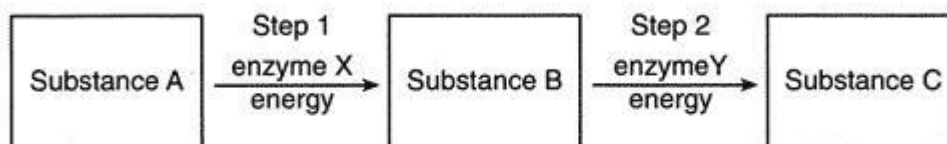




- Name:
- Date:

1

The diagram below represents the chemical pathway of a process in a human liver cell.



A particular liver cell is unable to make substance *C*. One possible explanation for the inability of this cell to make substance *C* is that

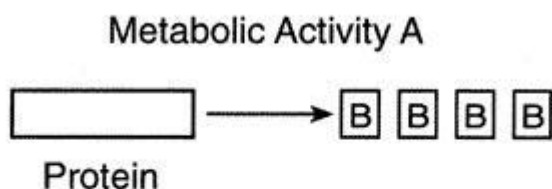
- (1) excess energy for step 2 prevented the conversion of substance *B* to substance *C*
- (2) an excess of enzyme *X* was present, resulting in a decrease in the production of substance *B*
- (3) nuclear DNA was altered resulting in the cell being unable to make enzyme *Y*
- (4) a mutation occurred causing a change in the ability of the cell to use substance *C*

Answer:

3

2

The diagram below represents one metabolic activity of a human.



Letters *A* and *B* are best represented by which row in the chart?

Row	Metabolic Activity A	B
(1)	respiration	oxygen molecules
(2)	reproduction	hormone molecules
(3)	excretion	simple sugar molecules
(4)	digestion	amino acid molecules

Answer:

4

3

When a person does strenuous exercise, small blood vessels (capillaries) near the surface of the skin increase in diameter. This change allows the body to be cooled. These statements best illustrate

- (1) synthesis
- (2) homeostasis
- (3) excretion
- (4) locomotion

Answer:

2

4

Which sequence represents the correct order of levels of organization found in a complex organism?

- (1) cells → organelles → organs → organ systems → tissues
- (2) tissues → organs → organ systems → organelles → cells
- (3) organelles → cells → tissues → organs → organ systems
- (4) organs → organ systems → cells → tissues → organelles

Answer:

3

5

Scientific studies show that identical twins who were separated at birth and raised in different homes may vary in height, weight, and intelligence. The most probable explanation for these differences is that

- (1) original genes of each twin increased in number as they developed
- (2) one twin received genes only from the mother while the other twin received genes only from the father
- (3) environments in which they were raised were different enough to affect the expression of their genes
- (4) environments in which they were raised were different enough to change the genetic makeup of both individuals

Answer:

3

6

When DNA separates into two strands, the DNA would most likely be directly involved in

- | | |
|-------------------|---------------------|
| (1) replication | (3) differentiation |
| (2) fertilization | (4) evolution |

Answer:

1

7

The instructions for the traits of an organism are coded in the arrangement of

- (1) glucose units in carbohydrate molecules
- (2) bases in DNA in the nucleus
- (3) fat molecules in the cell membrane
- (4) energy-rich bonds in starch molecules

Answer:

2

8

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

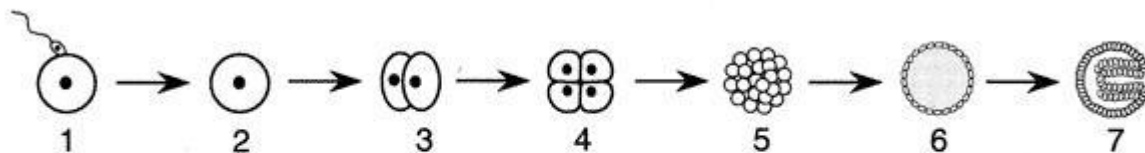
- (1) It is always known as a mutation.
- (2) It is always advantageous to an individual.
- (3) It is always passed on to offspring.
- (4) It is always detected by the process of chromatography.

Answer:

1

9

The sequence of diagrams below represents some events in a reproductive process.



To regulate similar events in human reproduction, what adaptations are required?

- (1) the presence of genes and chemicals in each cell in stages 1 to 7
- (2) an increase in the number of genes in each cell in stages 3 to 5
- (3) the removal of all enzymes from the cells in stage 7
- (4) the elimination of mutations from cells after stage 5

Answer:

1

10

In animals, the normal development of an embryo is dependent on

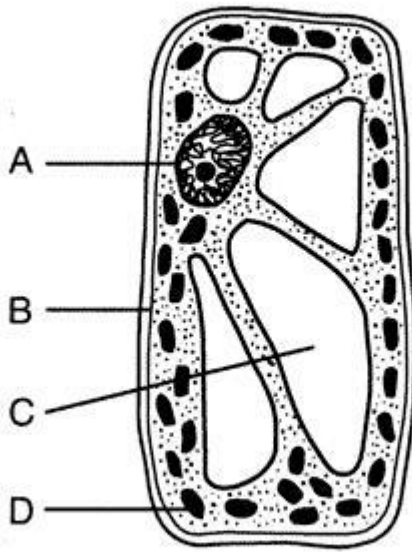
- (1) fertilization of a mature egg by many sperm cells
- (2) production of new cells having twice the number of chromosomes as the zygote
- (3) production of body cells having half the number of chromosomes as the zygote
- (4) mitosis and the differentiation of cells after fertilization has occurred

Answer:

4

11

Which letter indicates a cell structure that directly controls the movement of molecules into and out of the cell?



- (1) A
- (2) B

- (3) C
- (4) D

Answer:

2

12

Which process normally occurs at the placenta?

- (1) Oxygen diffuses from fetal blood to maternal blood.
- (2) Materials are exchanged between fetal and maternal blood.
- (3) Maternal blood is converted into fetal blood.
- (4) Digestive enzymes pass from maternal blood to fetal blood.

Answer:

2

13

Individual cells can be isolated from a mature plant and grown with special mixtures of growth hormones to produce a number of genetically identical plants. This process is known as

- (1) cloning
- (2) meiotic division
- (3) recombinant DNA technology
- (4) selective breeding

Answer:

1

14

The most immediate response to a high level of blood sugar in a human is an increase in the

- (1) muscle activity in the arms
- (2) blood flow to the digestive tract
- (3) activity of all cell organelles
- (4) release of insulin

Answer:

4

15

When a certain plant is without water for an extended period of time, guard cells close openings in the leaves of the plant. This activity conserves water and illustrates

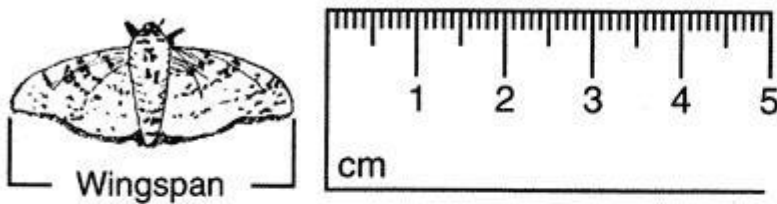
- (1) cellular communication involving the action of nerve cells and receptor sites
- (2) an increase in rate of growth due to a low concentration of water
- (3) maintenance of a dynamic equilibrium through detection and response to stimuli
- (4) a response to one biotic factor in the environment

Answer:

3

16

A peppered moth and part of a metric ruler are represented in the diagram below.



Which row in the chart below best represents the ratio of body length to wingspan of the peppered moth?

Row	Body Length:Wingspan
(1)	1:1
(2)	2:1
(3)	1:2
(4)	2:2

Answer:

3

17

Enzymes are used in moving sections of DNA that code for insulin from the pancreas cells of humans into a certain type of bacterial cell. This bacterial cell will reproduce, giving rise to offspring that are able to form

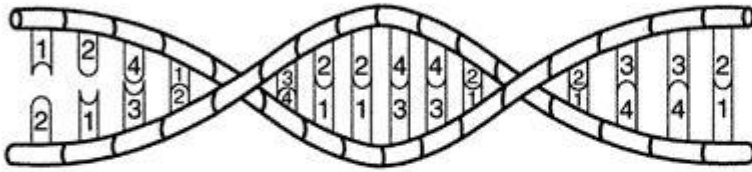
- (1) human insulin
- (2) antibodies against insulin
- (3) enzymes that digest insulin
- (4) a new type of insulin

Answer:

1

18

The diagram below represents a section of a molecule that carries genetic information.



The pattern of numbers represents

- (1) a sequence of paired bases
- (2) the order of proteins in a gene
- (3) folds of an amino acid
- (4) positions of gene mutations

Answer:

1

19

In the human pancreas, acinar cells produce digestive enzymes and beta cells produce insulin. The best explanation for this is that

- (1) a mutation occurs in the beta cells to produce insulin when the sugar level increases in the blood
- (2) different parts of an individual's DNA are used to direct the synthesis of different proteins in different types of cells
- (3) lowered sugar levels cause the production of insulin in acinar cells to help maintain homeostasis
- (4) the genes in acinar cells came from one parent while the genes in beta cells came from the other parent

Answer:

2

20

In sexually reproducing species, the number of chromosomes in each body cell remains the same from one generation to the next as a direct result of

- (1) meiosis and fertilization
- (2) mitosis and mutation
- (3) differentiation and aging
- (4) homeostasis and dynamic equilibrium

Answer:

1

21

One function of the placenta in a human is to

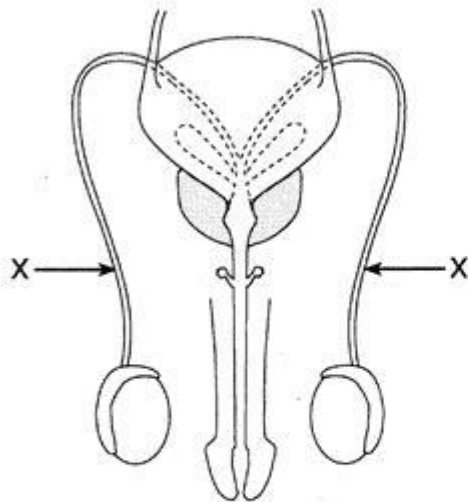
- (1) surround the embryo and protect it from shock
- (2) allow for mixing of maternal blood with fetal blood
- (3) act as the heart of the fetus, pumping blood until the fetus is born
- (4) permit passage of nutrients and oxygen from the mother to the fetus

Answer:

4

22

Some body structures of a human male are represented in the diagram below.



An obstruction in the structures labeled X would directly interfere with the

- (1) transfer of sperm to a female
- (2) production of sperm
- (3) production of urine
- (4) transfer of urine to the external environment

Answer:

1

23

Which statement best describes human insulin that is produced by genetically engineered bacteria?

- (1) This insulin will not function normally in humans because it is produced by bacteria.
- (2) This insulin is produced as a result of human insulin being inserted into bacteria cells.
- (3) This insulin is produced as a result of exposing bacteria cells to radiation, which produces a mutation.
- (4) This insulin may have fewer side effects than the insulin previously extracted from the pancreas of other animals.

Answer:

24

Cloning an individual usually produces organisms that

- (1) contain dangerous mutations
- (2) contain identical genes
- (3) are identical in appearance and behavior
- (4) produce enzymes different from the parent

Answer:

25

Which two systems are most directly involved in providing molecules needed for the synthesis of fats in human cells?

- (1) digestive and circulatory
- (2) excretory and digestive
- (3) immune and muscular
- (4) reproductive and circulatory

Answer:

26

Which statements best describe the relationship between the terms *chromosomes*, *genes*, and *nuclei*?

- (1) Chromosomes are found on genes. Genes are found in nuclei.
- (2) Chromosomes are found in nuclei. Nuclei are found in genes.
- (3) Genes are found on chromosomes. Chromosomes are found in nuclei.
- (4) Genes are found in nuclei. Nuclei are found in chromosomes.

Answer:

27

In a cell, information that controls the production of proteins must pass from the nucleus to the

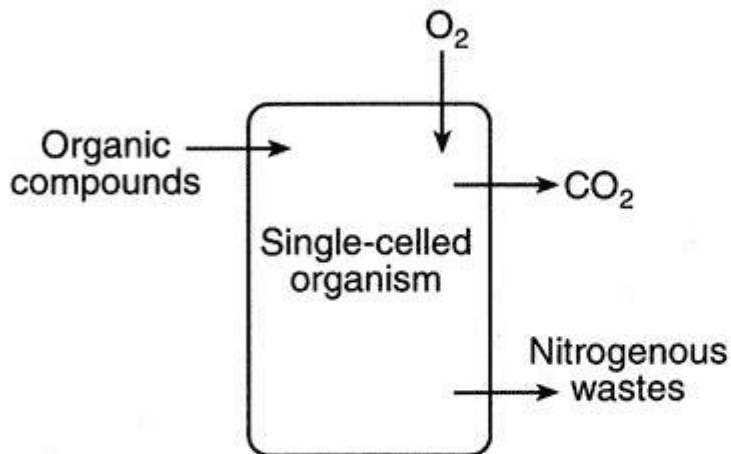
- | | |
|-------------------|------------------|
| (1) cell membrane | (3) mitochondria |
| (2) chloroplasts | (4) ribosomes |

Answer:

4

28

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) photosynthesis, only
- (3) excretion, only
- (4) the digestion of minerals

Answer:

1

29

The chart below shows relationships between genes, the environment, and coloration of tomato plants.

Inherited Gene	Environmental Condition	Final Appearance
A	Light	Green
B	Light	White
A	Dark	White
B	Dark	White

Which statement best explains the final appearance of these tomato plants?

- (1) The expression of gene *A* is not affected by light.
- (2) The expression of gene *B* varies with the presence of light.
- (3) The expression of gene *A* varies with the environment.
- (4) Gene *B* is expressed only in darkness.

Answer:

3

30

Nerve cells are essential to an animal because they directly provide

- (1) communication between cells
- (2) transport of nutrients to various organs
- (3) regulation of reproductive rates within other cells
- (4) an exchange of gases within the body

Answer:

1

31

Certain bacteria produce a chemical that makes them resistant to penicillin. Since these bacteria reproduce asexually, they usually produce offspring that

- (1) can be destroyed by penicillin
- (2) mutate into another species
- (3) are genetically different from their parents
- (4) survive exposure to penicillin

Answer:

4

32

A sudden change in the DNA of a chromosome can usually be passed on to future generations if the change occurs in a

- (1) skin cell
- (2) liver cell
- (3) sex cell
- (4) brain cell

Answer:

3

33

A change in the order of DNA bases that code for a respiratory protein will most likely cause

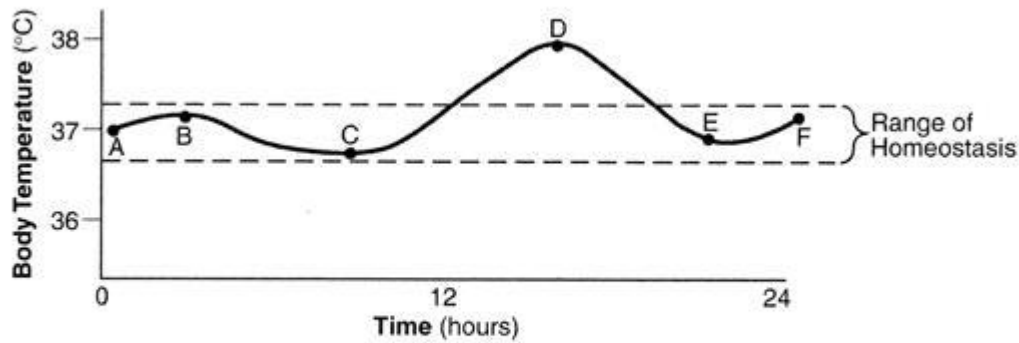
- (1) the production of a starch that has a similar function
- (2) the digestion of the altered gene by enzymes
- (3) a change in the sequence of amino acids determined by the gene
- (4) the release of antibodies by certain cells to correct the error

Answer:

3

34

The data in the graph below show evidence of disease in the human body.



A disruption in dynamic equilibrium is indicated by the temperature change between points

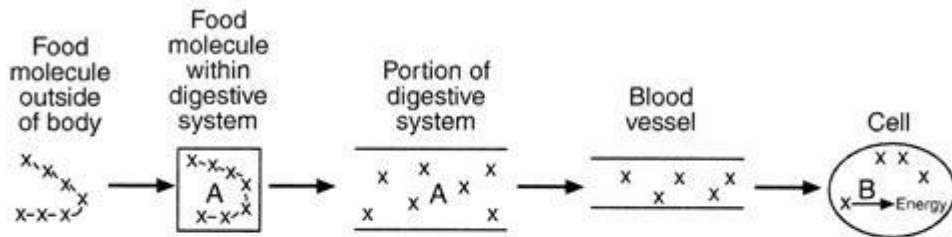
- (1) A and B
- (2) B and C
- (3) C and D
- (4) E and F

Answer:

3

35

The diagram below represents events involved as energy is ultimately released from food.



Which row in the table below best represents the chain of Xs and letters A and B in the diagram?

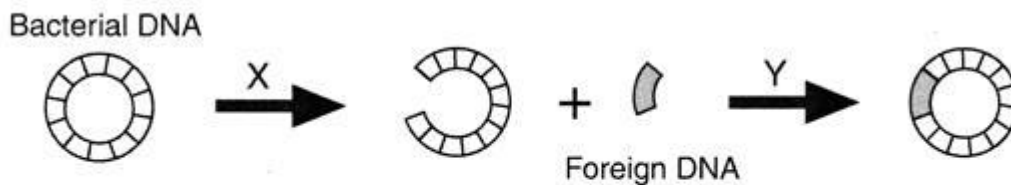
X-X-X-X-X-X	A and B
(1) nutrient	antibodies
(2) nutrient	enzymes
(3) hemoglobin	wastes
(4) hemoglobin	hormones

Answer:

2

36

The diagrams below represent some steps in a procedure used in biotechnology.



Letters X and Y represent the

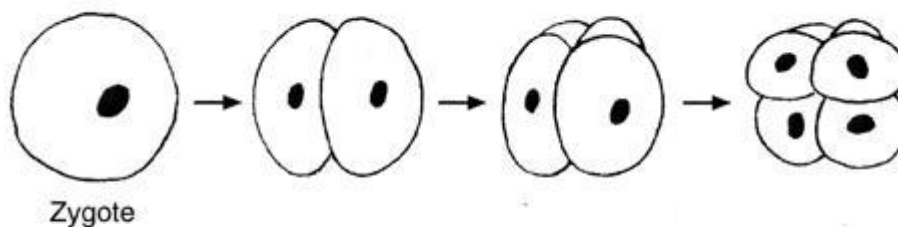
- (1) hormones that stimulate the replication of bacterial DNA
- (2) biochemical catalysts involved in the insertion of genes into other organisms
- (3) hormones that trigger rapid mutation of genetic information
- (4) gases needed to produce the energy required for gene manipulation

Answer:

2

37

The diagram below represents some stages of early embryonic development.



Which process is represented by the arrows in the diagram?

- | | |
|-------------------|---------------|
| (1) meiosis | (3) mitosis |
| (2) fertilization | (4) evolution |

Answer:

3

38

The diagram below represents a developing bird egg.



What is the primary function of this egg?

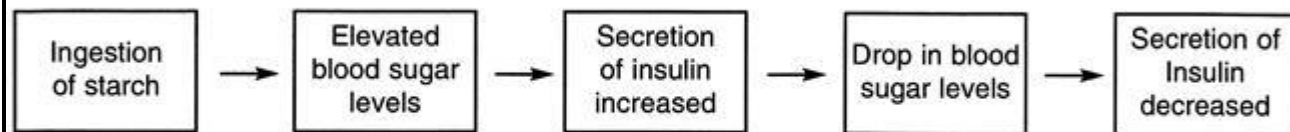
- (1) food supply for predators to preserve predator populations
- (2) adaptation to allow maximum freedom for parent birds
- (3) continuation of the species through reproduction
- (4) preservation of the exact genetic code of the parent birds

Answer:

3

39

What is represented by the sequence below?



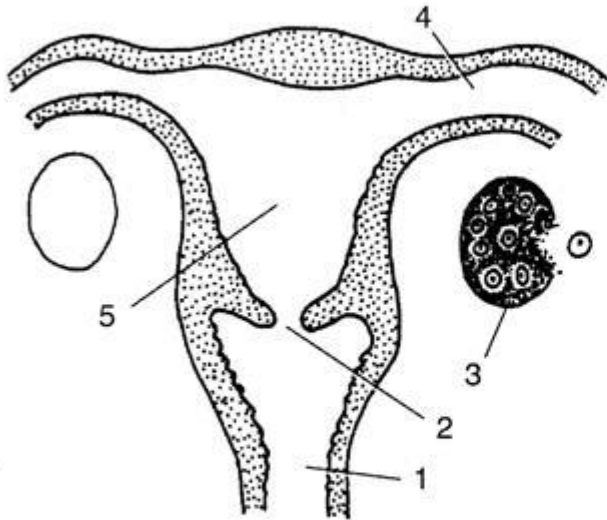
- (1) a feedback mechanism in multicellular organisms
- (2) an immune response by cells of the pancreas
- (3) differentiation of organic molecules
- (4) the disruption of cellular communication

Answer:

1

40

The diagram below represents part of the human female reproductive system.



Fertilization and development normally occur in structures

- | | |
|-------------|-------------|
| (1) 1 and 5 | (3) 3 and 1 |
| (2) 2 and 4 | (4) 4 and 5 |

Answer:

4

41

Which structure is best observed using a compound light microscope?

- (1) a cell
- (2) a virus
- (3) a DNA sequence
- (4) the inner surface of a mitochondrion

Answer:

1

42

Which words best complete the lettered blanks in the two sentences below?

Organic compounds, such as proteins and starches, are too A to diffuse into cells. Proteins are digested into B and starches are digested into C.

- (1) A—large, B—simple sugars, C—amino acids
- (2) A—small, B—simple sugars, C—amino acids
- (3) A—large, B—amino acids, C—simple sugars
- (4) A—small, B—amino acids, C—simple sugars

Answer:

3

43

The photographs below show some physical similarities between John Lennon and his son Julian.



Lewis, Ricki *Life* 3rd edition WCB/McGraw Hill

Which conclusion can be drawn regarding these similarities?

- (1) The DNA present in their body cells is identical.
- (2) The percentage of their proteins with the same molecular composition is high.
- (3) The base sequences of their genes are identical.
- (4) The mutation rate is the same in their body cells.

Answer:

2

44

The reproductive system of the human male produces gametes and

- (1) transfers gametes to the female for internal fertilization
- (2) produces enzymes that prevent fertilization
- (3) releases hormones involved in external fertilization
- (4) provides an area for fertilization

Answer:

1

45

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

Answer:

4

46

Which statement concerning simple sugars and amino acids is correct?

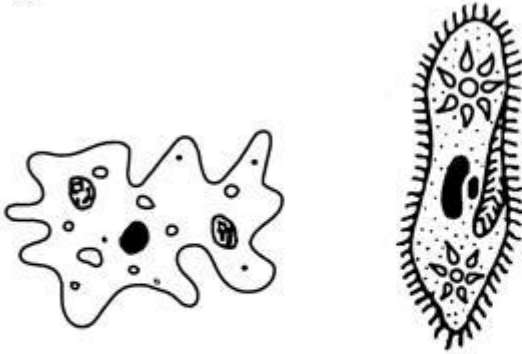
- (1) They are both wastes resulting from protein synthesis.
- (2) They are both building blocks of starch.
- (3) They are both needed for the synthesis of larger molecules.
- (4) They are both stored as fat molecules in the liver.

Answer:

3

47

The diagram below represents two single-celled organisms.



These organisms carry out the activities needed to maintain homeostasis by using specialized internal

- | | |
|----------------|-------------|
| (1) tissues | (3) systems |
| (2) organelles | (4) organs |

Answer:

2

48

The sequence of subunits in a protein is most directly dependent on the

- (1) region in the cell where enzymes are produced
- (2) DNA in the chromosomes in a cell
- (3) type of cell in which starch is found
- (4) kinds of materials in the cell membrane

Answer:

2

49

Fruit flies with the curly-wing trait will develop straight wings if kept at a temperature of 16°C during development and curly wings if kept at 25°C. The best explanation for this change in the shape of wings is that the

- (1) genes for curly wings and genes for straight wings are found on different chromosomes
- (2) type of genes present in the fruit fly is dependent on environmental temperature
- (3) environment affects the expression of the genes for this trait
- (4) higher temperature produces a gene mutation

Answer:

3

50

The genetic code of a DNA molecule is determined by a specific sequence of

- (1) ATP molecules (3) chemical bonds
- (2) sugar molecules (4) molecular bases

Answer:

4

51

To produce large tomatoes that are resistant to cracking and splitting, some seed companies use the pollen from one variety of tomato plant to fertilize a different variety of tomato plant. This process is an example of

- (1) selective breeding (3) direct harvesting
- (2) DNA sequencing (4) cloning

Answer:

1

52

The cells that make up the skin of an individual have some functions different from the cells that make up the liver because

- (1) all cells have a common ancestor
- (2) different cells have different genetic material
- (3) environment and past history have no influence on cell function
- (4) different parts of genetic instructions are used in different types of cells

Answer:

4

53

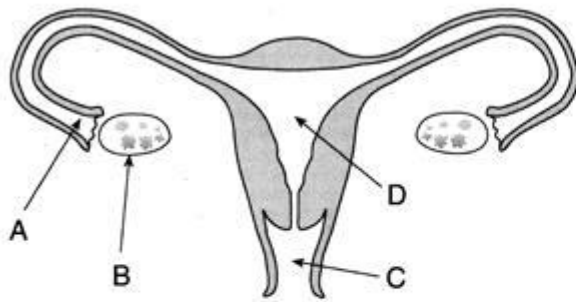
The production of certain human hormones by genetically engineered bacteria results from

- (1) inserting a specific group of amino acids into the bacteria
- (2) combining a portion of human DNA with bacterial DNA and inserting this into bacteria
- (3) crossing two different species of bacteria
- (4) deleting a specific amino acid from human DNA and inserting it into bacterial DNA

Answer:

2

54



In which part of this system does a fetus usually develop?

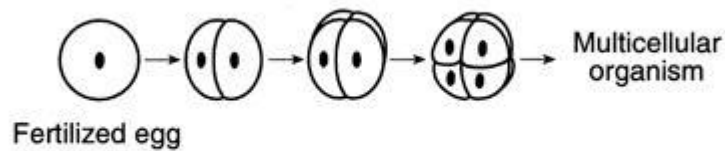
- (1) A
- (2) B
- (3) C
- (4) D

Answer:

4

55

Which phrase best describes a process represented in the diagram below?



- (1) a zygote dividing by mitosis
- (2) a zygote dividing by meiosis
- (3) a gamete dividing by mitosis
- (4) a gamete dividing by meiosis

Answer:

1

56

Which phrase does *not* describe cells cloned from a carrot?

- (1) they are genetically identical
- (2) they are produced sexually
- (3) they have the same DNA codes
- (4) they have identical chromosomes

Answer:

2

57

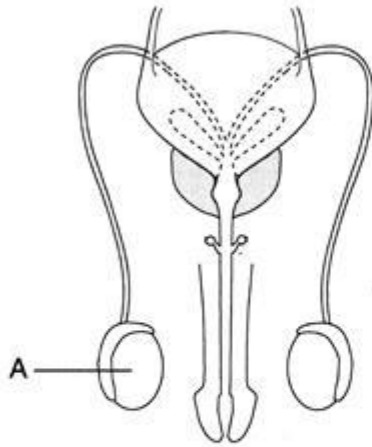
Human egg cells are most similar to human sperm cells in their

- (1) degree of motility
- (2) amount of stored food
- (3) chromosome number
- (4) shape and size

Answer:

58

The diagram below represents the reproductive system of a mammal.



The hormone produced in structure A most directly brings about a change in

- (1) blood sugar concentration
- (2) physical characteristics
- (3) the rate of digestion
- (4) the ability to carry out respiration

Answer:

59

Which situation is *not* an example of the maintenance of a dynamic equilibrium in an organism?

- (1) Guard cells contribute to the regulation of water content in a geranium plant.
- (2) Water passes into an animal cell causing it to swell.
- (3) The release of insulin lowers the blood sugar level in a human after eating a big meal.
- (4) A runner perspires while running a race on a hot summer day.

Answer:

60

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

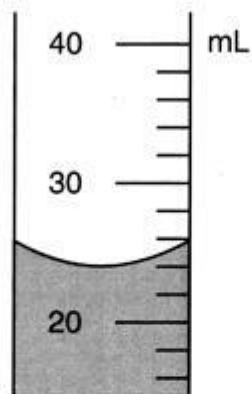
- (1) larger and brighter
- (2) smaller and brighter
- (3) larger and darker
- (4) smaller and darker

Answer:

1

61

The diagram below shows a portion of a graduated cylinder.



What is the volume of the liquid in this cylinder?

- (1) 22 mL
- (2) 24 mL
- (3) 25 mL
- (4) 26 mL

Answer:

2

62

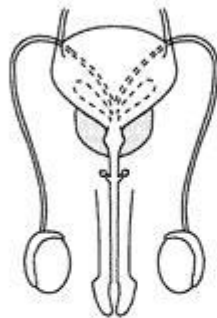
A mutation occurs in a cell. Which sequence best represents the correct order of the events involved for this mutation to affect the traits expressed by this cell?

- (1) a change in the sequence of DNA bases → joining amino acids in sequence → appearance of characteristic
- (2) joining amino acids in sequence → a change in the sequence of DNA bases → appearance of characteristic
- (3) appearance of characteristic → joining amino acids in sequence → a change in the sequence of DNA bases
- (4) a change in the sequence of DNA bases → appearance of characteristic → joining amino acids in sequence

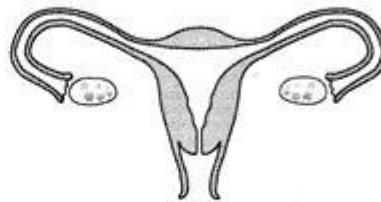
Answer:

1

The diagrams below represent organs of two individuals. The diagrams are followed by a list of sentences. For each phrase in questions 47 through 49, select the sentence from the list below that best applies to that phrase. Then record its *number* in the space provided.



Individual A



Individual B

Sentences

1. The phrase is correct for both Individual A and Individual B.
2. The phrase is not correct for either Individual A or Individual B.
3. The phrase is correct for Individual A, only.
4. The phrase is correct for Individual B, only

63

Contains organs that produce gametes

Answer:

1

64

Contains organs involved in internal fertilization

Answer:

1

65

Contains a structure in which a zygote divides by mitosis

Answer:

4

Standard(s):

[4.1.10.F](#), [4.1.12.F](#), [4.2.10.D](#), [4.2.12.D](#), [4.3.10.C](#), [4.3.12.C](#), [4.4.10.E](#), [4.4.12.E](#), [4.5.10.F](#), [4.5.12.F](#)

... Some of the most common and deadly bacteria do their mischief by forming a sticky scum called biofilm. Individually, the microbes are easy to control, but when they organize themselves into biofilms they can become deadly, said Dr. Barbara Iglewski of the University of Rochester. ...

Biofilms are actually intricately organized colonies of billions of microbes, all working in a coordinated way to defend against attack and to pump out a toxin that can be deadly.

Once they are organized, the bacteria are highly resistant to antibiotics and even strong detergents often cannot wash them away or kill them.

Iglewski and colleagues from Montana State University and the University of Iowa report in *Science* that they discovered how the microbes in the colonies communicate and found that once this conversation is interrupted, the deadly bugs can be easily washed away.

Using *Pseudomonas aeruginosa*, a common bacteria that is a major infection hazard in hospitals and among cystic fibrosis patients, the researchers isolated a gene that the bacteria uses to make a communications molecule. The molecule helps the microbes organize themselves into a biofilm — a complex structure that includes tubes to carry in nutrients and carry out wastes, including deadly toxins.

In their study, the researchers showed that if the gene that makes the communications molecule was blocked, the *Pseudomonas aeruginosa* could form only wimpy [weak], unorganized colonies that could be washed away with just a soap that has no effect on a healthy colony. ...

Adapted from: Paul Recer, "Researchers find new means to disrupt attack by microbes,"
The Daily Gazette, April 26, 1998.

66

Standard(s):

What is one characteristic of a biofilm?

- (1) presence of tubes to transport materials into and out of the colony
- (2) presence of a nervous system for communication within the colony
- (3) ease with which colonies can be broken down by detergents
- (4) lack of resistance of the bacterial colony to antibiotics

Answer:

1

67

Standard(s):

[4.1.10.F](#), [4.1.12.F](#), [4.2.10.D](#), [4.2.12.D](#), [4.3.10.C](#), [4.3.12.C](#), [4.4.10.E](#), [4.4.12.E](#), [4.5.10.F](#), [4.5.12.F](#)

Which statement best describes *Pseudomonas aeruginosa* bacteria?

- (1) They cause mutations in humans.
- (2) They are easy to control.
- (3) They cause major infection problems in hospitals.
- (4) They are deadly only to people with cystic fibrosis.

Answer:

3

68

The tubes in biofilms function much like the human

- (1) muscular and nervous systems
- (2) circulatory and excretory systems
- (3) digestive and endocrine systems
- (4) reproductive and respiratory systems

Answer:

2

Standard(s):

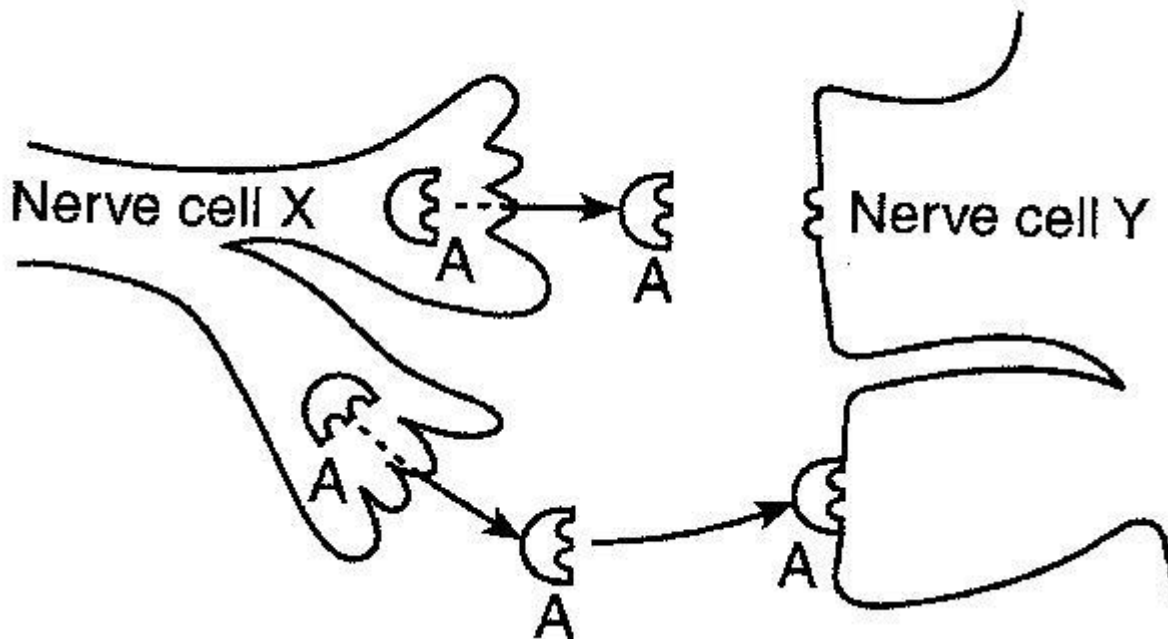
[4.1.10.F](#), [4.1.12.F](#), [4.2.10.D](#), [4.2.12.D](#), [4.3.10.C](#), [4.3.12.C](#), [4.4.10.E](#), [4.4.12.E](#), [4.5.10.F](#), [4.5.12.F](#)

Bacteria that form biofilms may be controlled most effectively by

- (1) antibiotics
- (2) detergents
- (3) cutting the tubes through which the bacteria communicate
- (4) blocking the expression of a gene that helps the colonies to organize

Answer:

4



The process represented in the diagram best illustrates

- (1) cellular communication
- (2) muscle contraction
- (3) extraction of energy from nutrients
- (4) waste disposal

Answer:

1

Which statement best describes the diagram?

- (1) Nerve cell X is releasing receptor molecules.
- (2) Nerve cell Y is signaling nerve cell X.
- (3) Nerve cell X is attaching to nerve cell Y.
- (4) Nerve cell Y contains receptor molecules for substance A.

Answer:

4

A drug is developed that, due to its molecular shape, blocks the action of substance A. Which shape would the drug molecule most likely resemble?



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

Answer:

2

In DNA, a sequence of three bases is a code for the placement of a certain amino acid in a protein chain. The table below shows some amino acids with their abbreviations and DNA codes.

Amino Acid	Abbreviation	DNA Code
Phenylalanine	Phe	AAA, AAG
Tryptophan	Try	ACC
Serine	Ser	AGA, AGG, AGT, AGC, TCA, TCG
Valine	Val	CAA, CAG, CAT, CAC
Proline	Pro	GGA, GGG, GGT, GGC
Glutamine	Glu	GTT, GTC
Threonine	Thr	TGA, TGG, TGT, TGC
Asparagine	Asp	TTA, TTG

Which amino acid chain would be produced by the DNA base sequence below?

C-A-A-G-T-T-A-A-A-T-T-A-T-T-G-T-G-A

- (1) Val — Glu — Phe — Asp — Thr — Asp
- (2) Val — Pro — Phe — Asp — Asp — Thr
- (3) Val — Glu — Phe — Asp — Asp — Thr
- (4) Val — Glu — Phe — Thr — Asp — Asp

Answer:

3

74

Identify one environmental factor that could cause a base sequence in DNA to be changed to a different base sequence. [1]

Scoring Guide:

Allow 1 credit for identifying one environmental factor that could cause a base sequence in DNA to be changed to a different base sequence. Acceptable responses include, but are not limited to:

- ultraviolet light
- radiation
- x rays
- chemicals

75

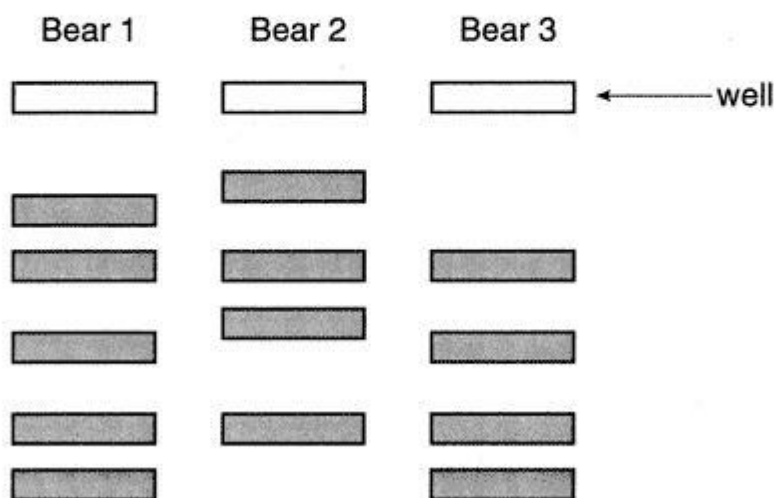
Describe how a protein would be changed if a base sequence mutates from GGA to TGA. [1]

Scoring Guide:

Allow 1 credit for describing how a protein would be changed if a base sequence mutates from GGA to TGA. Acceptable responses include, but are not limited to:

- The shape of the protein may be changed.
- The amino acid sequence would be different.
- The protein would contain threonine instead of proline.
- The protein being synthesized may not work correctly.
- The protein will not be able to function.

The diagram below shows the results of a test that was done using DNA samples from three bears of different species. Each DNA sample was cut into fragments using a specific enzyme and placed in the wells as indicated below. The DNA fragments were then separated using gel electrophoresis.



76

Which *two* bears are most closely related? Support your answer with data from the test results. [2]

Scoring Guide:

Allow a maximum of 2 credits, 1 credit for indicating that bears 1 and 3 are most closely related and 1 credit for indicating that they have more DNA bands (4) in common.

77

Identify one additional way to determine the evolutionary relationship of these bears. [1]

Scoring Guide:

Allow 1 credit for identifying one additional way to determine the evolutionary relationship of these bears. Acceptable responses include, but are not limited to:

- Compare proteins from the bears.
- Compare embryonic similarities.
- Compare structural similarities.

Note: Do not allow credit for comparison of life functions or habitats.

78

Gel electrophoresis is used to separate DNA fragments on the basis of their

- (1) size
- (2) color
- (3) functions
- (4) chromosomes

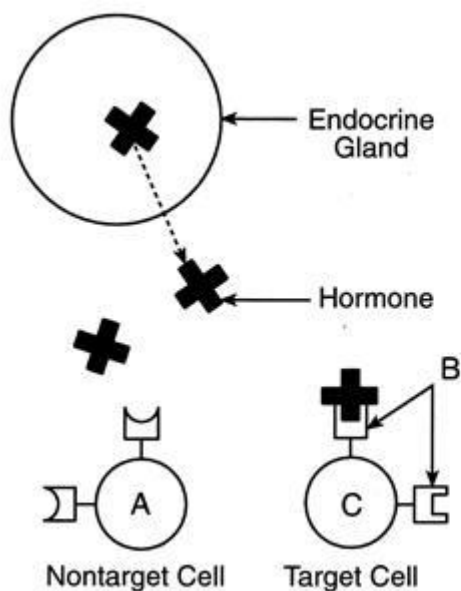
79

Identify one procedure, other than electrophoresis, that is used in the laboratory to separate the different types of molecules in a liquid mixture. [1]

Scoring Guide:

Allow 1 credit for identifying one procedure, other than electrophoresis, that is used in the laboratory to separate the different types of molecules in a liquid mixture. Acceptable responses include, but are not limited to:

- chromatography
- centrifugation
- diffusion through a membrane
- filtering



80

Letter *B* indicates

- (1) ribosomes
- (2) receptor molecules
- (3) tissues
- (4) inorganic substances

Answer:

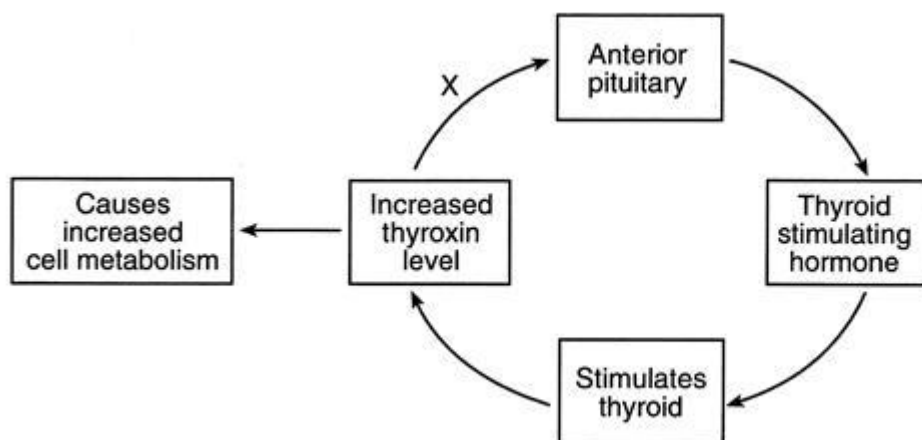
2

81

Explain why cell A is a nontarget cell for the hormone illustrated in the diagram. [1]

Scoring Guide:

Allow 1 credit for indicating that the receptor molecules on Cell A are not the correct shape to combine with the hormone or are not the correct receptors for the hormone.



82

This diagram illustrates part of

- (1) a feedback mechanism
- (2) an enzyme pathway
- (3) a digestive mechanism
- (4) a pattern of learned behavior

Answer:

1

83

Describe the action represented by the arrow labeled X in the diagram and state *one* reason that this action is important. [2]

Scoring Guide:

Allow a maximum of 2 credits, 1 credit for describing the action represented by arrow X and 1 credit for stating one reason that this action is important. Acceptable responses include, but are not limited to:

Action: high level of thyroxin causes the pituitary to produce less TSH

Importance: — to slow down metabolism
— to regulate metabolism

or

Action: shows control of the anterior pituitary

Importance: the pituitary controls the thyroid

84

Identify *one* hormone involved in another biological relationship and an organ that is directly affected by the hormone you identified. [2]

Scoring Guide:

Allow a maximum of 2 credits, 1 credit for identifying the hormone involved and 1 credit for identifying an organ directly affected by that hormone. Acceptable responses include, but are not limited to:

- Insulin—pancreas or *any* organ requiring glucose
- Glucagon—liver
- Estrogen—uterus

85

Which statement best describes the relationship between cells, DNA, and proteins?

- (1) Cells contain DNA that controls the production of proteins.
- (2) DNA is composed of proteins that carry coded information for how cells function.
- (3) Proteins are used to produce cells that link amino acids together into DNA.
- (4) Cells are linked together by proteins to make different kinds of DNA molecules.

Answer:

1

86

Which sequence of terms represents a decrease from the greatest number of structures to the least number of structures present in a cell?

- (1) nucleus → gene → chromosome
- (2) gene → nucleus → chromosome
- (3) gene → chromosome → nucleus
- (4) chromosome → gene → nucleus

Answer:

3

87

Which two organ systems provide materials required for the human body to produce ATP?

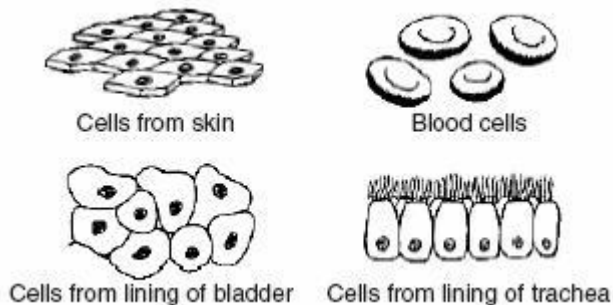
- (1) reproductive and excretory
- (2) digestive and respiratory
- (3) respiratory and immune
- (4) digestive and reproductive

Answer:

2

88

Some human body cells are shown in the diagrams below.



These groups of cells represent different

- (1) tissues in which similar cells function together
- (2) organs that help to carry out a specific life activity
- (3) systems that are responsible for a specific life activity
- (4) organelles that carry out different functions

Answer:

1

89

Strawberries can reproduce by means of runners, which are stems that grow horizontally along the ground. At the region of the runner that touches the ground, a new plant develops. The new plant is genetically identical to the parent because

- (1) it was produced sexually
- (2) nuclei traveled to the new plant through the runner to fertilize it
- (3) it was produced asexually
- (4) there were no other strawberry plants in the area to provide fertilization

Answer:

3

90

Genes involved in the production of abnormal red blood cells have an abnormal sequence of

- (1) ATP molecules
- (2) amino acids
- (3) sugars
- (4) bases

Answer:

4

91

Research has shown that certain body cells, known as stem cells, can develop into a variety of specialized cells. Various factors can cause stem cells to develop into different types of mature cells. These different types of

mature cells result from

- (1) different antibodies and mitotic cell division
- (2) identical genetic codes and meiotic cell division
- (3) different environments of the cells and the functioning of different parts of the genetic code
- (4) similar steps in the development of the cells and a reduction in the number of chromosomes in each cell

Answer:

3

92

Which statement is true of both mitosis and meiosis?

- (1) Both are involved in asexual reproduction.
- (2) Both occur only in reproductive cells.
- (3) The number of chromosomes is reduced by half.
- (4) DNA replication occurs before the division of the nucleus.

Answer:

4

93

A cell resulting from the fertilization of an egg begins to divide. Two cells are formed that normally remain attached and could develop into a new individual. If the two cells become separated, which statement describes what would most likely occur?

- (1) The cells would each have all of the needed genetic information, and both could survive.
- (2) The cells would each have only one-half of the needed genetic information, so both would die.
- (3) One cell would have all of the needed genetic information and would survive, but the other would have none of the needed genetic information and would die.
- (4) Each cell would have some of the needed genetic information, but would be unable to share it, so both would die.

Answer:

1

94

Down syndrome is a genetic disorder caused by the presence of an extra chromosome in the body cells of humans. This extra chromosome occurs in a gamete as a result of

- (1) an error in the process of cloning
- (2) an error in meiotic cell division
- (3) a gene mutation
- (4) replication of a single chromosome during mitosis

Answer:

2

95

When organisms break the bonds of organic compounds, the organisms can

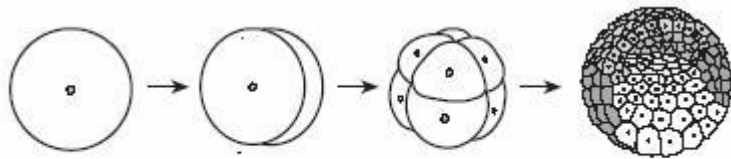
- (1) use the smaller molecules to plug the gaps in the cell membrane to slow diffusion
- (2) use the energy obtained to digest molecules produced by respiration that uses oxygen
- (3) obtain energy or reassemble the resulting materials to form different compounds
- (4) excrete smaller amounts of solid waste materials during vigorous exercise

Answer:

3

96

Part of embryonic development in a species is illustrated in the diagram below.



Fertilized egg

Embryo

Which set of factors plays the most direct role in controlling the events shown in the diagram?

- (1) genes, hormones, and cell location
- (2) antibodies, insulin, and starch
- (3) ATP, amino acids, and inorganic compounds
- (4) abiotic resources, homeostasis, and selective breeding

Answer:

1

Standard(s): [4.1.10.C](#)

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

In a class, each student made three models of the small intestine using three artificial membrane tubes. They filled each of the three tubes with equal amounts of water, starch, protein, and vitamin C. They added starch-digesting enzyme to tube 1. They added protein-digesting enzyme to tube 2. No enzyme was added to tube 3. The ends of the membrane tubes were sealed and the tubes were soaked for 24 hours in beakers of pure water. The beakers were numbered 1, 2, and 3, corresponding to the number of the tube they contained. At the end of the experiment, the students removed the tubes and tested the water in the beakers for the presence of nutrients.

97

Standard(s): [4.1.10.C](#)

Sugar would most likely be present in the water in

- (1) beaker 1, only
- (2) beaker 2, only
- (3) beakers 1 and 3, only
- (4) beakers 1, 2, and 3

Answer:

1

98

Which statement would be a valid inference if vitamin C had been present in the water in each beaker?

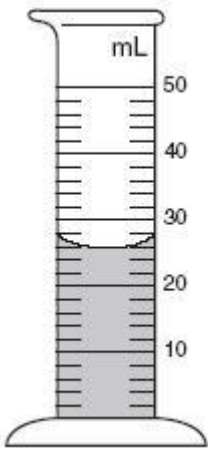
- (1) The water synthesized vitamin C.
- (2) Vitamin C is a small molecule.
- (3) The membrane tube produced vitamin C.
- (4) The concentration of vitamin C is higher in the beaker than in the membrane tube.

Answer:

2

99

What is the volume of the liquid in the graduated cylinder shown below?



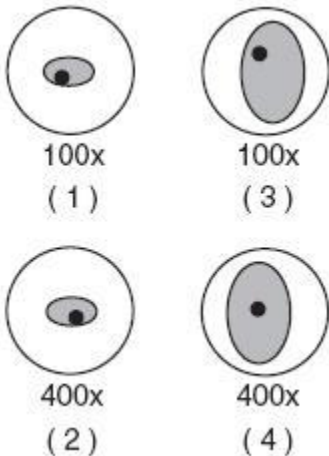
- (1) 23 mL
- (2) 26 mL
- (3) 27 mL
- (4) 28 mL

Answer:

2

100

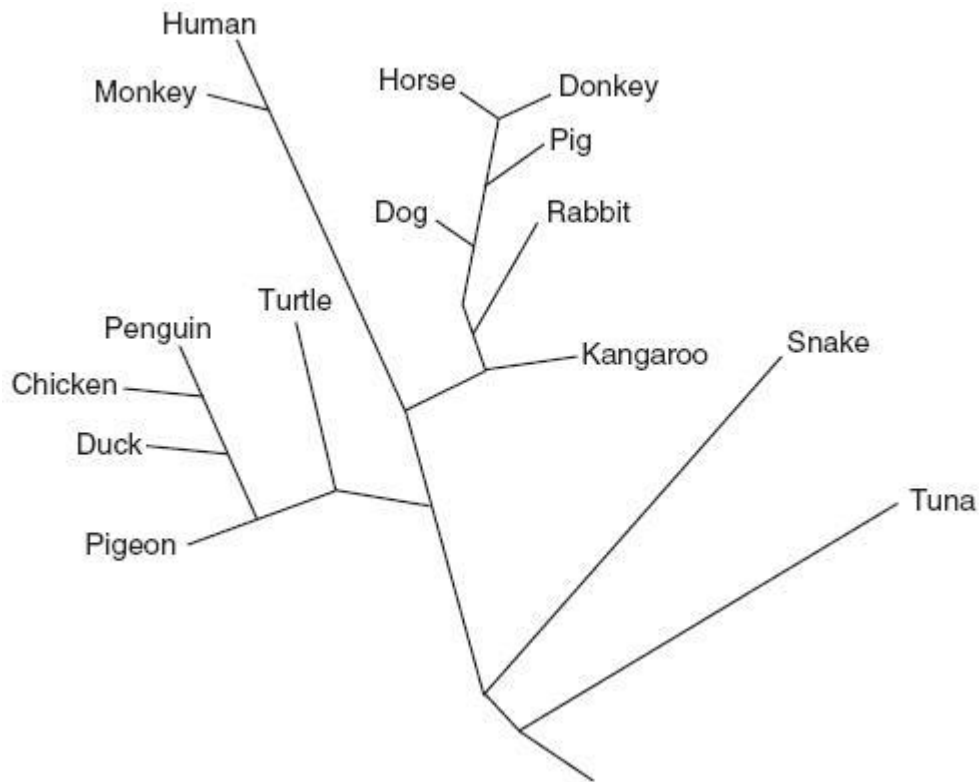
The diagrams below show four different one-celled organisms (shaded) in the field of view of the same microscope using different magnifications. Which illustration shows the largest one-celled organism?



Answer:

3

Based on their analysis of the differences in amino acid sequences of one kind of protein, scientists prepared the evolutionary tree shown below.



101

According to this diagram, the DNA of which pair of organisms would show the greatest similarity?

- (1) penguin and turtle
- (2) horse and donkey
- (3) snake and tuna
- (4) turtle and rabbit

Answer:

2

102

Older systems of classification always placed penguins, chickens, ducks, and pigeons in the bird group and turtles and snakes in the reptile group. Does this diagram support the older system of classification? Explain your answer. [1]

Scoring Guide:

Allow 1 credit for stating that the diagram does not support the older system of classification and providing an explanation. Acceptable responses include, but are not limited to:

- Snakes are in their own group, rather than grouped with turtles.
- Turtles are on the same branch as the birds.
- Snakes have one kind of protein that is very different from that found in turtles and birds.

103

According to this diagram, is the pig more closely related to the dog or the kangaroo?Justify your answer. [1]

Scoring Guide:

Allow 1 credit for stating that the pig is more closely related to the dog than it is to the kangaroo, and justifying that answer. Acceptable responses include, but are not limited to:

- separated more recently
 - closer together on the tree
 - have a more recent common ancestor
- The protein in the pig is more similar to that in the dog.

104

An increase in heart rate will most likely result in

- (1) a decrease in metabolic rate
(2) an increase in pulse rate
(3) an increase in cell division
(4) a decrease in body temperature

Answer:

2

105

Beak structures differ between individuals of one species of bird. These differences most likely indicate

- (1) the presence of a variety of food sources
(2) a reduced rate of reproduction
(3) a large supply of one kind of food
(4) an abundance of predators

Answer:

1

106

The chart below contains both autotrophic and heterotrophic organisms.

A	owl	cat	shark
B	mouse	corn	dog
C	squirrel	bluebird	alga

Organisms that carry out only heterotrophic nutrition are found in

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

Answer:

1

107

A stable pond ecosystem would not contain

- (1) materials being cycled

- (2) oxygen
- (3) decomposers
- (4) more consumers than producers

Answer:

4

108

Although all of the cells of a human develop from one fertilized egg, the human is born with many different types of cells. Which statement best explains this observation?

- (1) Developing cells may express different parts of their identical genetic instructions.
- (2) Mutations occur during development as a result of environmental conditions.
- (3) All cells have different genetic material.
- (4) Some cells develop before other cells.

Answer:

1

109

Humans require organ systems to carry out life processes. Single-celled organisms do not have organ systems and yet they are able to carry out life processes. This is because

- (1) human organ systems lack the organelles found in single-celled organisms
- (2) a human cell is more efficient than the cell of a single-celled organism
- (3) it is not necessary for single-celled organisms to maintain homeostasis
- (4) organelles present in single-celled organisms act in a manner similar to organ systems

Answer:

4

110

Certain poisons are toxic to organisms because they interfere with the function of enzymes in mitochondria. This results directly in the inability of the cell to

- (1) store information
- (2) build proteins
- (3) release energy from nutrients
- (4) dispose of metabolic wastes

Answer:

3

111

At warm temperatures, a certain bread mold can often be seen growing on bread as a dark-colored mass. The same bread mold growing on bread in a cooler environment is red in color. Which statement most accurately describes why this

change in the color of the bread mold occurs?

- (1) Gene expression can be modified by interactions with the environment.
- (2) Every organism has a different set of coded instructions.
- (3) The DNA was altered in response to an environmental condition.
- (4) There is no replication of genetic material in the cooler environment.

Answer:

1

112

Asexually reproducing organisms pass on hereditary information as

- (1) sequences of A, T, C, and G
- (2) chains of complex amino acids
- (3) folded protein molecules
- (4) simple inorganic sugars

Answer:

1

113

Species of bacteria can evolve more quickly than species of mammals because bacteria have

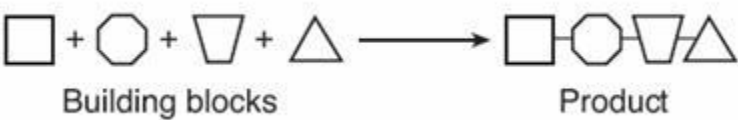
- (1) less competition
- (2) more chromosomes
- (3) lower mutation rates
- (4) higher rates of reproduction

Answer:

4

114

The diagram below represents the synthesis of a portion of a complex molecule in an organism.



Which row in the chart could be used to identify the building blocks and product in the diagram?

Row	Building Blocks	Product
(1)	starch molecules	glucose
(2)	amino acid molecules	part of protein
(3)	sugar molecules	ATP

(4)	DNA molecules	part of starch
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Answer:

2

115

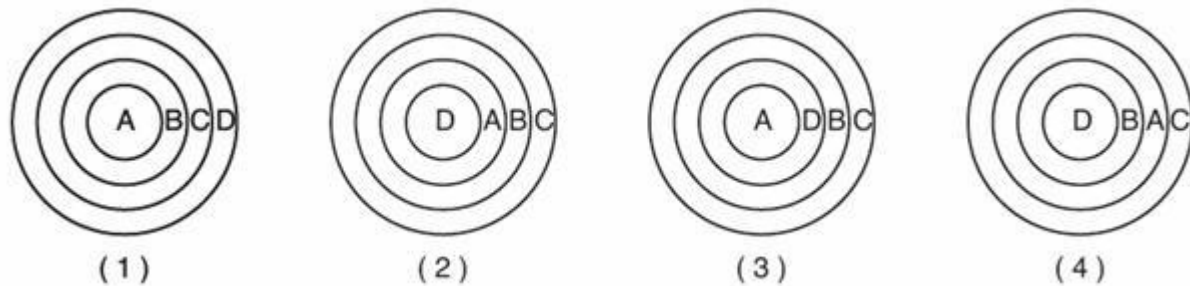
Which diagram best represents the relative locations of the structures in the list below?

A—chromosome

B—nucleus

C—cell

D—gene



Answer:

2

116

Which nuclear process is represented below?

A DNA molecule → The two strands of → Molecular bases → Two identical DNA
 untwists. DNA separate. pair up. molecules are produced.

(1) recombination

(2) fertilization

(3) replication

(4) mutation

Answer:

3

117

For centuries, certain animals have been crossed to produce offspring that have desirable qualities.

Dogs have been mated to produce Labradors, beagles, and poodles. All of these dogs look and behave very differently from one another. This technique of producing organisms with specific qualities is known as

(1) gene replication

(2) natural selection

(3) random mutation

(4) selective breeding

Answer:

4

118

Certain insects resemble the bark of the trees on which they live. Which statement provides a possible biological explanation for this resemblance?

- (1) The insects needed camouflage so they developed protective coloration.
- (2) Natural selection played a role in the development of this protective coloration.
- (3) The lack of mutations resulted in the protective coloration.
- (4) The trees caused mutations in the insects that resulted in protective coloration.

Answer:

2

119

When is extinction of a species most likely to occur?

- (1) when environmental conditions remain the same and the proportion of individuals within the species that lack adaptive traits increases
- (2) when environmental conditions remain the same and the proportion of individuals within the species that possess adaptive traits increases
- (3) when environmental conditions change and the adaptive traits of the species favor the survival and reproduction of some of its members
- (4) when environmental conditions change and the members of the species lack adaptive traits to survive and reproduce

Answer:

4

120

Standard(s): [BIO.A.1.2](#)

In what way are photosynthesis and cellular respiration similar?

- (1) They both occur in chloroplasts.
- (2) They both require sunlight.
- (3) They both involve organic and inorganic molecules.
- (4) They both require oxygen and produce carbon dioxide.

Answer:

3

121

Which process will increase variations that could be inherited?

- (1) mitotic cell division
- (2) active transport

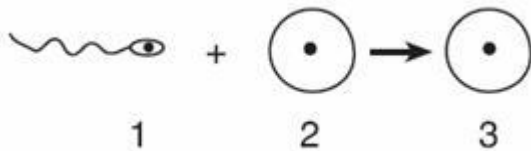
- (3) recombination of genes
- (4) synthesis of proteins

Answer:

3

122

Some cells involved in the process of reproduction are represented in the diagram below.



The process of meiosis formed

- (1) cell 1, only
- (2) cells 1 and 2
- (3) cell 3, only
- (4) cells 2 and 3

Answer:

2

123

Kangaroos are mammals that lack a placenta. Therefore, they must have an alternate way of supplying the developing embryo with

- (1) nutrients
- (2) carbon dioxide
- (3) enzymes
- (4) genetic information

Answer:

1