MARCO LEARNING®

AP Biology Insta-Review

Last Minute Cram Session

Tiffany Jones

@apbiopenguins

AP Biology students are penguins because they are Dressed for Success! You are now an AP Bio Penguin!

Today's Plan:

Special Thank You to Mrs. McClinton (Chat Q&A)

Exam Format

Overview of Units

Practice Questions

Q&A

Exam Format

Time: 90 minutes

- Section I: Multiple Choice
- 60 Questions
- 50% of Exam Weighting

Time: 90 minutes

- Section II: Free Response
- 6 Questions (2 Long, 4 Short)
- 50% of Exam Weighting

Based on the 2020 Practice Exam Scoring Guidelines

You need approximately 54 of the available 120 points for a 3 on the exam

Topic Breakdown

Units	Exam Weighting	#Qs
Unit 1: Chemistry of Life	8 – 11 % (5 – 7)	5.7
Unit 2: Cell Structure and Function	10 – 13% (6 – 8)	6.7
Unit 3: Cellular Energetics	12 – 18% (7 – 10)	9.3
Unit 4: Cell Communication and Cell Cycle	10 – 15% (6 – 9)	6.7

Topic Breakdown

Units	Exam Weighting	#Qs
Unit 5: Heredity	8 – 11% (5 – 7)	6
Unit 6: Gene Expression and Regulation	12 – 16% (7 – 10)	8
Unit 7: Natural Selection	13 – 20% (8 – 12)	9.3
Unit 8 Ecology	10 – 15% (6 – 9)	8.3

Multiple Choice Questions

Types of Questions

- Independent Questions
- Set Questions

Based on the 2020 Practice Exam

31 – 38 Independent Questions
22 – 29 Set Questions

Multiple Choice Questions

Types of Questions

- Independent Questions
- Set Questions

Insulin is a protein hormone that is secreted in response to elevated blood glucose levels. When insulin binds to its receptors on liver cells, the activated receptors stimulate phosphorylation cascades that cause the translocation of glucose transporters to the plasma membrane.

Based on the information provided, which of the following best describes the role of insulin in this liver cell signal transduction pathway?

(A) It acts as a ligand.

(B) It acts as a receptor.

(C) It acts as a secondary messenger.

(D) It acts as a protein kinase.

40. Plates that have only ampicillin-resistant bacteria growing include which of the following?

(A) I only
(B) III only
(C) IV only
(D) I and II

41. Which of the following best explains why there is no growth on plate II?

(A) The initial *E. coli* culture was not ampicillin-resistant.
(B) The transformation procedure killed the bacteria.
(C) Nutrient agar inhibits *E. coli* growth.
(D) The bacteria on the plate were transformed.

42. Plates I and III were included in the experimental design in order to

(A) demonstrate that the *E. coli* cultures were viable
(B) demonstrate that the plasmid can lose its amp^r gene
(C) demonstrate that the plasmid is needed for *E. coli* growth
(D) prepare the *E. coli* for transformation

43. Which of the following statements best explains why there are fewer colonies on plate IV than on plate III?

(A) Plate IV is the positive control.
(B) Not all *E. coli* cells are successfully transformed.
(C) The bacteria on plate III did not mutate.
(D) The plasmid inhibits *E. coli* growth.

44. In a second experiment, the plasmid contained the gene for human insulin as well as the amp^r gene. Which of the following plates would have the highest percentage of bacteria that are expected to produce insulin?

(A) I only
(B) III only
(C) IV only
(D) I and III

Strategies for Questions

Annotate your Questions

- Underline important words as you read the question
- Make quick reference notes from prompts and figures
- Write on the graphs and show your work

Trust yourself

- Cover up the answer choices and develop your own answer then check if its an option

Use your resources

- Use the figures or diagrams to help you answer the questions

Free Response Questions

Long FRQs (8 – 10 points)

- Q1: Interpreting and Evaluating Experimental Results
- Q2: Interpreting and Evaluating Experimental Results with Graphing

Short FRQs (4 points)

- Q3: Scientific Investigation
- Q4: Conceptual Analysis
- Q5: Analyze Model or Visual Representation
- Q6: Analyze Data

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Task Verbs

AP Biology CED pg. 206

Calculate: Perform mathematical steps to arrive at a final answer, including algebraic expressions, properly substituted numbers, and correct labeling of units and significant figures.

Construct/Draw: Create a diagram, graph, representation, or model that illustrates or explains relationships or phenomena. Labels may or may not be required.

Describe: Provide relevant characteristics of a specified topic.

Determine: Decide or conclude after reasoning, observation, or applying mathematical routines (calculations).

Evaluate: Judge or determine the significance or importance of information, or the quality or accuracy of a claim.

Explain: Provide information about how or why a relationship, process, pattern, position, situation, or outcome occurs, using evidence and/or reasoning to support or qualfiy a claim. Explain "how" typically requires analyzing the relationship, process, pattern, position, situation, or outcome; whereas explain "why" typically requires analysis of motivations or reasons for the relationship, process, pattern, position, situation, or outcome.

Identify: Indicate or provide information about a specified topic, without elaboration or explanation.

Justify: Provide evidence to support, qualify, or defend a claim, and/or provide reasoning to explain how that evidence supports or qualifies the claim.

Make a claim: Make an assertion that is based on evidence or knowledge.

Predict/Make a prediction: Predict the causes or effects of a change in, or disruption to, one or more components in a relationship, pattern, process, or system.

Represent: Use appropriate graphs, symbols, words, illustrations, and/or tables of numerical values to describe biological concepts, characteristics, and/or relationships.

State (the null/alternative hypothesis): Indicate or provide a hypothesis to support or defend a claim about a scientifically testable question.

Support a claim: Provide reasoning to explain how evidence supports or qualifies a claim.

Strategies for Questions

FRQ Writing

- Read the question, Read the question, Read the …
- Label your responses (a), (b), (c) & (d)
- Write in knowledge order
- Beware of contradictions
- Use the diagrams
- Define your terms

Helpful Resources for Content...

- **AP Biology Penguins Website:** 316 pg Review Guide, Quizizz Game Codes, Review PPTs, ...so much more
- **Social Media Accounts** (apbiopenguins) Instagram, YouTube, Twitter, TikTok
- **Podcast:** The APsolute RecAP
- **YouTube:** Bozeman Biology, Crash Course, Amoeba Sisters
- **Review Book to READ:** Barron's (7th Edition)

Practice… Practice… Practice

Multiple Choice

- AP Classroom
- 2013 Released AP Exam

Free Response

- AP Central → AP Biology → The Exam
- 1999 – 2019, 2021 Released FRQs
    - Questions
    - Scoring Guidelines
    - Student Responses
- AP Classroom

Unit 1: Chemistry of Life

Water Properties & Biochemistry

- Hydrogen Bonds
- Proteins
- Lipids
- Nucleic Acids
- Carbohydrates

This is the foundational knowledge that we will build upon for all of AP Biology.

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Multiple Choice Practice

Scientists examined the folded structure of a purified protein resuspended in water and found that amino acids with nonpolar R groups were primarily buried in the middle of the protein, whereas amino acids with polar R groups were primarily on the surface of the protein. Which of the following best explains the location of the amino acids in the folded protein?

a. Polar R groups on the surface of the protein can form ionic bonds with the charged ends of the water molecules.

b. Polar R groups are too bulky to fit in the middle of the protein and are pushed toward the protein's surface.

c. Nonpolar R groups that cannot form hydrogen bonds with water are pushed into the middle of the protein.

d. Nonpolar R groups from different parts of the protein form covalent bonds with each other to maintain the protein's structure.

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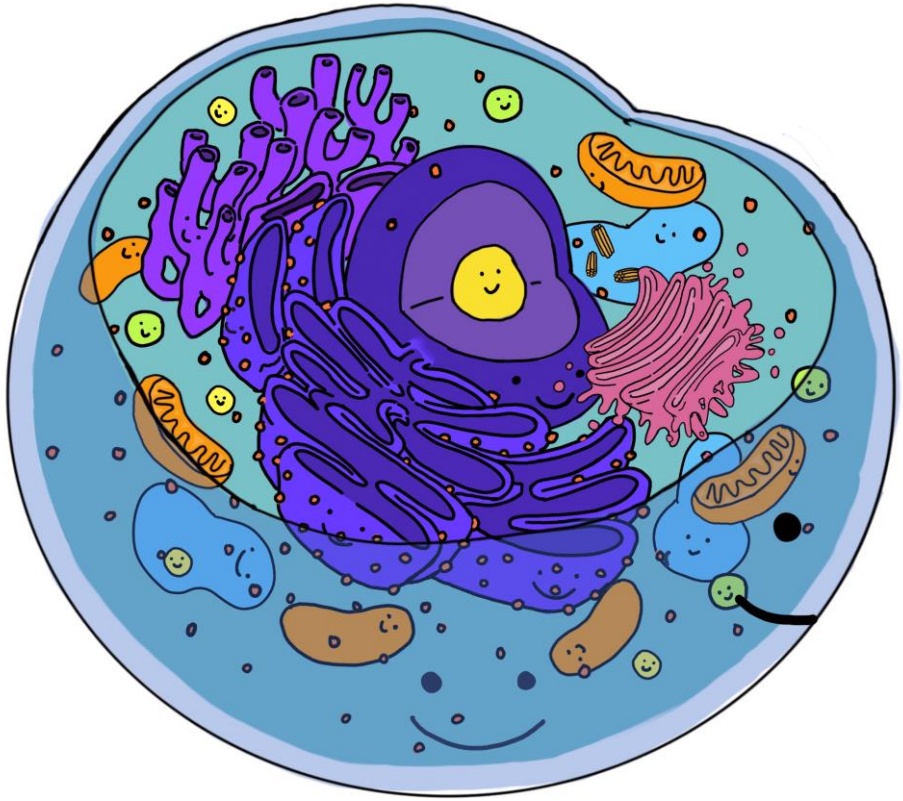
Unit Overview

Unit 2: Cell Structure & Function

Topics: Organelles & Membrane Transport



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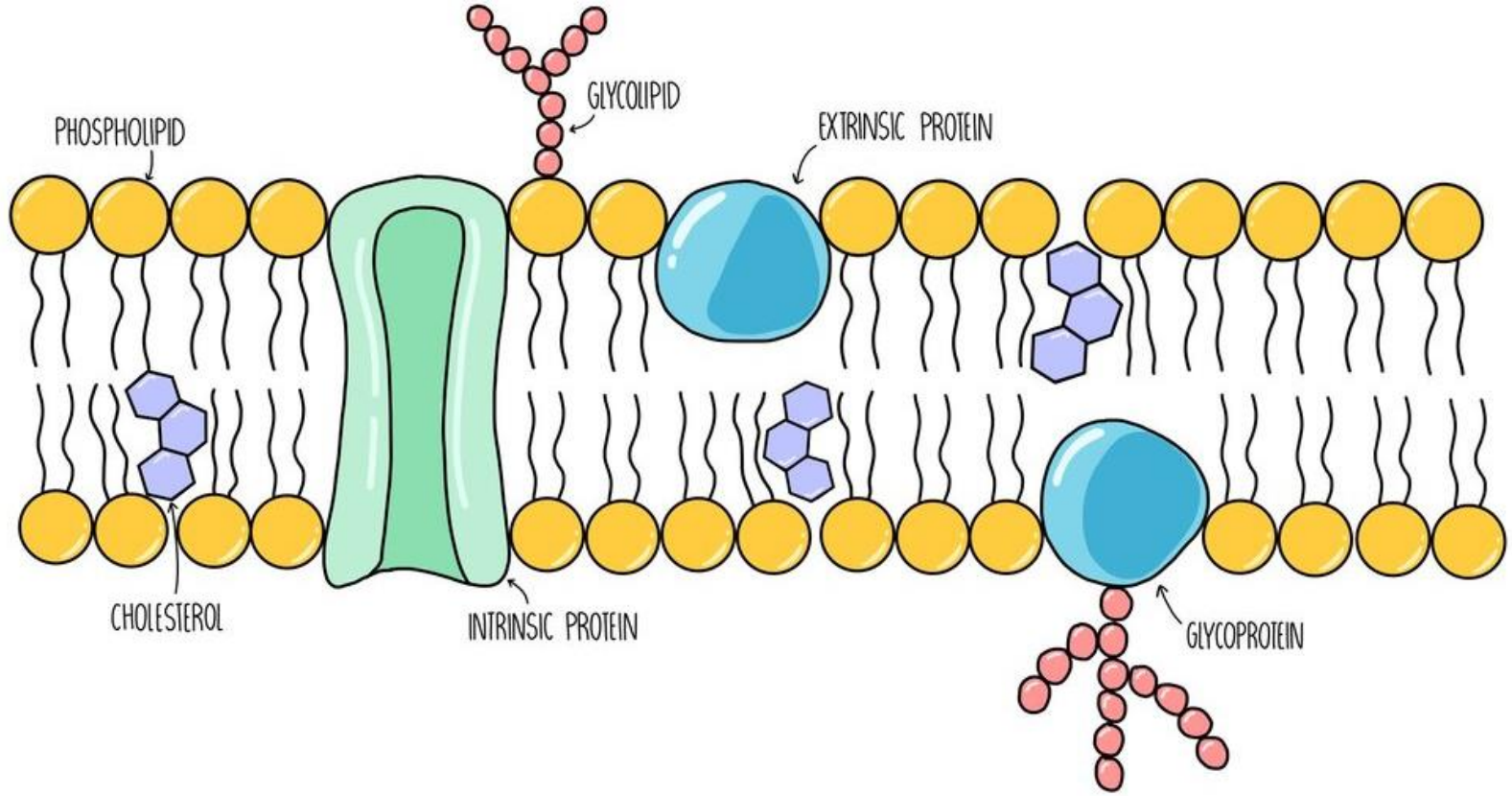
Unit Overview

Unit 2: Cell Structure & Function

Organelles & Membrane Transport



Multiple Choice Practice

If ATP breakdown (hydrolysis) is inhibited, which of the following types of movement across cell membranes is also inhibited?

a. Movement of oxygen into a cell — Passive/Simple

b. Movement of water through aquaporins — Passive/Facilitated

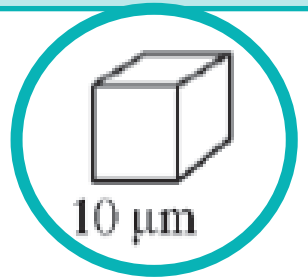
c. Passage of a solute against its concentration gradient — Active Transport

d. Facilitated diffusion of a permeable substance — Passive Transport

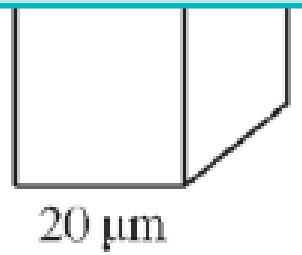
Multiple Choice Practice

Simple cuboidal epithelial cells line the ducts of certain human exocrine glands. Various materials are transported into or out of the cells by diffusion. (The formula for the surface area of a cube is $6 \times S^2$, and the formula for the volume of a cube is S^3, where S = the length of a side of the cube.) Which of the following cube-shaped cells would be most efficient in removing waste by diffusion?

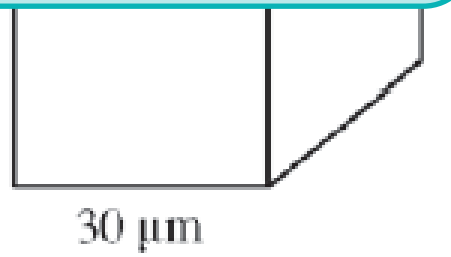
SA: $6(10)^2 = 600$
V: $10^3 = 1000$
SA/V: 0.6



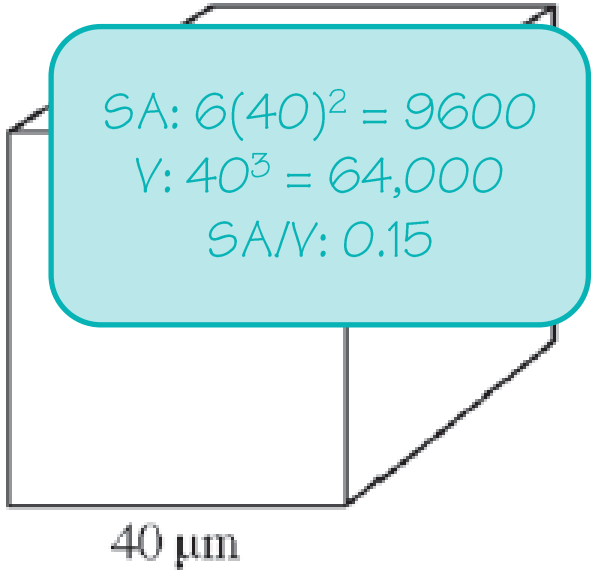
SA: $6(20)^2 = 2400$
V: $20^3 = 8000$
SA/V: 0.3



SA: $6(30)^2 = 5400$
V: $30^3 = 27{,}000$
SA/V: 0.2



SA: $6(40)^2 = 9600$
V: $40^3 = 64{,}000$
SA/V: 0.15



Unit 3: Cellular Energetics

Enzymes & Energy

- Proteins
- Cellular Respiration
- Photosynthesis

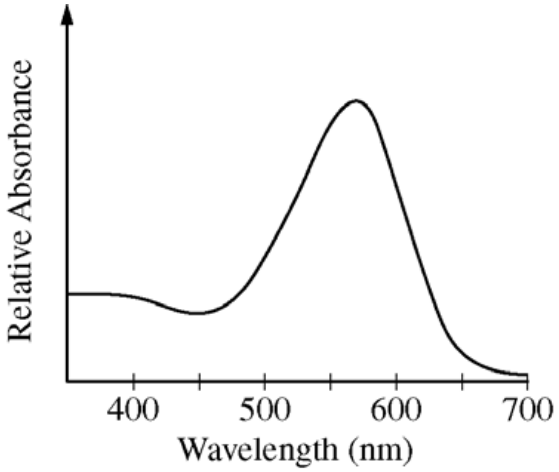
Don't get stuck on the minor details...

What goes in?
What comes out?
Where?
Why is it important?

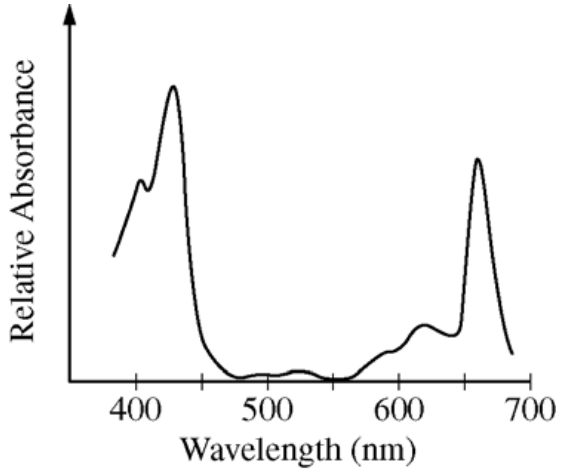
Free Response Practice

An absorption spectrum indicates the relative amount of light absorbed across a range of wavelengths. The graphs above represent the absorption spectra of individual pigments isolated from two different organisms. One of the pigments is chlorophyll a, commonly found in green plants. The other pigment is bacteriorhodopsin, commonly found in purple photosynthetic bacteria. The table above shows the approximate ranges of wavelengths of different colors in the visible light spectrum.

(a) **Identify** the pigment (chlorophyll a or bacteriorhodopsin) used to generate the absorption spectrum in each of the graphs above. **Explain** and **justify** your answer.



Graph I

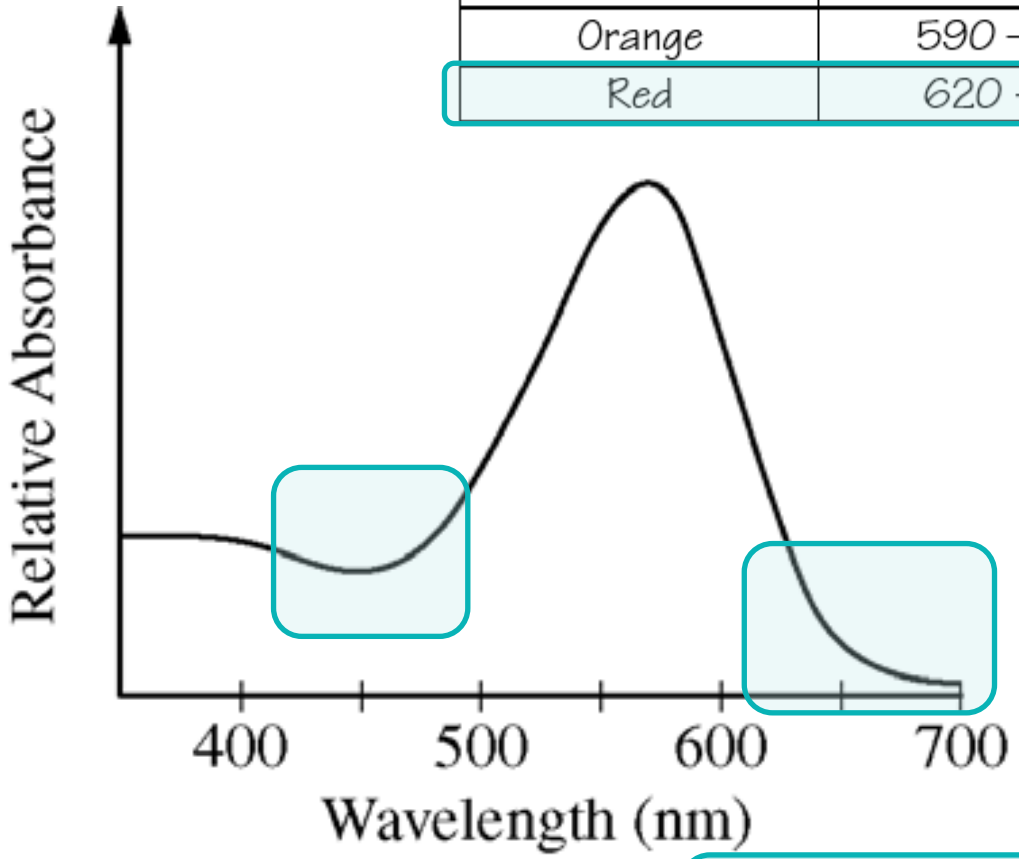


Graph II

Color	Wavelength (nm)
Violet	380 – 450
Blue	450 – 475
Cyan	475 – 495
Green	495 – 570
Yellow	570 – 590
Orange	590 – 620
Red	620 - 750

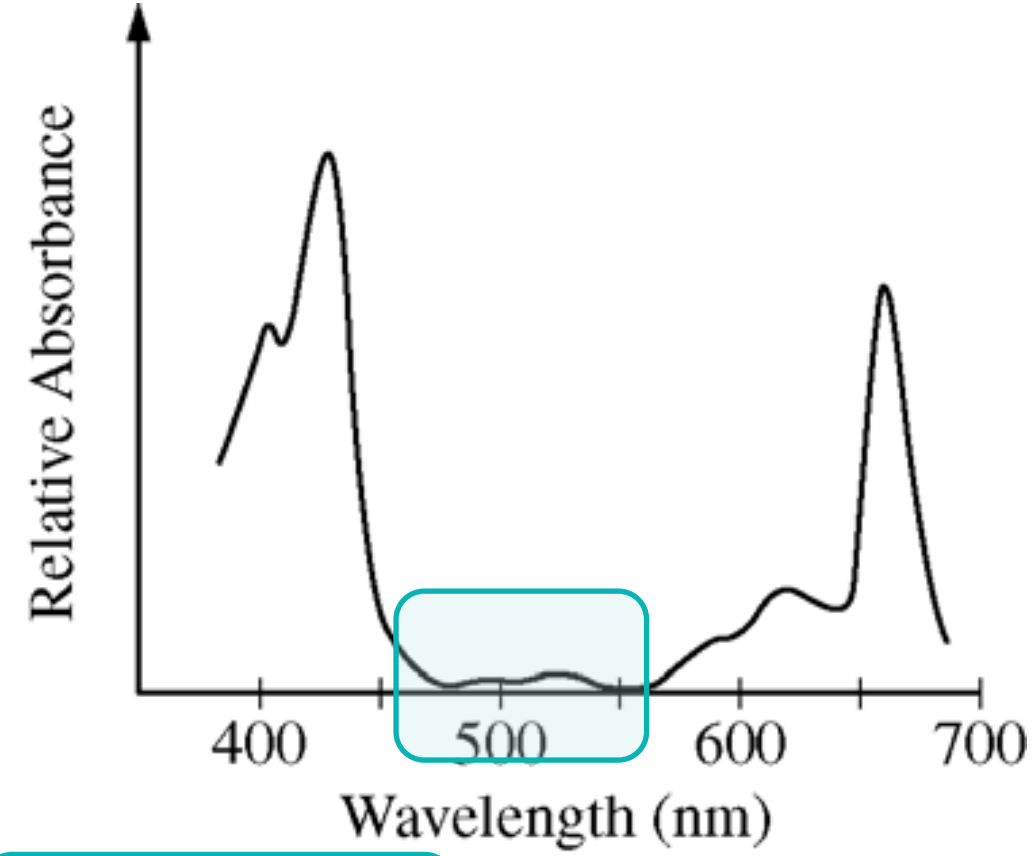
Free R…ractice

Color	Wavelength (nm)
Violet	380 – 450
Blue	450 – 475
Cyan	475 – 495
Green	495 – 570
Yellow	570 – 590
Orange	590 – 620
Red	620 - 750



Graph I

Bacteriorhodopsin (purple)

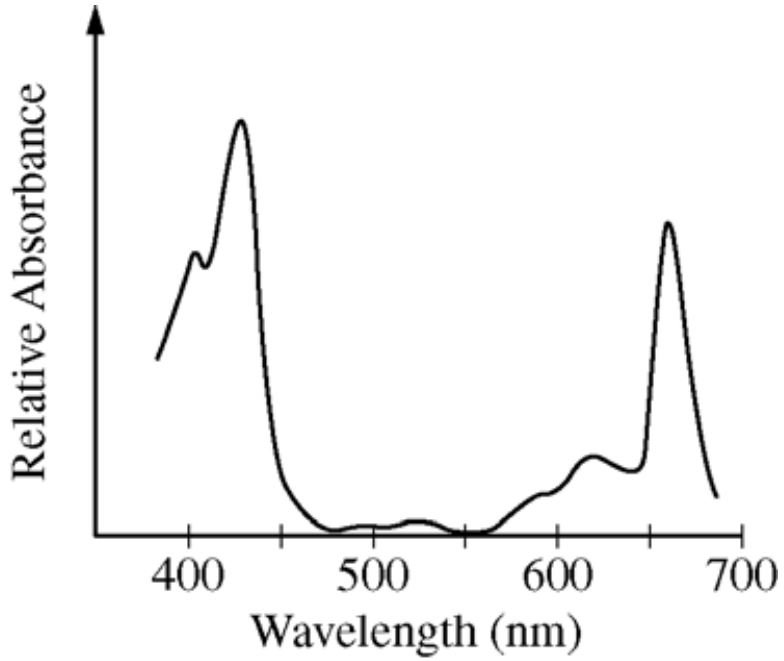


Chlorophyll a (green)

Graph II

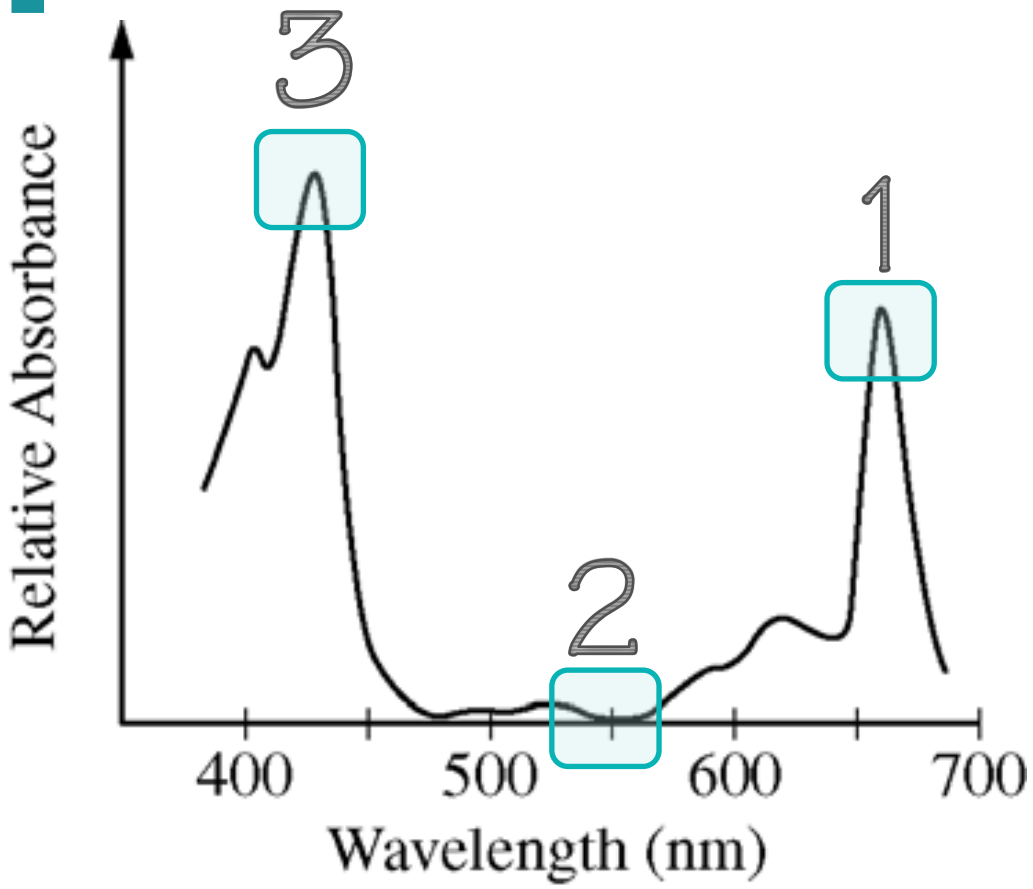
Free Response Practice

(b) In an experiment, identical organisms containing the pigment from Graph II as the predominant light-capturing pigment are separated into three groups. The organisms in each group are illuminated with light of a single wavelength (650 nm for the first group, 550 nm for the second group, and 430 nm for the third group). The three light sources are of equal intensity, and all organisms are illuminated for equal lengths of time. **Predict** the relative rate of photosynthesis in each of the three groups. **Justify** your predictions.



Graph II

Free Response Practice



Graph II

Free Response Practice

Wavelength (Group)	Prediction (**1 point each box**)	Justification (**1 point each box**)
650 nm (1st Group)	Intermediate rate	An intermediate level of absorption occurs at 650 nm (compared to 430 nm and 550 nm); *therefore*, an intermediate amount of energy is available to drive photosynthesis.
550 nm (2nd Group)	Lowest rate	The lowest level of absorption occurs at 550 nm; *therefore*, the least amount of energy is available to drive photosynthesis.
430 nm (3rd Group)	Highest rate	The highest level of absorption occurs at 430 nm; *therefore*, the greatest amount of energy is available to drive photosynthesis.

Unit 4: Cell Comm. & Cell Cycle

Signal Transduction & Mitosis

- Receptor, Transduction, Response
- Checkpoints
- Interphase
- Mitosis
- Cytokinesis

Multiple Choice Practice

Antidiuretic hormone (ADH) is important in maintaining homeostasis in mammals. ADH is released from the hypothalamus in response to high tissue osmolarity. In response to ADH, the collecting duct and distal tubule in the kidney become more permeable to water, which increases water reabsorption into the capillaries. The amount of hormone released is controlled by a negative feedback loop. Based on the model presented, which of the following statements expresses the proper relationship between osmolarity, ADH release, and urine production?

a. As tissue osmolarity rises, more ADH is released, causing less water to be excreted as urine.
b. As tissue osmolarity rises, less ADH is released, causing less water to be excreted as urine.
c. As tissue osmolarity rises, more ADH is released, causing more water to be excreted as urine.
d. As tissue osmolarity rises, less ADH is released, causing more water to be excreted as urine.

High osmolarity → release ADH

ADH → increase water reabsorption

Increase water reabsorption → decrease urine output

Unit 5: Heredity

Meiosis & Genetics

- Meiosis
- Comparison w/ Mitosis
- Mendelian Genetics
- Non-Mendelian Genetics

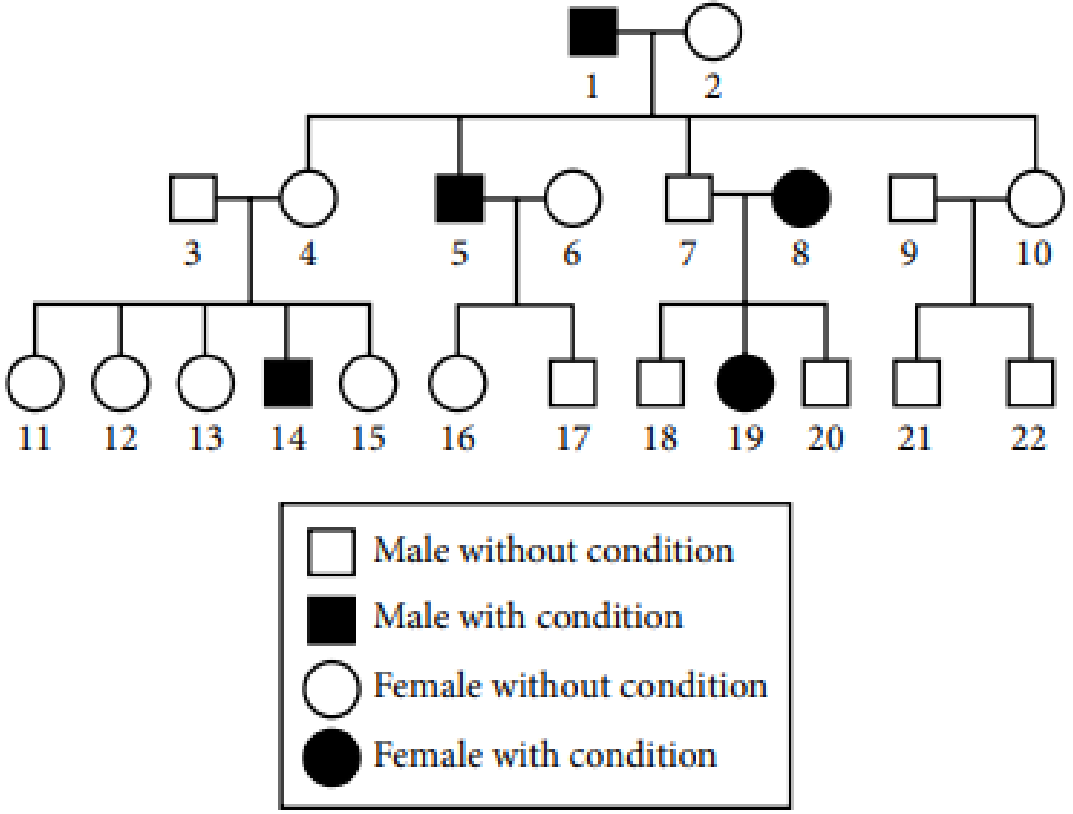
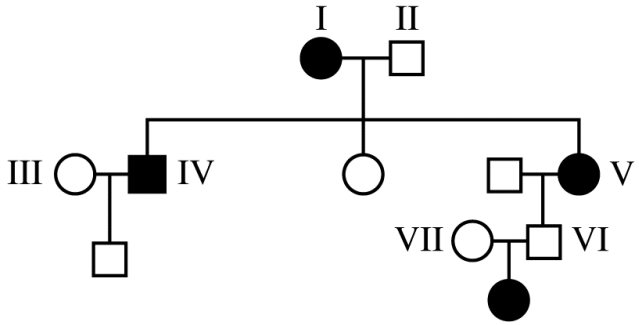


Figure 1. Inheritance of a particular condition over three generations of a family

Multiple Choice Practice

The following figures display data collected while studying a family, some members of which have sickle-cell disease—a rare genetic disorder caused by a mutation in the hemoglobin beta gene (HBB). There are at least two alleles of the HBB gene: the HbA allele encodes wild-type hemoglobin and the HbS allele encodes the sickle-cell form of hemoglobin. Genetic testing provided insight into the inheritance pattern for sickle-cell disease.



Based on the data shown in Figure 1, which of the following best describes the genotypes of individual family members in the pedigree?

a. All affected individuals possess at least one dominant allele of the hemoglobin beta gene.

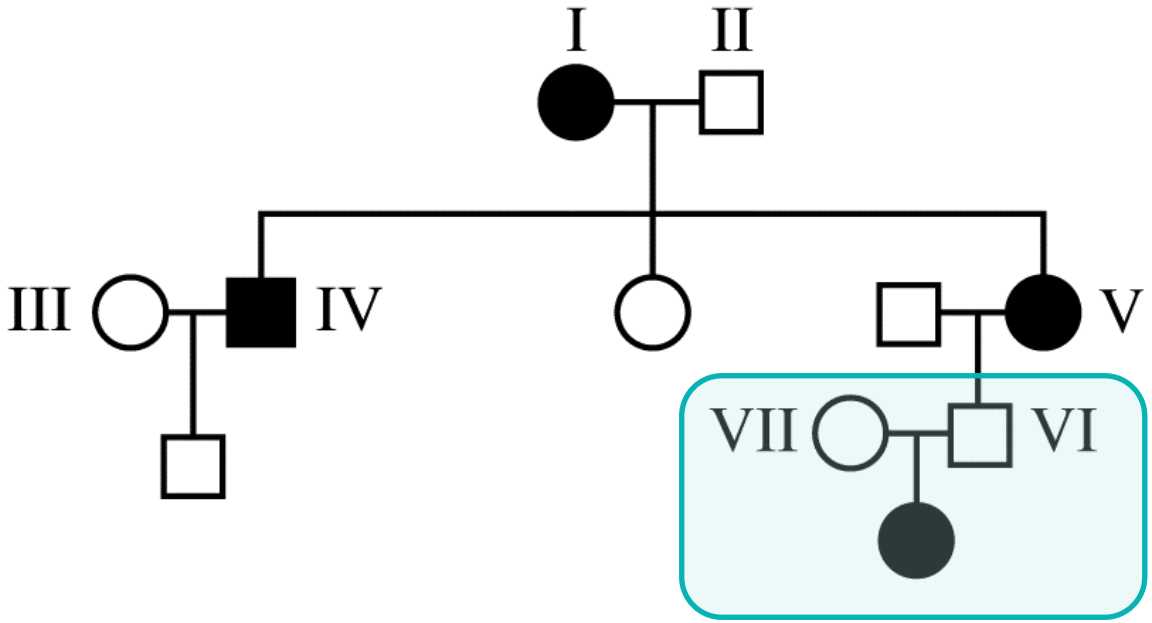
b. Healthy individuals may possess one mutant allele (HbS) of the hemoglobin beta gene.

c. Individuals IV and V must be heterozygous for the HbS (mutant) allele.

d. Individuals II and VI possess two copies of the HbA (wild-type) allele.

Multiple Choice Practice

Recessive



Affected individuals: HbS/HbS

Non-affected individuals: HbS/HbA HbA/HbA

Based on the data shown in Figure 1, which of the following best describes the genotypes of individual family members in the pedigree?

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b. Healthy individuals may possess one mutant allele (HbS) of the hemoglobin beta gene.

c. Individuals IV and V must be heterozygous for the HbS (mutant) allele.

d. Individuals II and VI possess two copies of the HbA (wild-type) allele.

Unit 6: Gene Express & Regulation

Molecular Genetics

- DNA vs. RNA
- Replication
- Transcription
- Translation
- Mutations
- BioTechnology

It's all about that central DOG-ma, right?

Free Response Practice

Gibberellin is the primary plant hormone that promotes stem elongation. GA 3-beta-hydrozylase (*GA3H*) is the enzyme that catalyzes the reaction that converts a precursor of gibberellin to the active form of gibberellin. A mutation in the *GA3H* gene results in a short plant phenotype. When a pure-breeding tall plant is crossed with a pure-breeding short plant, all offspring in the F_1 generation are tall. When the F_1 plants are crossed with each other, 75 percent of the plants in the F_2 generation are tall and 25 percent of the plants are short.

(a) The wild-type allele encodes a GA3H enzyme with alanine (Ala), a nonpolar amino acid, at position 229. The mutant allele encodes a GA3H enzyme with threonine (Thr), a polar amino acid, at position 229. **Describe** the effect of the mutation on the enzyme and **provide reasoning** to support how this mutation results in a short plant phenotype in homozygous recessive plants.

Description (1 point)	**Reasoning (1 point)**
The amino acid substitution changes the shape/structure/function of the protein.	The mutation decreases/eliminates gibberellin production.

Free Response Practice

(b) Using the codon chart provided, **predict** the change in the codon sequence that resulted in the substitution of alanine for threonine at amino acid position 229.

Second Base in Codon

First Base in Codon	U	C	A	G	Third Base in Codon
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA Stop UAG Stop	UGU Cys UGC Cys UGA Stop UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met or Start	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

Figure 1. The universal genetic code

Prediction (1 point maximum)

- G ↔ A in the first position (of the codon)
- 5′-GCN-3′ ↔ 5′-ACN-3′
- 5′-NGC-3′ ↔ 5′-NGT-3′ in the template strand of DNA

Free Response Practice

(c) **Describe** how individuals with one (heterozygous) or two (homozygous) copies of the wild-type *GA3H* allele can have the same phenotype.

Description (1 point)

- Enough active enzyme is produced from one wild-type/dominant allele.
- Enough gibberellin is produced in the presence of one wild-type/dominant allele.

Unit 7: Natural Selection

Evolution

- Selection
- Hardy-Weinberg
- Phylogeny
- Evidence of Evolution

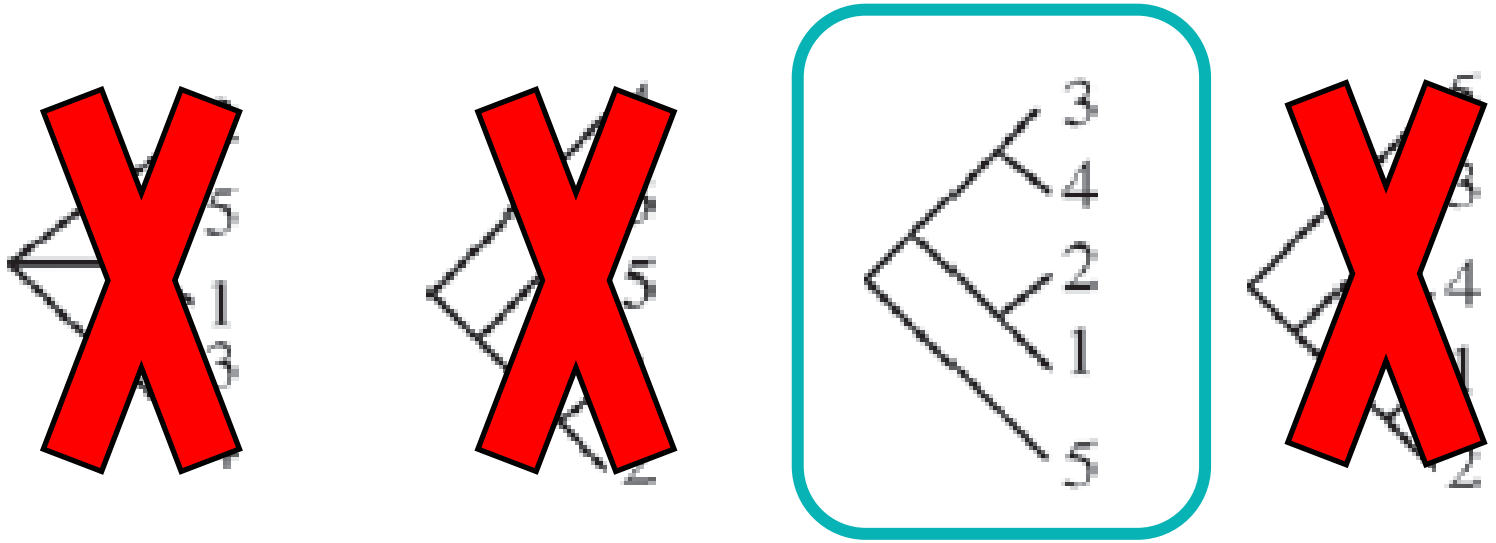
Multiple Choice Practice

Five new species of bacteria were discovered in Antarctic ice core samples. The nucleotide (base) sequences of rRNA subunits were determined for the new species. The table below shows the number of nucleotide differences between the species.

NUCLEOTIDE DIFFERENCES

Species	1	2	3	4	5
1	–	3	19	18	27
2		–	19	18	26
3			–	1	27
4				–	27
5					–

Which of the following phylogenetic trees is most consistent with the data?



Multiple Choice Practice

The data below demonstrate the frequency of tasters and non-tasters of a certain compound in four isolated populations that are in Hardy-Weinberg equilibrium. The allele for non-tasters is recessive. In which population is the frequency of the recessive allele highest?

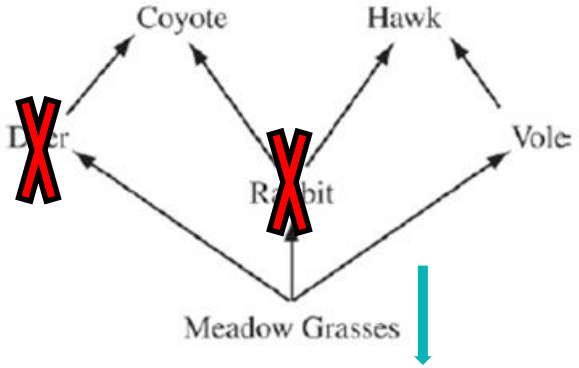
Letter Choice	Populations	Tasters (TT or Tt)	Non-tasters (tt)	Size of Population	
A	1	110	32	142	~1/5
B	2	8,235	4,328	12,563	~1/3
C	3	215	500	715	~5/7
D	4	11,489	2,596	14,085	~1/7

To estimate the recessive allele, take the square root of q^2 (nontaster frequency)

Unit 8: Ecology

- Energy Flow
- Population Ecology
- Community Ecology

Multiple Choice Practice



The following is a food web for a meadow habitat that occupies 25.6 km^2. The primary producers' biomass is uniformly distributed throughout the habitat and totals 1,500 kg/km^2.

Developers have approved a project that will permanently reduce the primary producers' biomass by 50 percent and remove all rabbits and deer.

Which of the following is the most likely result at the completion of the project?

a. The biomass of coyotes will be 6 kg, and the biomass of hawks will be 0.5 kg.

b. The biomass of coyotes will be dramatically reduced.

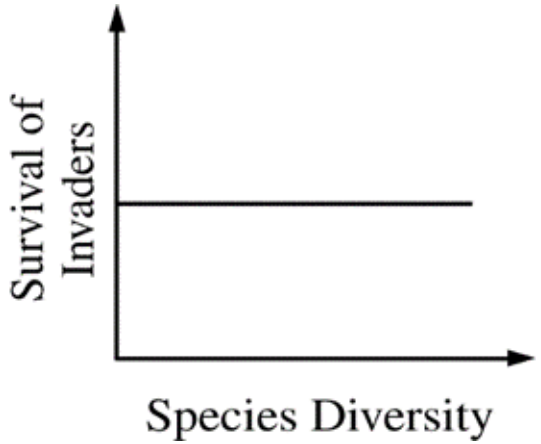
c. The coyotes will switch prey preferences and outcompete the hawks

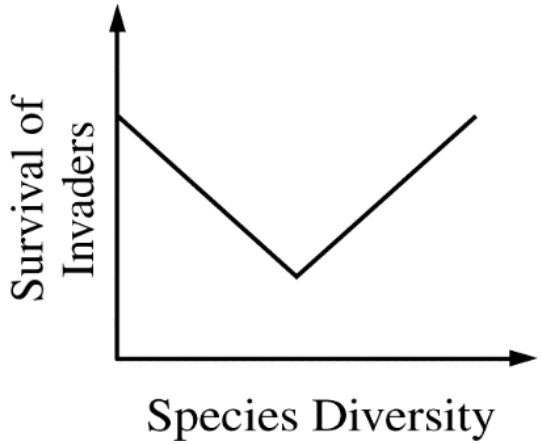
d. There will be 50 percent fewer voles and 90 percent fewer hawks.

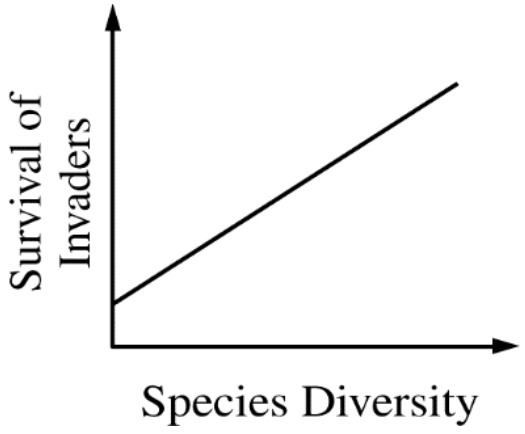
Multiple Choice Practice

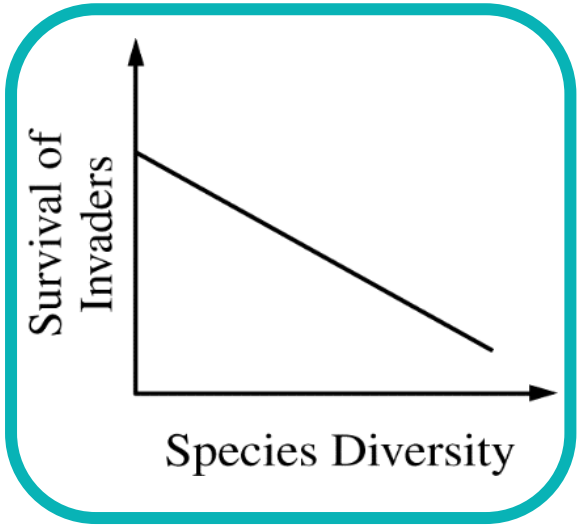
A researcher is investigating the relationship between the existing species diversity in a community and the ability of an introduced nonnative species to destabilize the community.

Which of the following graphs is most consistent with the claim that communities with high diversity are more resistant to change than are communities with low diversity?









Q & A

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