



Keystone Review

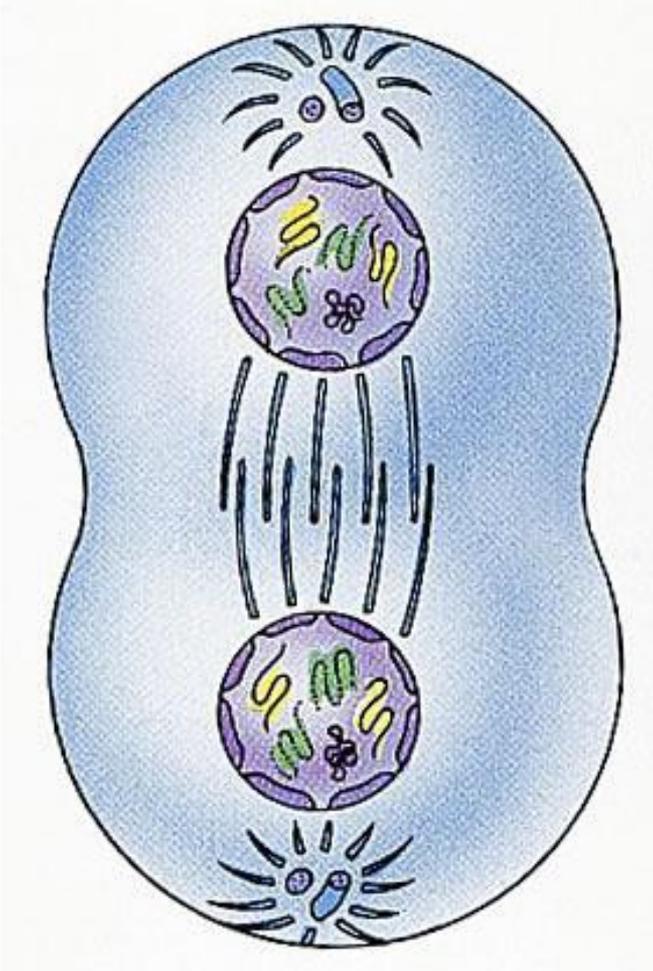
Module B



BIO.B.1.1 – Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.

- Describe the events that occur during the cell cycle: interphase, nuclear division, and cytokinesis.
- Compare the processes and outcomes of mitotic and meiotic nuclear division.

Which statement BEST describes the phase of the cell cycle shown?



- A. The cell is in prophase of mitosis because the number of chromosomes has doubled.
- B. The cell is in prophase I of meiosis because of the number of chromosomes has doubled.
- C. The cell is in telophase of mitosis because the cell is separating and contains two copies of each chromosome.
- D. The cell is in telophase of meiosis because the cell is separating and contains two copies of each

Answer - C

- A. Incorrect - The cell is not in prophase. This is obvious as the cell contains two nuclei, a condition which only occurs in telophase.
- B. Incorrect - The cell is not in prophase. This is obvious as the cell contains two nuclei, a condition which only occurs in telophase.
- C. Correct - The cell is in telophase, which can be seen from the two nuclei. Only telophase of mitosis includes two copies of each chromosome.
- D. Incorrect - The cell is in telophase, but in meiosis each cell contains only 1 copy of each chromosome.



Mitosis and meiosis are processes by which animal and plant cells divide. Which statement best describes a difference between mitosis and meiosis?

- A. Meiosis is a multi-step process.
- B. Mitosis occurs only in eukaryotic cells.
- C. Meiosis is used in the repair of an organism.
- D. Mitosis produces genetically identical daughter cells.

Answer - D

- A. Incorrect – both mitosis and meiosis are both multi-step processes
- B. Incorrect – mitosis occurs in both prokaryotic and eukaryotic cells
- C. Incorrect – meiosis produces gametes, it is not involved in the repair of organisms.
- D. Correct – mitosis produces genetically identical cells; meiosis produces genetically different cells.



Patau Syndrome can be a lethal genetic disorder in mammals, resulting from chromosomes failing to separate during meiosis.

Part A: Identify the step during the process of meiosis when chromosomes would most likely fail to separate.

Part B: Describe how chromosome separation in meiosis is different from chromosome separation in mitosis.

Part C: Compare the effects of a disorder caused by chromosomes failing to separate during meiosis, such as Patau syndrome, to the effects of chromosomes failing to separate during mitosis.



Identify the step during the process of meiosis when chromosomes would most likely fail to separate.

- Anaphase I or II are the most likely steps in which chromosomes would fail to separate. During Anaphase I, homologous chromosomes are pulled to opposite sides of the cell. If the spindle fibers do not attach properly during metaphase, the homologous pairs will not separate correctly. If the homologous pairs do not separate, two will go into one cell. Anaphase II is the phase in which sister chromatids are pulled to opposite sides of the cell. If sister chromatids fail to separate, two will go into one gamete. If this gamete were fertilized it would result in a trisomy, such as Down syndrome.



Describe how chromosome separation in meiosis is different from chromosome separation in mitosis.

There are two divisions within meiosis, meiosis I and meiosis II. During meiosis I, chromosomes line up in homologous pairs in order for the cell to be reduced from diploid to haploid. They then line up end to end in meiosis II in order to separate sister chromatids.

In mitosis, chromosomes separate only once. They line up end to end. This results in two identical, diploid cells.



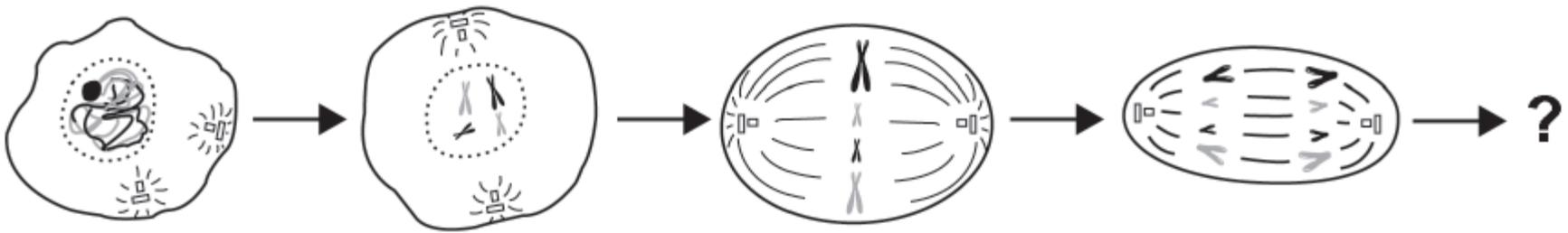
Compare the effects of a disorder caused by chromosomes failing to separate during meiosis, such as Patau syndrome, to the effects of chromosomes failing to separate during mitosis.

When a mutation occurs during meiosis, the organism in which the mutation occurs is not affected. However, the disorder will be passed to their offspring. Since all the cells in the offspring begin with the two parental gametes, every cell in the body of the offspring will contain the mutation.

When a mutation occurs during mitosis, the organism in which the mutation occurs is affected. However, the mutation will only occur in the localized region in which the mutated cell is found. It cannot be passed to

Which event **most likely** occurs next in mitosis?

Mitosis



- A. The chromatin condenses.
- B. The nuclear envelope dissolves.
- C. The chromosomes double in number.
- D. The cell membrane pinches inward to divide the cytoplasm.

Answer - D

- A. Incorrect - The condensing of the chromatin occurs during prophase at the beginning of mitosis.
- B. Incorrect - The nuclear envelope dissolves after the chromatin condenses into chromosomes during prophase.
- C. Incorrect - The chromosomes double in number during the S phase, not during mitosis.
- D. Correct: The next event would show telophase, when the cell begins to separate into two daughter cells.



Mitosis and meiosis are processes by which animal and plant cells divide. Which statement **best** describes a difference between mitosis and meiosis?

A. Meiosis is a multi-step process.

B. Mitosis occurs only in eukaryotic cells.

C. Meiosis is used in the repair of an organism.

D. Mitosis produces genetically identical daughter cells.



Answer - D

A. Incorrect - Both meiosis and mitosis are multi-step processes.

B. Incorrect - Mitosis also takes place in prokaryotic cells.

C. Incorrect - Meiosis generates gametes used in sexual reproduction.

D. Correct - Cells produced through mitosis contain DNA identical to the parent cells, whereas meiosis produces cells that are haploid and often genetically different.



Bio.B.1.2 – Explain how genetic information is inherited.

- Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
- Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.



What process helps to preserve the genetic information stored in DNA during DNA replication?

- A. The replacement of nitrogen base thymine with uracil.
- B. Enzymes quickly linking nitrogen bases with hydrogen bonds.
- C. The synthesis of unique sugar and phosphate molecules for each nucleotide.
- D. Nucleotides lining up along the template strand according to base pairing rules.

Answer: D

- A. Incorrect – DNA replication creates DNA, uracil is used only in RNA
- B. Incorrect – Nitrogen bases are linked with hydrogen bonds created by enzymes, but this is not what preserves genetic information.
- C. Incorrect – the genetic information in DNA is stored in the order of the base pairs, not in the sugar or phosphate.
- D. Correct – The template strand provides the enzymes with the correct nucleotide order. The order of the nucleotides is how the genetic information is store.



In a flowering plant species, red flower color is dominant over white flower color. What is the genotypes of any red-flowering plant resulting from this species?

- A. Red and white alleles present on one chromosome
- B. Red and white alleles present on two chromosomes
- C. A red allele present on both homologous chromosomes
- D. A red allele present on at least one of two homologous chromosomes.

Answer - D

- A. Incorrect – only one allele for each trait is present on each chromosome.
- B. Incorrect – since white alleles are recessive, their presence is irrelevant. An organisms would be red if it had one red and one white allele, or two red and no white alleles.
- C. Incorrect – only one red allele is needed since red is dominant.
- D. Correct – Since red is dominant, only one chromosome needs a red allele in order for the plant to have red flowers.



BIO.B.2.1 – Compare Mendelian and non-Mendelian patterns of inheritance.

- Describe and/or predict observed patterns of inheritance (i.e. dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).
- Describe processes that can alter composition or number of chromosomes (ie. Crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion)

Use the table below to answer the question.

Blood Types

Genotype(s)	Phenotype
ii	O
$I^A I^A, I^A i$	A
$I^B I^B, I^B i$	B
$I^A I^B$	AB

Blood type is inherited through multiple alleles, including I^A , I^B , and i . A child has type A blood. If the father has type AB blood, what are all the possible phenotypes of the mother?

- A. phenotypes O or A
- B. phenotypes A or AB
- C. phenotypes A, B, AB
- D. phenotypes O, A, B, AB

Answer: D

- A. Incorrect
- B. Incorrect
- C. Incorrect
- D. Correct – all blood types are possible. In all instances, an A or O allele could possibly have been passed to the child and combine with the A allele from the father.



A cattle farmer genetically crosses a cow (female) with a white coat with a bull (male) with a red coat. The resulting calf (offspring) is roan, which means there are red and white hairs intermixed in the coat of the calf. The genes for coat color in cattle are co-dominant.

- A. What cross would produce only roan offspring.
- B. Explain how a roan calf results from one white- and one red-coated parent. IN your explanation, use letters to represent genes. Be sure to indicate what colors the letters represent.
- C. Predict the possible genotypes and phenotypes of the offspring produced from two roan cattle.



A. Answer: White and red

B. A white parent and a red parent would produce all roan offspring. Roan offspring are all heterozygous, containing one red and one white allele. Red cows are homozygous for red alleles- RR. White cows are homozygous for white alleles -WW. Therefore, a red and a white cow would produce all heterozygous (RW), roan offspring.

C. Answer

- Roan cows would produce 25% red cows (RR), 50% roan cows (RW), and 25% white cows (WW)



Use the diagram below to answer the question.

Which type of change in chromosome composition is illustrated in the diagram?

- A. deletion
- B. insertion
- C. inversion
- D. translocation

Answer: D

- A. Incorrect – a deletion involves the removal of a gene or genes from the chromosome.
- B. Incorrect – an insertion involves adding genes to a chromosome
- C. Incorrect – an inversion involves rearranging genes on one chromosome
- D. Correct – this image shows two different sized chromosomes, indicating non-homologous chromosomes. A portion of one is being switched with a portion of the other. This is the definition of translocation.

A scientist observes that a certain trait is determined by a single allele. An organism inherited one version of the trait from one parent and another version from the other parent. Both versions of the trait are expressed in the phenotype of the offspring. Which pattern of inheritance **best** classifies the observed trait?

- A. dominance
- B. sex-linkage
- C. co-dominance
- D. incomplete dominance

Answer - C

- A. Incorrect - The pattern of inheritance does not reflect that one allele is dominant and the other is recessive since both traits are expressed in the individual.
- B. Incorrect - The information given does not provide enough evidence for a sex-linkage pattern of inheritance.
- C. Correct - The pattern of inheritance is best described as co-dominance because both traits are fully expressed in the phenotype of the individual.
- D. Incorrect - Since both versions of the trait are expressed without a modification of the phenotype expressed, the pattern of inheritance is not incomplete dominance.



BIO.B.2.2 – Explain the process of protein synthesis (i.e. transcription, translation, and protein modification).

- Describe how the processes of transcription and translation are similar in all organisms.
- Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.



Which statement describes a cell process that is common to both eukaryotic and prokaryotic cells?

- A. Both cell types carry out transcription in the nucleus.
- B. Both cell types use ribosomes to carry out translation.
- C. Both cell types assemble amino acids to carry out transcription.
- D. Both cell types carry out translation in the endoplasmic reticulum.

Answer - B

- A. Incorrect – prokaryotes lack a nucleus
- B. Correct – both prokaryotes and eukaryotes carry out translation on ribosomes.
- C. Incorrect – transcription does not involve amino acids
- D. Incorrect – prokaryotes lack endoplasmic reticulum.



The endoplasmic reticulum is a network of membranes within the cell, and it is often classified as rough or smooth, depending on whether there are ribosomes on its surface. Which statement **best** describes the role of rough endoplasmic reticulum in the cell?

- A. It stores all proteins for later use.
- B. It provides an attachment site for larger organelles.
- C. It aids in the production of membrane and secretory proteins.
- D. It stores amino acids required for the production of all proteins.

Answer - C

- A. Incorrect – the endoplasmic reticulum is not a storage organelle.
- B. Incorrect – ribosomes, which are small organelles, attach to rough ER
- C. Correct – ribosomes are housed on the rough ER. This is where translation occurs.
- D. Incorrect – ER is not a storage organelle

The bacterium *Acetobacter aceti* is found in acidic environments and has an acidic cytoplasm. For this reason, most of its proteins are able to function in acidic conditions. This property distinguishes *Acetobacter aceti* proteins from those of most other organisms. Which characteristic does *Acetobacter aceti* **most likely** share with other organisms?

- A. the method that the organism uses to reproduce itself
- B. the physical and chemical responses to environmental changes
- C. the type of organelle used to produce energy for cellular functions
- D. the process used to form proteins by transcription and translation

Answer - D

- A. Incorrect - Bacteria are prokaryotes and reproduce by binary fission; most organisms that are eukaryotes reproduce by mitosis and meiosis.
- B. Incorrect - Bacteria are prokaryotes, lacking membrane-bound organelles, which respond to changes in their environment differently than eukaryotic cells.
- C. Incorrect - Bacteria are prokaryotes and do not have membrane-bound organelles, such as mitochondria that produce energy for eukaryotic cells.
- D. Correct - Prokaryotes and eukaryotes both



BIO.B.2.3 Explain how genetic information is expressed.

- Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g. silent, nonsense, frameshift)



A genetic mutation resulted in a change in the sequence of amino acids of a protein, but the function of the protein was not changed. Which statement **best** describes the genetic mutation?

- A. It was a silent mutation that caused a change in the DNA of the organism.
- B. It was a silent mutation that caused a change in the phenotype of the organism.
- C. It was a nonsense mutation that caused a change in the DNA of the organism.
- D. It was a nonsense mutation that caused a change in the phenotype of the organism.

Answer - A

- A. Correct – silent mutations change the genetic code of the DNA, but do not result in changes to the protein function. Therefore, the phenotype of the organism is not affected.
- B. Incorrect – a silent mutation by definition does not change phenotype
- C/D. Incorrect – a nonsense mutation totally destroys protein function



A mutation occurs at the midpoint of a gene, altering all amino acids encoded after the point of mutation. Which mutation could have produced this change?

- A. deletion of two nucleotides
- B. deletion of three nucleotides
- C. insertion of six nucleotides
- D. insertion of twelve nucleotides

Answer - A

A. Correct - A deletion of two nucleotides will most likely cause a shift in the codon sequence that codes for an amino acid. This could cause a change in the sequence of amino acids attached after the point of the mutation.

B. Incorrect - A deletion of three nucleotides will cause a deletion of the original amino acid in the protein but will not cause a change in the rest of the amino-acid sequence.

C. Incorrect - An insertion of six nucleotides will add two additional amino acids to the protein but will not cause a change in the rest of the amino-acid sequence.

D. Incorrect - An insertion of twelve nucleotides will add four additional amino acids to the protein but will not cause a change in the rest of the amino-acid sequence.



BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics.

- Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g. selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy)



Genetic engineering has led to genetically modified plants that resist insect pests and bacterial and fungal infections. Which outcome would **most likely** be a reason why some scientists recommend caution in planting genetically modified plants?

- A. unplanned ecosystem interactions
- B. reduced pesticide and herbicide use
- C. improved agricultural yield and profit
- D. increased genetic variation and diversity

Answer - A

- A. Correct – genetically modified plants may spread their genes to wild plants during pollination, which cannot be controlled in the outdoor environment. This may result in genes for resistance being spread into ecosystems, causing unintended results.
- B. Incorrect – this type of genetic engineering reduces the use of pesticides and herbicides, but this is a positive effect.
- C. Incorrect – increasing resistance to pests would increase yields, but this is a reason to plant these plants.
- D. Incorrect – increased genetic diversity increases survival of a species and is a positive effect.



BIO.B.3.1 – Explain the mechanisms of evolution.

- Explain how natural selection can impact allele frequencies of a population.
- Describe factors that can contribute to the development of new species (e.g. isolating mechanisms, genetic drift, founder effect, migration).
- Explain how genetic mutations may result in genotypic and phenotypic variations within a population.



In North America, the eastern spotted skunk mates in late winter, and the western spotted skunk mates in late summer. Even though their geographic ranges overlap, the species do not mate with each other. What most likely prevents these two species from interbreeding?

- A. Habitat isolation
- B. Gametic isolation
- C. Geographic isolation
- D. Reproductive isolation

Answer – D

- A. Incorrect – these skunks share a geographic range and likely share habitat. Habitat isolation involves species which share a range but not the same habitat
- B. Incorrect – gametic isolation generally refers to species which send out gametes indiscriminately, such as pollen of trees
- C. Incorrect – geographic isolation involves two species whose ranges do not overlap
- D. Correct – all of these choices are reproductive isolation. These skunk species mate at different times, which is an example of temporal isolation. This is the best answer as temporal isolation is a type of reproductive isolation.



A mutation occurs in the genes that code for coat color in deer. Which change will most likely result from this mutation?

- A. A change in the selection pressures acting on coat color.
- B. A change in the coat-color genes of deer predator species
- C. An increase in coat-color diversity in the population
- D. An increase in the number of genes for coat color in the population.

Answer - C

- A. Incorrect – an additional coat color gene would not change selection pressures.
- B. Incorrect – a change in deer coat color will have no effect on the coat color of predator species
- C. Correct – an additional gene for coat color will definitely change the coat color diversity
- D. Incorrect – a mutation will increase the number of alleles for the gene, but will not create an entirely new gene

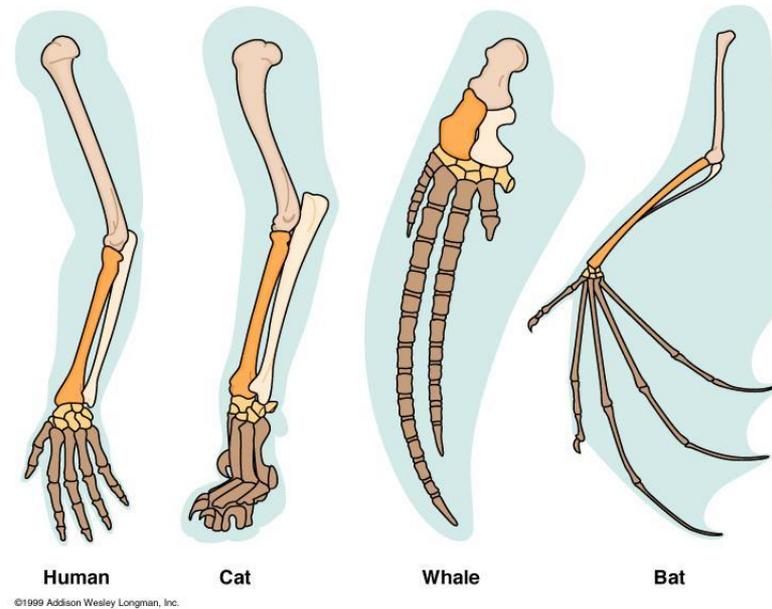


BIO.B.3.2 Analyze the sources of evidence for biological evolution.

A) Interpret evidence supporting the theory of evolution (i.e. fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).

The skeletons of mammalian forelimbs represent variations of a structure that was present in their common ancestor. What has most likely caused the variation in forelimbs?

- A. Changes in muscle structure
- B. Changes in the genetic code
- C. Trait formation due to behaviors
- D. Development of vestigial structures



Answer - C

- A. Incorrect – changes in muscle structure would not cause the variation in forelimbs. It is more likely bone structure changes would occur first.
- B. Correct – changes in the genetic codes would be needed to make a change in phenotype.
- C. Incorrect- the only traits that can be inherited are those that an organism is born with, therefore changes due to behaviors would not result in skeletal changes. For example, if you dye your hair green, you will not give birth to green-haired children.
- D. Incorrect – vestigial structures are those that are present, but no longer used, in organisms. All of these organisms use their forelimbs.

The gene COII is in the genome of many organisms. A comparison of the number of base differences between the COII gene in a rat and that of two other animals is shown.

Animal	Number of base differences from a rat
Mouse	101
Cow	136

Part A: Based on the data, describe a possible evolutionary relationship between rats, mice, and cows.

Part B: Describe how different organisms having a common gene such as COII supports the theory of evolution.

Part C: The COII gene of a monkey has 203 base differences from the same gene in a rat and 201 base differences from the same gene in a mouse. Compare the evolutionary relationships between the monkey, the rat, and the mouse.



Answers

Part A: Mice and rats are more closely related than rats and cows. This can be seen from the smaller number of differences in the COL1 protein.

Part B: Different organisms would not have the same gene by chance. If two organisms share a gene, it is likely that they shared a common ancestor who passed the gene on to each species.

Part C

- A rat and a mouse are more closely related to each other than to a monkey. They have only 101 base difference for the COII protein.
- The mouse is more closely related to the cow than the rat, with a difference of 201 bases rather than 203.



The frequency of an allele in a fly population changes from 89% to 20% after three generations. Which other events **most likely** occurred during the same time period?

- A. an environmental change and a fly population increase
- B. an environmental change and a fly population decrease
- C. interbreeding of flies with an invasive species and fly population speciation
- D. interbreeding of flies with an established local species and fly population speciation

Answer - B

A. Incorrect - An environmental change that did not favor the individuals in the population with the allele most likely led to the change in allele frequency; however, since the allele frequency decreased by so much, there would had to have been a decrease in the population within a three-generation period of time.

B. Correct - An environmental change that did not favor the individuals in the population with the allele most likely led to the change in allele frequency; since the allele frequency decreased by so much, there would had to have been a decrease in the population within a three-generation period of time.

C. Incorrect -Interbreeding between species is not likely to occur and can produce off spring that are not able to reproduce. Speciation would most likely need more than three generations to occur.

D. Incorrect - Interbreeding between species is not likely to occur and can produce off spring that are not able to reproduce. Speciation would most likely need more than three generations



BIO.B.3.3 Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution.

A. Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.

A group of students measured a ten-square-meter section of a pond ecosystem and recorded observations. Which statement is a testable hypothesis?

Quantitative	Qualitative
37 fish and 3 frogs	Leaves lie on the bottom of the pond
2 types of aquatic grass	Water insects move along the water's surface
12 small rocks and 1 medium rock sand	All 3 frogs are sitting on a pond bank

- A. The frogs living in the pond represent a population.
- B. Water is an abiotic component in the pond ecosystem
- C. If the fish are given more food, then they will be happier.
- D. If the frogs are startled, then they will jump into the water.

Answer: D

- A. Incorrect – this is not a testable hypothesis, it is simply a fact that the frogs living in that pond are defined as a population.
- B. Incorrect – also not a testable hypothesis
- C. Incorrect – it is not possible to judge the happiness of fish
- D. Correct – it is possible to set up an experiment to see the response of frogs to sudden stimuli



BIO.B.4.1- Describe ecological levels of organization in the biosphere.

- A. Describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, and biosphere).
- B. Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.



A student wrote several observations in a field notebook. Which term best classifies all of the student's observations?

Observations: 2 grey wolves, 5 moose, several species of conifer trees, large granite rock, shallow pond

- A. Population
- B. Food chain
- C. Ecosystem
- D. Community

Answer: C

- A. Incorrect – a population is a group of organisms belonging to the same species living in the same time and place.
- B. Incorrect – a food chain contains only organisms, not abiotic factors
- C. Correct – an ecosystem contains both the biotic and abiotic factors in an area
- D. Incorrect – a community is all the living species in a particular area at a particular time



A researcher observing an ecosystem describes the amount of sunlight, precipitation, and type of soil present. Which factor is the researcher most likely describing?

- A. biotic factors in a forest
- B. Biotic factors in a tundra
- C. Abiotic factors in a prairie
- D. Abiotic factors in an ocean

Answer - C

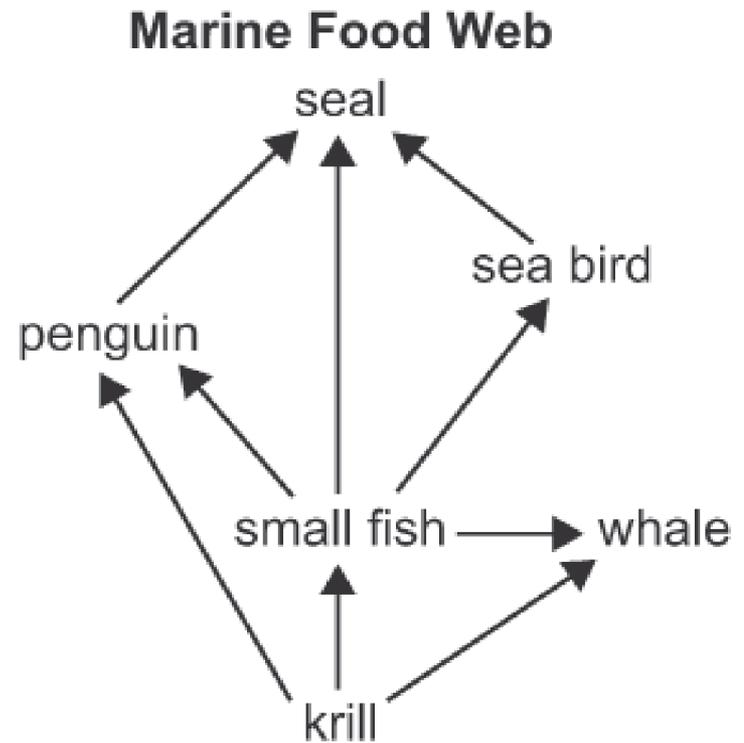
A or B. Incorrect – the factors described are abiotic, not biotic

C. Correct – the abiotic factors listed include soil, making this the only likely option.

D. Incorrect – the abiotic factors listed include soil, which is not likely to be described in an ocean environment.

Which sequence correctly describes the flow of energy between organisms in the marine food web?

- A. From seals to penguins to krill
- B. From whales to krill to small fish
- C. From sea birds to seals to penguins
- D. From small fish to penguins to seals



Answer - D

A. Incorrect – the arrows in the food web show the flow of energy. Energy flows from krill to penguins to seals

B. Incorrect – again, this is the reverse of the energy flow shown in the diagram

C. Incorrect – the arrows show that seals eat penguins, penguins do not eat seals

D. Correct – the arrows show that energy does flow from fish to penguins to seals.



A species of snapping turtles has a tongue that resembles a worm. The tongue is used to attract small fish. Which best describes the interaction between the fish and the snapping turtle?

- A. Predation
- B. Symbiosis
- C. Parasitism
- D. competition

Answer - A

- A. Correct – the snapping turtle is a predator which eats fish.
- B. Incorrect – predation is not a type of symbiosis. Symbiosis indicates a long-term relationship between two organisms
- C. Incorrect – parasitism involves one species living off of another and harming it, not just eating it whole
- D. Incorrect – competition involves two species requiring the same resource. In this instance, the snapping turtle and the fish are not after the same resource



BIO.B.4.2 – Describe interactions and relationships in an ecosystem

- A. Describe how matter recycles through an ecosystem (i.e. water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).
- B. Describe how ecosystems change in response to natural and human disturbances (e.g. climate changes, introduction of nonnative species, pollution, fires).
- C. Describe the effects of limiting factors on population dynamics and potential species extinction.
- D. Describe the effects of limiting factors on population dynamics and potential species extinction.



Which statement correctly describes how nitrogen in the soil returns to the atmosphere?

- A. Soil bacteria convert nitrates into nitrogen gas.
- B. Decomposers directly convert ammonium into nitrogen gas.
- C. Plants assimilate nitrites and convert them into nitrogen gas.
- D. Nitrogen-fixing bacteria in plant roots convert nitrates into nitrogen gas.

Answer - A

- A. Correct - Soil bacteria convert nitrates into nitrogen gas in a process known as denitrification.
- B. Incorrect – decomposers make nitrogen available to producers, but do not convert it into gas.
- C. Incorrect – plants only release nitrogen when they are decomposed
- D. Incorrect – nitrogen fixation removes nitrogen from the atmosphere.



Agricultural runoff can carry fertilizers into lakes and streams. This runoff can cause algae populations to greatly increase. Which effect does this change in the algae population sizes most likely have on affected lakes and streams?

- A. An increase in water level
- B. An increase in water clarity
- C. A reduction in dissolved oxygen needed by fish and shellfish
- D. A reduction in temperature variations near the water's surface

Answer - C

- A. Incorrect – an algal bloom will have no effect on water level
- B. Incorrect – an algal bloom will decrease clarity
- C. Correct – algal blooms lead to eutrophication, a process in which algae die and decompose. This leads to the removal of large quantities of oxygen to the water. Eventually, even decomposition stops and the body of water is filled with half-decomposed algae
- D. Incorrect – this would have no effect on temperature.



A farmer observed that an increase in a field's soil nitrogen content was followed by an increase in producer productivity. What does this observation most likely indicate about the relationship between nitrogen and the producers in the field?

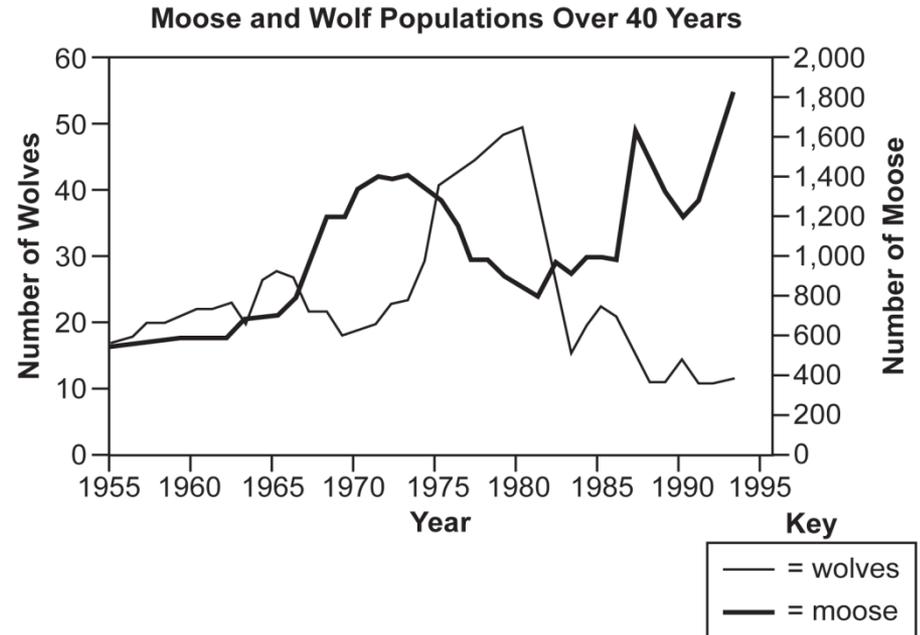
- A. Nitrogen was a biotic factor
- B. Nitrogen was a limiting factor
- C. Nitrogen became a surplus resource
- D. Nitrogen became a selection pressure

Answer - B

- A. Incorrect – nitrogen is an abiotic factor
- B. Correct – a limiting factor is something required for an ecosystem to maintain growth. When it is absent, growth stops. In this instance, the primary productivity increased with the application of nitrogen, indicating that it was the factor preventing growth in the ecosystem.
- C. Incorrect – nitrogen would not have caused an increase in productivity if it was a surplus resource.
- D. Incorrect – there is nothing being selected on in this example. Selection pressure indicates evolution, which has nothing to do with this example.

Isle Royale is located in Lake Superior. Isle Royale is home to populations of wolves and moose. The interactions between the wolves and moose, as well as the individual population sizes, have been studied since 1958. The graph shows the population sizes over time for both wolves and moose.

- A. Describe one limiting factor for the moose population.
- B. Explain one likely reason why the wolf population rapidly increased between 1975 and 1980.
- C. Predict what will happen to the moose population's size after 1994 by describing the shape of the curve. In your answer, be sure to



Answer

- A. Predation by wolves is one limiting factor. Wolves eat the moose. Other factors could include food availability, competition, disease, etc.
- B. Immediately previous to this time, the moose population dramatically increased. The moose are food for the wolves, therefore their population also rose.
- C. The moose population will continue to increase until the wolf population increases or the moose run out of food. This is predicted as the wolf population increased, causing a drop in moose population, after the last moose population increase. The moose are currently increasing again. If the wolf population does not rebound, the moose will eventually reach carrying capacity and their population levels will even out.

Scientists observed that the populations of top-level consumers in a particular ecosystem were rapidly decreasing. Further studies revealed that there was also a decline in producer productivity. Which other changes did the scientists **most likely** observe in the ecosystem?

- A. increased producer diversity
- B. decreased population size at all levels
- C. decreased primary consumer populations only
- D. increased primary and secondary consumer diversity

Answer - B

- A. Incorrect - A decline in producer productivity would most likely result in a decrease in producer diversity.
- B. Correct - A decline in the producers of an ecosystem will cause a decrease in all other organisms because
 - the producers are responsible for converting sunlight or chemical energy into usable energy for
 - consumers.
- C. Incorrect - Primary consumer populations will decrease, but secondary consumer populations will also decrease.
- D. Incorrect - A decline in producer productivity would most likely lead to a decrease in diversity in primary and
 - secondary consumers.