ANSWER KEY.

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Chromosomal Disorders and Karyotypes

Biology | ANSWER KEY

Show your work in the blank space. Use complete sentences where asked.

1. During meiosis in a sperm-producing cell, nondisjunction of chromosome 21 happens in the second division. A typical egg has 23 chromosomes.

(a) How many chromosomes are in each of the four sperm cells?

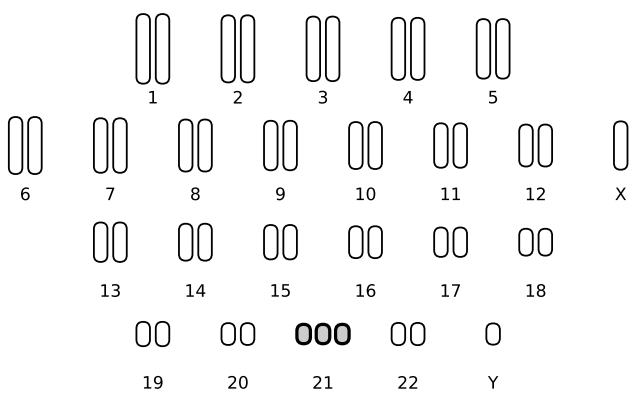
(b) If a sperm with 24 chromosomes fertilizes a typical egg, how many chromosomes are in the zygote?

(a) Two sperm have **23**. One has **24** (extra chromosome 21). One has **22** (missing chromosome 21).

(b) 24 + 23 = **47 chromosomes**.

2. The drawing is a karyotype (a drawn model).

Schematic karyotype (a drawn model)



(a) How many chromosomes does the cell have?

(b) Which pair has a different number of chromosomes from the others? How many copies are there?

(c) Write the karyotype in the form total number, sex chromosomes, change.

(a) 47 (22 pairs plus an extra chromosome 21 is 45, plus X and Y).

(b) Pair 21: three copies, called trisomy 21.

(c) 47,XY,+21

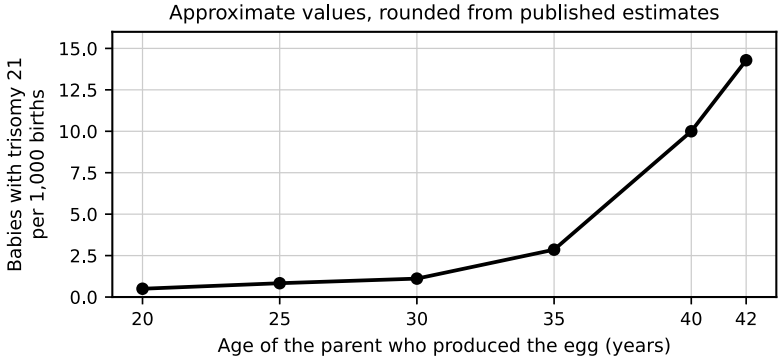
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3. Write the karyotype for a person with 47 chromosomes who has two X chromosomes and one Y chromosome.

A different person has the karyotype 45,X. Which chromosome is missing compared with 46,XX?

47,XXY. For 45,X: **one X chromosome** is missing (one sex chromosome is present instead of two).

4. The graph shows approximate, rounded values for the chance of a baby with trisomy 21 by the age of the parent who produced the egg.



(a) About how many babies with trisomy 21 per 1,000 births are expected at age 35?

(b) Write a claim, evidence, reasoning statement about how the chance changes with age.

(a) About 3 per 1,000 (about 1 in 350).

(b) Claim: the chance rises with age, and rises faster after 35. **Evidence:** about 1 per 1,000 at age 30, about 3 at 35, and about 10 at 40. **Reasoning:** eggs are made before birth and wait for years, and sorting errors in meiosis become more likely as they age, so more eggs have the wrong number of chromosomes.

A correct answer includes: two or more values from the graph and the idea that errors in meiosis are more likely with age.

5. Explain what nondisjunction is and why it changes the chromosome number of the zygote.

Nondisjunction is a failure of chromosomes to separate in meiosis. A gamete then has an extra or a missing chromosome (n + 1 or n - 1). When it joins with a typical gamete, the zygote has 47 or 45 chromosomes instead of 46.

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