

# BIOLOGY



## QUESTION CATALOGUE

# Biology/Living Environment

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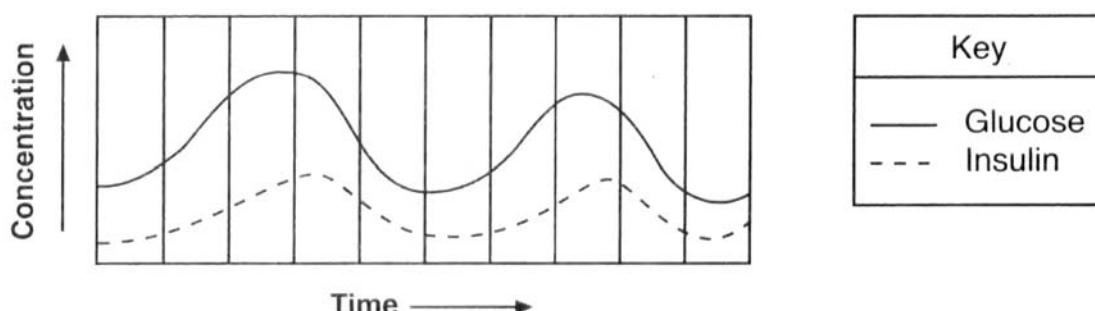
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# I. INTRODUCTION TO THE LIVING ENVIRONMENT

## 1. Definition and Concept of Life vi. Homeostasis

6480 The graph below shows the levels of glucose and insulin in the blood of a human over a period of time.



This graph represents

- (1) an allergic reaction
- (2) an antigen-antibody reaction

(3) maintenance of homeostasis

(4) autotrophic nutrition

7038 The leaves of a plant are dotted with openings known as stomata. When open, stomata allow the plant to exchange gases and allow moisture to evaporate, helping to draw water from the roots up into the plant. These activities help the plant to

- (1) produce light energy
- (2) **maintain homeostasis**
- (3) decompose organic matter
- (4) synthesize mineral

6855 The maintenance of homeostasis in the body is most directly related to

- (1) **cellular communication**
- (2) cycling of energy
- (3) aging of the organism
- (4) recombination of chromosomes

6771 The ability of the human body to keep blood-sugar levels within a fairly narrow range, despite the intake of meals high in carbohydrates, is an example of

- (1) active transport
- (2) genetic recombination
- (3) **homeostasis**
- (4) digestion

6760 Which process is most directly responsible for maintaining internal stability in an organism when its environment is constantly changing?

- (1) digestion
- (2) **feedback**
- (3) reproduction
- (4) evolution

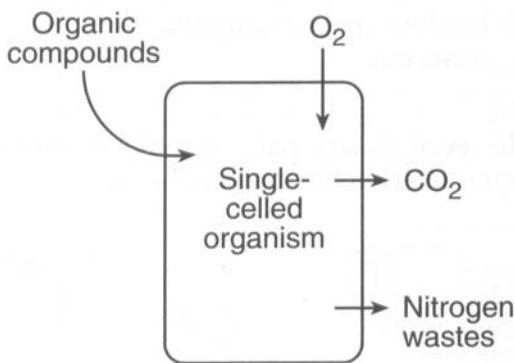
6016 Which situation indicates that a disruption of homeostasis has taken place?

- (1) the presence of hormones that keep the blood sugar level steady
- (2) the maintenance of a constant body temperature
- (3) cell division that is involved in normal growth
- (4) **a rapid rise in the number of red blood cells**

5016 Organisms undergo constant chemical changes as they maintain an internal balance known as

- (1) interdependence
- (2) **homeostasis**
- (3) synthesis
- (4) recombination

6094 The arrows in the diagram below indicate the movement of materials into and out of a single-celled organism.



The movements indicated by all the arrows are directly involved in

- (1) **the maintenance of homeostasis**
- (2) respiration, only
- (3) excretion, only
- (4) the digestion of proteins

5815 Which process illustrates a feedback mechanism in plants?

- (1) Chloroplasts take in more nitrogen, which increases the rate of photosynthesis.
- (2) Chloroplasts release more oxygen in response to a decreased rate of photosynthesis.
- (3) **Guard cells change the size of leaf openings, regulating the exchange of gases.**
- (4) Guard cells release oxygen from the leaf at night.

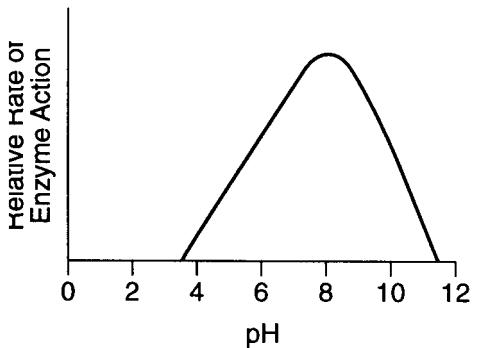
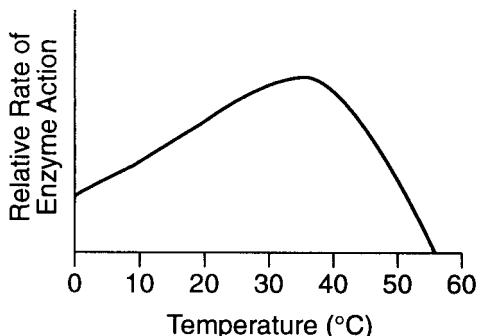
5289 Hormones and secretions of the nervous system are chemical messengers that

- (1) store genetic information
- (2) carry out the circulation of materials
- (3) extract energy from nutrients
- (4) **coordinate system interactions**

# I. INTRODUCTION TO THE LIVING ENVIRONMENT

## B. Chemical Enzyme Control

- 3396 Which statement best describes the enzyme represented in the graphs below?



- (1) This enzyme works best at a temperature of 35°C and a pH of 8.
- (2) This enzyme works best at a temperature of 50°C and a pH of 12
- (3) Temperature and pH have no effect on the action of this enzyme.
- (4) This enzyme works best at a temperature above 50°C and a pH above 12.

- 3115 Some species of bacteria thrive in very hot springs because

- (1) their enzymes function best at a temperature of 70° C or higher
- (2) their enzymes function best at the same temperature as enzymes in humans
- (3) they are able to carry out photosynthesis without sunlight
- (4) they are able to carry out respiration utilizing carbon dioxide in place of oxygen

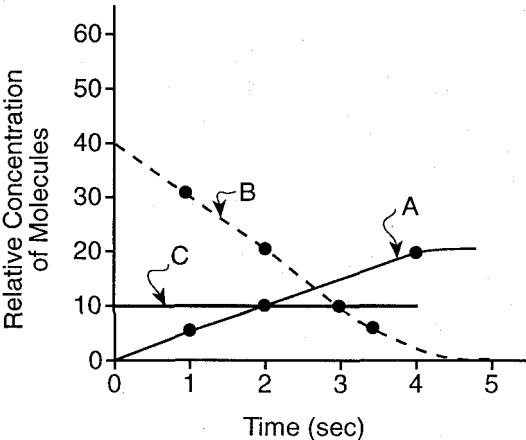
- 3110 Which factor would have the *least* effect on the rate at which an enzyme breaks down starch?

- (1) the pH of the solution in which the reaction is occurring
- (2) the concentrations of starch and enzyme
- (3) the temperature at which the reaction is taking place
- (4) the wavelength of light illuminating the reaction

# 4. Cell Biochemistry

## ii. Factors Affecting Rate of Reactions

- 2020 The graph below shows the relative concentration of molecules of three different substances, A, B, and C, in a reaction involving the synthesis of maltose from glucose.



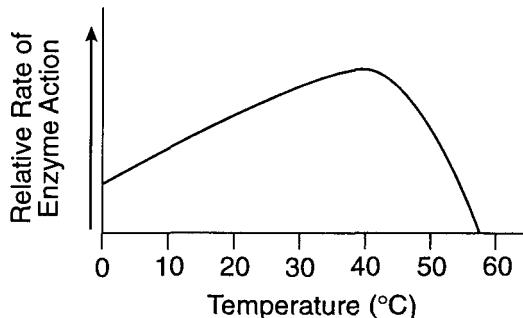
The change in the concentration of maltose molecules is represented by

- (1) A, only
- (2) B, only
- (3) C, only
- (4) both B and C

- 1809 Which graph best represents the effect of an increasing substrate concentration and a constant enzyme concentration on the relative rate of enzyme action?

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

Base your answers to questions 3495 through 3497 on the graph below and on your knowledge of biology.



3495 Which statement most accurately represents information shown in the graph?

- (1) Enzyme rates are not affected by cold temperatures.
- (2) At 0°C, the enzyme is inactive.
- (3) The enzyme is more active at 25°C than at 50°C.**
- (4) The enzyme is less active at 55°C than at 58°C.

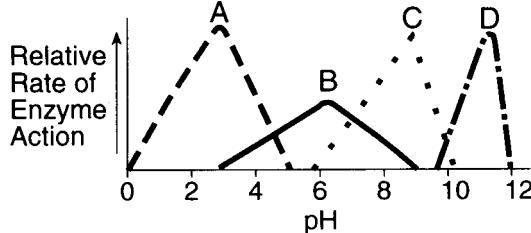
3496 Which factor most likely accounts for the change in the rate of enzyme action as the temperature increases from 40°C to 58°C?

- (1) Excess acids have been building up, causing the enzyme to become fatigued.
- (2) Too much substrate is present at these high temperatures.
- (3) Not enough substrate is present at these high temperatures.
- (4) The high temperature causes the shape of the enzyme to be altered.**

3497 The graph could best be used to illustrate

- (1) enzyme composition
- (2) optimum enzyme activity**
- (3) functions of coenzymes
- (4) enzyme molecule size

Base your answers to questions 4083 through 4085 on the graph below and on your knowledge of biology. The graph shows the relative rates of action of four enzymes, A, B, C, and D.



4083 Which enzyme shows the greatest change in its rate of action with the *least* change in pH?

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

4084 A solution with a pH of 6 contains enzyme C and its substrate. If a base is gradually added to this solution, the rate of action of enzyme C would most likely

- (1) remain constant
- (2) increase, then decrease
- (3) decrease, then increase
- (4) decrease constantly**

4085 Which two enzymes would function in a region of the human body having a neutral pH?

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

Base your answers to questions 3820 through 3822 on the table below and on your knowledge of biology.

Enzyme	Effective Temperature Range (°C)	Optimum pH
A	60–80	3
B	30–40	3.5
C	20–38	9
D	20–27	7

3820 If enzyme C is functioning at 25°C and a pH of 7, under which conditions would the rate of enzyme action probably increase?

- (1) The temperature is decreased to 22°C and the pH is kept the same.
- (2) The temperature is increased to 30°C and the pH is increased to 9.**
- (3) The temperature is kept the same and the pH is decreased to 6.
- (4) The temperature is increased to 44°C and the pH is kept the same.

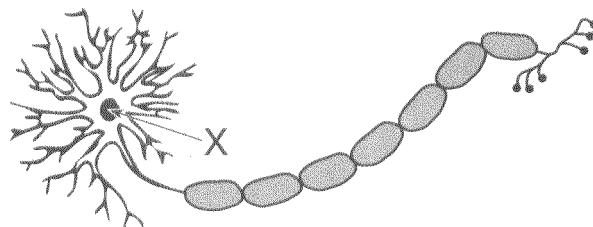
3821 At what temperature would enzyme D most likely be denatured?

- (1) 15°C
- (2) 20°C
- (3) 25°C
- (4) 39°C**

3822 Which enzyme would most likely be functional in bacteria living in a hot spring that is 35°C above normal human body temperature?

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

5686 Base your answer to the following question on the diagram below of a cell associated with coordination and on your knowledge of biology.

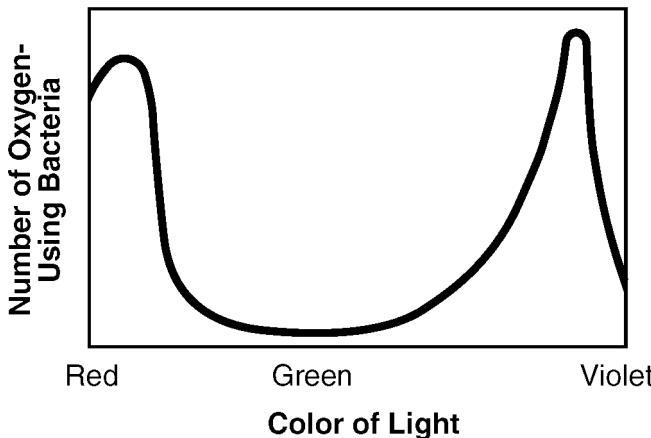


Structure X would be involved in the

- (1) storage of digestive enzymes
- (2) absorption of energy from the Sun
- (3) development of pathogens
- (4) synthesis of proteins**

**II. ADAPTATIONS FOR LIFE PROCESSES****A. Autotrophic Nutrition: Photosynthesis**

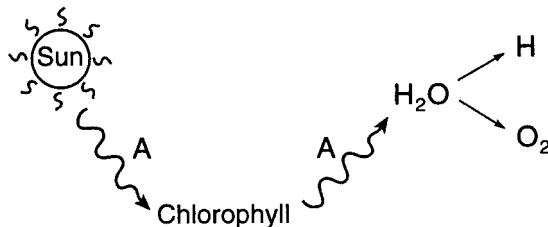
- 5487 The graph below shows the results of an experiment in which a container of oxygen-using bacteria and strands of a green algae were exposed to light of different colors.



Which statement best explains the results of this experiment?

- (1) The rate of photosynthesis is affected by variations in the light.
- (2) In all environments light is a vital resource.
- (3) The activities of bacteria and algae are not related.
- (4) Uneven numbers and types of species can upset ecosystem stability.

- 3823 The diagram below represents some chemical events that take place in one type of autotrophic nutrition.



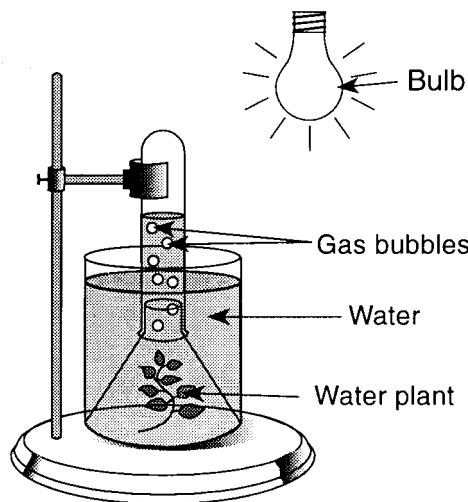
The arrows labeled A best represent

- (1) carbon dioxide
- (2) glucose
- (3) energy
- (4) lactic acid

- 3430 A scientific study showed that the depth at which algae were found in a lake varied from day to day. On clear days, the algae were found as much as 6 meters below the surface of the water but were only 1 meter below the surface on cloudy days. Which hypothesis best explains these observations?

- (1) Light intensity affects the growth of algae.
- (2) Wind currents affect the growth of algae.
- (3) Nitrogen concentration affects the growth of algae.
- (4) Precipitation affects the growth of algae.

- 3630 In the setup shown below, which color light will cause the plant to produce the *smallest* number of gas bubbles?



- (1) red
- (2) orange
- (3) blue
- (4) green

- 3220 A small piece of black paper was folded in half and used to cover part of the top and bottom portions of a leaf on a living geranium plant. After the plant was kept in sunlight for several days, the paper was removed. The leaf was then boiled in alcohol to remove the chlorophyll and placed in Lugol's iodine solution. Only the part of the leaf that had *not* been covered turned blue black. This investigation was most likely testing the hypothesis that

- (1) light is necessary for photosynthesis to occur
- (2) alcohol plus chlorophyll forms Lugol's solution
- (3) green plants use carbon dioxide in photosynthesis
- (4) plants use alcohol in the production of chlorophyll

- 2870 To determine the effect of color of light on plant growth, four groups of bean plants were grown under the light conditions described below.

- Group A – placed under red light  
 Group B – placed under green light  
 Group C – placed under violet light  
 Group D – placed in darkness

All other factors, such as light intensity and amount of moisture, were held constant. In this investigation, which group of bean plants served as the control?

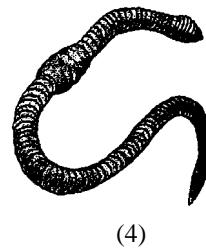
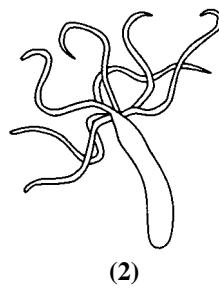
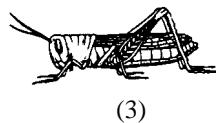
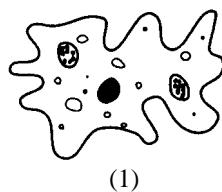
- (1) A
- (2) B
- (3) C
- (4) D

- 457 In most plants the process of photosynthesis occurs most rapidly when the plants are exposed to equal intensities of
- (1) green and red light
  - (2) blue and red light
  - (3) yellow and orange light
  - (4) green and yellow light

## II. ADAPTATIONS FOR LIFE PROCESSES

## 7. Adaptions Among Animals A. Protists & Hydra

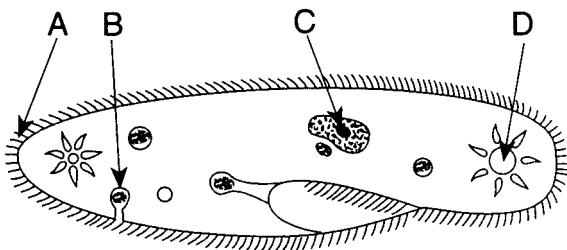
3457. Which organism represented below is often described as a sessile organism?



3633. Freshwater protozoans excrete ammonia and mineral salts by means of

- (1) diffusion through the cell membrane
- (2) small vacuoles released through the cell membrane
- (3) small tubes leading from the cytoplasm to openings in the cell membrane
- (4) contraction of food vacuoles

3763. Which structure indicated in the diagram of a paramecium below is used for the process of egestion?



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

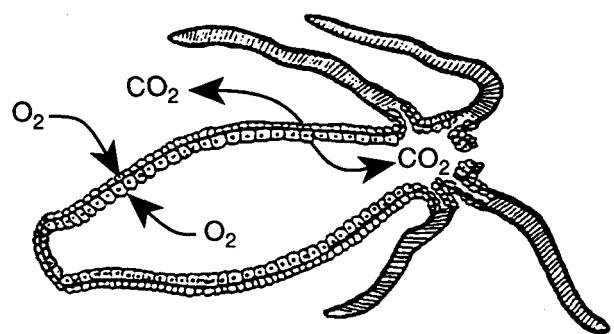
4254. The process of excretion in hydra is most similar to the process of excretion in

- (1) protozoans
- (2) grasshoppers
- (3) humans
- (4) annelids

4592. A paramecium eliminates excess water by means of

- (1) contractile vacuoles
- (2) lysosomes
- (3) an oral groove
- (4) a nucleolus

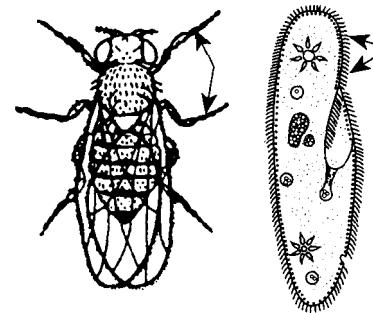
3770. The diagram below represents a hydra.



The movement of gases indicated by the arrows in the diagram takes place by the process of

- (1) pinocytosis
- (2) diffusion
- (3) active transport
- (4) dehydration synthesis

3776. Two organisms are represented in the diagram below.



The arrows in the diagram indicate structures that help these organisms to

- (1) obtain food
- (2) carry out photosynthesis
- (3) carry out respiration
- (4) excrete wastes

4551. In the hydra, impulses travel in both directions over a given nerve cell. Which inference could be made from this statement?

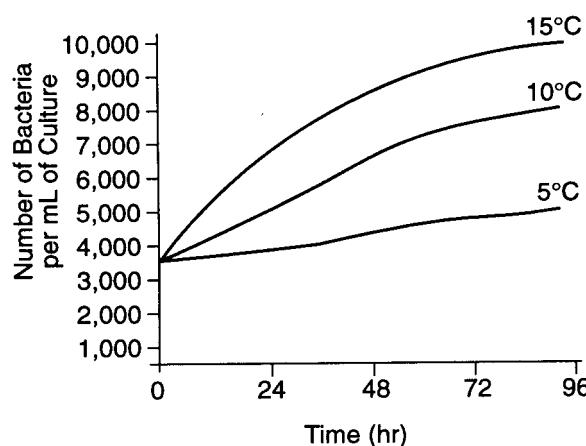
- (1) The ends of both axons and dendrites may secrete neurotransmitters.
- (2) Only the ends of axons secrete neurotransmitters.
- (3) Only the ends of dendrites secrete neurotransmitters.
- (4) The central nervous system of the hydra does not secrete neurotransmitters.

## II. ADAPTATIONS FOR LIFE PROCESSES

## Unit II - Part B and C Questions

### 1. Unit II - Tables, Graphs, Ext. Task

- 3435 The graph below represents the results of an investigation of the growth of three identical bacterial cultures incubated at different temperatures.



Which inference can be made from this graph?

- (1) Temperature is unrelated to the reproductive rate of bacteria.
- (2) Bacteria cannot grow at a temperature of 5°C.
- (3) Life activities in bacteria slow down at high temperatures.
- (4) Refrigeration will most likely slow the growth of these bacteria.**

- 3106 An investigation was conducted using three groups of laboratory rats, X, Y, and Z to determine the relative effects of glucose and adrenaline on the rate of heartbeat. The experimental conditions for each group of rats were kept the same except for the type of solution injected, as shown in the data table.

**Data Table**

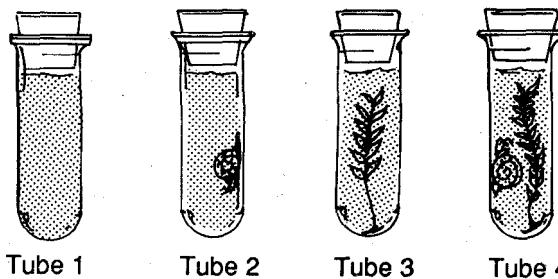
Group	Solution Injected
X	1 mL adrenaline in distilled water
Y	1 mL glucose in distilled water
Z	1 mL distilled water, only

According to the data table, which group of rats functioned as the control?

- (1) X, only
- (2) Y, only
- (3) Z, only**
- (4) both X and Y

Base your answers to questions 2994 through 2996 on the information and diagrams below and on your knowledge of biology.

In an investigation of the cycling of environmental gases, a student placed water and bromothymol blue in each of four test tubes as shown in the diagrams below. No additional items were placed in tube 1, a snail was placed in tube 2, an aquatic plant (elodea) was placed in tube 3, and both a snail and an elodea were placed in tube 4. The tubes were then stoppered and placed in bright light for 24 hours.



- 2994 How would the solution in tube 3 change after 24 hours?

- (1) It would contain more oxygen.**
- (2) It would change from yellow to blue.
- (3) It would change from blue to brick red.
- (4) It would contain less nitrogen.

- 2996 The function of tube 1 in this investigation is to

- (1) detect the presence of glucose
- (2) determine the amount of gases in the water
- (3) demonstrate the transparency of the solution
- (4) serve as a control**

- 1737 Base your answer on the information below and on your knowledge of biology.

Cobalt chloride paper is an indicator for moisture. It is blue when dry and turns pink when moist. In an investigation, one strip of dry cobalt chloride paper was placed on the upper epidermis of a leaf on a geranium plant, and one strip was placed on the lower epidermis of the same leaf. The leaf was securely wrapped in clear cellophane wrap. A piece of dry cobalt chloride paper was attached to each side of a clean glass slide, and the slide was sealed in clear cellophane wrap. The geranium plant and the sealed slide were placed in sunlight for 10 hours.

To determine if light affects the results of this investigation, the investigator should prepare another complete setup in the same way but change the procedure by

- (1) placing this setup in an area with no light**
- (2) submerging this setup in water for 12 hours
- (3) using a plant species with non-green leaves
- (4) placing the setup under artificial white light instead of sunlight

### III. HUMAN PHYSIOLOGY

#### C. Cells and Immunology

5739 The immune system of humans may respond to chemicals on the surface of an invading organism by

- (1) releasing hormones that break down these chemicals
- (2) synthesizing antibodies that mark these organisms to be destroyed**
- (3) secreting antibiotics that attach to these organisms
- (4) altering a DNA sequence in these organisms

5506 Which activity is *not* a function of white blood cells in response to an invasion of the body by bacteria?

- (1) engulfing these bacteria
- (2) producing antibodies to act against this type of bacteria
- (3) preparing for future invasions of this type of bacteria
- (4) speeding transmissions of nerve impulses to detect these bacteria**

5028 A researcher needs information on antigen–antibody reactions. Searching for which phrase would best lead the researcher to information about these reactions?

- (1) protein synthesis
- (3) white blood cell activity**
- (2) energy sources in nature
- (4) DNA replication

4804 Which activity is *not* a response of human white blood cells to pathogens?

- (1) engulfing and destroying bacteria
- (2) producing antibodies
- (3) identifying invaders for destruction
- (4) removing carbon dioxide**

4599 The immediate source of the intercellular fluid surrounding all human body cells is

- (1) blood plasma**
- (3) lymphatic tissue
- (2) enzymatic secretions
- (4) glomerular filtrations

4510 Maintenance of proper levels of intercellular fluid is most closely associated with

- (1) pulmonary circulation
- (3) lymphatic circulation**
- (2) coronary circulation
- (4) systemic circulation

4461 Which function is associated with phagocytes in the blood?

- (1) initiating blood clots
- (2) transporting dissolved nutrients
- (3) producing hormones
- (4) engulfing bacteria**

4046 Which phrase does not describe a way the human body responds to fight disease?

- (1) destruction of infectious agents by white blood cells
- (2) production of antibodies by white blood cells
- (3) increased production of white blood cells
- (4) production of pathogens by white blood cells**

3031 To receive necessary nutrients and eliminate wastes, all human body cells must be

- (1) surrounded by cilia
- (2) endocrine in nature
- (3) able to carry on phagocytosis
- (4) surrounded by a transport medium**

1556 In humans, excess fluid and other substances surrounding the cells are returned to the blood by

- (1) lymphocytes
- (3) platelets
- (2) arteries
- (4) lymph vessels**

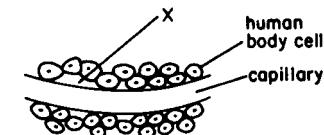
### 3. Transport in Humans

#### ii. WBCs, ICF and Lymph

2962 Bacteria and dead cells are removed from circulatory fluid in the

- (1) urinary bladder
- (3) alveoli
- (2) gallbladder
- (4) lymph nodes**

2909 The space marked X in the diagram at the right would normally contain

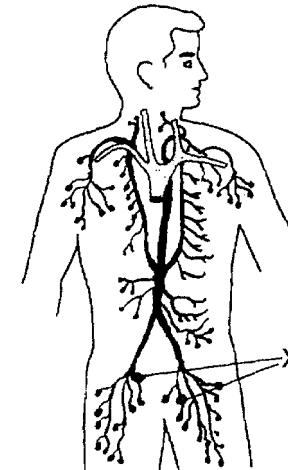


- (1) hemoglobin
- (3) intercellular fluid**
- (2) neurotransmitters
- (4) hydrolytic enzymes

2313 Lymphocytes are blood cells that are most closely associated with

- (1) antibody production**
- (3) clot formation
- (2) oxygen transport
- (4) carbon dioxide transport

1878 The diagram below represents the human lymphatic system.



A major function of the structures labeled X is to

- (1) pump lymph in the proper direction
- (2) transport glucose throughout the body
- (3) filter bacteria and dead cells from the lymph**
- (4) remove undigested food from the blood

1653 Which substance is known as lymph after it passes into lymph vessels?

- (1) hemoglobin
- (3) intercellular fluid**
- (2) cytoplasm
- (4) bile

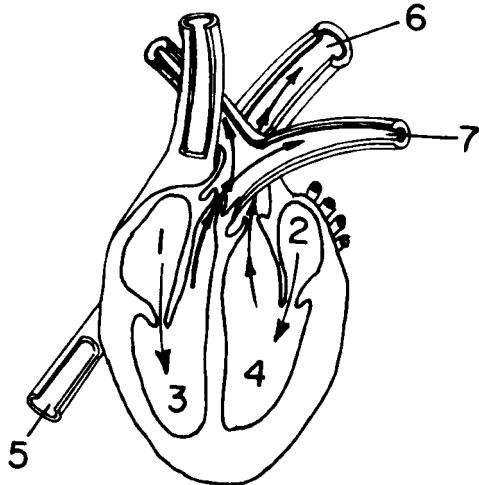
1652 Which blood component is correctly paired with a process in which it is directly involved?

- (1) white blood cells—clotting
- (2) platelets—oxygen transport
- (3) lymphocytes—antibody production**
- (4) red blood cells—bacteria destruction

1334 The liquid that is derived from human blood plasma and is in direct contact with the cells of the body is known as

- (1) bile
- (3) intercellular fluid**
- (2) cytoplasm
- (4) whole blood

Base your answers to questions **191** through **195** on the diagram of the adult human heart and on your knowledge of biology.





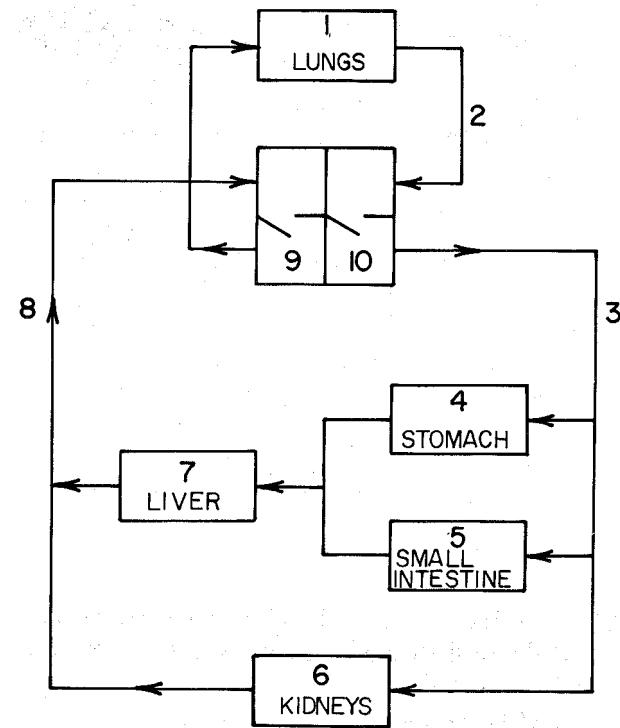

Base your answers to questions **2022** through **2059** on the incomplete chart below and on your knowledge of biology.

Malfunction	Cause	Body Part Affected
Arthritis	Breakdown of lysosomes in cartilage cells	A
B	Blood clot or hemorrhage	Brain
Meningitis	Bacteria or virus	C

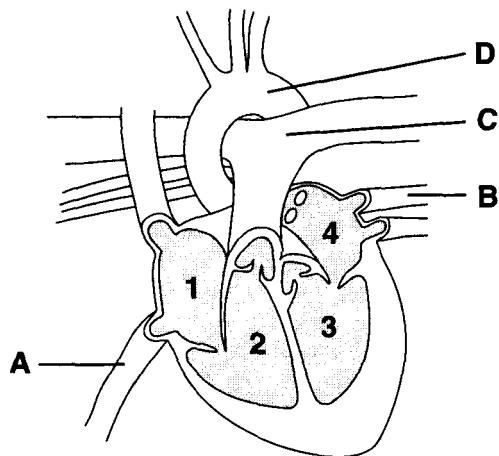
- 2059 Letter C most likely represents

- (1) neurons in arms and legs
  - (2) membranes lining bronchi and bronchioles
  - (3) membranes covering the brain and spinal cord**
  - (4) cells covering arteries and veins

Base your answers to questions **620** through **623** on the diagram below which represents the pathway of the blood throughout the body.



Base your answers to questions **4304** and **4305** on the diagram below of the human heart.



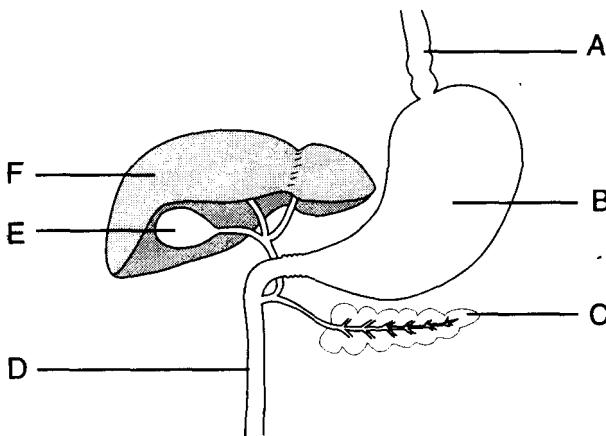
- 4304 Deoxygenated blood from the body is returned to the heart by way of structure



- 4305 Which heart chamber pumps blood toward the alveoli by way of the pulmonary arteries?



Base your answers to questions **4309** and **4310** on the diagram below.



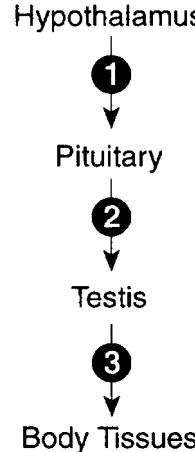
- 4309 A digestive function of organ *C* is the synthesis and secretion of

- (1) salivary amylase      (3) hydrochloric acid  
(2) **protease**              (4) bile

- 4310 Peristalsis occurs in structures



Base your answers to questions **4507** through **4509** on the diagram below and on your knowledge of biology. The arrows in the diagram indicate certain hormones in the human male body.



- 4507 The hormone testosterone is represented by



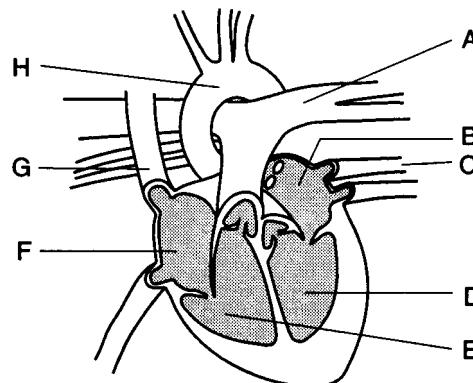
- 4508 A high level of hormone 3 in the blood inhibits the

- production of hormone 2. This situation is an example  
(1) nervous regulation      (3) deamination  
(2) hydrolysis                (4) **negative feedback**

- 4509 Which activity would most likely be a function of hormone  
32

- (1) stimulating the body tissues to produce secondary sex characteristics
  - (2) causing the thyroid to produce thyroxin
  - (3) increasing the blood-sugar level
  - (4) promoting the conversion of body fat into glycogen

Base your answers to questions **4645** through **4647** on the diagram below of the human heart and on your knowledge of biology.



- 4645 Which sequence represents part of the normal pathway of blood?

- (1)  $D \rightarrow B \rightarrow F \rightarrow E \rightarrow A$     (3)  $B \rightarrow D \rightarrow H \rightarrow G \rightarrow F$   
 (2)  $G \rightarrow E \rightarrow F \rightarrow H \rightarrow D$     (4)  $C \rightarrow B \rightarrow D \rightarrow A \rightarrow G$

## IV. REPRODUCTION AND DEVELOPMENT

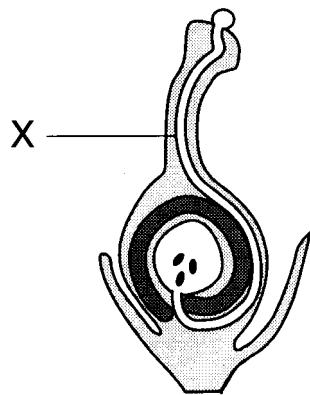
## 2. Reproduction In Flowers

### B. Fertilization and Embryo Development

4612 In flowering plants, the ripened ovary develops into a

- (1) seed
- (3) **fruit**
- (2) cotyledon
- (4) zygote

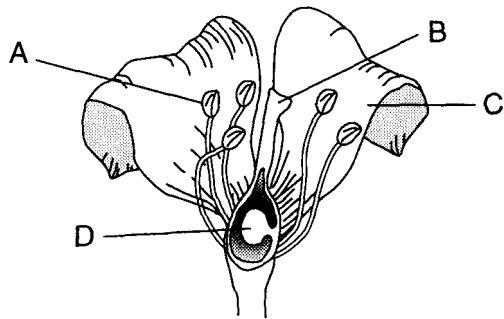
3921 The diagram below represents a reproductive process taking place in part of a flower.



The structure labeled X is an adaptation for

- (1) producing pollen
- (3) attracting pollinators
- (2) **internal fertilization**
- (4) seed dispersal

3791 A diagram of a flower is shown below.



Fertilization occurs in region

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

3656 Scientists have been able to produce mutations in plants by irradiating their seeds with gamma rays. The result of one of the mutations was a plant that could not produce flowers. Because of this lack of flowers, the plant would *not* be able to

- (1) carry out photosynthesis
- (2) transport water
- (3) **reproduce sexually**
- (4) grow more than a few inches tall

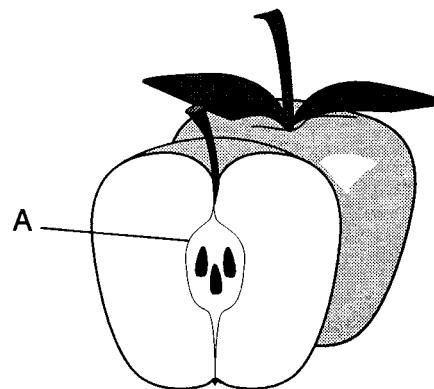
3144 In a plant, the site of meiosis and fertilization is the

- (1) **flower**
- (3) stem
- (2) root
- (4) leaf

37 In flowering plants, fertilization occurs in the

- (1) pollen grain
- (3) pollen tube
- (2) **ovule**
- (4) stamen

3471 From which flower part does structure A in the diagram below develop?



- (1) stamen
- (3) anther
- (2) petal
- (4) **ovary**

3367 The spotted touch-me-not, a flowering plant, has seed pods that burst open when touched and forcefully eject their seeds. Such an adaptation is favorable because it

- (1) **aids in the dispersal of the species**
- (2) attracts insects that aid in pollination
- (3) prevents germination within the seed pod
- (4) can cause genetic changes to occur

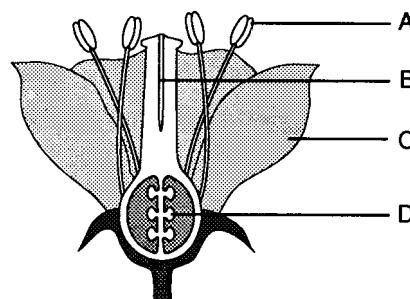
3366 Based on the fact that a watermelon contains many seeds, what can be inferred about a normal flower of a watermelon plant?

- (1) It contains many sepals and petals.
- (2) It contains very large anthers.
- (3) **It contains a large number of ovules.**
- (4) It contains a large number of stamens.

3042 In a plant, which structure enables sperm nuclei to reach the ovule?

- (1) stigma
- (3) stamen
- (2) **pollen tube**
- (4) seed coat

2921 Which letter indicates the structure within which fertilization takes place?



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



## V. GENETICS

## A. Basic Concepts

- 3043 In screech owls, red feathers are dominant over gray feathers. If two heterozygous red-feathered owls are mated, what percentage of their offspring would be expected to have red feathers?



- 2924 In chickens, rose comb (*R*) is dominant over single comb (*r*). When a heterozygous rose-combed rooster is mated with several single-combed hens, what is the expected phenotypic ratio of the offspring?

- (1) 100% rose-combed
  - (2) 100% single-combed
  - (3) 75% rose-combed and 25% single-combed
  - (4) **50% rose-combed and 50% single-combed**

- 2686 The gene for tallness ( $T$ ) is dominant over the gene for shortness ( $t$ ) in pea plants. A homozygous dominant pea plant is crossed with a heterozygous pea plant, and 200 seeds are produced. Approximately how many of these seeds can be expected to produce plants that are homozygous dominant?



- 2568 In summer squash, white-colored fruit is dominant over yellow-colored fruit. If homozygous yellow-fruited plants are crossed with heterozygous white-fruited plants, what is the expected percentage of fruit color produced in the offspring?

- (1) 100% yellow      (3) **50% yellow, 50% white**  
(2) 100% white      (4) 25% yellow, 75% white

- 2452 In pea plants, the trait for tall stems is dominant over the trait for short stems. If two heterozygous tall plants are crossed, what percentage of the offspring would be expected to have the same *phenotype* as the parents?

- (1) 25% (3) 75%  
**(2) 50%** (4) 100%

- 2224 Two mice that are heterozygous for black coat color are mated. Assuming coat color in mice is controlled by a single pair of genes, which genotypic ratio for coat color is expected in the offspring?



- 1782 In pea plants, the long-stem trait (L) is dominant and the short-stem trait (l) is recessive. Two pea plants were crossed, producing seeds that yielded 165 long-stem plants and 54 short-stem plants. The genotypes of the parent plants were most likely



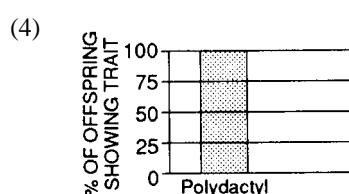
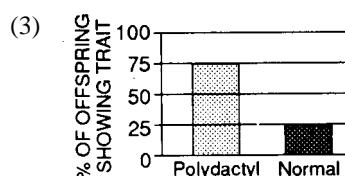
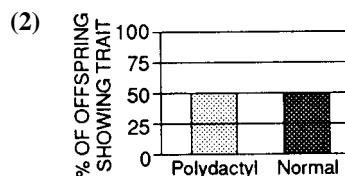
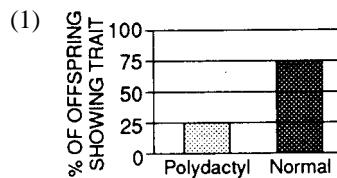
- 1569 In minks, the gene for brown fur ( $B$ ) is dominant over the gene for silver fur ( $b$ ). Which set of genotypes represents a cross that could produce offspring with silver fur from parents that both have brown fur?



## 1. Foundations of Genetics

### **iii. Punnett Square Problems**

- 2327 In humans, the trait for polydactyly (having extra fingers and toes) is dominant over the gene for the normal number of digits. Which bar graph best represents the expected percentages of phenotypes among the offspring produced by a heterozygous polydactyl individual and a homozygous recessive individual?



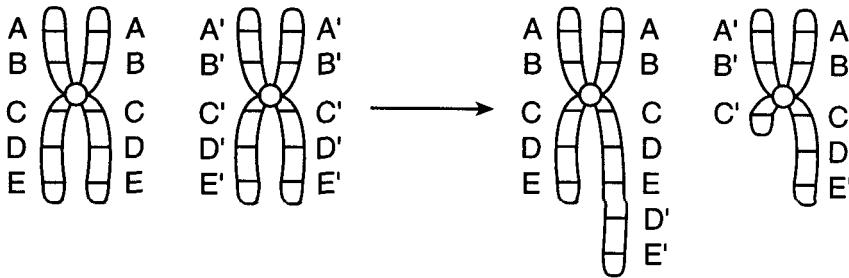
- 2219 The chart below indicates a method of representing traits in pea plants.

Symbol for Gene	Trait Represented
<i>T</i>	tall
<i>t</i>	short
<i>Y</i>	yellow
<i>y</i>	green

Some offspring of a cross in pea plants were tall and green. According to the chart, these plants could be represented by

- (1)  $TTYY$       (3)  $ttYy$   
 (2)  $Ttyy$       (4)  $TtYy$

- 4720 The diagram below represents a change that occurred in a pair of chromosomes during the formation of an egg cell. The letters represent genes on the pair of chromosomes.



The alteration that occurred will most likely

- (1) be passed on to every cell that develops from the egg cell    (3) convert sex cells into body cells  
(2) change the chromosome number of the body cells that    (4) trigger the production of pathogens

- 6700 A mutation that can be inherited by offspring would result from

- (1) random breakage of chromosomes in the nucleus of liver cells
  - (2) a base substitution in gametes during meiosis**
  - (3) abnormal lung cells produced by toxins in smoke
  - (4) ultraviolet radiation damage to skin cells

- 5946 An error in genetic information present in a body cell of a mammal would most likely produce

- (1) rapid evolution of the organism in which the cell is found
  - (2) a mutation that will affect the synthesis of a certain protein in the cell**
  - (3) an adaptation that will be passed on to other types of cells
  - (4) increased variation in the type of organelles present in the cell

- 5882 Mutations that occur in skin or lung cells have little effect on the evolution of a species because mutations in these cells

- (1) usually lead to the death of the organism
  - (2) cannot be passed on to offspring**
  - (3) are usually beneficial to the organism
  - (4) lead to more serious mutations in offspring

- 5658 A mutation occurs in the liver cells of a certain field mouse. Which statement concerning the spread of this mutation through the mouse population is correct?

  - (1) It will spread because it is beneficial.
  - (2) It will spread because it is a dominant gene.
  - (3) It will not spread because it is not in a gamete.**
  - (4) It will not spread because it is a recessive gene.



- 4617 Chromosomal mutations occurring in gametes of humans can affect the appearance of offspring because

- (1) many traits are usually affected
  - (2) only one trait is usually affected
  - (3) these mutations usually speed up embryonic development
  - (4) these mutations usually result in sex-linked traits

- 4141 A mutation may be passed on to future generations if it occurs within specialized cells of the





- 3930 Which mutation could be passed on to future generations?

- (1) a gene change in a liver cell
  - (2) cancer caused by excessive exposure of skin cells to the Sun
  - (3) a chromosomal alteration during gametogenesis**
  - (4) random breakage of a chromatid in a leaf cell of a maple tree

- 3149 Changes in the genetic material in sex cells are mutations that

- (1) may be transmitted to the next generation
  - (2) are always eliminated during meiosis
  - (3) are always sex-linked
  - (4) cannot affect the organism or its offspring

- 1787 Mutations can be transmitted to the next generation only if they are present in

## A. DNA

## iv. Gene Mutation

5239 The ozone layer of Earth's atmosphere helps to filter ultraviolet radiation. As the ozone layer is depleted, more ultraviolet radiation reaches Earth's surface. This increase in ultraviolet radiation may be harmful because it can directly cause

- (1) photosynthesis to stop in all marine organisms
- (2) abnormal migration patterns in waterfowl
- (3) mutations in the DNA of organisms**
- (4) sterility in most species of mammals and birds

5153 Which statement is true regarding an alteration or change in DNA?

- (1) It is always known as a mutation.**
- (2) It is always advantageous to an individual.
- (3) It is always passed on to offspring.
- (4) It is always detected by the process of chromatography.

4796 New inheritable characteristics would be *least* likely to result from

- (1) mutations which occur in muscle cells and skin cells**
- (2) mutations which occur in male gametes
- (3) mutations which occur in female gametes
- (4) the sorting and recombination of existing genes during meiosis and fertilization

4713 A medical test indicates that a patient has a defective protein. This condition is most likely due to a change in the directions coded in the

- (1) number of hydrogen atoms in starch molecules
- (2) sequence of inorganic molecules
- (3) number of carbon atoms in sugar molecules
- (4) sequence of subunits in DNA**

4531 A mutation may occur in a gene as a result of the

- (1) synthesis of a spindle apparatus
- (2) loss of a nucleotide**
- (3) loss of a nucleolus
- (4) replication of centromeres

4380 When the antibiotic penicillin was first introduced, it was immediately effective in combating staphylococcus bacteria infections. After a number of years, there were outbreaks of staphylococcal infections that did not respond to treatment with penicillin. The best explanation for this situation is that

- (1) members of the original population of bacteria that were penicillin resistant survived and reproduced, creating a more resistant population**
- (2) the bacteria that survived exposure to penicillin learned to avoid it
- (3) the bacteria that caused the new outbreaks were from populations that had never been exposed to penicillin
- (4) during each generation, the bacteria modified their own DNA to increase their ability to resist penicillin and passed this ability on to their descendants

4329 If an adenine nucleotide is deleted from a nucleotide sequence in a DNA molecule, the result is a

- (1) clone
- (2) mutation**
- (3) polypeptide
- (4) hybrid

4193 A single change in the sequence of nitrogenous bases in a DNA molecule would most likely result in

- (1) crossing-over
- (2) polyploidy
- (3) nondisjunction of chromosomes
- (4) a gene mutation**

3987 In the portions of the DNA molecules below, X represents the base sequence of strand I in the original DNA molecule, and Y represents the base sequence of strand I in the newly formed DNA molecule.

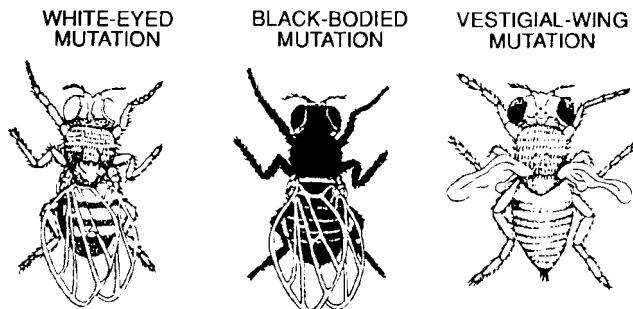
X: A-T-G-C-C-A-T-A-G

Y: A-T-G-C-C-A-A-T-G

The base sequence in Y is an example of

- (1) polyploidy
- (3) a gene mutation**
- (2) a chromosome deletion
- (4) translocation

3197 The diagram below illustrates differences that occur in fruit flies.



These differences could have been caused by

- (1) hydrogen bonds breaking in the process of DNA replication
- (2) random errors occurring in the process of DNA replication**
- (3) the substitution of ribose for deoxyribose in RNA
- (4) the substitution of uracil for thymine in RNA

1614 A single gene mutation would most likely occur if

- (1) messenger-RNA molecules temporarily bond to DNA molecules
- (2) the cytoplasm lacks the amino acids necessary to synthesize a certain polypeptide
- (3) a base sequence in a DNA molecule is changed**
- (4) transfer-RNA molecules do not line up properly on a messenger-RNA molecule

5431 The theory of biological evolution includes the concept that

- (1) **species of organisms found on Earth today have adaptations not always found in earlier species**
- (2) fossils are the remains of present-day species and were all formed at the same time
- (3) individuals may acquire physical characteristics after birth and pass these acquired characteristics on to their offspring.
- (4) the smallest organisms are always eliminated by the larger organisms within the ecosystem

4934 Which statement represents the major concept of the biological theory of evolution?

- (1) A new species moves into a habitat when another species becomes extinct.
- (2) Every period of time in Earth's history has its own group of organisms.
- (3) **Present-day organisms on Earth developed from earlier, distinctly different organisms.**
- (4) Every location on Earth's surface has its own unique group of organisms.

4621 Many scientists believe that the earliest cells on Earth were relatively simple, lacking nuclear membranes and other organized cellular structures. Over time, more complex cells developed from these simple cells.

These statements describe the concept of

- (1) inheritance of acquired characteristics
- (2) **evolution**
- (3) dominance
- (4) use and disuse

4285 Although similar in many respects, two species of organisms exhibit differences that make each well adapted to the environment in which it lives. The process of change that may account for these differences is

- (1) **evolution**
- (2) germination
- (3) regeneration of lost structures
- (4) transmission of homologous structures

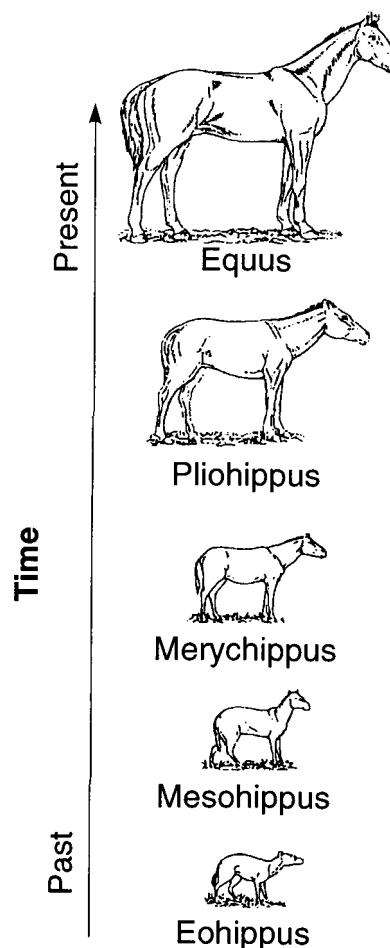
3934 A possible explanation for the differences in structure, function, and behavior between chimpanzees and humans is provided by the

- (1) heterotroph hypothesis (3) cell theory
- (2) lock-and-key model (4) **theory of evolution**

3268 Comparative studies in embryology, biochemistry, and cytology provide information used by modern biologists to examine new concepts about the

- (1) function of mouth parts in the grasshopper
- (2) function of nephridia in the earthworm
- (3) theory of use and disuse
- (4) **theory of organic evolution**

3804 The diagram below shows the gradual change over time in the anatomy of the horse.



Which concept is best illustrated by the physical variations in the horse as its body size and structure change over time?

- (1) acquired characteristics (3) intermediate inheritance
- (2) artificial selection (4) **organic evolution**

1997 Possible explanations for the differences in body structures, body functions, and behavior between various life-forms are included in the

- (1) **theories of organic evolution**
- (2) cell theory
- (3) fossil records of vertebrates
- (4) concept of use and disuse

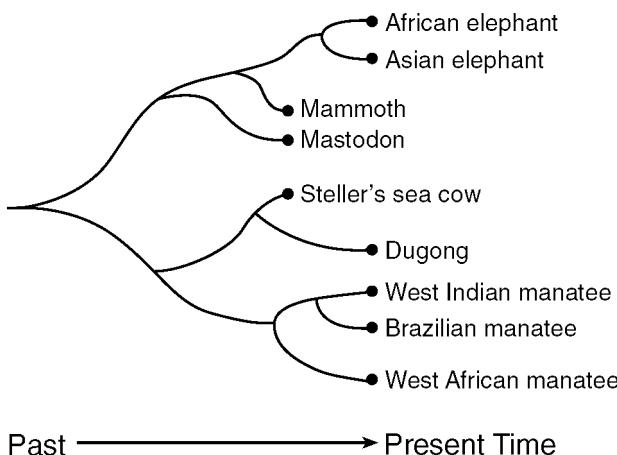
1579 Genetic variations are the raw material for evolution. These variations cannot be acted upon by natural selection factors unless they

- (1) produce only unfavorable characteristics
- (2) produce only favorable characteristics
- (3) are found in fossil records of the population
- (4) **are in the phenotype of the organism**

## VI. EVOLUTION

### B. Supporting Observations

5163 The relationship of some mammals is indicated in the diagram below.



Which statement about the African elephant is correct?

- (1) **It is more closely related to the mammoth than it is to the West African manatee.**
- (2) It is more closely related to the West Indian manatee than it is to the mastodon.
- (3) It is not related to the Brazilian manatee or the mammoth.
- (4) It is the ancestor of Steller's sea cow.

4724 Which statement is best supported by fossil records?

- (1) **Many organisms that lived in the past are now extinct.**
- (2) Species occupying the same habitat have identical environmental needs.
- (3) The struggle for existence between organisms results in changes in populations.
- (4) Structures such as leg bones and wing bones can originate from the same type of tissue found in embryos.

4382 Which statement about the rates of evolution for different species is in agreement with the theory of evolution?

- (1) They are identical, since the species live on the same planet.
- (2) They are identical, since each species is at risk of becoming extinct.
- (3) **They are different, since each species has different adaptations that function within a changing environment.**
- (4) They are different, since each species has access to unlimited resources within its environment.

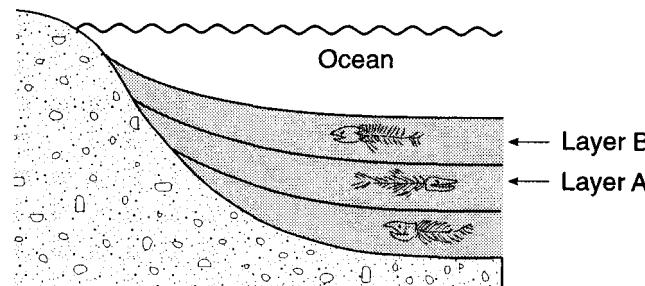
## 2. Modern Evolutionary Theory

### iii. Geologic Record/Ancestral Tree

4282 In a certain area of undisturbed layers of rock, fossils of horseshoe crabs may be found in the upper layer, and a lower layer contains fossils of trilobites. Trilobites are extinct aquatic arthropods resembling modern horseshoe crabs. This information suggests that

- (1) horseshoe crabs will soon become extinct
- (2) horseshoe crabs and trilobites are completely unrelated organisms
- (3) **horseshoe crabs may have evolved from trilobites**
- (4) trilobites may have evolved from horseshoe crabs

3378 The diagram below shows undisturbed sedimentary strata at the bottom of an ocean.



The fossils found in layer B resemble the fossils found in layer A. This similarity suggests that

- (1) the fossils in layer B were formed before the fossils in layer A
- (2) **modern forms of life may have evolved from earlier forms of life**
- (3) vertebrate fossils are only found in sediments
- (4) the fossils in layer A must be more complex than those in layer B

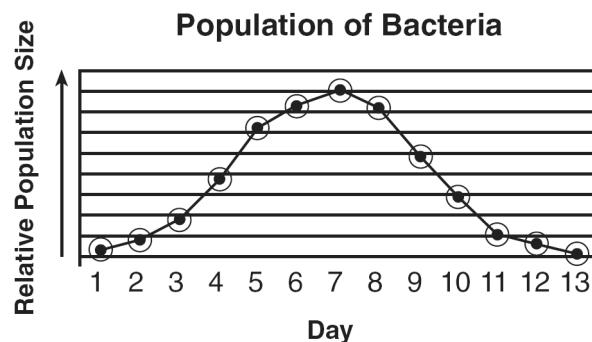
2460 A scientist studying fossils in undisturbed layers of rock identified a species that, he concluded, changed little over the years. Which observation probably would have led him to this conclusion?

- (1) The simplest fossil organisms appeared only in the oldest rocks.
- (2) The simplest fossil organisms appeared only in the newest rocks.
- (3) **The same kind of fossil organisms appeared in old and new rocks.**
- (4) No fossil organisms of any kind appeared in the newest rocks.

## VII. ECOLOGY

### A. Ecosystems

6644 A sample of bacteria was added to a culture dish containing a food supply. The dish was kept in an incubator for two weeks, where temperature and other conditions that favored bacterial growth were kept constant. The graph below shows changes that occurred in the bacterial population over the two weeks.



Which statement provides the best explanation for some of the changes observed?

- (1) The bacteria were unable to reproduce until day 8.
- (2) **The bacteria consumed all of the available food.**
- (3) The culture dish contained an antibiotic for the first five days.
- (4) The temperature increased and the bacteria died.

6483 The size of a frog population in a pond remains fairly constant over a period of several years because of

- (1) decreasing competition
- (2) **environmental carrying capacity**
- (3) excessive dissolved oxygen
- (4) the depth of water

6459 Abiotic factors that characterize a forest ecosystem include

- (1) light and biodiversity
- (2) **temperature and amount of available water**
- (3) types of procedures and decomposers
- (4) pH and number of heterotrophs

6400 Which factor has the greatest influence on the type of ecosystem that will form in a particular geographic area?

- (1) genetic variations in the animals
- (2) **climate conditions**
- (3) number of carnivores
- (4) percentage of nitrogen gas in the atmosphere

5960 In an ocean, the growth and survival of seaweed, small fish, and sharks depends on abiotic factors such as

- (1) **sunlight, temperature, and minerals**
- (2) sunlight, pH, and type of seaweed
- (3) number of decomposers, carbon dioxide, and nitrogen
- (4) number of herbivores, carbon, and food

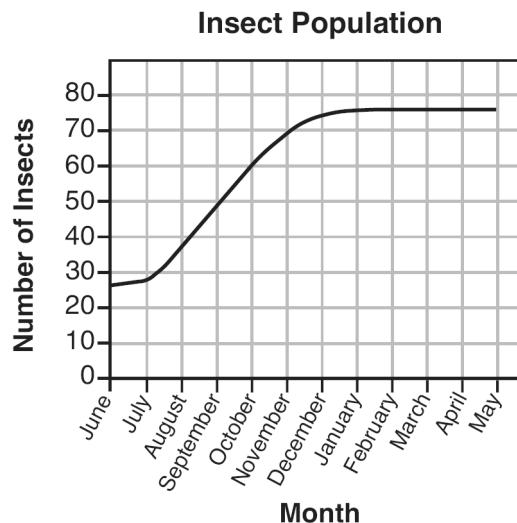
2805 The abiotic factors of a given area include the

- (1) animals (3) plants
- (2) **climatic conditions** (4) decomposers

### 1. Ecosystems, Biomes & Succession

#### iii. Abiotic, Biotic and Carrying Capacity

6203 Students conducting a study on an insect population placed 25 insects of the same size in a box. The amount of food, water, and shelter available to the insects was kept constant. Each month, students removed and counted the number of insects present, recorded the total, and returned the insects to the box. The graph below shows the number of insects in the box over a 12-month period.



What inference can be made regarding this insect population?

- (1) All the insects in the box are the same age.
- (2) The insects hibernated from January to April.
- (3) The population has carnivorous members.
- (4) **The population reached carrying capacity by January.**

5944 After a rabbit population reaches the carrying capacity of its habitat, the population of rabbits will most likely

- (1) decrease, only
- (2) increase, only
- (3) **alternately increase and decrease**
- (4) remain unchanged

5899 Four environmental factors are listed below.

- A. energy
- B. water
- C. oxygen
- D. minerals

Which factors limit environmental carrying capacity in a land ecosystem?

- (1) A, only (3) A, C, and D, only
- (2) B, C, and D, only (4) **A, B, C, and D**

5174 An environment can support only as many organisms as the available energy, minerals, and oxygen will allow. Which term is best described by this statement?

- (1) biological feedback (3) homeostatic control
- (2) **carrying capacity** (4) biological diversity

## VII. ECOLOGY

### B. Biomes

4202 Some characteristics of four different biomes are represented in the chart below.

Biome	Characteristic Plant Life	Characteristic Animal Life
A	succulent plants	kangaroo rat, lizard
B	grasses	antelope, bison
C	deciduous trees	fox, deer
D	conifers	moose, black bear

Which biome is characterized by moderate precipitation, cold winters, warm summers, and climax plants that lose their leaves in the winter?

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

3996 The type of climax vegetation associated with a terrestrial biome is primarily determined by yearly temperature variation and the

- (1) presence of animal predators  
(2) presence of climax fauna  
(3) number of deciduous trees  
**(4) annual precipitation**

3728 The taiga biome is characterized by

- (1) long, cold winters; frozen subsoil; and no trees  
**(2) cold winters, coniferous trees, and much snow**  
(3) heavy rainfall, broad-leaved trees, and hot temperatures  
(4) hot days, cool nights, and little precipitation

3204 Which climatic condition, flora, and fauna are characteristic of a tundra biome?

- (1) subsoil permanently frozen, lichens, and moose  
**(2) subsoil permanently frozen, lichens, and caribou**  
(3) long winters, conifers, and moose  
(4) long winters, conifers, and caribou

1845 The types of herbivorous mammals present in a given terrestrial community depends most directly on the

- (1) type of plants present**  
(2) amount of nitrogen in the atmosphere  
(3) number of decomposers present  
(4) amount of oxygen dissolved in ponds and streams

1517 Which is the normal sequence of land biomes from the Equator to the North Pole at the same altitude?

- (1) tundra, taiga, tropical rain forest, temperate deciduous forest  
(2) tropical rain forest, tundra, taiga, temperate deciduous forest  
**(3) tropical rain forest, temperate deciduous forest, taiga, tundra**  
(4) temperate deciduous forest, tundra, taiga, tropical rain forest

### 1. Ecosystems, Biomes & Succession i. Terrestrial

1617 Which ecological unit provides the physical setting for the poem below?

The days be hot, the nights be cold,  
But cross we must, we rush for gold.  
The plants be short, the roots spread wide,  
Me leg she hurts, thorn's in me side.  
I fall, I crawl, I scream, I rave,  
Tiz me life that I must save.  
How can it be, I've come undone,  
Here 'neath this blazin' eternal Sun?  
The days be hot, the nights be cold,  
Me lonely bones alone grow old.

- (1) a desert biome**                          (3) a deciduous forest  
(2) a terrestrial food chain                  (4) a coniferous-tree biome

643 Land biomes are usually identified by the

- (1) number of years needed for succession to occur  
(2) largest animals found within their geographic areas  
**(3) type of climax vegetation present**  
(4) amount of sunlight reaching their producers

443 Which land biome is characterized by conifers, which include spruce and fir, as the dominant vegetation?

- (1) taiga**                          (3) desert  
(2) tundra                          (4) grassland

343 Generally, an increase in altitude has the same effect on the habitat of organisms as

- (1) an increase in latitude**  
(2) an increase in moisture  
(3) a decrease in available light  
(4) a decrease in longitude

234 A coniferous forest would be *least* likely to appear within the

- (1) United States                          (3) Canadian Provinces  
**(2) Arctic Circle**                          (4) U.S.S.R.

233 If a person traveled south from the Arctic Circle to the Equator, what would be the most probable sequence of land biomes he would pass through?

- (1) temperate forest → taiga → tundra → tropical forest  
(2) taiga → tundra → temperate forest → tropical forest  
(3) tundra → tropical forest → taiga → temperate forest  
**(4) tundra → taiga → temperate forest → tropical forest**

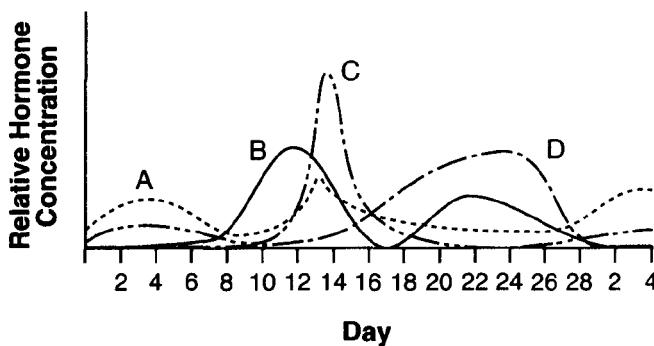
230 In a certain area, the climate is seasonal, (cold winters, warm summers), rainfall is moderate, and most trees shed their broad leaves in the fall. This area is known as a

- (1) tundra  
(2) taiga  
**(3) temperate deciduous forest**  
(4) tropical rain forest

## VIII. LABORATORY SKILLS

## 2. Experimental Fundamentals D. Organizing / Interpreting Data

- 6796 The graph below shows the relative concentrations of certain hormones in the blood during the human female reproductive cycle.



Which hormone has the lowest concentration on which day?

- (1) hormone A on day 4      (3) hormone C on day 12  
(2) **hormone B on day 2**      (4) hormone D on day 20

- 6547 Scientists in the United States, Europe, and Africa have now suggested that the hippopotamus is a relative of the whale. Earlier studies placed the hippo as a close relative of wild pigs, but recent studies have discovered stronger evidence for the connection to whales. This information suggests that

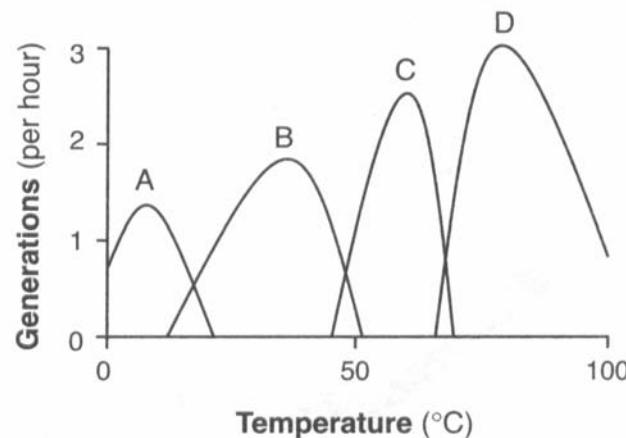
- (1) genetic engineering was involved in the earlier theories  
(2) structural evidence is the best evolutionary factor to consider  
(3) natural selection does not occur in hippopotamuses  
(4) **scientific explanations are tentative and subject to change**

- 6198 A biologist used the Internet to contact scientists around the world to obtain information about declining amphibian populations. He was able to gather data on 936 populations of amphibians, consisting of 157 species from 37 countries. Results showed that the overall numbers of amphibians dropped 15% a year from 1960 to 1966 and continued to decline about 2% a year through 1997.

What is the importance of collecting an extensive amount of data such as this?

- (1) Researchers will now be certain that the decline in the amphibian populations is due to pesticides.  
(2) The data collected will prove that all animal populations around the world are threatened.  
(3) Results from all parts of the world will be found to be identical.  
(4) **The quantity of data will lead to a better understanding of the extent of the problem.**

- 6412 The graph below provides information about the reproductive rates of four species of bacteria, A, B, C, and D, at different temperatures.



Which statement is a valid conclusion based on the information in the graph?

- (1) Changes in temperature cause bacteria to adapt to form new species.  
(2) Increasing temperatures speed up bacteria reproduction.  
(3) Bacteria can survive only at temperatures between 0°C and 100°C.  
(4) **Individual species reproduce within a specific range of temperatures.**

- 5287 A student could best demonstrate knowledge of how energy flows throughout an ecosystem by

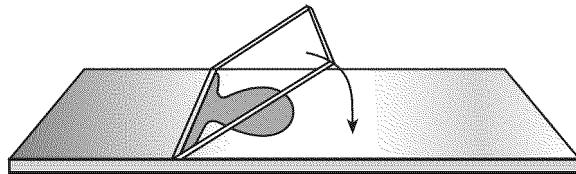
- (1) **drawing a food web using specific organisms living in a pond**  
(2) conducting an experiment that demonstrates the process of photosynthesis  
(3) labeling a diagram that illustrates ecological succession  
(4) making a chart to show the role of bacteria in the environment

- 648 Graphs of the data from laboratory investigations are used to

- (1) **observe general trends in the data**  
(2) make the observed data more accurate  
(3) prevent errors in measuring data  
(4) help change the original data tables

## A. Parts and Procedures

- 5752 The diagram below shows how a coverslip should be lowered onto some single-celled organisms during the preparation of a wet mount.



Why is this a preferred procedure?

- (1) The coverslip will prevent the slide from breaking.
- (2) The organisms will be more evenly distributed.
- (3) The possibility of breaking the coverslip is reduced.
- (4) The possibility of trapping air bubbles is reduced.**

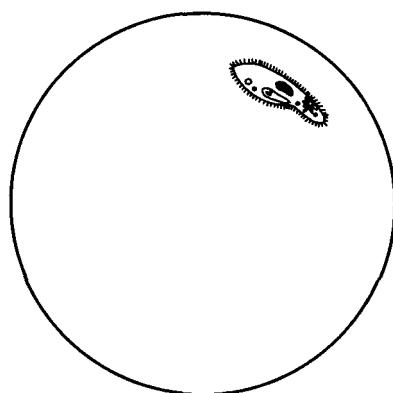
- 5321 After switching from the high-power to the low-power objective lens of a compound light microscope, the area of the low-power field will appear

- (1) larger and brighter**
- (3) larger and darker
- (2) smaller and brighter
- (4) smaller and darker

- 5251 A slide of human blood cells was observed in focus under the low-power objective of a compound light microscope that had clean lenses. When the microscope was switched to high power, the image was dark and fuzzy. Which parts of the microscope should be used to correct this situation?

- (1) nosepiece and coarse adjustment
- (2) diaphragm and ocular
- (3) objective and fine adjustment
- (4) diaphragm and fine adjustment**

- 4364 A cell in the field of view of a compound light microscope is shown in the diagram below.



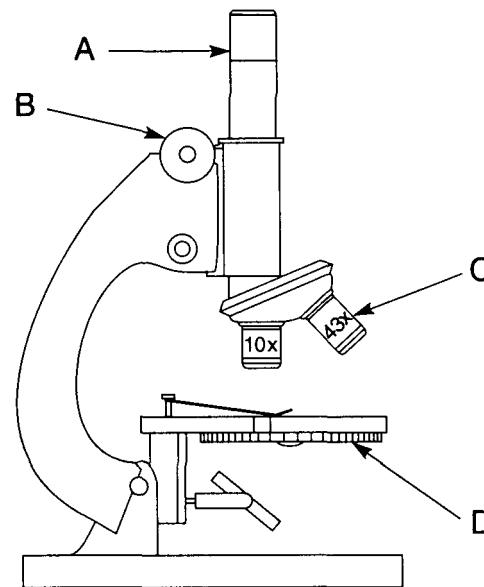
In which direction should the slide be moved to center this cell in the microscopic field?

- (1) to the right and up**
- (3) to the left and up
- (2) to the right and down
- (4) to the left and down

- 882 Which part of a microscope should be used with the low-power objective, but *not* with the high-power objective?

- (1) coarse adjustment**
- (3) diaphragm
- (2) fine adjustment
- (4) ocular

- 4013 A compound light microscope is represented in the diagram below.



Which microscope part is correctly paired with its function?

- (1) A – magnifies the image of the specimen**
- (2) B – used for focusing only when the high-power objective is used
- (3) C – provides the field of view with the largest diameter
- (4) D – holds the specimen on the stage

- 3732 Which structure in a stained cheek cell would most likely be visible when viewed through the high-power objective of a compound light microscope?

- (1) cell wall
- (3) chloroplast
- (2) ribosome
- (4) nucleolus**

- 3599 A student observed several cell layers positioned on top of one another in the high-power field of view of a compound light microscope. To observe the details of only one of these cell layers, the student should

- (1) move the slide from left to right
- (2) adjust the diaphragm to a smaller opening
- (3) rotate the fine adjustment**
- (4) turn the ocular

- 3553 When an *Elodea* leaf is placed in a concentrated salt solution, its cells lose water. When this process is observed with a compound light microscope, which organelle is more noticeable after the cells lose water?

- (1) cell membrane**
- (3) endoplasmic reticulum
- (2) mitochondrion
- (4) ribosome

- 1950 A specimen was viewed under the high-power objective of a compound light microscope. Its length was estimated to be 0.75 millimeter. What is the approximate length of the specimen in micrometers?

- (1) 0.00075
- (3) 75
- (2) 0.75
- (4) 750**