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5 **Questions DNA Structure** October 2021

1) Multiple choice: more than one option can be correct
(from http://www.biology-test.com/dna-online-test/index.html)

a) The backbone of each polynucleotide strand in a DNA double helix consists of alternating ...
- deoxyribose and phosphate groups
- base and phosphate groups
- ATP and phosphate groups
- histone and phosphate groups
- ribose and phosphate groups

b) A nucleotide consists of
- a nitrogen base and a five carbon sugar
- two nitrogen bases, a five carbon sugar, and a phosphate unit
- a nitrogen base
- a nitrogen base, a five carbon sugar, and a phosphate unit

c) In a DNA molecule, base pairing occurs normally between ...
- cytosine and guanine
- adenine and uracil
- thymine and cytosine
- guanine and uracil
- adenine and thymine

d) A phosphate group in DNA consists of a central phosphorous surrounded by how many oxygens?
- three
- two
- four
- six

e) The two pyrimidine bases in DNA are ...
- adenine and guanine
- cytosine and guanine
- cytosine and thymine
- adenine and thymine
- adenine and uracil

f) In the DNA, complementary base pairs are held together by which kind of bonds?
- peptide bonds
- ionic bonds
- non-polar covalent bonds
- james bonds
- hydrogen bonds
- phosphodiester bonds

g) A DNA strand has the following bases: 5' -TACGATCATAT- 3'. What are the bases on its complementary strand?

- 5' -ATGCTAGTTTA- 3'
- 3' -GCATATACGCG- 5'
- 3' -TACGATCATAT- 5'
- 3' -AUGCUAGUAUA- 5'
- 3' -ATGCTAGTATA- 5'
- 5' -ATGCTAGTATA- 3'
- 3' -TATACTAGCAT- 5'
- 5' -ATATGATCGTA- 3'

h) One strand in a DNA double helix runs 5' to 3' while the other runs 3' to 5'. The two DNA strands are ...

- identical
- antiparallel
- parallel
- heterocyclic

i) How many hydrogen bonds link cytosine and guanine, and adenine and thymine, respectively?

- cytosine and guanine: 3, adenine and thymine: 2
- cytosine and guanine: 2, adenine and thymine: 3
- cytosine and guanine: 3, adenine and thymine: 3
- cytosine and guanine: 2, adenine and thymine: 2

j) The DNA molecule of a certain organism is found to be composed of 28% guanine. What percentage of thymine would you expect?

$(100 - 28 \times 2)/2 = 22\%$

G 28%
C 28%
A 22%
T 22%

2) Farmer Henry has problems breeding his pigs. Three mother pigs seem to have problems to conceive and another 4 pigs had stillbirth. The veterinary realized that Henry's pigs are infected with a virus. Fortunately, the virus could be isolated. An initial analysis revealed that its genome consisted of 10% adenine, 24% thymine, 30% guanine and 36% cytosine. What is the genetic material?

A≠T, G≠C
∝ double

single stranded DNA
ssDNA

3) Why did Hershey and Chase choose the radioisotopes ^{32}P and ^{35}S for use in their experiment? Could they have used radioactive isotopes of carbon (C) and oxygen (O) instead? Why or why not?

Viruse grown in the presence of radioactive phosphorus contained redioactive DNA but not radioactive protein because DNA contains phrosphorus but protein doesn't. Similarly viruses grown on radioactive sulfur contained readioactive protein but not radioactive DNA because DNA does not contain sulfur. They can not use isotypes of carbon and oxygen because DNA and protein both contain carbon and oxygen.

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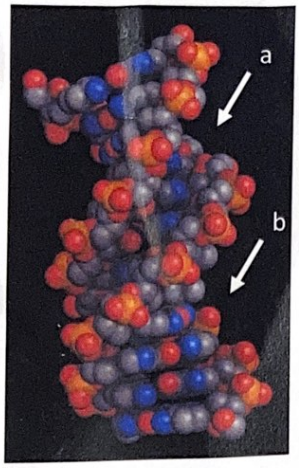
Structure of DNA

October 2021

1)



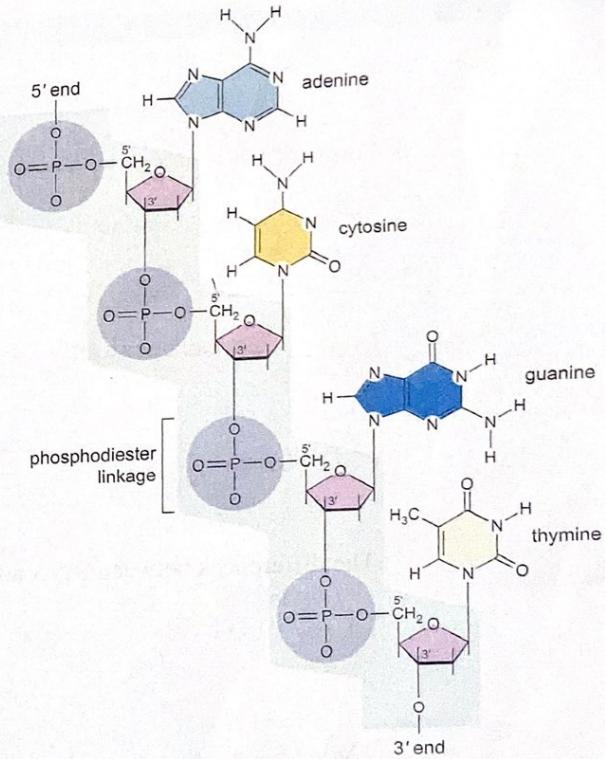
Double helix with

a) minor groove

b) major groove

2) Backbone: deoxyribose interconnected with phosphodiester linkages

The two strands have complementary sequences and are antiparallel



3) Bases:

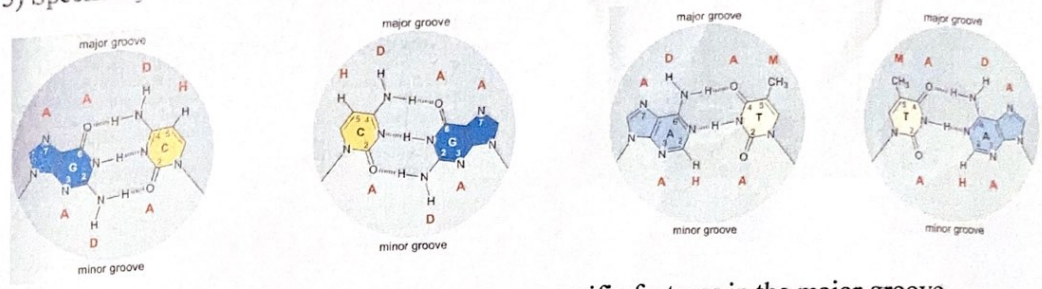
- Pyrimidine: Cytosine
  Thymine

- Purine: Adenine
  Guanine

4) Base pairing: Adenine with Thymine with two H-bridges

Guanine with Cytosine with three H-bridges

5) Specificity of minor and major groove



Sequence specific binding depends on sequence specific features in the major groove.

6) Forms of DNA double helices

In vivo the most commonly found form is the B-form (other forms: A-form and Z form). It is right-handed and has about 10 base pairs per turn.

7) The differences between RNA and DNA are

RNA: usually single stranded; Ribose; A=U, G≡C;

DNA: two strands; Deoxyribose; A=T, C≡G;