

SI GOB - Full Discipline Demo

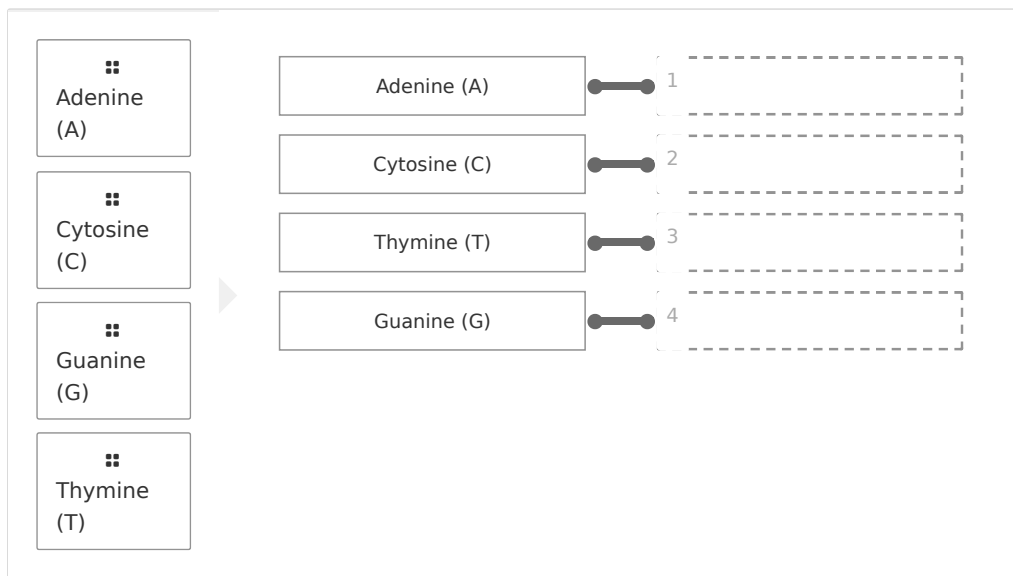
GOB-Extraction of DNA

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI GOB - Full Discipline Demo
Course	SI GOB - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Determine the correct complementary base pair for each nucleotide.



The diagram illustrates a base pairing exercise. On the left, there are four boxes representing nucleotides: Adenine (A), Cytosine (C), Guanine (G), and Thymine (T). Each box contains a small icon of a base pair (two dots) above the text. A large grey arrow points from these boxes to the right. On the right, there are four horizontal dashed boxes, each preceded by a number (1, 2, 3, 4) and a small icon of a base pair. The dashed boxes are intended for the user to write the complementary base for each nucleotide on the left.

Nucleotide	Complementary Base
Adenine (A)	Thymine (T)
Cytosine (C)	Guanine (G)
Guanine (G)	Cytosine (C)
Thymine (T)	Adenine (A)

Correct answers:

- 1 Thymine (T) 2 Guanine (G) 3 Adenine (A) 4 Cytosine (C)

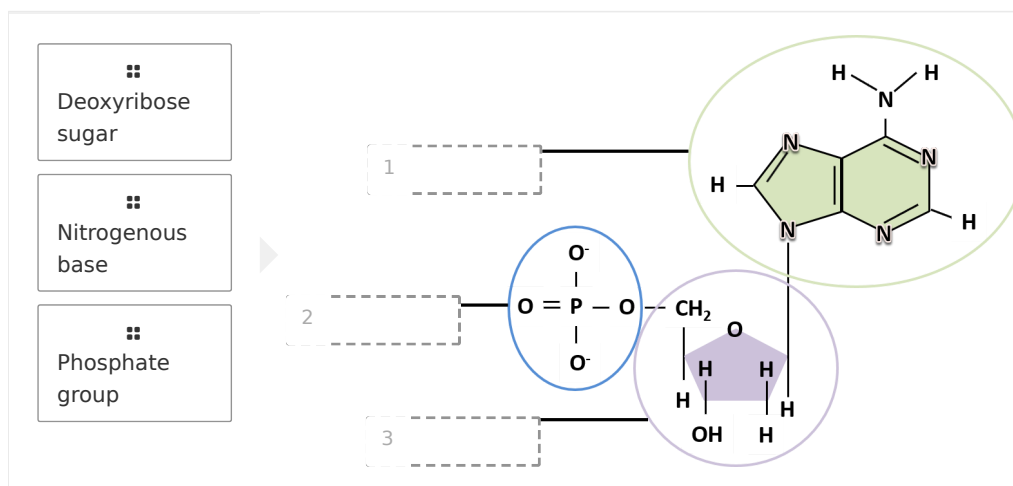
Match each term with the best description.

⚡ Base pairing	Genetic material of all living organisms 1
⚡ DNA	Basic structural units of DNA 2
⚡ Double helix	A bond between nucleotides 3
⚡ Nucleotides	Nucleotides wind around one another in this type of formation 4

Correct answers:

1 DNA 2 Nucleotides 3 Base pairing 4 Double helix

Label the parts of the nucleotides.



Correct answers:

1 Nitrogenous base 2 Phosphate group 3 Deoxyribose sugar

Exploration

DNA is genetic information that is present in all living organisms.

- ☒ True ✓
- ☐ False

The building blocks, or structural units, of a DNA molecule are called ____.

- ☒ nucleotides ✓
- ☐ double helix strands
- ☐ base pairs
- ☐ adenine units

The ____ of each nucleotide is identical, but the ____ differs between the four nucleotides.

- ☐ nitrogenous base and phosphate group; deoxyribose sugar group
- ☐ nitrogenous base and deoxyribose sugar group; phosphate group
- ☒ phosphate group and deoxyribose sugar group; nitrogenous base ✓

The term "double helix" means ____.

- ☐ DNA is shaped like two flat ladders twisted into a knot
- ☒ DNA is made of two parallel strands that twist around each other ✓
- ☐ DNA nucleotides are paired by connecting sugars
- ☐ DNA nucleotides are made of a pentose, phosphate and nitrogenous base

In a DNA molecule, cytosine will form a base pair with ____.

- ☐ adenine
- ☐ cytosine
- ☒ guanine ✓
- ☐ thymine

Exercise 1

Describe the physical appearance of the pea DNA.

The answer to this question may differ depending on the student's results and point of view.

Based on tests conducted at HOL, the results were:

- The DNA looked like very small beige fibers. The DNA appeared airy and fragile. It was all concentrated in the alcohol layer of the test tube.

Were your experimental results what you expected to see? Specifically, was there more or less DNA than you expected?

The answer to this question may differ depending on the student's results and point of view.

Based on tests conducted at HOL, the results were:

- The experimental results were not as expected. The student may expect that the DNA would appear in a double-helical form and appear more robust. While the student would not be certain how much DNA to expect from the experiment, the student will likely be surprised how few DNA strands were extracted.

What was the purpose of adding the detergent to the experiment? If the detergent was not used, do you think the experiment results would have changed? Explain your answer.

The purpose of the detergent is to break through (dissolve) the cell membrane and nucleus, allowing the DNA to "spill out." If the detergent was not used in the experiment, the DNA would not separate from the nucleus and cell membrane and would not come out of the solution when the alcohol is added.

If you used 5% isopropyl alcohol instead of 91%, do you think the experiment results would have changed? Explain your reasoning.

Alcohol is needed to precipitate the DNA. A 5% isopropyl alcohol would not be expected to precipitate the DNA from the solution, as 5% isopropyl alcohol is primarily water. DNA is soluble in water. If 5% isopropyl alcohol was used in place of the 91%, one would not expect to see DNA precipitation upon addition of the alcohol, as it would remain in solution.

The four nitrogen bases are similar as they all contain a cyclohexane structure. Guanine and Adenine also contain a cyclopentane ring, in addition to the cyclohexane ring. Thymine and cytosine both contain oxygen. All four nitrogen bases are contained in deoxyribonucleic acids, along with a sugar and a phosphate group.

Competency Review

_____ is the genetic material of all living organisms, from bacteria and fungi to plants and animals.

- ☒ Deoxyribonucleic acid ✓
- ☐ The cell
- ☐ The cytoplasm
- ☐ The lipid bilayer

DNA is composed of three chains wound in a triple helix.

- ☐ True
- ☒ False ✓

The sugar group of a nucleotide is a ____ .

- ☐ nitrose sugar group
- ☒ deoxyribose sugar group ✓
- ☐ ribose sugar group
- ☐ All of the above

The base pair for adenine is ____.

- ☐ guanine (G)
- ☐ cytosine (C)
- ☒ thymine (T) ✓
- ☐ adenine (A)

A blender or mortar and pestle is used to ____ when extracting DNA from peas.

- ☐ clump the DNA together
- ☐ isolate the DNA from surrounding proteins
- ☐ precipitate the DNA from the solution
- ☒ separate the cells ✓

Alcohol should be ____ before use when extracting DNA from peas.

- ☐ at room temperature
- ☒ chilled ✓
- ☐ heated

DNA isolated from peas appears as a ____.

- ☐ green layer of solution
- ☒ white mass of stringy filaments ✓
- ☐ yellow clump of small spheres

The double helix of DNA is held together by ____.

- ☐ ionic bonds
- ☒ hydrogen bonds ✓
- ☐ covalent bonds

Extension Questions

The extraction of DNA is a common procedure in biotechnology research laboratories. Research the methods of extracting DNA in biotechnology facilities. Describe how the extraction methods used in this lesson compare to those of research laboratories. (SAMPLE ANSWER BELOW)

Extraction of DNA in biotechnology labs involves mechanically separating DNA from intact cells using vortexing and grinding machines and salt. The blender or mortar and pestle and salt used in this lesson compare favorably.

Biotechnology labs then use an enzyme to separate the DNA from other cellular components. The papain powder was the enzyme used in this lesson.

Laboratories then precipitate the DNA with an alcohol. Chilled isopropyl alcohol was used in this lesson.

Biotechnology labs may also centrifuge the DNA samples after adding alcohol to facilitate separating the DNA from the solution and to maximize the amount of DNA collected. This lesson did not employ this technique since the goal was merely to observe DNA strands.