

The molecule

60 minutes • A1.2.1 to A1.2.3, A1.2.5, A1.2.6 • Chapters 1, 2, 3, 5

DNA as the genetic material, the nucleotide, the backbone and the double strand, drawn the IB way and built as models

BY THE END, STUDENTS CAN

- ☐ Explain why DNA is the genetic material of every living organism, and why RNA viruses do not break the rule A1.2.1
- ☐ Draw a nucleotide as a circle, a pentagon and a rectangle, each joined in the right place A1.2.2
- ☐ Explain how condensation builds a strand with a strong sugar–phosphate backbone, and draw a short strand of RNA A1.2.3, A1.2.5
- ☐ Draw two antiparallel strands joined by hydrogen bonds between A and T, and C and G A1.2.6

TIMING

0–8	8 min	Do now: Who am I?	
8–15	7 min	Where the genetic material is	
15–27	12 min	Draw it the IB way	
27–52	25 min	Two models, one Venn	
52–60	8 min	Exit	
60 min		One lesson	

STARTER

- 8 min** **Do now: Who am I?**
- Each student wears a card with a term or a scientist on it, unseen, and asks yes or no questions until they guess it. The keyword bank is in the activity below.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 Every living thing keeps its instructions in DNA

CHAPTER 01 IN THE SLIDES

Tap the parts of the figure in turn: Bacterium, Yeast cell, Plant cell, Animal cell, Phage, Influenza virus and Coronavirus.

Predict box: A virus is found whose genes are made of RNA. Does that break the rule that DNA is the genetic material of all living organisms? Hands up or mini whiteboards first.

Answer B: No: viruses are not counted as living organisms

02 Three parts, one monomer

CHAPTER 02 IN THE SLIDES

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A nucleotide is built from **three parts**.
2. The **sugar** sits in the middle, bonded to both of the others.
3. The IB draws them as a **circle**, a **pentagon** and a **rectangle**, in these positions.
4. Nitrogen comes from the base and **phosphorus** from the phosphate.

Predict box: How many different nucleotides does a cell use to build DNA? Hands up or mini whiteboards first.

Answer C: Four: the sugar and phosphate are the same, only the base differs

03 Building a strand with a strong backbone

CHAPTER 03 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. One **nucleotide**.
2. **Condensation**: the phosphate bonds to the sugar above, and water leaves.
3. Each new bond releases one **water** molecule.
4. Sugar, phosphate, sugar, phosphate: a covalently bonded **backbone**.
5. One nucleotide is a circle, a pentagon and a rectangle **together**.

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Two **nucleotides**, each a phosphate, a sugar and a base.
2. The phosphate of one and the sugar of the other face each other.
3. They leave as **water**, and a **sugar-phosphate bond** joins the sugar of one to the phosphate of the next: **condensation**, making a **dinucleotide**.
4. Add water and the bond splits again, the H to one nucleotide and the OH to the other: **hydrolysis**.

Predict box: How many water molecules are released when 10 nucleotides join into one strand? Hands up or mini whiteboards first.

Answer A: 9

05 Two strands, one helix

CHAPTER 05 IN THE SLIDES

Switch the figure through Flat: the ladder the exam asks for and Twisted into a double helix, and have the class say what will change before each.

Predict box: To be copied, the two strands of DNA must come apart. Why does pulling them apart not break the strands themselves? Hands up or mini whiteboards first.

Answer C: Weak hydrogen bonds join the two strands, while each strand is a chain of strong covalent bonds

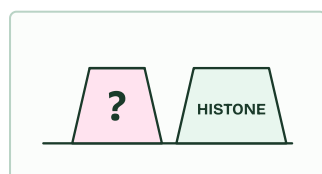
THE LESSON

7 min **Where the genetic material is**
Chapter 1's figure on the board: tap the cells and viruses. Take the virus predict box by vote before anyone opens the answer.

12 min **Draw it the IB way**
Chapter 2's and chapter 3's figures step by step, with students drawing on mini whiteboards at the same steps. Then the bond builder on the board: predict the water count for ten nucleotides first.

25 min **Two models, one Venn**
Pairs build a paper model and a sweet model of DNA, then complete the Venn diagram. Finish on "Watson and Crick built models too", chapter 5's aside.

ACTIVITIES

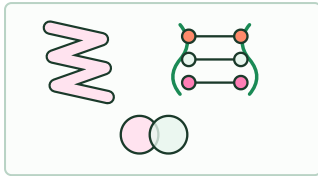


CARD GAME

Who am I?

Each student wears a card with a term or a scientist on it, unseen, and asks yes or no questions until they guess it. The keyword bank: nucleotide, phosphate group, deoxyribose, ribose, adenine, thymine, guanine, cytosine, uracil, hydrogen bond, sugar-phosphate backbone, antiparallel, double helix, complementary base pairing, condensation, DNA, RNA, virus. At higher level add purine, pyrimidine, histone, nucleosome, 5' end, bacteriophage, Chargaff, Hershey, Chase.

Needs: cards and sticky tape or headbands.

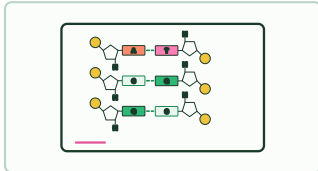


MODEL

Two models, one Venn

Pairs build a paper (origami) model and a sweet model of DNA, then draw a Venn diagram: what each shows, what it leaves out, what both get wrong, and how to improve one. Push for these: the origami shows the twist and the antiparallel strands; the sweets show pairing and the backbone; neither shows atoms, hydrogen bonds or scale.

Needs: a printed DNA origami sheet that you have permission to copy (the guide does not supply one); for the sweet model, two colours of liquorice laces, four colours of soft sweets and cocktail sticks; beads and pipe cleaners for anyone who cannot or will not use sweets.



DRAWING

Draw it the IB way

On mini whiteboards: one nucleotide, then a four-nucleotide RNA strand, then three antiparallel base pairs, each checked against the figure at the same step. Stress the corners the bonds leave from.

Needs: mini whiteboards and pens.

PLENARY

8

min

Exit

Draw three base pairs, antiparallel, and label a backbone, a hydrogen bond and one whole nucleotide.

WHAT STUDENTS GET WRONG

A nucleotide and a base are the same thing. A nucleotide is a phosphate, a sugar and a base.

Bases join to phosphates. Bases join to sugars; phosphates join sugar to sugar.

Hydrogen bonds hold a strand together. Within a strand, covalent; between strands, hydrogen.

Antiparallel means twisted. It means running in opposite directions.

STRETCH AND SUPPORT

Support: cut the figures' captions into cards to put in order, use the dotted key terms as a glossary, and give a drawing frame with the pentagon corners marked for the IB drawings.

Support: use the three mnemonics (Apples in the Tree, Some Bananas Split, Pure As Gold) as a starter in each lesson.

IN THE GUIDE

- 1 [Every living thing keeps its instructions in DNA](#)
- 2 [Three parts, one monomer](#)
- 3 [Building a strand with a strong backbone](#)
- 5 [Two strands, one helix](#)
- A1.1 [The whole guide, with the figures that play](#)
- PPTX [This lesson's slides, in the order of this plan](#)

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- [Tarsia puzzle, dominoes and picture reveal](#) on A1.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A1.2, to present or run with no projector
- An [escape room built from the question bank](#) on A1.2

ALREADY ON THE SITE FOR A1.2

- Lesson: [Nucleic Acids](#)
- Quiz: [Nucleic Acids \(HL\)](#)
- Quiz: [Nucleic Acids](#)
- Revision map: [A1.2 Nucleic acids](#), to fill in
- Exam questions: [A1.2 in the exam maker](#), a paper with its markscheme

CARD SETS ON SPLYCR

- Open a set to host it as a class game, or make a copy to edit.
- [A1.2 Nucleic Acids](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on A1.2 at standard level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=A1.2&level=SL&paper=quiz&marks=15&src=ep



How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.