

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

LIVING ENVIRONMENT

Wednesday, January 27, 2016 — 9:15 a.m. to 12:15 p.m., only

Student Name _____

School Name _____

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

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.

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 Bacteria and humans are similar in that they both
 - (1) contain genetic material
 - (2) are single-celled
 - (3) lack cell organelles
 - (4) carry out autotrophic nutrition
- 2 Which cell structure is mainly responsible for releasing energy from food molecules in some single-celled organisms?
 - (1) ribosome
 - (2) chloroplast
 - (3) cell membrane
 - (4) mitochondrion
- 3 During gas exchange, the cell membrane of a single-celled organism has the same function as which organ system in humans?
 - (1) nervous
 - (2) reproductive
 - (3) digestive
 - (4) respiratory
- 4 An ecosystem is self-sustaining as long as organisms have sufficient quantities of energy, oxygen, minerals, and water. When organisms die, some of these materials are recycled back to plants in the ecosystem primarily through the activity of
 - (1) predators
 - (2) decomposers
 - (3) pathogens
 - (4) parasites
- 5 Which sequence represents structures organized from least complex to most complex?
 - (1) nerve cell → nucleus → nervous system → brain
 - (2) nucleus → nerve cell → brain → nervous system
 - (3) brain → nervous system → nucleus → nerve cell
 - (4) nervous system → brain → nerve cell → nucleus
- 6 Which group consists entirely of organic molecules?
 - (1) protein, oxygen, fat
 - (2) protein, starch, fat
 - (3) water, carbon dioxide, oxygen
 - (4) water, starch, protein
- 7 A scientist plans to cut a segment of DNA so that it can be inserted into the DNA of a bacterium, a single-celled organism. The scientist needs to use a special type of organic molecule to perform this cutting process. This molecule is
 - (1) a lipid
 - (2) a carbohydrate
 - (3) an enzyme
 - (4) a hormone
- 8 A finite resource in the environment that keeps a population from steadily increasing is known as
 - (1) dynamic equilibrium
 - (2) a limiting factor
 - (3) a reproductive enzyme
 - (4) ecological succession
- 9 Human reproduction usually involves
 - (1) internal fertilization and internal development
 - (2) external fertilization and external development
 - (3) internal fertilization and external development
 - (4) external fertilization and internal development
- 10 Even though human proteins are synthesized from only 20 different amino acids, there are thousands of different proteins found in human cells. This great variety of proteins is possible because the
 - (1) size of a specific amino acid can vary within a protein
 - (2) chemical composition of a specific amino acid can vary
 - (3) sequence and number of amino acids can be different in each protein
 - (4) same amino acid can have many different properties

- 11 Aphids, small insects that feed on the sap of plants, undergo asexual reproduction during the summer months. They produce eggs that are formed without the separation of chromosomes. These eggs do not need to be fertilized, and all of the resulting offspring are female.

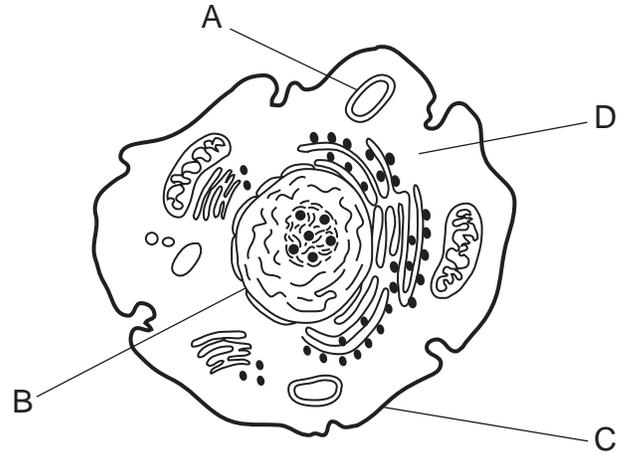


Source: http://www.bbc.co.uk/nature/adaptations/Asexual_reproduction

The best explanation for all of these offspring being female is that

- (1) there is not enough food to support male aphids
 - (2) asexual reproduction produces offspring with many mutations
 - (3) only the females are able to feed on the sap of the plants
 - (4) asexual reproduction produces offspring that are genetically identical to the parent
- 12 Potato farmers in Ireland during the mid 1800s all grew the same type of potato. The potato plants were all produced as clones of one another. When a fungus infected the crop, all of the potatoes were destroyed. This occurred because these potato plants
- (1) had little genetic variability
 - (2) had increased biodiversity
 - (3) were the product of fertilization
 - (4) were the result of biotechnology

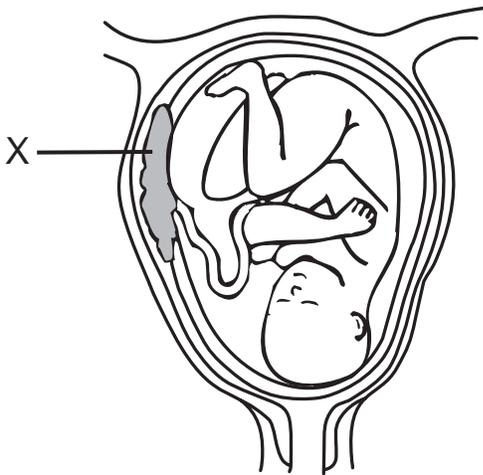
- 13 A cell is represented in the diagram below.



The coded information that the cell uses to synthesize many different proteins is stored in structure

- (1) A
 - (2) B
 - (3) C
 - (4) D
- 14 Wildflowers grow and reproduce during the spring snowmelt in the desert region of Death Valley, California. Which environmental factor would most likely have the greatest influence on these activities?
- (1) percentage of nitrogen in the atmosphere
 - (2) number of plant species in the area
 - (3) variety of scavengers in the ecosystem
 - (4) amount of time that water is present
- 15 Which statement best describes how a major change in the size of one population affects an ecosystem?
- (1) It will immediately affect every population and the physical conditions.
 - (2) It will affect the physical conditions, but not the other populations.
 - (3) It could directly or indirectly affect the physical conditions and any population.
 - (4) It affects every population, not the physical conditions.

16 The diagram below represents a stage in the development of a fetus.



A major function of structure X is to

- (1) produce gametes by meiosis
- (2) protect the fetus from physical injury
- (3) exchange materials between the mother and the fetus
- (4) store food to provide the fetus with nutrients

17 Which statement is most likely correct regarding soil bacteria that inhabit the polar regions of Earth?

- (1) They do not carry out the process of respiration.
- (2) They contain enzymes that function at low temperatures.
- (3) They are part of the abiotic resources of that ecosystem.
- (4) They do not reproduce.

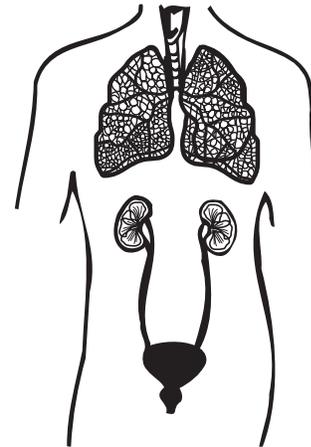
18 Some plants increase in height due to changes in specialized regions of cells in the tips of their branches. The processes that result in these changes include

- (1) meiosis, cell growth, and cloning
- (2) mitosis, zygote formation, and cloning
- (3) meiosis, gamete formation, and differentiation
- (4) mitosis, cell growth, and differentiation

19 The hormone adrenaline can affect only cells with

- (1) appropriately shaped receptors
- (2) the appropriate antibodies
- (3) ribosomes that produce adrenaline
- (4) genes that break down adrenaline

20 The diagram below shows part of the human body with some organs that help to carry out the removal of wastes.



The energy necessary to perform this function comes directly from the

- (1) exchange of H_2O and O_2 during respiration
- (2) blood flowing through the organs
- (3) ATP molecules produced during cellular respiration
- (4) water that is eliminated by the organs

21 In living cells, chemical processes, such as synthesis, all require the action of

- (1) specialized antibiotics
- (2) hormones
- (3) salts
- (4) biological catalysts

22 Plants that live in hot, dry climates have evolved mechanisms to help conserve limited water supplies. One example is the closing of leaf openings by guard cells during the day to decrease water loss from their leaves. This detection of and response to an environmental stimulus is an example of

- (1) a feedback mechanism
- (2) a genetic mutation
- (3) an organ malfunction
- (4) an allergic reaction

23 Which sequence best represents the flow of energy through an ecosystem?

- (1) Sun → green plants → herbivores → carnivores
- (2) Sun → herbivores → producers → consumers
- (3) green plants → carnivores → consumers → herbivores
- (4) consumers → carnivores → herbivores → producers

24 A student set up a small freshwater fish tank. The tank included water, fish, gravel, a snail, and plants, as represented below.



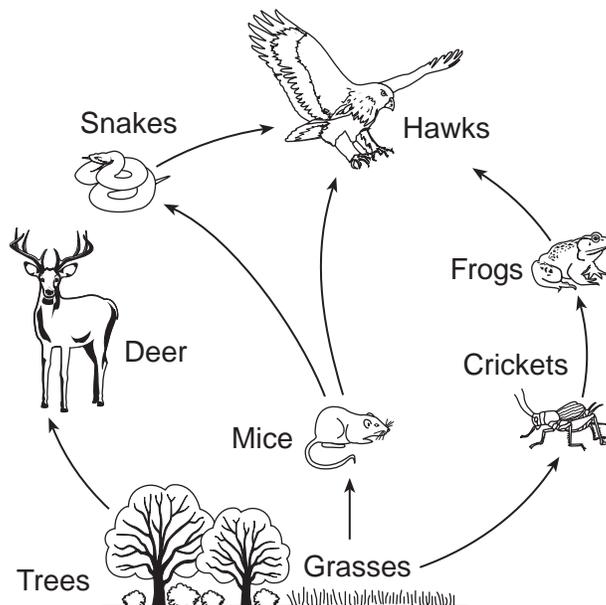
Which statement best describes an activity performed by a student investigating an abiotic factor using this setup?

- (1) He records the temperature of the water.
- (2) He feeds the fish 0.5 gram of fish food twice a day.
- (3) He measures the growth of the plants with a metric ruler.
- (4) He observes the snail scrape algae off the gravel.

25 Which situation is most likely to lead to ecological succession?

- (1) The fish populations in a large lake remain the same for many years.
- (2) Hunters are allowed to hunt wolves, with no limits, for one season.
- (3) The amount of industrialization increased in an area, resulting in the increased burning of fossil fuels.
- (4) A farmer who has planted corn for many years retires, and the field is left abandoned.

26 The diagram below represents interactions that occur between some organisms in an ecosystem.



Which factor would most likely cause an increase in the number of frogs?

- (1) an increase in the number of deer
- (2) a decrease in the amount of grasses
- (3) an increase in the number of snakes
- (4) a decrease in the amount of trees

27 Members of a bird-watching club observed the activities of three species of birds for an entire spring and summer. They noticed that the different species fed at different heights in the same pine tree. Which ecological concept is supported by this observation?

- (1) Organisms that feed on different foods in the same area of an ecosystem fill the same niche.
- (2) Organisms that live in the same ecosystem can occupy different niches in the ecosystem.
- (3) Different species feeding in the same ecosystem will eventually compete with each other, eliminating all the species except one.
- (4) Different species living in the same area of an ecosystem usually have the same physical characteristics.

28 Which factor would be *least* likely to contribute to the development of a new species?

- (1) plentiful resources within the environment occupied by the species
- (2) increased genetic variation within the species
- (3) changes in the environment of the species
- (4) the ability of the species to increase its numbers by sexual reproduction

29 Water pollution as a result of fertilizer runoff from farms is harmful because it initially

- (1) changes the chemical composition of nearby streams and lakes
- (2) adds ozone to the atmosphere, increasing global temperatures
- (3) decreases the water temperature of streams and lakes
- (4) decreases the amount of nutrient recycling in lakes

30 Overfishing has depleted the rich harvests of fish from the oceans. As a solution, a large industry that cultivates shrimp and fish in warm coastal ponds has been developed. To make way for these ponds, mangrove forests are cut down. Local organisms are displaced. In order for people to decide if this new fish farming technology is a good long-term solution, they must consider

- (1) the risks and costs as well as the benefits
- (2) that the mangrove forests would probably die off someday anyway
- (3) that food production is always more important than any other concern
- (4) the number of fish produced in the first year as compared with ocean fishing

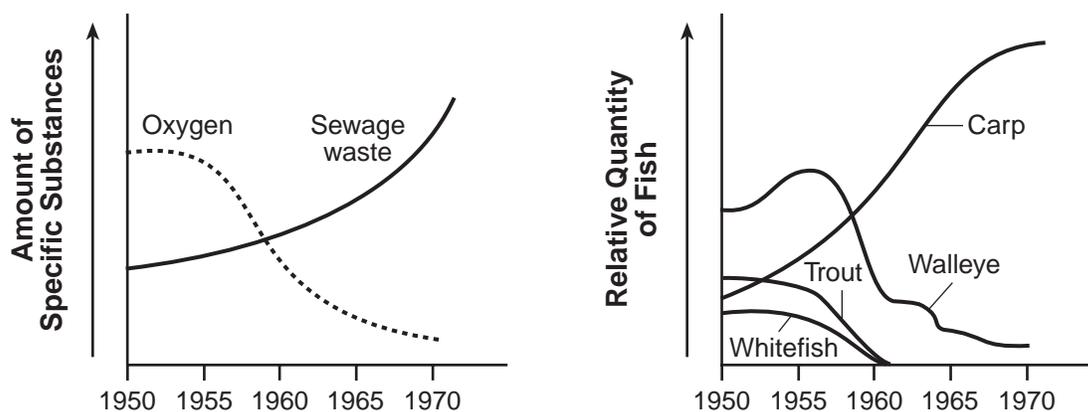
Part B-1

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 graphs below and on your knowledge of biology. The graphs show the effect of sewage (human organic waste) flowing into a lake on the level of dissolved oxygen in the water and the size of different fish populations.

Oxygen Content and Fish Population in a Lake



31 Which statement concerning the oxygen level in the lake can be inferred from the graphs?

- (1) Trout and whitefish require higher oxygen levels than do carp.
- (2) Carp are more sensitive to oxygen levels than are other fish.
- (3) The fish in this lake all require the same amount of oxygen for survival.
- (4) Walleye populations were highest when the oxygen levels were lowest.

32 Which inference can be made from the graphs?

- (1) The increase in sewage waste from 1950 to 1970 was due to a decreasing human population.
 - (2) The decrease in sewage waste shows that the environmental problems associated with land pollution have been solved.
 - (3) Sewage waste is a good source of nutrients for most fish.
 - (4) Increases in sewage waste were responsible for decreasing oxygen levels in the lake.
-

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

The emerald ash borer is an insect that was introduced into North America sometime in the 1990s. It probably arrived in the United States in wooden packing material carried in cargo ships or on airplanes coming from Asia. The ash borer was first reported killing ash trees in Michigan in 2002. Since then, it has spread to Pennsylvania and New York.

Since its arrival, the insect has destroyed tens of millions of trees. One of the ways the ash borer has been able to spread so quickly is through the transport of wood that is infested with their larvae. The USDA has proposed the introduction of Asian wasps to control the ash borer population.

33 The best explanation for the fact the emerald ash borer is not as great a problem in Asia as it is in the United States is that

- (1) there are few natural predators of the ash borer in the United States, while there are many in Asia
- (2) the same pesticides that work in Asia do not work on controlling the ash borer in the United States
- (3) only healthy ash borers arrived in the United States, while many unhealthy ash borers are present in the population in Asia
- (4) the ash borers are not as adapted to the climate in the United States as they are to the one in Asia

34 One action that individuals can take to control the spread of the emerald ash borer is to

- (1) spray all the oak trees at one time with a variety of pesticides
 - (2) plant only trees from Asia in yards and parks
 - (3) plant more ash trees to replace those that are infected
 - (4) use wood from only local sources for heating and for campfires
-

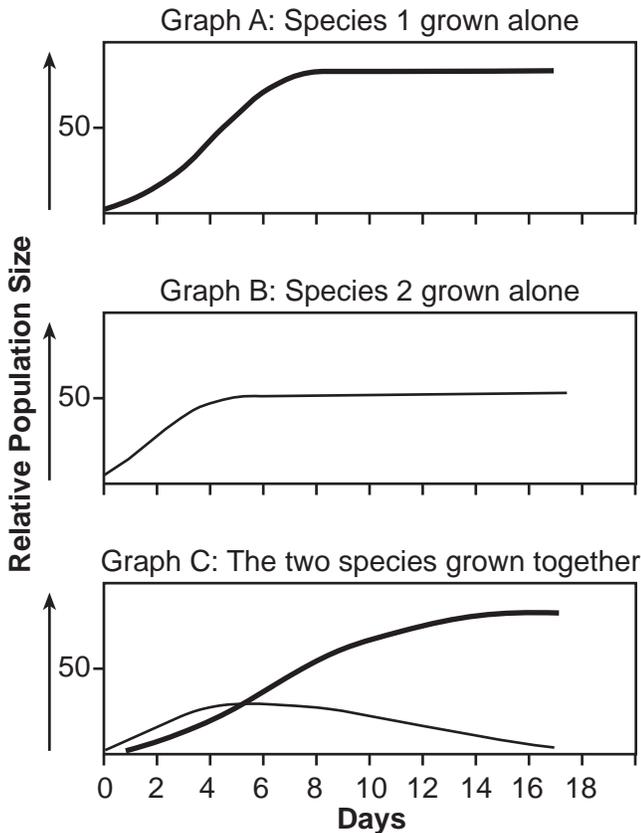
35 A news release about production of farm-raised salmon contains the following information:

- The program is mating targeted fish to concentrate key traits in Atlantic salmon stocks.
- The three-year process includes spawning, tagging, and choice of parent fish.
- The fish are weighed, measured, and monitored to identify those with the best growth rates.
- The project examines the performance of fish to determine which fish to use to produce the next generation.

These statements indicate that the producers are attempting to improve salmon through the use of

- | | |
|--------------------------|------------------------|
| (1) genetic engineering | (3) selective breeding |
| (2) homeostatic feedback | (4) natural selection |

36 The three graphs below show the population changes in two species of single-celled organisms that have been grown separately and together in identical environments.

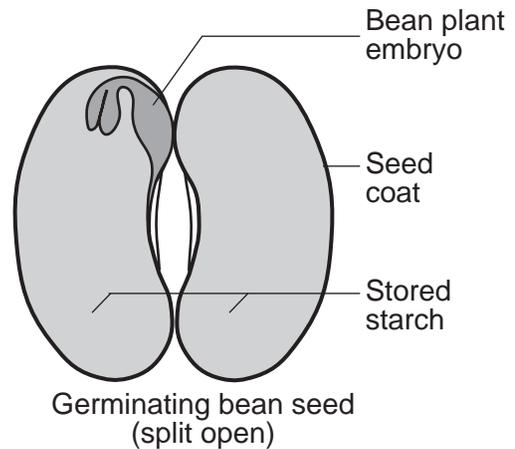


KEY	
Species 1	—————
Species 2	—————

Which term is the most closely associated with the changes in relative population size shown in graph C?

- (1) mutation
- (2) artificial selection
- (3) genetic engineering
- (4) competition

Base your answers to questions 37 and 38 on the diagram and information below and on your knowledge of biology. The diagram represents a germinating bean seed that has been split open.



37 When water is available and growth begins, the plant embryo inside the seed secretes enzymes to digest the starch stored in the seed. The enzymes in cells of the plant embryo are produced directly by the

- (1) ribosomes
- (2) nuclei
- (3) mitochondria
- (4) vacuoles

38 Plants are able to continue to grow and develop once the starch supply in the seed is gone, because they

- (1) develop roots to absorb starch from the environment
 - (2) grow leaves, which use light energy for cell respiration
 - (3) have chloroplasts and use light energy to make more food
 - (4) produce more seeds, which contain additional food reserves
-

Base your answers to questions 39 through 41 on the passage below and on your knowledge of biology.

Blood Doping

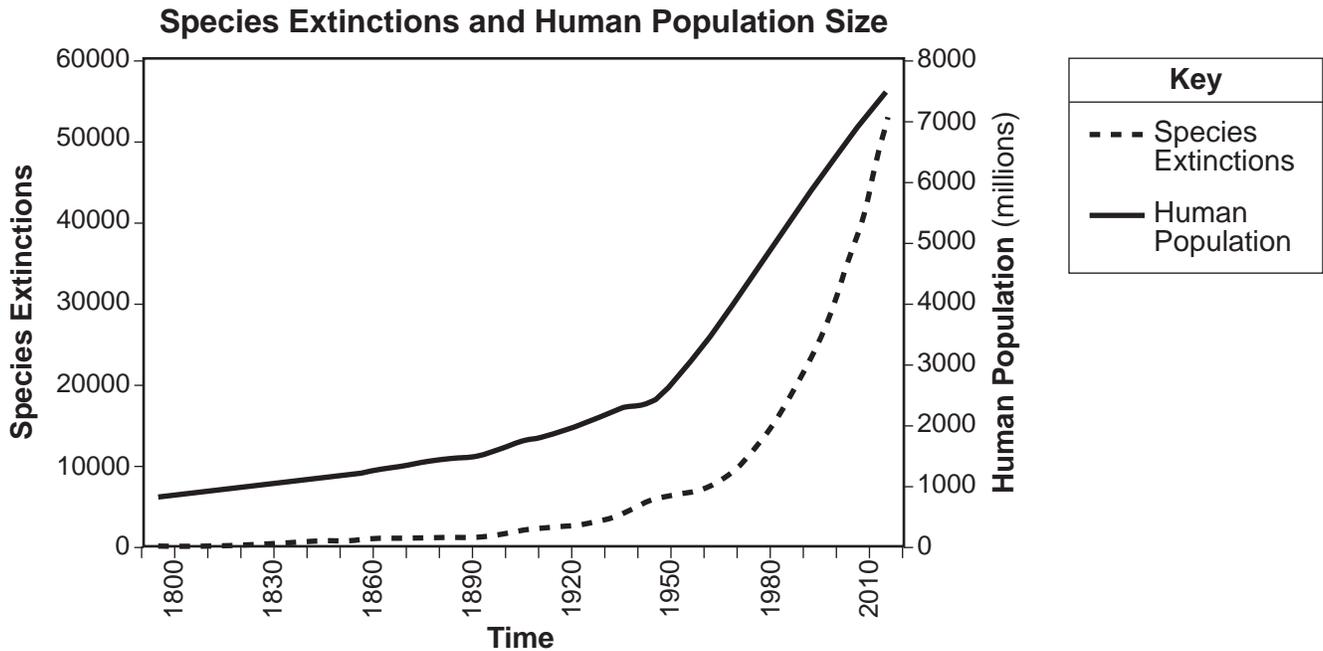
Some athletes who compete in endurance events, such as marathon runners or cyclists, believe that they will be more competitive if they can increase the number of red blood cells in their bloodstreams. One way of increasing the number of red blood cells in an athlete is to engage in blood doping.

Blood doping is an illegal practice in which athletes harvest their own blood months before a competition, isolate the red blood cells, and freeze them. Just before the date of the competition, the blood cells are returned to the athlete's bloodstream. Another type of blood doping involves using donated blood from another person (blood transfusions). In either case, the athlete will have more red blood cells available than competitors who do not engage in blood doping.

Athletes who use their own blood cells to blood dope often become anemic as a result. Anemia is a condition caused by a lack of red blood cells and/or iron in the blood. Iron is a necessary part of the pigment used to carry oxygen to the cells. Athletes who use donated blood to blood dope also run the risk of contracting a blood-borne disease.

- 39 An athlete might believe that there is a benefit to blood doping with red blood cells because it
- (1) could improve the delivery of oxygen to the muscles
 - (2) could increase the amount of training necessary
 - (3) would help to deliver necessary nutrient molecules to the cells
 - (4) would help an athlete to fight disease
- 40 Using blood doping to artificially increase the number of red blood cells in an athlete might lead to a long-term shortage of red blood cells because
- (1) red blood cells could stop being produced by meiosis
 - (2) homeostasis could be disrupted in the athlete
 - (3) red blood cells could attack and destroy the extra red blood cells
 - (4) the athlete would no longer need red blood cells
- 41 An athlete who uses blood from another person for blood doping runs the risk of contracting a blood-borne disease because
- (1) white blood cells are not passed on through blood transfusions
 - (2) blood is tested for pathogens before it is donated
 - (3) pathogens can exist in the blood and be passed on through transfusions
 - (4) iron is a pigment needed to carry oxygen
-

Base your answers to questions 42 and 43 on the graph below and on your knowledge of biology. The graph shows the number of species that have become extinct since 1800. It also shows the change in the size of the human population for the same period of time.



Source: modified from USGS

42 The graph indicates that the number of species that have become extinct

- (1) has increased with increasing human population
- (2) has decreased with increasing human population
- (3) is not affected by the size of the human population
- (4) is greater than the size of the human population

43 The rapid increase in human population between 1960 and 2010 is most likely the direct result of advances in

- (1) medical technology
- (2) space exploration
- (3) communication technology
- (4) marine exploration

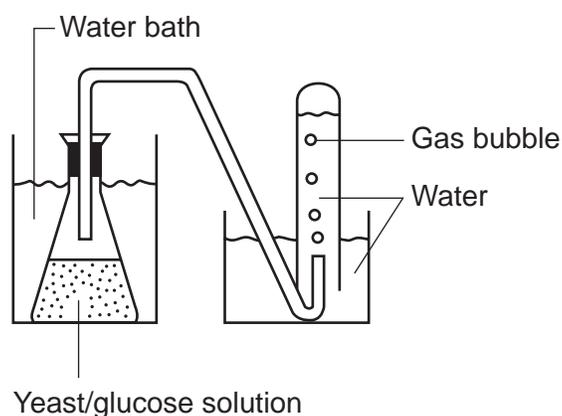
Part B-2

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 47 on the information and data table below and on your knowledge of biology.

The diagram below represents a setup used in an experiment to determine the effect of temperature on fermentation. Fermentation is a type of respiration in yeast that produces alcohol and a gas. Five setups were used. Each was kept at a different temperature. The number of gas bubbles released in each tube was counted and recorded in the data table below.



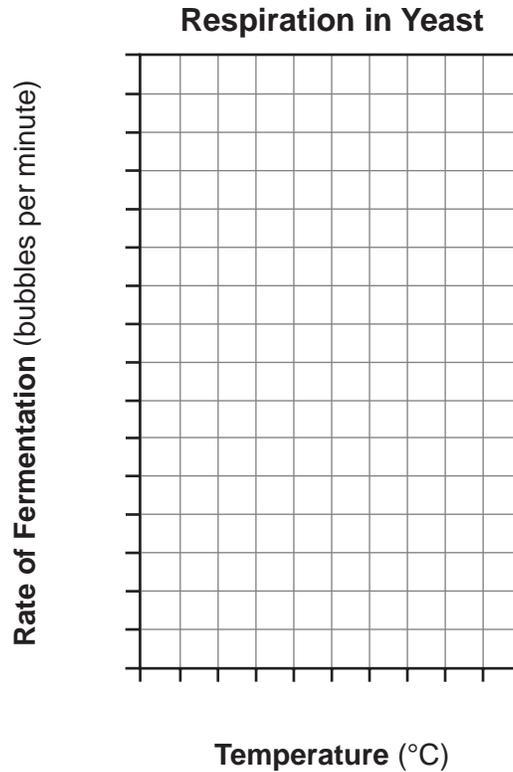
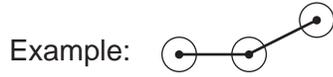
Respiration in Yeast

Temperature (°C)	Rate of Fermentation (gas bubbles per minute)
15	10
20	40
25	70
30	100
35	130

Directions (44–45): Using the information in the data table, construct a line graph on the grid, following the directions below.

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

45 Plot the data, connect the points, and surround each point with a small circle. [1]



46 State the relationship between the rate of fermentation and temperature. [1]

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

47 The number of bubbles produced at 27°C would be approximately

- | | |
|--------|---------|
| (1) 30 | (3) 80 |
| (2) 60 | (4) 110 |

48 The number of amino acid differences in the protein cytochrome c between chimpanzees and some other animals is shown in the table below.

Comparison of Chimpanzee Cytochrome c to that of Other Animals

Animal	Number of Amino Acid Differences
Chimpanzee	0
Dog	8
Dogfish shark	24
Rattlesnake	12
Rhesus monkey	1

Explain how the data in the table can be used to determine possible evolutionary relationships. [1]

Base your answers to questions 49 and 50 on the information below and on your knowledge of biology.

Since 1980, the vulture population in India has declined from 40 million to 60 thousand due to poisoning by a pain reliever used in cattle. If only 1% of the cattle carcasses fed on by vultures are animals that have been treated with the drug, it can lead to a drastic decline in the vulture population. The grim picture is that over 10% of the carcasses have been found to contain this drug.

Vultures feed exclusively on the carcasses of dead animals. This helps to prevent the spread of diseases such as rabies and anthrax among wildlife, livestock, and humans. Without as many vultures present, other scavengers such as dogs have moved in and taken advantage of the newly available food. The abundance of these other scavengers has led to an increase in the number of cases of human rabies and an outbreak of tuberculosis, anthrax, and foot-and-mouth disease. These diseases are not spread to humans by vultures.

Note: The answer to question 49 should be recorded on your separate answer sheet.

- 49 The best explanation for the increase in rabies, anthrax, and other diseases in humans is that the
- (1) decrease in the number of vultures has upset ecosystem stability
 - (2) vulture population is being killed off by an increase in cases of human rabies
 - (3) vultures are changing their feeding role from scavenger to decomposer
 - (4) people are consuming scavengers that have eaten diseased vultures

Note: The answer to question 50 should be recorded on your separate answer sheet.

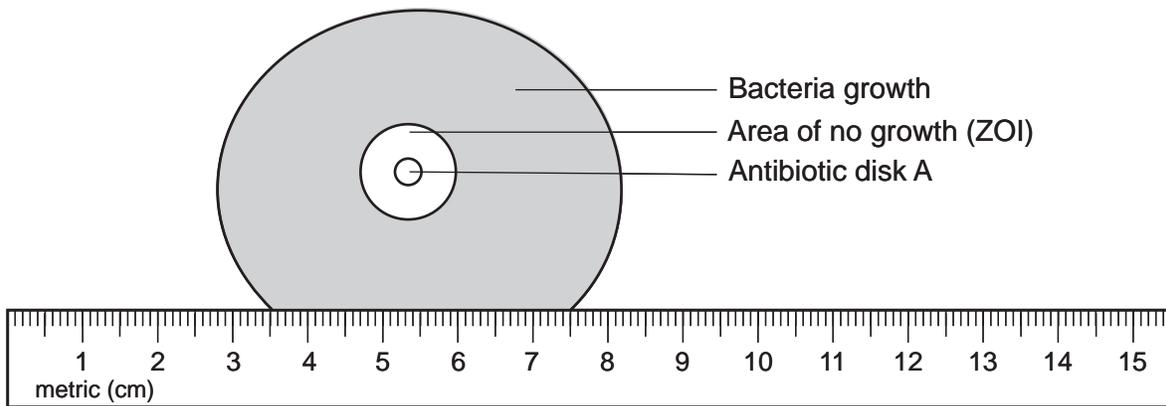
- 50 Dogs can be vaccinated against the rabies virus. When a vaccinated dog is exposed to the rabies virus, the dog will most likely
- (1) develop a mutation that will make the dog sick and the dog will be unable to recover
 - (2) have a damaged immune system and will not be able to be protected
 - (3) have an immune response and will be able to fight the microbes
 - (4) develop a response that will allow the immune system to attack some of the body's own cells
-

Base your answers to questions 51 through 54 on the information below and on your knowledge of biology.

Scientists will often grow bacteria in prepared petri dishes. In some experiments, the petri dish will also contain paper disks soaked in a particular antibiotic. The area where the bacteria do not grow is called the zone of inhibition, or ZOI. The diameter of the ZOI indicates the effectiveness of the antibiotic.

The ZOI data collected by one scientist while trying to determine which disk (A, B, C, or D) is most effective at killing *Streptococcus* bacteria are: Disk D–9 mm, Disk B–8 mm, Disk C–0 mm.

51 Using the metric ruler represented below, determine the diameter in millimeters (mm) of the ZOI for antibiotic disk A shown below. [1]



ZOI Disk A _____ mm

52 Insert the appropriate heading (with units) for the second column in the data table below and record the data from this investigation. [1]

Disk	
A	
	0
D	

53 Which disk is most likely the control for this experiment? Support your answer. [1]

Disk: _____

54 Identify the letter of the most effective antibiotic and explain why you selected that antibiotic. [1]

Letter: _____

Base your answer to question 55 on the information below and on your knowledge of biology.

Termites depend on microbes living in their guts to digest molecules of the large, complex carbohydrate, cellulose. Cellulose is the part of wood termites feed on. The microbes produce a substance called cellulase, which speeds up the breakdown of cellulose into molecules of glucose. Termites cannot make cellulase on their own. Without the help of the microbes, the termites are not able to absorb the nutrients that they need to survive.

55 Explain why the microbes are necessary in order for the termites to absorb nutrients that they need to survive. [1]

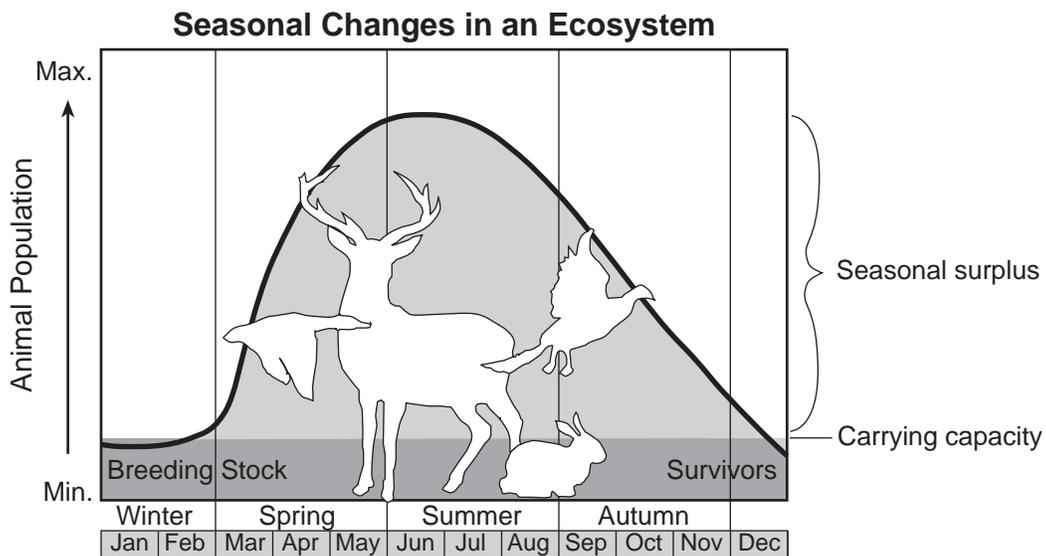
Part C

Answer all questions in this part. [17]

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

56 For many years, health officials had encouraged using antibacterial hand soap. Today, many scientists recommend using hand soap with no added antibacterial substances. State *one* reason why using antibacterial hand soap may no longer be recommended. [1]

Base your answers to questions 57 and 58 on the chart below and on your knowledge of biology. The chart shows seasonal changes in an ecosystem and the overall carrying capacity of the ecosystem.



57 State why the populations decrease between July and December. [1]

58 Explain what is meant by the carrying capacity of a particular population in an ecosystem. [1]

Base your answers to questions 59 through 61 on the information below and on your knowledge of biology.

Solid Waste Management Act of 1988

In the Solid Waste Management Act of 1988, the New York State legislature established our *State Solid Waste Management Policy*. The solid waste management priorities in New York State are:

- (a) first, to reduce the amount of solid waste generated;
- (b) second, to reuse material for the purpose for which it was originally intended or to recycle material that cannot be reused;
- (c) third, to recover, in an environmentally acceptable manner, energy from solid waste that can not be economically and technically reused or recycled; and
- (d) fourth, to dispose of solid waste that is not being reused, recycled or from which energy is not being recovered, by land burial or other methods approved by the department.

59 State *one* specific benefit increased recycling efforts would have on the environment in New York State. [1]

60 Identify *one* factor that would hinder recycling efforts within a community and state how it could be corrected. [1]

Factor: _____

Correction: _____

61 State *one* community action, other than recycling, that could be implemented to address one part of the Solid Waste Management Act of 1988 and explain how this action would improve the environment of the community. [1]

Community Action: _____

Improvement: _____

Base your answers to questions 62 and 63 on the information below and on your knowledge of biology.

Guppies are small, tropical freshwater fish that display wide variation in coloration. Some have bright splotches of blue, red, and orange, while others are quite drab and dull. Research has shown that females prefer to mate with brightly colored males; however, this trait makes them more likely to be seen. Guppies, like all species, must be able to both survive and reproduce in order to avoid extinction.

62 Identify *one* process that is responsible for the variations in coloration observed in guppies. [1]

63 Both types of adaptations in coloration (bright and drab) can be considered advantageous for guppies. Identify *one* factor that could affect which color trait is selected for in a particular environment. [1]

Base your answers to question 64–67 on the information below and on your knowledge of biology.

64–67 All organisms need to reproduce for the continuation of their species. Discuss the process of reproduction in humans. In your answer, be sure to:

- identify *one* hormone present in a female that is involved in regulating the reproductive cycle [1]
- state *one* way the nucleus of a sex cell is different from the nucleus of a body cell [1]
- state how the normal chromosome number for humans is maintained from one generation to the next [1]
- identify *one* action by the mother that can influence the development of the embryo and state a result of that influence [1]

Base your answers to questions 68 through 70 on the information below and on your knowledge of biology.

EVOLUTION OF THE ELEPHANT

Today's elephants are the result of a long process of evolution. Over millions of years, small changes were passed from one generation to the next. The first fossil elephant species were small, but over time, they increased both in size and weight. The three species alive today are the sole survivors of a once much more widespread group.

Source: www.factmonster.com/dk/science/encyclopedia/evolution.html

68 Explain why some elephant species did not survive. [1]

69 Provide a possible explanation for the increase in size and weight of the elephants over millions of years. [1]

70 Explain why it took so long for elephants to evolve in this way, while insects and bacteria can undergo evolution much more rapidly. [1]

71 Identify *one* way in which the process of growth of a human embryo is similar to the process of reproduction in a single-celled organism. [1]

72 Enzymes and antibodies are molecules that have specific shapes that give them different functions. Select either enzyme or antibody, and explain how the shape of the molecule you chose helps it carry out its normal function. [1]

Molecule: _____

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 the statement or answers the 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 An experiment was conducted to determine the effect of activity on pulse rate. Data were collected and recorded in the table below.

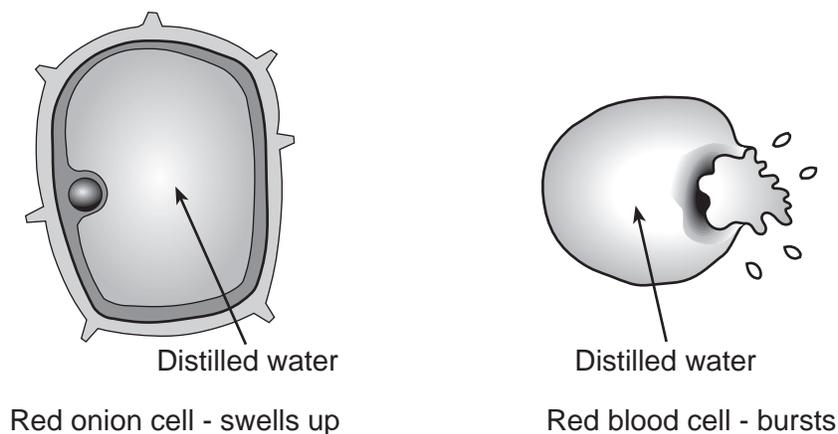
Activity #	Pulse Rate Recorded (per minute)
1	146
2	86
3	55
4	75

Which activity most likely corresponds to the pulse rate of the person while sleeping?

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

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

74 The diagram below represents what occurred when an onion cell and a red blood cell were placed in distilled water.

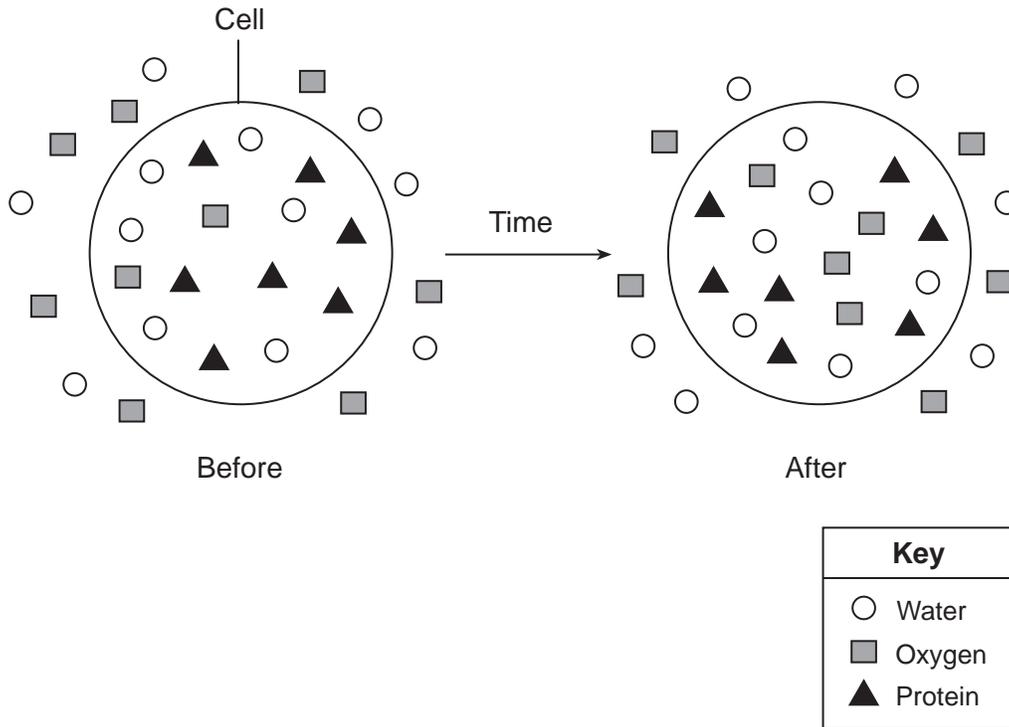


The best explanation for why the onion cells do not burst, while red blood cells often do, is that

- (1) the red blood cells have only a cell membrane, which does not protect them from bursting
(2) the onion cells do not have a cell wall that could protect them from bursting
(3) the onion cells have a cell membrane, which can protect them from bursting
(4) the red blood cells have a cell wall, which does not protect them from bursting

Note: The answer to question 75 should be recorded on your separate answer sheet.

75 The diagram below represents the distribution of some molecules inside and outside of an artificial cell over a period of time.



Which statement is best supported by the diagram?

- (1) Oxygen molecules entered the cell over time by active transport.
- (2) Water molecules are too large to enter or leave the cell, so they remained where they were at the start of the investigation.
- (3) Protein molecules are kept inside of the cell because the cell needs them.
- (4) The protein molecules are too large to diffuse out of the cell.

Note: The answer to question 76 should be recorded on your separate answer sheet.

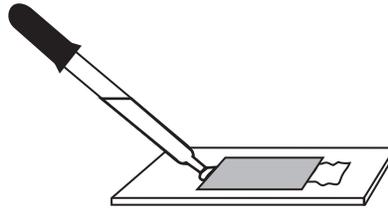
76 A microscope slide viewed with high power can most likely be damaged by

- (1) adding distilled water
- (2) adding salt water
- (3) rotating the coarse adjustment knob
- (4) rotating the fine adjustment knob

77 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. [1]

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

78 The diagram below represents a laboratory technique.



State *one* reason a student would use this technique during a scientific investigation. [1]

79 A student wished to determine the evolutionary relationships between three unidentified plant species (X, Y, and Z) and a known species *Botana curus*. Using an indicator powder to test for the presence of a specific chemical, the student made the observations shown in the data table below.

In the space provided in the data table, write an observation the student would expect to make if species Y were more closely related to *Botana curus* than it was to species X and Z. [1]

Student Observations

Plant Species	Observations When Mixed With Indicator Powder
<i>Botana curus</i>	produced a lot of bubbles/fizzed
X	no reaction
Y	
Z	no reaction

80 A student proposes that, if volunteers warm up before squeezing a clothespin for one minute, they will increase the number of times that they can squeeze it without tiring. He states that this is because their muscles will be better prepared for exercise. The data from an experiment are shown in the data table below.

Student Results

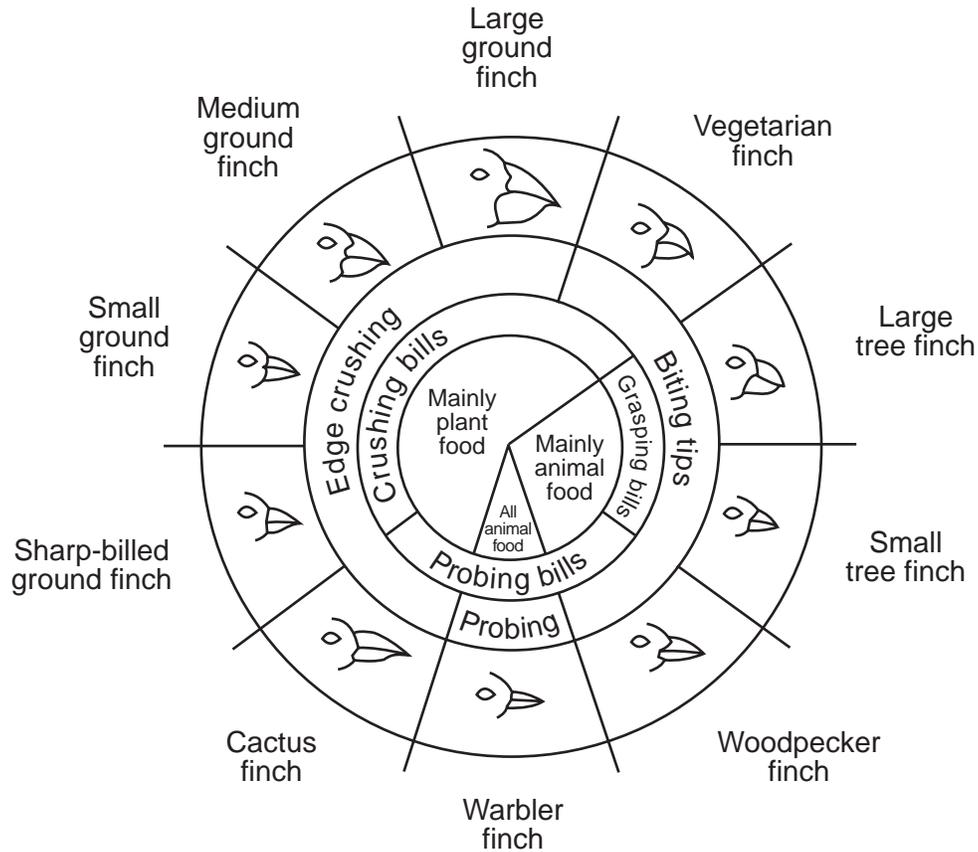
Trial	Group	Group Description	Average Number of Squeezes/Minute
1	1	10 students who warm up before squeezing	72
1	2	10 students who do not warm up before squeezing	73
2	3	25 students who warm up before squeezing	67
2	4	25 students who do not warm up before squeezing	65

Which trial from the chart above provides the best data to support his claim? Support your answer. [1]

Trial: _____

Base your answers to questions 81 and 82 on the information in the diagram below and on your knowledge of biology.

Variations in Beaks of Galapagos Islands Finches



from: *Galapagos: A Natural History Guide*

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

81 Based on the information in the chart, which statement is correct?

- (1) Finches that eat animals always have larger beaks than finches that eat plants.
- (2) Finches that eat plants all have very large beaks.
- (3) Finches with crushing bills eat only animals for food.
- (4) Finches with grasping bills usually eat animals for food.

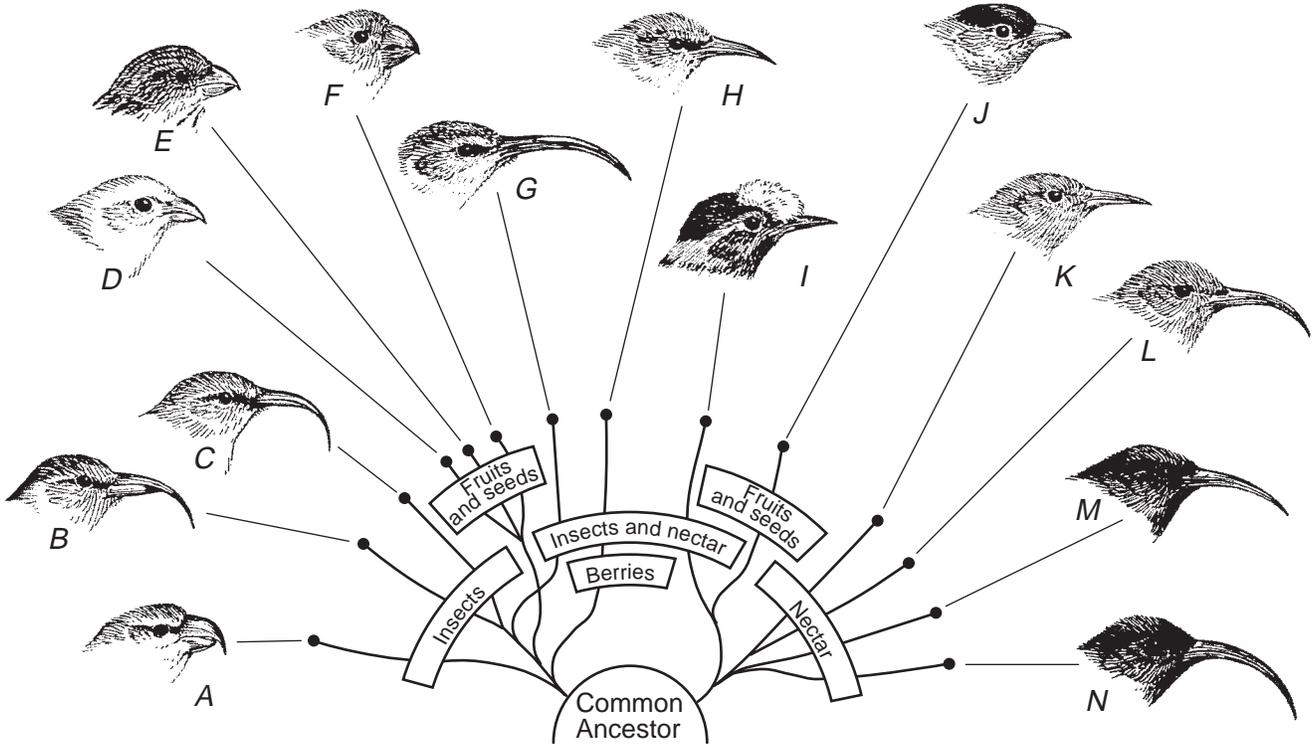
Note: The answer to question 82 should be recorded on your separate answer sheet.

82 The first species of finch to inhabit the Galapagos Islands thousands of years ago was most likely an insect eater. Today, finch species on these islands feed on a great variety of plants and animals. One early event that probably occurred that led to this feeding diversity was that

- (1) members of the ancestral finch species had to decide if they would be better off feeding on seeds rather than on relatively scarce insect species
- (2) some of the finch ancestors were born with beaks that were different from the beaks of other finches, and could eat both insects and seeds
- (3) some members of the ancestral species that fed on insects began to die off, leaving few offspring
- (4) another species of bird, a seed eater, arrived on the islands and began to breed with members of the ancestral species

Base your answers to questions 83 through 85 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.

Hawaiian Honey Creepers



83 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. [1]

84 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. [1]

85 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. [1]

LIVING ENVIRONMENT

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LIVING ENVIRONMENT

FOR TEACHERS ONLY

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

LIVING ENVIRONMENT

Wednesday, January 27, 2016 — 9:15 a.m. to 12:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: <http://www.p12.nysed.gov/assessment/> and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Multiple Choice for Parts A, B-1, B-2, and D
Allow 1 credit for each correct response.

Part A			
1 1	9 1	17 2	25 4
2 4	10 3	18 4	26 3
3 4	11 4	19 1	27 2
4 2	12 1	20 3	28 1
5 2	13 2	21 4	29 1
6 2	14 4	22 1	30 1
7 3	15 3	23 1	
8 2	16 3	24 1	
Part B-1			
31 1	35 3	39 1	43 1
32 4	36 4	40 2	
33 1	37 1	41 3	
34 4	38 3	42 1	
Part B-2			
47 3	49 1	50 3	
Part D			
73 3	75 4	81 4	
74 1	76 3	82 2	

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Regents Examination in Living Environment. Additional information about scoring is provided in the publication *Information Booklet for Scoring Regents Examinations in the Sciences*.

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

Allow 1 credit for each correct response.

At least two science teachers must participate in the scoring of the Part B–2, Part C, and Part D open-ended questions on a student's paper. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

Students' responses must be scored strictly according to the Scoring Key and Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Wednesday, January 27, 2016. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

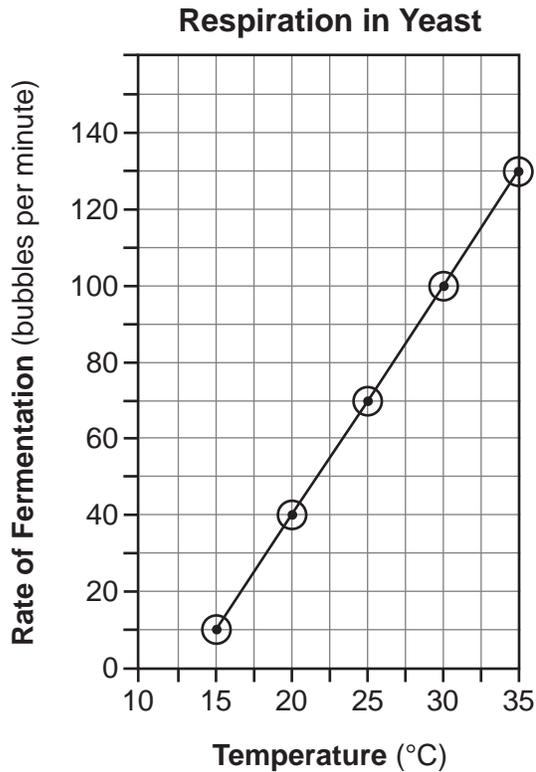
Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Part B–2

44 [1] Allow 1 credit for marking an appropriate scale, without any breaks, on each labeled axis.

45 [1] Allow 1 credit for correctly plotting the data and connecting the points.

Example of a 2-credit graph for questions 44 and 45:



Note: Allow credit if points are plotted correctly but *not* circled.

Do *not* assume that the intersection of the x - and y -axis is the origin (0,0) unless it is labeled. An appropriate scale only needs to include the data range in the data table.

Do *not* allow credit for plotting points that are not in the data table, e.g., (0,0), or for extending lines beyond the data points.

46 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- The rate increases as temperature increases.
- As the temperature decreases, the rate decreases.
- The number of carbon dioxide bubbles produced increases with temperature.
- Fermentation increases as temperature goes up.
- It is a direct relationship.

47 MC on scoring key

- 48 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- The more closely related the organisms, the fewer amino acid differences.
 - A greater number of differences probably means that they are not closely related.

49 MC on scoring key

50 MC on scoring key

- 51 [1] Allow 1 credit for 13 mm (+/- 2mm).
Note: Do *not* allow credit for a student response in centimeters.

- 52 [1] Allow 1 credit.

Example of a 1-credit response:

Disk	Measurement of ZOI (mm) or ZOI (mm) or Diameter (mm)
A	13 (+/- 2mm)
B	8
C	0
D	9

Note: For measurement of disk A, allow credit for the student's response to question 51.
 Do *not* allow credit if appropriate units are not included in the heading.

- 53 [1] Allow 1 credit for C or disk C and supporting the answer. Acceptable responses include, but are not limited to:
- no ZOI
 - did not kill bacteria so probably contains no antibiotics

- 54** [1] Allow 1 credit for A and explaining why the antibiotic was selected. Acceptable responses include, but are not limited to:
- the least amount of bacteria around the antibiotic disk
 - the biggest zone of inhibition
 - the biggest area of no bacteria

Note: Allow credit for an answer consistent with the student's data table for question 52.

- 55** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Termites cannot digest cellulose, but the microbes can do it for them.
 - The microbes digest the cellulose into glucose, which is small enough to be absorbed by the termite.
 - The microbes provide the substance needed to break down the cellulose into glucose.

Part C

- 56** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Overuse of antibacterial agents may result in an increase in the number of resistant bacteria.
 - Some bacteria are beneficial and may also be killed.
 - Antibacterial agents kill nonresistant bacteria, allowing the resistant ones to survive and reproduce.
- 57** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- There is not enough food, so some die of starvation.
 - disease
 - Predators kill them.
 - hunting
 - colder weather
 - They are over the carrying capacity.
 - increased competition
 - They migrate.
- 58** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Carrying capacity is the maximum number of individuals the environment can support over an extended period of time.
 - It is the largest population size that can survive in an area year-round.
 - It is the maximum population size that an area's resources can support.
- 59** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- less trash put in landfills
 - less use of raw materials/limited resources
 - reduced use of nonrenewable resources
 - less litter in the environment
- 60** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Factor: People won't recycle.
Correction: Fine individuals who put recyclables in their garbage.
- Factor: lack of education about recycling
Correction: Distribute recycling information *or* sponsor television and radio ads.
- Factor: too time consuming
Correction: Companies can collect unsorted recyclables.

61 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Community Action: requiring deposits on water/soda bottles

Improvement: reduce solid waste

Community Action: requiring reduced packaging of products *or* using reusable shopping bags

Improvement: less waste produced

Community Action: building power plants that use solid waste for fuel

Improvement: recover energy from solid waste

62 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— mutation

— sexual reproduction

— meiosis/crossing-over

— recombination of genes

— natural selection

— sexual selection

63 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The absence or presence of predators determines which trait is selected for.

— The female guppies determine which trait is selected for.

— Colors present in the environment determine which trait is selected for.

— type of predators present

— the clarity of the water

Note: The student's response to the bulleted items in question 64–67 need *not* appear in the following order.

64 [1] Allow 1 credit for identifying *one* hormone present in a female that is involved in regulating the reproductive cycle. Acceptable responses include, but are not limited to:

— progesterone

— estrogen

— LH

65 [1] Allow 1 credit for stating *one* way the nucleus of a sex cell is different from the nucleus of a body cell. Acceptable responses include, but are not limited to:

— It has half the normal chromosome number/half of the genes.

— Sex cells are haploid/monoploid.

— 23 chromosomes in sex cells, 46 in body cell

- 66** [1] Allow 1 credit for stating how the normal chromosome number for humans is maintained from one generation to the next. Acceptable responses include, but are not limited to:
- The egg and sperm each have half the normal chromosome number, and when they join, it restores the normal number for the species.
 - through the process of gamete production and fertilization
 - Each parent contributes half of the chromosomes.
- 67** [1] Allow 1 credit for identifying *one* action by the mother that can influence the development of the embryo and stating a result of that influence. Acceptable responses include, but are not limited to:
- Alcohol use can lead to Fetal Alcohol Syndrome.
 - Smoking can lead to low birth weight.
 - Poor nutrition can lead to underweight babies.
 - Drug use can lead to birth defects.
 - Good nutrition can lead to a healthy baby.
 - Drinking alcohol puts the embryo at risk.
 - Proper prenatal care might detect potential problems early so they can be treated.
- 68** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- They lacked adaptations to the changing environmental conditions.
 - They were unable to compete for food or other resources.
 - They did not have the variations required for survival in their environment.
- 69** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Larger size made them more successful in competing for food.
 - Being larger made them better able to protect themselves.
 - Larger elephants had more offspring that survived.
- 70** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Elephants reproduce more slowly than insects/bacteria.
 - Insects have many more offspring at one time.
 - Bacteria have a short generation time, compared to elephants.
- 71** [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- They both involve mitosis.
 - Both processes produce cells containing identical genetic information.
 - The cells are produced asexually.

72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Molecule:

antibody: The antibody binds to a specific pathogen

or

enzyme: An enzyme has a specific shape that must match the shape of the molecules with which it interacts (lock and key or induced fit).

Part D

73 MC on scoring key

74 MC on scoring key

75 MC on scoring key

76 MC on scoring key

77 [1] Allow 1 credit for completing the data table as shown below.

Pulse Rates

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

78 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- to add a solution to a slide without removing the coverslip
- to add stain (or water) to a slide

79 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Example of a 1-credit response:

Plant Species	Observations When Mixed With Indicator Powder
<i>Botana curus</i>	produced a lot of bubbles/fizzed
X	no reaction
Y	produced a lot of bubbles <i>or</i> fizzed <i>or</i> reacted
Z	no reaction

80 [1] Allow 1 credit for stating which trial from the above chart provides the best data to support his claim and supporting the answer. Acceptable responses include, but are not limited to:

- Trial 2, because more students were used.
- Trial 2, because they squeezed more when they warmed up first.
- Neither, because the averages were not very different.

81 MC on scoring key

82 MC on scoring key

83 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- Fruit and seed eaters have shorter, thicker beaks.
- The nectar-eating birds have longer, thinner beaks.
- Their beaks are shorter.

84 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- 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.

85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- There were no 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.

The *Chart for Determining the Final Examination Score for the January 2016 Regents Examination in Living Environment* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Wednesday, January 27, 2016. Conversion charts provided for previous administrations of the Regents Examination in Living Environment must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to <http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm>.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

January 2016 Living Environment

Standards	Question Numbers			
	Part A 1–30	Part B–1 31–43	Part B–2 44–55	Part C 56–72
Standard 1 — Analysis, Inquiry and Design				
Key Idea 1				
Key Idea 2				
Key Idea 3		32	44, 45, 46, 47, 52, 53, 54	
Appendix A (Laboratory Checklist)			51	
Standard 4				
Key Idea 1	1, 2, 3, 5, 6, 14	36, 37	49, 55	57
Key Idea 2	7, 10, 11, 13	35		65, 66, 71
Key Idea 3	28		48	56, 62, 63, 68, 69, 70
Key Idea 4	9, 12, 16, 18	43		64, 67
Key Idea 5	17, 19, 20, 21, 22	38, 39, 40, 41	50	72
Key Idea 6	4, 8, 15, 23, 24, 25, 26, 27			58
Key Idea 7	29, 30	31, 33, 34, 42		59, 60, 61

Part D 73–85	
Lab 1	79
Lab 2	73, 77, 80
Lab 3	81, 82, 83, 84, 85
Lab 5	74, 75, 76, 78

Regents Examination in Living Environment – January 2016

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

Raw Score	Scale Score	Raw Score	Scale Score	Raw Score	Scale Score
85	100	56	78	27	49
84	98	55	77	26	48
83	97	54	76	25	47
82	96	53	76	24	45
81	96	52	75	23	44
80	95	51	74	22	42
79	94	50	73	21	41
78	93	49	73	20	39
77	92	48	72	19	38
76	92	47	71	18	36
75	91	46	70	17	35
74	90	45	69	16	33
73	89	44	68	15	31
72	89	43	67	14	29
71	88	42	66	13	28
70	87	41	66	12	26
69	87	40	65	11	24
68	86	39	64	10	22
67	85	38	63	9	20
66	84	37	61	8	18
65	84	36	60	7	16
64	83	35	59	6	14
63	82	34	58	5	12
62	82	33	57	4	9
61	81	32	56	3	7
60	80	31	55	2	5
59	80	30	53	1	2
58	79	29	52	0	0
57	78	28	51		

To determine the student’s final examination score, find the student’s total test raw score in the column labeled “Raw Score” and then locate the scale score that corresponds to that raw score. The scale score is the student’s final examination score. Enter this score in the space labeled “Scale Score” on the student’s answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student’s final score. The chart above is usable only for this administration of the Regents Examination in Living Environment.