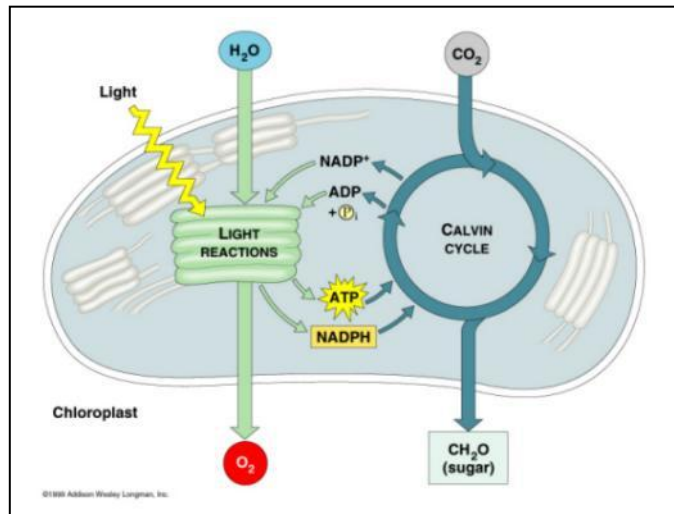


1) Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle?

- A) electrons and H<sup>+</sup>
- B) H<sub>2</sub>O and O<sub>2</sub>
- C) CO<sub>2</sub> and glucose
- D) ADP, P<sub>i</sub>, and NADP<sup>+</sup>
- E) ATP and NADPH



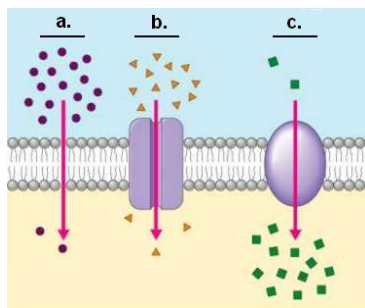
2) If you wanted to measure the rate of photosynthesis in an aquatic plant growing in an aquarium, list at least two things you could measure.

- A) light and water uptake
- B) oxygen and sugar production
- C) carbon dioxide production and light
- D) ATP and NADPH production
- E) water and carbon dioxide production

3) What is the primary function of the Calvin cycle in photosynthesis?

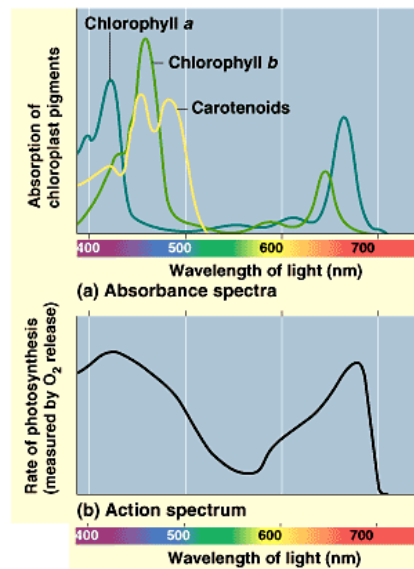
- A) synthesize simple sugars from carbon dioxide
- B) use ATP to release carbon dioxide
- C) split water and release oxygen
- D) use NADPH to release carbon dioxide
- E) transport RuBP out of the chloroplast

4) Which function below is most similar to the electron transport chain function in the thylakoid membrane producing ATP during the Light Reaction?



5) Figure 10.1 shows the absorption spectrum for chlorophyll pigments and the action spectrum for photosynthesis. Which is the best conclusion based on the graphs?

- A) All wavelengths are equally effective at driving photosynthesis.
- B) Green and yellow wavelengths inhibit the absorption of red and blue wavelengths.
- C) Only chlorophyll a absorbs the light that actually drives photosynthesis.
- D) Bright sunlight destroys photosynthetic pigments.
- E) Green and yellow wavelengths are least effective at driving photosynthesis.



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**Figure 10.1**

6) A particular triplet of bases in the template strand of DNA is AGT. The corresponding codon for the mRNA transcribed is

- A) TCA.      B) UCA.      C) UGA.      D) UUU      E) AGT.

The following questions refer to Figure 17.1, a 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	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

**Figure 17.1**

7) A possible sequence of nucleotides in the template strand of DNA that would code for the polypeptide sequence phe-leu-ile-val would be

- A) 3' AAA-AAT-ATA-ACA 5'.
- B) 5' TTG-CTA-CAG-TAG 3'.
- C) 5' AUG-CTG-CAG-TAT 3'.
- D) 3' AAA-GAA-TAA-CAA 5'.
- E) 3' AAC-GAC-GUC-AUA 5'.

8) What amino acid sequence will be generated, based on the following mRNA codon sequence? 5'AUG-UCU-UCG-UUA-UCC-UUG

- A) met-ser-ser-leu-ser-leu
- B) met-ser-leu-ser-leu-ser
- C) met-glu-arg-arg-gln-leu
- D) met-arg-glu-arg-glu-arg
- E) met-leu-phe-arg-glu-glu

9) What is the sequence of amino acids based on the mRNA sequence 5'UUC-CUU

- A) cyc-phe-
- B) phe-ser-
- C) leu-pro-
- D) leu-cys-
- E) phe-leu-

10) A particular eukaryotic protein is 300 amino acids long. Which of the following could be the maximum number of nucleotides in the DNA that codes for the amino acids in this protein?

- A) 1,800
- B) 3
- C) 100
- D) 900
- E) 300

11) If the triplet CCC codes for the amino acid proline in bacteria, then in plants CCC should code for

- A) phenylalanine.
- B) valine.
- C) proline.
- D) leucine.
- E) cystine.

12) The genetic code is essentially the same for all organisms. From this, one can logically assume all of the following *except*

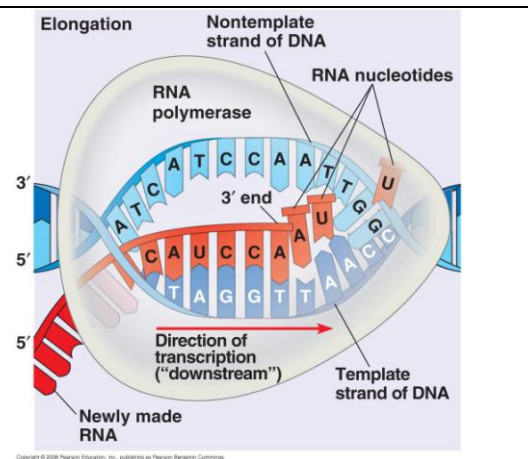
- A) all organisms have a common ancestor.
- B) different organisms have the same number of different types of amino acids.
- C) DNA was the first genetic material.
- D) the same codons in different organisms usually translate into the same amino acids.
- E) a gene from an organism could theoretically be expressed by any other organism.

13) Which of the following statements best describes the termination of transcription in prokaryotes?

- A) RNA polymerase transcribes through the terminator sequence, causing the polymerase to fall off the DNA and release the transcript.
- B) RNA polymerase transcribes through an intron, and the snRNPs cause the polymerase to let go of the transcript.
- C) RNA polymerase transcribes through the polyadenylation signal, causing proteins to associate with the transcript and cut it free from the polymerase.
- D) RNA polymerase transcribes through a stop codon, causing the polymerase to stop advancing through the gene and release the mRNA.
- E) Once transcription has initiated, RNA polymerase transcribes until it reaches the end of the chromosome.

14) RNA polymerase moves along the template strand of DNA in the \_\_\_\_\_ direction, and adds nucleotides to the \_\_\_\_\_ end of the growing transcript.

- A) 3' to 5'; 3'
- B) 5' to 3'; 3'
- C) 5' to 3'; 5'
- D) 3' to 5'; 5'



15) What are the coding segments of a stretch of eukaryotic DNA called?

- A) codons
- B) introns
- C) replicons
- D) exons
- E) transposons

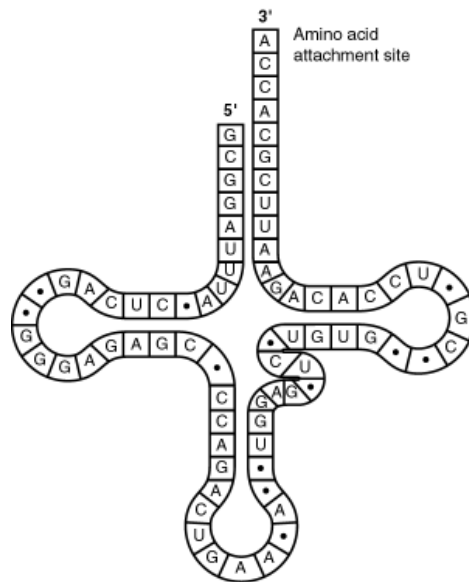
16) All of the following are directly involved in translation *except*

- A) DNA.
- B) aminoacyl-tRNA synthetase enzymes.
- C) mRNA.
- D) ribosomes.
- E) tRNA.

17) A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is 5

- A) UUU.
- B) TTT.
- C) UUA.
- D) AAA.
- E) either UAA or TAA, depending on first base wobble.

- 18) What is an anticodon part of?
- A) tRNA
  - B) DNA
  - C) mRNA
  - D) a ribosome
  - E) an activating enzyme



**Figure 17.2**

- 19) Figure 17.2 represents tRNA that recognizes and binds a particular amino acid. Which codon on the mRNA strand codes for this amino acid?
- A) GUG
  - B) CAU
  - C) GUA
  - D) CUU
  - E) UGG
- 20) During translation, chain elongation continues until what happens?
- A) All tRNAs are empty.
  - B) No further amino acids are needed by the cell.
  - C) The polypeptide is long enough.
  - D) The ribosomes run off the end of mRNA.
  - E) A stop codon is encountered.

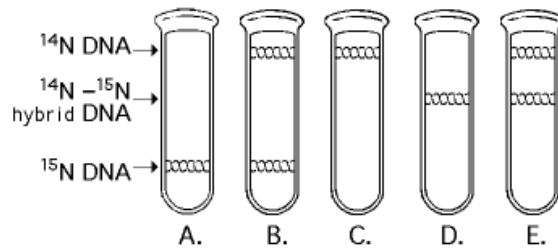
The following questions refer to Figure 17.1, a table of codons.

		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	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
						Third Base

Figure 17.1

- 21) What amino acid does the mRNA sequence UCA code for  
 A) Ala            B) Lys            C) Ser            D) Phe            E) Trp
- 22) For a couple of decades, biologists knew the nucleus contained DNA and proteins. The prevailing opinion was that the genetic material was proteins, and not DNA. The reason for this belief was that proteins are more complex than DNA. This is because 57)  
 A) proteins have a greater variety of three-dimensional forms than does DNA.  
 B) protein contain sugar and phosphate where DNA does not  
 C) proteins are made of 20 amino acids and DNA is made of four nucleotides.  
 D) Only A and C are correct.  
 E) A, B, and C are correct.
- 23) What does transformation involve in bacteria?  
 A) the infection of cells by a phage DNA molecule  
 B) assimilation of external DNA into a cell  
 C) the creation of a strand of DNA from an RNA molecule  
 D) the type of semiconservative replication shown by DNA  
 E) the creation of a strand of RNA from a DNA molecule
- 24) What kind of chemical bond is found between paired bases of the DNA double helix?  
 A) covalent  
 B) sulfhydryl  
 C) ionic  
 D) hydrogen  
 E) phosphate

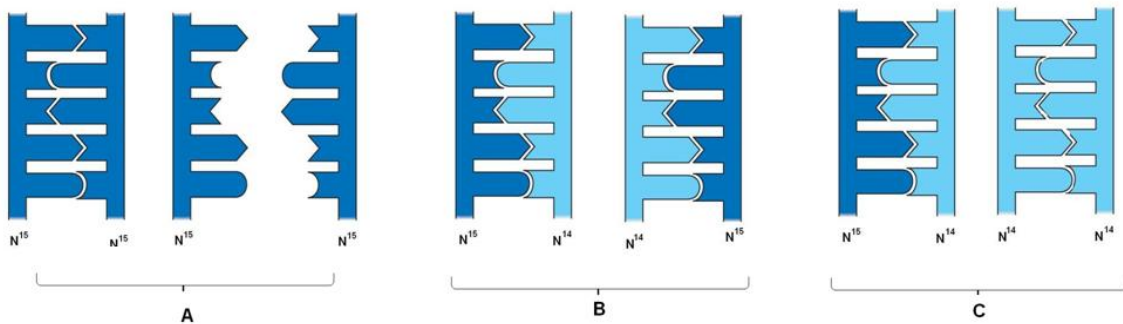
Use Figure 16.1 to answer question 24. The tubes represent the results after "density gradient" centrifugation, where the tubes are spun and the heavier molecules fall proportionate to their weight.



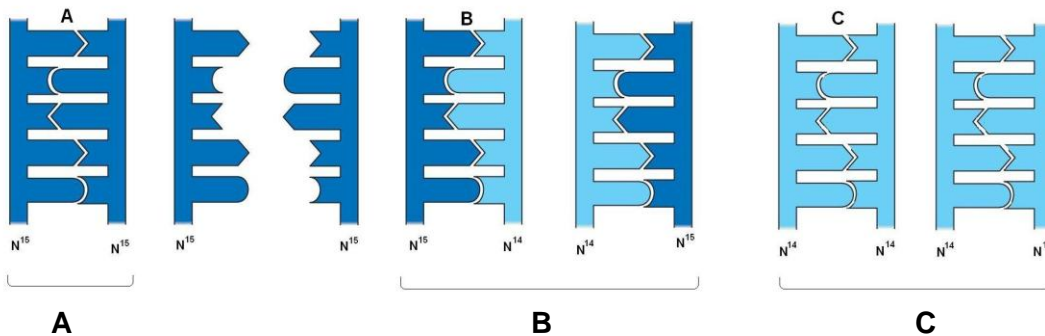
**Figure 16.1**

25) In the late 1950s, Meselson and Stahl grew bacteria in a medium containing "heavy" nitrogen ( $^{15}\text{N}$ ) and then transferred them to a medium containing  $^{14}\text{N}$ . Which of the results in Figure 16.1 would be expected after two DNA replication in the presence of  $^{14}\text{N}$ ?

26) Which represents one cycle of DNA replication?



27) Which below would sink the least during density gradient centrifugation?



28) Which enzyme catalyzes the dehydration synthesis of a DNA strand in the 5'-3' direction?

- A) DNA polymerase
- B) helicase
- C) topoisomerase
- D) DNA ligase
- E) primase

29) What determines the nucleotide sequence of the newly synthesized strand during DNA replication?

- A) the relative amounts of the four nucleoside triphosphates in the cell
- B) the nucleotide sequence of the template strand
- C) the primase used in the reaction
- D) the particular DNA polymerase catalyzing the reaction
- E) both A and D

*Refer to the following list of enzymes to answer the following questions. The answers may be used once, more than once, or not at all.*

- A. *helicase*
- B. *nuclease*
- C. *ligase*
- D. *DNA polymerase I*
- E. *primase*

30) removes the RNA nucleotides from the primer and adds equivalent DNA nucleotides to the 3' end of Okazaki fragments

31) separates the DNA strands during replication

32) covalently connects segments of DNA

33) synthesizes short segments of RNA

34) A new DNA strand elongates only in the 5' to 3' direction because

- A) DNA polymerase can only add nucleotides to the free 3' end.
- B) DNA polymerase begins adding nucleotides at the 5' end of the template.
- C) the polarity of the DNA molecule prevents addition of nucleotides at the 3' end.
- D) replication must progress toward the replication fork.
- E) Okazaki fragments prevent elongation in the 3' to 5' direction.

35) Which of the following is analogous to telomeres?

- A) the correct letters used to replace errors in a document after they have been deleted in a word processor
- B) the central spindle that a CD fits around while in the case
- C) the mechanism of a zipper that allows the separated parts to be joined
- D) the two ends of a shoelace
- E) the pull tab on a soft drink can

- 36) A eukaryotic cell lacking telomerase would
- have a high probability of becoming cancerous.
  - undergo a reduction in chromosome length.
  - produce Okazaki fragments.
  - be highly sensitive to sunlight.
  - be unable to repair thymine dimers.
- 37) The reason that linked genes are inherited together is that
- genes align that way during metaphase I.
  - they are located on the same chromosome.
  - the number of genes in a cell is greater than the number of chromosomes.
  - chromosomes are unbreakable.
  - alleles are paired.
- 38) A man who carries an Y-linked allele will pass it on to
- half of his sons.
  - all of his sons.
  - half of his daughters.
  - all of his children.
  - all of his daughters.
- 39) A Barr body is normally found in the nucleus of which kind of human cell?
- somatic cells of a female only
  - sperm cells only
  - both male and female somatic cells
  - somatic cells of a male only
  - unfertilized egg cells only
- 40) What do all human females inherit from their father?
- an X chromosome
  - mitochondrial DNA
  - the SRY gene
  - A and B only
  - A, B, and C

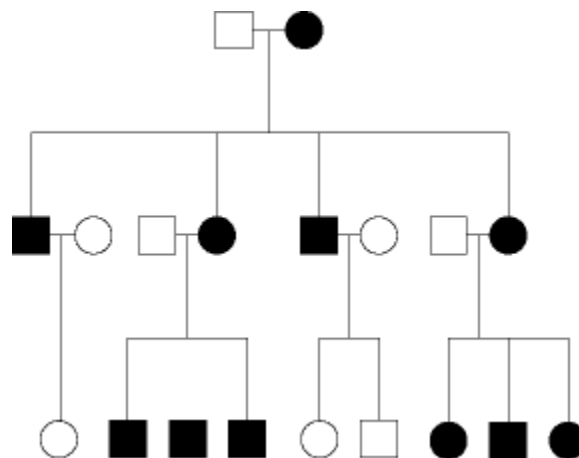


Figure 15.6

- 41) The pedigree in Figure 15.6 shows the transmission of a trait in a particular family. Based on this pattern of transmission, the trait is most likely
- A) sex-linked recessive on X chromosome.
  - B) mitochondrial gene.
  - C) autosomal recessive.
  - D) autosomal incomplete dominance.
  - E) sex-linked dominant on Y chromosome.

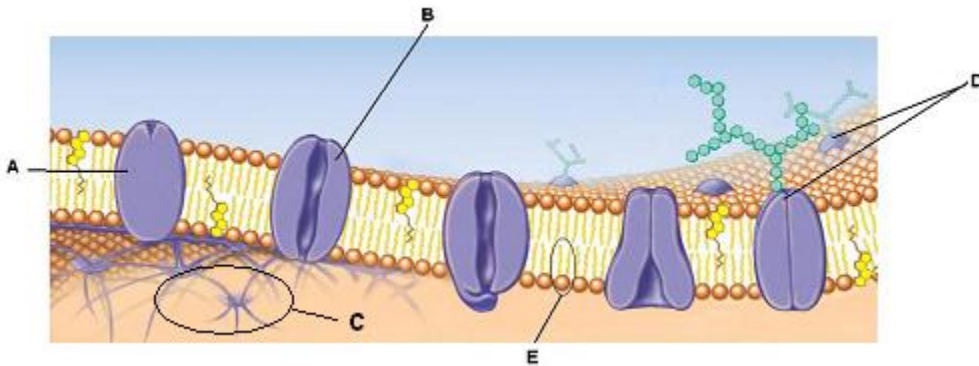
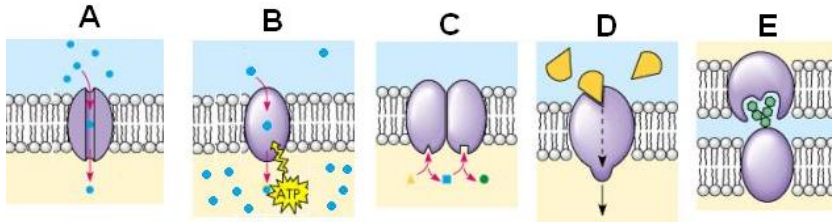
- 42) Which of the following statements about mitochondria is *false*?
- A) Because mitochondria are present in the cytoplasm, mitochondrial diseases are transmitted maternally.
  - B) Like nuclear genes, mitochondrial genes usually follow Mendelian patterns of inheritance.
  - C) Mitochondria contain circular DNA molecules that code for proteins and RNAs.
  - D) Because of the role of the mitochondria in producing cellular energy, mitochondrial diseases often affect the muscles and nervous system.
  - E) Many mitochondrial genes encode proteins that play roles in the electron transport chain and ATP synthesis.

*Use the following information to answer the questions below.*

*A man and woman are married and have two kids. The woman has blood type A, the daughter type O and the son type B.*

- 43) Which of the following is a possible genotype for the son?
- A) *BB*
  - B) *OO*
  - C) *BA*
  - D) *AA*
  - E) *BO*
- 44) Which of the following is a possible genotype for the mother?
- A) *AB*
  - B) *AA*
  - C) *OO*
  - D) *AO*
  - E) *BB*
- 45) Which of the following is a possible phenotype for the father?
- A) *O*
  - B) *B*
  - C) *AB*
  - D) *A*
  - E) impossible to determine
- 46) A couple, each being carriers of the recessive cystic fibrosis trait, have a child? What is the chance this child will have cystic fibrosis?
- A) 100%
  - B) 75%
  - C) 50%
  - D) 25%
  - E) zero
- 47) What is the chance they will have two children in succession and both children will have cystic fibrosis?
- A) 1
  - B) 1/2
  - C) 1/4
  - D) 1/8
  - E) 1/16

48) Familial hypercholesterolemia is a recessive condition that results from a mutation that compromises the efficiency of receptor mediated endocytosis. Which membrane function below best represents this function?



49) Which of the above is most likely responsible for tissue rejection?

Use the following information to answer the questions below.

A woman and her spouse both show the normal phenotype for normal pigmentation, but both had one parent who was an albino. Albinism is an autosomal recessive trait.

50) What is the probability that their first child will be an albino?

- A)  $1/4$       B) 1      C) 0      D)  $3/4$       E)  $1/2$

51) A woman has three sons. What is the chance her next child will be a daughter?

- A)  $5/6$ .      B) 1.      C) 0.      D)  $1/2$ .      E)  $1/6$ .

*The questions below will use the following answers. Each answer may be used once, more than once, or not at all.*

- A. Huntington's disease
- B. Tay-Sachs disease
- C. phenylketonuria
- D. cystic fibrosis
- E. sickle-cell disease

52) This results from a defect in membrane proteins that normally function in chloride ion transport.

53) Substitution of the "wrong" amino acid in the hemoglobin protein results in this disorder.

54) What is a genome?

- A) a specific segment of DNA that is found within a prokaryotic chromosome
- B) all of an organism's genes
- C) an ordered display of chromosomes arranged from largest to smallest
- D) a specific sequence of polypeptides within each cell
- E) a specialized polymer of four different kinds of monomers

55) Asexual reproduction and sexual reproduction are different in that

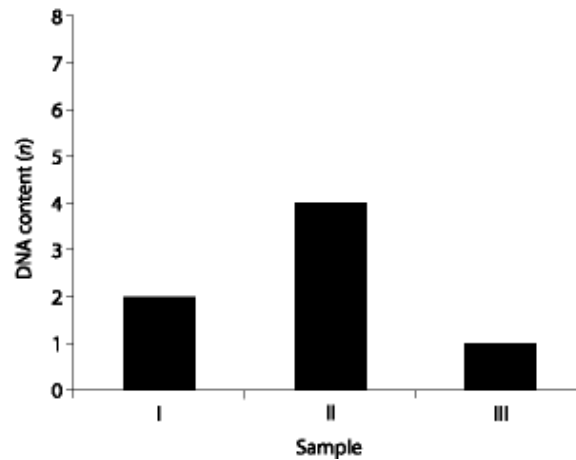
- A) asexual reproduction produces offspring that are genetically identical to the parents, whereas sexual reproduction gives rise to genetically distinct offspring.
- B) asexual reproduction involves a single parent, whereas sexual reproduction involves two.
- C) individuals reproducing asexually transmit 100% of their genes to their progeny, whereas individuals reproducing sexually only transmit 50%.
- D) asexual reproduction only requires mitosis, whereas sexual reproduction always involves meiosis.
- E) all of the above

56) What is a karyotype?

- A) the collection of all the mutations present within a genome
- B) a system of classifying cell nuclei
- C) the set of unique physical characteristics that define an individual
- D) a display of every pair of homologous chromosomes within a cell, organized according to size and shape
- E) a unique combination of chromosomes found in a gamete

- 57) The human X and Y chromosomes are
- A) of approximately equal size.
  - B) both present in every somatic cell of males and females alike.
  - C) almost entirely homologous, despite their different names.
  - D) called "sex chromosomes" because they determine an individual's sex.
  - E) all of the above
- 58) If the liver cells of an animal have 24 chromosomes, how many chromosomes do its sperm cells have?
- A) 48 B) 12 C) 6 D) 24 E) 64
- 59) Which of the following is *true of a species that has a chromosome number of  $2N=32$*
- A) During the S phase of the cell cycle there will be 32 chromatids.
  - B) The species has 16 pair of chromosomes.
  - C) The species is diploid with 16 chromosomes.
  - D) A gamete from this species has 4 chromosomes.
  - E) There are 8 homologous pairs.
- 60) Which of the following is the term for a human cell that contains 22 pairs of autosomes and two X chromosomes?
- A) an unfertilized egg cell
  - B) a sperm cell
  - C) a female somatic cell
  - D) a male somatic cell
  - E) both A and D

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



**Figure 13.3**

- 61) Which cell might represent a cell in the S phase of the cell cycle?  
A) I  
B) II  
C) III  
D) either I or II  
E) either II or III
- 62) Which sample might represent a sperm cell?  
A) I  
B) II  
C) III  
D) either I or II  
E) either II or III
- 63) For a species with 5 pair of chromosomes, how many different combinations of maternal and paternal chromosomes are possible for the gametes?  
A) 4  
B) 8  
C) 16  
D) 32  
E) 64
- 64) How does the sexual life cycle increase the genetic variation in a species?  
A) by allowing random fertilization  
B) by allowing independent assortment of chromosomes, producing 8 million genetically different gametes when  $2N=46$   
C) by allowing crossing over of homologous chromosomes during prophase of Meiosis I.  
D) A and B only  
E) A, B, and C

- 65) What is a chromatid?  
 A) a replicated chromosome seen during prophase and metaphase  
 B) another name for the homologous pairs of chromosomes found in genetics  
 C) a special region that holds two centromeres together  
 D) a chromosome found outside the nucleus  
 E) a chromosome found only in S-Phase of the cell cycle
- 66) Chromosomes first become visible during \_\_\_\_\_ of mitosis.  
 A) prophase  
 B) telophase  
 C) anaphase  
 D) prometaphase  
 E) metaphase
- 67) The MPF protein complex turns itself off by  
 A) exiting the cell.  
 B) activating a process that destroys cyclin.  
 C) binding to chromatin.  
 D) activating the anaphase-promoting complex.  
 E) activating an enzyme that stimulates cyclin.
- 68) Which of the following is *true* concerning cancer cells?  
 A) They do not exhibit density-dependent inhibition when growing in culture.  
 B) They are not subject to cell cycle controls.  
 C) When they stop dividing, they do so at random points in the cell cycle.  
 D) B and C only  
 E) A, B, and C

**Table 12.1: Minutes Spent in Cell Cycle Phases**

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

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.

- 69) Of the following, the best conclusion concerning the difference between the S phases for beta and gamma is that  
 A) beta contains more RNA than gamma.  
 B) gamma contains more DNA than beta.  
 C) gamma contains 48 times more DNA and RNA than beta.  
 D) beta is a plant cell and gamma is an animal cell.  
 E) beta and gamma contain the same amount of DNA.

- 70) The best conclusion concerning delta is that the cells
- A) divide in the G<sub>1</sub> phase.
  - B) are actually in the G<sub>0</sub> phase.
  - C) contain no RNA.
  - D) contain only one chromosome that is very short.
  - E) contain no DNA.

Refer to the diagram of a meiotic process in Figure 13.3 to answer the following questions.

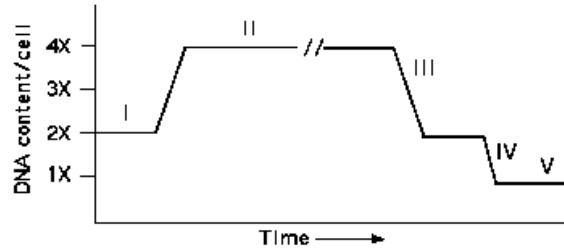
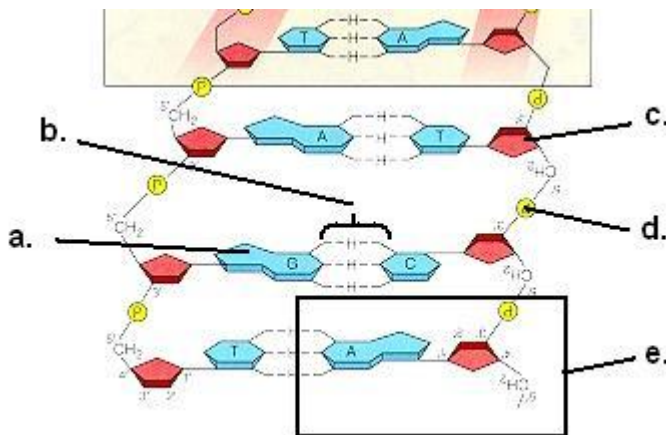


Figure 13.3

- 71) Which number represents G<sub>2</sub>?
- A) I                  B) II                  C) III                  D) IV                  E) V
- 72) Which number represents the DNA content of a sperm cell?
- A) I                  B) II                  C) III                  D) IV                  E) V

Which below is most likely

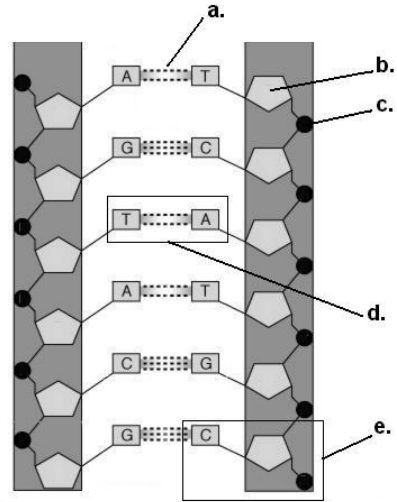
- 73) Deoxyribose
- 74) Hydrogen bonds
- 75) Nucleotide
- 76) Nitrogenous base



77) Monosaccharide

78) Phosphate

79) Base pair

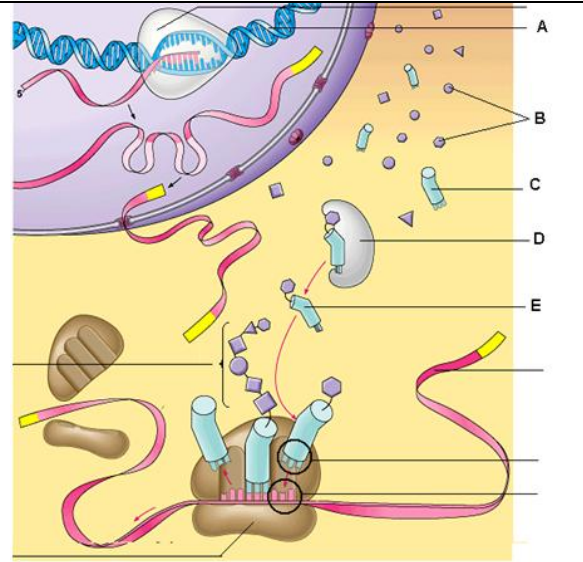


80) tRNA

81) amino acids

82) aminoacyl t-RNA

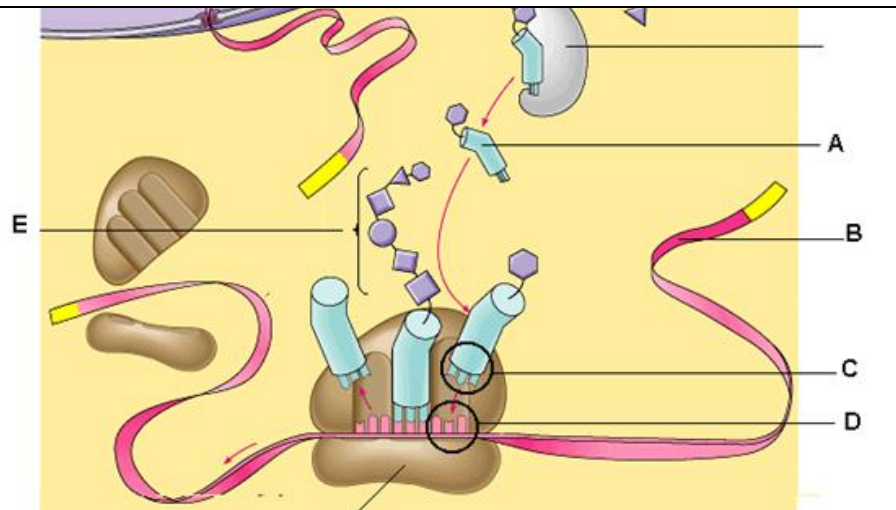
83) aminoacyl t-RNA synthase



84) Codon

85) Anticodon

86) protein

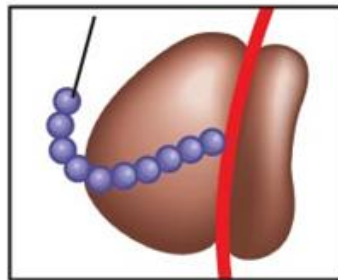
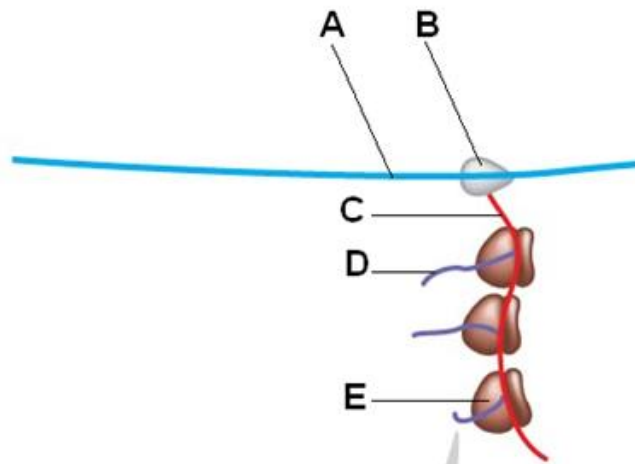
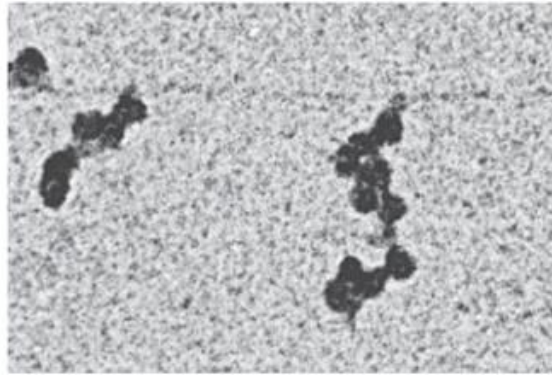


Match the terms below with the labels at right.

- 87) Protein
- 88) mRNA
- 89) Ribosome
- 90) DNA
- 91) RNA Polymerase

92) Is the image at right from a prokaryotic or eukaryotic cell?

- A. prokaryotic
- B. eukaryotic



end