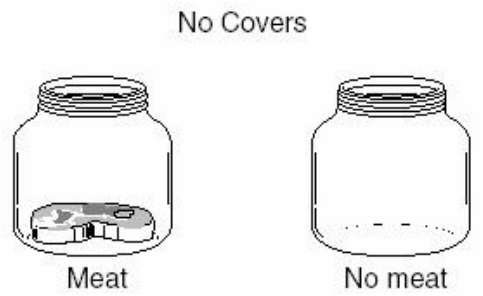
DIRECTIONS for numbers 1- 120 .
Read each question carefully and choose the best answer.

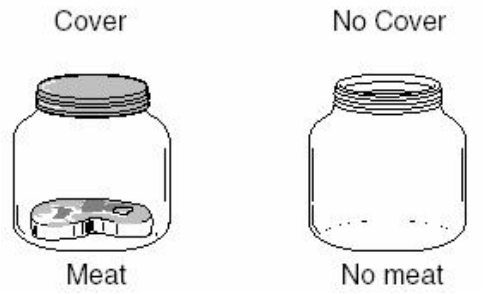
1

People long ago believed that maggots came from meat. In the late 1600s, Francesco Redi made the hypothesis that maggots came from flies rather than from meat. Which of these experimental designs could be used to test Redi's hypothesis?

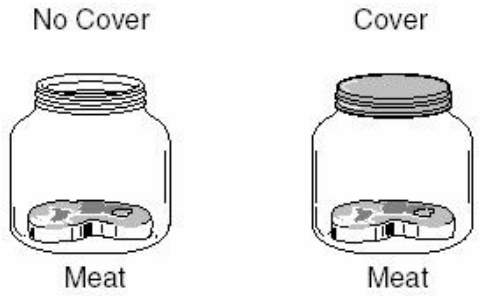
A



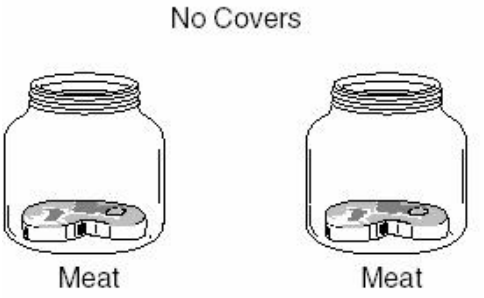
B



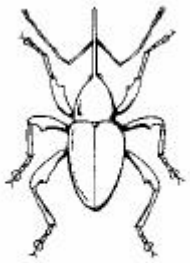
C



D



2



Oak Weevil
Curculio rectus

Which of these is most closely related to the oak weevil?

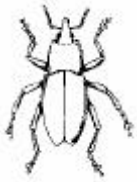
A

Mullein Weevil
Gymnetron tetrum

B

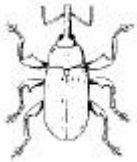
Hazelnut Weevil
Curculio neocorylus

C



Pine Reproduction Weevil
Cylindrocopturus eatoni

D



Boll Weevil
Anthonomus grandis

Go on to next page

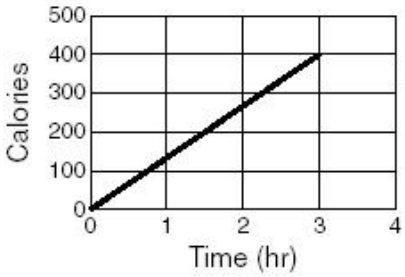
3

Calorie Use Table (by 120 lb adult female)

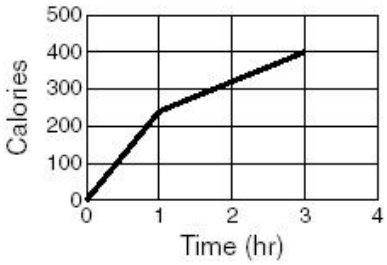
Activity	Calories Used (per hr)
Walking	80
Gymnastics	170
Jogging	240
Tennis	280
Bicycling	320
Swimming	440

According to the table, which graph below illustrates the calories used for 1 hour of jogging followed by 2 hours of walking?

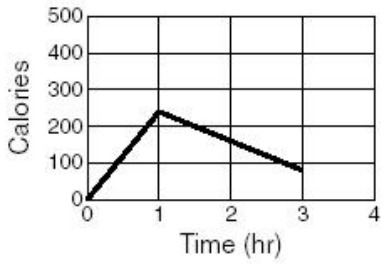
A



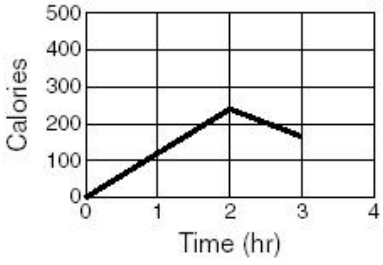
B



C



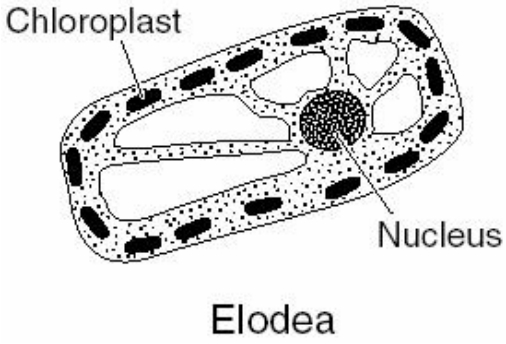
D



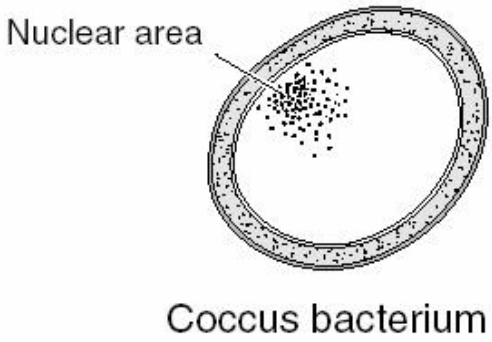
4

Which of these is capable of moving quickly in response to its environment?

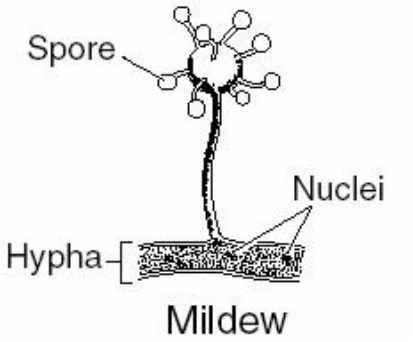
A



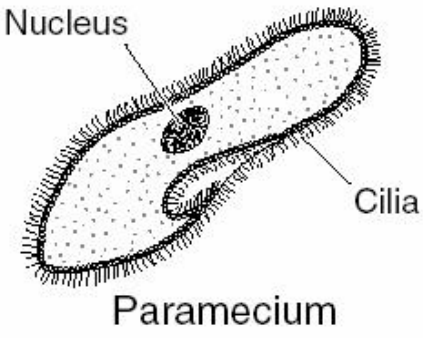
B



C



D



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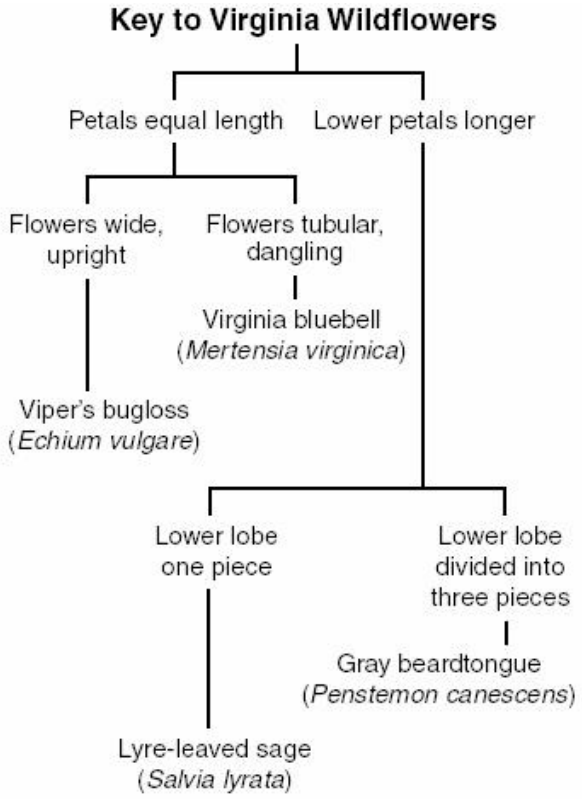
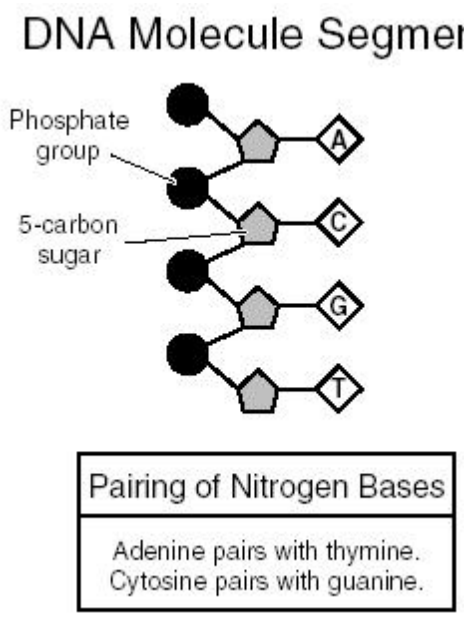
5



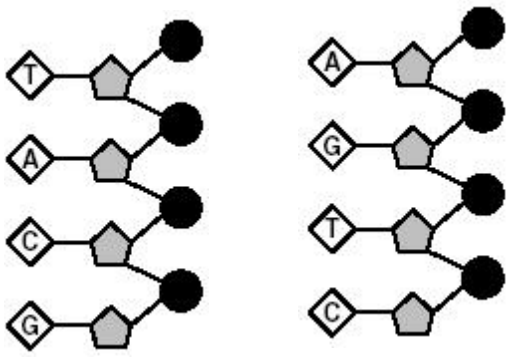
This key can be used to identify the species of some wildflowers found in Virginia. All of the plants have blue or purple flowers with five petals that are fused together. According to this key, to what species does the plant shown belong?

A Viper's bugloss (*Echium vulgare*)
B Virginia bluebell (*Mertensia virginica*)
C Gray beardtongue (*Penstemon canescens*)
D Lyre-leaved sage (*Salvia lyrata*)

6

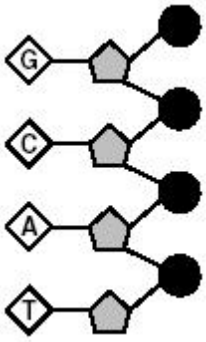


Which of these segments could be used to correctly complete the DNA molecule in the diagram above?

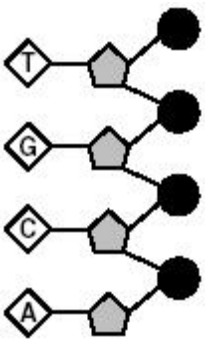


A

B



C



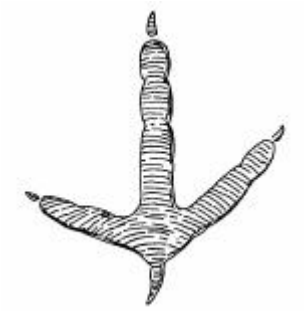
D

Go on to next page

7 These feet belong to different birds. Three of the birds spend most of their time on the ground, while one bird rarely walks on the ground. Which foot belongs to the bird that is best adapted for grasping branches?

A

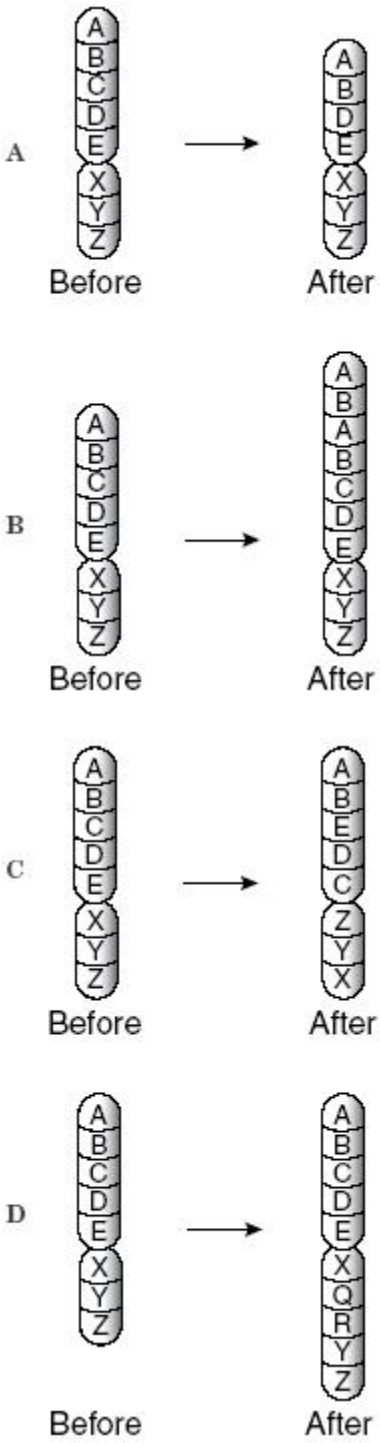
B



C

D

8 Inversions in chromosomes occur when part of a chromosome breaks out and is reinserted upside down. Which of the diagrams below represents an inversion?



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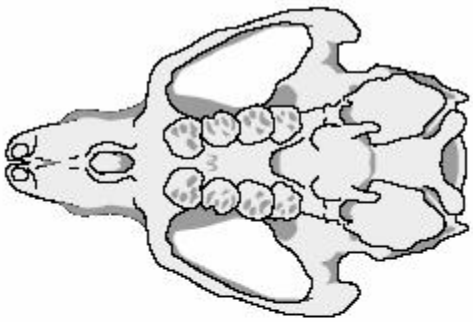
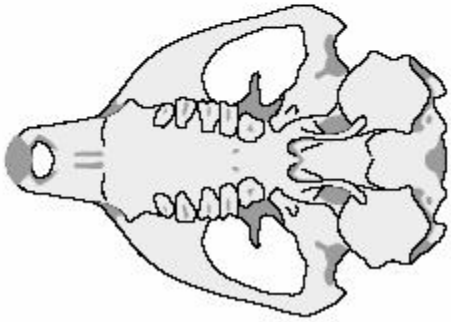
9 The skulls below belong to different animals. Which skull belongs to the animal that is probably unrelated to the other three?

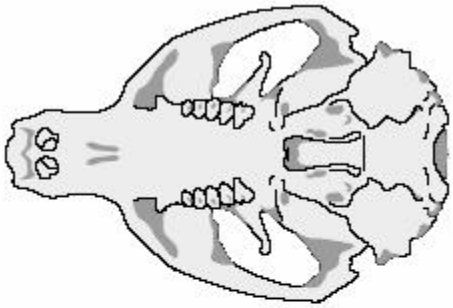
A



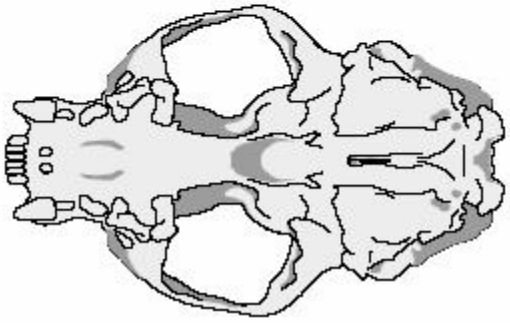
B



C

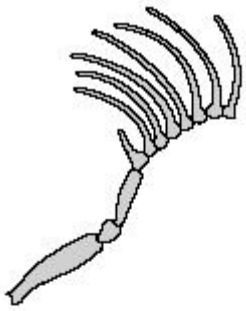


D

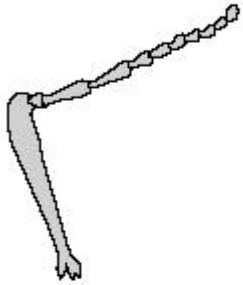


10 Increased surface area increases the number of molecules that can be collected from the air. According to this information, which beetle antenna is best adapted for chemically sensing the air?

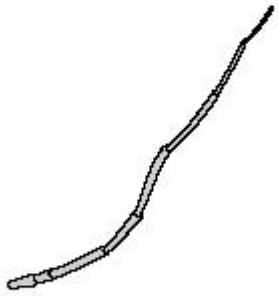
A



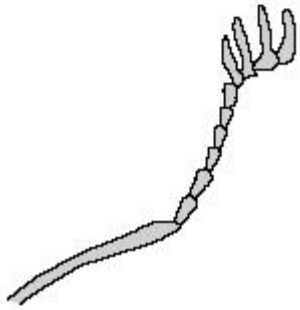
B



C



D



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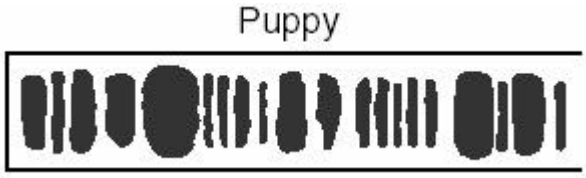
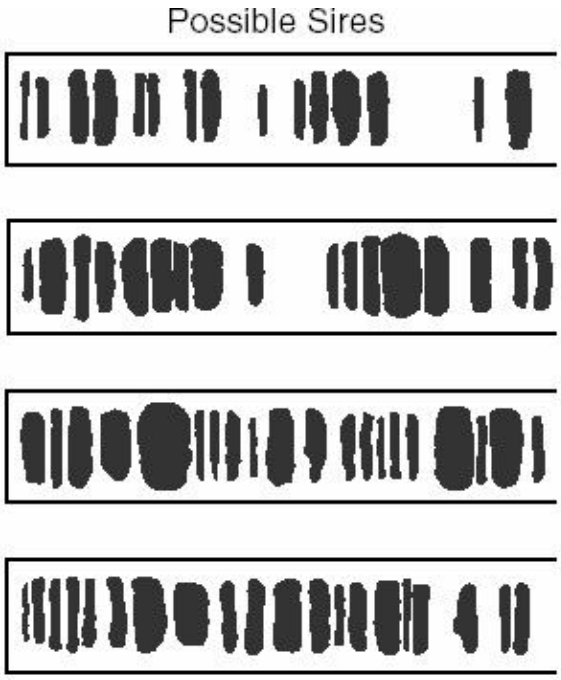
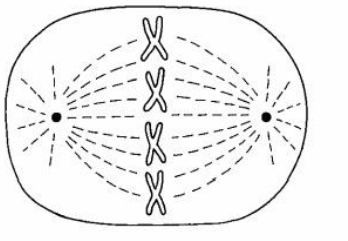
11



The DNA fingerprints were made from blood samples taken from a puppy and four possible sires of this puppy in an effort to determine the puppy's pedigree. According to this information, which sire was probably the father of this puppy?

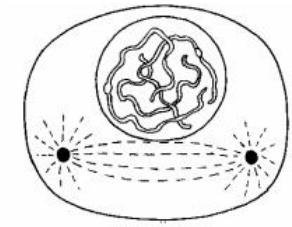


12

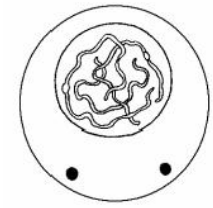


Which phase of mitosis would be seen next?

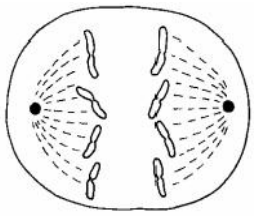
A



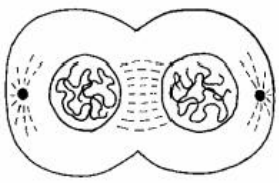
B



C

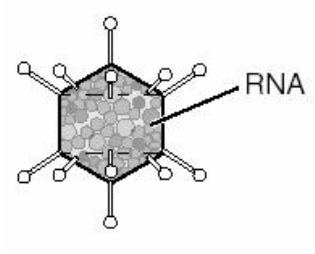


D

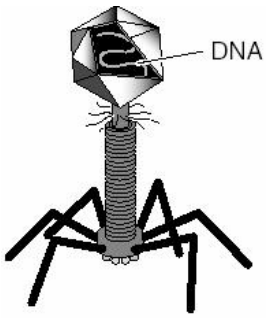


13 Which of these could *not* be a virus?

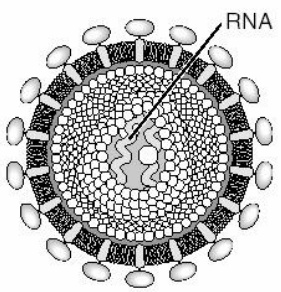
A



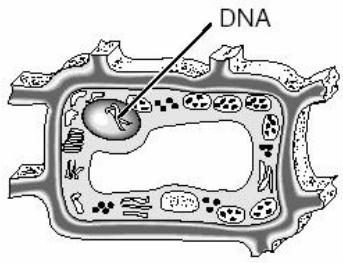
B



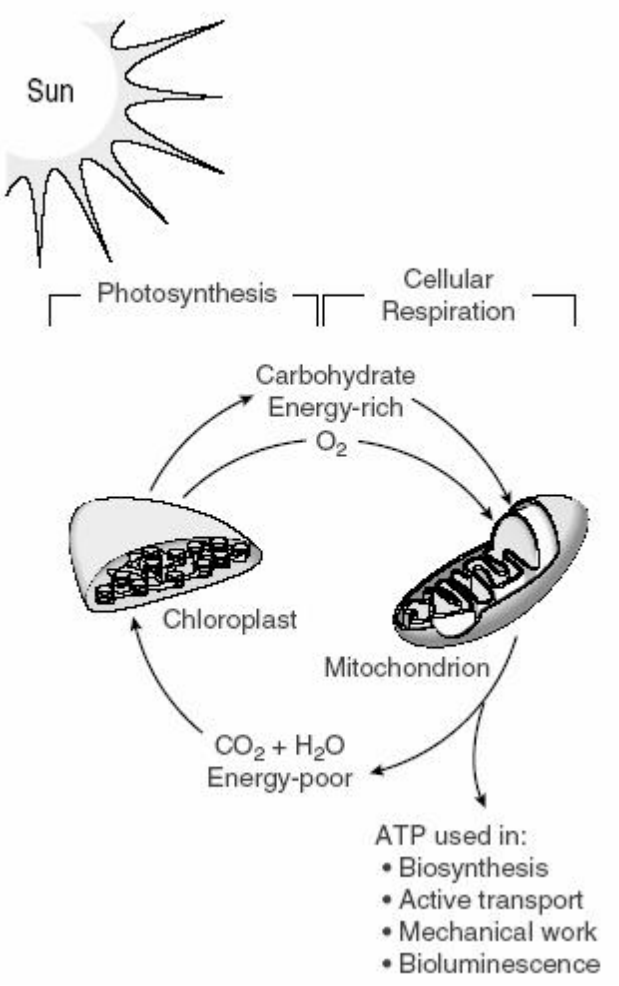
C



D



14



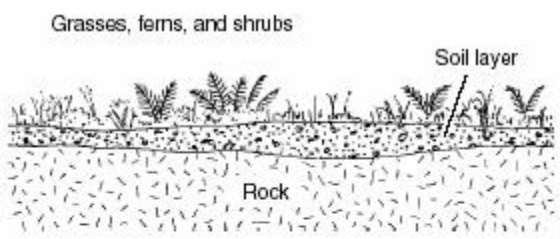
Which statement is supported by the diagram?

A The mitochondrion uses the sun's energy directly.
B The end products of photosynthesis do not provide energy for cellular respiration.
C The main source of energy for photosynthesis is carbohydrates.
D Carbohydrates are converted into ATP by the mitochondrion.

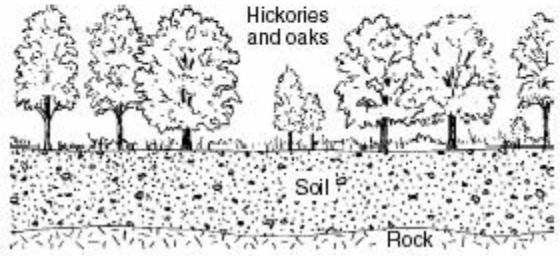
Go on to next page

15 Each drawing represents different stages in community succession within the state of Virginia. Which of the following drawings represents the climax community in this succession pattern?

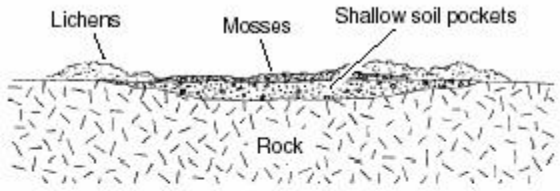
A



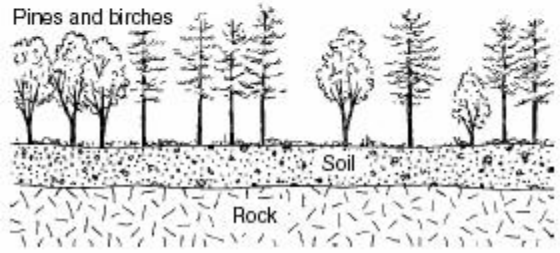
B



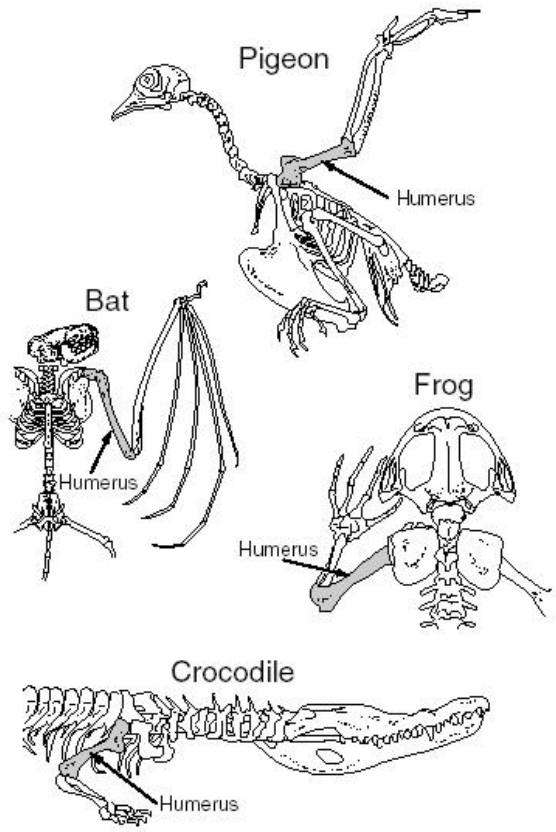
C



D



16



All the organisms shown above belong to the Phylum Chordata. The structural similarity in the organisms suggests that _____.

A the humerus is attached to the skeleton by immovable joints
B only animals that walk on 4 legs need the humerus
C the humerus is the same size in all chordates
D chordates have common ancestors

17

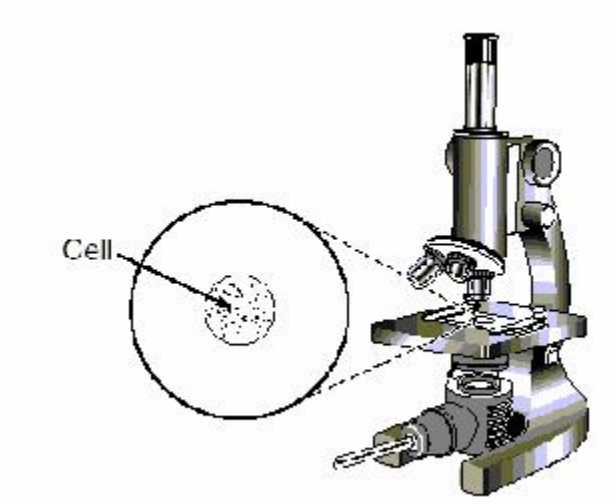
Number of Plant Seedlings	Water (mL/week)	Temperature at which plants were grown (C)	Number of Daylight Hours	Relative Humidity	Average Number of New Leaves per Week
50	50	19	12	85	4
50	50	20	12	85	8
50	50	21	12	85	10
50	50	22	12	85	5

Which variable appears to control leaf production in these plants?

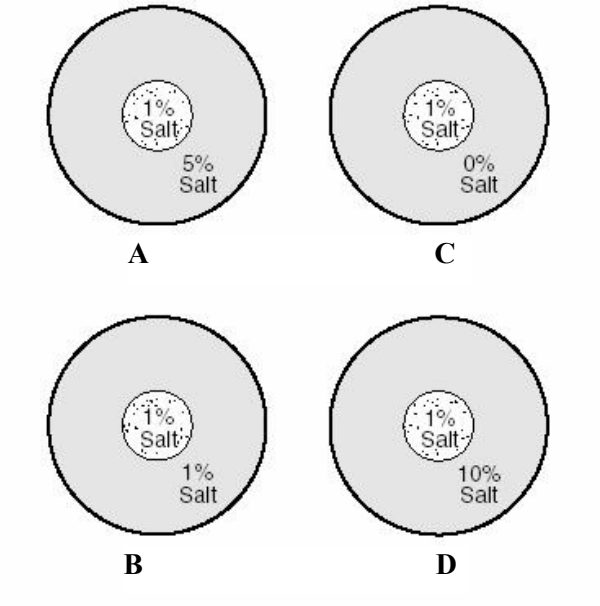
A The amount of water
B The temperature
C The number of daylight hours
D The relative humidity

Go on to next page

18



Which solution below would cause no change in cell a student was studying the responses of cells to solutions of varying salt concentrations size?



19

Second Base

First Base	U	C	A	G	Third Base
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	stop	stop	A
	Leu	Ser	stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gin	Arg	A
	Leu	Pro	Gin	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

Genetic Code for Amino Acids

According to this table, a codon AGC is the code for which amino acid?

A Cysteine (Cys)
B Leucine (Leu)
C Serine (Ser)
D Tyrosine (Tyr)

20

This organism is most closely related to animals in the Phylum Arthropoda, the phylum that contains beetles, because it has _____.

A legs
B antennae
C jointed appendages
D an elongated body

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21

Test Paper Results

Chart A

pH	Red Litmus	Blue Litmus	pH Paper
Acid - pH2	red	red	red
Acid - pH4	red	red	orange
Acid - pH6	red	red	yellow
Base - pH8	blue	blue	green
Base - pH10	blue	blue	blue

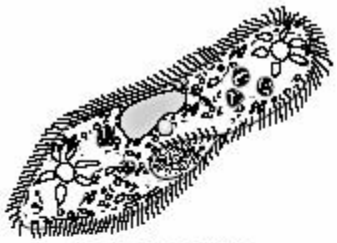
Chart B

Substance	Red Litmus	Blue Litmus	pH Paper
Water	red	blue	yellow-green
Apples	red	red	red-orange
Beans	red	red	yellow
Milk	red	blue	yellow
Shrimp	red	blue	yellow-green

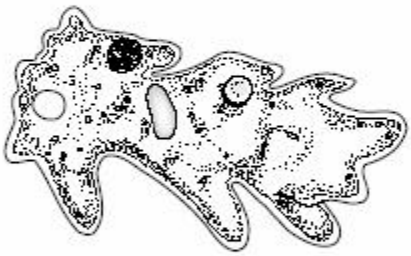
Chart A shows how changes in Ph cause testing paper to change color. Chart B shows how testing papers reacted with several experimental substances. Which of these has a pH of about 3?

A Apples
B Beans
C Milk
D Shrimp

22



Paramecium



Amoeba

Euglena

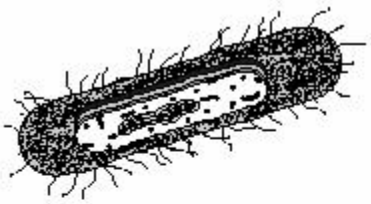
The one-celled eukaryotic organisms above are often found in freshwater ponds. What is one characteristic they all have in common?

A Cilia
B Nucleus
C Pseudopodia
D Flagellum

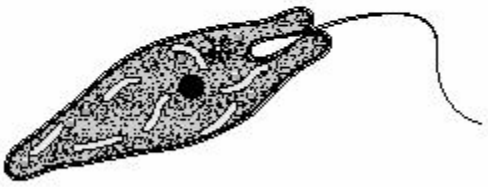
Go on to next page

23 Which of these is the best model of a prokaryotic cell?

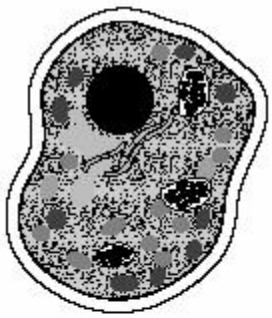
A



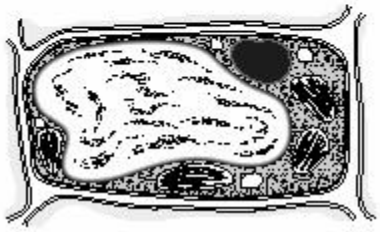
B



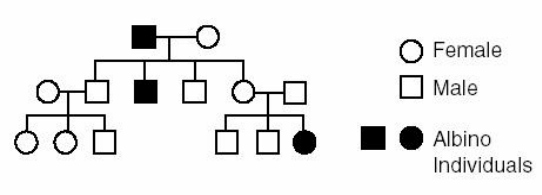
C



D



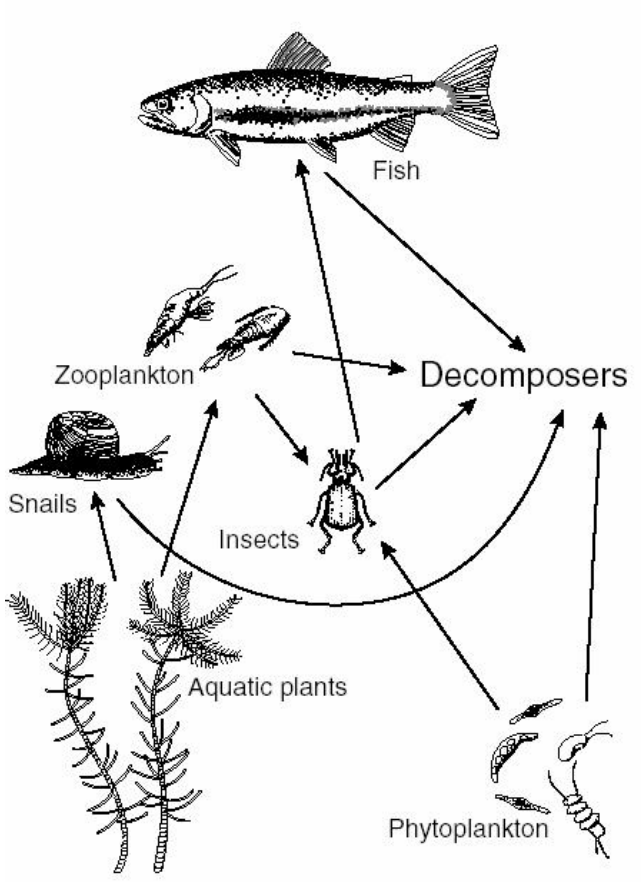
24



Albino individuals lack all pigmentation so that their hair and skin are white. This family tree shows that albinism _____.

A is carried only by females in this family
B is a recessive genetic trait
C is a sex-linked gene
D requires both parents to be albinos

25



Energy is transferred from insects to fish in this system by ____.

A water
B radiation
C food consumption
D decaying processes

26

Comparison of Photosynthesis and Respiration

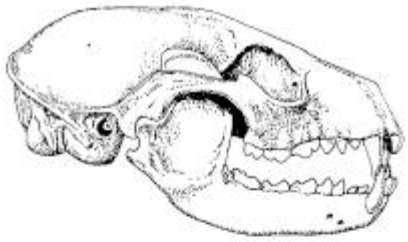
	Photosynthesis	Respiration
Raw Materials	Water and CO_2	Glucose and oxygen
Products	Glucose and oxygen	Water and CO_2
Purpose	Store energy	Release energy

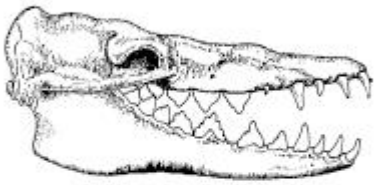
The processes of photosynthesis and respiration can be thought of as a cycle because _____.

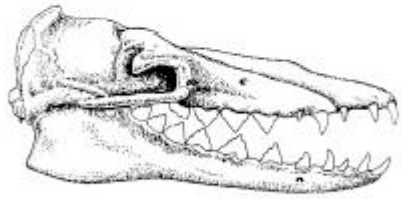
A one is used only by plants and the other is used only by animals
B both give off oxygen to be used by animals
C the products of one are used as the raw materials of the other
D they both have the same purpose

Go on to next page

27 Which skull belongs to an herbivore?

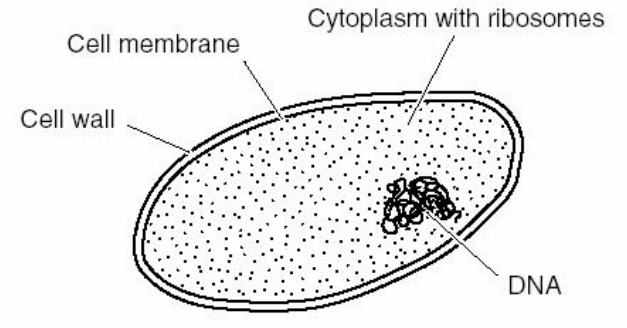
A 

B 

C 

D 

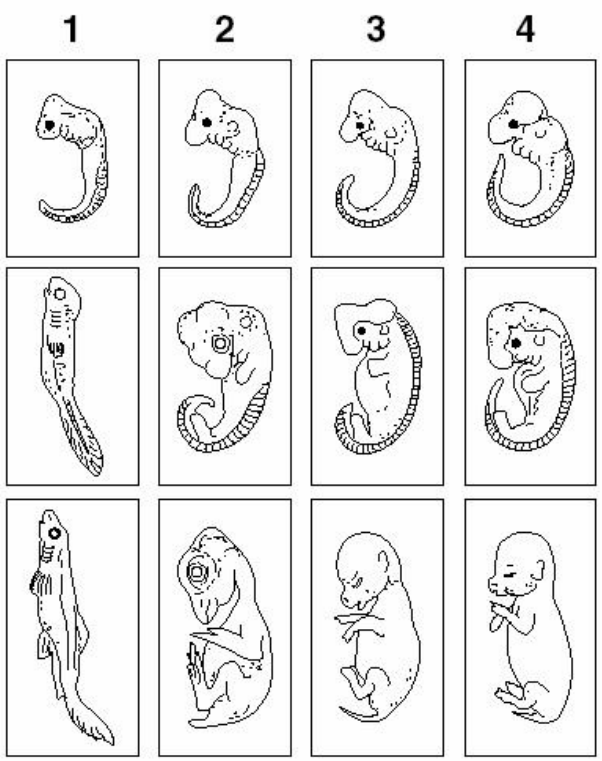
28



How is the prokaryotic bacterium in the diagram different from a eukaryotic cell?

A It has ribosomes to make proteins.
B It stores its genetic information in DNA.
C It has no membrane-bound nucleus.
D It has a cell membrane.

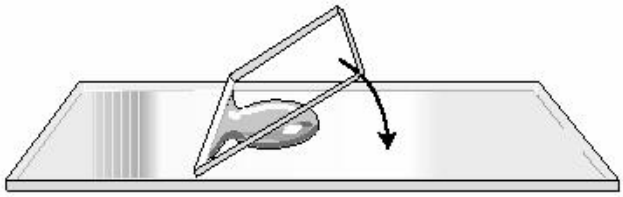
29



The above chart shows vertebrate embryo development. Which of these would be ***least*** related to the others?

A 1
B 2
C 3
D 4

30

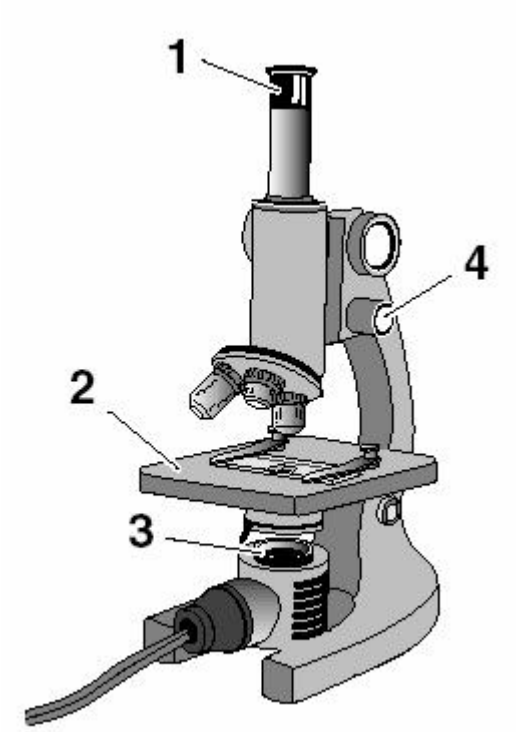


The picture shows a coverslip correctly being lowered onto a slide. This method is used because it _____.

A reduces the possibility of air bubbles on the slid
B prevents the escape of microorganisms found in the water
C allows microorganisms to move freely in the water
D prevents the coverslip from moving

Go on to next page

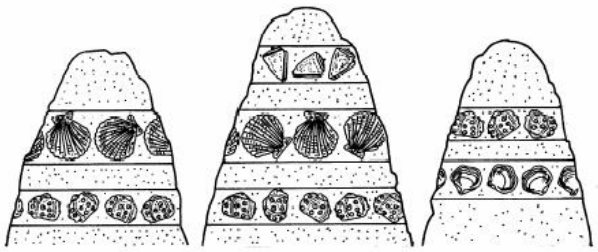
31



When viewing a prepared slide under the compound microscope, a student has to remove his glasses. This means he will need to readjust for fine focus with which part labeled above?

A 1
B 2
C 3
D 4

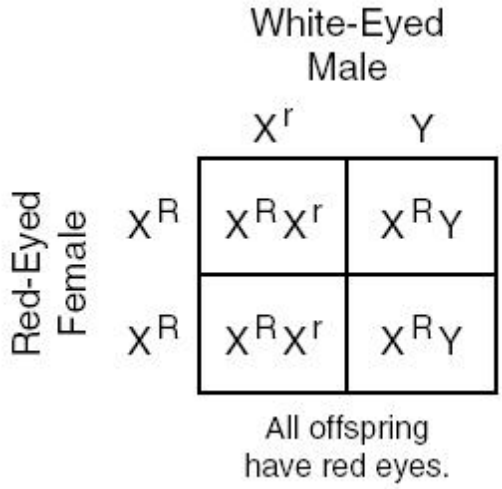
32



The picture shows three columns of xposed rock that are within a three-kilometer area. According to this information, the dominant past environment of this area has been _____.

A arctic tundra
B shallow marine
C deciduous forest
D tropical desert

33



In 1910, Thomas Morgan discovered traits linked to sex chromosomes in the fruit fly. The Punnett square above shows the cross between red-eyed females and white-eyed males. Fruit flies usually have red eyes. If a female and male offspring from the cross shown above are allowed to mate, what would the offspring probably look like?

A 2 red-eyed females; 2 white-eyed males
B 2 red-eyed females; 1 red-eyed male, 1 white-eyed male
C 1 red-eyed female and 1 white-eyed female; 2 red-eyed males
D 2 white-eyed females; 1 white-eyed male and 1 red-eyed male

34

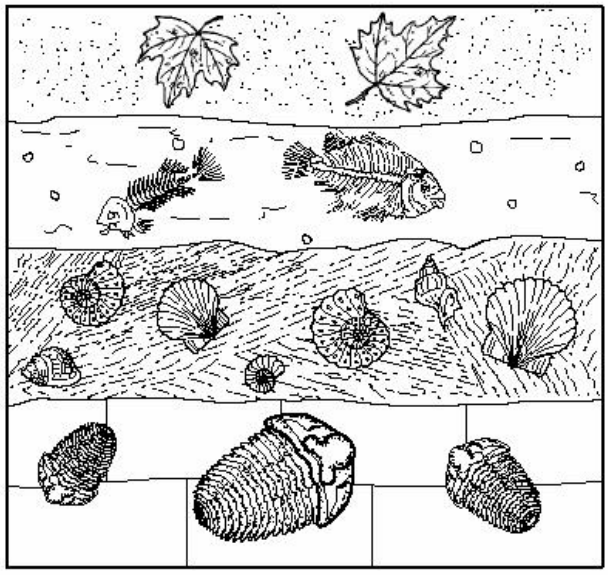
Representative Animals from a Local Ecosystem	
Type of Organism	Number of Individual Species Collected
Grasses	11
Trees	1
Fish	16
Amphibians	12
Reptiles	8
Mammals	3

The chart shows the types of organisms and the number of species collected from a local ecosystem. According to these data, this ecosystem was most likely a _____.

A tundra
B marsh
C desert
D savanna

Go on to next page

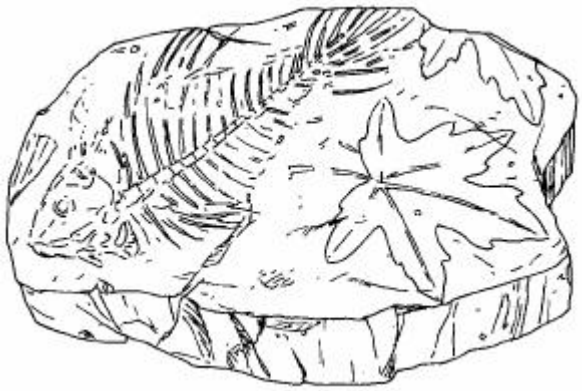
35



The diagram shows undisturbed sedimentary rock strata containing fossils. Which statement ***best*** summarizes the history of this area?

A The area was once a forest and was replaced by a freshwater lake.
B The area was once a freshwater lake and was replaced by a saltwater sea.
C The area was once a saltwater sea and later was replaced by a coniferous forest.
D The area was once a saltwater sea and later was replaced by a forest.

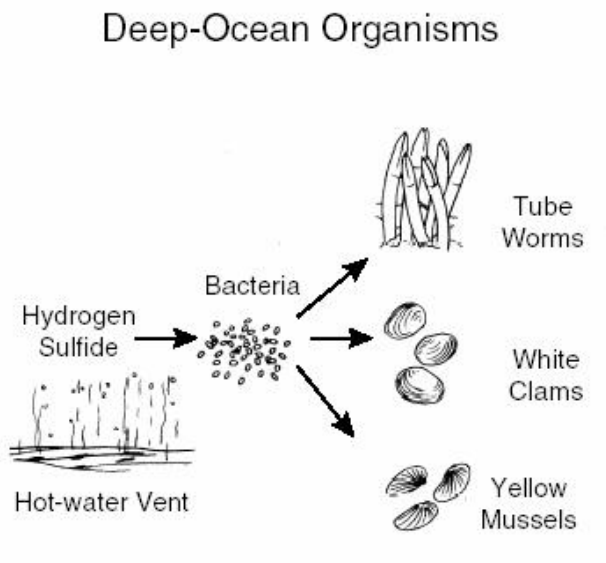
36



In which type of environment did this fossilized fish most likely live?

A Deep ocean trench
B A coral reef
C A freshwater lake
D Near an ocean vent

37



Around hot-water vents deep in the ocean live specialized communities. Bacteria turn hydrogen sulfide into sugars by a chemical process. The bacteria then provide food to other life forms, as shown in the diagram. Compared to food chains on land, the bacteria fill the same role as_____.

A hawks
B rabbits
C green plants
D mushrooms

38

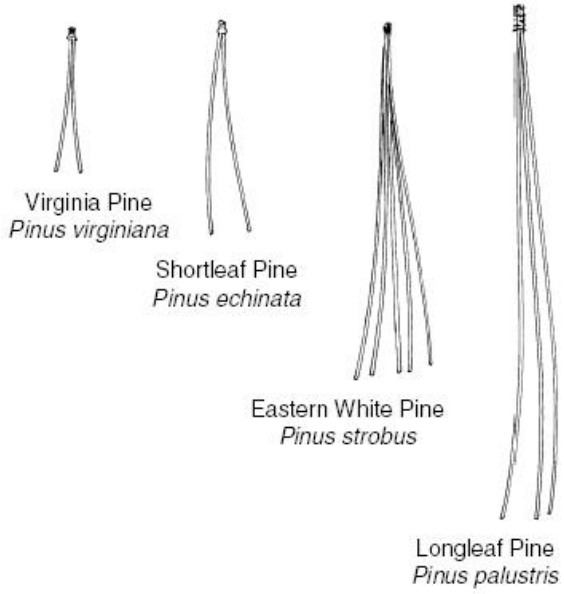
	F	f
F	**FF**	**Ff**
f	**Ff**	**ff**

In rabbits, short fur (F) is dominant to long fur (f). According to the Punnett square, what is the chance of two heterozygous short-haired rabbits having offspring with short fur?

A One in four
B Two in four
C Three in four
D Four in four

Go on to next page

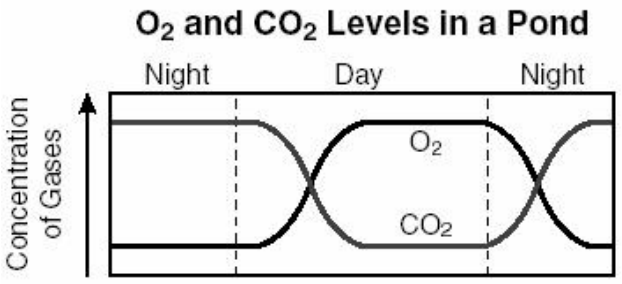
39



A biology student collected pine needles from four different species of trees. She then made diagrams showing the number and actual length of needles in a bundle and the common and scientific name of each species. Use her diagram above to help you answer the following question. These four different pine trees are ***not*** classified in the same _____.

A order
B species
C genus
D phylum

40



The above graph shows how dissolved O_2 and CO_2 levels changed in a pond over a 24-hour period. What caused the decrease in O_2 concentration during the night?

A Increased evaporation
B Decreased photosynthesis
C Increased respiration
D Decreased temperatures

41

A

Number of Dogs With Fleas	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
	25	4	25	1	25	10

B

Number of Dogs With Fleas	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
	25	2	25	12	25	5

C

Number of Dogs With Fleas	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
	25	10	25	4	25	12

D

Number of Dogs With Fleas	Brand X		Brand Y		Brand Z	
	Before	After	Before	After	Before	After
	25	5	25	1	25	4

A company that produces Brand X flea shampoo claims to have the most effective shampoo for killing fleas. Which of these sets of data supports the Brand X claim?

42

Bird Sightings at Willow Point

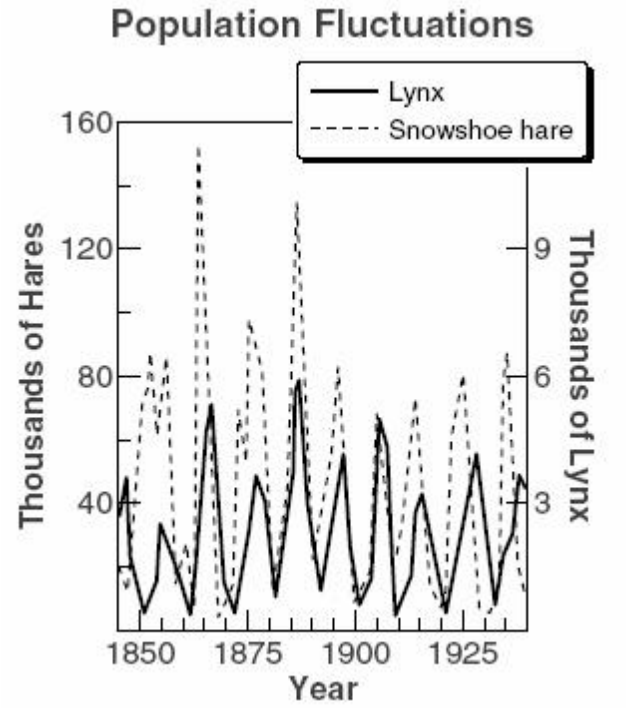
Date	# Sparrows	# Wrens	# Jays
May 12	43	12	10
May 13	54	13	8
May 14	44	11	13
May 15	52	14	9
May 16	47	10	10

Based on the data in the table, what is the difference between the mean number of sparrows and the mean number of jays observed at Willow Point between May 12 and May 16?

A 190
B 48
C 38
D 36

Go on to next page

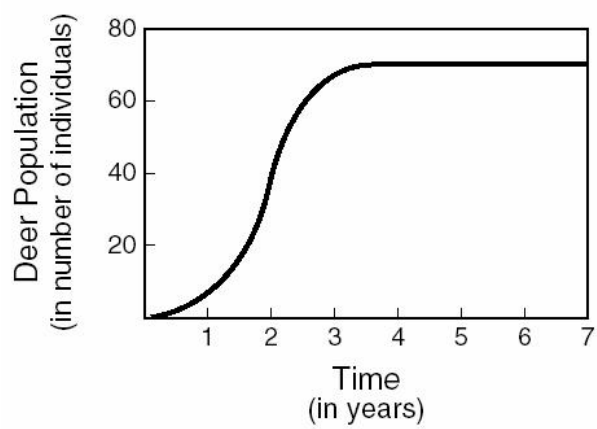
43



This graph shows the sizes of lynx and hare populations between the years of 1845 and 1940. If a predator of the lynx enters the food chain, you might expect the number of _____.

A lynx and hares to become equal
B lynx to increase
C hares to increase
D hares and lynx to decrease

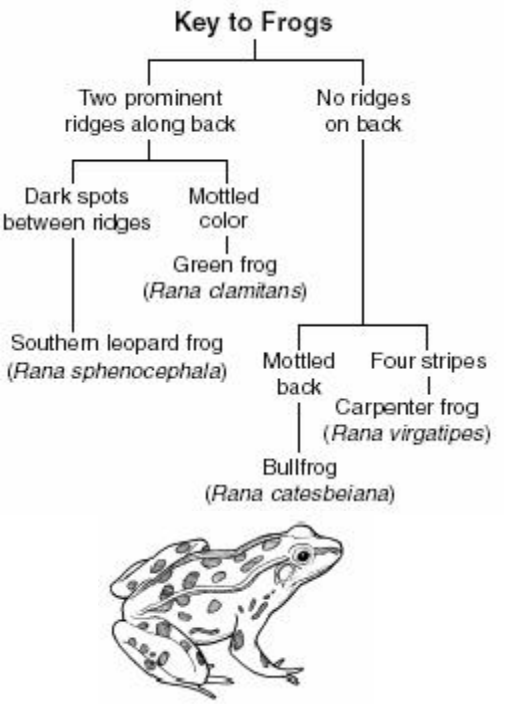
44



In the graph above, what is the population of deer at the carrying capacity of the environment?

A 10
B 30
C 50
D 70

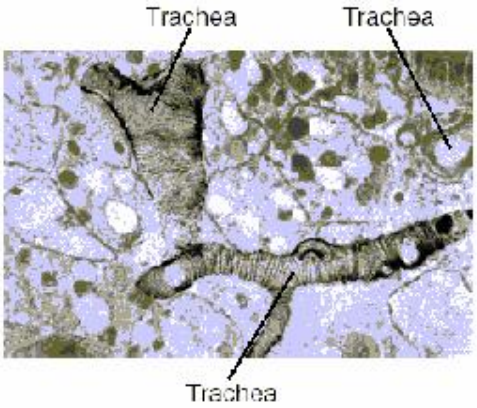
45



This key can be used to distinguish four species of frogs found in ponds in eastern Virginia. To which species does the frog shown belong?

A *Rana sphenocephala*
B *Rana clamitans*
C *Rana catesbeiana*
D *Rana virgatipes*

46

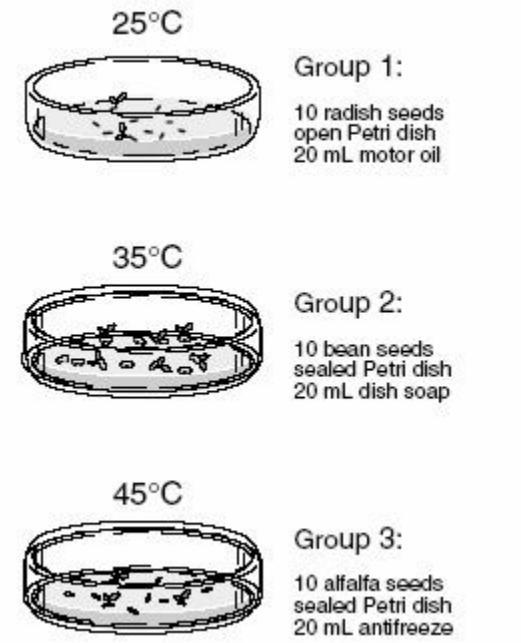


The picture shows the trachea and surrounding tissue of a flea. Which of these best describes the shape of the flea trachea?

A A single, coiled tube
B A double-helix shape
C A long, branched tube
D A six-sided cylinder

Go on to next page

47



In the lab setup pictured above, a student is trying to determine the effect of pollutants on the growth of three groups of seeds. The results will not be valid because the experiment has no _____.

A conclusion
B hypothesis
C control
D variable

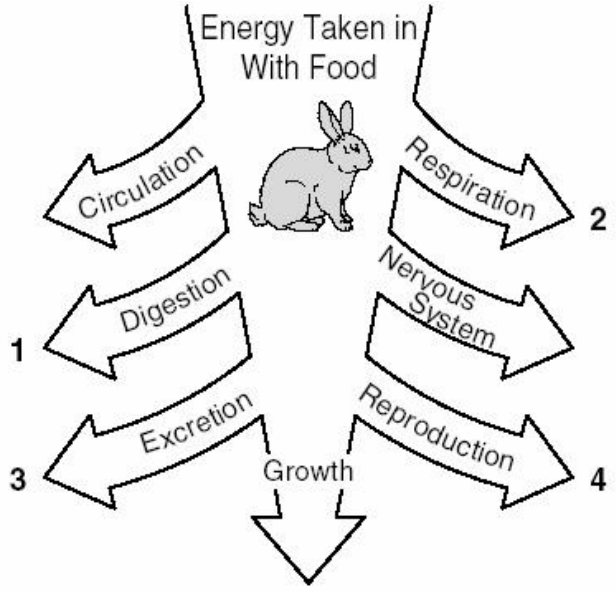
48

	G	g
G	GG	Gg
g	Gg	gg

In corn plants, green (G) is dominant to albino (g). According to the Punnett square, what is the chance of this heterozygous cross producing albino corn plants?

A One in four
B Two in four
C Three in four
D Four in four

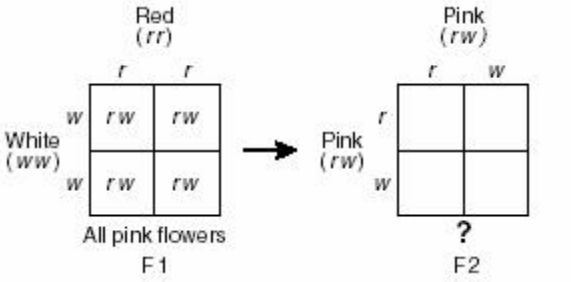
49



Rabbits have developed behavioral and physiological strategies to sustain them through periods of environmental stress. Which of the numbered life processes above could be sacrificed without affecting an individual rabbit's survival in periods of extremely poor environmental conditions?

A 1
B 2
C 3
D 4

50

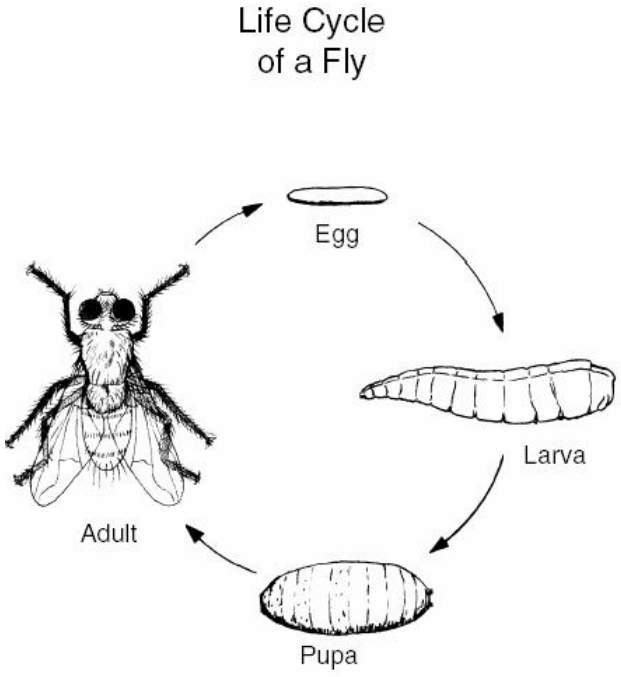


In snapdragons, the combined expression of both alleles for flower color produces a new phenotype that is pink. This illustrates incomplete dominance. The Punnett square above shows that both the white and red snapdragons are homozygous. Which of the following would be the correct product from a cross between two heterozygous pink snapdragons?

A 2 red, 1 pink, 1 white
B 1 red, 2 pink, 1 white
C 1 red, 1 pink, 2 white
D 2 red, 2 white

Go on to next page

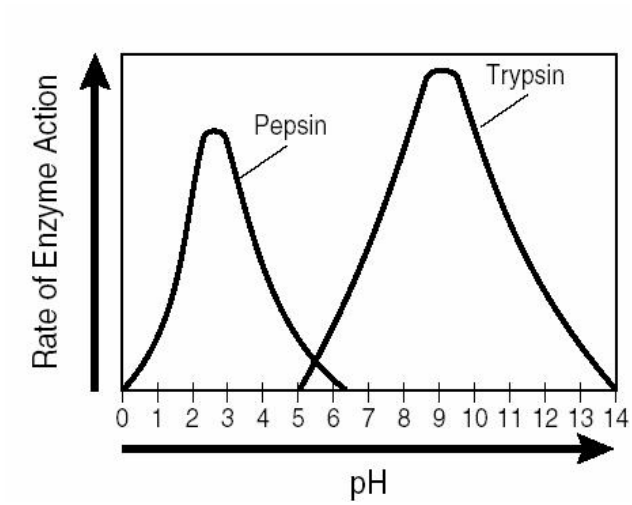
51



Which animal develops in a cycle most similar to the one shown above?

A A bird
B A moth
C A hydra
D A grasshopper

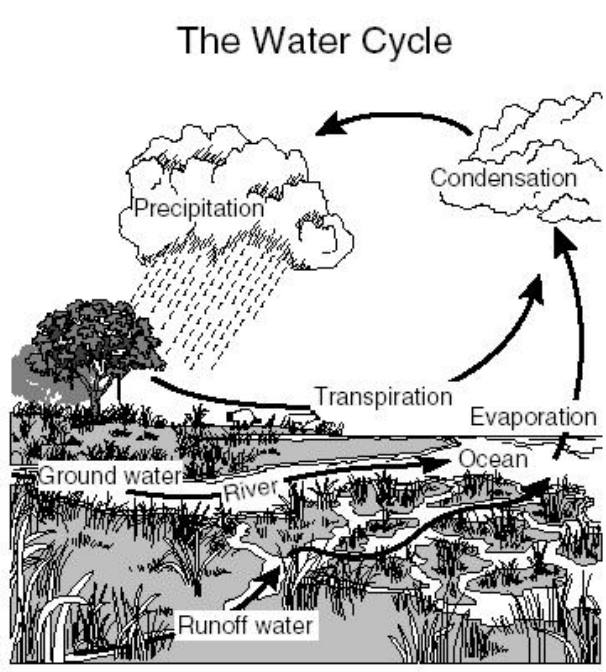
52



This graph shows that ____.

A more enzymes are present at a higher pH
B pepsin is less sensitive to pH than trypsin
C pepsin is less effective at low pH than trypsin
D pH affects the activity rate of enzymes

53



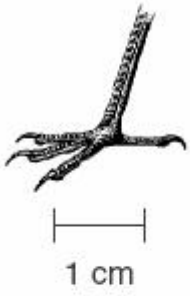
According to this simplified water cycle, the process of transpiration is the process that ____.

A causes photosynthesis in plants
B releases water vapor from plants
C speeds the evaporation of water
D increases the rate of the water cycle

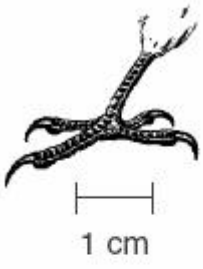
54

Which bird's foot is ***best*** adapted to flying into a region and picking up prey?

A

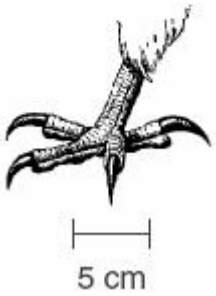


B



C

D



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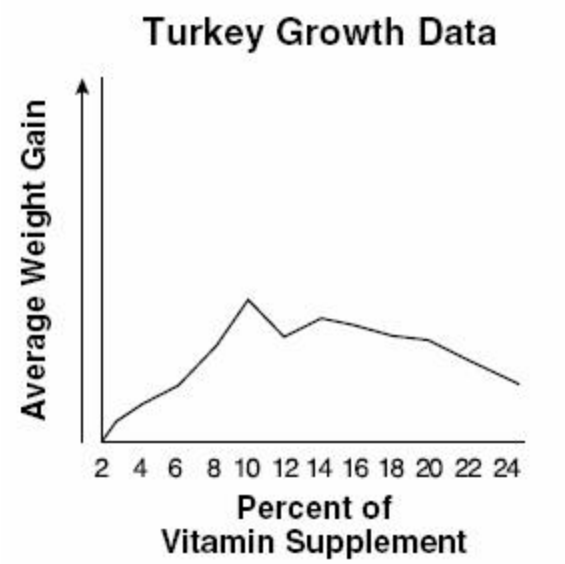
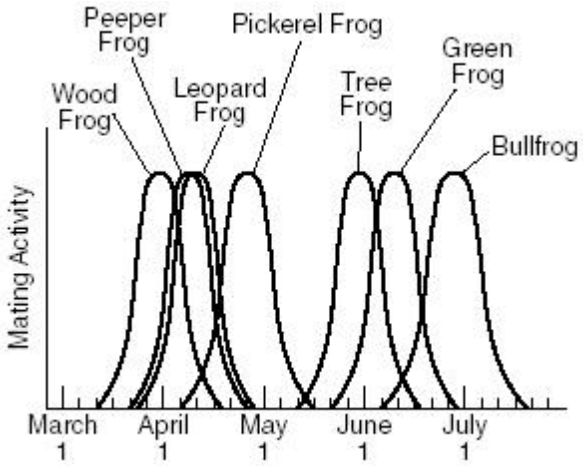
55



A study on a poultry farm was conducted to determine the percentage of vitamin supplement necessary to add to the feed of turkeys in order to maximize their growth. According to this data, what percentage of vitamin supplement should be added to the turkeys' diet?

A 6%
B 8%
C 10%
D 14%

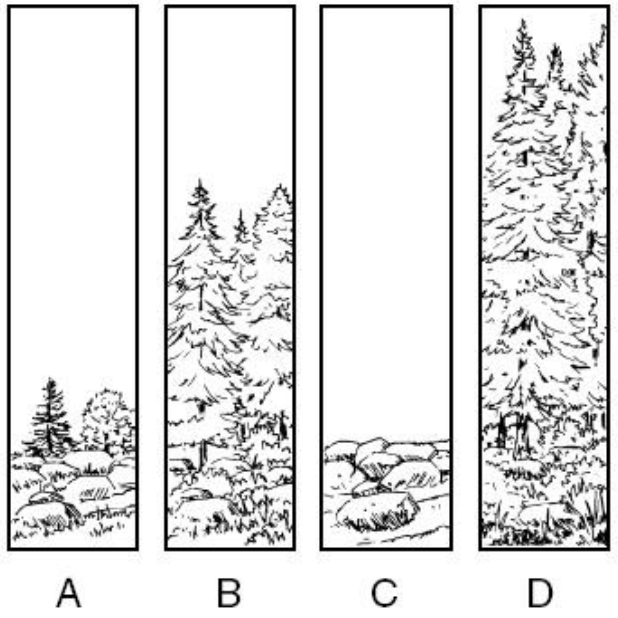
56



Which frog species would be most likely to interbreed?

A Peeper and leopard
B Wood and pickerel
C Bullfrog and green
D Tree and pickerel

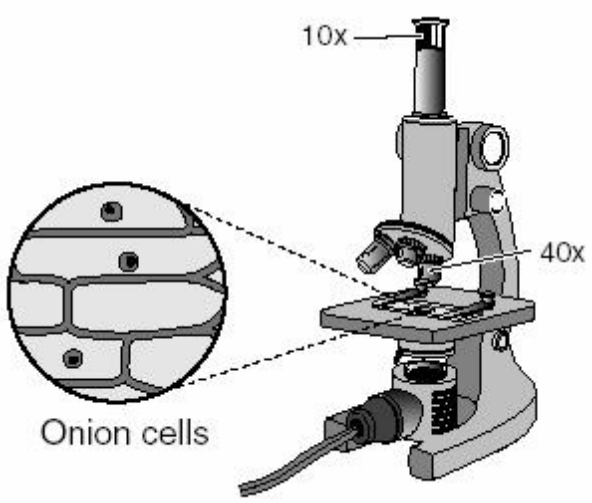
57



Which order of diagrams would show primary succession in an area that had never before been occupied by living organisms?

A A, C, B, D
B C, A, B, D
C D, B, C, A
D B, A, C, D

58

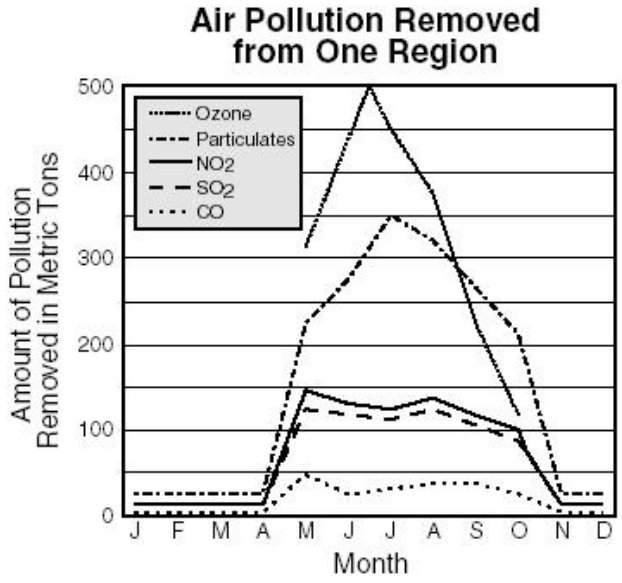


What is the total magnification used to view these onion cells through this microscope setup?

A 10×
B 40×
C 50×
D 400×

Go on to next page

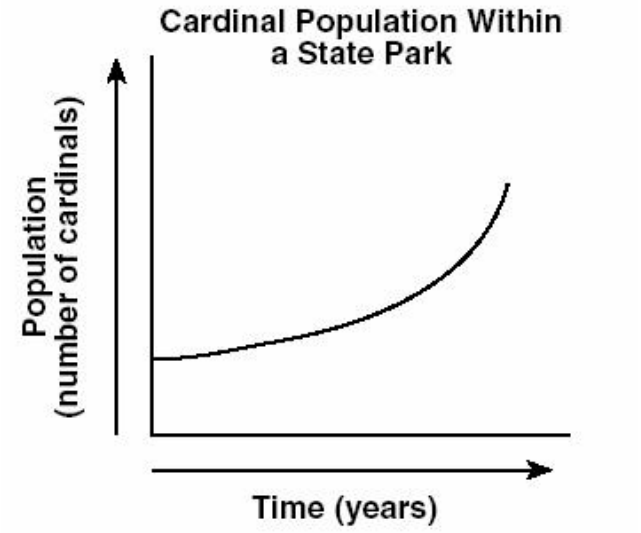
59



The graph shows the amount of pollutants removed by trees. During October, the trees were able to remove the greatest amount of _____.

A ozone
B particulates
C NO_2
D SO_2

60



Which hypothesis is best supported by this graph?

A A disease of cardinals spread throughout the park.
B Dominant cardinal chicks were the first to be fed.
C The population of cardinal predators increased.
D The cardinals' food supply increased.

61

Transition forest – overlap zones between needleleaf forests and deciduous forests

Appalachian Cove forest – climax forests known for high humidity and lush foliage

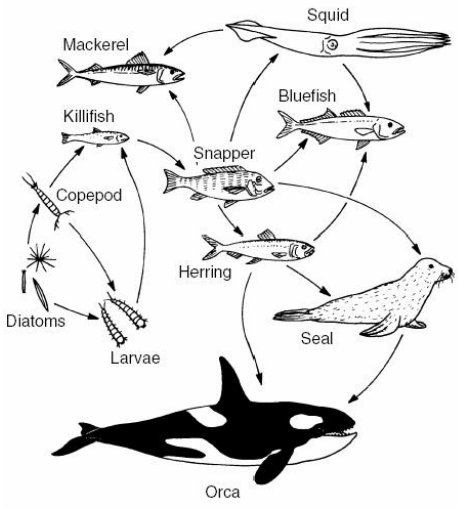
Northern Needleleaf forest – spruce-fir forests found on the highest, coolest peaks

Oak-Hickory forest – classic deciduous forests with abundant food and shelter

Shenandoah National Park is home to many different types of ecosystems. According to the characteristics shown above, which ecosystem would ***most likely*** be home to a mixture of wildlife species from northern, cooler ranges and southern, warmer ranges?

A Transition forest
B Appalachian Cove forest
C Northern Needleleaf forest
D Oak-Hickory forest

62



In the diagram, which organism provides nutrients for the largest number of other organisms?

A Herring
B Snapper
C Bluefish
D Seal

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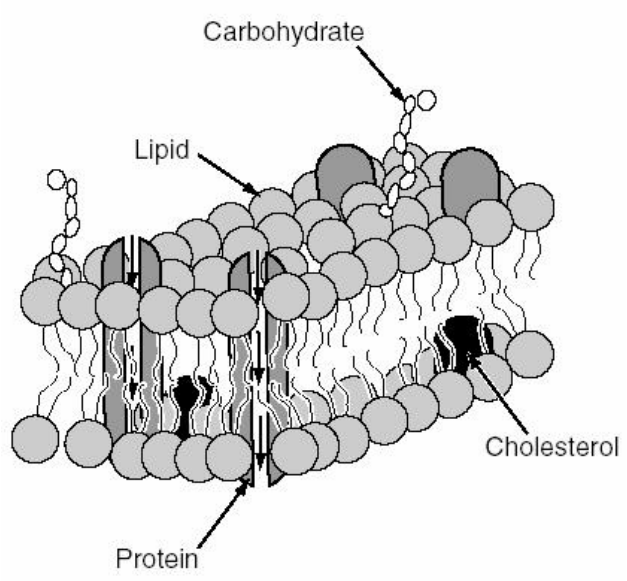
63



In the cell membrane model shown above, the molecules which move large molecules into and out of the cell are known as ____.

A cholesterol
B proteins
C lipids
D carbohydrates

64

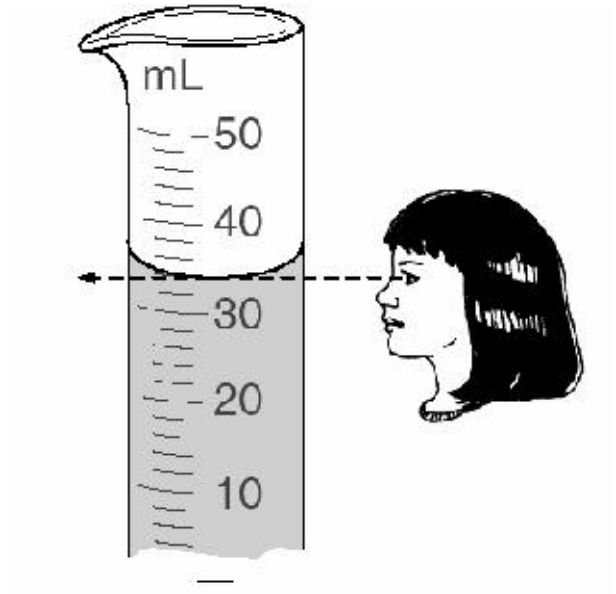
Field Data

Pond	pH of Pond Water	Number of Duckweed Plants
A	6	150
B	12	300
C	8	500
D	4	80

The above information was collected in the field while studying the effect of pH on the growth of the duckweed plant. The data shows that duckweed has optimum growth at a pH of _____.

A 4
B 6
C 8
D 12

65

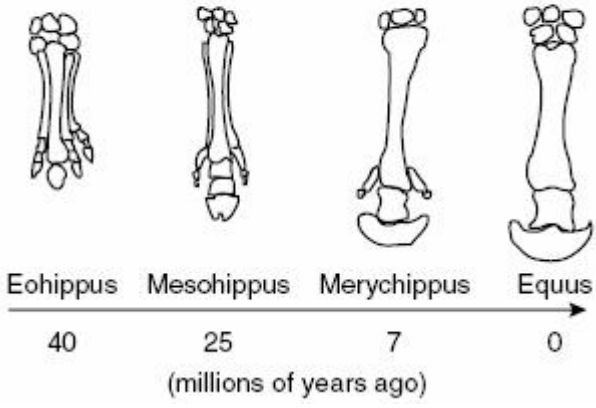


Jan consistently read the volume of liquids as shown. How would this practice impact her work?

A Her measurements would lack precision.
B Her measurements would be too high.
C Her measurements would be too low for less dense liquids.
D Her measurements would be very accurate.

66

Fossil Records of Horse Foot Structure Over Time

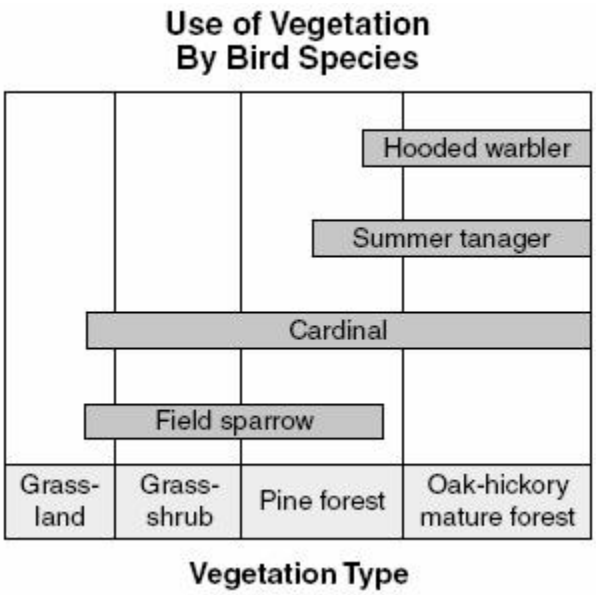


According to the diagram, during the last 40 million years, the structure of the horse's foot has _____.

A lost its toes
B become smaller
C grown toes
D remained the same size

Go on to next page

67



An experiment is designed to clear an oak-hickory forest and replant the area with pines. Which of the following species would be *most* threatened by this experiment?

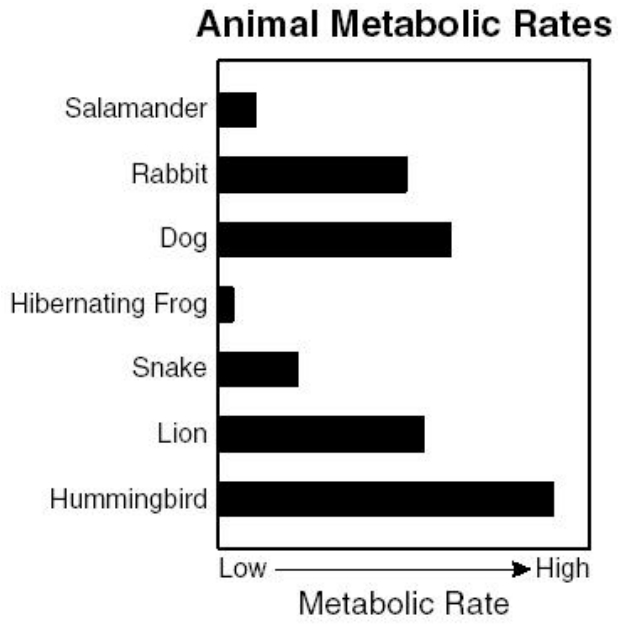
A Field sparrow
B Cardinal
C Summer tanager
D Hooded warbler

68

Which of the following is the ***best*** evidence that this bird is nocturnal?

A The shape of its beak
B The size of its eyes
C The thickness of its feathers
D The length of its talons

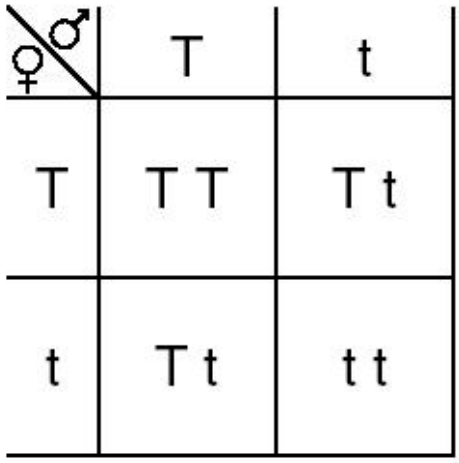
69



According to the graph, the highest metabolic rate is found in _____.

A amphibians
B reptiles
C birds
D mammals

70



In pea plants, tall plants are dominant to short plants. If two heterozygous tall plants are crossed, what percent of the offspring will probably be short?

A 75%
B 50%
C 25%
D 0%

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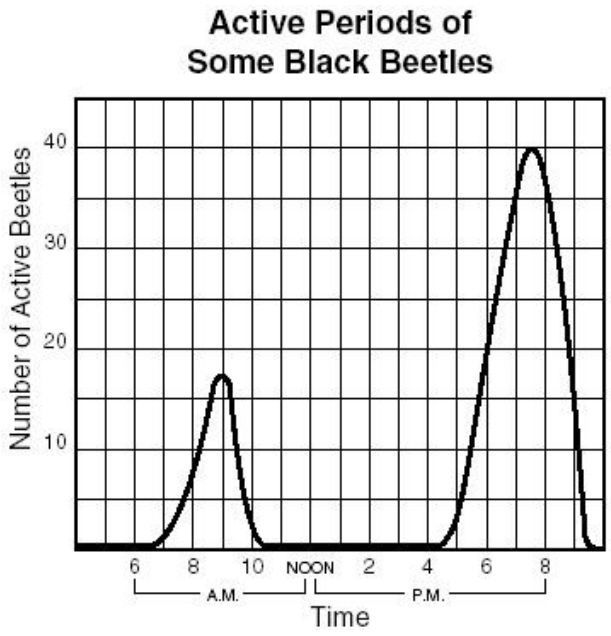
71



The hypothesis best supported by this graph is that these beetles are most active when the area is _____.

A free from predators
B coolest with some sunlight
C wettest from dew
D richest in oxygen supplies

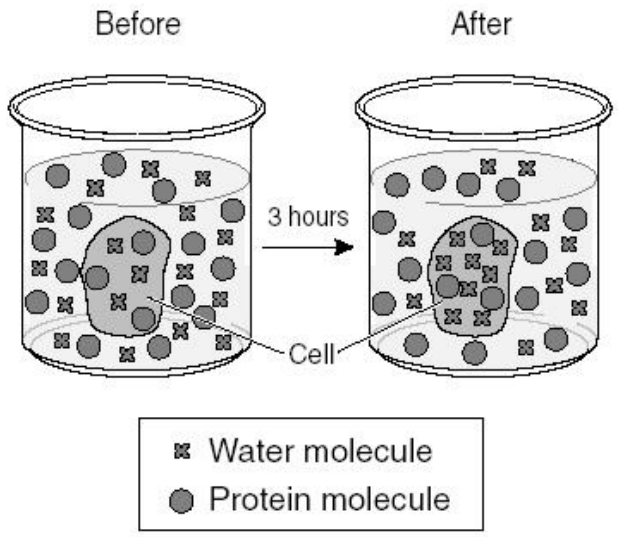
72

Structures Present in Vertebrate Embryos							
Stage of Development	Structure	Frog	Fish	Pig	Bird	Turtle	Human
early	tail	✔	✔	✔	✔	✔	✔
early	gill slits	✔	✔	✔	✔	✔	✔
early	notochord	✔	✔	✔	✔	✔	✔
late	external ears			✔			✔
late	limbs	✔		✔	✔	✔	✔

According to the table, as vertebrate embryos develop _____.

A amphibians and humans develop the same structures
B only mammals develop both limbs and external ears
C reptiles and amphibians grow external ears
D limbs and external ears grow on mammals and birds

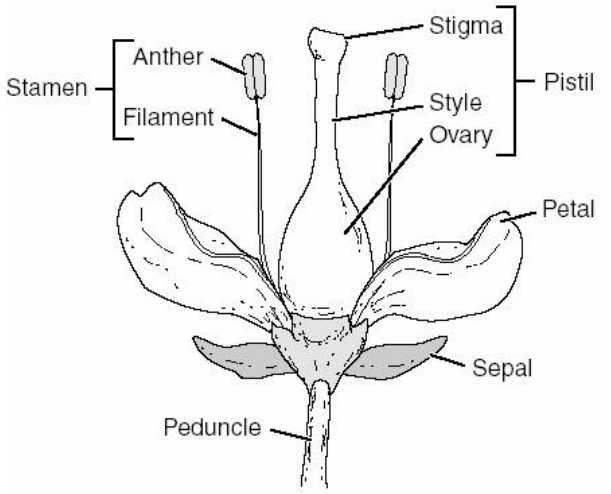
73



The above diagram shows the process of osmosis. Only the water molecules could enter the cell because water molecules _____.

A have more energy than the protein molecules
B are smaller than the protein molecules
C are more numerous than the protein molecules
D contain more hydrogen atoms than the protein molecules

74



In which part of the flower does fertilization take place?

A Stamen
B Pistil
C Petal
D Sepal

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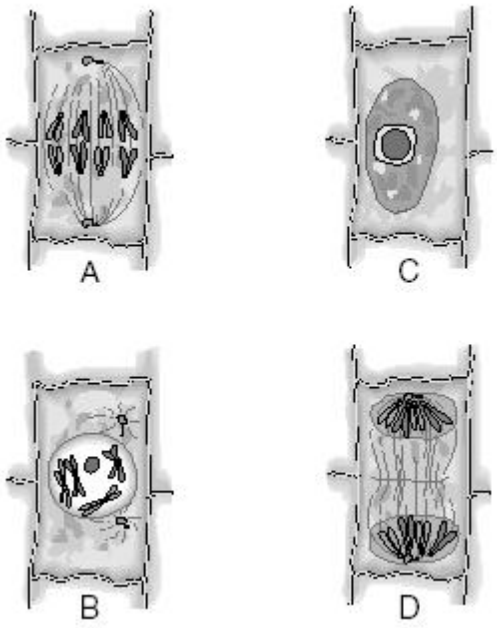
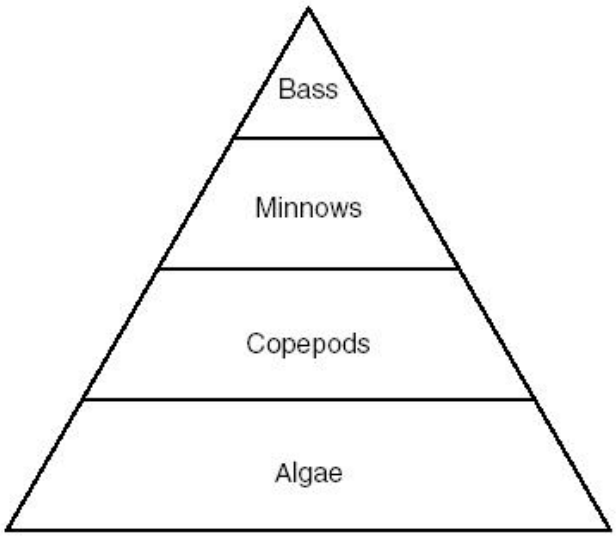
75



What is the correct sequence for plant cell mitosis?

A A, B, D, C
B C, B, A, D
C B, A, D, C
D D, C, B, A

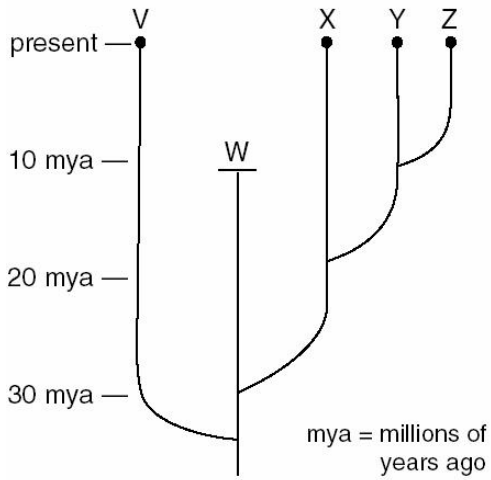
76



Which level of this food pyramid represents the largest biomass?

A Bass
B Minnows
C Copepods
D Algae

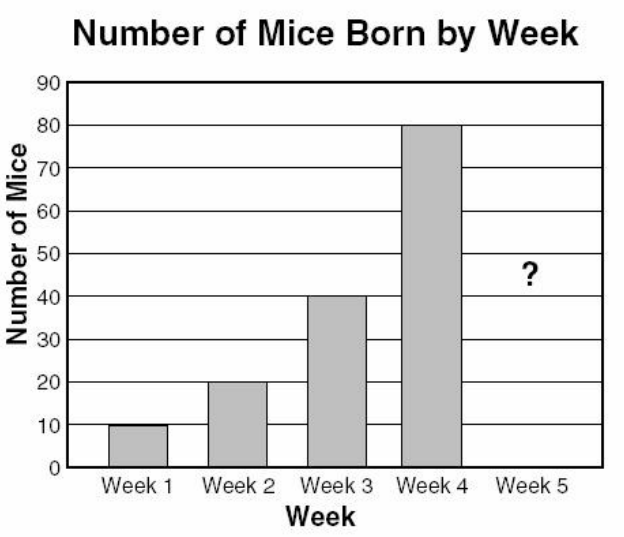
77



Which statement is *best* supported by the phylogenetic tree shown?

A Species V is still alive today and is the oldest species.
B Species W is still developing from a prior species.
C Species X, Y, and Z became extinct 20 million years ago.
D Species W first came into existence 10 million years ago.

78

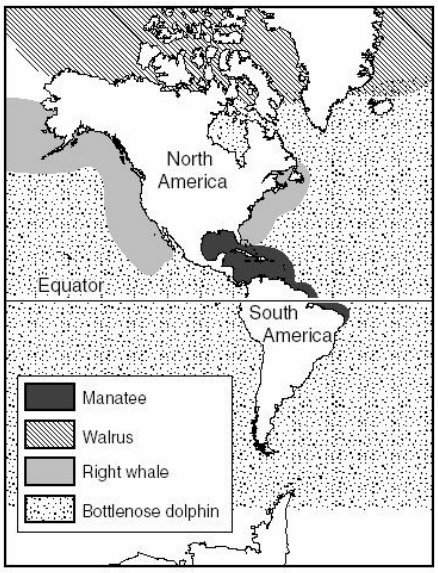


According to the graph, how many mice will be born in week 5 if the trend continues?

A 160
B 140
C 100
D 90

Go on to next page

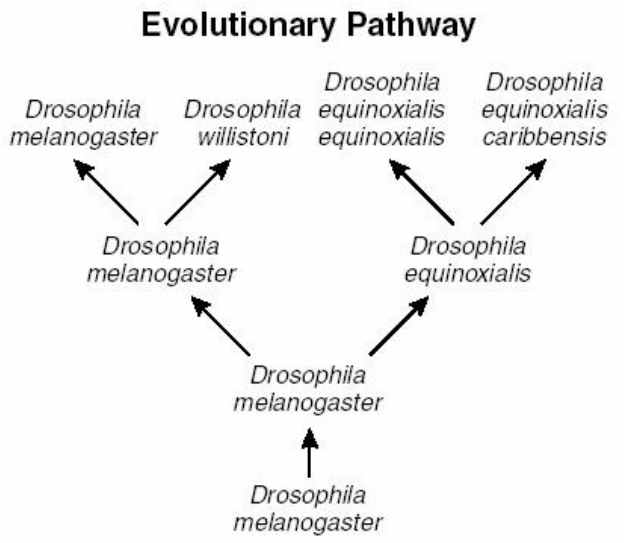
79



According to this map, which animal would *most likely* avoid cold waters?

A Manatee
B Walrus
C Right whale
D Bottlenose dolphin

80



Which type of *Drosophila* probably changed the ***least*** over time?

A *Drosophila melanogaster*
B *Drosophila willistoni*
C *Drosophila equinoxialis equinoxialis*
D *Drosophila equinoxialis caribbensis*

81

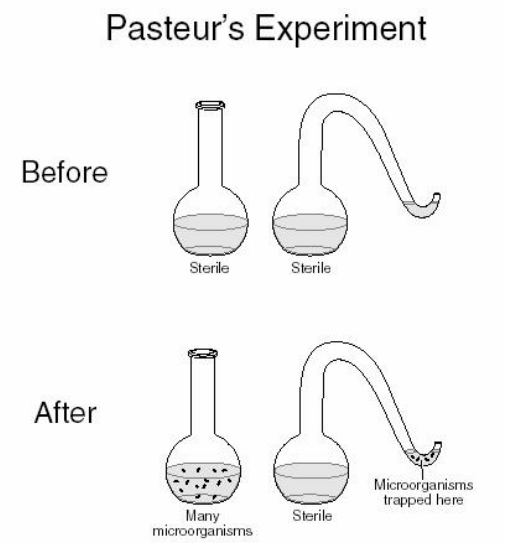
Comparison of Disinfectants

Disinfectant	Bacterial Colony Size (mm)	
	Trial 1	Trial 2
None	6.0	5.5
1	3.0	2.0
2	2.5	1.5
3	4.0	4.0
4	1.5	1.5

Four disinfectants were tested in two trials, each for their effectiveness in controlling bacterial growth. The table shows the bacterial growth in each trial after four days. Which of the following conclusions is ***best*** supported by the results of this study?

A Disinfectants kill most bacteria on contact.
B Strong concentrations of disinfectants can be harmful.
C Some disinfectants are more effective than others.
D Disinfectants cannot be used to control bacterial infections.

82



The results of Pasteur's experiment helped Pasteur to _____.

A reject the theory of spontaneous generation
B isolate the virus responsible for smallpox
C produce a vaccine against rabies
D convince people to cover food

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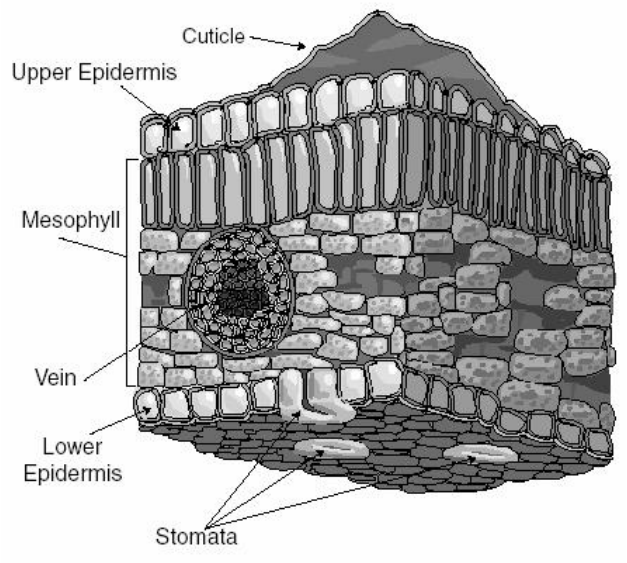
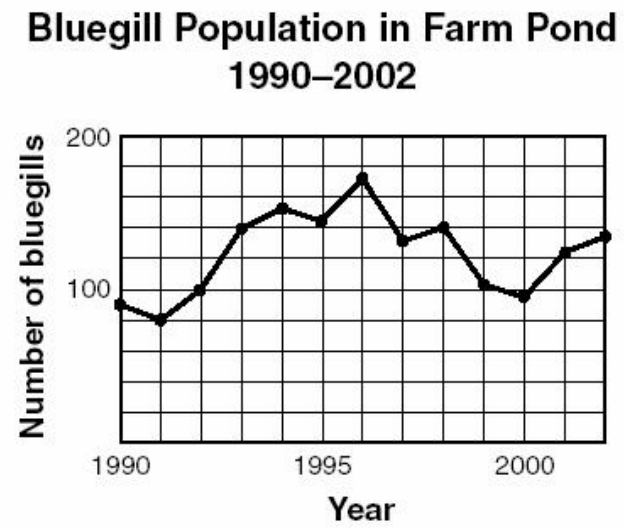
83



Which area of the leaf is most responsible for protecting the leaf from the drying effects of the air?

A The epidermis
B The mesophyll
C The vein
D The cuticle

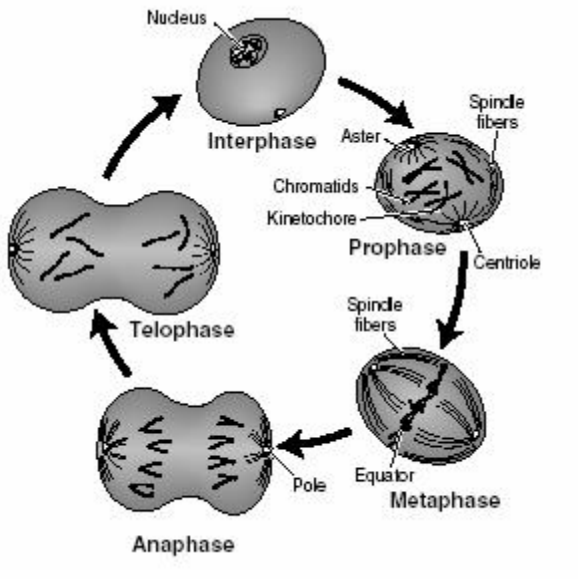
84



According to the data in the graph, during which time period did the overall bluegill population decline?

A 1990–1993
B 1993–1996
C 1996–1999
D 1999–2002

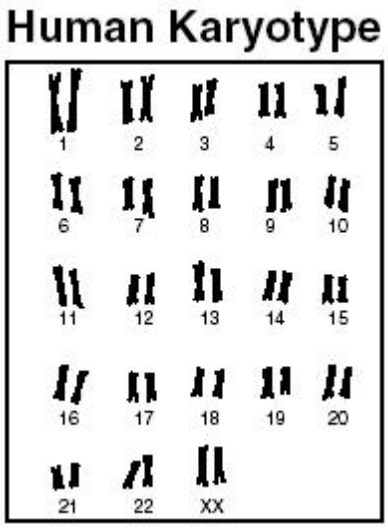
85



Which of the following phases is the first step in mitosis?

A Anaphase
B Metaphase
C Prophase
D Telophase

86

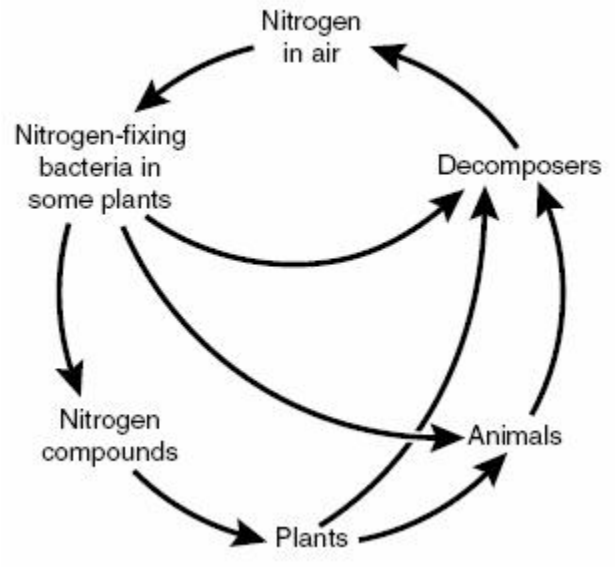


A chart of human chromosome pairs is called a karyotype. What information is revealed in the karyotype above?

A The sex
B The age
C Trisomy
D Gene dominance

Go on to next page

87



The diagram shows a simplified nitrogen cycle. Which process is responsible for returning nitrogen to the air?

A Excretion
B Decomposition
C Photosynthesis
D Nitrification

88

Two plants are crossed, and the traits of height and color are assessed in the offspring. The following cross was conducted: *TTPP* × *ttpp*.

T = dominant allele for height, tall plant
t = recessive allele for height, short plant
P = dominant allele for color, purple
p = recessive allele for color, white

	TP	TP	TP	TP
tp				
tp				
tp				
tp				

Which of the following choices correctly describes the offspring?

A Three-quarters of the plants are tall and purple.
B Three-quarters of the plants are short and white.
C All are short and white.
D All are tall and purple.

89

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

In order to form recombinant DNA, scientists have found a way to cut a DNA segment using an enzyme named *Eco*RI. This enzyme cuts DNA wherever the sequence C-T-T-A-A-G occurs between the A and the G base. Which of these would result if *Eco*RI were used on the DNA in the diagram above?

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

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

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

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

90

Organism	Direction of Movement		
	Toward Light	Away from Light	Neither
Euglena	X		
Paramecium			X
Fungus			X
Coleus plant	X		
Earthworm		X	

These data were collected by observing responses of different organisms to light. Which conclusion is supported by these data?

A Organisms that use photosynthesis areattracted to light.
B Protists are not attracted to light.
C Animals are attracted to light.
D Decomposers are attracted to light.

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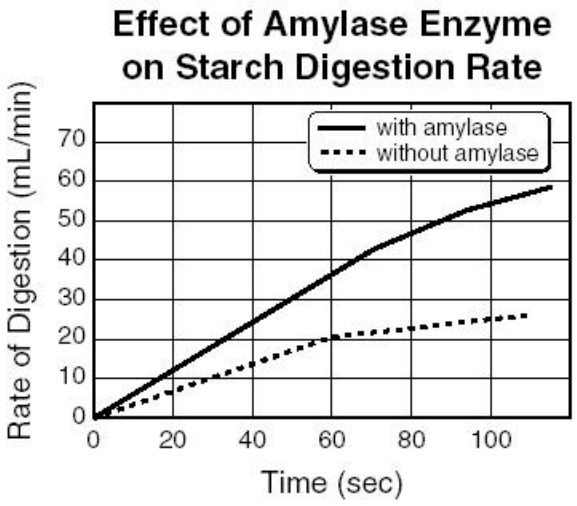
91



According to the graph, addition of the enzyme amylase causes the reaction to _____.

A slow down
B speed up
C give off heat
D take in heat

92

Cell Organelles and Functions

Kingdom	Metabolism	Control	Covering	Food Production
Fungi	mitochondria	nucleus	cell wall	none
Animalia	mitochondria	nucleus	cell membrane	none
Plantae	mitochondria	nucleus	cell wall	chloroplasts
Protista	mitochondria	nucleus	cell membrane	some with chloroplasts
Monera	ribosomes	DNA strand	cell wall	none

Which of these statements is supported by the data shown in the table?

A Most kingdoms are made up of prokaryotic cells.
B All cells have nuclei for control of cell functions.
C Eukaryotic cells vary in covering and in food production.
D Each of the kingdoms has different organelles for metabolism.

93

The picture shows an x-ray diffraction of DNA. The x-ray diffraction of DNA led to the idea that DNA _____.

A is a double helix
B contains paired bases
C can copy itself
D is a very long molecule

94

Flower Characteristics

Characteristics	Insect-Pollinated Plants	Wind- or Water-Pollinated Plants
Appearance	often colorful	plain
Reproductive parts	sometimes hidden	exposed

The differences in the above characteristics of flower species ***most likely*** resulted from _____.

A parasitism, which did not harm the host species
B mutualism between different plant species
C adaptations in response to different selection pressures
D defensive mutations allowing concealment of species

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95

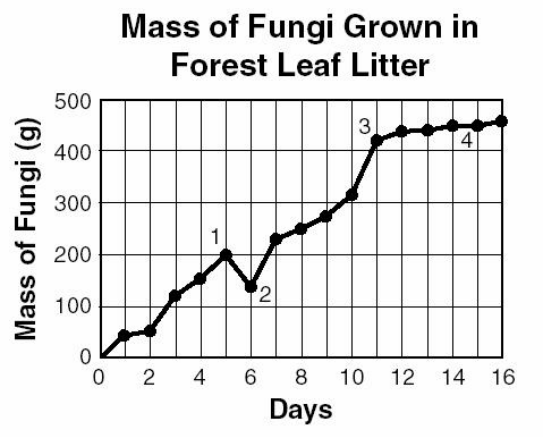
Average Water Loss (Transpiration) in Corn Plants (mL/hr)

Plot	May 15	May 30	June 15	July 1	July 15
1	1.2	3.4	6.4	10.7	8.5
2	1.1	3.1	11.9	9.8	8.8
3	1.2	3.5	5.5	10.1	9.2
4	1.1	3.8	6.2	9.5	8.4

In the above table, which item of data is most likely to be *invalid*?

A Plot 1 on July 1
B Plot 2 on June 15
C Plot 3 on May 15
D Plot 4 on May 30

96



Which data point on the graph is probably invalid?

A 1
B 2
C 3
D 4

97

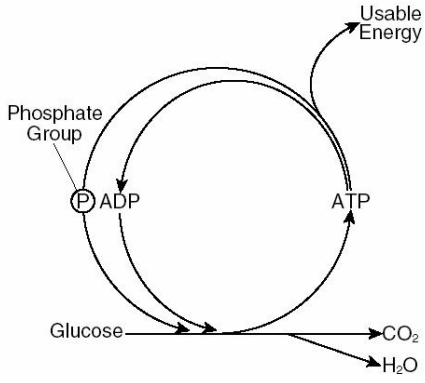
Effects of Ultraviolet Light on Wheat Crop Production

Experimental Plot (4m x 15m)	Wavelength (nm)	Wave intensity (Joules/m^2)	Crop Yield (g/m^2)
A	357.6	0	110
B	357.6	8	110
C	357.6	20	30
D	357.6	25	20

Which of these statements is best supported by these data?

A Wheat plants exposed to high-intensity ultraviolet light produce fewer seeds.
B Chloroplasts of wheat are able to filter out low-intensity ultraviolet light.
C High-intensity ultraviolet light may be used to control weed growth.
D No exposure to ultraviolet light increases pollination in wheat plants.

98



The picture models a cellular metabolic process. The *main* purpose of this process is to produce _____.

A phosphate groups
B usable energy
C ADP
D H_2O

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99

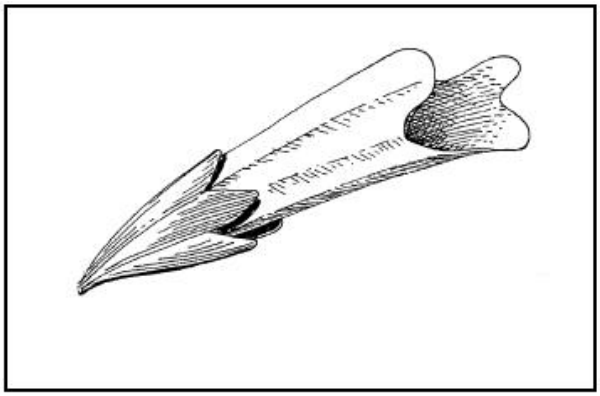
Heart Chambers in Different Animals

	Fish	Bird	Turtle	Frog	Dog
Number of atria	1	2	2	2	2
Number of ventricles	1	2	2	1	2
Separation of ventricles	—	Total	Partial	—	Total

Which type of animal is most closely related to a mammal, based on heart structure?

A Fish
B Bird
C Turtle
D Frog

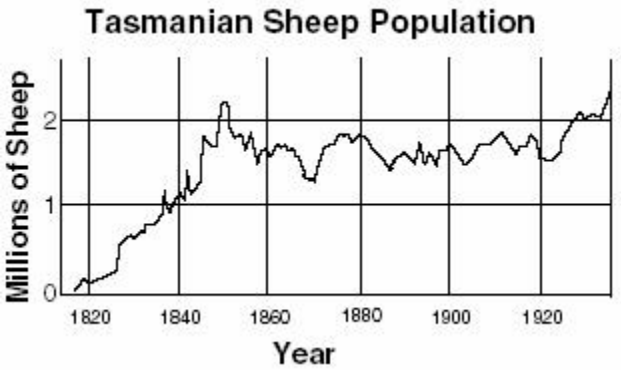
100



A flower with this shape would use what type of pollinator?

A Wind
B Mammal
C Rain
D Hummingbird

101



This graph suggests that from 1840 to 1920, the carrying capacity for sheep in Tasmania was approximately _____.

A 0.75 million
B 1.00 million
C 1.75 million
D 2.25 million

102

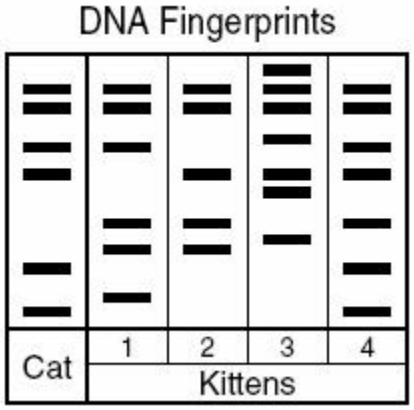
Stimuli	Number of Movements Toward	Number of Movements Away From	No Response
light	0	10	0
sound	5	4	1
magnetism	4	4	2
gravity	7	2	1

As a result of the above experiment, responses of a planarian to different environmental stimuli were recorded. Planaria seem to have the strongest response to ____.

A light
B sound
C magnetism
D gravity

Go on to next page

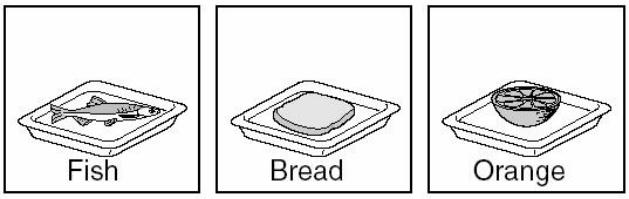
103



The picture shows a segment of DNA from a cat. Which of these is most likely the kitten of this cat?

A 1
B 2
C 3
D 4

104



The picture shows some containers of different foods that were left in the open for 2 days. Which question could best be answered by this experiment?

A Which food attracts flies from the greatest distance?
B How does a fly digest different foods?
C Which food attracts the most flies?
D How much energy do flies get from different foods?

105

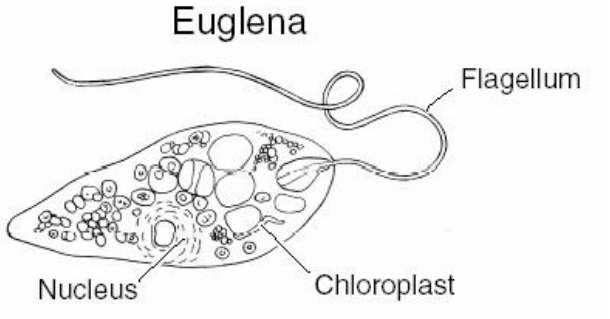
Experimental Results

Fertilizer	Plant 1	Plant 2
1	10 mm	8 mm
2	6 mm	3 mm
3	13 mm	10 mm
4	9 mm	4 mm

The data show the growth of two bean plants over several weeks using four different fertilizers. The experimental data would be more valid if which of the following variables was included in the experiment?

A A fifth fertilizer was tested.
B Only one plant was tested.
C The plants were grown at variable temperatures.
D A control without fertilizer was included for each plant.

106



What is the purpose of the flagellum?

A Circulation
B Catching prey
C Movement
D Attachment

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107

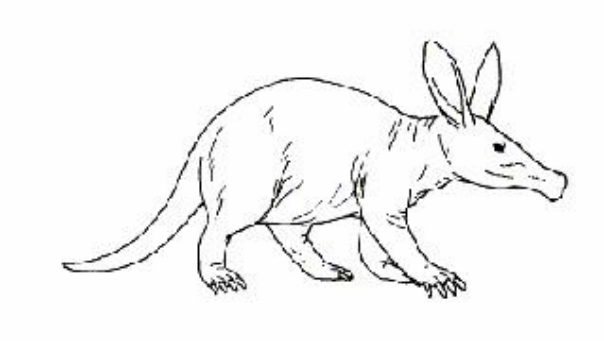
Rabbit Test Cross Results

Parent Generation	Black × White
F_1	all black
F_2	75% black 25% white

What conclusion can be drawn from the genetic information above?

A The white parent carried a dominant allele.
B All the F_1 rabbits carried a recessive allele.
C All the white rabbits are heterozygous.
D All the black rabbits in the F_2 generation are homozygous.

108



Which of these hypotheses is ***best*** supported by observations of this animal?

A This animal spends much of its time digging.
B This animal usually hunts for food at night.
C This animal is herbivorous.
D This animal has poor hearing.

109

DNA Base Sequence Comparison

Human	AGG CAT AAA CCA ACC GAT TAA
Chimpanzee	AGG CCC CTT CCA ACC GAT TAA
Gorilla	AGG CCC CTT CCA ACC AGG CCA

This chart compares the base sequences of homologous segments of DNA from three primates. Based on this information, how many differences in the resulting amino acid sequences would you expect to find between humans and chimpanzees?

A 2
B 3
C 4
D 6

110

Red Cardinal

Which characteristic supports the hypothesis that this bird spends a great deal of time in the trees and shrubs?

A The thickness of its bill
B The crest of feathers on its head
C The shape of its feet
D The color of its wings

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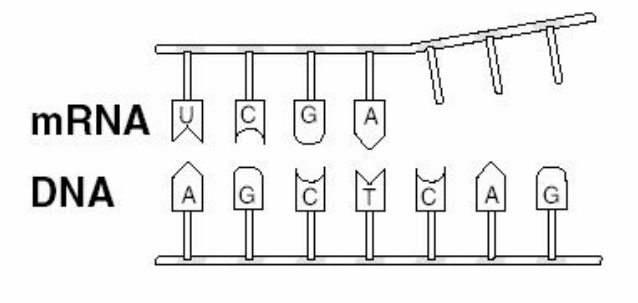
Unknown animal: Met-Gly-Ser-Tyr-Tyr-Arg-His-His-Glu-Lys-Asp

One method of determining the classification of an animal is by comparing the amino acid sequence. Which of these animals most closely resembles the unknown animal?

A Horse: Met-Gly-Ser-Ser-Tyr-Arg-Arg-Asp-His-Glu-Lys-Asp
B Dog: Met-Gly-Ser-Tyr-Tyr-Arg-His-Asp-Glu-Lys-Asp
C Cat: Met-Gly-Ser-Tyr-Tyr-Arg-His-His-Arg-Cys-Thre-Asp
D Mouse: Met-Gly-Ser-Tyr-Tyr-Arg-His-Glu-Val-Val-Leu

112



Which of these will complete the mRNA strand matched to DNA?

A CAG
B AUG
C GUC
D UAC

113

Which characteristic supports the hypothesis that this animal spends a great deal of time burrowing through the soil?

A The shape of its body
B The position of its nose
C The length of its tail
D The size of its claws

114

Effects of Phosphates on the Growth of Grama Grass

Group (25 individuals)	Incubation Temperature (°c)	Phosphate Solution (ppm)	Volume of Daily Irrigation (mL)	Average Height of Grass After 30 Days (cm)
A	20	0	200	10
B	20	15	200	10
C	20	30	200	12
D	20	60	200	18

Which factor would need to be known before a valid conclusion could be based upon these data?

A The original average height of grass
B The length of the study period
C The density of the phosphate solutions
D The mineral content of the potting soil

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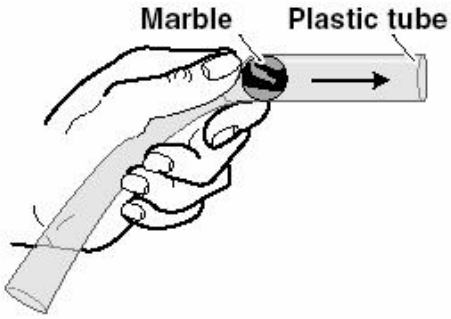
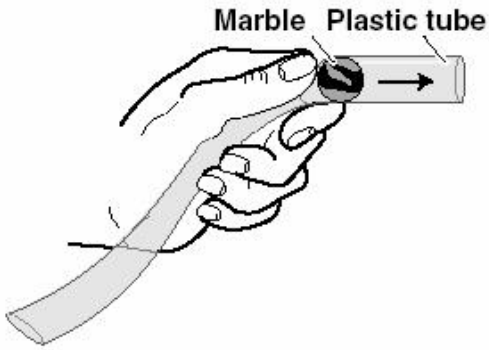
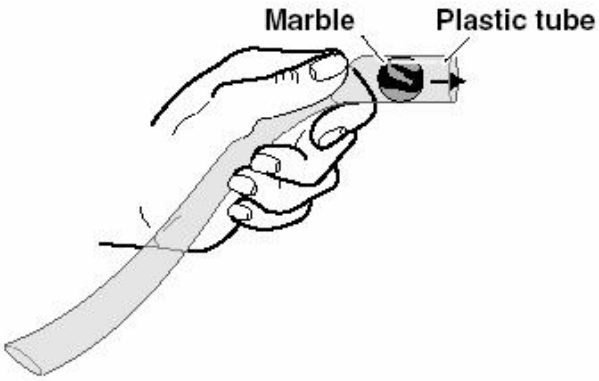
Picture 1



Picture 2



Picture 3



The picture shows a model being used to explain how food is moved through the gastrointestinal (GI) tract. What do the fingers pushing the marble along represent?

A The pressure of blood vessels surrounding the GI tract
B The production of fluids by the GI tract
C The contraction of muscles in the GI tract
D The electrical impulses from the nervous system to the GI tract

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Sandy Beach and Dune Wildlife Locator Chart

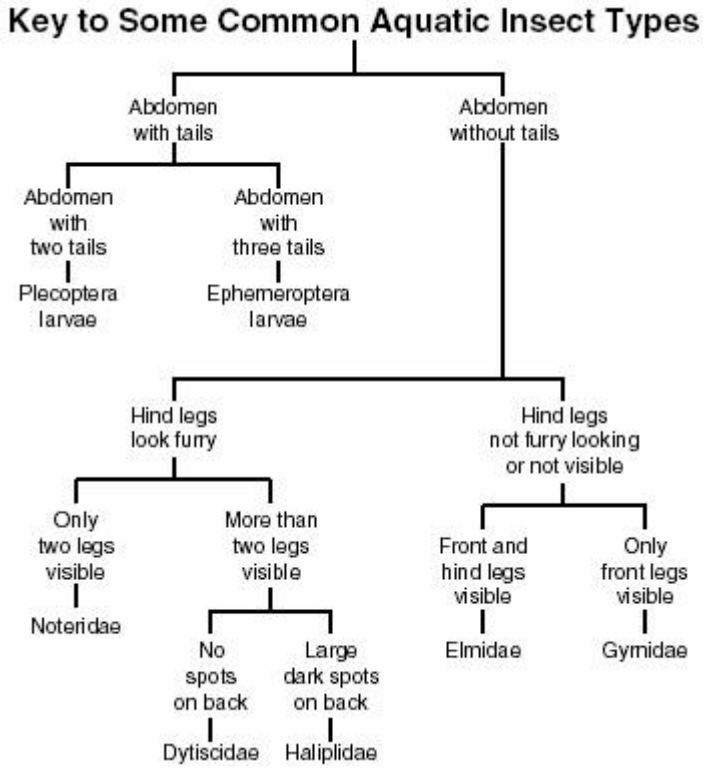
	Feeds in Dunes	Feeds on Wet Sand or Beach	Feeds at High-tide mark
Nests in Tree Canopy or Shrubs	Yellow-billed Cuckoo American Robin Cedar Waxwing		Fish Crow Boat-tailed Grackle
Nests in Tree Trunks	Downy Woodpecker Northern Flicker		Raccoon
Nests on Ground	Eastern Cottontail	Black-bellied Plover Wilson's Plover Semipalmated Plover Piping Plover American Oystercatcher Willet Sanderling Semipalmated Sandpiper Dunlin Laughing Gull Ring-billed Gull Great Black-backed Gull	Ruddy Turnstone
Nests in Fresh Water	Fowler's Toad		

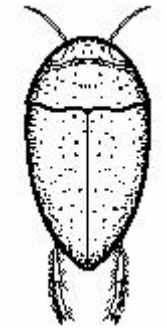
A student studying wildlife nesting patterns in the sandy beach and dune ecosystem of the Chincoteague National Wildlife Refuge would find nests of the most species in which of the following locations?

A Shrubs
B Tree trunks
C Ground
D Fresh water

Go on to next page

117



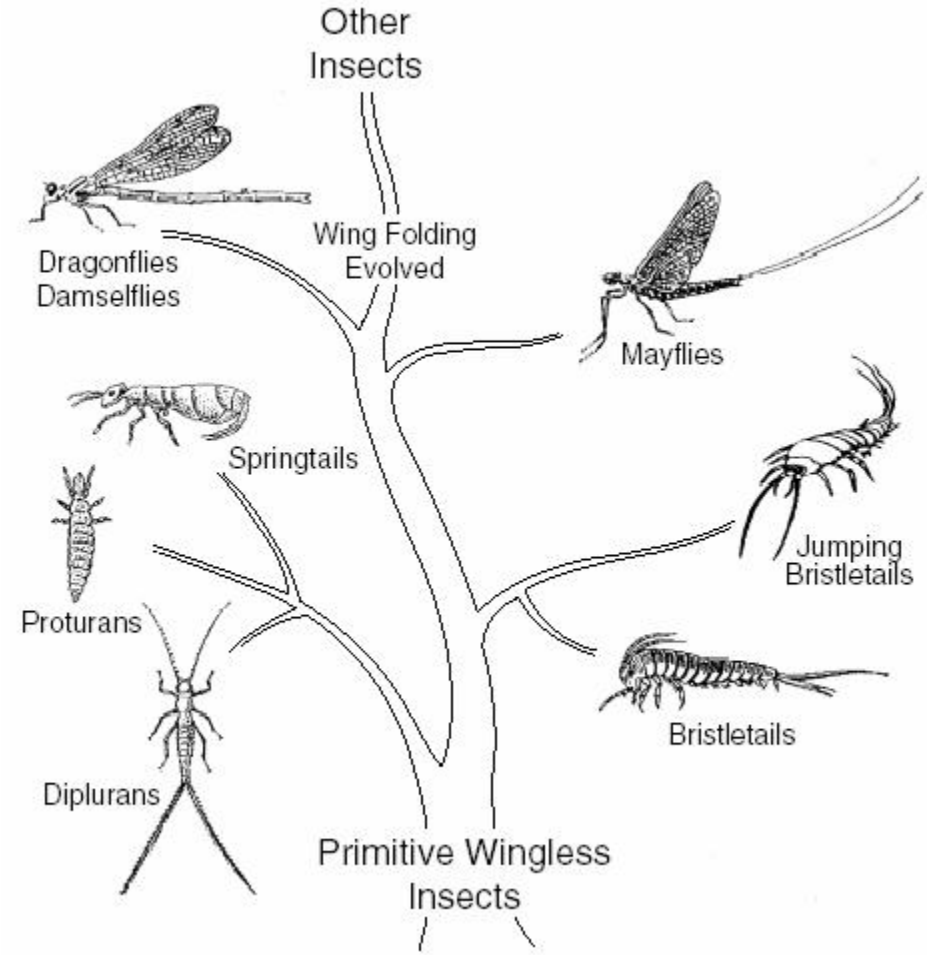


According to this key, to what family does the insect above belong?

A Dytiscidae
B Haliplidae
C Gyrnidae
D Noteridae

Go on to next page

118



According to this chart, the insects that are most closely related are the _____.

A springtails and bristletails
B dragonflies and proturans
C springtails and proturans
D bristletails and mayflies

119

Plant Characteristics

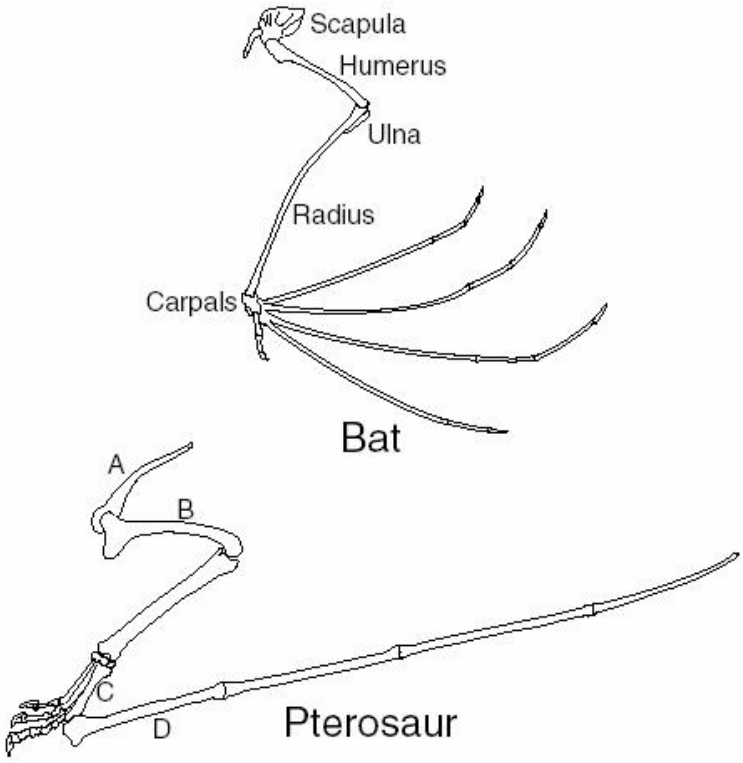
Plant	Type of Growth	Leaves	Flowers	Fruit
Cucumber	sprawling vines	fuzzy, dark green, 3-5 lobes	yellow	long and spiny
Eggplant	erect, bushy stems	fuzzy, large ovate	violet	large, egg-shaped berry, varying in color
Pumpkin	sprawling vines	large, fuzzy, triangular, lobed	yellow	large (2-20 lb), oblate to oblong, smooth rind
Pepper	straight and woody	slick, medium green	white	juiceless berries or pods, varying shape, size, and color
Okra	erect, shrub-like	heart-shaped and 3-5 lobes	yellow, crimson center	hairy, tapering capsule, 4-10 inches long

The cucumber belongs to the Cucurbitacae family and is recognized by its long, trailing vines with fuzzy, three- to five-pointed leaves and long, spiny fruit. Using the characteristics in the chart above, which plant is ***most*** closely related to the cucumber?

A Eggplant
B Pumpkin
C Pepper
D Okra

Go on to next page

120



The picture above shows part of the pectoral girdle and limb of two flying vertebrates known as the bat and the prehistoric pterosaur. Which bone of the pterosaur corresponds to the humerus of the bat?

A A
B B
C C
D D

Stop here

Scoring Key

?	⊙	Answer/ Scale	Objective
1	1	C	BIO.Scientific Investigation
2	2	B	BIO.Life at Systems _Organisms Level
3	3	B	BIO.Scientific Investigation
4	4	D	BIO.Life at Systems _Organisms Level
5	5	B	BIO.Life at Systems _Organisms Level
6	6	D	BIO.Life at Molecular _Cellular Level
7	7	A	BIO.Interaction of Life Forms
8	8	C	BIO.Life at Molecular _Cellular Level
9	9	D	BIO.Life at Systems _Organisms Level
10	10	A	BIO.Scientific Investigation
11	11	C	BIO.Life at Molecular _Cellular Level
12	12	C	BIO.Life at Molecular _Cellular Level
13	13	D	BIO.Life at Molecular _Cellular Level
14	14	D	BIO.Life at Molecular _Cellular Level
15	15	B	BIO.Interaction of Life Forms
16	16	D	BIO.Life at Systems _Organisms Level
17	17	B	BIO.Scientific Investigation
18	18	B	BIO.Life at Systems _Organisms Level
19	19	C	BIO.Life at Molecular _Cellular Level
20	20	C	BIO.Life at Systems _Organisms Level
21	21	A	BIO.Scientific Investigation
22	22	B	BIO.Life at Molecular _Cellular Level
23	23	A	BIO.Life at Molecular _Cellular Level
24	24	B	BIO.Life at Systems _Organisms Level
25	25	C	BIO.Interaction of Life Forms
26	26	C	BIO.Life at Molecular _Cellular Level
27	27	D	BIO.Life at Systems _Organisms Level
28	28	C	BIO.Life at Molecular _Cellular Level
29	29	A	BIO.Life at Systems _Organisms Level
30	30	A	BIO.Scientific Investigation
31	31	D	BIO.Scientific Investigation
32	32	B	BIO.Interaction of Life Forms
33	33	B	BIO.Life at Systems _Organisms Level
34	34	B	BIO.Interaction of Life Forms
35	35	D	BIO.Interaction of Life Forms
36	36	C	BIO.Interaction of Life Forms
37	37	C	BIO.Interaction of Life Forms
38	38	C	BIO.Life at Systems _Organisms Level
39	39	B	BIO.Life at Systems _Organisms Level
40	40	B	BIO.Life at Molecular _Cellular Level
41	41	B	BIO.Scientific Investigation
42	42	C	BIO.Scientific Investigation
43	43	C	BIO.Interaction of Life Forms
44	44	D	BIO.Interaction of Life Forms
45	45	A	BIO.Life at Systems _Organisms Level
46	46	C	BIO.Scientific Investigation
47	47	C	BIO.Scientific Investigation
48	48	A	BIO.Life at Systems _Organisms Level
49	49	D	BIO.Interaction of Life Forms
50	50	B	BIO.Life at Systems _Organisms Level
51	51	B	BIO.Life at Systems _Organisms Level
52	52	D	BIO.Life at Molecular _Cellular Level
53	53	B	BIO.Interaction of Life Forms
54	54	D	BIO.Interaction of Life Forms
55	55	C	BIO.Scientific Investigation
56	56	A	BIO.Interaction of Life Forms
57	57	B	BIO.Interaction of Life Forms
58	58	D	BIO.Scientific Investigation

? = Test Question Number ⊙= line on GP Form

?	⊙	Answer/ Scale	Objective
59	59	B	BIO.Scientific Investigation
60	60	D	BIO.Interaction of Life Forms
61	61	A	BIO.Interaction of Life Forms
62	62	B	BIO.Interaction of Life Forms
63	63	B	BIO.Life at Molecular _Cellular Level
64	64	C	BIO.Scientific Investigation
65	65	D	BIO.Scientific Investigation
66	66	A	BIO.Interaction of Life Forms
67	67	D	BIO.Scientific Investigation
68	68	B	BIO.Life at Systems _Organisms Level
69	69	C	BIO.Life at Systems _Organisms Level
70	70	C	BIO.Life at Systems _Organisms Level
71	71	B	BIO.Scientific Investigation
72	72	B	BIO.Life at Systems _Organisms Level
73	73	B	BIO.Life at Molecular _Cellular Level
74	74	B	BIO.Life at Systems _Organisms Level
75	75	B	BIO.Life at Molecular _Cellular Level
76	76	D	BIO.Interaction of Life Forms
77	77	A	BIO.Interaction of Life Forms
78	78	A	BIO.Scientific Investigation
79	79	A	BIO.Scientific Investigation
80	80	A	BIO.Interaction of Life Forms
81	81	C	BIO.Scientific Investigation
82	82	A	BIO.Life at Molecular _Cellular Level
83	83	D	BIO.Life at Systems _Organisms Level
84	84	C	BIO.Scientific Investigation
85	85	C	BIO.Life at Molecular _Cellular Level
86	86	A	BIO.Life at Systems _Organisms Level
87	87	B	BIO.Interaction of Life Forms
88	88	D	BIO.Life at Systems _Organisms Level
89	89	C	BIO.Life at Molecular _Cellular Level
90	90	A	BIO.Life at Systems _Organisms Level
91	91	B	BIO.Life at Molecular _Cellular Level
92	92	C	BIO.Life at Molecular _Cellular Level
93	93	A	BIO.Life at Molecular _Cellular Level
94	94	C	BIO.Interaction of Life Forms
95	95	B	BIO.Scientific Investigation
96	96	B	BIO.Scientific Investigation
97	97	A	BIO.Scientific Investigation
98	98	B	BIO.Life at Molecular _Cellular Level
99	99	B	BIO.Life at Systems _Organisms Level
100	100	D	BIO.Life at Systems _Organisms Level
101	101	C	BIO.Interaction of Life Forms
102	102	A	BIO.Life at Systems _Organisms Level
103	103	D	BIO.Life at Molecular _Cellular Level
104	104	C	BIO.Scientific Investigation
105	105	D	BIO.Scientific Investigation
106	106	C	BIO.Life at Molecular _Cellular Level
107	107	B	BIO.Life at Systems _Organisms Level
108	108	A	BIO.Scientific Investigation
109	109	A	BIO.Life at Molecular _Cellular Level
110	110	C	BIO.Life at Systems _Organisms Level
111	111	B	BIO.Life at Molecular _Cellular Level
112	112	C	BIO.Life at Molecular _Cellular Level
113	113	D	BIO.Life at Systems _Organisms Level
114	114	A	BIO.Scientific Investigation
115	115	C	BIO.Scientific Investigation
116	116	C	BIO.Interaction of Life Forms

?	⊙	Answer/ Scale	Objective
117	117	D	BIO.Life at Systems _Organisms Level
118	118	C	BIO.Scientific Investigation
119	119	B	BIO.Life at Systems _Organisms Level
120	120	B	BIO.Interaction of Life Forms

Total questions on test: 120

Minimum points required to achieve mastery category

Objectives measured: 4	Items	Points	●	◒	Questions measuring this objective
BIO.Scientific Investigation	31	31	23	20	1 3 10 17 21 30 31 41 42 46 47
BIO.Scientific Investigation					55 58 59 64 65 67 71 78 79 81 84
BIO.Scientific Investigation					95 96 97 104 105 108 114 115 118
BIO.Life at Systems _Organisms Level	34	34	26	22	2 4 5 9 16 18 20 24 27 29 33
BIO.Life at Systems _Organisms Level					38 39 45 48 50 51 68 69 70 72 74
BIO.Life at Systems _Organisms Level					83 86 88 90 99 100 102 107 110 113 117
BIO.Life at Systems _Organisms Level					119
BIO.Life at Molecular _Cellular Level	28	28	21	18	6 8 11 12 13 14 19 22 23 26 28
BIO.Life at Molecular _Cellular Level					40 52 63 73 75 82 85 89 91 92 93
BIO.Life at Molecular _Cellular Level					98 103 106 109 111 112
BIO.Interaction of Life Forms	27	27	21	18	7 15 25 32 34 35 36 37 43 44 49
BIO.Interaction of Life Forms					53 54 56 57 60 61 62 66 76 77 80
BIO.Interaction of Life Forms					87 94 101 116 120
Totals		120	91	78	

Items used in test

?	Item name	?	Item name	?	Item name
1	BIO.SOL2001.35	32	BIO.SOL2002.43	63	BIO.SOL2003.35
2	BIO.SOL2003.29	33	BIO.SOL2001.15	64	BIO.SOL2005.44
3	BIO.SOL2001.41	34	BIO.SOL2006.39	65	BIO.SOL2002.46
4	BIO.SOL2001.44	35	BIO.SOL2003.40	66	BIO.SOL2004.24
5	BIO.SOL2004.1	36	BIO.SOL2004.2	67	BIO.SOL2004.14
6	BIO.SOL2001.30	37	BIO.SOL2002.29	68	BIO.SOL2005.45
7	BIO.SOL2001.21	38	BIO.SOL2002.11	69	BIO.SOL2001.3
8	BIO.SOL2004.13	39	BIO.SOL2001.10	70	BIO.SOL2001.32
9	BIO.SOL2004.48	40	BIO.SOL2001.26	71	BIO.SOL2001.47
10	BIO.SOL2004.40	41	BIO.SOL2005.15	72	BIO.SOL2005.24
11	BIO.SOL2002.25	42	BIO.SOL2006.32	73	BIO.SOL2001.38
12	BIO.SOL2006.50	43	BIO.SOL2004.29	74	BIO.SOL2003.44
13	BIO.SOL2006.28	44	BIO.SOL2002.48	75	BIO.SOL2001.2
14	BIO.SOL2004.34	45	BIO.SOL2005.46	76	BIO.SOL2001.36
15	BIO.SOL2005.18	46	BIO.SOL2002.31	77	BIO.SOL2006.11
16	BIO.SOL2001.34	47	BIO.SOL2004.23	78	BIO.SOL2003.32
17	BIO.SOL2004.50	48	BIO.SOL2003.13	79	BIO.SOL2006.9
18	BIO.SOL2002.18	49	BIO.SOL2005.14	80	BIO.SOL2005.25
19	BIO.SOL2001.42	50	BIO.SOL2005.6	81	BIO.SOL2005.50
20	BIO.SOL2002.14	51	BIO.SOL2002.2	82	BIO.SOL2006.19
21	BIO.SOL2003.15	52	BIO.SOL2003.19	83	BIO.SOL2003.17
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23	BIO.SOL2005.28	54	BIO.SOL2004.12	85	BIO.SOL2005.10
24	BIO.SOL2006.44	55	BIO.SOL2004.10	86	BIO.SOL2001.22
25	BIO.SOL2003.37	56	BIO.SOL2001.1	87	BIO.SOL2004.22
26	BIO.SOL2001.33	57	BIO.SOL2001.48	88	BIO.SOL2006.6
27	BIO.SOL2004.9	58	BIO.SOL2005.1	89	BIO.SOL2001.7
28	BIO.SOL2002.19	59	BIO.SOL2001.8	90	BIO.SOL2005.41
29	BIO.SOL2003.48	60	BIO.SOL2003.25	91	BIO.SOL2001.27
30	BIO.SOL2001.18	61	BIO.SOL2005.12	92	BIO.SOL2001.17
31	BIO.SOL2003.6	62	BIO.SOL2006.48	93	BIO.SOL2002.6

Items used in test

?	Item name	?	Item name	?	Item name
94	BIO.SOL2005.31	103	BIO.SOL2004.7	112	BIO.SOL2003.1
95	BIO.SOL2004.19	104	BIO.SOL2003.8	113	BIO.SOL2004.47
96	BIO.SOL2006.1	105	BIO.SOL2002.32	114	BIO.SOL2003.28
97	BIO.SOL2002.16	106	BIO.SOL2002.38	115	BIO.SOL2002.36
98	BIO.SOL2006.41	107	BIO.SOL2004.36	116	BIO.SOL2004.26
99	BIO.SOL2006.14	108	BIO.SOL2002.10	117	BIO.SOL2002.47
100	BIO.SOL2001.28	109	BIO.SOL2005.35	118	BIO.SOL2001.29
101	BIO.SOL2005.37	110	BIO.SOL2002.45	119	BIO.SOL2002.8
102	BIO.SOL2003.23	111	BIO.SOL2002.17	120	BIO.SOL2002.35