This turbine was most likely installed because wind power is

- (1) renewable and does substantial damage to the atmosphere
- (2) renewable and does minimal damage to the atmosphere
- (3) nonrenewable and does substantial damage to the atmosphere
- (4) nonrenewable and does minimal damage to the atmosphere

- 28 Which activity would reduce biodiversity in a forest ecosystem?
- (1) adding plants that are naturally resistant to insects
 - (2) protecting wildflowers from logging activities
 - (3) replacing harvested trees with young trees that are naturally found in the forest
 - (4) clearing a large area and planting one species of hardwood tree that can be used for lumber

- 29 An increase in the amount of ultraviolet light entering the atmosphere through holes in the ozone layer will most likely
- (1) reduce the rate of photosynthesis in fungi
 - (2) result in rapid recycling of finite resources
 - (3) prevent animal migration
 - (4) cause an increase in the rate of certain mutations

- 30 Many scientists suggest that billions of years ago, life on Earth began with
- (1) simple, single-celled organisms
 - (2) simple, multicellular organisms
 - (3) complex, single-celled organisms
 - (4) complex, multicellular organisms

Part B-1

Answer all questions in this part. [13]

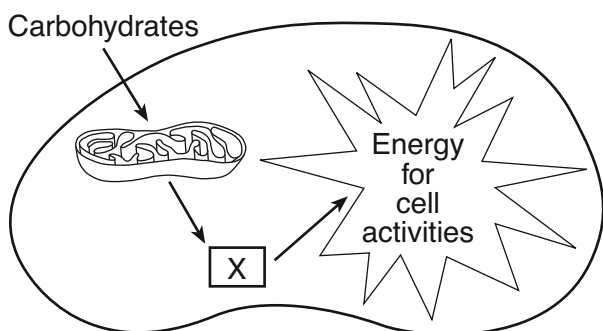
Directions (31–43): For *each* statement or question, record on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

Base your answers to questions 31 and 32 on the information below and on your knowledge of biology.

Diabetes is a condition characterized by elevated blood sugar levels. One form of diabetes occurs when insulin fails to properly regulate blood sugar levels. Complications from diabetes can include nerve cell damage and poor blood flow, especially in the feet and legs. In individuals with diabetes, wounds usually take longer than normal to heal.

- 31 The failure of a cell to react in a normal manner to insulin is most likely the result of a problem with
- | | |
|---------------|------------------|
| (1) vacuoles | (3) mitochondria |
| (2) receptors | (4) sugars |
- 32 One reason for the change in wound healing time in a diabetic is that
- (1) elevated hormone levels block the synthesis of glucose in immune cells
 - (2) nerve damage increases absorption of glucose by healthy cells
 - (3) poor circulation reduces the supply of nutrients and oxygen to the cells
 - (4) decreased enzyme production slows protein synthesis in pancreatic cells

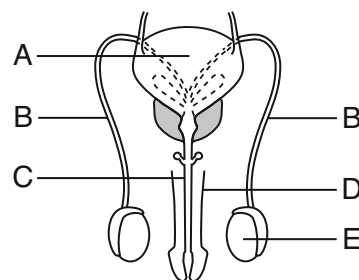
33 The diagram below represents a series of events that occur in living cells.



Which molecule is indicated by X?

- | | |
|-------------|--------------------|
| (1) glucose | (3) carbon dioxide |
| (2) ATP | (4) protein |

Base your answers to questions 34 and 35 on the diagram below and on your knowledge of biology. The letters in the diagram indicate structures present in a human male.

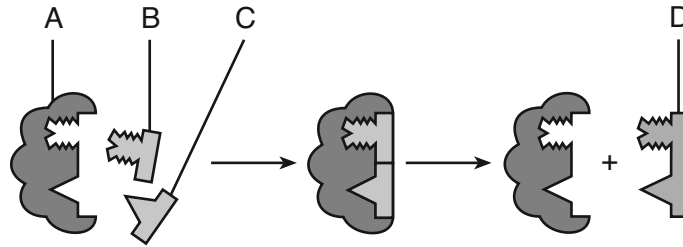


- 34 Which structure produces the male hormone responsible for characteristics such as muscle development, deep voice, and gamete production?
- | | |
|-------|-------|
| (1) A | (3) E |
| (2) B | (4) D |
- 35 What change would occur immediately if both structures labeled B were damaged or blocked?
- (1) Structure A would decrease in size.
 - (2) The blood supply to structure E would decrease.
 - (3) Gametes would no longer be transported to structure C.
 - (4) Structure D would be able to deliver more gametes.

36 Which term refers to the ecological niche of many bacteria and fungi in an ecosystem?

- | | |
|----------------|---------------|
| (1) decomposer | (3) producer |
| (2) herbivore | (4) scavenger |

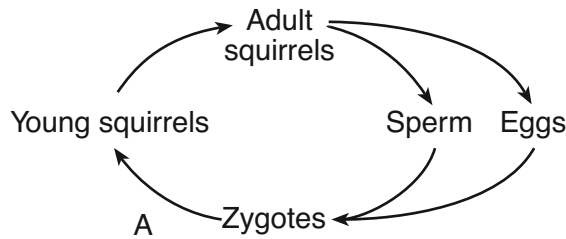
37 The diagram below represents a model of a biological process that occurs in humans at normal body temperature, 37°C.



Increasing body temperature to 40°C would interfere most directly with the rate of function of structure

- (1) A
- (2) B
- (3) C
- (4) D

Base your answers to questions 38 and 39 on the diagram below and on your knowledge of biology. The diagram represents the reproductive cycle of a squirrel species with 40 chromosomes in each zygote.



38 A process that could be represented by A is

- (1) fertilization
- (2) meiosis
- (3) mitosis
- (4) mutation

39 A liver cell in this species of squirrel would have

- (1) 20 chromosomes
- (2) 40 chromosomes
- (3) 60 chromosomes
- (4) 80 chromosomes

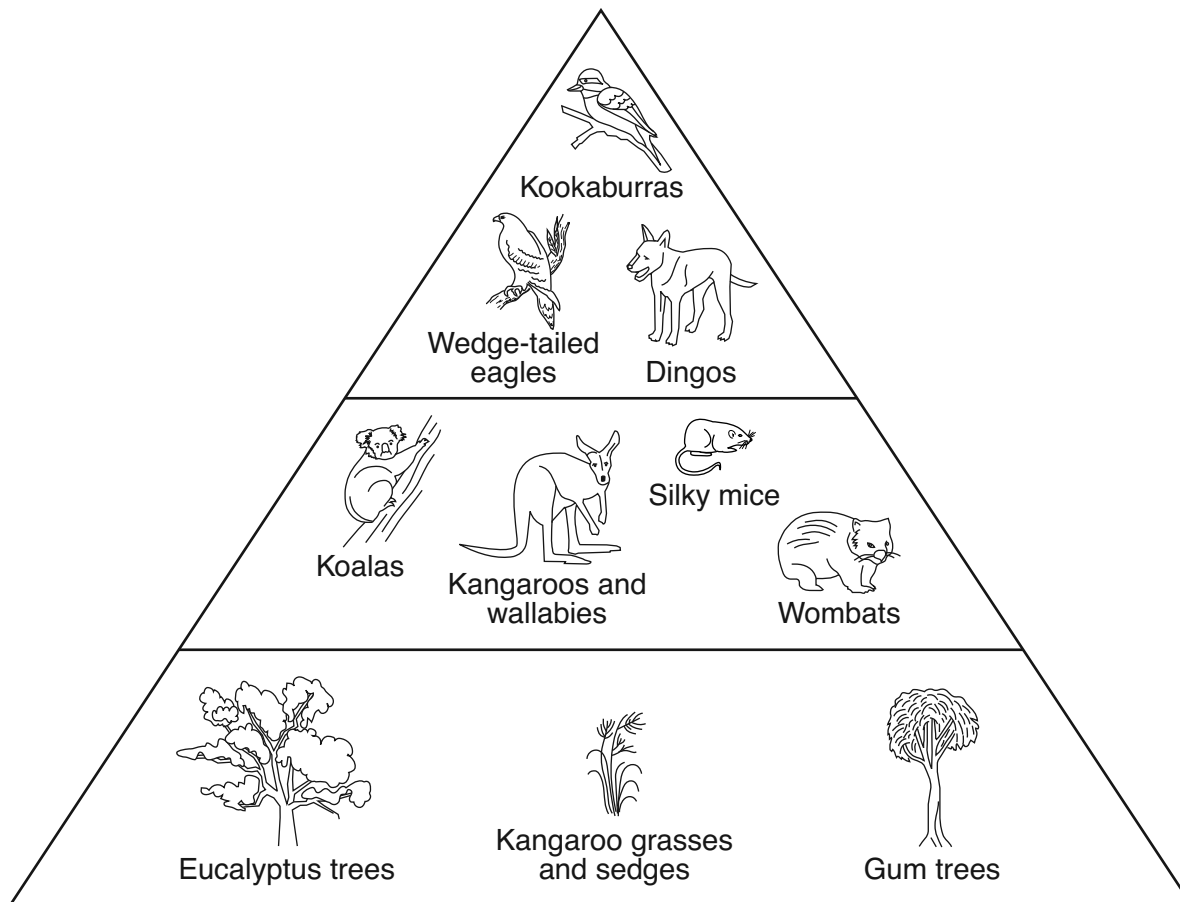
40 A sample of body cells and samples of sex cells received from four members of a species are screened for the presence of a specific gene mutation. The results of the gene-testing procedure conducted on the cells are shown in the table below.

Species Member Tested	Type of Cells Tested and the Result (+ = mutation present, - = mutation absent)		
	Body Cells	Sperm	Egg
1	+		+
2	+	+	
3	-		+
4	+	-	

Which species member would be *unlikely* to pass the gene mutation on to its offspring?

- (1) 1
- (2) 2
- (3) 3
- (4) 4

Base your answers to questions 41 through 43 on the diagram below and on your knowledge of biology. The diagram represents an energy pyramid for an ecosystem in the Australian outback.



41 Wombats are classified as herbivores because they can

- (1) get energy from the Sun
- (2) provide energy for the kookaburras
- (3) get nutrition from the grasses and sedges
- (4) provide nutrition for the kangaroos

42 Which two organisms could have a predator-prey relationship?

- (1) kookaburras and gum trees
- (2) kangaroos and silky mice
- (3) dingos and kangaroo grasses
- (4) wedge-tailed eagles and wombats

43 Dingos are an introduced species in Australia that are outcompeting many native species. Which of the current environmental problems most likely resulted directly from the introduction of dingos to Australia?

- (1) vanishing of kangaroo grasses
 - (2) near extinction of wallabies
 - (3) forests overrun with koalas
 - (4) increase in the kookaburra population
-

Part B-2

Answer all questions in this part. [12]

Directions (44–55): For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes each statement or answers each question. For all other questions in this part, follow the directions given and record your answers in the spaces provided in this examination booklet.

Base your answers to questions 44 through 48 on the information and data table below and on your knowledge of biology.

Daphnia (water fleas) are sensitive to many changes in pond ecosystems. For this reason they are often used in bioassays, tests in which organisms are exposed to various levels of a chemical to determine what levels are safe. The results of these tests determine whether or not the chemical being tested will affect other pond organisms.

An experiment was designed to determine the toxicity of different salt solutions on cultures of daphnia. Five fish tanks were each filled with the same amount of water containing different concentrations of salt. Ten daphnia were placed into each tank. After 48 hours, the number of daphnia that had survived and the number of daphnia that had died in each tank were recorded and the percent mortality was calculated. The results of the experiment are shown in the data table below.

Effect of Salt Concentration on Daphnia After 48 Hours

Salt Concentration (g/L)	Number that Survived	Number that Died	Mortality (%)
0.63	8	2	20
1.25	7	3	30
2.5	10	0	0
5.0	3	7	70
10.0	0	10	100

Directions (44–46): Using the information in the data table, construct a line graph on the grid on the next page, following the directions below.

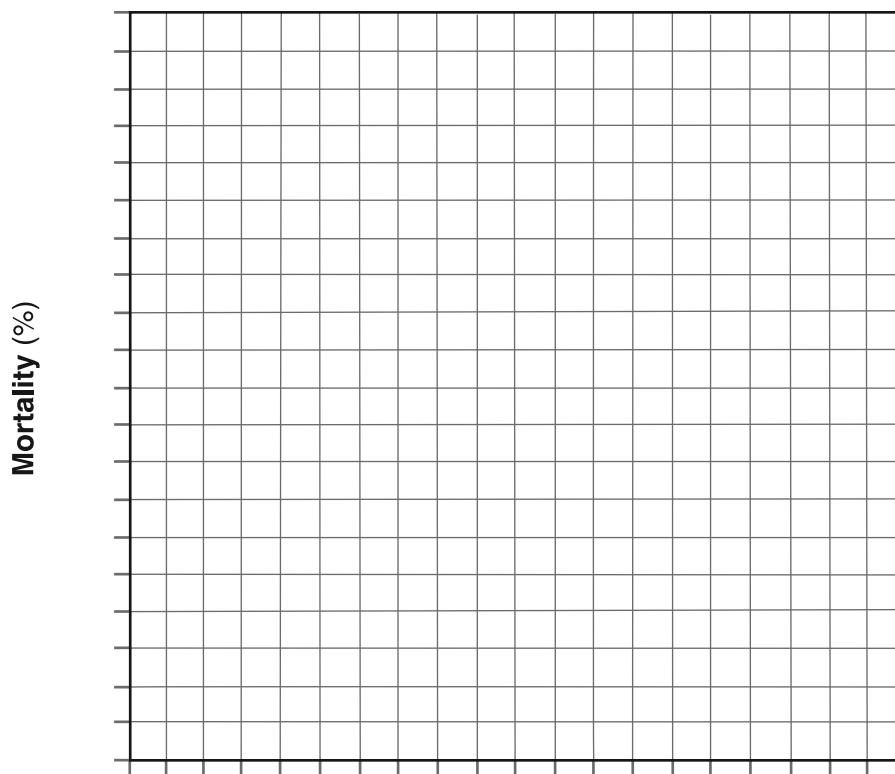
44 Label the x -axis. Be sure to include units. [1]

45 Mark an appropriate scale, without any breaks, on each axis. [1]

46 Plot the data for mortality on the grid. Surround each point with a small circle and connect the points. [1]



**Effect of Salt Concentration on Daphnia
After 48 Hours**



Note: The answer to question 47 should be recorded on your separate answer sheet.

47 Which salt concentration was most toxic to the daphnia in this experiment?

- (1) 1.25 g/L
- (2) 2.5 g/L

- (3) 5.0 g/L
- (4) 10.0 g/L

48 Which salt concentration is most likely closest to the concentration of salt found in the natural environment of this species of daphnia? Support your answer. [1]

Salt concentration: _____ g/L

Base your answers to questions 49 through 51 on the information below and on your knowledge of biology.

Beware of Dust Mites



Quietly lurking within our mattresses, under our beds, and inside sofas and carpets are creatures too small to be seen without a microscope. Dust mites are arthropods closely related to spiders, scorpions, and ticks. They feed on the dead skin cells regularly shed by humans and their animal pets. The average human sheds about 10 grams of dead skin a week. Cats and dogs create even more dander for dust mites to eat. The mites also eat pollen, fungi, and bacteria. They do not drink water but absorb it from the air.

Dust mites do not carry diseases and are harmless to most people. It's their bathroom habits that make some of us itch and sneeze. Many people develop severe allergies to dust mite feces (wastes). If you lie on a rug where dust mites live, you might develop itchy red bumps on your skin. Breathe in dust containing their feces and you might have more serious symptoms, such as difficulty breathing or a severe asthma attack.

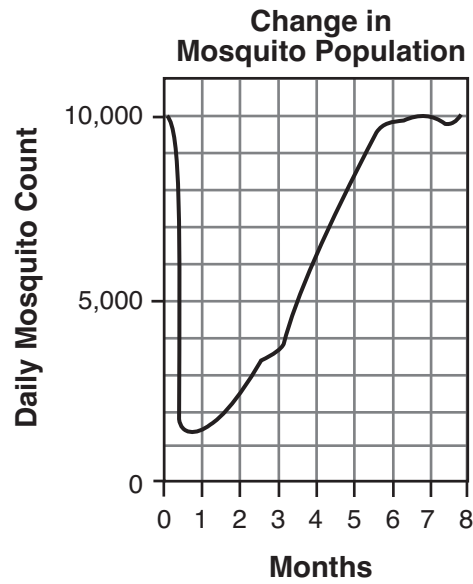
Dust mites thrive in warm, humid environments — eating and nesting in dust-collecting bedding, fabric, and carpet. Think about this! A typical mattress can contain anywhere from 100,000 to 10 million dust mites. Nearly 100,000 dust mites can live in one square yard of carpet.

During a process called sensitization, a person's immune system mistakenly identifies the inhaled dust mite waste as an invader. The next time the person is exposed to the dust mite waste, the immune system launches an allergic reaction.

Note: The answers to questions 49 and 50 should be recorded on your separate answer sheet.

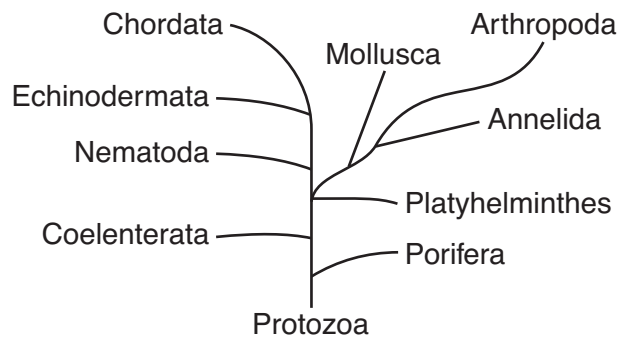
- 49 The immune system of an individual who is allergic to dust mite waste produces
- (1) specialized chemicals that mark dust mite waste for destruction
 - (2) viruses that combat dust mites
 - (3) white blood cells that attack human skin cells
 - (4) white blood cells that attack the skin cells of cats and dogs
- 50 An allergic reaction occurs when the immune system
- (1) does not respond to pathogens
 - (2) maintains homeostasis
 - (3) responds to usually harmless environmental substances
 - (4) undergoes rapid, uncontrolled cell division
- 51 State *one* way, other than using a pesticide, that an individual could *decrease* the number of dust mites present in his home. [1]

52 A small village that is heavily infested with mosquitoes was sprayed with an insecticide once a week for several months. Changes in the size of the mosquito population are shown in the graph below.



State *one* way that the population of mosquitoes present 7 months after spraying differs genetically from the population of mosquitoes present before the spraying began. [1]

53 The diagram below shows a branching “tree” representing the evolution of ten different groups of organisms alive today.

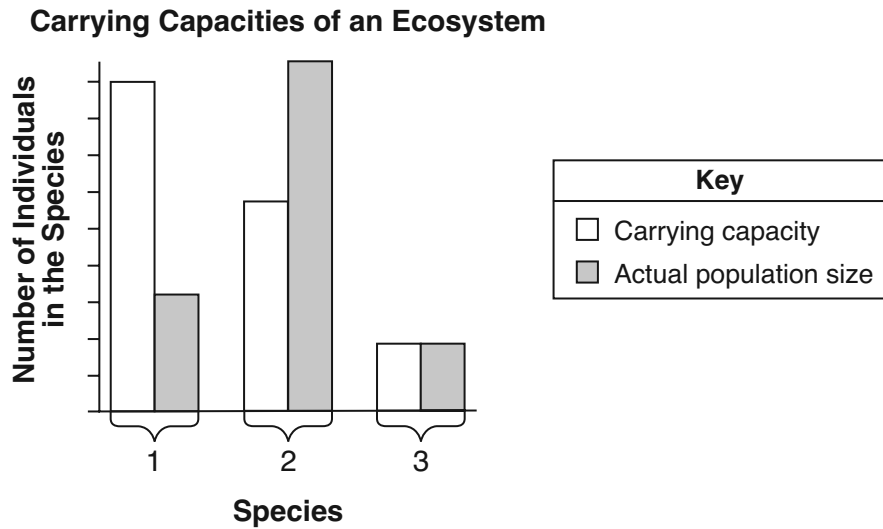


Identify the group of organisms that is most closely related to the Arthropoda group. Support your answer. [1]

Group of organisms: _____

Base your answers to questions 54 and 55 on the information and graph below and on your knowledge of biology. The graph contains information about an ecosystem.

The graph below shows the carrying capacities of an ecosystem for three different species, 1, 2, and 3, that inhabit an area and the actual population sizes of these three different species in the area.



54 Identify which species population would most likely have the greatest competition among its members. Support your answer using information from the graph. [1]

Species number: _____

55 Explain how an ecosystem can have three different carrying capacities. [1]

Part C

Answer all questions in this part. [17]

Directions (56–72): Record your answers in the spaces provided in this examination booklet.

Base your answers to questions 56 through 60 on the information below and on your knowledge of biology.

A chemical known as fertex affects external fertilization of sea urchin eggs. An experiment was set up using three tanks to investigate the effect of fertex. Each tank had a different concentration of fertex: 1%, 2%, and 3%. Ten sea urchin eggs and 2 mL of sea urchin sperm were added to each of the three tanks. A fourth tank was set up as a control.

56 State *one* way the contents of the control tank would differ from the contents of the three experimental tanks. [1]

57 Identify *two* factors that must be kept the same in all four tanks. [1]

Factor 1: _____

Factor 2: _____

58 State *one* way to improve the validity of the experimental results. [1]

59 Identify the independent variable in the experiment. [1]

60 State *one* example of the type of data that should be collected during the experiment. [1]

Base your answer to question 61–63 on the information below and on your knowledge of biology.

61–63 In order to enroll in most schools, students must be vaccinated against certain viral diseases, such as mumps. Even with these vaccinations, many students still suffer from other diseases. Discuss how a vaccination works and why some students still become infected with other diseases. In your answer, be sure to:

- identify what is present in a vaccine that stimulates an immune response [1]
- describe how a vaccine protects against disease [1]
- state why a student vaccinated against mumps can still be infected by the pathogens that cause other diseases, such as chicken pox [1]

64 Recently, the bison population in Yellowstone National Park declined significantly. This was due in part to a particularly harsh winter. State *one* reason why a harsh winter would have this negative effect on the bison population. [1]

65 People who live in rural areas often use septic tanks for the storage of sewage. These people often flush a product containing harmless bacteria down the toilet once a month. These bacteria break down the sewage before it enters the environment. State *one* ecologically sound reason for this action. [1]

Base your answer to question 66–68 on the information below and on your knowledge of biology.

Officials OK Insect Release To Control Invasive Vine

The U.S. federal government has approved the release of a non-indigenous [nonnative] insect on Guam and in the Northern Marianas to control the rapid spread of a vine that is covering forests like a blanket, the *Saipan Tribune* reports.

The U.S. Department of Agriculture has given the green light to breed and release the *Heteropsylla spinulosa* insect, which eats the *Mimosa dilotricha* [*diplotricha*] vine. The fast-spreading plant is found in many Pacific Islands, but is particularly widespread in the Northern Marianas and on Guam. It usually kills the trees and shrubs that it covers.

Officials will collect the insect from Pohnpei, in the Federated States of Micronesia, Palau and Australia.

Source: "Officials OK Insect Release To Control Invasive Vine," 4/2/08, www.saipantribune.com

66–68 Discuss the advantages of using the insect to control the rapid spread of the *Mimosa diplotricha* vine on Guam and the Northern Marianas. In your answer, be sure to:

- state *one* possible way the *Mimosa diplotricha* vine kills trees and shrubs [1]
- identify *one* location from which the *Heteropsylla spinulosa* insect will be collected [1]
- explain why releasing the insect might be safer than spraying chemicals to kill the vine [1]

Base your answer to question 69–72 on the information below and on your knowledge of biology.

Chickens as Drug Factories

Scientists in Scotland have successfully produced five generations of chickens that lay eggs containing certain protein-based drugs. The scientists changed the DNA of the chickens so that two drugs, one used to treat skin cancer and the other used to treat multiple sclerosis, were present in the egg whites. Cows, sheep, and goats have already been altered to produce protein-based drugs in their milk. Chickens are considered good “drug factories” because they are inexpensive to care for, they grow fast, and their chicks inherit the special drug-producing ability.

69–72 Explain why scientists altered the DNA of the chickens instead of altering a protein already present in the chickens. In your answer, be sure to:

- identify the technique used to alter the DNA [1]
- state *one* reason why the scientists altered the DNA of the chickens instead of altering a protein already present in the chickens [1]
- state *one* advantage of using chickens for this procedure [1]
- state *one* reason why some people might *not* support this method of drug production [1]

Part D

Answer all questions in this part. [13]

Directions (73–85): For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes each statement or answers each question. For all other questions in this part, follow the directions given and record your answers in the spaces provided in this examination booklet.

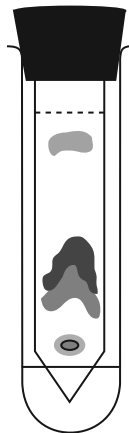
Note: The answer to question 73 should be recorded on your separate answer sheet.

73 Certain chemicals, such as cytochrome C, are found within cells of all living organisms. The biochemical structure of cytochrome C in ground finches and in tree finches is very similar. This suggests that tree finches and ground finches have

- (1) identical DNA
- (2) a common ancestor
- (3) evolved at the same time
- (4) the same nesting site

Note: The answer to question 74 should be recorded on your separate answer sheet.

74 The diagram below represents the results of a laboratory procedure.

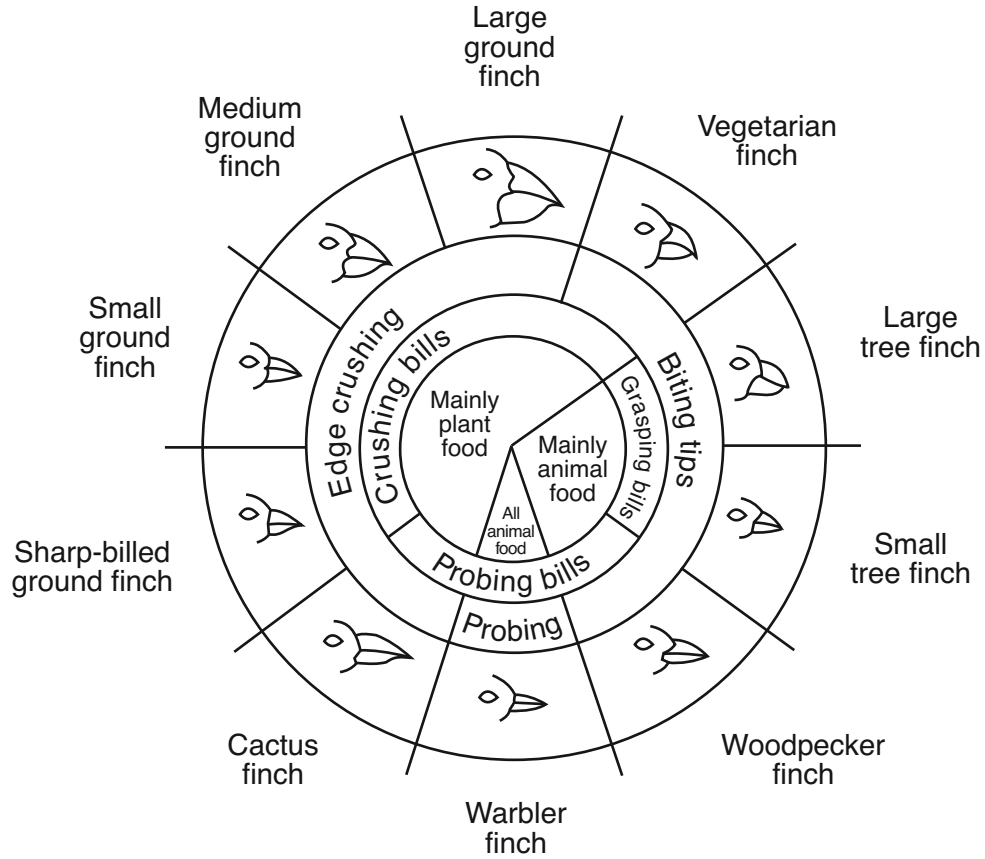


This procedure is used to

- (1) separate molecules in a liquid mixture
- (2) determine the rate of photosynthesis in plants
- (3) detect glucose in a solution
- (4) examine the gene sequences of organisms

Base your answers to questions 75 through 77 on the diagram below and on your knowledge of biology.

Variations in Beaks of Galapagos Islands Finches



from: *Galapagos: A Natural History Guide*

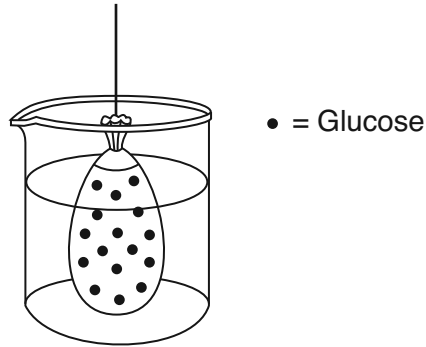
Note: The answers to questions 75 and 76 should be recorded on your separate answer sheet.

- 75 Which species of finch has an edge-crushing bill that can also probe into plants for food?
- | | |
|-------------------------------|------------------------|
| (1) cactus finch | (3) warbler finch |
| (2) sharp-billed ground finch | (4) large ground finch |
- 76 One finch that would most likely compete with the warbler finch for food is the
- | | |
|----------------------|-------------------------------|
| (1) woodpecker finch | (3) sharp-billed ground finch |
| (2) cactus finch | (4) vegetarian finch |
- 77 The large ground finch, sharp-billed ground finch, and small tree finch inhabit the same island. If the insect population decreases, which finch would most likely be affected? Support your answer. [1]

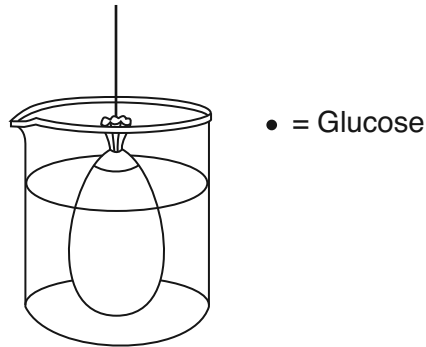
Finch: _____

Base your answers to questions 78 and 79 on the information below and on your knowledge of biology.

An artificial cell filled with a glucose solution was placed in a beaker of water, as represented below. The beaker was left undisturbed for 20 minutes.



78 In the diagram below, draw in the expected location of the glucose molecules after 20 minutes. [1]



79 If both glucose and starch were added to the artificial cell, where would the starch be located after 20 minutes? [1]

80 State *one* advantage of using a stain to study frog skin cells with a microscope. [1]

Note: The answer to question 81 should be recorded on your separate answer sheet.

- 81 An experiment was designed to test whether students could squeeze a clothespin more times in 1 minute after resting or after exercising. What would be a hypothesis for the experiment?
- (1) Do students squeeze clothespins more often in 1 minute after exercising?
 - (2) Can most students squeeze a clothespin more times after they rest?
 - (3) Ten students who exercise before squeezing a clothespin squeezed it more times in 1 minute than ten students who rested first.
 - (4) Students who rest before squeezing a clothespin will squeeze it fewer times in 1 minute than students who exercise beforehand.

Note: The answer to question 82 should be recorded on your separate answer sheet.

- 82 DNA samples can be separated according to size using the technique of
- (1) chromatography
 - (2) electrophoresis
 - (3) replication
 - (4) dissection

Base your answers to questions 83 through 85 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

83 Complete the missing amino acid sequences for plant species A in the table below. [1]

84 Complete the missing mRNA base sequences for plant species B in the table below. [1]

Plant Species Table

Endangered plant species	DNA base sequence	AAT	CCG	AGT	GGA
	mRNA base sequence	UUA	GGC	UCA	CCU
	amino acid sequence	LEU	GLY	SER	PRO
Plant species A	DNA base sequence	AAC	CCA	AGT	GGA
	mRNA base sequence	UUG	GGU	UCA	CCU
	amino acid sequence	_____	_____	_____	_____
Plant species B	DNA base sequence	ATA	CCC	AGG	GGA
	mRNA base sequence	_____	_____	_____	_____
	amino acid sequence	TYR	GLY	SER	PRO
Plant species C	DNA base sequence	CAT	CCT	ATA	GGA
	mRNA base sequence	GUA	GGA	UAU	CCU
	amino acid sequence	VAL	GLY	TYR	PRO

85 Based on the information provided in the completed table, which plant species is most closely related to the endangered species? Support your answer. [1]

Species: _____
