

DNA STRUCTURE

Cornell Doodle Notes TEACHER NOTES

These scaffolded Cornell Doodle Notes combine two effective note-taking strategies and can be used to introduce the structure of the DNA molecule, including the double helix shape, nucleotides, phosphate and sugar backbone, nitrogenous base pairing, hydrogen bonds, purines, and pyrimidines. These notes support NGSS MS-LS3: Heredity: Inheritance and Variation of Traits: Disciplinary Core Idea MS-LS3.A: Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual; Crosscutting Concepts: Cause and Effect Relationships; Structure and Function.

Cornell Notes are a note-taking strategy in which topic questions are written in a narrow left-hand column and definitions, explanations, and diagrams are filled in in the right-hand column. At the bottom of Cornell Notes, there is typically a section included for reflection on the lesson's main points. See the example to the right.

Doodle Notes (or Sketch Notes) are another note-taking strategy for which pictures and graphics activate the visual pathways of the brain, which helps with retention of information when compared to standard note-taking. Your visual learners will really benefit from seeing and coloring in the pictures aside the main points of the notes!

Doodle Notes is a registered trademark used with permission. See DoodleNotes.org for more details.

The image shows two versions of the Cornell Doodle Notes template. The top version is a blank template with sections for 'CUES' (left), 'NAME, DATE, TOPIC, CLASS' (top right), 'NOTES' (right), 'TAKEN DURING CLASS' (sub-section of Notes), 'WRITTEN SOON AFTER CLASS' (CUES), 'ANTICIPATED EXAM QUESTIONS' (CUES), 'MAIN IDEAS OR PEOPLE' (CUES), 'VOCABULARY WORDS' (CUES), and 'USED FOR REVIEW & STUDY' (bottom). The bottom version is a completed 'DNA Structure' worksheet. It includes an 'Essential Question' box, 'Topic Questions' (1 and 2), and various diagrams and text boxes about DNA structure, including a sun, a book, and chemical structures of nucleotides.

This is a sample page from the DNA Structure Cornell Doodle Notes. It features a large title 'DNA Structure' at the top, followed by 'Cornell Doodle Notes'. Below that is an 'Essential Question' box asking 'What is the chemical and physical structure of the DNA molecule?'. A stylized DNA helix is drawn in the bottom left corner.

I created a Powerpoint that goes with these notes. The Powerpoint walks the students through the lesson from the Essential Question and through all of the Topic Questions. There is a "Sum It Up" section at the end of the notes, for which students practice applying the concepts.



SEE THE PRINTING TIPS ON NEXT PAGE

On the following pages, you will find 4 versions of the Cornell Doodle Notes:

KEY

The KEY : pages 4-6 : All notes and "answers" are included on this version



Green Circle : pages 7-9 : Use this version for your lower-level students who need more support, take more time, or who are learning English as a second language...they will have to fill in missing words



Blue Square : pages 10-12 : Use this version for your mainstream students...they will have to write each of the topic questions and fill in more of the words and sentences throughout



Black Diamond: pages 13 - 15 : Use this version for your high-level students who work more quickly or who like to write in their own handwriting...they will have to fill in almost all of the text throughout the notes

Note: the "Sum It Up" section is the same for all student versions.

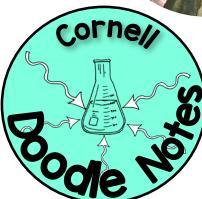
On the next page are the directions for accessing the Powerpoint for this product via Google Drive (Google Slides). This is obviously option depending on how you choose to use this in your classroom.

Here are some ways that I suggest using this resource:

- 1) Whole-Group lesson with differentiation : decide which students should receive which level of the notes. Hand out the notes to the students. Use the Powerpoint as a presentation and talk aloud through the lesson while the students take notes. Allow them to color/doodle further during and at the end of the lesson.
- 2) Differentiated Small-Group lesson : separate your students into groups by learning level. Give each student group sets of the appropriate notes for their level. Make sure each group has a device to view the presentation. Post the Powerpoint or Google Slides to your Google Classroom or other online learning platform, or email the Powerpoint version to one 'student leader' in each group. The students would view the Powerpoint/Slides together on one device and fill in the notes. Encourage them to add color/further notes.
- 3) Individual Note-Taking or Flipped Classroom : Post the Powerpoint or Google Slides presentation to your Google Classroom or other online learning platform. Hand out the appropriate-level notes to each student. Students can work at their own pace to view the presentation and complete their notes. Encourage them to add color/further notes.

Thank you very much for your purchase!
If this product has met your needs,
please consider leaving feedback at
TeachersPayTeachers.com. I read each
and every feedback and I appreciate
your time. Also please feel free to email
me at SunriseScienceTPT@gmail.com
with any questions or concerns!
© Sunrise Science 2018

You may also be
interested in my other
Cornell Doodle Notes
products! Click on the
picture to the right!



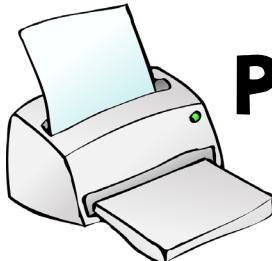
Thank you to these
amazing artists!

kimberly geswein fonts
KG

KB3 TEACH FONTS

SARAH PECOCK
ILLUSTRATION





PRINTING TIPS!

It depends how you'd like your students to use these notes. They can be printed one-sided and folded up into an interactive notebook, or you can print them double-sided and have students keep them in binders/folders.

If you print them double-sided, this is what I suggest doing:

- o In the print settings on Adobe/Reader, keep the "Auto Orientation" button selected
- o Click "FLIP ON LONG EDGE"
- o Type in the page numbers that you'd like to print and the number of copies
- o You can also print the pages one-sided and run them double-sided through your school's copy machine!

Printing the notes this way will avoid your students having to rotate their paper when they go to the next side. Instead, they will flip and the left and right columns will be in the same place!



EXAMPLE COLORED NOTES

GOOGLE DRIVE DIRECTIONS

Below are some instructions for how to download this product and share it with your students via Google Drive. Just a note- although this is a digital resource, please know that it is for personal classroom use for only you and your students to share via email, Google Drive, or Google Classroom. Please do not upload this resource online where it can be accessed by the general public.

CLICK ON THIS LINK TO ACCESS YOUR PURCHASE IN GOOGLE!:
<https://tinyurl.com/yacuslzc>

When you click the link above, you'll be taken to a screen that says "Copy Document". Click the blue button that says "Make a Copy". This will transfer the file to your own Google Drive account.

Preferably, share this resource with your students through your Google Classroom, OR once all of your students have their own Google Drive account (drive.google.com), share the above link with them and have them make their own copy of the assignments into their own Google Drive.

Name: _____

Class: _____ Date: _____

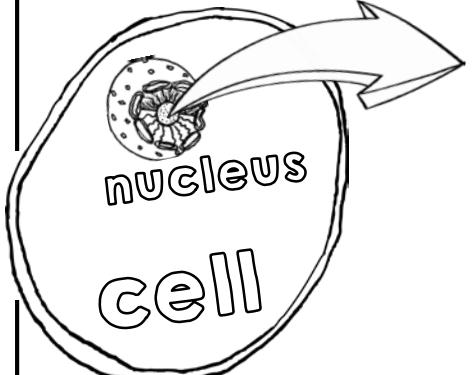
DNA Structure

TOPIC QUESTIONS:

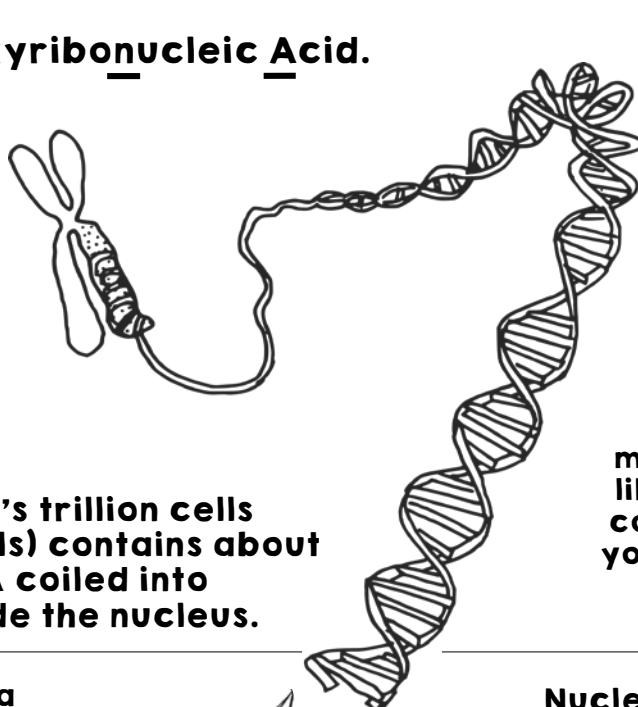
1

What is DNA?

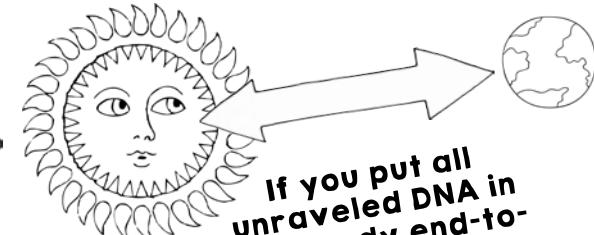
DNA stands for Deoxyribonucleic Acid.



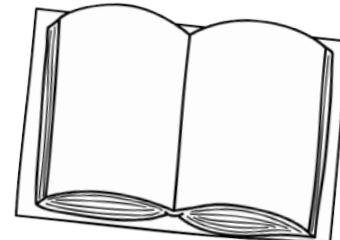
Each of your body's trillion cells (except red blood cells) contains about 2 meters of DNA coiled into chromosomes inside the nucleus.



DNA is a molecule. It is like a book of code that tells your cells what to do to.



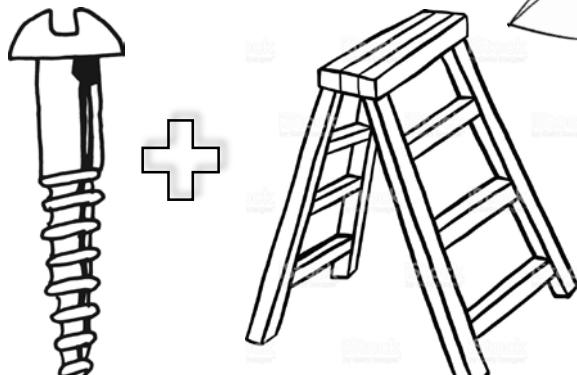
If you put all unraveled DNA in your body end-to-end, it would go from the Earth to the Sun hundreds of times!



2

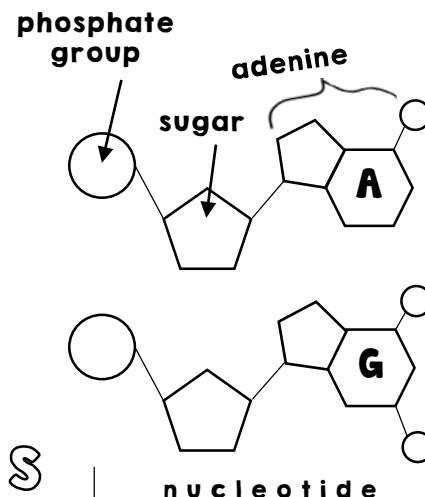
What are the parts of the DNA molecule?

DNA is in the shape of a 'double helix', which is sort of like a twisted ladder.

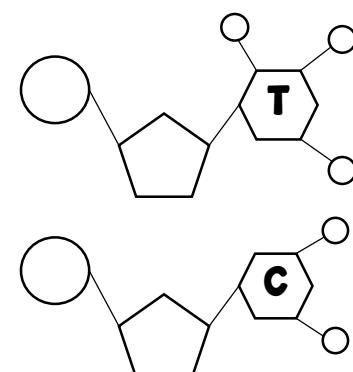


The building blocks of the molecule are called

n u c l e o t i d e s



Nucleotides are composed of:
 → a phosphate group
 → a deoxyribose sugar molecule
 → and one of four different nitrogenous bases called adenine, thymine, guanine, or cytosine

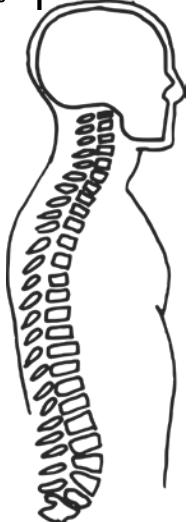


Color the phosphate groups purple, the sugars yellow, the adenine red, thymine green, guanine orange, and cytosine blue.

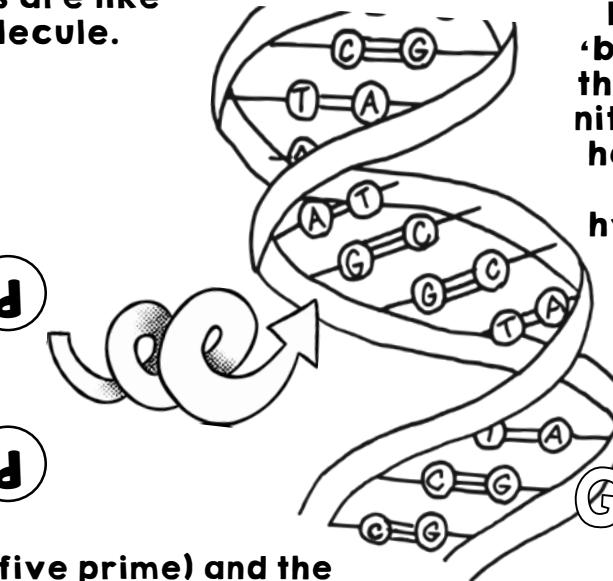
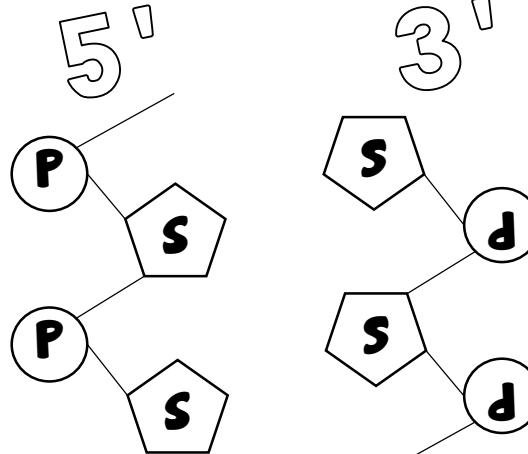
TOPIC QUESTIONS:

3

How is the double helix structured?



The phosphate and sugar groups are like the 'backbone' of the DNA molecule.



In between the 'backbone' sides, there are pairs of nitrogenous bases held together by two or three hydrogen bonds.

The sequence of the base pairs is **THE GENETIC CODE!**

4

How do the nitrogenous bases pair together?

THE RULES OF DNA!

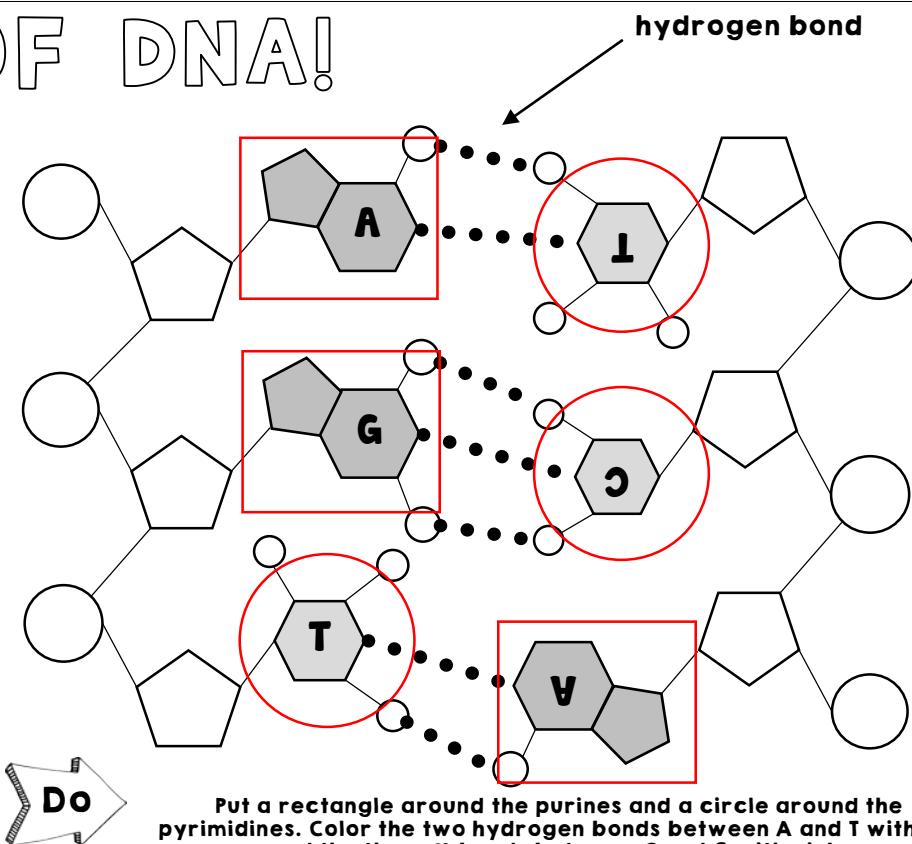
Adenine always pairs with Thymine by two hydrogen bonds.

Cytosine always pairs with Guanine by three hydrogen bonds.

In order for the base pairs to 'fit' between the two sides of DNA's 'backbone', a PURINE must bond to a PYRIMIDINE.

Adenine and Guanine have two carbon-nitrogen ring structures and are called PURINES.

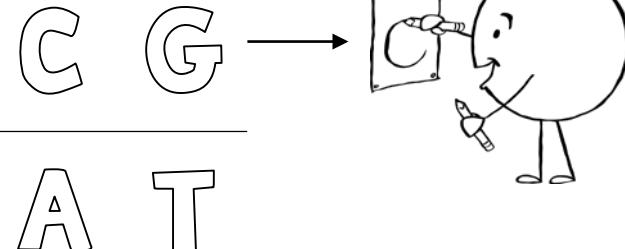
Thymine and Cytosine have one carbon-nitrogen ring structure and are called PYRIMIDINES.



Put a rectangle around the purines and a circle around the pyrimidines. Color the two hydrogen bonds between A and T with tan and the three H-bonds between C and G with pink.

TOPIC QUESTIONS:**5**

What are some ways to remember how the bases pair together?



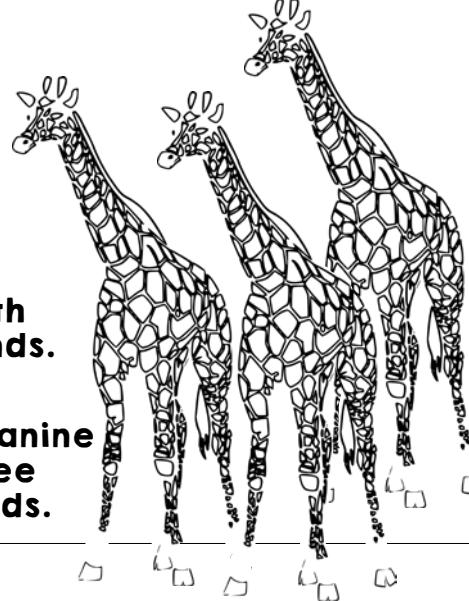
The two 'circle' letters pair together and the two 'stick' letters pair together.



Two Angry Tigers and Three Calm Giraffes.

Adenine and Thymine pair with two hydrogen bonds.

Cytosine and Guanine pair with three hydrogen bonds.

**SUM IT UP!**

1. What does DNA stand for? Deoxyribonucleic Acid

2. Where is DNA located within a cell? Wrapped into chromosomes within the nucleus

3. What is the 'twisted ladder' shape of the DNA molecule? Double helix

4. What are the three parts of a nucleotide? phosphate group,
deoxyribose sugar, nitrogenous base

5. What two nitrogenous bases have two ring structures and are called purines?

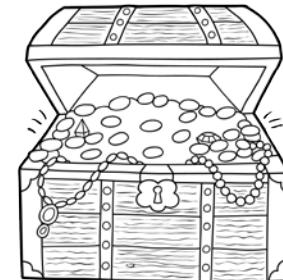
adenine and guanine

6. What two nitrogenous bases have one ring structure and are called pyrimidines?

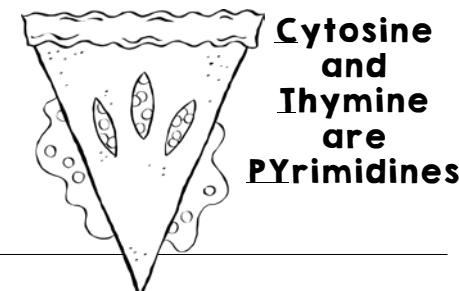
cytosine and thymine

7. What two structures make up the 'backbone' of the DNA molecule?

phosphate group and deoxyribose sugar

PURE As Gold

Adenine and Guanine are PURINES

Cut the PY

Cytosine and Thymine are PYrimidines

8. What type of bonds hold the base pairs together? hydrogen bonds

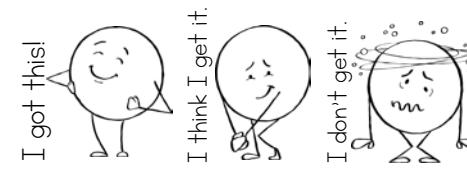
9. Underneath each letter in this DNA sequence, write the letter of the base that would pair with it in its complimentary strand:

A	T	G	C	G	C	T	A	T	T	G
T	A	C	G	C	G	A	T	A	A	C

10. One side of the double helix is called the 5' prime side and the other is called the 3' prime side.

**\$2 SUMMARY**

Write a summary of this lesson. You have \$2 and each word costs 10 cents.



How are you feeling about the basics of DNA Structure? Circle one:

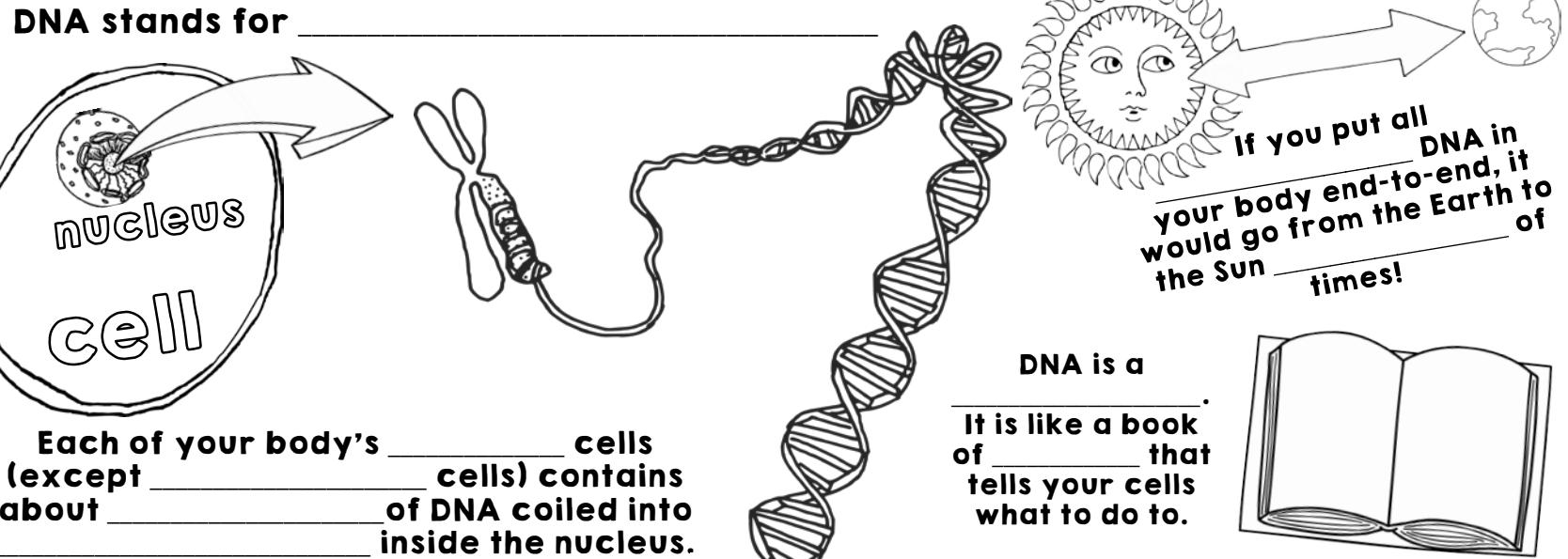
DNA Structure

**ESSENTIAL
QUESTION:**

TOPIC QUESTIONS:

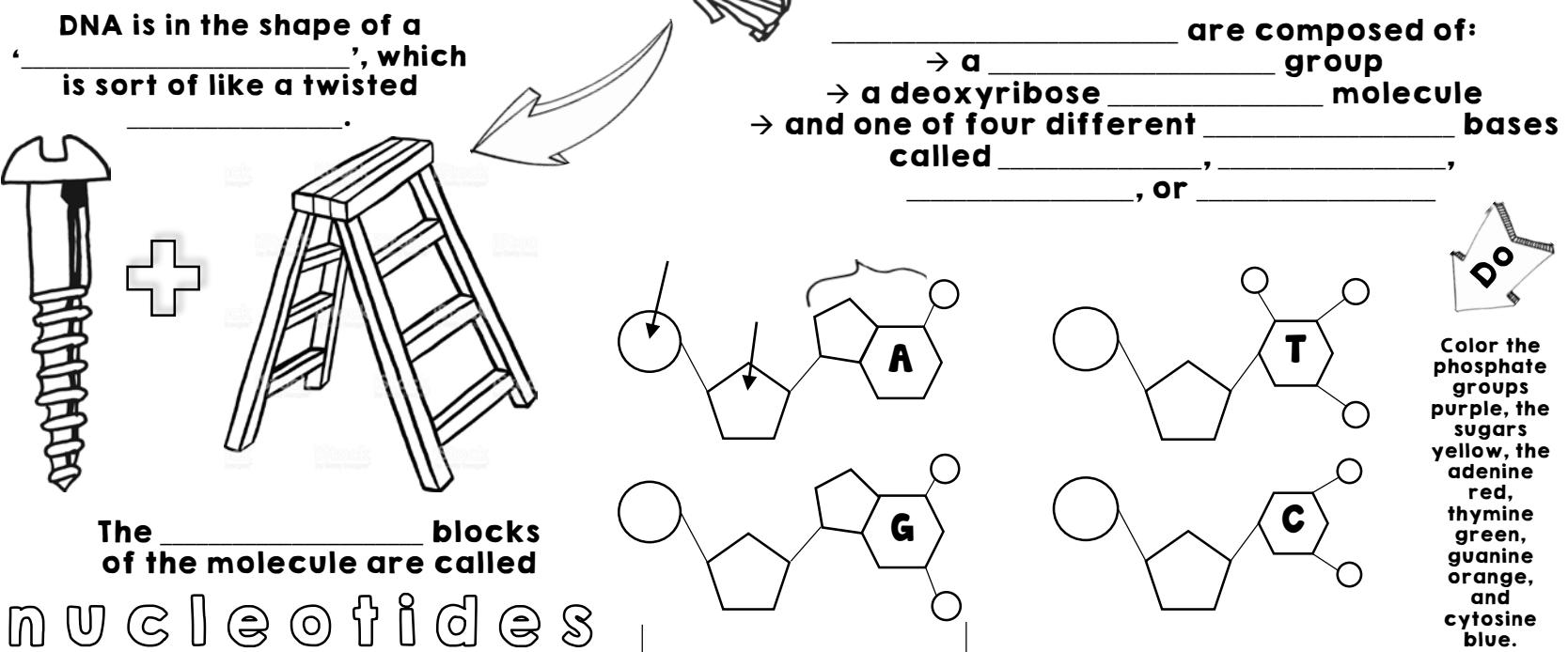
1

**What is
_____?**



2

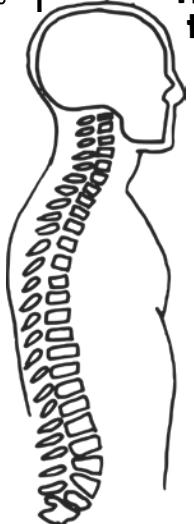
**What are the
_____ of the
DNA
_____?**



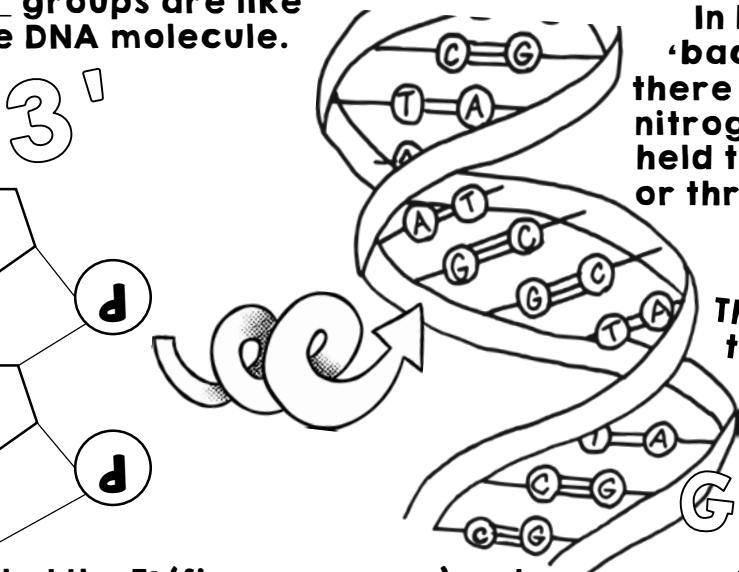
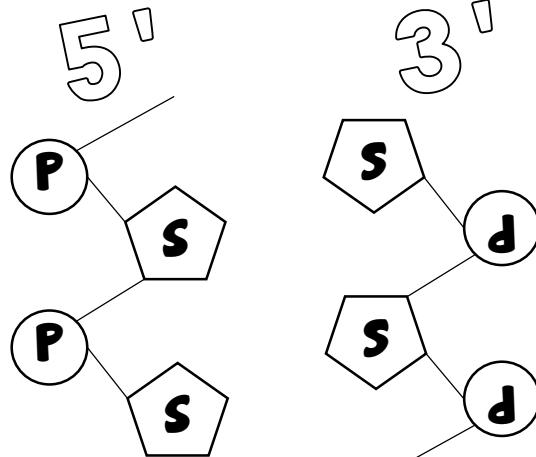
TOPIC QUESTIONS:

3

How is the structured?



The phosphate and _____ groups are like the '_____ ' of the DNA molecule.



In between the
'backbone' sides,
there are _____ of
nitrogenous _____
held together by two
or three _____
bonds.

The _____ of the base pairs is **THE GENETIC CODE!**

One side of the ‘_____’ is called the 5’ (five _____) and the other is called the _____ (three prime) side. This indicates how the phosphate and sugar are linked. The two sides of the backbone are ‘_____’ compared to one another.

4

**How do the
bases
together?**

THE RULES OF DNA!

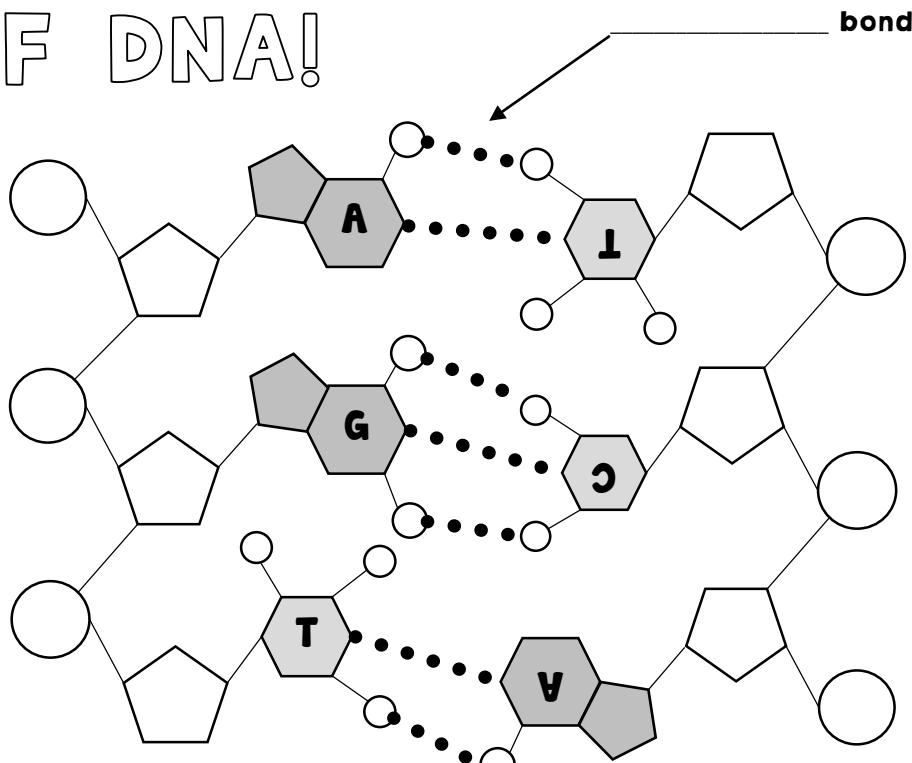
always pairs with
 by _____ hydrogen
bonds.

always pairs with
 by _____ hydrogen
bonds.

In order for the base pairs to ‘fit’ between the two sides of DNA’s ‘backbone’, a _____ must bond to a _____.

Adenine and Guanine have _____ carbon-nitrogen ring structures and are called _____.

Thymine and Cytosine have _____ carbon-nitrogen ring structure and are called _____.



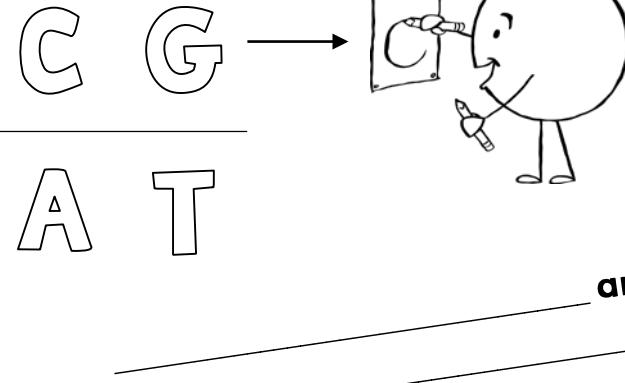
DC

Put a rectangle around the purines and a circle around the pyrimidines. Color the two hydrogen bonds between A and T with tan and the three H-bonds between C and G with pink.

TOPIC QUESTIONS:

5

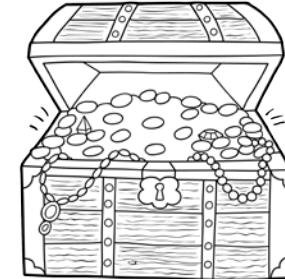
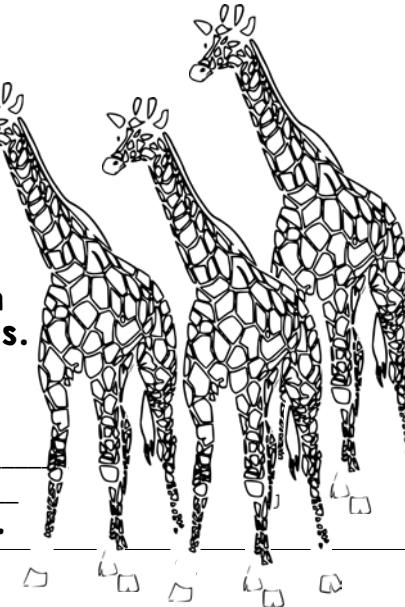
What are some ways to
how the bases pair together?



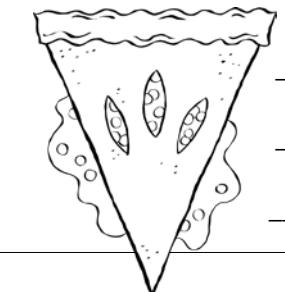
The two '_____
letters pair together
and the two '_____
letters pair together.



and _____.
and _____
pair with _____
hydrogen bonds.
and _____
pair with _____
hydrogen bonds.



and
are



and
are

SUM IT UP!

1. What does DNA stand for? _____

2. Where is DNA located within a cell? _____

3. What is the 'twisted ladder' shape of the DNA molecule? _____

4. What are the three parts of a nucleotide? _____

5. What two nitrogenous bases have two ring structures and are called purines?
_____ and _____

6. What two nitrogenous bases have one ring structure and are called pyrimidines?
_____ and _____

7. What two structures make up the 'backbone' of the DNA molecule?
_____ and _____

8. What type of bonds hold the base pairs together? _____

9. Underneath each letter in this DNA sequence, write the letter of the base
that would pair with it in its complimentary strand:

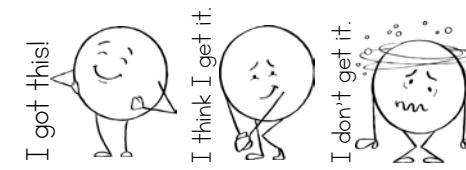
A T G C G C T A T T G

10. One side of the double helix is called the ____ prime side and the other is
called the ____ prime side.



\$2 SUMMARY

Write a summary of this lesson. You have
\$2 and each word costs 10 cents.



How are you feeling about the basics
of DNA Structure? Circle one:

DNA Structure

**ESSENTIAL
QUESTION:**

TOPIC QUESTIONS:

1

DNA stands for _____

A drawing of a cell with a nucleus. Inside the nucleus, there is a coiled structure representing DNA. An arrow points from the word "nucleus" to the nucleus and from the word "cell" to the entire cell outline.

A detailed line drawing of a DNA double helix, showing its characteristic ladder-like structure with rungs made of nucleotides.

An illustration of the Sun with a face and a long, wavy arrow pointing towards the Earth. The arrow represents the length of all the DNA in a person's body.

If you put all
your body end-to-end, it
would go from the Earth to
the Sun _____
times!

DNA is ...

A simple line drawing of an open book, symbolizing knowledge or education.

Each of your body's _____ cells
(except _____ cells) contains
about _____ of DNA coiled into
inside the nucleus.

2

DNA is in the shape of ...

Two illustrations: a screw on the left and a ladder on the right. Arrows point from these illustrations to the DNA helix above, suggesting that DNA is composed of repeating units similar to these structures.

The _____ blocks
of the molecule are called

nucleotides

_____ are composed of:
→ a _____ group
→ a deoxyribose _____ molecule
→ and one of four different _____ bases
called _____, _____,
_____, or _____

A diagram of an adenine nucleotide. It shows a purine base (adenine, labeled 'A') attached to a deoxyribose sugar, which is further attached to a phosphate group (represented by a circle with a minus sign).

A diagram of a guanine nucleotide. It shows a purine base (guanine, labeled 'G') attached to a deoxyribose sugar, which is further attached to a phosphate group.

A diagram of a thymine nucleotide. It shows a pyrimidine base (thymine, labeled 'T') attached to a deoxyribose sugar, which is further attached to a phosphate group.

A diagram of a cytosine nucleotide. It shows a pyrimidine base (cytosine, labeled 'C') attached to a deoxyribose sugar, which is further attached to a phosphate group.

A small, open notepad with the letters "DO" written on the cover.

Color the
phosphate
groups
purple, the
sugars
yellow, the
adenine
red,
thymine
green,
guanine
orange,
and
cytosine
blue.

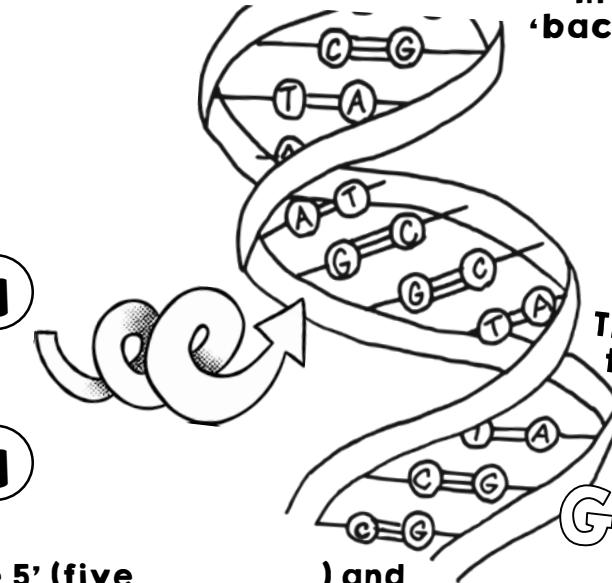
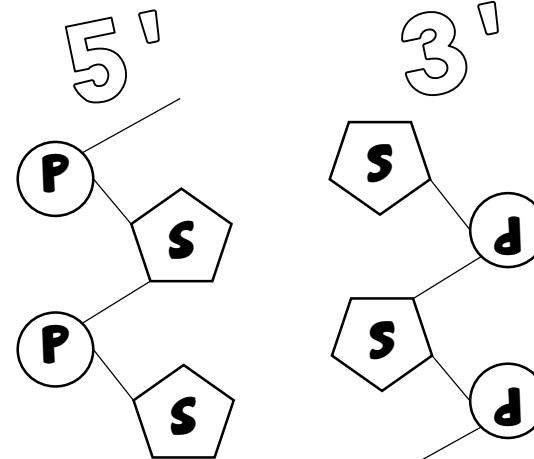
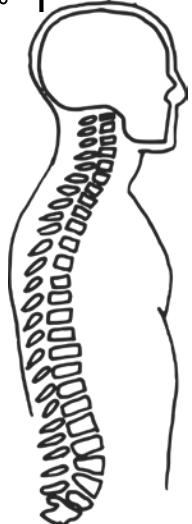
© Sunrise Science 2018

TOPIC QUESTIONS:

The _____ and _____ groups are ...

In between the
'backbone' sides ...

3



The _____ the base pairs is
THE GENETIC CODE!

One side of the '_____' is called the 5' (five _____) and the other is called the _____ (three prime) side. This indicates how the phosphate and sugar are linked. The two sides of the backbone are '_____ ' compared to one another.

4

THE RULES OF DNA!

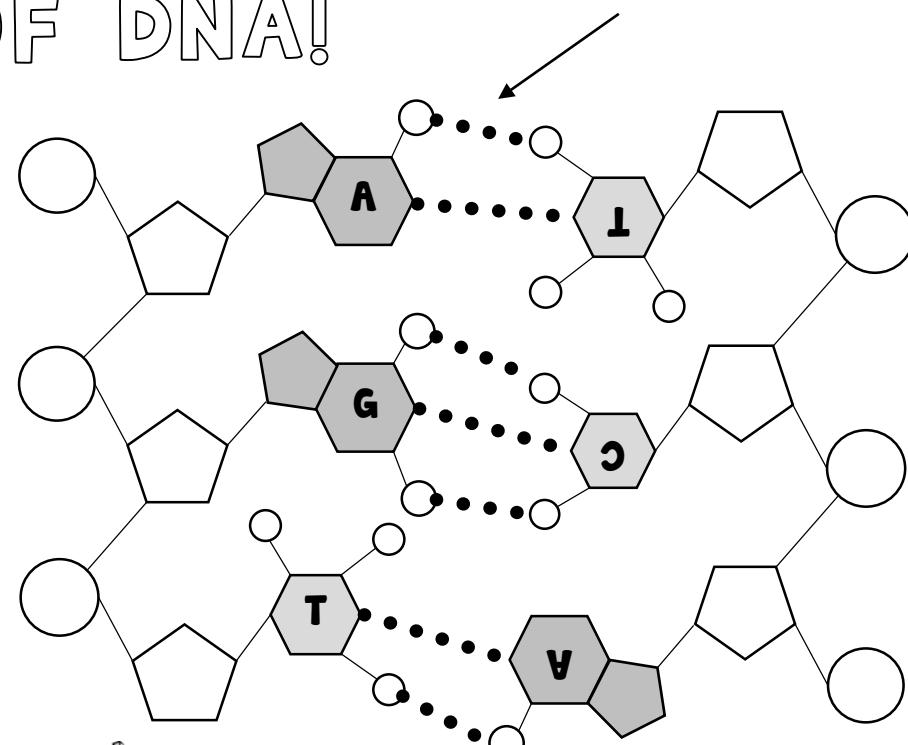
_____ always pairs with
by _____ hydrogen
bonds.

_____ always pairs with
by _____ hydrogen
bonds.

In order for the base pairs to 'fit' between the two sides of DNA's 'backbone', ...

Adenine and Guanine have _____ carbon-nitrogen ring structures and are called _____.

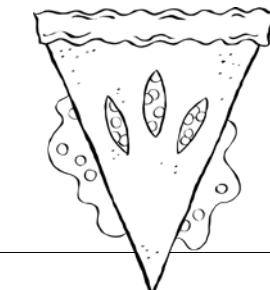
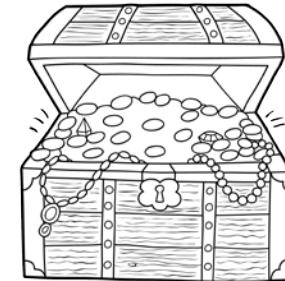
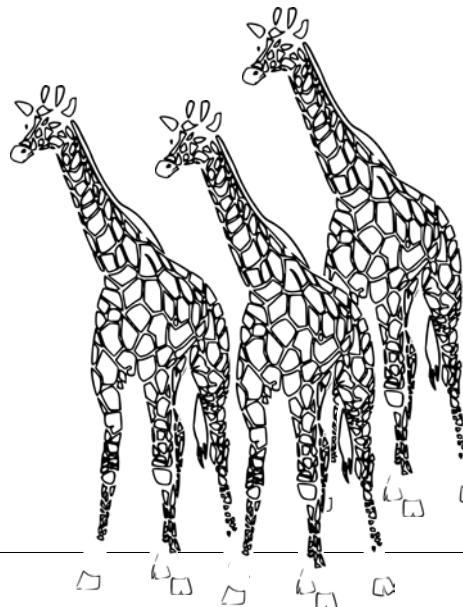
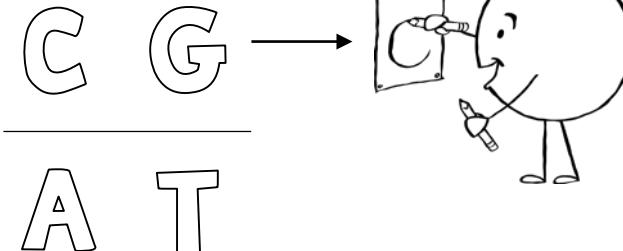
Thymine and Cytosine have _____ carbon-nitrogen ring structure and are called _____.



Put a rectangle around the purines and a circle around the pyrimidines. Color the two hydrogen bonds between A and T with tan and the three H-bonds between C and G with pink.

TOPIC QUESTIONS:

5



SUM IT UP!

1. What does DNA stand for? _____

2. Where is DNA located within a cell? _____

3. What is the 'twisted ladder' shape of the DNA molecule? _____

4. What are the three parts of a nucleotide? _____

5. What two nitrogenous bases have two ring structures and are called purines?

_____ and _____

6. What two nitrogenous bases have one ring structure and are called pyrimidines?

_____ and _____

7. What two structures make up the 'backbone' of the DNA molecule?

_____ and _____

8. What type of bonds hold the base pairs together? _____

9. Underneath each letter in this DNA sequence, write the letter of the base that would pair with it in its complimentary strand:

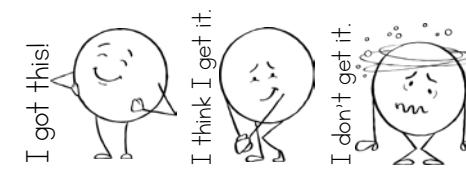
A T G C G C T A T T G

10. One side of the double helix is called the ___ prime side and the other is called the ___ prime side.



\$2 SUMMARY

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How are you feeling about the basics of DNA Structure? Circle one:

DNA Structure

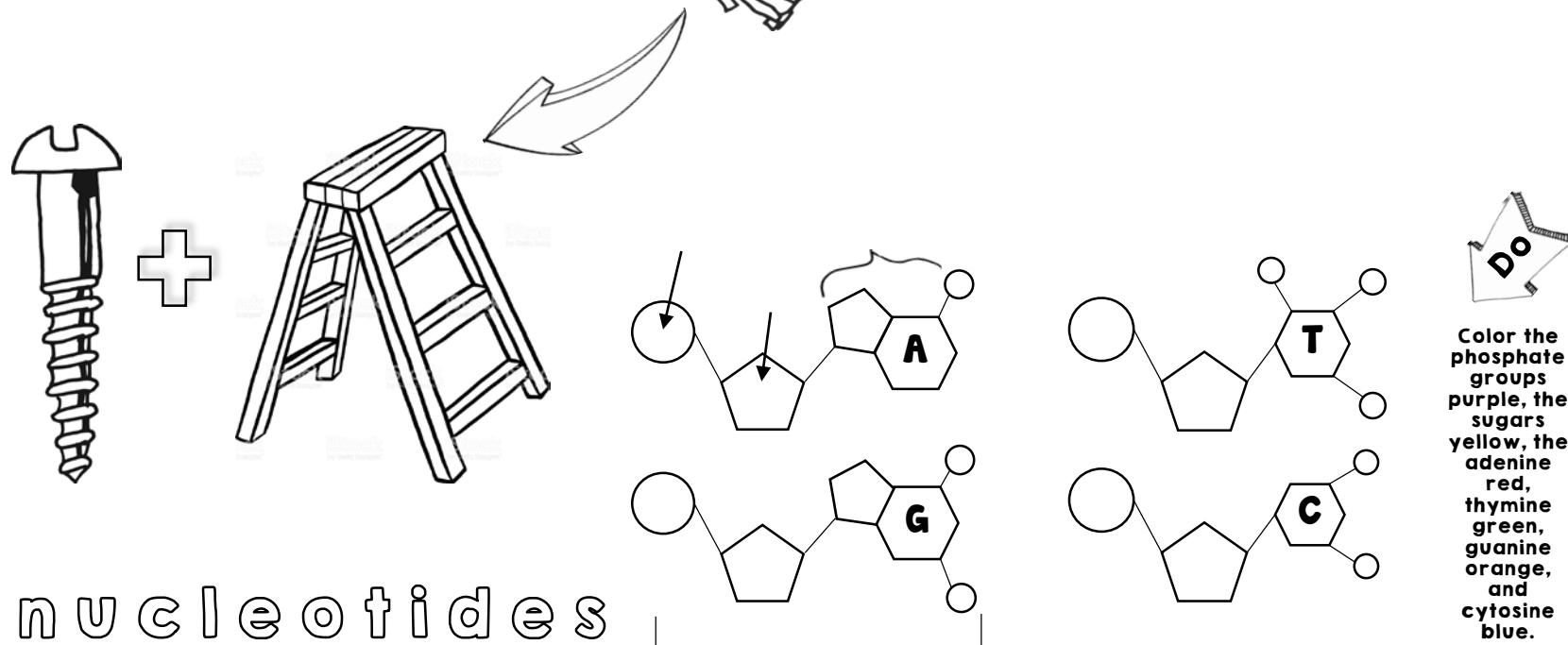
ESSENTIAL
QUESTION:

TOPIC QUESTIONS:

1

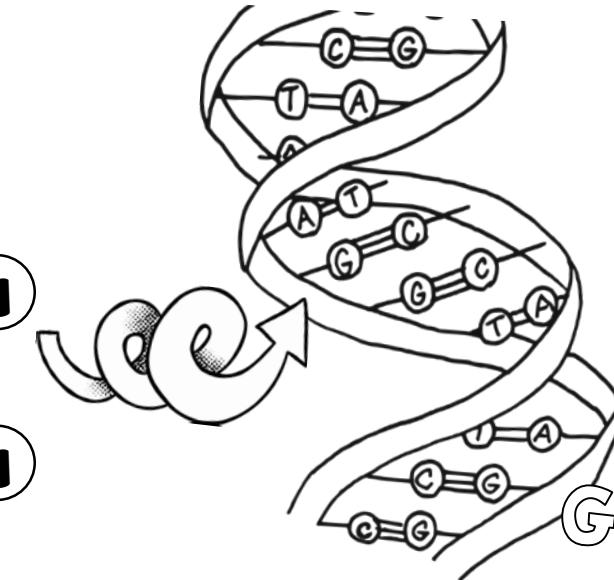
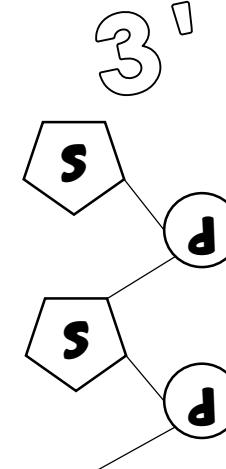
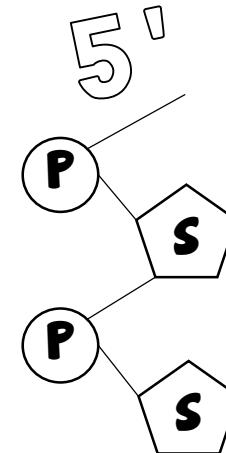
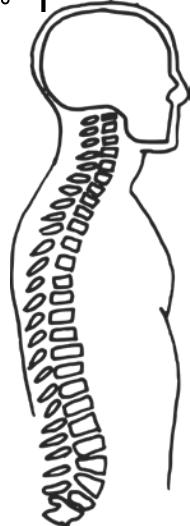


2



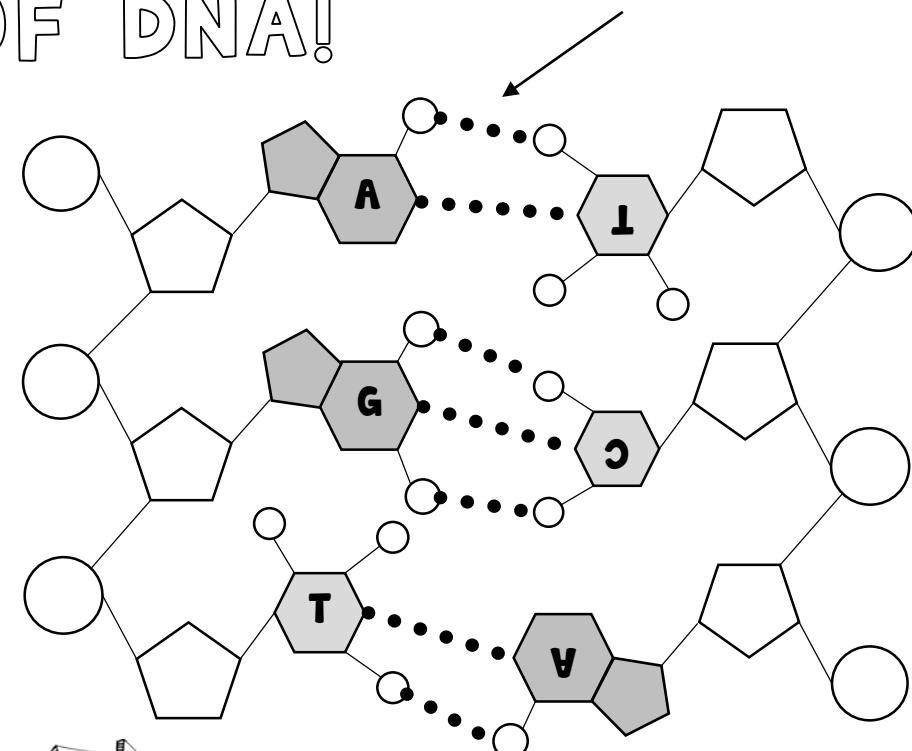
TOPIC QUESTIONS:

3



4

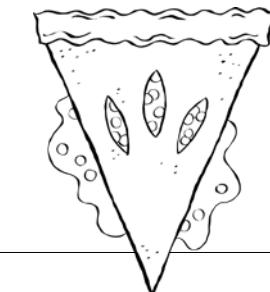
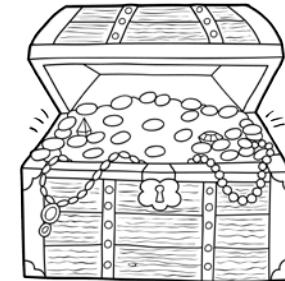
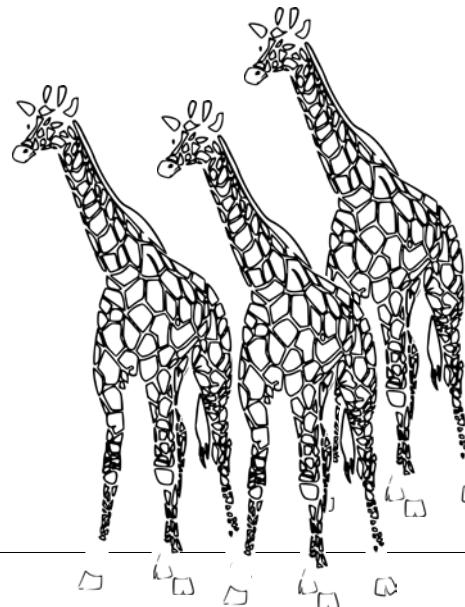
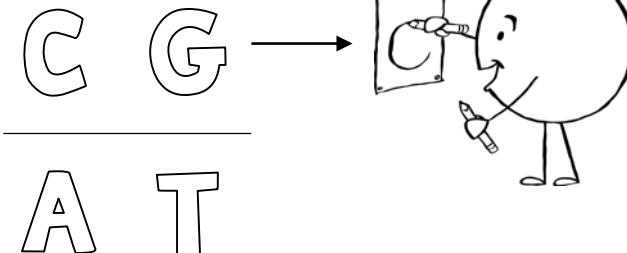
THE RULES OF DNA!



Put a rectangle around the purines and a circle around the pyrimidines. Color the two hydrogen bonds between A and T with tan and the three H-bonds between C and G with pink.

TOPIC QUESTIONS:

5



SUM IT UP!

1. What does DNA stand for? _____

2. Where is DNA located within a cell? _____

3. What is the 'twisted ladder' shape of the DNA molecule? _____

4. What are the three parts of a nucleotide? _____

5. What two nitrogenous bases have two ring structures and are called purines?

_____ and _____

6. What two nitrogenous bases have one ring structure and are called pyrimidines?

_____ and _____

7. What two structures make up the 'backbone' of the DNA molecule?

_____ and _____

8. What type of bonds hold the base pairs together? _____

9. Underneath each letter in this DNA sequence, write the letter of the base that would pair with it in its complimentary strand:

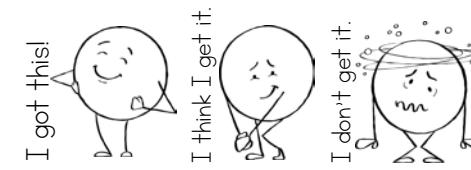
A T G C G C T A T T G

10. One side of the double helix is called the ___ prime side and the other is called the ___ prime side.



\$2 SUMMARY

Write a summary of this lesson. You have
\$2 and each word costs 10 cents.



How are you feeling about the basics
of DNA Structure? Circle one:

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