

GCSE Combined Science: Trilogy

Worksheet: Sex determination

TIME 30 min	TOTAL 28 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Sex determination

NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Ordinary human body cells contain pairs of chromosomes. One pair carries the genes that determine sex.

0 1 . 1

How many pairs of chromosomes are there in an ordinary human body cell?

.....

.....

.....

[1 mark]

0 1 . 2

Which sex chromosomes does a human female have?

Tick (✓) **one** box.

XX

☐

XY

☐

YY

☐

X only

☐

[1 mark]

0 1 . 3

Which sex chromosome is found in every human egg cell?

Tick (✓) **one** box.

X

☐

Y

☐

XX

☐

XY

☐

[1 mark]

0 1 . 4

What do the other 22 pairs of chromosomes control?

.....

.....

[1 mark]

0 1 . 5

Which parent's gamete determines the sex of a child?

.....

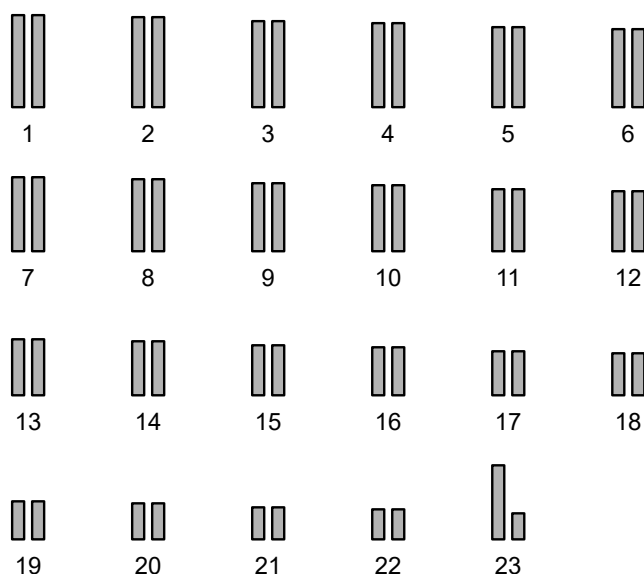
.....

[1 mark]

0 2

Figure 1 shows the chromosomes from one body cell of a person, arranged in numbered pairs.

Figure 1



0 2 . 1

How many pairs of chromosomes are shown in Figure 1?

.....

.....

.....

Number of pairs =

[1 mark]

0 2 . 2

Pair 23 are the sex chromosomes.

Is this person male or female? Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 2 . 3

How many chromosomes are there in one sperm cell made by this person?

.....

.....

.....

Number of chromosomes =

[1 mark]

0 2 . 4

Which sex chromosome could a sperm cell made by this person contain?

Tick (✓) **one** box.

X only

☐

Y only

☐

Either X or Y

☐

Both X and Y

☐

[1 mark]

0 3

A scientist examined 400 sperm cells from one man and identified the sex chromosome in each. 206 of the sperm cells contained an X chromosome and 194 contained a Y chromosome.

0 3 . 1

Calculate the percentage of the sperm cells that contained a Y chromosome.

.....

.....

.....

.....

Percentage = %

[2 marks]

0 3 . 2

Explain why about half of a man's sperm cells contain an X chromosome and half contain a Y chromosome.

[2 marks]

0 3 . 3

Suggest why the numbers of X and Y sperm cells in the sample were not exactly equal.

[1 mark]

0 4

In some countries, parents having IVF can choose an embryo of a particular sex for personal or family reasons, rather than for a medical reason. This is called family balancing. It is not allowed in the UK.

0 4 . 1

Suggest **one** argument for allowing family balancing, and **one** argument against it.

[2 marks]

0 5

In humans, females have the sex chromosomes XX and males have the sex chromosomes XY. Approximately half of babies born are male and half are female.

0 5 . 1

Explain, using a genetic diagram, why approximately half of babies born are expected to be male and half female.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[6 marks]

0 6

In humans, females have the sex chromosomes XX and males have the sex chromosomes XY.

0 6 . 1

Explain why it is the sperm, not the egg, that determines the sex of a baby.

.....

.....

.....

.....

[2 marks]

0 6 . 2

What percentage of the sperm made by a man carry a Y chromosome?

.....

.....

.....

.....
[1 mark]

0 6 . 3

Explain why a human sperm cell contains 23 chromosomes.

.....

.....

[1 mark]

0 6 . 4

Describe how the sex chromosomes of a male are different from the other 22 pairs of chromosomes in his cells.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Sex determination · 28 marks

Question 1 (5 marks)

01.1 [1 mark]

Answer: 23

- 23 (1)
-

01.2 [1 mark]

Correct: XX

01.3 [1 mark]

Correct: X

01.4 [1 mark]

Answer: Characteristics only (not sex)

- (other) characteristics only / not sex (1)
-

01.5 [1 mark]

Answer: The father's (the sperm)

- the father's / the sperm (1)
-

Question 2 (5 marks)

02.1 [1 mark]

Answer: 23

- 23 (1)

02.2 [2 marks]

Answer: Male, because the two sex chromosomes are different: one is a much smaller Y chromosome

- male (1)
- the two sex chromosomes are different (X and Y) / one of them is much smaller (a Y chromosome) (1)

02.3 [1 mark]

Answer: 23

- 23 (1)

02.4 [1 mark]

Correct: Either X or Y

Question 3 (5 marks)

03.1 [2 marks]

Answer: 48.5%

- $194 \div 400 \times 100$ (1)
- 48.5 (%) (1)

Notes: Correct answer with no working scores 2 marks.

03.2 [2 marks]

Answer: A man's body cells contain one X and one Y chromosome; during meiosis they separate, so each sperm cell gets either the X or the Y

- a man's body cells contain one X and one Y chromosome (XY) (1)
- during meiosis the X and Y separate, so each sperm cell receives either the X or the Y (one chromosome from each pair) (1)

03.3 [1 mark]

Answer: Chance: the sample of 400 is only a small part of all the sperm, so it will not match the expected 1 : 1 ratio exactly

- chance / random variation in which sperm cells were sampled (the sample is not all of the sperm) (1)
-

Question 4 (2 marks)

04.1 [2 marks]

Answer: For: it gives parents a choice over their family, for example if they already have several children of one sex. Against: if widely used, it could lead to unequal numbers of males and females in a population

- for: gives parents choice / control over their family, e.g. if they already have several children of one sex (1)
 - against: if used widely it could lead to unequal numbers of males and females in a population / some see it as an inappropriate use of medical resources (1)
-

Question 5 (6 marks)

05.1 [6 marks]

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- body cells have 23 pairs of chromosomes, one pair of which are the sex chromosomes
- females have two X chromosomes (XX); males have one X chromosome and one Y chromosome (XY)
- during meiosis, all of a woman's eggs carry a single X chromosome, because both of her sex chromosomes are X
- a man's sperm cells carry either an X chromosome or a Y chromosome, in equal numbers
- a genetic diagram (Punnett square) combining the mother's gametes (X, X) with the father's gametes (X, Y) gives genotypes XX and XY in a 1 : 1 ratio
- an embryo that inherits XX develops as female; an embryo that inherits XY develops as male
- because a man produces equal numbers of X-carrying and Y-carrying sperm, and fertilisation by either type is equally likely, approximately half of offspring are expected to be male and half female

Notes: Level 3 (5–6 marks): a correct, complete genetic diagram / reasoning linking gamete formation to the 1 : 1 ratio and to sex determination. Level 2 (3–4 marks): partially correct reasoning or diagram, e.g. states XX / XY but does not clearly explain the 1 : 1 ratio of sperm. Level 1 (1–2 marks): simple, isolated facts, e.g. 'XX is female, XY is male', without genetic reasoning.

Question 6 (5 marks)

06.1 [2 marks]

Answer: All eggs carry an X chromosome, but half of sperm carry X and half carry Y; if a Y sperm fertilises the egg the baby is a boy (XY)

- all eggs contain an X chromosome (1)
 - sperm contain either an X or a Y chromosome, so the sperm decides whether the baby is XX or XY (1)
-

06.2 [1 mark]

Answer: 50%

- 50 (%) (1)
-

06.3 [1 mark]

Answer: It is made by meiosis, so it contains one chromosome from each of the 23 pairs

- made by meiosis / contains one chromosome from each pair / a single set of chromosomes (1)
-

06.4 [1 mark]

Answer: The X and Y chromosomes are different from each other, whereas the chromosomes in each of the other pairs match

- the X and Y are different (from each other) / do not match, but the other pairs match (1)
-