

1. Analysis of a DNA sample from the nuclei of a flower determined that the thymine content of the nucleotides in the DNA was 23%. Select the row that identifies the likely content of adenine, cytosine and guanine in the DNA.

Row	Adenine	Cytosine	Guanine
a.	23%	27%	27%
b.	23%	27%	23%
c.	27%	23%	23%
d.	27%	23%	27%

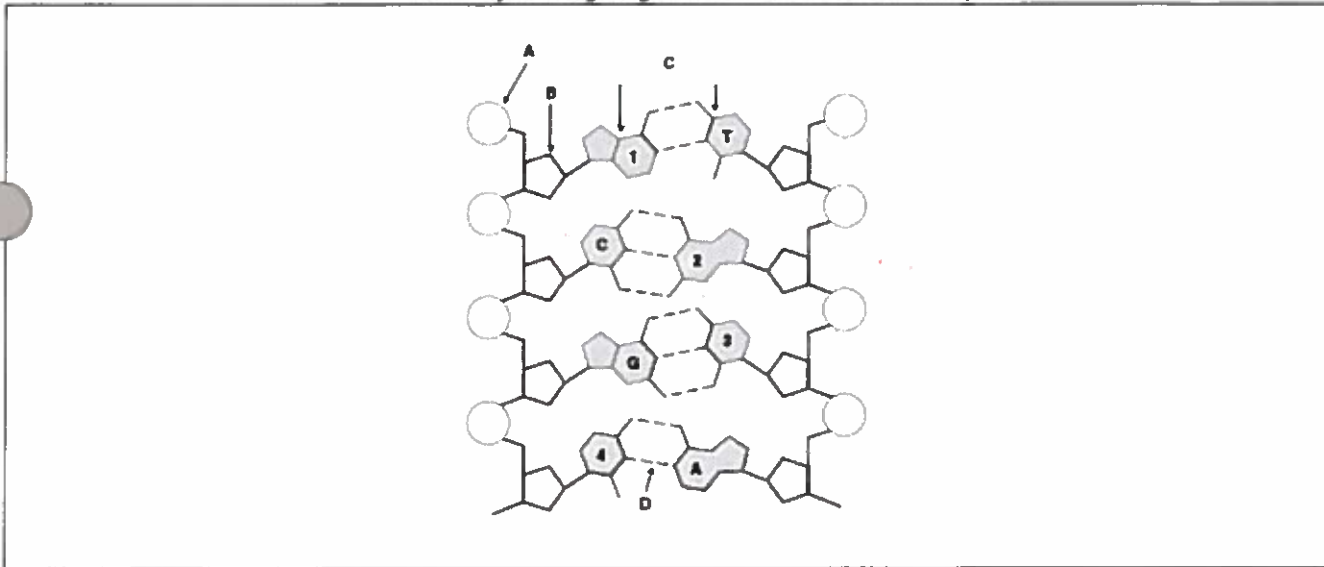
2. The double-helix model of DNA resembles a twisted ladder in which the "steps" of the ladder are

- a. a purine paired with a pyrimidine base.
- b. A paired with G; C paired with T.
- c. a sugar-phosphate paired with a sugar phosphate molecule.
- d. two purine bases paired together; two pyrimidine bases paired together.

3. The two scientists credited with producing the first structural model of DNA were

- a. Rosalind Franklin and Erwin Chargaff.
- b. Phoebus Levene and Fredrick Griffith.
- c. James Watson and Francis Crick.
- d. Oswald Avery and Colin MacLeod.

Use the following diagram to answer the next two questions.



4. Which row correctly identifies the structures labelled 1, 2, 3, and 4 respectively?

Row	Structure 1	Structure 2	Structure 3	Structure 4
a.	adenine	guanine	cytosine	uracil
b.	uracil	cytosine	guanine	thymine
c.	thymine	cytosine	guanine	adenine
d.	adenine	guanine	cytosine	thymine

5. The letter "D" on this diagram represents

- a. the deoxyribose molecule.
- b. the ribose molecule.
- c. hydrogen bonds between the complementary bases.
- d. the covalent bonds between the sugar and phosphate groups.

6. Which row below completes the following statement? Statement: "A(n) *i* is defined as the functional sub-unit of DNA that directs the production of one *ii*. The *iii* of an organism is the sum of all the DNA that is carried in the cell of the organism."

Row	<i>i</i>	<i>ii</i>	<i>iii</i>
a.	amino acid	polypeptides	protein
b.	gene	polypeptides	genome
c.	non-coding section	genes	genotype
d.	genome	RNA molecules	phenotype

7. The most widely accepted model for the replication of a DNA molecule is the
- conservative model.
 - liberal model.
 - dispersive model.
 - semi-conservative model.
8. The enzyme that is responsible for adding new nucleotides to the 3' end of a growing DNA chain during DNA replication is
- helicase.
 - RNA polymerase.
 - DNA polymerase.
 - DNA ligase.
9. Which row does NOT correctly compare DNA and mRNA?

Row	DNA	mRNA
a.	contains the base thymine	contains the base uracil
b.	is double stranded	is single stranded
c.	leaves the nucleus	Stays in the nucleus
d.	contains the sugar deoxyribose	contains the sugar ribose

Use the following information to answer the next two questions.

The tables below represent a portion of a DNA molecule and its corresponding mRNA, tRNA and polypeptide chain.

DNA:	C	G	T							
	G	C	A			T	G	A		
mRNA:	C	G	U	U		A			Y	
tRNA:						X		G	C	A
Amino acids:	W		Tryptophan							

10. The nitrogen bases for positions X and Y are, respectively,
- uracil and guanine
 - uracil and cytosine
 - adenine and cytosine
 - thymine and guanine
11. The amino acid labeled W is
- methionine
 - tryptophan
 - arginine
 - alanine

Use the following information to answer the next question.

Hereditary hemochromatosis (HHC) is an autosomal recessive disorder characterized by elevated levels of iron in the blood. This disorder causes increased absorption of iron from the diet, which is then deposited in the liver, heart, pancreas, joints and endocrine glands.

12. The HHC mutation in DNA is encoded in mRNA by the process of
- translation in the nucleus
 - translation on the ribosome
 - transcription in the nucleus
 - transcription on the ribosome

Use the following information to answer the next question.

A bacterium has been found that synthesizes a type of plastic called polyhydroxybutyrate (PHB). Researchers can remove genes from this bacterium, "cut" open the DNA in plant cells, and insert the bacterial genes. Plants grown from these transformed cells will synthesize PHB.

- from Science News

13. The row that identifies the enzymes likely used by researchers to move the genes from the bacterium to a plant is

Row	Enzyme(s) Used on Bacterial DNA	Enzyme(s) Used on Plant DNA
a.	Ligase only	Ligase and restriction
b.	Restriction only	Ligase only
c.	Restriction only	Restriction and ligase
d.	Restriction and ligase	Restriction only

14. If the nucleotide code of a marker sequence is TAC CTT GAC AAT, then the sequence of the amino acids in the protein produced would be

AUG GAA CUG

- a. tyrosine – valine – glutamine – leucine
 b. tyrosine – valine – aspartate – asparagine
 c. methionine – glutamate – leucine – leucine
 d. methionine – glutamate – glutamine – asparagine

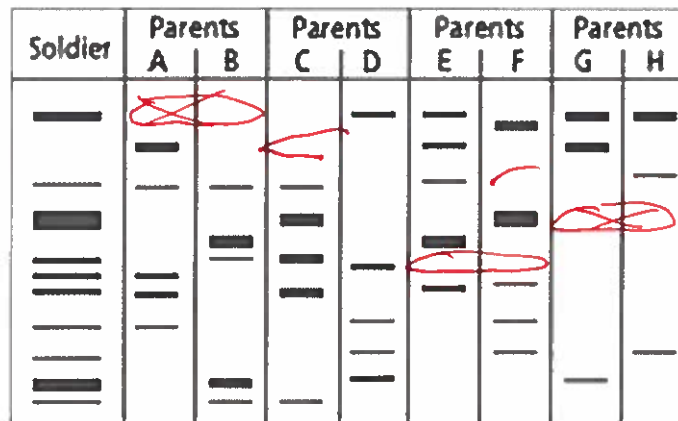
Use the following information to answer the next question.

Scientists are able to genetically engineer food crops. For example, scientists are able to delete sections of DNA located between two genes that code for a protein. The "stop" signal can be removed from the end of the first gene, which results in the production of an elongated strand of mRNA containing codons for both genes. The mRNA folds onto itself and becomes double-stranded mRNA when its bases are complementary.

-based on Nature, 2003

5. The double-stranded mRNA does not function normally because the
- a. mRNA cannot unzip to allow replication to occur
 b. tRNA anticodons cannot attach to the mRNA codons
 c. mRNA cannot attach to the DNA during transcription
 d. amino acids cannot attach to the mRNA during transcription

Use the following information to answer the next question.



16. Look at the DNA fingerprint pattern shown above. Which pair of parents' DNA matched the soldier's DNA?

- a. A and B
 b. C and D
 c. E and F
 d. G and H

Use the following information to answer the next two questions.

Normal pigs generate phosphorus-rich waste that can pollute lakes and streams. Scientists at the University of Guelph have reported the successful birth and growth of three transgenic pigs, called "Enviropigs", which produce fecal waste that is low in phosphorus. A composite gene was made from a bacterial gene and a mouse gene. The composite gene was inserted into each pig when each was a single-celled zygote. The bacterial gene coded for the enzyme phytase, and the mouse gene coded for a protein secreted in saliva. The combination of these two genes allows the pigs to produce phytase in their saliva. Phytase is an enzyme that digests the organic phosphorus found in their food.

- Based on Golovan et al., 2001

17. DNA cut from bacteria and DNA cut from mouse cells were fused to form a composite gene that was inserted into the pig cells.

The enzymes used in the process of producing a composite gene are:

- a. restriction and ligase enzymes
- b. polymerase and ligase enzymes
- c. phytase and restriction enzymes
- d. polymerase and phytase enzymes

18. The composite gene that was inserted into the single-celled zygote is present in the salivary glands and other cells of the pig because, as the embryo grew, the DNA

- a. replicated in interphase and the chromatids separated in mitosis
- b. replicated in interphase and the chromatids separated in meiosis
- c. was transcribed in interphase and the chromatids separated in mitosis
- d. was transcribed in interphase and the chromosomes separated in meiosis

19. A strand of DNA undergoes a mutation. The normal strand and mutated strand are listed below. Note that the site of the mutation is underlined.

Normal DNA: TAC AAA AAC GGA ATA GTA GCA

Mutated DNA: TAC AAA AAC GGA ATT GTA GCA

U A U

U A A

This is an example of a:

- a. frameshift mutation
- b. missense mutation
- c. nonsense mutation
- d. silent mutation