

Chromosomes, meiosis and gametes: practice questions

8 questions · 25 marks · mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 25

1 UNIT 2 STYLE [1 mark]

Which event in meiosis results in independent assortment of chromosomes?

- A. ☐ Crossing over in prophase I
- B. ☐ Random orientation of homologous pairs in metaphase I
- C. ☐ Separation of sister chromatids in anaphase II
- D. ☐ Replication of DNA before meiosis I

2 UNIT 2 STYLE [1 mark]

What is the function of the cortical reaction in fertilisation?

- A. ☐ To digest a path through the zona pellucida
- B. ☐ To fuse the nuclei of the sperm and egg
- C. ☐ To prevent more than one sperm entering the egg
- D. ☐ To provide energy for the movement of the sperm

3 UNIT 2 STYLE [3 marks]

Define the term locus. Explain why two genes on the same chromosome may not be inherited independently.

4 UNIT 2 STYLE

[5 marks]

Explain how meiosis produces genetically different gametes.

5 UNIT 2 STYLE

[2 marks]

The domestic cat has a haploid number of 19 chromosomes. Calculate the number of different combinations of chromosomes that can occur in the gametes of one cat because of independent assortment alone. Show your working.

Answer = ...

6 UNIT 2 STYLE

[4 marks]

Describe how a mammalian sperm cell is adapted for its function.

7

UNIT 2 STYLE

[5 marks]

Describe the events that take place from the time a sperm reaches the zona pellucida of an egg until a zygote forms.

[illegible]

8

UNIT 2 STYLE

[4 marks]

Describe how fertilisation takes place in a flowering plant, from the arrival of a pollen grain at the stigma.

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B

2. [1]

C C

3. [3]

- locus is the position / location of a gene on a chromosome (1)
- genes on the same chromosome are linked / on the same chromosome (1)
- the alleles are passed on together / stay on the same chromosome during meiosis (1)
- unless separated by crossing over (1)
- Max 3

4. [5]

- crossing over occurs in prophase I (1)
- between non-sister chromatids of homologous chromosomes / at chiasmata (1)
- exchanging alleles / sections of DNA, giving new combinations of alleles (1)
- in metaphase I homologous pairs line up at the equator (1)
- each pair orientated independently / randomly, so maternal and paternal chromosomes assort independently (1)
- giving different combinations of chromosomes in the gametes (1)
- Max 5

5. [2]

- $2^n / 2^{19}$ (1)
- 524 288 (1)
- correct answer with no working gains 2 marks

6. [4]

- flagellum / tail for swimming / movement (1)
- many mitochondria in the midpiece to produce ATP (1)
- acrosome contains hydrolytic enzymes to digest the zona pellucida (1)
- haploid nucleus carries the paternal genes (1)
- small size / streamlined (1)
- Max 4

7. [5]

- sperm binds to receptors on the zona pellucida (1)
- acrosome reaction: the acrosome releases enzymes (1)
- enzymes digest a path through the zona pellucida (1)
- sperm and egg cell surface membranes fuse and the sperm nucleus enters the egg (1)
- cortical reaction: cortical granules release enzymes, the zona pellucida hardens, preventing polyspermy (1)
- haploid nuclei fuse to form a diploid zygote (1)
- Max 5

8. [4]

- pollen grain germinates and a pollen tube grows down the style (1)
- tube is guided by chemicals from the ovule (1)
- tube enters the ovule through the micropyle (1)
- two male nuclei released from the tube (1)
- one male nucleus fuses with the egg nucleus to form the zygote (1)
- the other fuses with the polar nuclei to form the endosperm (nucleus) (1)
- Max 4