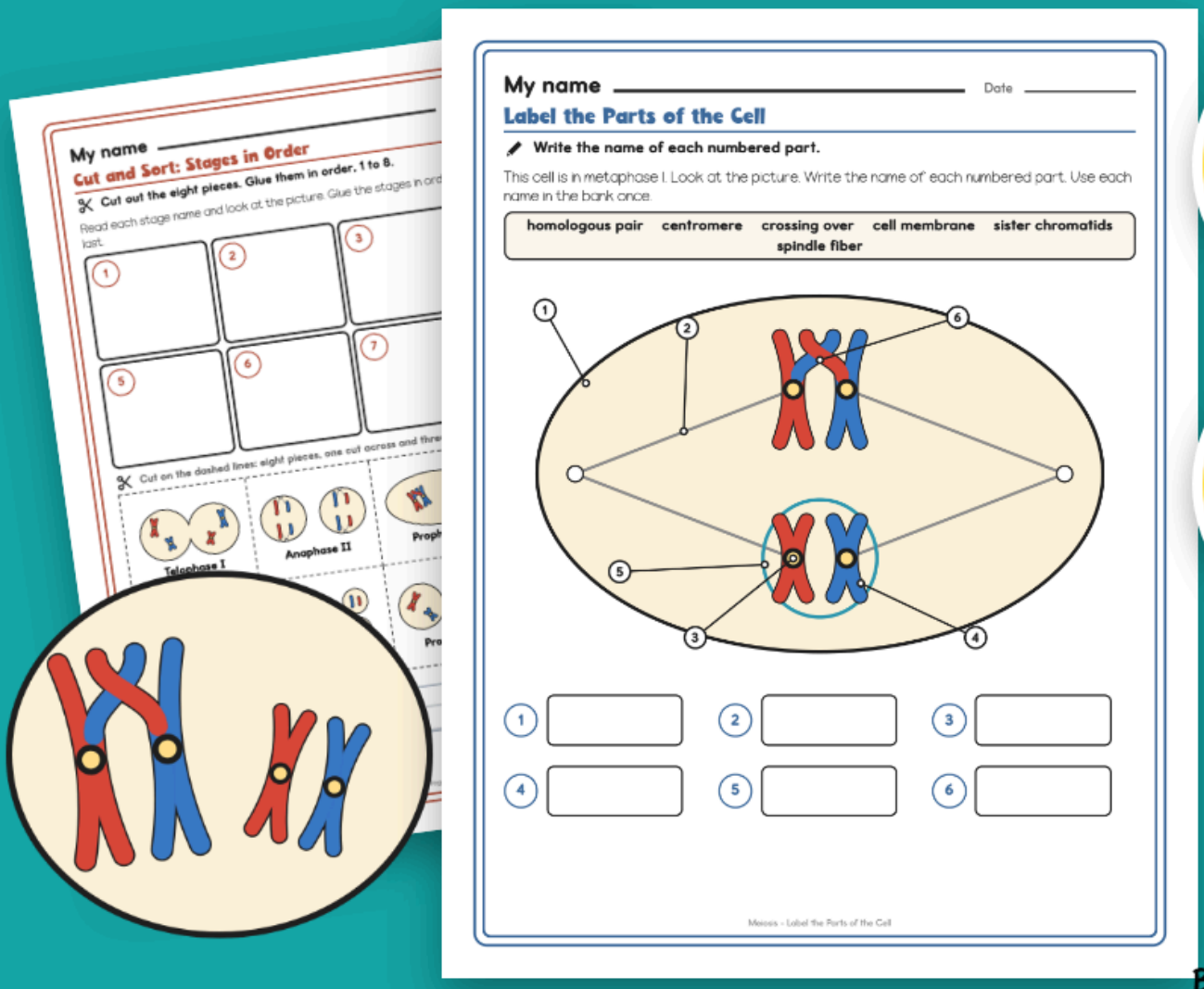
MEIOSIS WORKSHEETS

STAGES · CROSSING OVER · QUIZ · KEY



GRADES 8-10

29 STUDENT PAGES

Bright Path Sped

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- Open it in a PDF reader (Adobe Acrobat Reader, Preview, or your browser), click into a line or a box, type, and Save As.
- The name line, every answer box, every ruled work box and every check box on the student pages are type-in fields, and so are the tracker, class grid, team note and family page. You can also print any page and write by hand.
- It works offline. No account, no subscription, no internet connection needed after you download it.

Print at 100 percent

Turn off fit to page and shrink to fit so the ruled lines stay 0.34 inch apart. Every student page is black and white inside a colored border, so it still reads when copied in black and white. The red and blue chromosomes copy as two shades of gray.

Student work

A filled-in tracker, class grid or team note carries a real student's name. Keep it in the data folder, and use a first name only on any page that leaves your hands.

Need help?

If a field will not behave or a page will not print the way you expect, use Ask a Question on the product page before leaving a review. Every question is read, and a fix to the file ships as a free update: re-download it any time from My Purchases.

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PREVIEW

How To Read a Page

The parts of a student page, then the kinds of sheet in the order they come.

The parts of a page

- **The answer box.** A bordered box for a letter, a number or a word. Click it to type, or print and write in it.
- **The ruled work box.** Lines 0.34 inch apart for sentences. Write one idea to a line.
- **The check box.** True or false, yes or not yet, haploid or diploid: click or mark.
- **The word bank.** A box of words to use. Some words are used once, some not at all.
- **The cut line.** Eight pieces in a short grid, edge to edge: one cut across and three cuts down.

Kind of sheet	How many	What the student does
Readings and cards	4 sheets	Read, answer, and keep the stage cards to look things up.
Words and matching	5 sheets, 30 items	Match words, fill in words, match clues to stages, try a worked example.
Diagrams	4 sheets, 18 items	Label stages and parts of a cell; study crossing over.
Compare and count	3 sheets, 24 items	Haploid or diploid, the Meiosis I and II chart, and the steps in order.
True or false and mistakes	3 sheets, 16 items	Check sentences, fix false ones, find Mara's mistakes.
Writing	4 sheets, 12 questions	Short answers with at least four ruled lines, then explain-it boxes with at least five each.
Quizzes, exit tickets, sorts	12 items, 3 tickets, 16 pieces	Two quizzes, one exit sheet, two cut-and-sort mats.

Untimed, unscored on the page

No student page has a timer or a score on it. The keys and the tracker are for you. The answer keys are on pages 34 to 40.

Short answers and explain-its

Their keys (page 39) say what to look for, not one right sentence. Accept any answer that uses a fact from the readings or the stage cards.

Printing and the type-in fields

Every page prints clean in black and white. The name line, every answer box, every ruled box and every check box are type-in fields in any PDF reader: click one, type, then save. This is a fillable PDF, not a slideshow or a word-processor file.

Room to work

Short-answer boxes hold four lines and explain-it boxes hold five. If a student needs more room, hand over one page a day, or let students write on scrap paper and copy their best sentences into the box.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Reading 1: Why Cells Need Meiosis

Read about chromosomes and gametes. Then answer.

Chromosomes, diploid cells and haploid cells

Most cells in your body have two sets of chromosomes, one set from each parent. A cell with two sets is **diploid**, written 2n. The two matching chromosomes in a pair are **homologous chromosomes**. They carry the same genes, but they may carry different versions of them. A human body cell has 46 chromosomes, which is 23 pairs. Sex cells, called **gametes** (sperm and egg), are made by **meiosis**. A gamete has only one set of chromosomes, so it is **haploid**, written n. A human gamete has 23 chromosomes. When a sperm and an egg join in **fertilization**, the new cell is diploid again.

Main idea: What is this reading mostly about?

Check what you read. Write the letter in the box.

1. What does diploid mean?
   - **A** A cell with two sets of chromosomes
   - **B** A cell with one set of chromosomes
   - **C** A cell with no chromosomes

2. What are gametes?
   - **A** Body cells such as skin cells
   - **B** Pairs of chromosomes
   - **C** Sex cells such as sperm and egg

3. Why is a gamete haploid?
   - **A** It has two sets of chromosomes
   - **B** It has only one set of chromosomes
   - **C** It has no genes

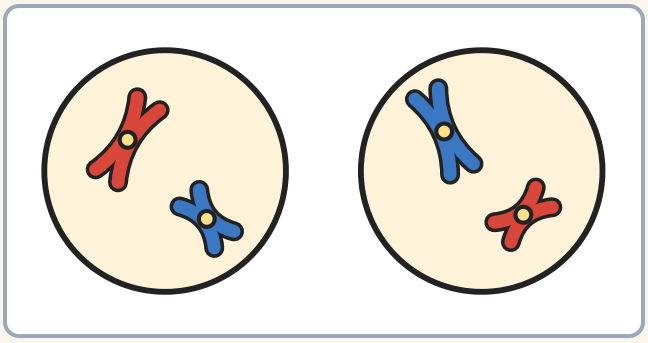
PREVIEW

My name _____ Date _____

Stage Cards: Meiosis II

Read the cards. Keep them all week.

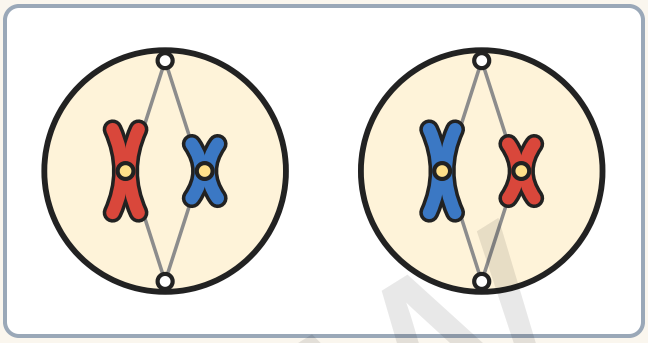
Prophase II



What happens
The two cells get ready to divide again. The chromosomes are not copied again.

Look for
Two separate cells, X shapes spread out

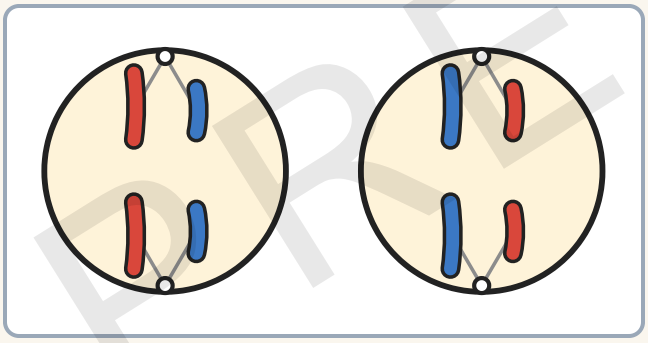
Metaphase II



What happens
In each cell, the X shapes line up single file across the middle.

Look for
A row of X shapes in each cell

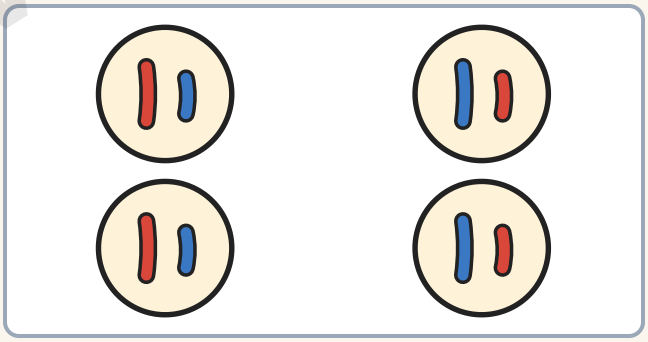
Anaphase II



What happens
Spindle fibers pull the sister chromatids apart. Each chromatid is now its own chromosome.

Look for
Single strands moving to opposite ends

Telophase II



What happens
Both cells split. The result is four haploid cells.

Look for
Four small cells, single strands inside

Pick one stage. Tell how it is different from the same stage in Meiosis I.

PREVIEW

My name _____ Date _____

Fill In the Words

Fill in each blank. Use the word bank.

Read each sentence. Fill each blank with a word from the bank. Two words are not used.

gamete	**centromere**	**haploid**	**spindle**	**sister**
fertilization	**diploid**	**zygote**	**crossing**	**homologous**

1. Meiosis starts with one _____ cell.
2. Meiosis ends with four _____ cells.
3. Two matching chromosomes, one from each parent, are a _____ pair.
4. In prophase I, pieces swap between homologous chromosomes. This is called _____ over.
5. In meiosis II, the _____ chromatids are pulled apart.
6. Threads called _____ fibers pull the chromosomes apart.
7. A sperm or an egg is a _____.
8. The joining of a sperm and an egg is called _____.

Pick one word from the bank. Use it in a sentence about meiosis.

PREVIEW

My name _____ Date _____

Which Stage?

Which stage is it? Write its name.

Each stage name is used one time. Use the stage cards (pages 7 and 8) to help you.

Telophase I	**Anaphase II**	**Prophase I**	**Metaphase II**
Anaphase I	**Telophase II**	**Prophase II**	**Metaphase I**

1. In each cell, the chromosomes line up single file in the middle. _____
2. Homologous pairs line up across the middle of the cell. _____
3. Both cells split. The result is four haploid cells. _____
4. The cell splits in two. Each new cell is haploid. _____
5. Homologous chromosomes pair up and can swap pieces. _____
6. Sister chromatids are pulled apart. _____
7. Homologous chromosomes are pulled to opposite ends of the cell. _____
8. Two haploid cells get ready to divide. No new copying happens. _____

Pick one clue. Tell the word that helped you.

PREVIEW

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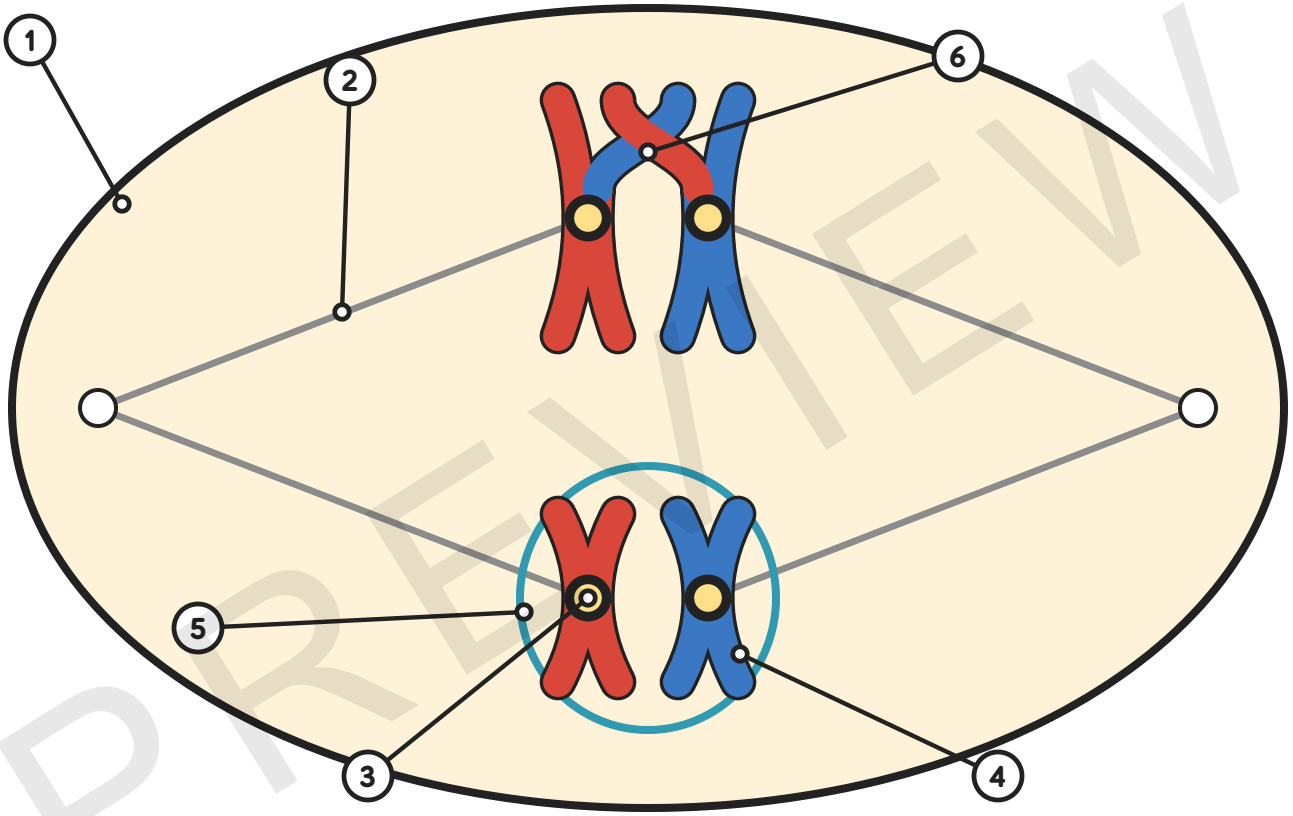
My name _____ Date _____

Label the Parts of the Cell

Write the name of each numbered part.

This cell is in metaphase I. Look at the picture. Write the name of each numbered part. Use each name in the bank once.

homologous pair	**centromere**	**crossing over**	**cell membrane**	**sister chromatids**
spindle fiber				



PREVIEW

1 _____ 2 _____ 3 _____

4 _____ 5 _____ 6 _____

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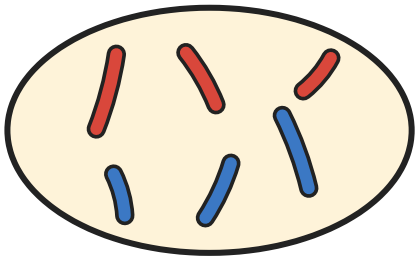
My name _____ Date _____

Haploid or Diploid?

Count the chromosomes. Is the cell haploid or diploid?

Each cell has single chromosomes. Matching pairs are the same length. Red and blue are the two parents.

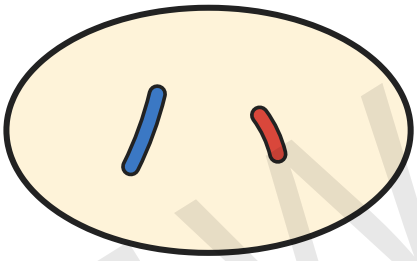
A **Cell A**



Chromosomes: ☐

☐ **haploid** ☐ **diploid**

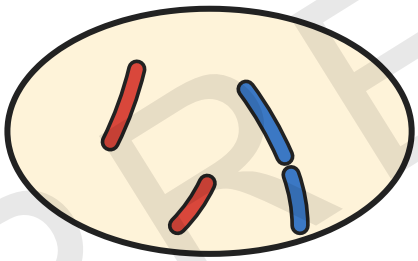
B **Cell B**



Chromosomes: ☐

☐ **haploid** ☐ **diploid**

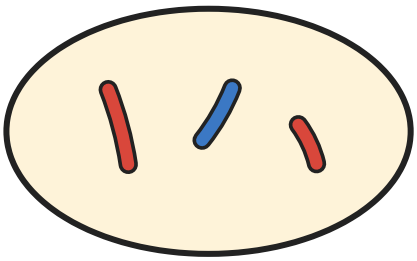
C **Cell C**



Chromosomes: ☐

☐ **haploid** ☐ **diploid**

D **Cell D**



Chromosomes: ☐

☐ **haploid** ☐ **diploid**

1 A diploid cell has 2n = 8. After meiosis, each gamete has n = ☐

2 A human body cell has 46 chromosomes. How many matching pairs is that? ☐

How can you tell a diploid cell from a haploid cell?

PREVIEW

My name _____ Date _____

True or False 1

Is it true or false? Check one.

Check true or false for each sentence.

1. Meiosis makes four cells from one cell. ☐ true ☐ false

2. Gametes are diploid. ☐ true ☐ false

3. Homologous chromosomes are a matching pair, one from each parent. ☐ true ☐ false

4. Crossing over happens in meiosis II. ☐ true ☐ false

5. Meiosis I pulls homologous pairs apart. ☐ true ☐ false

6. The cells made by meiosis are identical to the parent cell. ☐ true ☐ false

Pick one false sentence. Fix it so it is true.

PREVIEW

My name _____ Date _____

Short Answers 1

Answer each question in sentences.

Use facts from the readings and the stage cards. Write in sentences.

1. What is meiosis? Say how many cells it starts with and how many it makes.

2. Tell the difference between homologous chromosomes and sister chromatids.

3. Why do gametes need to be haploid?

PREVIEW

My name _____ Date _____

Explain It 2

Explain your thinking in sentences.

Use what you know about meiosis. Say why.

Start with: I know that ____ because ____.

4 Follow one pair of homologous chromosomes from the start of meiosis to the four cells. Tell what happens to it.

5 Why does fertilization make a diploid cell? Use the words haploid and zygote.

6 Tell one way meiosis is like mitosis and one way it is different.

PREVIEW

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My name _____ Date _____

Quiz B

Pick the best answer. Write its letter.

Take your time. Guess if you are not sure.

7 What happens in anaphase II?

A Homologous pairs are pulled apart
B Crossing over happens
C Sister chromatids are pulled apart

8 What is the result of meiosis?

A Four haploid cells
B Two diploid cells
C Four diploid cells

9 Which cells does meiosis make?

A Skin cells
B Gametes
C Muscle cells

10 A cell has 2n = 10. How many chromosomes are in a gamete?

A 10
B 20
C 5

11 Which stage lines up homologous pairs in the middle?

A Metaphase I
B Prophase II
C Telophase I

12 What joins to make a zygote?

A Two skin cells
B A sperm and an egg
C Two sister chromatids

PREVIEW

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My name _____ Date _____

Check My Own Work

Check your own work. Mark yes or not yet.

1	I can say what meiosis is and what it makes.	☐ yes	☐ not yet
2	I can tell haploid from diploid.	☐ yes	☐ not yet
3	I can name the stages of meiosis I.	☐ yes	☐ not yet
4	I can name the stages of meiosis II.	☐ yes	☐ not yet
5	I can tell what is pulled apart in meiosis I and in meiosis II.	☐ yes	☐ not yet
6	I can explain what crossing over is.	☐ yes	☐ not yet
7	I can count chromosomes and find n and 2n.	☐ yes	☐ not yet
8	I can explain why the four cells are not identical.	☐ yes	☐ not yet

The part I can explain best is...

The part I still need help with is...

PREVIEW

Answer Key: Readings, Words, Matching

Every letter is the position of the right option in the printed list.

Readings pages 5, 6

Item	Letter	Answer
5.1	A	A cell with two sets of chromosomes
5.2	C	Sex cells such as sperm and egg
5.3	B	It has only one set of chromosomes
6.1	C	Four haploid cells
6.2	A	Homologous chromosomes swap pieces
6.3	B	Sister chromatids

Meiosis Words page 9

Word	Letter	Meaning
1. meiosis	D	cell division that makes four haploid cells (gametes) from one diploid cell
2. gamete	F	a sex cell, such as a sperm or an egg
3. homologous pair	B	two matching chromosomes, one from each parent
4. haploid	E	having one set of chromosomes (n)
5. diploid	A	having two sets of chromosomes (2n)
6. crossing over	C	when homologous chromosomes swap pieces during prophase I

Match the Parts page 12

Word	Letter	Meaning
1. Chromosome	D	A long strand of DNA that carries many genes
2. Sister chromatids	G	Two identical copies of one chromosome, joined together
3. Centromere	B	The spot where two sister chromatids are joined
4. Tetrad	E	A homologous pair after copying: four chromatids together
5. Spindle fiber	H	A thread that pulls chromosomes or chromatids toward the ends of the cell
6. Gene	A	A section of DNA that holds the instructions for one trait
7. Fertilization	F	The joining of a sperm and an egg
8. Zygote	C	The diploid cell made when a sperm and an egg join

Fill In the Words page 10

Blank	Word	The sentence
1.	diploid	Meiosis starts with one [diploid] cell.
2.	haploid	Meiosis ends with four [haploid] cells.
3.	homologous	Two matching chromosomes, one from each parent, are a [homologous] pair.
4.	crossing	In prophase I, pieces swap between homologous chromosomes. This is called [crossing] over.
5.	sister	In meiosis II, the [sister] chromatids are pulled apart.
6.	spindle	Threads called [spindle] fibers pull the chromosomes apart.
7.	gamete	A sperm or an egg is a [gamete].
8.	fertilization	The joining of a sperm and an egg is called [fertilization].

PREVIEW

Answer Key: Crossing Over, Haploid or Diploid, Chart

In a diploid cell every length appears twice (a matching pair); in a haploid cell each length appears once.

Crossing Over page 17

Item	Answer	Why
17.1	4	Each of the two homologous chromosomes has two sister chromatids.
17.2	2 and 3	Chromatids 2 and 3 each carry both colors.
17.3	prophase I	Homologous chromosomes pair up in prophase I.
17.4	homologous chromosomes	It happens between homologous chromosomes, not between sister chromatids.

A note on the chart

Meiosis II starts with the two haploid cells that meiosis I made, which is why the start of meiosis II is two haploid cells. Accept any wording that says the same thing.

Haploid or Diploid? page 18

Item	Answer	Cell or question
Cell A	6	diploid
Cell B	2	haploid
Cell C	4	diploid
Cell D	3	haploid
Bottom 1	4	A diploid cell has 2n = 8. After meiosis, each gamete has n =
Bottom 2	23	A human body cell has 46 chromosomes. How many matching pairs is that? =

Meiosis I and Meiosis II Chart page 19

Row	Meiosis I	Meiosis II
What is pulled apart?	homologous pairs	sister chromatids
How many cells at the start?	1 diploid cell	2 haploid cells
How many cells at the end?	2 haploid cells	4 haploid cells
Does crossing over happen?	can happen	does not happen

PREVIEW

Answer Key: Writing

These pages have no single right sentence. Accept any answer that uses a fact from the readings or the stage cards.

Short answers: what to look for pages 23, 24

Item	Look for
23.1	Meiosis is cell division that makes gametes. It starts with one diploid cell and makes four haploid cells.
23.2	Homologous chromosomes are a matching pair, one from each parent. Sister chromatids are the two identical copies of one chromosome after it is copied.
23.3	When a sperm and an egg join, each brings one set of chromosomes. If gametes were diploid, the number would double with every generation. Accept any answer that says the new cell must end up with the right diploid number.
24.1	Homologous pairs separate. Accept any correct stage: pairs form and cross over (prophase I), pairs line up in the middle (metaphase I), pairs are pulled apart (anaphase I), or the cell splits (telophase I).
24.2	The sister chromatids are pulled apart and each of the two cells splits, so there are four haploid cells.
24.3	Homologous chromosomes swap pieces. It happens in prophase I.

Explain it: what to look for pages 25, 26

Item	Look for
25.1	Crossing over swaps pieces between homologous chromosomes, so the chromatids carry new mixes. Accept also: the homologous pairs line up in a random way.
25.2	n = 4, because a gamete has half the chromosomes, one of each pair.
25.3	Meiosis I pulls homologous pairs apart and ends with two haploid cells. Meiosis II pulls sister chromatids apart and ends with four haploid cells. Accept any correct difference.
26.1	The pair is copied, pairs up and may cross over (prophase I), lines up (metaphase I) and is pulled apart (anaphase I). Then the sister chromatids are pulled apart (anaphase II), so each of the four cells gets one chromosome of the pair. Accept any correct path.
26.2	A haploid sperm and a haploid egg join. Each brings one set of chromosomes, so the zygote has two sets and is diploid.
26.3	Alike: both are cell division and both copy the chromosomes first. Different: meiosis makes four haploid cells, and mitosis makes two diploid cells. Accept any correct comparison.

Exit tickets

- Exit tickets (page 30): ticket 1 names meiosis I (homologous pairs are pulled apart) and meiosis II (sister chromatids are pulled apart); ticket 2 says haploid is one set (n) and diploid is two sets (2n), each with an example cell; ticket 3 is open.

PREVIEW

Class Progress Grid

Every student on one grid: items right by kind of sheet.

Class or group _____ Month _____

Student	Readings (of 6)	Words (of 14)	Matching (of 16)	Labels (of 14)	Crossing and n (of 14)	Chart and order (of 14)	True or false (of 12)	Mistakes (of 4)	Quizzes (of 12)	Sorts (of 16)

PREVIEW

How to fill this in

For each column, add up how many items that student has right with no prompt (the tracker rows). One glance across a row shows which skill is easiest and which is next.

Grouping for small-group time

Students low in Readings or Words need the readings, the stage cards and the worked example first (pages 5 to 10 and 11). Students low in Labels need pages 14 to 16 again, with the cards beside them. Students near full marks can move to the sorts and the quizzes (pages 32 to 33 and 28 to 29).

Meiosis at Home

Dear family, this week we are learning how a cell divides to make sex cells with half the chromosomes. These questions are for talking, not for a grade. Short answers are fine.

Student _____ Week of _____

Three things to talk about

- Ask your student to say what meiosis makes and how many cells it makes. Short answers are fine.
- Ask: what is the difference between haploid and diploid? (Haploid has one set of chromosomes; diploid has two.)
- Ask: what is crossing over? (Homologous chromosomes swap pieces in prophase I.)

My words from home

A stage of meiosis _____

What happens in it _____

What meiosis makes _____

Words that may come up

Meiosis: cell division that makes four haploid cells (gametes) from one diploid cell. **Gamete:** a sex cell, such as a sperm or an egg. **Homologous chromosomes:** a matching pair, one from each parent. **Crossing over:** homologous chromosomes swap pieces. **Haploid:** one set of chromosomes. **Diploid:** two sets.

Note from the teacher

Note from home

PREVIEW

Binder Cover

Slide this into the front of a binder. The divider tabs and a spine label to cut out are on the next page (page 48).

Science - Biology

MEIOSIS

Stages, Practice and Answer Keys

Stages | **Crossing over** | **Haploid or diploid**

Teacher _____ Class or student _____

PREVIEW