

AP BIOLOGY



QUESTION CATALOGUE

AP Biology

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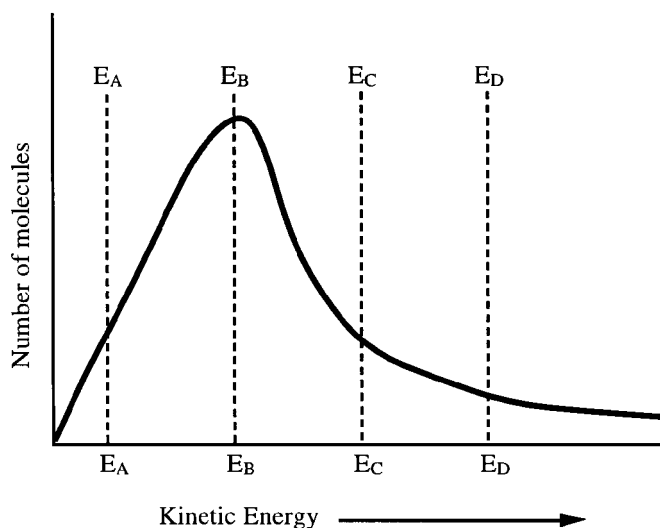
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1417. In which of the following reaction types is the activation energy of the forward reaction greater than the activation energy of the reverse reaction?
- (A) Exothermic (D) Combination
(B) **Endothermic** (E) None of the above
(C) Displacement

1418. Which of the following is NOT a mechanism by which enzymes lower the activation energy?
- (A) By increasing the speed of the reaction
(B) By allowing for proper orientation of enzyme-substrate complex
(C) By allowing for more collisions
(D) **By supplying the energy for the reaction**
(E) By forming temporary bonds

1420. Base your answer on the graph below which shows the number of molecules with a given kinetic energy plotted as a function of kinetic energy. Four catalysts are available, A, B, C, and D, which have associated reaction activation energies E_A , E_B , E_C , E_D , respectively.

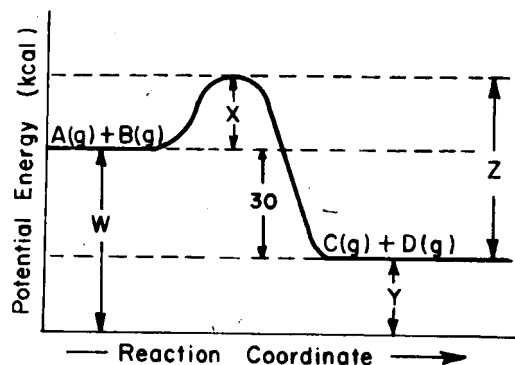


Which catalyst has an activation energy which results in the shortest reaction time?

- (A) **Catalyst 'A' associated with energy E_A**
(B) Catalyst 'B' associated with energy E_B
(C) Catalyst 'C' associated with energy E_C
(D) Catalyst 'D' associated with energy E_D
(E) The activation energies of catalysts A, B, C, and D all result in the same reaction time.
2076. The activation energy of a reaction can be altered by the addition of
- (A) substrates (D) ATP
(B) heat energy (E) ADP
(C) **enzymes**

1421. In a reaction, the spark plug of an engine can best be classified as
- (A) a catalyst
(B) **a supplier of activation energy**
(C) the rate determining step
(D) the activated complex
(E) the volatile reactant

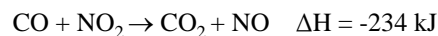
1422.



The distance marked "Z" represents

- (A) The activation energy for $A(g) + B(g) \leftrightarrow C(g) + D(g)$
(B) The heat of reaction energy for $A(g) + B(g) \leftrightarrow C(g) + D(g)$
(C) **The activation energy for $C(g) + D(g) \leftrightarrow A(g) + B(g)$**
(D) The heat of reaction for $C(g) + D(g) \leftrightarrow A(g) + B(g)$
(E) None of the above

1423. Consider the following reaction:



The activation energy of the following reaction is 134 kJ. What is the activation energy for the reverse reaction?

- (A) -134 kJ (D) **368 kJ**
(B) -100 kJ (E) 422 kJ
(C) 234 kJ

2447. The activation energy of a given reaction is usually provided by

- (A) glucose (D) oxygen
(B) enzymes (E) hydrocarbons
(C) **heat**

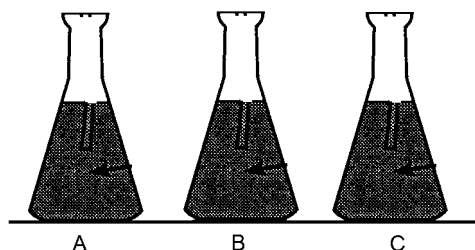
2448. The barrier of activation energy is necessary for life because

- (A) there would be too much free energy
(B) the law of thermodynamics favors the formation of complex molecules
(C) exergonic reactions require heat
(D) it is important to have more reactants than products
(E) **complex molecules have the potential to decompose spontaneously**

417. Base your answer to the following question on the information and diagram below.

A biologist prepares an analysis of the activity of the enzyme maltase, which promotes the hydrolysis of disaccharides to monosaccharides. Three flasks containing 10 milliliters of 4 percent maltose in water are prepared with the addition of the substances described below at time zero.

- Beaker A: Addition of 0.6 ml 1% Maltase Solution
 Beaker B: Addition of 0.6 ml Boiled Maltase Solution
 Beaker C: Addition of 0.6 ml Distilled Water



How can the biologist find proof for enzyme denaturation by observing starch digestion in the flasks?

- (A) Compare flasks A and B a few minutes after time zero.
 (B) Compare flasks B and C a few minutes after time zero.
 (C) Compare flasks A and C a few minutes after time zero.
 (D) Compare flask A at time zero and again few minutes later.
 (E) Compare flask C at time zero and again few minutes later.

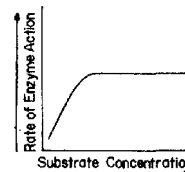
1166. An enzyme can overcome the presence of a competitive inhibitor by

- (A) decreasing the substrate concentration
 (B) **increasing the substrate concentration**
 (C) increasing the temperature
 (D) decreasing the temperature
 (E) altering the pH

2089. The following pairs have opposite effects on enzyme function EXCEPT

- (A) cofactors and urea
 (B) decreased temperature and increased substrate concentration
 (C) sodium hydroxide and increased enzyme concentration
 (D) **sulfuric acid and competitive inhibitors**
 (E) coenzymes and repressors

2090. Base your answer to the following question on the diagram below.



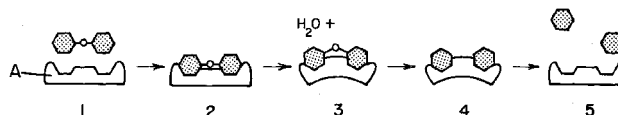
As seen in the above diagram, after a certain point, increasing substrate concentration no longer increases enzyme activity. This is evidence of

- (A) cofactor over-saturation
 (B) destruction of enzyme
 (C) **negative feedback**
 (D) noncompetitive inhibition
 (E) none of the above

2092. Which of the following is NOT true of enzymes?

- (A) They reduce the energy required for most reactions.
 (B) They allow reactions to occur at body temperature.
 (C) They are usually unchanged, so can be reused, which increases efficiency.
 (D) **They allow reactions to occur without the addition of ATP.**
 (E) Their formation is genetically controlled.

2093. Base your answer to the following question on the reaction depicted below.



Enzyme A functions in the cytoplasm as depicted. When excess galactose binds to an allosteric site not shown above, the enzyme becomes dormant. Enzyme A is

- (A) constitutive and inducible
 (B) **constitutive and repressible**
 (C) regulative and inducible
 (D) denatured and irreversible
 (E) toxic and irreversible

2094. Cyanide is poisonous to humans because it

- (A) prevents complete gas exchange in alveoli
 (B) disrupts astrocyte function
 (C) **binds irreversibly to allosteric sites**
 (D) alters blood cell conformation
 (E) none of the above

225. Mitochondria are thought to be descendants of endosymbiotic bacterial cells. Which of the following statements best supports this statement?
- (A) Mitochondria and bacteria possess different ribosomes and DNA.
 - (B) Mitochondria and bacteria possess similar ribosomes and DNA.**
 - (C) Both mitochondria and bacteria have cristae.
 - (D) Neither mitochondria nor bacteria possess chloroplasts.
 - (E) Glycolysis occurs in both mitochondria and bacteria.

1540. Mitochondria and bacteria share which similarities?

- (A) They both have similar ribosomes and DNA.**
- (B) They both have cell walls.
- (C) They both have chromosomes.
- (D) They both reproduce sexually.
- (E) There are no similarities.

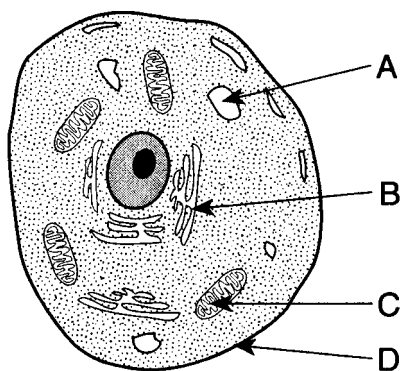
1541. The mitochondria of eukaryotes evolved from what type of organism?

- (A) Anaerobic bacteria
- (B) Aerobic bacteria**
- (C) Euglena
- (D) Ameoba
- (E) Any kind of eukaryote

1542. Chloroplasts of eukaryotes evolved from which of the following?

- (A) Cyanobacteria**
- (B) Photosynthetic prokaryotes
- (C) Photosynthetic protista
- (D) Plants
- (E) Any kind of eukaryote

2241. Base your answer to the following question on the picture below.



Indicate the structure(s) thought to be descendant of endosymbiotic bacterial cells.

- (A) A only
- (B) C only**
- (C) A and C
- (D) A and B
- (E) B and C

2519. Which of the following best describes the theory of serial endosymbiosis?

- (A) A prokaryotic cell takes up genes from the surrounding environment.
- (B) An organism will benefit from the symbiotic relationship, while neither is harmed.
- (C) Cyanobacteria synthesize food and restore oxygen to the atmosphere.
- (D) Some organelles were once small prokaryotes.**
- (E) Prokaryotes mediate the return of elements from the nonliving components of the environment.

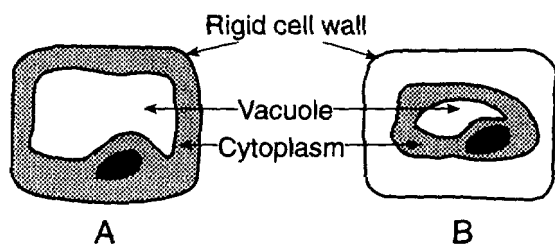
E. Movement of Materials In/Out of Cells

i. Diffusion and Osmosis

2590. If a plant cell is immersed in a solution having higher water potential than the cell, which of the following will occur?
- (A) Osmotic loss from the cell will cause the cell to become flaccid.
 (B) The cell wall will break down.
 (C) **Osmotic uptake of the water will cause the cell to swell.**
 (D) The plant cell will be crushed due to the water pressure.
 (E) Nothing will occur because the plant cell wall is impermeable to water.
2466. If a Paramecium living in pond water were to lose function of its contractile vacuole, what would be the result?
- (A) It would not be able to consume the proper amount of nutrients.
 (B) It would activate its sodium-potassium pumps.
 (C) It would rapidly undergo mitosis.
 (D) **It would fill with water and lyse.**
 (E) It would shrink.
2465. During osmosis, water will move from a hypotonic solution to
- (A) the isotonic solution
 (B) a cell with greater osmotic pressure
 (C) **a hypertonic solution**
 (D) the solution with more aquaporins
 (E) a hypotonic solution

2464. Which of the following best describes the reason for the diffusion of solutes in water?
- (A) **Entropy** (D) Active transport
 (B) Countercurrent exchange (E) Bulk flow
 (C) Endosymbiosis

Base your answers to questions 2244 through 2242 on the picture below. (Before and after pictures of a cell placed in a particular solution.)



2244. Cell A was placed in a solution that is
- (A) **hypertonic** (D) flaccid
 (B) hypotonic (E) supertonic
 (C) isotonic

2243. The cell in picture B is considered
- (A) lysed (D) **flaccid**
 (B) impermeable (E) water
 (C) turgid

2242. The cell above may have come from
- (A) cyanobacteria
 (B) **A cell that undergoes photosynthesis**
 (C) Human cheek cell
 (D) Xylem tissue
 (E) Myoblasts

1875. Plasmolysis of a plant cell is caused by
- (A) **a loss of turgor pressure**
 (B) catabolism
 (C) cell wall decomposition
 (D) dehydration synthesis
 (E) excess chloroplast activity

1812. Diffusion of material involves which of the following?
- (A) The movement of a substance up its concentration gradient.
 (B) The movement of water with the current.
 (C) The movement of a substance from a low concentration to a high concentration.
 (D) **The movement of a substance from a high concentration to a low concentration.**
 (E) The movement of material.

1307. A cellophane bag with 2M sucrose that is only permeable to water is placed in a beaker with distilled water. After 1 minute one would observe
- (A) **the bag expanding**
 (B) the bag shrinking
 (C) the bag expands then shrinks
 (D) nothing happens
 (E) none of the above

829. If a human cheek cell is placed in pure water, the movement of water into the cells is known as
- (A) **osmosis** (D) diffusion
 (B) passive transport (E) transpiration
 (C) active transport

750. A plant cell that loses water will
- (A) **become flaccid**
 (B) become turgid
 (C) become low in solute concentration
 (D) burst
 (E) gain osmotic pressure in the cell

2475. How is the energy stored in food molecules released and used to synthesize ATP?

- (A) **Relocation of electrons in redox reactions.**
- (B) Lysosomes degrade macromolecules to release the stored energy.
- (C) Anabolic pathways.
- (D) Biosynthesis.
- (E) Rearrangement of the atoms that constitute the food molecules.

2252. In plants, ATP is synthesized in the

- (A) chloroplasts and endoplasmic reticulum
- (B) **chloroplasts and mitochondria**
- (C) cytosol and mitochondria
- (D) mitochondria and nucleus
- (E) chloroplasts and cytosol

2251. ATP serves as an effective energy transfer molecule because of

- (A) **the nature of the bonds existing between adjacent phosphate groups**
- (B) its release in response to the binding of calcium ions to enzymes on the cell membrane
- (C) its role in cytochrome activity during the electron transport chain
- (D) its ability to be both consumed and produced during glycolysis
- (E) its rapid production by the mitochondria of prokaryotic cells

2250. When bonds are broken, energy that is not used by the cell to carry out cellular processes is

- (A) stored in the nucleus
- (B) **given off as heat**
- (C) digested by the lysosomes
- (D) packaged in the endoplasmic reticulum
- (E) oxidized

1950. The structure of ATP most closely resembles that of

- (A) acetylcholine
- (B) **adenine nucleoside**
- (C) glutamate
- (D) thymine nucleotide
- (E) norepinephrine

1949. All of the following molecules are involved in energy production EXCEPT

- (A) **ACh**
- (B) ATP
- (C) FADH₂
- (D) GDP
- (E) NADH

1948. Which of the following gives the correct order of bond energies from highest to lowest?

- I. C – C covalent bonds
 - II. ionic bonds
 - III. phosphate group bonds
- (A) I – II – III
 - (B) I – III – II
 - (C) II – I – III
 - (D) III – II – I
 - (E) **III – I – II**

1816. High energy phosphate bonds are present in which of the following molecules?

- I. Glucose
 - II. ATP
 - III. Water
- (A) I only
 - (B) **II only**
 - (C) III only
 - (D) I and II
 - (E) II and III

1248. ATP synthase in the inner mitochondrial and chloroplast membranes is a

- (A) nucleic acid
- (B) **protein**
- (C) glycocalyx
- (D) triglyceride
- (E) phospholipid

1122. The structure of ATP most closely resembles

- (A) proteins
- (B) DNA
- (C) glucose
- (D) **RNA**
- (E) lipids

936. Which of the following cellular processes is associated with ATP hydrolysis?

- (A) **The active transport of hydrogen ions into a cell during photosynthesis.**
- (B) The passive diffusion of molecules through a cell membrane.
- (C) The movement of water into a cell via osmosis.
- (D) The influx of sodium ions into a nerve cell.
- (E) The movement of glucose into a cell via facilitated diffusion.

663. Each ATP molecule consists of each of the following subcomponents EXCEPT

- (A) **a pyrimidine base**
- (B) a 5-carbon ring sugar
- (C) an adenosine base
- (D) three phosphate molecules
- (E) a ribose molecule

2574. If carbohydrates are not available for catabolism, what must occur before proteins can be used as fuel?

- (A) Fermentation
- (B) Photosynthesis
- (C) **Digestion**
- (D) Oxidation
- (E) Synthesis

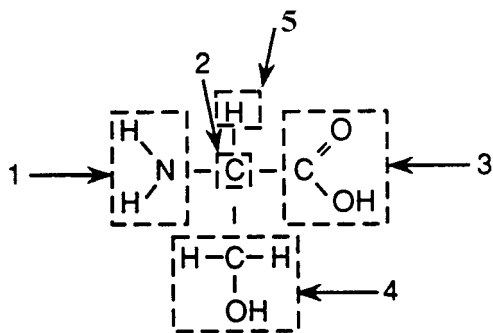
2276. Which of the following is the most similar to chemiosmosis?

- (A) Photosynthesis
- (B) Diffusion
- (C) **Cotransport**
- (D) Redox reaction
- (E) Fermentation

2264. Which of the following statements is true about respiration and fermentation?

- (A) **Both processes share the same oxidizing agent to accept the electrons from food during glycolysis.**
- (B) Both processes yield the same amount of ATP per glucose molecule.
- (C) Both processes sustain glycolysis by using pyruvate as the final electron acceptor.
- (D) Both processes use the same mechanisms for oxidizing NADH back to NAD⁺.
- (E) Both processes use the same enzymes.

2064. Base your answer to the following question on the diagram below.



How would phenylalanine differ from the molecule depicted above?

- (A) Group 1 differs
- (B) Group 3 differs
- (C) **Group 4 differs**
- (D) Group 5 differs
- (E) It differs completely from the molecule depicted above.

1993. Causes of cancer include all of the following EXCEPT

- (A) **cell differentiation**
- (B) oncogene mutation
- (C) pyrimidine dimer formation
- (D) radiation
- (E) transduction by retrovirus

1982. How much ATP is produced from the 2 NADH₂⁺ oxidized back into NAD⁺ during lactic acid formation?

- (A) **0 ATP**
- (B) 2 ATP
- (C) 4 ATP
- (D) 6 ATP
- (E) 8 ATP

Base your answers to questions 1981 through 1977 on your knowledge of aerobic respiration of one molecule of glucose.

1981. How much ATP is produced by substrate-level phosphorylation?

- (A) 0 ATP
- (B) 2 ATP
- (C) **4 ATP**
- (D) 6 ATP
- (E) 8 ATP

1980. How much ATP is produced by oxidative phosphorylation from the FADH₂ produced in the TCA cycle?

- (A) 0 ATP
- (B) 2 ATP
- (C) **4 ATP**
- (D) 6 ATP
- (E) 8 ATP

1979. How much ATP is produced by oxidative phosphorylation from the NADH₂⁺ produced in the Krebs cycle?

- (A) 0 ATP
- (B) 6 ATP
- (C) 12 ATP
- (D) **18 ATP**
- (E) 24 ATP

1978. How much ATP is produced by oxidative phosphorylation from the NADH₂⁺ formed during oxidative decarboxylation of pyruvate?

- (A) 0 ATP
- (B) 2 ATP
- (C) 4 ATP
- (D) **6 ATP**
- (E) 8 ATP

1977. How much ATP is produced by oxidative phosphorylation from the NADH₂⁺ formed during glycolysis?

- (A) 0 ATP
- (B) 2 ATP
- (C) **4 ATP**
- (D) 6 ATP
- (E) 8 ATP

1976. Overall, glucose metabolism is

- (A) adiabatic
- (B) endergonic
- (C) **exergonic**
- (D) hypertonic
- (E) isothermal

1975. Aerobic respiration includes all of the following EXCEPT

- (A) glucose catalysis
- (B) **magnesium excitation**
- (C) reduction-oxidation reactions
- (D) oxidative phosphorylation
- (E) substrate-level phosphorylation

II. HEREDITY AND EVOLUTION
A. Meiosis and Gametogenesis

1. Heredity
i. Stages of Meiosis

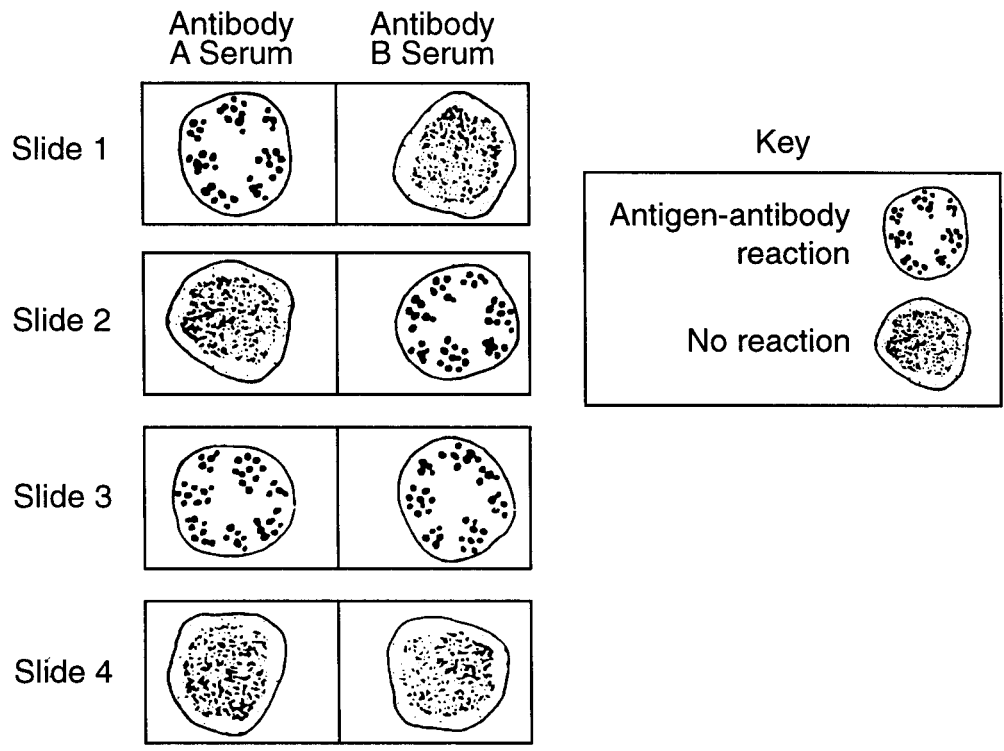
228. In meiosis, which of the following does NOT occur in two rounds?
- (A) Prophase
 - (B) Metaphase
 - (C) Anaphase
 - (D) Telophase
 - (E) **Interphase**
163. How many different sex cells can be produced given the genotype WwXXYyZZ?
- (A) 2
 - (B) **4**
 - (C) 8
 - (D) 16
 - (E) 32

II. HEREDITY AND EVOLUTION
A. Meiosis and Gametogenesis

1. Heredity
ii. Meiosis I vs. Meiosis II

2144. Recombination of DNA occurs in
- (A) **prophase I**
 - (B) telophase I
 - (C) anaphase II
 - (D) prophase II
 - (E) metaphase II
1430. In both meiosis I and II, the interphase period includes
- (A) DNA synthesis
 - (B) chromosomal separation
 - (C) crossing-over
 - (D) **chromosomes uncoiling**
 - (E) spindle apparatus forming
1429. Which of the following is a similarity between meiosis I and meiosis II?
- I. The ploidy of the end products.
 - II. Random assortment of genes from each chromosome pair in the cell.
 - III. Crossing over occurs.
- (A) I only
 - (B) **II only**
 - (C) III only
 - (D) I and III
 - (E) II and III

Base your answers to questions 988 through 987 on the diagram below.



988. The agglutination test of Slide 3 represents which of the following blood types?

- (A) A (B) B (C) AB (D) O (E) A-

987. The agglutination test of Slide 1 represents what blood type?

- (A) A (B) B (C) AB (D) O (E) AB+

Base your answers to questions 2173 through 2168 on the following information.

A man gets into a serious car accident and is bleeding severely. He is taken to the hospital, where they find out his blood type is the universal acceptor.



2173. Human antibodies are passed from mother to child through the

- (A) **colostrum**
 (B) placenta
 (C) uterus
 (D) mixing of fetal and parental blood
 (E) lymph

2172. The mother of the patient comes to donate blood but is deemed unfit because she is taking medication. Her blood type genotype is AB. The patient may receive all of the following blood types EXCEPT

- (A) AO
 (B) AA
 (C) AB
 (D) OO
 (E) **the patient can receive all of the above**

2171. The inheritance of type AB blood is evidence of

- (A) Blending inheritance (D) Independent assortment
 (B) **Codominance** (E) Pseudodominance
 (C) Epistasis

2170. The wrong blood type would be rejected by the patient's body because of the interaction of

- (A) A and B hemoglobin
 (B) **antigens and agglutinins**
 (C) cytotoxic T cells and macrophages
 (D) fibrinogen and thromboplastin
 (E) platelets and rhesus proteins

II. HEREDITY AND EVOLUTION

2. Molecular Genetics

A. DNA and RNA - Structure and Function

ii. DNA Structure/Composition

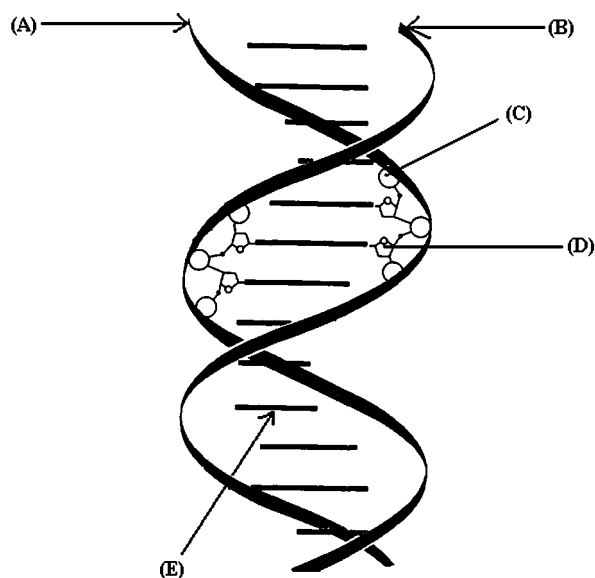
2187. When DNA is condensed, chemical reactions between parts of DNA are prevented by

- (A) **histones**
- (B) inhibitor proteins
- (C) nitrogenous bases
- (D) operons
- (E) repressor proteins

1318. DNA contains all of the following EXCEPT

- (A) adenine
- (B) phosphate
- (C) thymine
- (D) deoxyribose
- (E) **uracil**

Base your answers to questions 1260 through 1257 on the diagram below.



1260. These run antiparallel to one another.

- (A) A and E
- (B) A and D
- (C) **A and B**
- (D) C and D
- (E) D and E

1259. Hydrogen bonds that join bases of the helix together are represented by letter

- (A) A
- (B) B
- (C) C
- (D) D
- (E) **E**

1258. A phosphate group is represented by letter

- (A) A
- (B) B
- (C) **C**
- (D) D
- (E) E

1257. Deoxyribose is represented by letter

- (A) A
- (B) B
- (C) C
- (D) **D**
- (E) E

1163. DNA has all of the following characteristics EXCEPT

- (A) **the molecule is single stranded**
- (B) contains sugar phosphate backbones
- (C) nitrogenous bases are linked by hydrogen bonds
- (D) one end has a 5' phosphate group and the other has a 3' hydroxyl group
- (E) the molecule is antiparallel

1131. The combination of a base, sugar, and phosphate is known as a

- (A) protein base
- (B) molecular unit
- (C) nucleoside
- (D) **nucleotide**
- (E) base pair

1105. Uracil is complementary to which nitrogenous base?

- (A) Thymine
- (B) Guanine
- (C) Cytosine
- (D) **Adenine**
- (E) Uracil

672. DNA nucleotides vary from each other at the

- (A) **the nitrogenous base region**
- (B) the ribose region
- (C) the deoxyribose region
- (D) the phosphate group region
- (E) the sugar molecule region

648. One of the strands of DNA in a double helix has the base sequence ATGATTC. The base sequence of the complementary strand of DNA is

- (A) **TACTAAG**
- (B) TUCTUUG
- (C) GACGAAT
- (D) CAGCAAG
- (E) UACUAAG

77. DNA that is complexed with proteins called histones is called

- (A) transposable element
- (B) cofactor
- (C) **chromatin**
- (D) codon
- (E) messenger

75. Which of the following statements is true?

- (A) **DNA has a deoxyribose sugar, while RNA has a ribose sugar**
- (B) Both DNA and RNA are double-stranded
- (C) Both DNA and RNA contain the bases adenine and thymine
- (D) The nitrogenous bases classified as purines include adenine and cytosine
- (E) Cytosine pairs with thymine

II. HEREDITY AND EVOLUTION

A. DNA and RNA - Structure and Function

2295. Base your answer to the following question on the chart below.

Messenger RNA (mRNA) Codes for Selected Amino Acids

Amino Acid	mRNA Code
Leucine	C-C-A
Arginine	C-G-A
Phenylalanine	U-U-U
Valine	G-U-U
Lysine	A-A-A

If a polypeptide chain has the amino acid sequence, Leu-Arg-Lys, what would be the corresponding anticodons found on the tRNA?

- (A) CCA CGA TTT (D) GGU GCU AAA
 (B) CCA CGA AAA (E) GGT CCA TTT
 (C) **GGU GCU UUU**

2293. During translation, the initiation complex is composed of

- (A) an RNA polymerase, a DNA molecule, and accessory proteins
 (B) **an mRNA, a tRNA molecule, and two ribosomal subunits**
 (C) a DNA polymerase, an mRNA molecule, and a polypeptide chain
 (D) a tRNA molecule, an amino acid, and an anticodon
 (E) an mRNA, an rRNA molecule, and a small ribosomal subunit

2292. The anticodon region can be found

- (A) **within a tRNA molecule**
 (B) on the polypeptide chain
 (C) within an mRNA molecule
 (D) on the large subunit of the ribosome
 (E) attached to the end of an amino acid

2280. The two main processes linking gene to protein are

- (A) elongation and termination
 (B) replication and transformation
 (C) initiation and transcription
 (D) **transcription and translation**
 (E) termination and translation

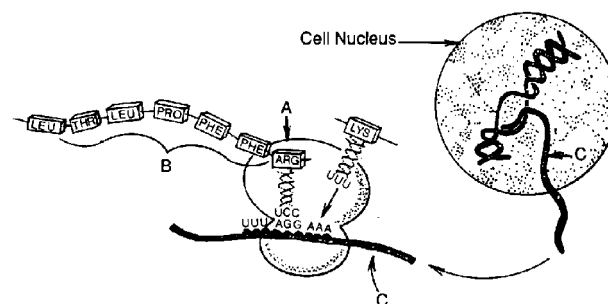
2212. Essential amino acids are those

- (A) **only acquired from external food sources**
 (B) immediately required for synthesis of a specific protein
 (C) necessary for DNA synthesis
 (D) packaged by the Golgi body for secretion
 (E) regularly produced by the cells

2. Molecular Genetics

v. Translation - Location & Process

Base your answers to questions 2286 through 2284 on the image below.



2286. Identify the structure indicated by letter B

- (A) DNA (D) **polypeptide chain**
 (B) mRNA (E) nucleotide chain
 (C) tRNA

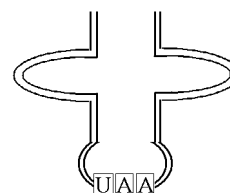
2285. A triplet code is responsible for

- (A) attaching amino acids to DNA
 (B) **encoding the instructions for the polypeptide chain**
 (C) placing the correct protein on the mRNA strand
 (D) transcribing the DNA strand from its template
 (E) synthesizing mRNA from a complementary protein strand

2284. The structure indicated by the letter B is

- (A) **a polypeptide chain** (D) mRNA
 (B) the nuclear envelops (E) DNA
 (C) tRNA

Base your answers to questions 2209 through 2206 on the following diagram



2209. The sequence depicted above binds to the opposite sequence on another molecule by

- (A) disulfide bonds (D) phosphodiester linkages
 (B) **hydrogen bonds** (E) van der Waals forces
 (C) ionic bonds

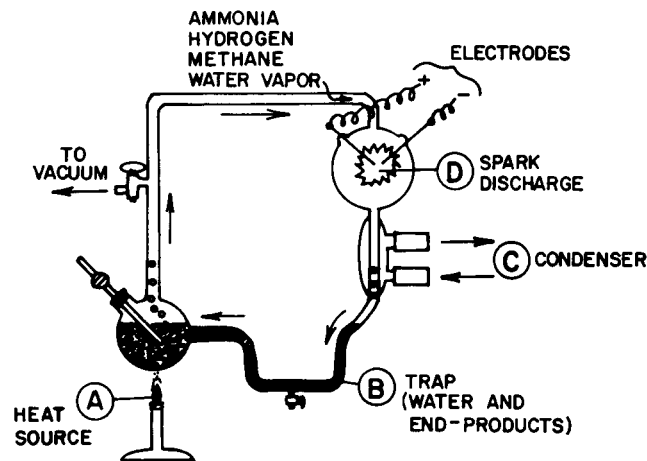
2208. The corresponding nucleotide sequence for the one depicted above is

- (A) **TAA** (D) AUC
 (B) UAA (E) CAA
 (C) ATT

A. Early Evolution of Life

i. Miller Experiment, Primeval Earth

Base your answers to questions 2331 through 2330 on the diagram below.



2331. Which of the following was the main reason for conducting this experiment?

- (A) To test the abiotic origins of life.
- (B) To show that organisms came from the sea.
- (C) To test the concept of biogenesis.
- (D) To show that underwater volcanoes and deep sea vents provided the essential resources for life.
- (E) To prove that the molecular ingredients for life were not present early in life

2330. According to Miller and Urey, the heat source is necessary to simulate

- (A) the sun, which was more active billions of years ago
- (B) the habitat necessary for prokaryotic reproduction
- (C) the primordial sea
- (D) the air in which life began
- (E) volcanic activity which stimulated terrestrial mutations

2117. Microspheres are defined as

- (A) ecological subcategories within the biosphere
- (B) experimentally-produced protobionts with selectively permeable membranes
- (C) gene pools subject to regular change in genotype frequency
- (D) globules that convey genetic information in the theory of pangenesis
- (E) subunits that compose nuclear histones

2114. During the early history of the Earth, the primary source of energy was

- (A) ATP
- (B) enthalpy
- (C) UV radiation
- (D) radioactive materials
- (E) all of the above

2115. Earth's primitive atmosphere consisted of all of the following except

- (A) Ar
- (B) CO₂
- (C) HCl
- (D) H₂O
- (E) N₂

2113. According to Oparin and Haldane, oxygen's presence in the early atmosphere would have hindered molecule formation because of oxygen's

- (A) high density
- (B) high reactivity
- (C) high number of isotopes
- (D) low atomic number
- (E) low radioactivity

2112. In the Miller-Urey experiment, application of electric sparks to simple gases resulted in the formation of

- (A) steroids
- (B) ozone
- (C) simple amino acids
- (D) polysaccharides
- (E) RNA

2111. Which of the following is thought to be true about conditions on Earth during the early stages of the geological time scale?

- (A) Cyanobacteria in marine environments were the first species to develop.
- (B) Electricity in the atmosphere prevented monomers from bonding to oxygen atoms.
- (C) Microspheres in terrestrial environments were the first polymers to form.
- (D) Protobionts were the first reproducing organisms to evolve.
- (E) The Earth's early atmosphere was highly reductive.

1783. The Earth's early atmosphere probably contained mostly

- (A) hydrogen gas and methane gas
- (B) water vapor and hydrogen peroxide
- (C) carbon dioxide and nitrogen
- (D) oxygen, helium and argon
- (E) oxygen and ozone

840. Which of the following gases was NOT utilized in Miller's famous experiment, which showed that the release of a spark into a gaseous mixture would produce various organic compounds?

- (A) Oxygen gas
- (B) Ammonia gas
- (C) Hydrogen gas
- (D) Methane gas
- (E) Water vapor

II. HEREDITY AND EVOLUTION
B. Evidence for Evolution

3. Evolutionary Biology
iii. Comparative Anatomy

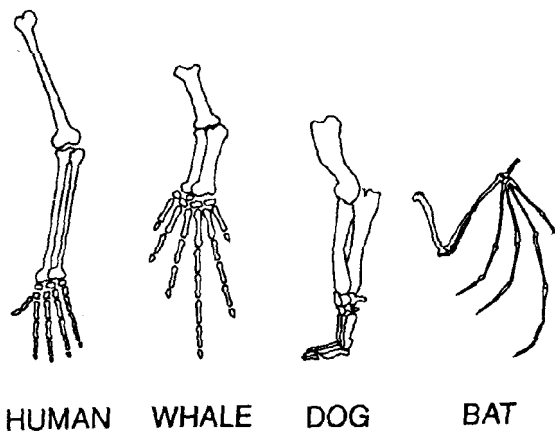
2586. Why are *Hox* genes important to the evolution of mammals and other animals?
- (A) *Hox* genes are easily mutated by abiotic factors.
 - (B) The gene sequence is highly conserved throughout many eukaryotes and prokaryotes.**
 - (C) *Hox* genes are responsible for producing favorable traits.
 - (D) The gene sequence can be transplanted across different species.
 - (E) *Hox* genes are responsible for allopatric speciation.

2124. The similarities of a bird's wing and an insect's wing are evidence of
- (A) convergent evolution** (D) parapatric speciation
 - (B) divergent evolution (E) neutral selection
 - (C) homologous structures

1196. The tonsils and appendix are examples of
- (A) vestigial structures** (D) homologous structures
 - (B) balance polymorphism (E) analogous structures
 - (C) divergent evolution

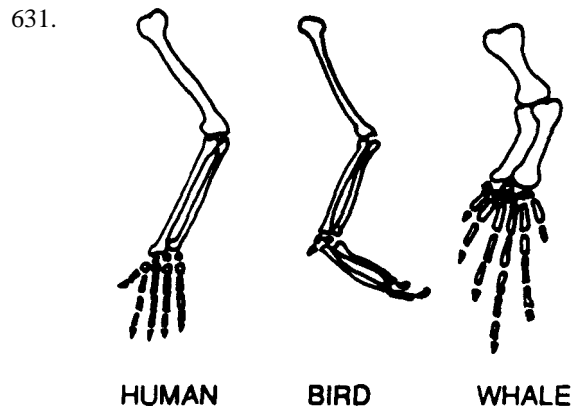
1100. Why are green algae thought to be the ancestors of land plants?
- (A) They have homologies in lysosome structure.
 - (B) They share homologies in centriole composition.
 - (C) They share similar structure and pigmentation of chloroplasts.**
 - (D) They have similar waxy cuticles.
 - (E) They have similar seed structure.

1028. Base your answer on the diagram below.

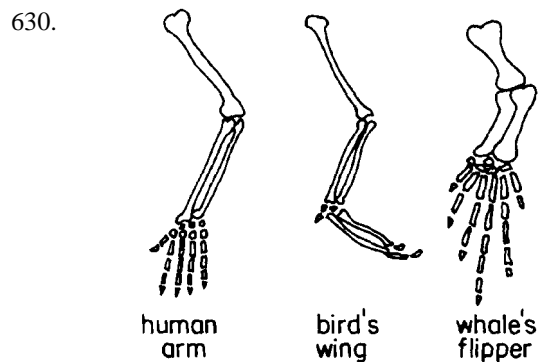


- The forelimbs of these organisms
- (A) are all homologous structures**
 - (B) are all vestigial structures
 - (C) are evidence of convergent evolution
 - (D) are considered analogous structures
 - (E) demonstrate punctuated equilibrium

800. In terms of comparative anatomy, select the structure that is NOT homologous to the arm of an ape.
- (A) The wing of an insect** (D) The leg of a frog
 - (B) The flipper of a whale (E) The arm of a man
 - (C) The wing of a bird



- The structures in the diagram are
- (A) homologous** (D) disruptive
 - (B) analogous (E) allopatric
 - (C) stabilizing



- The diagram best represents which of the following?
- (A) Survival of the fittest (D) Reproductive isolation
 - (B) Acquired characteristics (E) Convergence
 - (C) Common Ancestry**

392. Base your answer to the following question on the choices below.
- (A) Bottleneck
 - (B) Adaptive radiation
 - (C) Convergent evolution
 - (D) Allopatric speciation
 - (E) Gene flow

Describes two unrelated species that share similar traits
C

III. ORGANISMS AND POPULATIONS

1. Diversity of Organisms

A. Evolutionary Patterns & Relationships

i. Phylogenetics, Systematics, Taxonomy

Base your answers to questions 406 and 407 on the chart below.

Phylum	Germ Layers	Body Symmetry	Gut Openings	Coelom
A		none	0	
B	2	radial	1	
C	3	bilateral	1	acoelomate
D	3	bilateral	2	pseudocoelomate
E	3	radial	2	coelomate

406. Phylum D represents which of the following?

- (A) Platyhelminthes
 (B) Cnidaria
 (C) **Rotifera and Nematode**
 (D) Echinodermata
 (E) Mollusca

407. Which of the following phyla have deuterostome embryonic development?

- (A) A (B) B (C) C (D) D (E) E

192. Which of the following is a radially symmetrical organism with saclike bodies and mesogleal layers?

- (A) **Ctenophora** (D) Annelida
 (B) Aschelminthes (E) Mollusca
 (C) Arthropoda

488. The eyes of squids and vertebrates are physically and functionally similar; however, these animals do not share a recent common ancestor. This is an example of

- (A) divergent evolution (D) parallel evolution
 (B) **convergent evolution** (E) allopatric speciation
 (C) coevolution

627. Base your answer to the following question on the choices below.

- (A) Survival of the fittest
 (B) Acquired characteristics
 (C) Common ancestry
 (D) Reproductive isolation
 (E) Convergence

Independent evolution of similar structures in distantly-related organisms

E

923. Phylogenies are useful for scientists because they

- (A) **reconstruct the evolutionary history and common ancestry of various organisms.**
 (B) they are indisputable evidence of past evolutionary patterns.
 (C) calibrate how long ago two similar species diverged.
 (D) measure the number of similarities between organisms.
 (E) are based on morphological characteristics.

938. Which of the following pairs of organisms are the most closely related taxonomically?

- (A) **Mushrooms and yeast** (D) Bacteria and anthropods
 (B) Conifers and ciliates (E) Algae and echinoderms
 (C) Mollusks and ferns

1106. Which group is the most different phylogenetically?

- (A) Moss and Pine
 (B) Protozoans and Slime Molds
 (C) Bacteria and Blue-Green Algae
 (D) Bivalves and Cephalopods
 (E) **Agnatha and Angiosperm**

1151. Groups of finches from given populations migrated and began occupying several habitats on the Galapagos Islands. The evolutionary pathway that accounts for the existence of many species of finch on a specific Galapagos Island is

- (A) **adaptive radiation** (D) isolation
 (B) punctuated equilibrium (E) convergent evolution
 (C) genetic drift

1184. Which of the following describes when populations resemble each other but are completely unrelated?

- (A) directional selection (D) **convergent evolution**
 (B) stabilizing selection (E) speciation
 (C) divergent evolution

III. ORGANISMS AND POPULATIONS

A. Plant Classification and Morphology

29. The function of xylem is to
(A) **transport water and dissolved minerals**
(B) transport organic solutes
(C) cover and protect
(D) strengthen and support
(E) store reserve materials
36. Phloem transports
(A) **carbohydrates** (D) minerals
(B) ions (E) protein
(C) water
108. Which of the following is NOT a function of the stem of a plant?
(A) Transport of water (D) Leaf support
(B) **Absorption** (E) Food storage
(C) Transport of food
157. What is the correct order of stem layers from the outside to the inside?
(A) cortex - xylem - phloem - cambium - pith
(B) cambium - cortex - xylem - phloem - pith
(C) cambium - cortex - phloem - xylem - pith
(D) cortex - cambium - phloem - xylem - pith
(E) **cortex - phloem - cambium - xylem - pith**
256. The rate of flow of nutrients through the phloem is regulated by
(A) passive transport by the pith
(B) surface area of the root hairs
(C) **active transport by the sieve-tube members**
(D) active transport by the tracheid and vessel cells
(E) length of the roots
312. Which of the following is LEAST likely to be a factor in plant growth?
(A) Tissues that cause primary growth are called apical meristems
(B) Lateral meristems increase the girth or width of the plant
(C) Vascular cambium produces secondary xylems and secondary phloems
(D) Cork cambium produces tissues of the outer bark
(E) **Lenticels allow for gas exchange through the leaves**
330. Greatest support of the stem and leaves are typical of which tissue type?
(A) epidermal (D) meristematic
(B) parenchyma (E) chlorenchyma
(C) **sclerenchyma**

2. Structure/Function of Plants/Animals

ii. Stem Tissue Identification & Function

350. Removing a ring of bark from a tree most directly affects the process of
(A) **translocation** (D) cohesion
(B) transpiration (E) photoperiodism
(C) photosynthesis
574. Which of the following is dead at functional maturity?
(A) **Tracheids** (D) Sieve-tube members
(B) Companion cell (E) Guard cell
(C) Palisade mesophyll
- Base your answers to questions 594 through 597 on the choices below.
- (A) Apical meristem
(B) Vascular meristem
(C) Epidermis
(D) Cork cambium
(E) Lenticels
594. Outer layer of the meristem in woody stems
D
595. Refers to actively dividing cells located at the tip of roots and stems
A
597. Pores used for gas exchange in woody stems
E
-
650. Xylem is vascular tissue in plants that
(A) **transports ions away from the roots**
(B) transports dissolved materials toward the roots
(C) transports sucrose away from the roots
(D) transports sucrose towards the roots
(E) transports ions towards the roots
760. A cross-section of a plant stem is composed of 5 distinct layers. Order these 5 layers from the outer-most layer to the inner-most layer.
(A) **cortex, phloem, cambium, xylem, pith**
(B) pith, cambium, xylem, phloem, cortex
(C) phloem, cortex, cambium, pith, xylem
(D) pith, xylem, phloem, cambium, cortex
(E) cortex, phloem, xylem, pith, cambium
820. Vascular cambium cell division results in
(A) **xylem and phloem production**
(B) the closing of stomates and moisture loss prevention
(C) pith cells to store food
(D) cells of the spongy layer to increase in photosynthetic ability
(E) the thickening of tree bark

III. ORGANISMS AND POPULATIONS

A. Plant Classification and Morphology

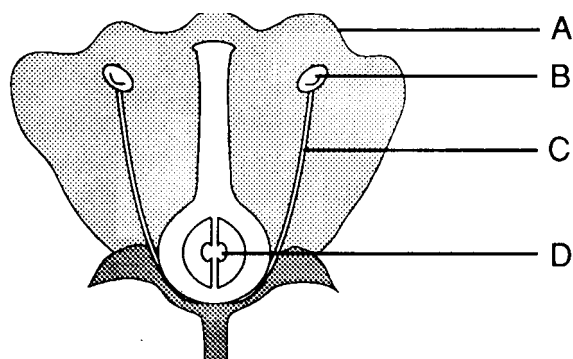
244. Which of the following plant structures are NOT found in the stamen or produced there?

- (A) Anther
- (B) Filament
- (C) Microspores
- (D) Style
- (E) Pollen grains

255. Which of the following characteristics is common to all "flowering plants?"

- (A) Enclosed seeds located within a fruit or nut
- (B) Scattered vascular bundles
- (C) Fibrous root system
- (D) Netted venation of leaves
- (E) Two cotyledons

Base your answers to questions 274 through 276 on the diagram of the flowering plant below.



274. Pollen-producing structure

- (A) A
- (B) B
- (C) C
- (D) D
- (E) none of the above

275. Female portion of the plant

- (A) A
- (B) B
- (C) C
- (D) D
- (E) none of the above

276. The "sticky" portion

- (A) A
- (B) B
- (C) C
- (D) D
- (E) none of the above

381. Which of the following use wind or animals to disperse pollen?

- (A) Angiosperms
- (B) Gymnosperms
- (C) Ferns
- (D) Liverworts
- (E) Golden algae

2. Structure/Function of Plants/Animals

v. Angiosperm Flower and Fruit Structure

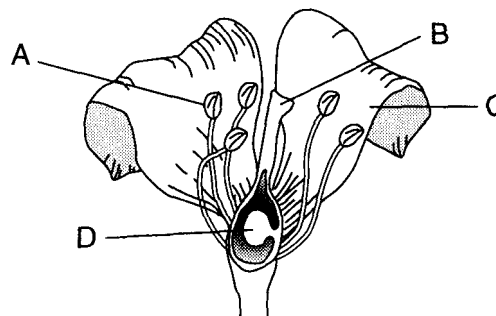
561. How do angiosperms differ from all other plants?

- (A) They produce a pollen tube
- (B) They produce fruits
- (C) They use animals to disperse their seeds
- (D) The sporophyte generation is dominant
- (E) They produce wind-dispersed pollen

810. Angiosperms differ from other terrestrial plant groups in that they

- (A) have flowers and fruits
- (B) have cones
- (C) have needles
- (D) produce spores
- (E) have xylem and phloem

Base your answers to questions 1013 through 1015 on the diagram below.



1013. The structure labeled A is the

- (A) anther
- (B) stigma
- (C) ovule
- (D) filament
- (E) style

1014. The structure labeled B is the

- (A) style
- (B) carpel
- (C) ovule
- (D) anther
- (E) receptacle

1015. The structure labeled D is the

- (A) ovary
- (B) filament
- (C) anther
- (D) stamen
- (E) style

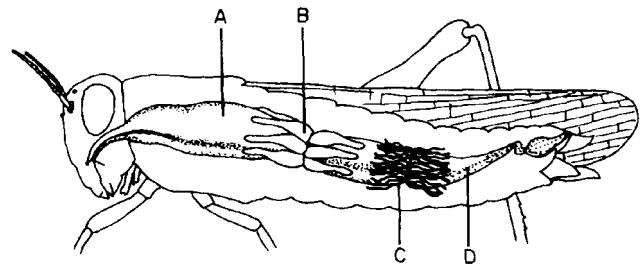
1159. The reproductive organ of the angiosperm is the

- (A) seed
- (B) leaf
- (C) stem
- (D) flower
- (E) root

60. Which of the following is a correct insect metamorphic life cycle sequence?
 (A) pupa-egg-larva-adult (D) egg-pupa-larva-adult
 (B) larva-pupa-egg-adult (E) **egg-larva-pupa-adult**
 (C) larva-egg-pupa-adult
81. Which is the correct respiratory surface for grasshoppers?
 (A) Gills
 (B) Plasma membrane of each cell
 (C) Moist skin
 (D) **Trachea network**
 (E) Air sacs in lungs
94. Which of the following statements about the circulatory system in earthworms is NOT true?
 (A) **The blood is not confined to blood vessels at all times.**
 (B) It is a "closed" system.
 (C) A pump that forces blood to the capillaries consists of five pairs of aortic loops.
 (D) The ventral blood vessel transports blood toward the rear of the worm.
 (E) The dorsal blood vessel forces blood back to the aortic loops at the anterior end of the worm.
282. Base your answer to the following question on the choices below.
- (A) Annelida
 (B) Arthropoda
 (C) Porifera
 (D) Nematoda
 (E) Chordata
- Jointed legs; chitinous skeleton; open circulatory system
B
676. The correct sequence for the steps in butterfly metamorphosis is
 (A) **egg-larva-pupa-adult** (D) pupa-larva-egg-adult
 (B) egg-pupa-larva-adult (E) pupa-egg-adult-larva
 (C) larva-egg-pupa-adult
691. Select the organism(s) that is/are accurately paired with its corresponding class classification.
 (A) Spiders are members of the class Insecta
 (B) Lobsters and shrimp are members of the class Arachnida.
 (C) **Crayfish and crabs are members of the class Crustacea**
 (D) Snails and slugs are members of the class Insecta
 (E) Grasshoppers are members of the class Gastropoda

692. Arthropods are characterized by which of the following features?
 (A) **Chitinous exoskeletons**
 (B) Non-jointed appendages
 (C) Phloems
 (D) Alveoli in the lungs
 (E) Cells that contain cell walls
920. Which of the following classes within the phylum Arthropoda have six legs, three body parts, and one pair of antennae?
 (A) **Insecta** (D) Chilopoda
 (B) Arachnida (E) Diplopoda
 (C) Crustacea

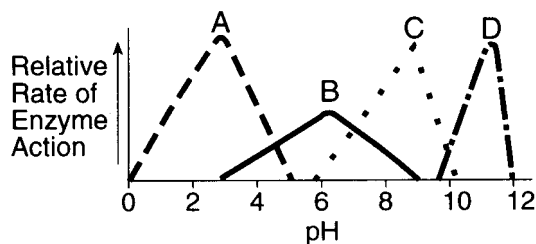
Base your answers to questions **1042** through **1045** on the diagram of a grasshopper below.



1042. The structure labeled A refers to
 (A) the gizzard (D) the stomach
 (B) **the crop** (E) the malpighian tubules
 (C) the gastric caecum
1043. The structure labeled B refers to the
 (A) **gastric caecum** (D) crop
 (B) malpighian tubules (E) stomach
 (C) gizzard
1044. The structure labeled C refers to the
 (A) **malpighian tubules** (D) stomach
 (B) crop (E) gastric caecum
 (C) gizzard
1045. The structure labeled D refers to the
 (A) **large intestine** (D) gastric caecum
 (B) stomach (E) gizzard
 (C) malpighian tubules

147. Which is the correct order that food takes through the digestive tract?
- (A) oral cavity - esophagus - pharynx - stomach - small intestine - large intestine
 - (B) oral cavity - pharynx - esophagus - stomach - large intestine - small intestine
 - (C) oral cavity - pharynx - esophagus - stomach - small intestine - large intestine**
 - (D) oral cavity - pharynx - stomach - esophagus - small intestine - large intestine
 - (E) oral cavity - pharynx - esophagus - small intestine - stomach - large intestine

Base your answers to questions 201 and 202 on the graph below.

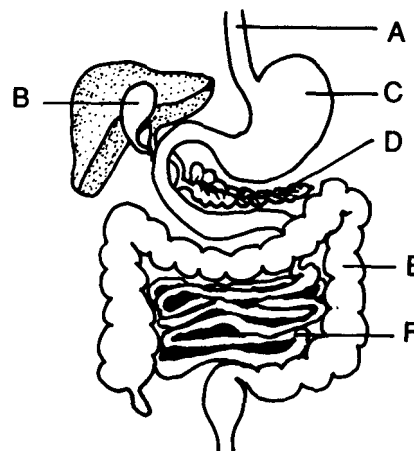


201. Enzyme A may be found in which organ?
- (A) Stomach**
 - (B) Mouth
 - (C) Intestine
 - (D) Liver
 - (E) Kidney
202. An enzyme which works well at a pH of 9 could be which human enzyme?
- (A) Amylase
 - (B) Pepsin
 - (C) Sucrase
 - (D) Trypsin**
 - (E) Maltase

267. Which of the following is the most direct result of the presence of fat in the small intestine?
- (A) The liver produces insulin.
 - (B) The pancreas produces chymotrypsin.
 - (C) The stomach produces pepsin.
 - (D) The intestinal lining produces the hormone secretin.
 - (E) The gall bladder releases bile.**

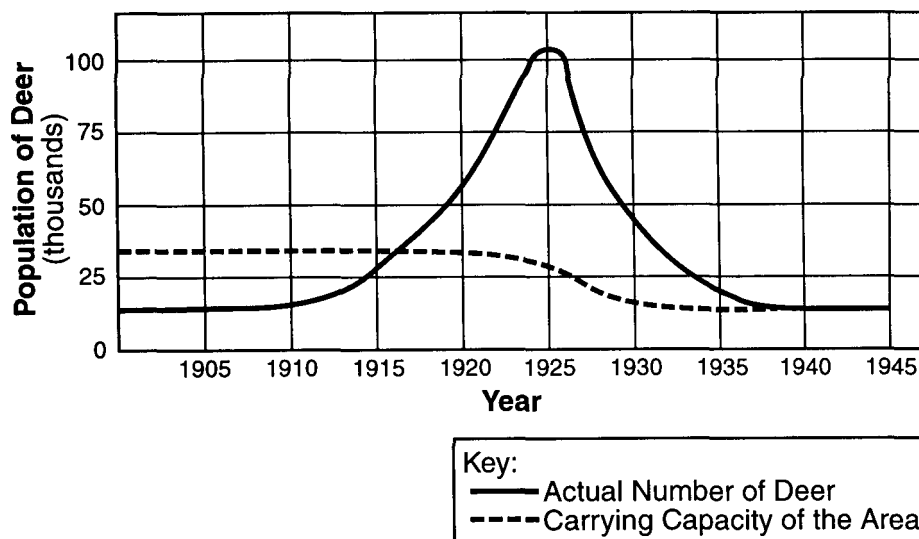
268. Which of the following statements about the stomach is **INCORRECT**?
- (A) It emulsifies fat.**
 - (B) It temporarily stores ingested food.
 - (C) It partially digests protein.
 - (D) It kills bacteria.
 - (E) It secretes mucus.

Base your answers to questions 447 through 451 on the diagram below.



447. Food moves through here in a wavelike motion known as peristalsis
- (A) A, E and F**
 - (B) C and D
 - (C) D and E
 - (D) B, D and E
 - (E) B and E
448. Breaks food down in an acidic environment
- (A) A**
 - (B) B
 - (C) C
 - (D) D
 - (E) E
449. Bile is stored in this organ
- (A) B**
 - (B) C
 - (C) D
 - (D) E
 - (E) F
450. Reabsorbs water and salts
- (A) B
 - (B) C
 - (C) D
 - (D) E**
 - (E) F
451. Secretes enzymes including trypsin and chymotrypsin
- (A) A
 - (B) B
 - (C) C
 - (D) D**
 - (E) F
634. The optimum site in the body and pH level for pepsin activity is
- (A) the small intestine and a pH of 2
 - (B) the small intestine and a pH of 11
 - (C) the stomach and a pH of 2**
 - (D) the stomach and a pH of 11
 - (E) the stomach and a pH of 7

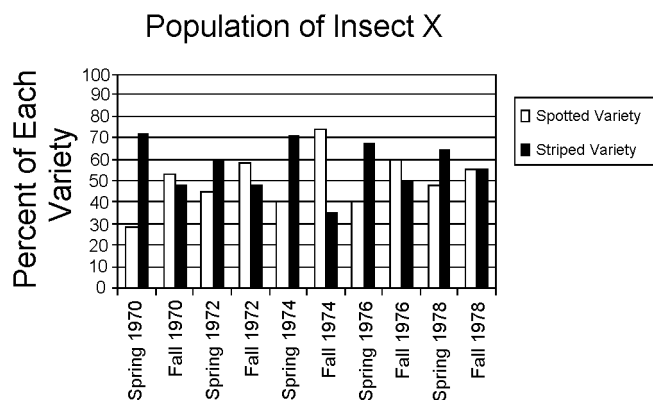
1039. Refer to the diagram below to answer the question.



During what year is the population at equilibrium with its environment?

- (A) 1905 (B) 1915 (C) 1925 (D) 1930 (E) 1940

Base your answers to questions 398 and 399 on the graph below of the hypothetical population of insect X.



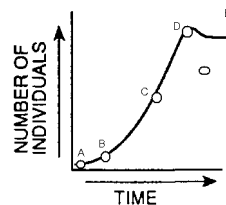
398. Which of the following statements about this population is correct?

- (A) This is an example of balanced polymorphism
 (B) The striped insects feed on the spotted insects
 (C) The gene frequency of the spotted variety is increasing overall
(D) There is no differential mortality
 (E) The gene frequency of the striped variety is increasing overall

399. The most likely conclusion from studying the information presented in the graph is that

- (A) Two different species are involved
(B) One variety may be adaptively superior at one time and the other variety at another time
 (C) There are more spotted insects in the fall than in the spring of each year
 (D) Some years these insects mate in the fall and other years they mate in the spring
 (E) The allele for spotted insects is codominant with the allele for striped

888.



For the environment of the population shown, which point along the curve of the diagram best represents the carrying capacity?

- (A) A (D) D
 (B) B (E) E
 (C) C

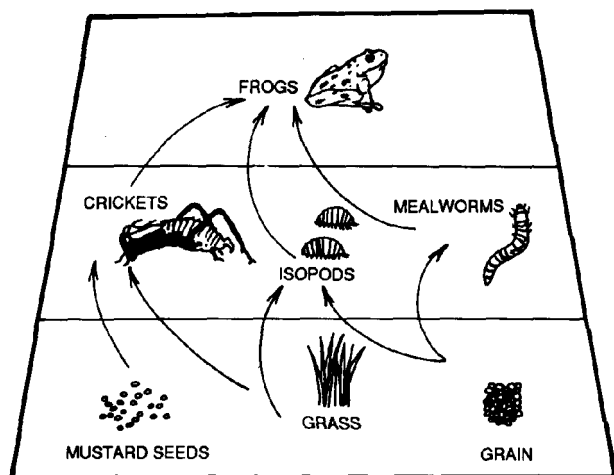
III. ORGANISMS AND POPULATIONS

C. Ecosystems

i. Food Chain, Pyramids, Trophic Levels

826. Select the response that is true of tertiary consumers in an ecosystem.
- (A) There are more secondary consumers than tertiary consumers.
- (B) They eat secondary consumers.**
- (C) They contain the most biomass out of all of the trophic levels.
- (D) They are the strongest and largest trophic level.
- (E) This level of the food chain has the highest amount of diversity.

Base your answers to questions 882 through 884 on the food web below.



882. Which of the following are eaten by consumers?
- (A) crickets, isopods, mealworms, mustard seeds, grass and grain
- (B) frogs, crickets, isopods, mealworms, mustard seeds, grass, grain
- (C) mustard seeds, grass, grain
- (D) crickets, isopods, mealworms**
- (E) frogs

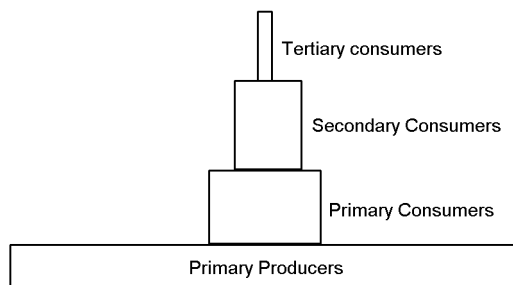
883. All of the following are true about the food web shown EXCEPT
- (A) Most of the biomass is concentrated at the top of the food web.**
- (B) The mustard seeds, grass, and grain are at the producer level of the food web.
- (C) Crickets, isopods, and mealworms are the primary consumers in the food web.
- (D) Frogs are the secondary consumers in the food web.
- (E) Most of the energy is concentrated at the base of the food web.

884. The energy from all the organisms in this food web will inevitably return to the environment after being acted upon by
- (A) decomposer organisms**
- (B) the producer organisms
- (C) the primary consumer organisms
- (D) the secondary consumer organisms
- (E) tertiary consumer organisms

1032. In the four diagrammatic statements below, the arrows should be read as "influences." For example, A \rightarrow B would be read "A influences B," and B \curvearrowright B would read "B influences itself." Which diagrammatic statement best defines ecology?

- (A) organisms \rightarrow environment
 \curvearrowright
- (B) organisms \rightarrow environment
 \curvearrowright
- (C) organisms \leftarrow environment
 \curvearrowright
- (D) organisms \leftrightarrow environment**
 \curvearrowright \curvearrowright
- (E) None of the above.

Base your answers to questions 1199 through 1201 on the pyramid of biomass for an aquatic community.



1199. The greatest amount of energy present in this pyramid is found at the level of
- (A) tertiary consumers **(D) primary producers**
- (B) secondary consumers (E) none of the above
- (C) primary consumers

Base your answers to questions 1572 through 1574 on the information below. You design an experiment to test whether environmental tobacco smoke affects the growth and development of lungs. The experiment involves counting septal cells in lungs of mice exposed to tobacco smoke. The data is shown below.

Control Group		Experimental Group	
Slide #	Septa Count	Slide #	Septa Count
1	10	2	5
3	13	4	5
5	12	6	6
Mean = 11.7		Mean = 5.3	

1572. What conclusions can be reached?

- (A) Mice exposed to smoke have more septa than mice not exposed, giving the exposed mice a larger lung surface area to allow for gas exchange.
- (B) Mice exposed to smoke have fewer septa than mice not exposed, giving the exposed mice a larger lung surface area to allow for gas exchange.
- (C) Mice exposed to smoke have more septa than mice not exposed, giving the exposed mice a smaller lung surface area to allow for gas exchange.
- (D) Mice exposed to smoke have fewer septa than mice not exposed, giving the exposed mice a smaller lung surface area to allow for gas exchange.**
- (E) Septa number is not correlated with lung surface area and gas exchange.

1574. What role can you conclude septa play in gas exchange?

- (A) Additional septa decrease lung volume but increasing alveolar size.
- (B) Additional septa increase lung volume, without changing alveolar size.**
- (C) Additional septa decrease lung surface area, not lung volume.
- (D) Additional septa increase lung surface area, not lung volume.
- (E) Additional septa increase lung volume, as well as alveolar size.

1611. If *Daphnia* are placed in a warm environment their body temperature should

- (A) decrease
- (B) **increase**
- (C) decrease then increase
- (D) increase then decrease
- (E) remain the same

1612. As the body temperature of cold blooded animals increases, their heart rate

- (A) decreases
- (B) **increases**
- (C) decreases then increases
- (D) increases then decreases
- (E) remains the same

1657. What does systolic blood pressure measure?

- (A) Blood pressure maintained by the arterial walls
- (B) Blood pressure generated during relaxation of ventricles
- (C) Blood pressure generated during contraction of ventricles**
- (D) Blood pressure of the heart
- (E) Blood pressure during sleep

1626. The following results were obtained from an experiment with water fleas:

Temperature of Environment (degrees Celcius)	Heartbeat/minute
25	20
45	80

What is the Q_{10} for this experiment?

- (A) 0.5
- (B) 1.0
- (C) 2
- (D) 3**
- (E) 4

1658. Why do people who are physically fit require less time than unfit people to reestablish the resting heart rate following exercise?

- (A) Fit people are better at exercise.
- (B) Fit people breath less often per minute.
- (C) Fit people have a smaller stroke volume.
- (D) Fit people deliver more oxygen to tissues.**
- (E) Fit people have a lower resting heart rate.