

Exam

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following best demonstrates the unity among all organisms? 1) _____
A) emergent properties
B) the structure and function of DNA
C) descent with modification
D) matching DNA nucleotide sequences
E) natural selection
- 2) Which of the following best describes a model organism? 2) _____
A) It is well studied, easy to grow, and results are widely applicable.
B) It lends itself to many studies that are useful to beginning students.
C) It is often pictured in textbooks and easy for students to imagine.
D) It is small, inexpensive to raise, and lives a long time.
E) It has been chosen for study by the earliest biologists.
- 3) Which of the following are qualities of any good scientific hypothesis? 3) _____
I. It is testable.
II. It is falsifiable.
III. It produces quantitative data.
IV. It produces results that can be replicated.
A) I only
B) II only
C) III only
D) I and II
E) III and IV
- 4) When applying the process of science, which of these is tested? 4) _____
A) a hypothesis
B) a question
C) an observation
D) a result
E) a prediction
- 5) Which branch of biology is concerned with the naming and classifying of organisms? 5) _____
A) informatics
B) schematic biology
C) evolution
D) genomics
E) taxonomy

- 6) To understand the chemical basis of inheritance, we must understand the molecular structure of DNA. This is an example of the application of which concept to the study of biology? 6) _____
- A) the cell theory
 - B) feedback regulation
 - C) reductionism
 - D) emergent properties
 - E) evolution
- 7) Which of the following is an example of qualitative data? 7) _____
- A) The fish swam in a zigzag motion.
 - B) The contents of the stomach are mixed every 20 seconds.
 - C) The plant's height is 25 centimeters (cm).
 - D) The six pairs of robins hatched an average of three chicks.
 - E) The temperature decreased from 20°C to 15°C.
- 8) Given the cooperativity of science, which of the following is most likely to result in an investigator being intellectually looked down upon by other scientists? 8) _____
- A) Being found to have falsified or created data to better fit a hypothesis.
 - B) Doing meticulous experiments that show data that contradict what has been previously reported by the scientific community.
 - C) Spending most of a lifetime investigating a small and seemingly unimportant organism.
 - D) Making money as the result of studies in which a new medication is discovered.
 - E) Getting negative results from the same set of experiments.
- 9) Which of these is an example of inductive reasoning? 9) _____
- A) If horses are always found grazing on grass, they can be only herbivores and not omnivores.
 - B) If protists are all single-celled, then they are incapable of aggregating.
 - C) Hundreds of individuals of a species have been observed and all are photosynthetic; therefore, the species is photosynthetic.
 - D) These organisms live in sunny parts of this area so they are able to photosynthesize.
 - E) If two species are members of the same genus, they are more alike than each of them could be to a different genus.
- 10) When the body's blood glucose level rises, the pancreas secretes insulin and, as a result, the blood glucose level declines. When the blood glucose level is low, the pancreas secretes glucagon and, as a result, the blood glucose level rises. Such regulation of the blood glucose level is the result of 10) _____
- A) catalytic feedback.
 - B) bioinformatic regulation.
 - C) negative feedback.
 - D) positive feedback.
 - E) protein-protein interactions.
- 11) What coefficients must be placed in the following blanks so that all atoms are accounted for in the products? 11) _____
- $$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{ ____ } \text{C}_2\text{H}_6\text{O} + \text{ ____ } \text{CO}_2$$
- A) 1; 1 B) 1; 3 C) 3; 1 D) 1; 2 E) 2; 2

Atomic mass →	12 C	16 O	1 H	14 N	32 S	31 P
Atomic number →	6	8	1	7	16	15

- 12) In the figure above, how many electrons does nitrogen have in its valence shell? 12) _____
 A) 14 B) 8 C) 2 D) 5 E) 7
- 13) What is the difference between covalent bonds and ionic bonds? 13) _____
 A) Covalent bonds are formed between atoms to form molecules; ionic bonds are formed between atoms to form compounds.
 B) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the electrical attraction between atoms.
 C) Covalent bonds involve the sharing of pairs of electrons between atoms; ionic bonds involve the sharing of single electrons between atoms.
 D) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the sharing of protons between atoms.
 E) Covalent bonds involve the transfer of electrons between atoms; ionic bonds involve the sharing of electrons between atoms.
- 14) In ammonium chloride salt (NH_4Cl) the anion is a single chloride ion, Cl. What is the cation of NH_4Cl ? 14) _____
 A) H_3 , with a charge of +1
 B) NH_4 , with a charge of +4
 C) NH_4 , with a charge of +1
 D) NH , with a charge of +1
 E) N, with a charge of +1
- 15) What results from an unequal sharing of electrons between atoms? 15) _____
 A) an ionic bond
 B) a nonpolar covalent bond
 C) a polar covalent bond
 D) a hydrophobic interaction
 E) a hydrogen bond
- 16) What is the maximum number of covalent bonds an element with atomic number 8 can make with hydrogen? 16) _____
 A) 3 B) 1 C) 6 D) 2 E) 4

Atomic mass →	12 C	16 O	1 H	14 N	32 S	31 P
Atomic number →	6	8	1	7	16	15

17) Based on electron configuration, which of these elements in the figure above would exhibit a chemical behavior most like that of oxygen? 17) _____

- A) sulfur
- B) hydrogen
- C) carbon
- D) nitrogen
- E) phosphorus

18) Which of the following best describes the relationship between the atoms described below? 18) _____

Atom 1	Atom 2
${}^1_1\text{H}$	${}^3_1\text{H}$

- A) They are polymers.
- B) They each contain 1 neutron.
- C) They are isomers.
- D) They contain 1 and 3 protons, respectively.
- E) They are isotopes.

19) Compared with ${}^{31}\text{P}$, the radioactive isotope ${}^{32}\text{P}$ has 19) _____

- A) a different atomic number.
- B) one more proton.
- C) a different charge.
- D) one more neutron.
- E) one more electron.

20) Which of the following statements is false? 20) _____

- A) Iron is an example of an element needed by all organisms.
- B) Other than some trace elements, animals are mostly made up of the same elements as plants, in similar proportions.
- C) Some trace elements are very abundant on Earth.
- D) Carbon, hydrogen, oxygen, and nitrogen are the most abundant elements of living matter.
- E) Virtually all organisms require the same elements in the same quantities.

21) How many molecules of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$ molecular mass = 180 daltons) would be present in 90 grams of glucose? 21) _____

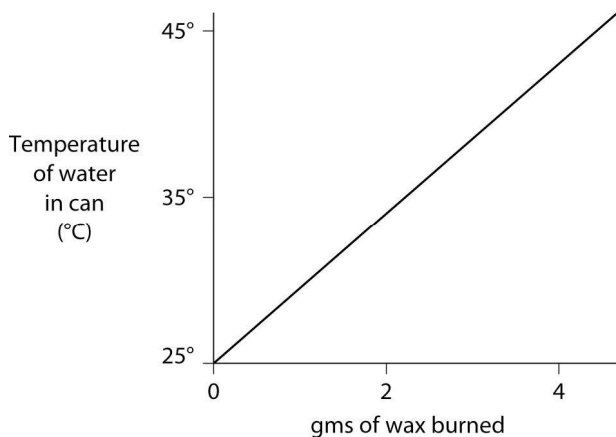
- A) $(90 \times 6.02) \times 10^{23}$
- B) $(90/180) \times 6.02 \times 10^{23}$
- C) $(6.02/180) \times 10^{23}$
- D) 90×10^{23}
- E) $(6.02/90) \times 10^{23}$

- 22) A strong acid like HCl 22) _____
A) both ionizes completely in aqueous solutions and is a strong buffer at low pH.
B) increases the pH when added to an aqueous solution.
C) ionizes completely in an aqueous solution.
D) is a strong buffer at low pH.
E) reacts with strong bases to create a buffered solution.

- 23) Which of the following solutions would require the greatest amount of base to be added to bring the solution to neutral pH? 23) _____
A) household bleach at pH 12
B) gastric juice at pH 2
C) vinegar at pH 3
D) tomato juice at pH 4
E) black coffee at pH 5

- 24) A slice of pizza has 500 kcal. If we could burn the pizza and use all the heat to warm a 50-L container of cold water, what would be the approximate increase in the temperature of the water? (Note: A liter of cold water weighs about 1 kg.) 24) _____
A) 5°C B) 10°C C) 1°C D) 50°C E) 100°C

- 25) A small birthday candle is weighed, then lighted and placed beneath a metal can containing 100 mL of water. Careful records are kept as the temperature of the water rises. Data from this experiment are shown on the graph. What amount of heat energy is released in the burning of candle wax? 25) _____



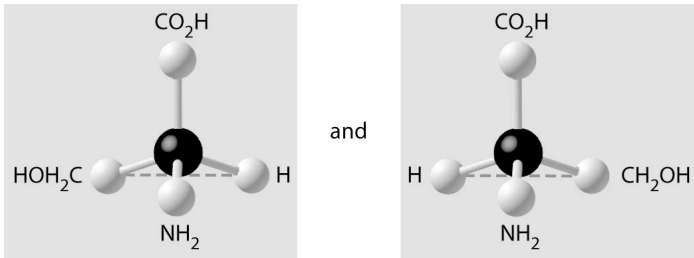
- A) 5 kilocalories per gram of wax burned
B) 50 kilocalories per gram of wax burned
C) 10 kilocalories per gram of wax burned
D) 20 kilocalories per gram of wax burned
E) 0.5 kilocalories per gram of wax burned
- 26) Increased atmospheric CO₂ concentrations might have what effect on seawater? 26) _____
A) Seawater will become more acidic, and carbonate concentrations will decrease.
B) There will be no change in the pH of seawater, because carbonate will turn to bicarbonate.
C) Seawater will become more alkaline, and carbonate concentrations will decrease.
D) Seawater will become more acidic, and bicarbonate concentrations will decrease.
E) Seawater will become more acidic, and carbonate concentrations will increase.

- 27) One mole (mol) of glucose (molecular mass = 180 daltons) is 27) _____
A) 1 kg of glucose dissolved in 1 L of solution.
B) 180×10^{23} molecules of glucose.
C) both 180 grams of glucose and 6.02×10^{23} molecules of glucose.
D) the largest amount of glucose that can be dissolved in 1 L of solution.
E) 180 kilograms of glucose.
- 28) The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called? 28) _____
A) a hydrophilic bond
B) a hydrogen bond
C) a covalent bond
D) a van der Waals interaction
E) an ionic bond
- 29) If a solution has a pH of 7, this means that 29) _____
A) this is a solution of pure water.
B) the concentration of H^+ ions in the water equals the concentration of OH^- ions in the water.
C) this is a solution of pure water, and the concentration of H^+ ions in the water is $10^{-7} M$.
D) there are no H^+ ions in the water.
E) this is a solution of pure water, and the concentration of H^+ ions equals the concentration of OH^- ions in the water.
- 30) You have two beakers. One contains pure water, the other contains pure methanol (wood alcohol). The covalent bonds of methanol molecules are nonpolar, so there are no hydrogen bonds among methanol molecules. You pour crystals of table salt (NaCl) into each beaker. Predict what will happen. 30) _____
A) NaCl crystals will dissolve readily in methanol but will not dissolve in water.
B) NaCl crystals will NOT dissolve in either water or methanol.
C) NaCl crystals will dissolve readily in water but will not dissolve in methanol.
D) When the first crystals of NaCl are added to water or to methanol, they will not dissolve; but as more crystals are added, the crystals will begin to dissolve faster and faster.
E) Equal amounts of NaCl crystals will dissolve in both water and methanol.
- 31) Amino acids are acids because they always possess which functional group? 31) _____
A) hydroxyl
B) amino
C) carboxyl
D) carbonyl
E) phosphate
- 32) Which two functional groups are always found in amino acids? 32) _____
A) hydroxyl and carboxyl
B) ketone and methyl
C) amino and sulfhydryl
D) carboxyl and amino
E) carbonyl and amino

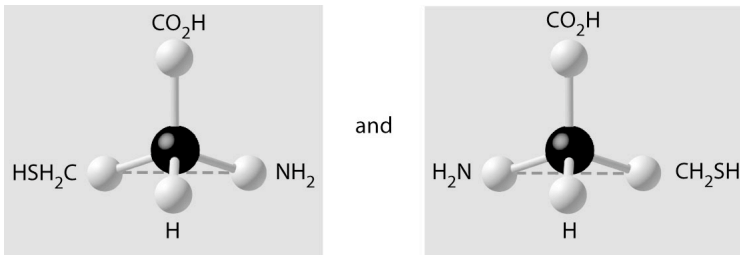
33) Which pair of molecules shown below are *not* enantiomers of a single molecule?

33) _____

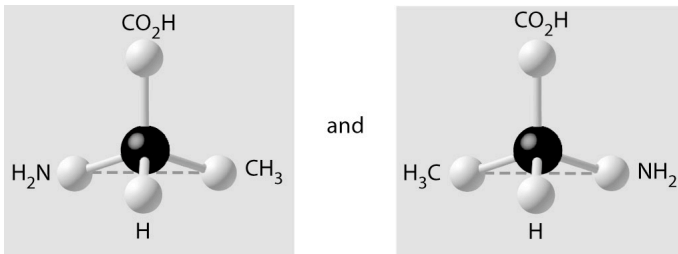
A)



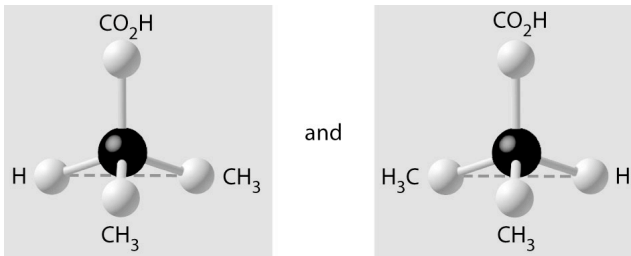
B)



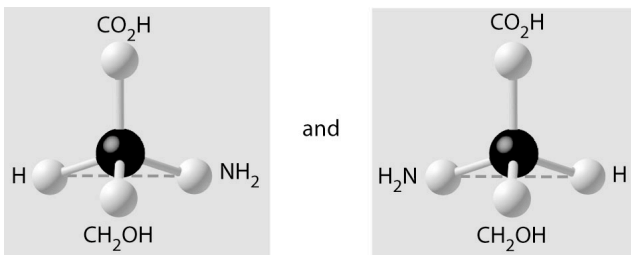
C)

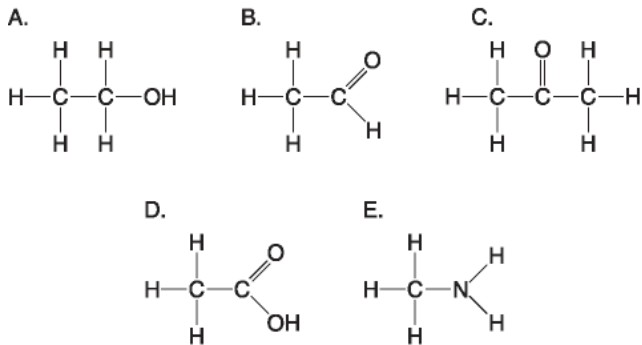


D)



E)

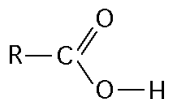




34) Which molecule shown above has a carbonyl functional group in the form of a ketone?

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

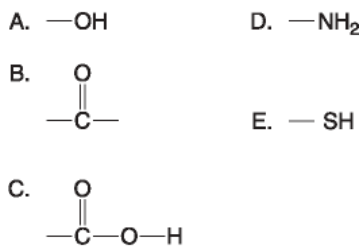
34) _____



35) What is the name of the functional group shown in the figure above?

- A) carbonyl B) aldehyde C) ketone D) carboxyl E) hydroxyl

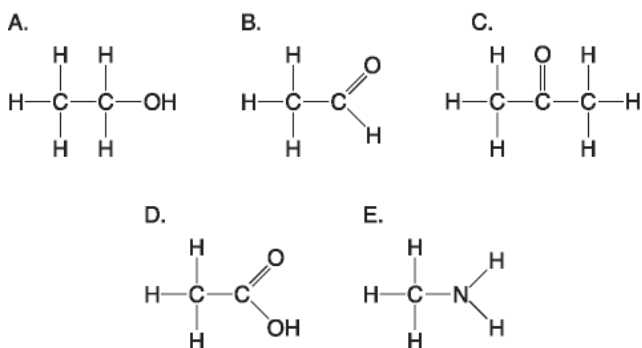
35) _____



36) Which of the groups shown above is a carbonyl functional group?

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

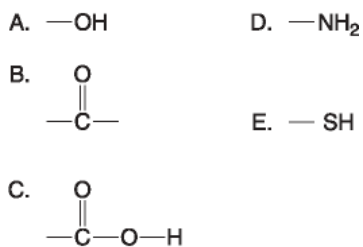
36) _____



37) Which molecule(s) shown above is (are) ionized in aqueous solution at pH 7?

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

37) _____



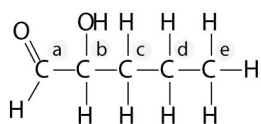
38) Which functional group shown above is characteristic of alcohols? 38) _____

A) A B) B C) C D) D E) E

39) How many electron pairs does carbon share in order to complete its valence shell? 39) _____

A) 1 B) 8 C) 2 D) 4 E) 3

Answer the following questions based on the figure below.



40) Identify the asymmetric carbon in this molecule. 40) _____

A) A B) B C) C D) D E) E

The following questions are based on the 15 molecules illustrated in Figure 5.8. Each molecule may be used once, more than once, or not at all.

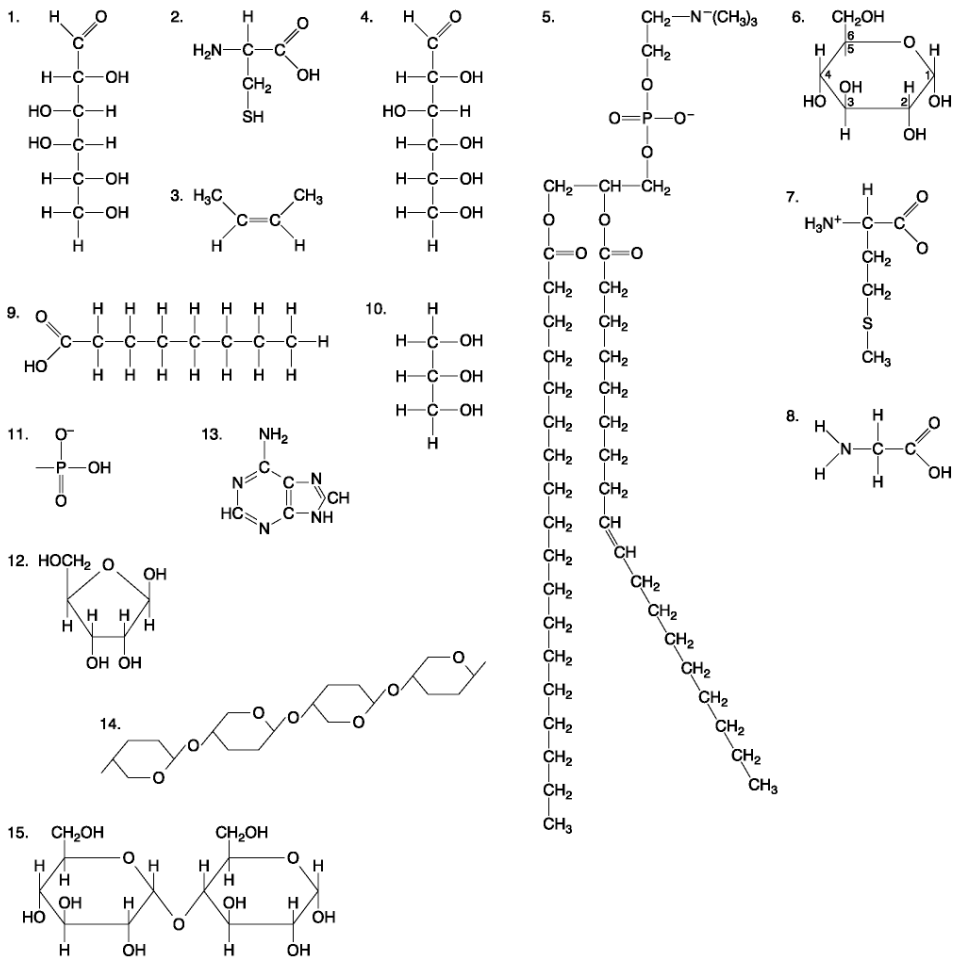


Figure 5.8

41) Which molecule is glycerol?
 A) 15 B) 1

C) 14 D) 10

E) 6

41) _____

Use the following information to answer the questions below.

Approximately 32 different monomeric carbohydrate subunits are found in various natural polysaccharides. Proteins are composed of 20 different amino acids. DNA and RNA are each synthesized from four nucleotides.

42) Among these biological polymers, which has the least structural variety?
 A) DNA B) polysaccharides
 C) proteins D) RNA

42) _____

- 43) Which of these classes of biological molecules consist of both small molecules and macromolecular polymers? 43) _____
- A) carbohydrates
 - B) lipids, carbohydrates, proteins, and nucleic acids all consist of only macromolecular polymers
 - C) lipids
 - D) nucleic acids
 - E) proteins
- 44) The bonding of two amino acid molecules to form a larger molecule requires which of the following? 44) _____
- A) formation of a glycosidic bond
 - B) addition of a water molecule
 - C) formation of a hydrogen bond
 - D) removal of a water molecule
 - E) both removal of a water molecule and formation of a hydrogen bond
- 45) Which of the following statements about the 5' end of a polynucleotide strand of DNA is correct? 45) _____
- A) The 5' end has phosphate attached to the number 5 carbon of the nitrogenous base.
 - B) The 5' end has a phosphate group attached to the number 5 carbon of ribose.
 - C) The 5' end is the fifth position on one of the nitrogenous bases.
 - D) The 5' end has a carboxyl group attached to the number 5 carbon of ribose.
 - E) The 5' end has a hydroxyl group attached to the number 5 carbon of ribose.
- 46) All of the following contain amino acids *except* 46) _____
- A) hemoglobin.
 - B) antibodies.
 - C) enzymes.
 - D) cholesterol.
 - E) insulin.
- 47) Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes? 47) _____
- A) The pyrimidines would be separated from the deoxyribose sugars.
 - B) The phosphodiester linkages of the polynucleotide backbone would be broken.
 - C) All bases would be separated from the deoxyribose sugars.
 - D) The two strands of the double helix would separate.
 - E) The purines would be separated from the deoxyribose sugars.

Use the following information to answer the questions below.

Approximately 32 different monomeric carbohydrate subunits are found in various natural polysaccharides. Proteins are composed of 20 different amino acids. DNA and RNA are each synthesized from four nucleotides.

- 48) Professor Jamey Marth at the University of California, Santa Barbara, identified 70 molecules that are used to build cellular macromolecules and structures. These include at least 34 saccharides, 8 nucleosides, and 20 amino acids. In theory, then, which class of biological polymer has the greatest information-coding capacity? 48) _____
- A) polysaccharides
B) RNA
C) proteins
D) DNA
- 49) Lactose, a sugar in milk, is composed of one glucose molecule joined by a glycosidic linkage to one galactose molecule. How is lactose classified? 49) _____
- A) as a disaccharide
B) as a pentose
C) as a hexose
D) as a monosaccharide
E) as a polysaccharide
- 50) Which of the following categories includes all others in the list? 50) _____
- A) starch
B) carbohydrate
C) polysaccharide
D) monosaccharide
E) disaccharide
- 51) Which structure is the site of the synthesis of proteins that may be exported from the cell? 51) _____
- A) lysosomes
B) rough ER
C) plasmodesmata
D) free cytoplasmic ribosomes
E) Golgi vesicles
- 52) The advantage of light microscopy over electron microscopy is that 52) _____
- A) specimen preparation for light microscopy does not produce artifacts.
B) light microscopy provides for higher magnification than electron microscopy.
C) light microscopy provides higher contrast than electron microscopy.
D) light microscopy provides for higher resolving power than electron microscopy.
E) light microscopy allows one to view dynamic processes in living cells.
- 53) Hydrolytic enzymes must be segregated and packaged to prevent general destruction of cellular components. Which of the following organelles contains these hydrolytic enzymes in animal cells? 53) _____
- A) central vacuole
B) glyoxysome
C) peroxisome
D) chloroplast
E) lysosome

- 54) Thylakoids, DNA, and ribosomes are all components found in 54) _____
A) vacuoles.
B) lysosomes.
C) nuclei.
D) chloroplasts.
E) mitochondria.
- 55) Which organelle is the primary site of ATP synthesis in eukaryotic cells? 55) _____
A) lysosome
B) vacuole
C) mitochondrion
D) peroxisome
E) Golgi apparatus
- 56) Which of the following statements concerning bacteria and archaea cells is correct? 56) _____
A) DNA is present in both archaea cells and bacteria cells.
B) Archaea cells contain a membrane-bound nucleus; bacteria do not.
C) Archaea cells contain small membrane-enclosed organelles; bacteria do not.
D) DNA is present in the mitochondria of both bacteria and archaea cells.
- 57) The nuclear lamina is an array of filaments on the inner side of the nuclear membrane. If a method were found that could cause the lamina to fall into disarray, what would you expect to be the most likely consequence? 57) _____
A) failure of chromosomes to carry genetic information
B) the loss of all nuclear function
C) inability of the nucleus to keep out destructive chemicals
D) a change in the shape of the nucleus
E) the inability of the nucleus to divide during cell division
- 58) Which of the following makes it necessary for animal cells, although they have no cell walls, to have intercellular junctions? 58) _____
A) Cell membranes do not distinguish the types of ions and molecules passing through them.
B) Maintenance of tissue integrity and barriers to fluid leakage requires cells to adhere tightly to one another.
C) Cell-to-cell communication requires physical attachment of one cell to another.
D) Large molecules, such as proteins and RNA molecules, do not readily get through one, much less two, adjacent cell membranes.
E) The relative shapelessness of animal cells requires a mechanism for keeping the cells aligned.
- 59) Which structure is common to plant *and* animal cells? 59) _____
A) centriole
B) chloroplast
C) wall made of cellulose
D) mitochondrion
E) central vacuole

60) Cells require which of the following to form cilia or flagella?

60) _____

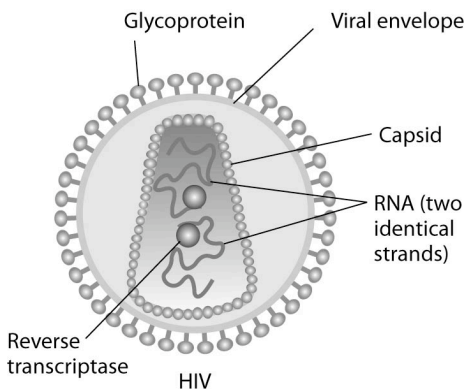
- A) intermediate filaments
- B) actin
- C) laminin
- D) secretory vesicles
- E) centrosomes

61) When a membrane is freeze-fractured, the bilayer splits down the middle between the two layers of phospholipids. In an electron micrograph of a freeze-fractured membrane, the bumps seen on the fractured surface of the membrane are

61) _____

- A) cholesterol molecules.
- B) peripheral proteins.
- C) carbohydrates.
- D) phospholipids.
- E) integral proteins.

Human immunodeficiency virus (HIV) infects cells that have both CD4 and CCR5 cell surface molecules. The viral nucleic acid molecules are enclosed in a protein capsid, and the protein capsid is itself contained inside an envelope consisting of a lipid bilayer membrane and viral glycoproteins. One hypothesis for viral entry into cells is that binding of HIV membrane glycoproteins to CD4 and CCR5 initiates fusion of the HIV membrane with the plasma membrane, releasing the viral capsid into the cytoplasm. An alternative hypothesis is that HIV gains entry into the cell via receptor-mediated endocytosis, and membrane fusion occurs in the endocytotic vesicle. To test these alternative hypotheses for HIV entry, researchers labeled the lipids on the HIV membrane with a red fluorescent dye.



62) What would be observed by live-cell fluorescence microscopy if HIV is endocytosed first, and then fuses with the endocytotic vesicle membrane?

62) _____

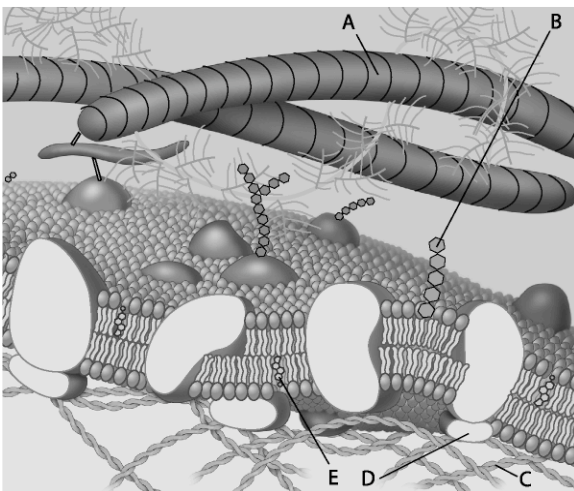
- A) A spot of red fluorescence will remain outside the cell after delivering the viral capsid.
- B) A spot of red fluorescence will move into the infected cell's interior.
- C) A spot of red fluorescence will remain on the infected cell's plasma membrane, marking the site of membrane fusion and HIV entry.
- D) The red fluorescent dye-labeled lipids will diffuse in the endocytotic vesicle membrane and become difficult to detect.
- E) Fluorescence microscopy does not have enough resolution to visualize fluorescently labeled HIV virus particles.

- 63) Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly? 63) _____
- A) starch
 - B) CO₂
 - C) an amino acid
 - D) glucose
 - E) K⁺

Cystic fibrosis is a genetic disease in humans in which the CFTR protein, which functions as a chloride ion channel, is missing or nonfunctional in cell membranes.

- 64) The CFTR protein belongs to what category of membrane proteins? 64) _____
- A) gap junctions
 - B) cotransporters
 - C) aquaporins
 - D) hydrophilic channels
 - E) electrogenic ion pumps

For the following questions, match the labeled component of the cell membrane in the figure with its description.



- 65) Which component is the peripheral protein? 65) _____
- A) A B) B C) C D) D E) E
- 66) You are working on a team that is designing a new drug. In order for this drug to work, it must enter the cytoplasm of specific target cells. Which of the following would be a factor that determines whether the molecule selectively enters the target cells? 66) _____
- A) hydrophobicity of the drug molecule
 - B) similarity of the drug molecule to other molecules transported by the target cells
 - C) lipid composition of the target cells' plasma membrane
 - D) blood or tissue type of the patient
 - E) lack of charge on the drug molecule

- 67) In what way do the membranes of a eukaryotic cell vary? 67) _____
- A) Certain proteins are unique to each membrane.
 - B) Phospholipids are found only in certain membranes.
 - C) Some membranes have hydrophobic surfaces exposed to the cytoplasm, while others have hydrophilic surfaces facing the cytoplasm.
 - D) Only certain membranes of the cell are selectively permeable.
 - E) Only certain membranes are constructed from amphipathic molecules.
- 68) A patient has had a serious accident and lost a lot of blood. In an attempt to replenish body fluids, distilled water—equal to the volume of blood lost—is transferred directly into one of his veins. What will be the most probable result of this transfusion? 68) _____
- A) It will have no unfavorable effect as long as the water is free of viruses and bacteria.
 - B) The patient's red blood cells will shrivel up because the blood fluid has become hypertonic compared to the cells.
 - C) The patient's red blood cells will swell because the blood fluid has become hypotonic compared to the cells.
 - D) The patient's red blood cells will shrivel up because the blood fluid has become hypotonic compared to the cells.
 - E) The patient's red blood cells will burst because the blood fluid has become hypertonic compared to the cells.
- 69) Which of the following would increase the electrochemical potential across a membrane? 69) _____
- A) a chloride channel
 - B) a proton pump
 - C) both a proton pump and a potassium channel
 - D) a potassium channel
 - E) a sucrose-proton cotransporter
- 70) In most cells, there are electrochemical gradients of many ions across the plasma membrane even though there are usually only one or two electrogenic pumps present in the membrane. The gradients of the other ions are most likely accounted for by 70) _____
- A) cotransport proteins.
 - B) cellular metabolic reactions that create or destroy ions.
 - C) passive diffusion across the plasma membrane.
 - D) carrier proteins.
 - E) ion channels.

The following questions are based on the reaction $A + B \leftrightarrow C + D$ shown in Figure 8.1.

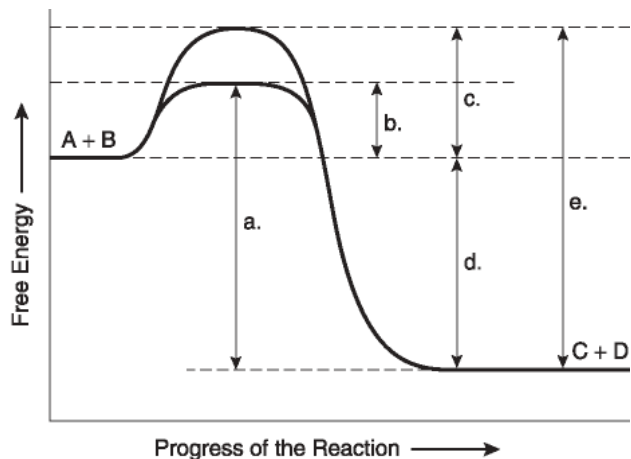


Figure 8.1

71) Which of the following represents the ΔG of the reaction in Figure 8.1?

- A) a B) b C) c D) d E) e

71) _____

A series of enzymes catalyze the reaction $X \rightarrow Y \rightarrow Z \rightarrow A$. Product A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme.

72) What is substance X?

- A) a substrate
 B) an allosteric inhibitor
 C) the product
 D) an intermediate
 E) a coenzyme

72) _____

73) Which of the following is true of enzymes?

- A) Enzymes increase the rate of chemical reaction by providing activation energy to the substrate.
 B) Nonprotein cofactors alter the substrate specificity of enzymes.
 C) Enzyme function is independent of physical and chemical environmental factors such as pH and temperature.
 D) Enzymes increase the rate of chemical reaction by lowering activation energy barriers.
 E) Enzyme function is increased if the 3-D structure or conformation of an enzyme is altered.

73) _____

74) Which of the following statements is representative of the second law of thermodynamics?

- A) Cells require a constant input of energy to maintain their high level of organization.
 B) Conversion of energy from one form to another is always accompanied by some gain of free energy.
 C) Every energy transformation by a cell decreases the entropy of the universe.
 D) Heat represents a form of energy that can be used by most organisms to do work.
 E) Without an input of energy, organisms would tend toward decreasing entropy.

74) _____

75) Which of the following best describes enthalpy (H)?

75) _____

- A) the system's entropy
- B) the total kinetic energy of a system
- C) the condition of a cell that is not able to react
- D) the cell's energy equilibrium
- E) the heat content of a chemical system

76) Which of the following shows the correct changes in thermodynamic properties for a chemical reaction in which amino acids are linked to form a protein?

76) _____

- A) $+\Delta H, -\Delta S, +\Delta G$
- B) $-\Delta H, -\Delta S, +\Delta G$
- C) $+\Delta H, -\Delta S, -\Delta G$
- D) $+\Delta H, +\Delta S, +\Delta G$
- E) $-\Delta H, +\Delta S, +\Delta G$

77) Choose the pair of terms that correctly completes this sentence: Catabolism is to anabolism as _____ is to _____.

77) _____

- A) exergonic; spontaneous
- B) free energy; entropy
- C) exergonic; endergonic
- D) entropy; enthalpy
- E) work; energy

The following questions are based on the reaction $A + B \leftrightarrow C + D$ shown in Figure 8.1.

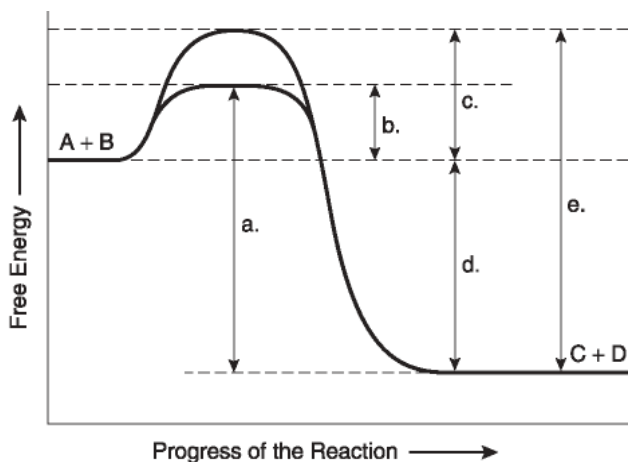
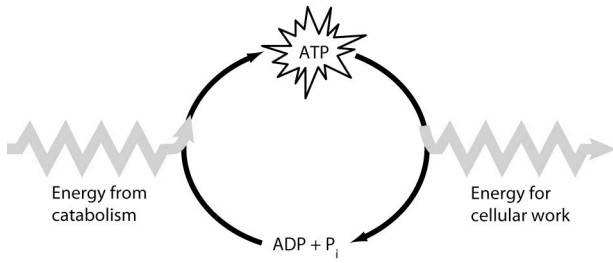


Figure 8.1

78) Which of the following in Figure 8.1 would be the same in either an enzyme-catalyzed or a noncatalyzed reaction?

78) _____

- A) a
- B) b
- C) c
- D) d
- E) e



79) Which of the following is the most correct interpretation of the figure?

79) _____

- A) $\text{ADP} + \text{P}_i$ are a set of molecules that store energy for catabolism.
- B) ATP is a molecule that acts as an intermediary to store energy for cellular work.
- C) Inorganic phosphate is created from organic phosphate.
- D) P_i acts as a shuttle molecule to move energy from ATP to ADP.
- E) Energy from catabolism can be used directly for performing cellular work.

The following questions are based on the reaction $A + B \leftrightarrow C + D$ shown in Figure 8.1.

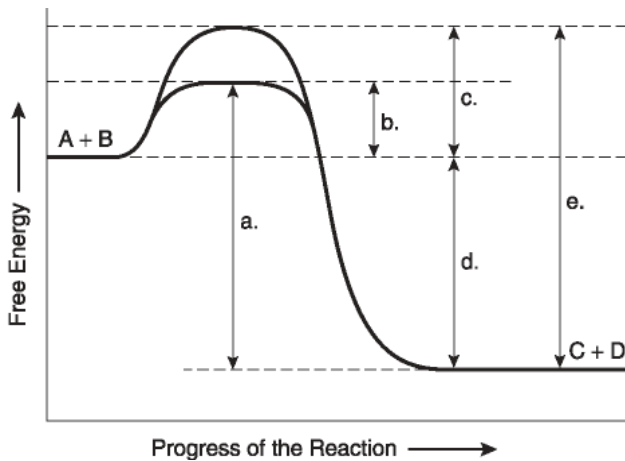


Figure 8.1

80) Which of the following terms best describes the forward reaction in Figure 8.1?

80) _____

- A) chemical equilibrium, $\Delta G = 0$
- B) exergonic, $\Delta G > 0$
- C) endergonic, $\Delta G > 0$
- D) endergonic, $\Delta G < 0$
- E) exergonic, $\Delta G < 0$

81) Which of the following occurs in the cytosol of a eukaryotic cell?

81) _____

- A) citric acid cycle
- B) fermentation and chemiosmosis
- C) oxidation of pyruvate to acetyl CoA
- D) oxidative phosphorylation
- E) glycolysis and fermentation

82) Which of the following statements describes NAD⁺? 82) _____

A) NAD⁺ is reduced to NADH during glycolysis, pyruvate oxidation, and the citric acid cycle.
 B) In the absence of NAD⁺, glycolysis can still function.
 C) NAD⁺ has more chemical energy than NADH.
 D) NAD⁺ is oxidized by the action of hydrogenases.
 E) NAD⁺ can donate electrons for use in oxidative phosphorylation.

83) The *immediate* energy source that drives ATP synthesis by ATP synthase during oxidative phosphorylation is the 83) _____

A) oxidation of glucose and other organic compounds.
 B) H⁺ concentration across the membrane holding ATP synthase.
 C) flow of electrons down the electron transport chain.
 D) transfer of phosphate to ADP.
 E) affinity of oxygen for electrons.

84) In glycolysis, for each molecule of glucose oxidized to pyruvate 84) _____

A) two molecules of ATP are used and four molecules of ATP are produced.
 B) two molecules of ATP are used and two molecules of ATP are produced.
 C) six molecules of ATP are used and six molecules of ATP are produced.
 D) four molecules of ATP are used and two molecules of ATP are produced.
 E) two molecules of ATP are used and six molecules of ATP are produced.

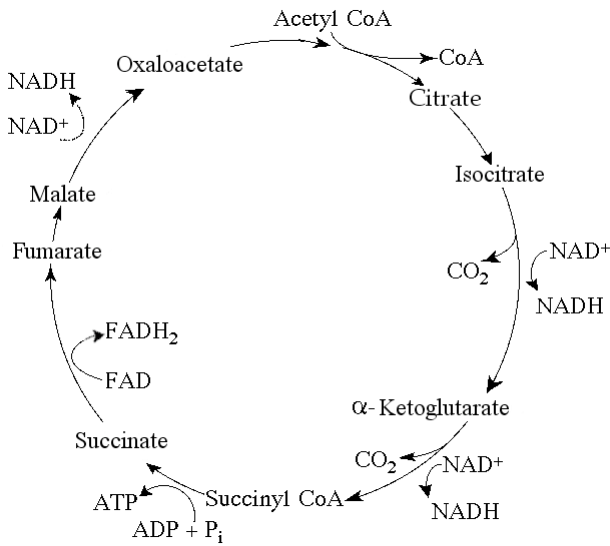


Figure 9.2 The citric acid cycle.

85) Starting with one molecule of isocitrate and ending with fumarate, how many ATP molecules can be made through substrate-level phosphorylation (see Figure 9.2)? 85) _____

A) 12 B) 1 C) 2 D) 11 E) 24

- 86) When skeletal muscle cells are oxygen-deprived, the heart still pumps. What must the heart muscle cells be able to do? 86) _____
- A) derive sufficient energy from fermentation
 - B) continue aerobic metabolism when skeletal muscle cannot
 - C) remove lactate from the blood
 - D) transform lactate to pyruvate again
 - E) remove oxygen from lactate
- 87) Yeast cells that have defective mitochondria incapable of respiration will be able to grow by catabolizing which of the following carbon sources for energy? 87) _____
- A) fatty acids
 - B) glucose, proteins, and fatty acids
 - C) proteins
 - D) Such yeast cells will not be capable of catabolizing any food molecules, and will therefore die.
 - E) glucose
- 88) Starting with one molecule of glucose, the energy-containing products of glycolysis are 88) _____
- A) 2 FADH₂, 2 pyruvate, and 4 ATP.
 - B) 6 CO₂, 30 ATP, and 2 pyruvate.
 - C) 6 CO₂, 2 ATP, and 2 pyruvate.
 - D) 2 NAD⁺, 2 pyruvate, and 2 ATP.
 - E) 2 NADH, 2 pyruvate, and 2 ATP.
- 89) In addition to ATP, what are the end products of glycolysis? 89) _____
- A) H₂O, FADH₂, and citrate
 - B) NADH and pyruvate
 - C) CO₂ and pyruvate
 - D) CO₂ and H₂O
 - E) CO₂ and NADH
- 90) What is the term for metabolic pathways that release stored energy by breaking down complex molecules? 90) _____
- A) anabolic pathways
 - B) fermentation pathways
 - C) catabolic pathways
 - D) bioenergetic pathways
 - E) thermodynamic pathways
- 91) In a cyanobacterium, the reactions that produce NADPH occur in 91) _____
- A) neither the light reactions nor the Calvin cycle.
 - B) the Calvin cycle alone.
 - C) the chloroplast, but is not part of photosynthesis.
 - D) both the light reactions and the Calvin cycle.
 - E) the light reactions alone.

- 92) The reactions that produce molecular oxygen (O_2) take place in 92) _____
- A) the light reactions alone.
 - B) both the light reactions and the Calvin cycle.
 - C) the Calvin cycle alone.
 - D) the chloroplast, but are not part of photosynthesis.
 - E) neither the light reactions nor the Calvin cycle.
- 93) In the thylakoid membranes, what is the main role of the antenna pigment molecules? 93) _____
- A) split water and release oxygen to the reaction-center chlorophyll
 - B) synthesize ATP from ADP and P_i
 - C) transfer electrons to ferredoxin and then NADPH
 - D) harvest photons and transfer light energy to the reaction-center chlorophyll
 - E) concentrate photons within the stroma
- 94) In thylakoids, protons travel through ATP synthase from the thylakoid space to the stroma. Therefore, the catalytic "knobs" of ATP synthase would be located 94) _____
- A) on the stromal side of the membrane.
 - B) on the side facing the thylakoid space.
 - C) on the ATP molecules themselves.
 - D) built into the center of the thylakoid stack (granum).
 - E) on the pigment molecules of photosystem I and photosystem II.
- 95) Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle? 95) _____
- A) H_2O and O_2
 - B) electrons and H^+
 - C) ADP, P_i , and $NADP^+$
 - D) CO_2 and glucose
 - E) ATP and NADPH
- 96) In the process of carbon fixation, RuBP attaches a CO_2 to produce a six-carbon molecule, which is then split to produce two molecules of 3-phosphoglycerate. After phosphorylation and reduction produces glyceraldehyde 3-phosphate (G3P), what more needs to happen to complete the Calvin cycle? 96) _____
- A) regeneration of RuBP
 - B) addition of a pair of electrons from NADPH
 - C) regeneration of ATP from ADP
 - D) inactivation of RuBP carboxylase enzyme
 - E) regeneration of $NADP^+$

97) Cyclic electron flow may be photoprotective (protective to light-induced damage). Which of the following experiments could provide information on this phenomenon? 97) _____

- A) use bacteria with only cyclic flow and measure the number and types of photosynthetic pigments they have in their membranes
- B) use plants that can carry out both linear and cyclic electron flow, or only one or another of these processes, and compare their light absorbance at different wavelengths and different light intensities
- C) use mutated organisms that can grow but that cannot carry out cyclic flow of electrons and compare their abilities to photosynthesize in different light intensities against those of wild-type organisms
- D) use plants with only photosystem I operative and measure how much damage occurs at different wavelengths
- E) use bacteria that have only cyclic flow and look for their frequency of mutation damage at different light intensities

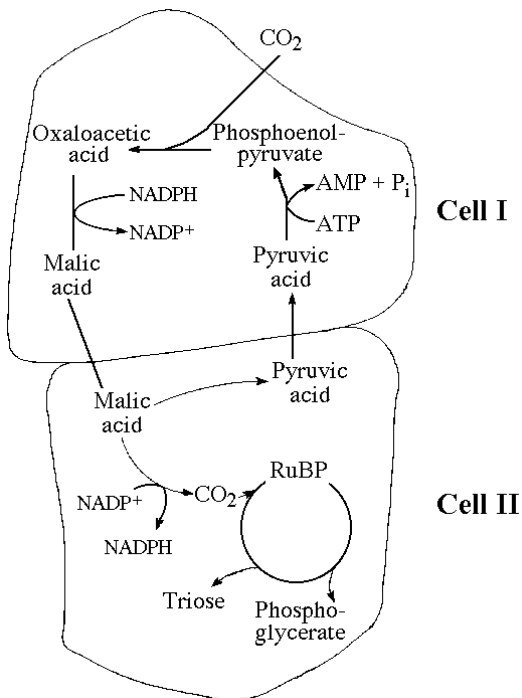


Figure 10.3

98) Referring to Figure 10.3, oxygen would inhibit the CO₂ fixation reactions in 98) _____

- A) neither cell I nor cell II.
- B) cell II only.
- C) both cell I and cell II.
- D) cell I during the night and cell II during the day.
- E) cell I only.

- 99) When oxygen is released as a result of photosynthesis, it is a direct by-product of 99) _____
- A) reducing NADP⁺.
 - B) the electron transfer system of photosystem II.
 - C) chemiosmosis.
 - D) the electron transfer system of photosystem I.
 - E) splitting water molecules.
- 100) In mitochondria, chemiosmosis translocates protons from the matrix into the intermembrane space, whereas in chloroplasts, chemiosmosis translocates protons from 100) _____
- A) the matrix to the stroma.
 - B) the thylakoid space to the stroma.
 - C) the intermembrane space to the matrix.
 - D) the stroma to the photosystem II.
 - E) the stroma to the thylakoid space.
- 101) Binding of a signaling molecule to which type of receptor leads directly to a change in the distribution of ions on opposite sides of the membrane? 101) _____
- A) ligand-gated ion channel
 - B) G protein-coupled receptor
 - C) phosphorylated receptor tyrosine kinase dimer
 - D) receptor tyrosine kinase
 - E) intracellular receptor
- 102) Which of the following is a correct association? 102) _____
- A) phosphodiesterase activity and the removal of phosphate groups
 - B) kinase activity and the addition of a tyrosine
 - C) adenylyl cyclase activity and the conversion of cAMP to AMP
 - D) GTPase activity and hydrolysis of GTP to GDP
 - E) phosphorylase activity and the catabolism of glucose
- 103) Which of the following describes the events of apoptosis? 103) _____
- A) Its DNA and organelles are fragmented, the cell shrinks and forms blebs, and the cell self-digests.
 - B) Its DNA and organelles become fragmented, it dies, and it is phagocytized.
 - C) The cell dies and the presence of its fragmented contents stimulates nearby cells to divide.
 - D) The cell dies, it is lysed, its organelles are phagocytized, and its contents are recycled.
 - E) Its nucleus and organelles are lysed, then the cell enlarges and bursts.
- 104) In which of the following ways could signal transduction most probably be explored in research to treat cancer? 104) _____
- A) increase in the concentration of phosphodiesterases in order to produce more AMP
 - B) expansion of the role of transduction inhibitors in the cells before they give rise to cancer
 - C) increase in calcium ion uptake into the cytoplasm in order to modulate the effects of environmental carcinogens
 - D) removal of serine/threonine phosphate acceptors from transduction pathways in colon pre-cancerous growths
 - E) alteration of protein kinases in cell cycle regulation in order to slow cancer growth

- 105) What is most likely to happen to an animal's target cells that lack receptors for local regulators? 105) _____
- A) Hormones would not be able to interact with target cells.
 - B) They could divide but never reach full size.
 - C) They might not be able to multiply in response to growth factors from nearby cells.
 - D) They could develop normally in response to neurotransmitters instead.
 - E) They might compensate by receiving nutrients via a factor.
- 106) Using the yeast signal transduction pathways, both types of mating cells release the mating factors. These factors bind to specific receptors on the correct cells, 106) _____
- A) then one cell nucleus binds the mating factors and produces a new nucleus in the opposite cell.
 - B) which in turn releases a growth factor that stimulates mitosis in both cells.
 - C) which induce changes in the cells that lead to cell fusion.
 - D) stimulating cell membrane disintegration, releasing the mating factors that lead to new yeast cells.
 - E) which produce more of the a factor in a positive feedback.
- 107) If a pharmaceutical company wished to design a drug to maintain low blood sugar levels, one approach might be to design a compound 107) _____
- A) that increases phosphorylase activity.
 - B) that activates epinephrine receptors.
 - C) that increases cAMP production in liver cells.
 - D) that keeps sugar molecules from crossing the plasma membrane of liver cells.
 - E) to block G protein activity in liver cells.
- 108) What are scaffolding proteins? 108) _____
- A) ladderlike proteins that allow receptor-ligand complexes to climb through cells from one position to another
 - B) relay proteins that orient receptors and their ligands in appropriate directions to facilitate their complexing
 - C) proteins that can reach into the nucleus of a cell to affect transcription
 - D) microtubular protein arrays that allow lipid-soluble hormones to get from the cell membrane to the nuclear pores
 - E) large molecules to which several relay proteins attach to facilitate cascade effects
- 109) Because most receptors are membrane proteins, which of the following is usually true? 109) _____
- A) They change their conformation after binding with signal polypeptides.
 - B) They open and close in response to protein signals.
 - C) They preferentially bind with lipid or glycolipid signal molecules.
 - D) They lead to changes in intracellular ion concentration.
 - E) They are only attached to one membrane surface: exterior or interior.
- 110) Lipid-soluble signaling molecules, such as testosterone, cross the membranes of all cells but affect only target cells because 110) _____
- A) intracellular receptors are present only in target cells.
 - B) only target cells possess the cytosolic enzymes that transduce the testosterone.
 - C) only target cells retain the appropriate DNA segments.
 - D) only in target cells is testosterone able to initiate the phosphorylation cascade leading to activated transcription factor.
 - E) most cells lack the Y chromosome required.

- 111) Besides the ability of some cancer cells to overproliferate, what else could logically result in a tumor? 111) _____
- A) lack of appropriate cell death
 - B) inability to form spindles
 - C) metastasis
 - D) changes in the order of cell cycle stages
 - E) inability of chromosomes to meet at the metaphase plate
- 112) If cells in the process of dividing are subjected to colchicine, a drug that interferes with the formation of the spindle apparatus, at which stage will mitosis be arrested? 112) _____
- A) telophase
 - B) interphase
 - C) anaphase
 - D) metaphase
 - E) prophase
- 113) Which of the following does *not* occur during mitosis? 113) _____
- A) spindle formation
 - B) separation of the spindle poles
 - C) condensation of the chromosomes
 - D) replication of the DNA
 - E) separation of sister chromatids
- 114) What causes the decrease in the amount of cyclin at a specific point in the cell cycle? 114) _____
- A) the changing ratio of cytoplasm to genome
 - B) an increase in production once the restriction point is passed
 - C) the cascade of increased production once its protein is phosphorylated by Cdk
 - D) the binding of PDGF to receptors on the cell surface
 - E) its destruction by a process initiated by the activity of its complex with a cyclin
- 115) Suppose a biologist can separate one of a dozen pieces of chromatin from a eukaryotic (animal) nucleus. It might consist of which of the following? 115) _____
- A) two chromatids attached together at a centromere
 - B) a single circular piece of DNA
 - C) two long strands of DNA plus proteins
 - D) two chromosomes, each with six chromatids
 - E) one-twelfth of the genes of the organism
- 116) Which of the following is true concerning cancer cells? 116) _____
- A) When they stop dividing, they do so at random points in the cell cycle; they are not subject to cell cycle controls; and they do not exhibit density-dependent inhibition when growing in culture.
 - B) When they stop dividing, they do so at random points in the cell cycle.
 - C) They are not subject to cell cycle controls.
 - D) When they stop dividing, they do so at random points in the cell cycle, and they are not subject to cell cycle controls.
 - E) They do not exhibit density-dependent inhibition when growing in culture.

- 117) If there are 20 centromeres in a cell at anaphase, how many chromosomes are there in each daughter cell following cytokinesis? 117) _____
- A) 40 B) 30 C) 20 D) 80 E) 10

Use the data in Table 12.1 to answer the following questions.

The data were obtained from a study of the length of time spent in each phase of the cell cycle by cells of three eukaryotic organisms designated beta, delta, and gamma.

Cell Type	G ₁	S	G ₂	M
Beta	18	24	12	16
Delta	100	0	0	0
Gamma	18	48	14	20

Table 12.1: Minutes Spent in Cell Cycle Phases

- 118) The best conclusion concerning delta is that the cells 118) _____
- A) are actually in the G₀ phase.
 B) divide in the G₁ phase.
 C) contain no RNA.
 D) contain only one chromosome that is very short.
 E) contain no DNA.

The following questions are based on Figure 12.3.

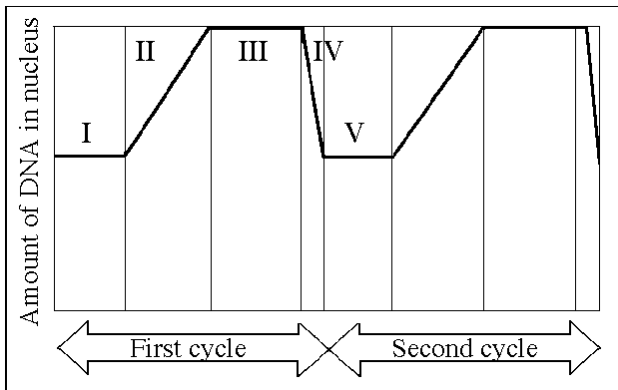


Figure 12.3

- 119) In the figure above, mitosis is represented by which numbered part(s) of the cycle? 119) _____
- A) I B) II C) III D) IV E) V

Use the following information to answer the questions below.

The lettered circle in Figure 12.1 shows a diploid nucleus with four chromosomes. There are two pairs of homologous chromosomes, one long and the other short. One haploid set is symbolized as black and the other haploid set is gray. The chromosomes in the unlettered circle have not yet replicated. Choose the correct chromosomal conditions for the following stages.

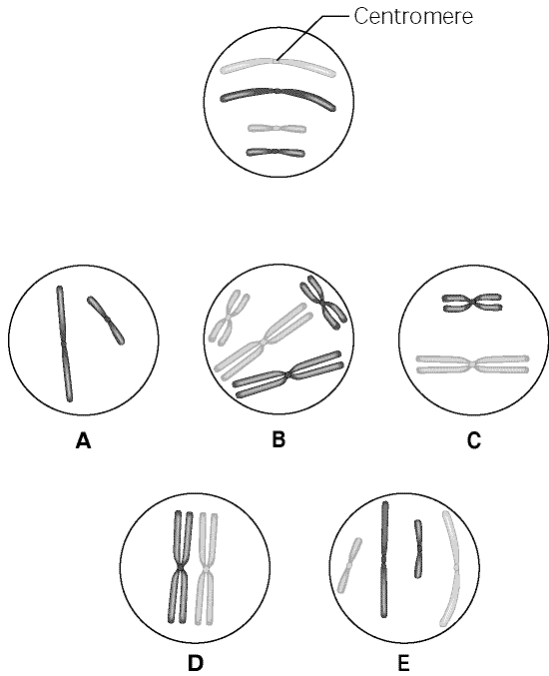


Figure 12.1

120) What is the correct chromosomal condition for one daughter nucleus at telophase of mitosis?

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

120) _____

You have isolated DNA from three different cell types of an organism, determined the relative DNA content for each type, and plotted the results on the graph shown in Figure 13.3. Refer to the graph to answer the following questions.

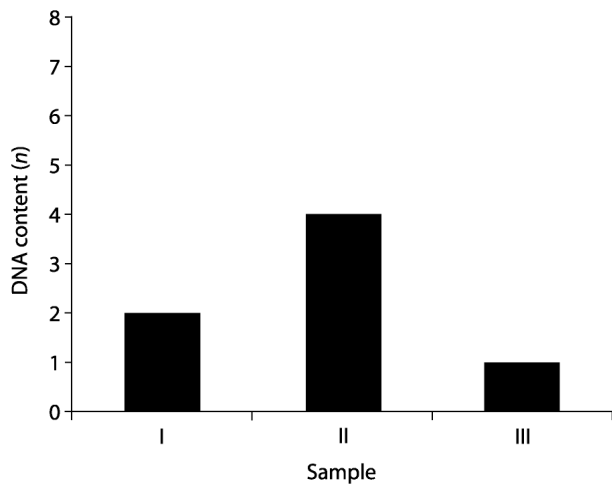


Figure 13.3

121) Which sample of DNA might be from a nerve cell arrested in G_0 of the cell cycle?

121) _____

- A) I
- B) II
- C) III
- D) either I or II
- E) either I or III

Refer to the life cycles illustrated in Figure 13.1 to answer the following questions.

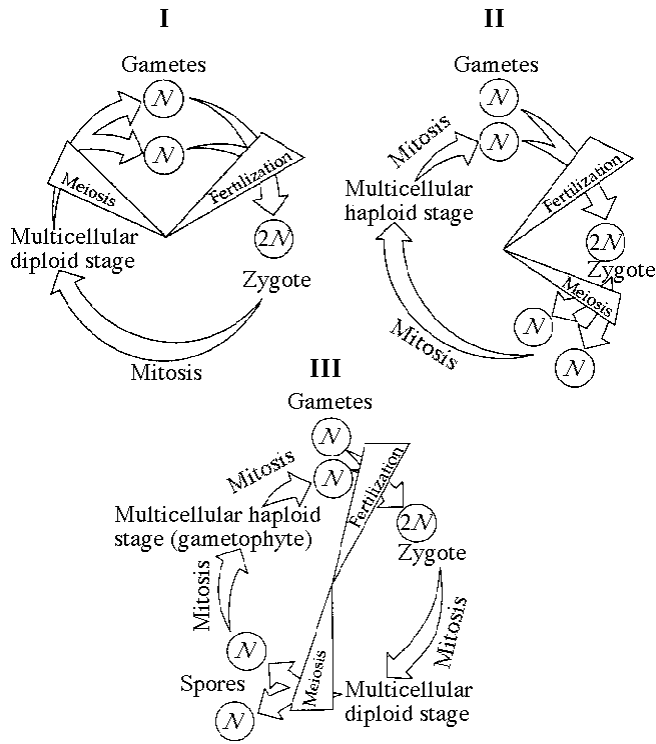


Figure 13.1

- 122) Which of the life cycles is typical for animals? 122) _____
 A) I only B) II only C) III only D) I and II E) I and III
- 123) The karyotype of one species of primate has 48 chromosomes. In a particular female, cell division goes awry and she produces one of her eggs with an extra chromosome (25). The most probable source of this error would be a mistake in which of the following? 123) _____
 A) mitosis in her ovary
 B) metaphase I of one meiotic event
 C) telophase I of one meiotic event
 D) either anaphase I or II
 E) telophase II of one meiotic event

Refer to the following information and Figure 13.4 to answer the following questions.

A certain (hypothetical) organism is diploid, has either blue or orange wings as the consequence of one of its genes on chromosome 12, and has either long or short antennae as the result of a second gene on chromosome 19, as shown in Figure 13.4.

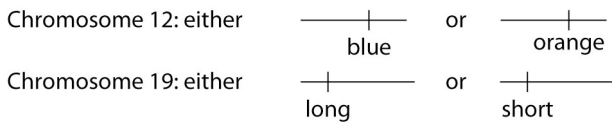


Figure 13.4

- 124) A certain female's number 12 chromosomes both have the blue gene and number 19 chromosomes both have the long gene. As cells in her ovaries undergo meiosis, her resulting eggs (ova) may have which of the following? 124) _____
- A) one chromosome 12 with one blue gene and one chromosome 19 with one long gene
 - B) either one blue or one orange gene in addition to either one long or one short gene
 - C) either two number 19 chromosomes with long genes or two with short genes
 - D) either two number 12 chromosomes with blue genes or two with orange genes
- 125) Which of the following might result in a human zygote with 45 chromosomes? 125) _____
- A) fertilization of a 23 chromosome human egg by a 22 chromosome sperm of a closely related species
 - B) failure of the egg nucleus to be fertilized by the sperm
 - C) an error in the alignment of chromosomes on the metaphase plate
 - D) lack of chiasmata in prophase I
 - E) an error in either egg or sperm meiotic anaphase
- 126) Eukaryotic sexual life cycles show tremendous variation. Of the following elements, which do all sexual life cycles have in common? 126) _____
- I. Alternation of generations
 - II. Meiosis
 - III. Fertilization
 - IV. Gametes
 - V. Spores
- A) II, IV, and V
 - B) I, II, and IV
 - C) I, IV, and V
 - D) II, III, and IV
 - E) I, II, III, IV, and V

You have isolated DNA from three different cell types of an organism, determined the relative DNA content for each type, and plotted the results on the graph shown in Figure 13.3. Refer to the graph to answer the following questions.

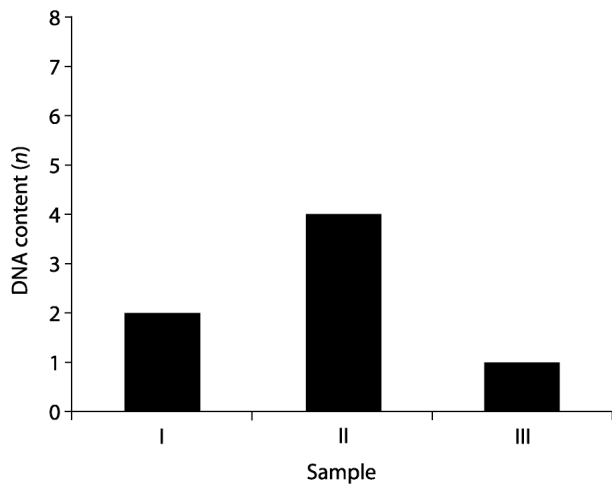


Figure 13.3

- 127) Which sample might represent an animal cell in the G₂ phase of the cell cycle? 127) _____
- A) I
 - B) II
 - C) III
 - D) both I and II
 - E) either II or III
- 128) If an organism is diploid and a certain gene found in the organism has 18 known alleles (variants), then any given organism of that species can/must have which of the following? 128) _____
- A) at most, 2 alleles for that gene
 - B) up to 18 genes for that trait
 - C) a haploid number of 9 chromosomes
 - D) up to 18 chromosomes with that gene
 - E) up to, but not more than, 18 different traits
- 129) To view and analyze human chromosomes in a dividing cell, which of the following is/are required? 129) _____
- A) fluorescent staining
 - B) a stain particular to human cells
 - C) DNA stain and a light microscope
 - D) radioactive staining
 - E) electron microscope

Use the following information to answer the next questions.

There is a group of invertebrate animals called rotifers, among which a particular group of species reproduces, as far as is known, only asexually. These rotifers, however, have survived a long evolutionary history without evidence of having been overcome by excessive mutations.

- 130) In these asexual rotifers, how does variation occur without meiosis and fertilization? 130) _____
- A) Rotifers must produce haploid spores.
 - B) The rotifers have evolved a different mechanism to exchange DNA.
 - C) Variation is caused by mutation and maintained by selection.
 - D) Rotifers must live only in specialized environments.
 - E) Some rotifers must selectively lose chromosomes.

Use the following pedigree (Figure 14.3) for a family in which dark-shaded symbols represent individuals with one of the two major types of colon cancer. Numbers under the symbols are the individual's age at the time of diagnosis.

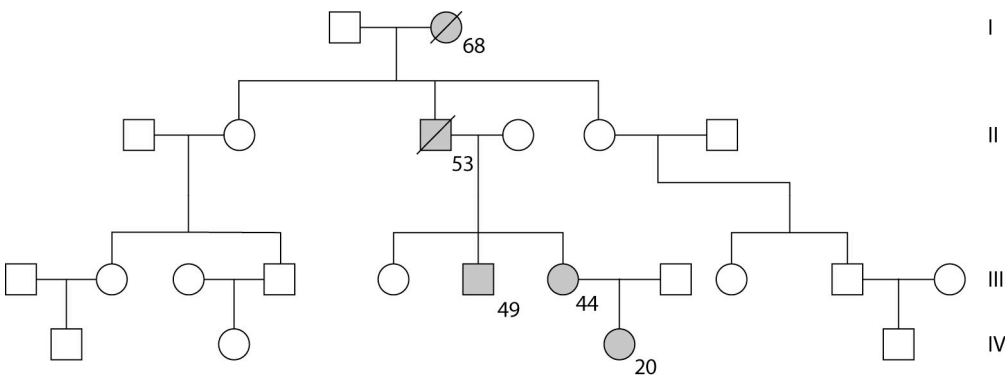


Figure 14.3

- 131) In each generation of this family after generation I, the age at diagnosis is significantly lower than would be found in nonfamilial (sporadic) cases of this cancer (~ 63 years). What is the most likely reason? 131) _____
- A) This cancer requires mutations in more than this one gene.
 - B) Affected members of this family are born with colon cancer, and it can be detected whenever they are first tested.
 - C) Members of this family know to be checked for colon cancer early in life.
 - D) Hereditary (or familial) cases of this cancer typically occur at earlier ages than do nonfamilial forms.
 - E) This is pure chance; it would not be expected if you were to look at a different family.

Use the following information to answer the questions below.

Labrador retrievers are black, brown, or yellow. In a cross of a black female with a brown male, results can be either all black puppies, 1/2 black to 1/2 brown puppies, or 3/4 black to 1/4 yellow puppies.

- 132) How many genes must be responsible for these coat colors in Labrador retrievers? 132) _____
- A) 2
 - B) 3
 - C) 1
 - D) 4
 - E) 5

Use the information given here to answer the following questions.

Feather color in budgies is determined by two different genes, Y and B , one for pigment on the outside and one for the inside of the feather. $YYBB$, $YyBB$, or $YYBb$ is green; $yyBB$ or $yyBb$ is blue; $YYbb$ or $Yybb$ is yellow; and $yybb$ is white.

- 133) A blue budgie is crossed with a white budgie. Which of the following results is *not* possible? 133) _____
- A) a 9:3:3:1 ratio
 - B) blue offspring only
 - C) green and yellow offspring
 - D) yellow offspring only
 - E) green offspring only

Use Figure 14.1 and the following description to answer the questions below.

In a particular plant, leaf color is controlled by gene locus D . Plants with at least one allele D have dark green leaves, and plants with the homozygous recessive dd genotype have light green leaves. A true-breeding dark-leaved plant is crossed with a light-leaved one, and the F_1 offspring is allowed to self-pollinate. The predicted outcome of the F_2 is diagrammed in the Punnett square shown in Figure 14.1, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

	D	d
D	1	2
d	3	4

Figure 14.1

- 134) Which of the boxes correspond to plants with a heterozygous genotype? 134) _____
- A) 1
 - B) 2, 3, and 4
 - C) 1, 2, and 3
 - D) 1 and 2
 - E) 2 and 3
- 135) A scientist discovers a DNA-based test for one allele of a particular gene. This and only this allele, if homozygous, produces an effect that results in death at or about the time of birth. Of the following, which is the best use of this discovery? 135) _____
- A) Follow the segregation of the allele during meiosis.
 - B) Test school-age children for the disorder.
 - C) Design a test for identifying heterozygous carriers of the allele.
 - D) Screen all newborns of an at-risk population.
 - E) Introduce a normal allele into deficient newborns.

- 136) Which of the following is an example of polygenic inheritance? 136) _____
- A) pink flowers in snapdragons
 - B) skin pigmentation in humans
 - C) Huntington's disease in humans
 - D) the ABO blood group in humans
 - E) white and purple flower color in peas

- 137) Which of the following is the best statement of the use of the addition rule of probability? 137) _____
- A) the probability of producing two or more heterozygous offspring
 - B) the probability that two or more independent events will both occur in the offspring of one set of parents
 - C) the probability that either one of two independent events will occur
 - D) the probability that two or more independent events will both occur
 - E) the likelihood that a trait is due to two or more meiotic events

Use the following information to answer the questions below.

Tallness (T) in snapdragons is dominant to dwarfness (t), while red (R) flower color is dominant to white (r). The heterozygous condition results in pink (Rr) flower color.

- 138) If snapdragons are heterozygous for height as well as for flower color, a mating between them will result in what ratio? 138) _____
- A) 6:3:3:2:1:1
 - B) 1:2:1
 - C) 27:9:9:9:3:3:3:1
 - D) 9:3:3:1
 - E) 9:4:3

Use the following information to answer the questions below.

Skin color in a certain species of fish is inherited via a single gene with four different alleles.

- 139) How many different types of gametes would be possible in this system? 139) _____
- A) 4 B) 2 C) 8 D) 1 E) 16

- 140) In certain plants, tall is dominant to short. If a heterozygous plant is crossed with a homozygous tall plant, what is the probability that the offspring will be short? 140) _____
- A) 1/2 B) 1/4 C) 0 D) 1 E) 1/6

- 141) Calico cats are female because 141) _____
- A) the males die during embryonic development.
 - B) multiple crossovers on the Y chromosome prevent orange pigment production.
 - C) a male inherits only one of the two X-linked genes controlling hair color.
 - D) the Y chromosome has a gene blocking orange coloration.
 - E) only females can have Barr bodies.

- 142) Sturtevant provided genetic evidence for the existence of four pairs of chromosomes in *Drosophila* in which of these ways? 142) _____
- A) *Drosophila* genes cluster into four distinct groups of linked genes.
 - B) *Drosophila* genes have, on average, four different alleles.
 - C) There are four major functional classes of genes in *Drosophila*.
 - D) The entire *Drosophila* genome has approximately 400 map units.
 - E) The overall number of genes in *Drosophila* is a multiple of four.
- 143) SRY is best described in which of the following ways? 143) _____
- A) an autosomal gene that is required for the expression of genes on the X chromosome
 - B) a gene present on the X chromosome that triggers female development
 - C) an autosomal gene that is required for the expression of genes on the Y chromosome
 - D) a gene region present on the Y chromosome that triggers male development
 - E) a gene required for development, and males or females lacking the gene do not survive past early childhood
- 144) What is a syndrome? 144) _____
- A) a characteristic that only appears in conjunction with one specific aneuploidy
 - B) a characteristic facial appearance
 - C) a characteristic trait usually given the discoverer's name
 - D) a group of traits typically found in conjunction with a particular chromosomal aberration or gene mutation
 - E) a group of traits, all of which must be present if an aneuploidy is to be diagnosed
- 145) Mitochondrial DNA is primarily involved in coding for proteins needed for electron transport. Therefore, in which body systems would you expect most mitochondrial gene mutations to be exhibited? 145) _____
- A) the nervous and muscular systems
 - B) the skin and senses
 - C) the immune system and the blood
 - D) the circulation system
 - E) the excretory and respiratory systems
- 146) A gene is considered to be non-Mendelian in its inheritance pattern if it seems to "violate" Mendel's laws. Which of the following would be considered Mendelian? 146) _____
- A) a gene derived solely from maternal inheritance
 - B) a gene whose expression varies depending on the gender of the transmitting parent
 - C) a gene transmitted to males from the maternal line and from fathers to daughters
 - D) a gene transmitted via the cytoplasm or cytoplasmic structures
 - E) a gene transmitted by a virus to egg-producing cells
- 147) If nondisjunction occurs in meiosis II during gametogenesis, what will be the result at the completion of meiosis? 147) _____
- A) Two of the four gametes will be haploid, and two will be diploid.
 - B) 1/4 of the gametes will be $n + 1$, 1/4 will be $n - 1$, and 1/2 will be n .
 - C) All the gametes will be diploid.
 - D) Half of the gametes will be $n + 1$, and half will be $n - 1$.
 - E) There will be three extra gametes.

Use the following information to answer the questions below.

A plantlike organism on the planet Pandora can have three recessive genetic traits: bluish leaves, due to an allele (*a*) of gene *A*; a feathered stem, due to an allele (*b*) of gene *B*; and hollow roots due to an allele (*c*) of gene *C*. The three genes are linked and recombine as follows:

A geneticist did a testcross with an organism that had been found to be heterozygous for the three recessive traits and she was able to identify progeny of the following phenotypic distribution (+ = wild type):

Phenotypes	Leaves	Stems	Roots	Number
1	<i>a</i>	+	+	14
2	<i>a</i>	+	<i>c</i>	0
3	<i>a</i>	<i>b</i>	+	32
4	<i>a</i>	<i>b</i>	<i>c</i>	440
5	+	<i>b</i>	+	0
6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1,000

- 148) In which progeny phenotypes has there been recombination between genes *A* and *B*? 148) _____
- A) 2, 4, 5, and 8
 - B) in all 8 of them
 - C) 2, 3, 5, and 7
 - D) 1, 2, 5, and 6
 - E) 1, 3, 6, and 7
- 149) Why does recombination between linked genes continue to occur? 149) _____
- A) New allele combinations are acted upon by natural selection.
 - B) The forces on the cell during meiosis II always result in recombination.
 - C) Recombination must occur or genes will not assort independently.
 - D) Recombination is a requirement for independent assortment.
 - E) Without recombination there would be an insufficient number of gametes.

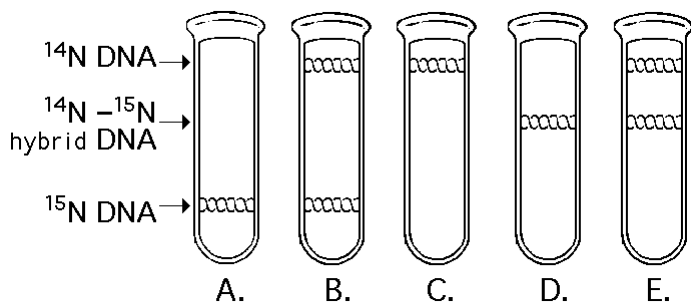
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6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1,000

- 150) The greatest distance among the three genes is between *a* and *c*. What does this mean? 150) _____
- A) Gene *a* is closest to *b*.
 - B) Gene *a* is not recombining with *c*.
 - C) Gene *a* is between *b* and *c*.
 - D) Genes are in the order: *a-b-c*.
 - E) Distance *a-b* is equal to distance *a-c*.
- 151) Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism. 151) _____
- Approximately what percentage of the nucleotides in this sample will be thymine?
- A) 16%
 - B) 8%
 - C) 42%
 - D) 31%
 - E) It cannot be determined from the information provided.
- 152) Replication in prokaryotes differs from replication in eukaryotes for which of the following reasons? 152) _____
- A) Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
 - B) Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.
 - C) Prokaryotes have telomeres, and eukaryotes do not.
 - D) The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
 - E) Prokaryotic chromosomes have histones, whereas eukaryotic chromosomes do not.



153) Once the pattern found after one round of replication was observed, Meselson and Stahl could be confident of which of the following conclusions? 153) _____

- A) Replication is not dispersive.
- B) Replication is neither dispersive nor conservative.
- C) Replication is not semi-conservative.
- D) Replication is not conservative.
- E) Replication is semi-conservative.

154) The enzyme telomerase solves the problem of replication at the ends of linear chromosomes by which method? 154) _____

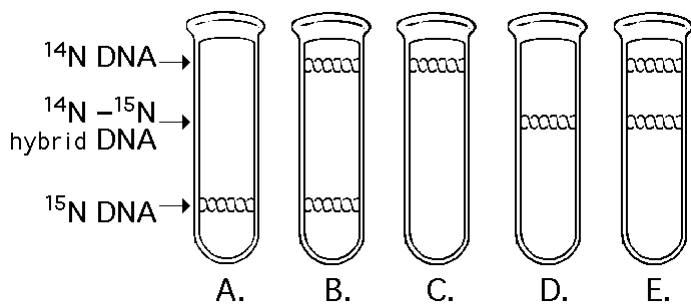
- A) adding numerous short DNA sequences such as TTAGGG, which form a hairpin turn
- B) causing specific double-strand DNA breaks that result in blunt ends on both strands
- C) adding a single 5' cap structure that resists degradation by nucleases
- D) adding numerous GC pairs which resist hydrolysis and maintain chromosome integrity
- E) causing linear ends of the newly replicated DNA to circularize

155) How do we describe transformation in bacteria? 155) _____

- A) the creation of a strand of RNA from a DNA molecule
- B) the type of semiconservative replication shown by DNA
- C) the infection of cells by a phage DNA molecule
- D) the creation of a strand of DNA from an RNA molecule
- E) assimilation of external DNA into a cell

156) Which of the following would you expect of a eukaryote lacking telomerase? 156) _____

- A) inability to repair thymine dimers
- B) production of Okazaki fragments
- C) a reduction in chromosome length in gametes
- D) a high probability of somatic cells becoming cancerous
- E) high sensitivity to sunlight



157) A space probe returns with a culture of a microorganism found on a distant planet. Analysis shows that it is a carbon-based life-form that has DNA. You grow the cells in ^{15}N medium for several generations and then transfer them to ^{14}N medium. Which pattern in the figure above would you expect if the DNA was replicated in a conservative manner? 157) _____

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

158) Suppose you are provided with an actively dividing culture of *E. coli* bacteria to which radioactive thymine has been added. What would happen if a cell replicates once in the presence of this radioactive base? 158) _____

- A) One of the daughter cells, but not the other, would have radioactive DNA.
 B) Radioactive thymine would pair with nonradioactive guanine.
 C) All four bases of the DNA would be radioactive.
 D) Neither of the two daughter cells would be radioactive.
 E) DNA in both daughter cells would be radioactive.

159) Which of the following represents the order of increasingly higher levels of organization of chromatin? 159) _____

- A) looped domain, 30-nm chromatin fiber, nucleosome
 B) nucleosome, looped domain, 30-nm chromatin fiber
 C) nucleosome, 30-nm chromatin fiber, looped domain
 D) looped domain, nucleosome, 30-nm chromatin fiber
 E) 30-nm chromatin fiber, nucleosome, looped domain

160) Individuals with the disorder xeroderma pigmentosum are hypersensitive to sunlight. This occurs because their cells are impaired in what way? 160) _____

- A) They cannot undergo mitosis.
 B) They do not recombine homologous chromosomes during meiosis.
 C) They cannot exchange DNA with other cells.
 D) They cannot repair thymine dimers.
 E) They cannot replicate DNA.

The following information should be used for the next few questions.

A part of an mRNA molecule with the following sequence is being read by a ribosome: 5' CCG-ACG 3' (mRNA). The following charged transfer RNA molecules (with their anticodons shown in the 3' to 5' direction) are available. Two of them can correctly match the mRNA so that a dipeptide can form.

tRNA Anticodon	Amino Acid
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

- 164) The dipeptide that will form will be 164) _____
A) glycine-cysteine.
B) proline-threonine.
C) cysteine-alanine.
D) alanine-alanine.
E) threonine-glycine.
- 165) A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA 165) _____
that binds the mRNA codon is
A) UUA.
B) UUU.
C) TTT.
D) AAA.
E) either UAA or TAA, depending on first base wobble.
- 166) Which of the following is true of transcription in domain Archaea? 166) _____
A) It is roughly simultaneous with translation.
B) It is regulated in the same way as in domain Bacteria.
C) Promoters are identical to those in domain Eukarya.
D) There is only one kind of RNA polymerase.
E) It terminates in a manner similar to bacteria.

The following questions refer to this table of codons.

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

- 167) A peptide has the sequence NH₂-phe-pro-lys-gly-phe-pro-COOH. Which of the following sequences in the coding strand of the DNA could code for this peptide?
- 3' UUU-CCC-AAA-GGG-UUU-CCC
 - 5' TTT-CCC-AAA-GGG-TTT-CCC
 - 5' ACT-TAC-CAT-AAA-CAT-TAC-UGA
 - 5' GGG-AAA-TTT-AAA-CCC-ACT-GGG
 - 3' AUG-AAA-GGG-TTT-CCC-AAA-GGG

167) _____

- 168) What is a ribozyme?

- an enzyme that catalyzes the association between the large and small ribosomal subunits
- an RNA with enzymatic activity
- an enzyme that synthesizes RNA as part of the transcription process
- an enzyme that uses RNA as a substrate
- an enzyme that synthesizes RNA primers during DNA replication

168) _____

- 169) Gene expression in the domain Archaea in part resembles that of bacteria and in part that of the domain Eukarya. In which way is it most like the domain Eukarya? 169) _____
- A) Post-transcriptional splicing is like that of Eukarya.
 - B) Transcription termination often involves attenuation.
 - C) Domain Archaea have numerous transcription factors.
 - D) There is only one RNA polymerase.
 - E) Initiation of translation is like that of domain Eukarya.

Use the following information to answer the next few questions.

The enzyme polynucleotide phosphorylase randomly assembles nucleotides into a polynucleotide polymer.

- 170) You add polynucleotide phosphorylase to a solution of adenosine triphosphate and guanosine triphosphate. How many artificial mRNA 3 nucleotide codons would be possible? 170) _____
- A) 64 B) 4 C) 3 D) 16 E) 8