Name: _____ **Period: _____**

DNA, Fantastic!

View it at www.sciencemusicvideos.com

Welcome, I'm so happy you came by
For a lesson 'bout the essence of b-i-o-l-o-g-y
DNA's the topic; it's so fantastic,
We're talking 'bout Deoxyribonucleic acid

If you've ever wondered 'bout development in elephants
Or bumble bees, coffee trees, well DNA's the recipe
In its home in a chromosome in the nucleus
DNA drives the bus, genetically controlling us

In ferns and worms infectious germs, mommy's egg and daddy's sperm
DNA's the information linking up the generations
It's the code of life so listen up well,
'Cause DNA's the molecule in charge of every cell!

CHORUS
DNA! Fantastic
Deoxyribonucleic Acid
We're talking 'bout deoxyribonucleic acid
DNA! Fantastic

The shape is key -- probably well known to you
Double helix, twisted ladder, or a double corkscrew
Imagine a twisted length of tape with
Deoxyribose sugars on the edges with phosphates

Sugar phosphate sugar phosphate making up the sides of the
Ladder with nitrogenous bases on the inside
With the bases like the rungs and together with
Deoxyribose sugar and a phosphate make a nucleotide

Deoxyribonucleotides are the monomers
Link them up together for the DNA polymer
Point three four nanometers marks the space between
One nucleotide and the next one's place

And for the helix to make one turn takes
10 bases in a row as you can discern
Since space 'tween nucleotides is point three four,
One turn takes nanometers three point four

So stylish! So slick!
First described in '53 by Watson and Crick and
Don't forget Franklin she took that famous X-Ray pic
But she died so she never got her Nobel Prize.

CHORUS

The nitrogenous bases comes in one of four varieties,
Known by the letters A, T, C and G
A is for Adenine, Thymine's got the "T"
C it stands for Cytosine and Guanine's got the "G"

A and G with two nitrogen rings are purines
C and T with one ring are pyrimidines
C only bonds with G, A only with T
Because like puzzle pieces they're complementary

They fit together, snuggled up like hand and glove,
Like enzymes and substrates, like people in love
A-T, C-G, matched up like lock and key
Forming hydrogen bonds, either two or three.

Hydrogen bonds, you know they aren't very strong,
But they're enough to hold DNA together all day long
The way the bases fit together couldn't be sweeter,
They give DNA a width of two nanometers

DNA's double stranded, looks pretty swell
The strands' orientation is anti parallel
With one standing up, the other on its head
It's how they fit together, Crick and Watson said!

CHORUS

Sugars and phosphates make the backbone, the structure
But the sequence of the bases is where you find instructions
For development of bodies and the cytoplasmic symphony,
That constitutes life's miracle in goats and golden algae,

Your sequence of bases is unique, a special batch,
Unless you're an identical twin it's nowhere matched,
And you can bet, that if you're not Jango Fett
That you've got no clone, no one like you's been known!

Our bases comprise our individuality,
You might have "A" where I might have a "G"
Explaining why I'm bald and you got all that hair
These differences can show up anywhere,

The protein hemoglobin, now listen up well,
It carries oxygen in your red blood cells,
Hemoglobin's made of four protein pieces,
A trait widely shared among animal species.

Hundreds of bases spell one hemoglobin piece,
Hundreds of A's, G's, Ts and Cs
The gene starts CAC-GTG-CAC
Then TGA-GGA-CTC-CTC

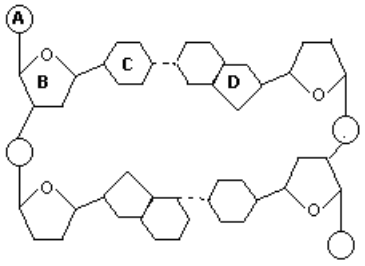
The key is these bases are information,
For hemoglobin's function and conformation,
Hundreds of bases, in a predetermined order,
A single change brings on a major disorder,

Change T to A in one single spot
This little point mutation might not seem like a lot,
Thymine to Adenine might not seem that big to ya'
But baby that's the cause of sickle cell anemia
CHORUS

DNA, Fantastic! (www.sciencemusicvideos.com)

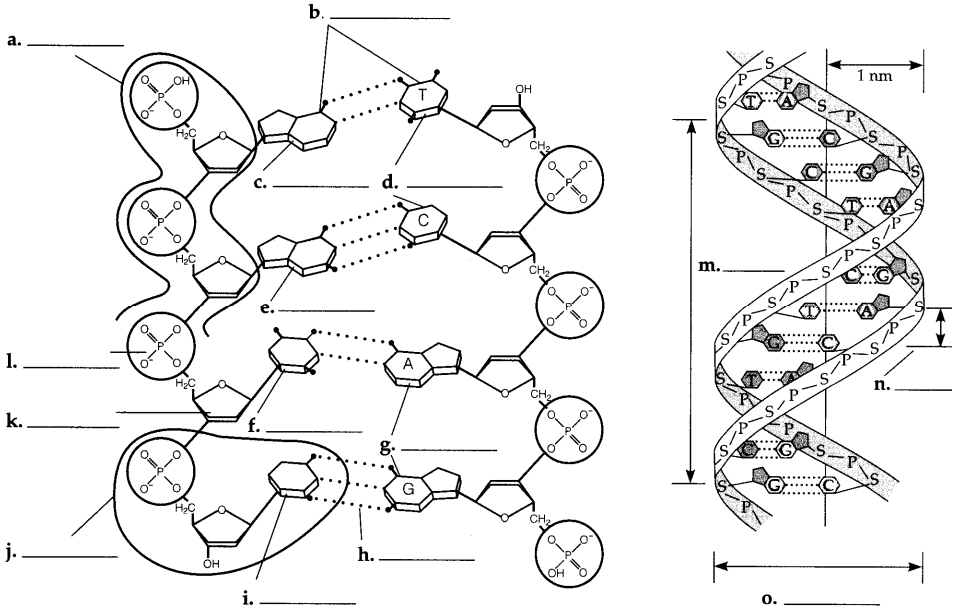
DNA Diagrams to Know

Diagram 1:



1. Letters A, B, and C together form a …	1. _____
2. Letter A is …	2. _____
3. Letter B is …	3. _____
4. Letter C is …	4. _____
5. If letter C is adenine, then D must be …	5. _____
6. If letter D is guanine, then C must be …	6. _____
7. In the "twisted ladder" analogy for DNA, C and D are the …	7. _____
8. In the "twisted ladder" analogy, "A" and "B" are the …	8. _____
9. In this diagram, which letters hold the information that makes up genes	9. _____

Diagram 2



Answer bank
.34 nm
2 nm
3.4 nm
A single nucleotide
Adenine
Base pair
Cytosine
Deoxyribose
Guanine
Hydrogen bond
Phosphate
Purine bases
Pyrimidine bases
Sugar phosphate backbone
Thymine

PARTS YOU SHOULD KNOW (first try)	PARTS YOU SHOULD KNOW (2nd try)
a. _____	a. _____
b. _____	b. _____
c. _____	c. _____
d. _____	d. _____
e. _____	e. _____
f. _____	f. _____
g. _____	g. _____
h. _____	h. _____
i. _____	i. _____
j. _____	j. _____
k. _____	k. _____
l. _____	l. _____
m. _____	m. _____
n. _____	n. _____
o. _____	o. _____

***DNA, Fantastic!* Checking Understanding. Read the lyrics (and use prior knowledge) to answer**

1. Based on the 1st three verses, list three reasons why DNA is important:
   a. _____
   b. _____
   c. _____
2. What are two common analogies for DNA's shape?

3. In the ladder analogy, the sides of the ladder are …

4. The rungs of the latter are composed of _____ _____.
5. What are the three sub-parts of a nucleotide: _____, _____, and _____.
6. What's the monomer of DNA? _____
7. Moving along the sugar-phosphate backbone, what's the distance between one nucleotide and the next? _____
8. How many bases in a row are required for the helix to make one complete turn: _____
9. A complete turn (one "wavelength") requires how many nanometers? _____
10. The two scientists generally credited with DNA's discovery are

11. The less recognized scientist whose X-ray images of DNA were essential clues to determining the molecule's structure was _____
12. List the four nitrogenous bases (both letter and full name): _____, _____, _____ and _____.
13. (Advanced): The two purine bases are _____ and _____. These both have _____nitrogen ring(s).
14. (Advanced): The two pyrimidine bases are _____ and _____. These both have _____ nitrogen ring(s).
15. Describe the base pairing rules for the nitrogenous bases.

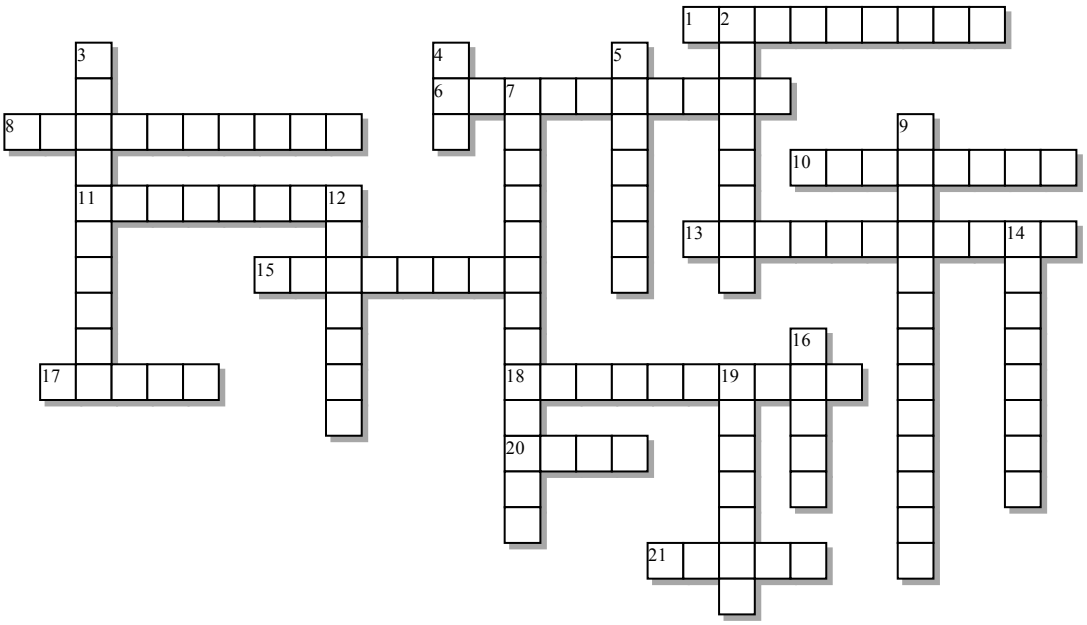
16. Like enzyme and substrate, the matching bases have shapes that are _____.
17. List a few other pairs of things (not enzymes, not nitrogenous bases) that are also complementary.

18. The bonds that connect complementary base pairs are _____ bonds. By contrast, all the other bonds in DNA are _____ bonds.
19. While hydrogen bonds are individually very _____, they collectively exert enough force to _____
20. DNA's diameter is _____. Therefore its radius is _____.
21. Anti-parallel means that

22. DNA's information is found in the _____ of its _____.
23. Except for identical twins, everyone's DNA sequence is _____.
24. Hemoglobin is a protein found in _____. Its function is to _____.
25. A specific single point mutation in the gene for hemoglobin results in _____.

DNA, Fantastic! Crossword Puzzle
View it at www.sciencemusicvideos.com
Glenn Wolkenfeld © 2012

Name:_____
Date:_____



DNA, Fantastic!

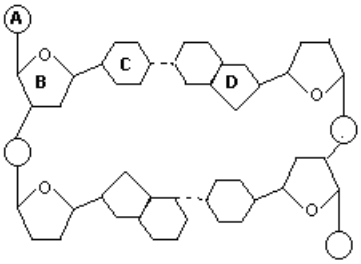
Across:
1 - The part of the DNA backbone that is not connected to a nitrogenous base
6 - the monomer of nucleic acids
8 - A package of DNA in the nucleus of the cell.
10 - The scientist who used X-ray imaging to help explain the structure of DNA
11 - A change of one base for another in a DNA sequence is known as a point
13 - The five carbon sugar in DNA
15 - Sugars and phosphates form the _____ of the DNA molecule.
17 - DNA's shape is referred to as a double
18 - DNA's width is two
20 - Because each strand is upside down relative to the other, we call them _____ parallel
21 - In the ladder analogy for DNA, the bases are like the

Down:
2 - Bonds between nitrogenous bases are _____ bonds
3 - A type of nitrogenous base with only one ring
4 - The molecule of heredity; what genes are made out of
5 - Like proteins and polysaccharides, DNA is a
7 - Matching base pairs, like enzymes and substrates, have bases that are
9 - The uniqueness of our DNA is the genetic basis of our
12 - The part of the cell where DNA is found
14 - The information in DNA is held in the base _____
16 - Watson and _____ are given most of the credit for discovering the structure of DNA
19 - The base that bonds with adenine

Possible Answers:
Crick, DNA, Franklin, anti, backbone, chromosome, complementary, deoxyribose, helix, hydrogen, individuality, mutation, nanometers, nucleotide, nucleus, phosphate, polymer, pyrimidine, rungs, sequence, thymine

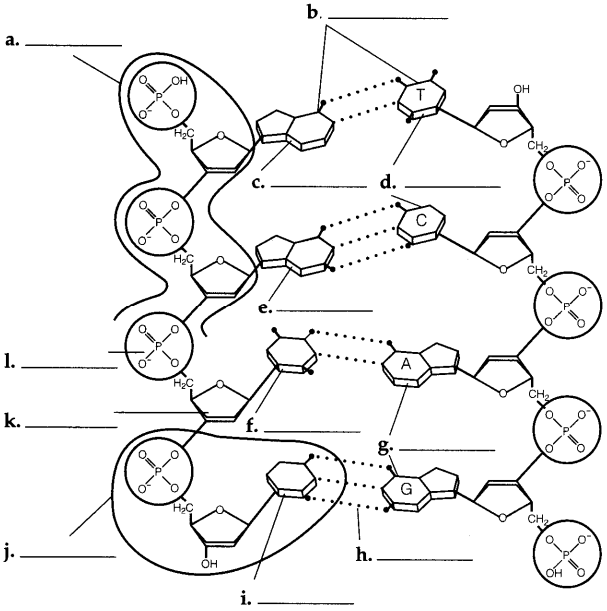
DNA Diagrams to Know (ANSWER KEY)

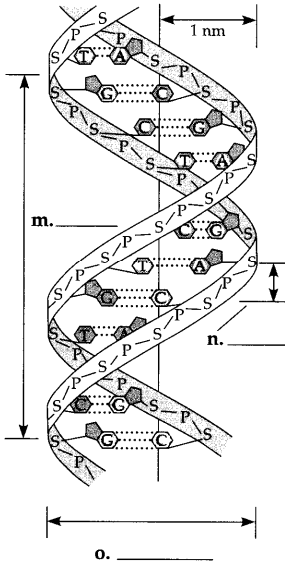
Diagram 1:



1. Letters A, B, and C together form a …	*1. nucleotide*
2. Letter A is …	*2. phosphate*
3. Letter B is …	*3. Deoxyribose (sugar)*
4. Letter C is …	*4. a nitrogenous base*
5. If letter C is adenine, then D must be …	*5. Thymine*
6. If letter D is guanine, then C must be …	*6. cytosine*
7. In the "twisted ladder" analogy for DNA, C and D are the …	*7. rungs*
8. In the "twisted ladder" analogy, "A" and "B" are the …	*8. sides (of the ladder)*
9. In this diagram, which letters hold the information that makes up genes	*9. C and D (the bases)*

Diagram 2





Answer bank

.34 nm
2 nm
3.4 nm
A single nucleotide
Adenine
Base pair
Cytosine
Deoxyribose
Guanine
Hydrogen bond
Phosphate
Purine bases
Pyrimidine bases
Sugar phosphate backbone
Thymine

PARTS YOU SHOULD KNOW (first try)

a. Sugar phosphate backbone
b. Base pair
c. Adenine
d. Pyrimidine bases
e. Guanine
f. Thymine
g. Purine bases
h. Hydrogen bonds
i. Cytosine
j. A single nucleotide
k. Deoxyribose
l. Phosphate
m. 3.4 nanometers
n. 0.34 nanometers
o. 2 nanometers

PARTS YOU SHOULD KNOW (2nd try)

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____
h. _____
i. _____
j. _____
k. _____
l. _____
m. _____
n. _____
o. _____

***DNA, Fantastic!* Checking Understanding**

1. Based on the 1st three verses, list three reasons why DNA is important:
    a. DNA is the recipe for development
    b. DNA controls the cells
    c. DNA's the molecule of heredity ("the information linking up the generations)
2. What are two common analogies for DNA's shape?
   Double helix, twisted ladder
3. In the ladder analogy, the sides of the ladder are …
   Sugars and phosphates
4. The rungs of the latter are composed of nitrogenous bases
5. What are the three sub-parts of a nucleotide: deoxyribose sugar, phosphate and nitrogenous base
6. What's the monomer of DNA? Nucleotide (or deoxyribonucleotide)
7. Moving along the sugar-phosphate backbone, what's the distance between one nucleotide and the next? .34 nanometers
8. How many bases in a row are required for the helix to make one complete turn: 10
9. A complete turn (one "wavelength") requires how many nanometers? 3.4 nm
10. The two scientists generally credited with DNA's discovery are
    James Watson, Francis Crick
11. The less recognized scientist whose X-ray images of DNA were essential clues to determining the molecule's structure was Rosalind Franklin
12. List the four nitrogenous bases (both letter and full name): (A) Adenine, (T) Thymine, (C) Cytosine, and (G) Guanine
13. (Advanced): The two purine bases are adenine and guanine These both have two nitrogen ring(s).
14. (Advanced): The two pyrimidine bases are cytosine and thymine These both have one nitrogen ring(s). Just remember that the "y"s go together!
15. Describe the base pairing rules for the nitrogenous bases.
    A only bonds with T, C only with G
16. Like enzyme and substrate, the matching bases have shapes that are complementary
17. List a few other pairs of things (not enzymes, not nitrogenous bases) that are also complementary.
    Answers will vary, and might include complementary colors, antibody and antigen, nut and bolt, and probably enter into the mammalian equivalents of ovipositor and oviduct
18. The bonds that connect complementary base pairs are hydrogen bonds. By contrast, all the other bonds in DNA are covalent bonds.
19. While hydrogen bonds are individually very weak they collectively exert enough force to "hold DNA together all day long"
20. DNA's diameter is 2 nanometers. Therefore its radius is one nanometer
21. Anti-parallel means that the only way the strands fit together is for one to be upside down relative to the other. Biochemically, that means that one strand will have a 5' to3' orientation, while the complement will have a 3' to 5' orientation
22. DNA's information is found in the sequence of its bases
23. Except for identical twins, everyone's DNA sequence is unique
24. Hemoglobin is a protein found in red blood cells. Its function is to carry oxygen.
25. A specific single point mutation in the gene for hemoglobin results in sickle cell anemia

Name:_____
Date:_____

DNA, Fantastic Crossword (SOLUTION)