

Inheritance practice questions

20 questions • 66 marks • mark scheme at the back

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Name

Total / 66

Chromosomes, genes and proteins **Spec 17.1**

1 Which combination of gametes can produce a male baby? [1 mark]

- A. ☐ egg with X and sperm with X
- B. ☐ egg with X and sperm with Y
- C. ☐ egg with Y and sperm with X
- D. ☐ egg with Y and sperm with Y

2 (a) State what chromosomes are made of. [1] (b) Define the term allele. [1] (c) A gene codes for a protein. State what is meant by the term gene. [1] [3 marks]

3 Describe how the sex of a human baby is inherited. Use the terms X chromosome and Y chromosome in your answer. [4 marks]

4 **Supplement** [1 mark]

What determines the shape of a protein molecule?

- A. ☐ the sequence of amino acids
- B. ☐ the number of ribosomes in the cell
- C. ☐ the number of chromosomes in the nucleus
- D. ☐ the sequence of bases in a different gene

9

Supplement

[1 mark]

A human cell with 46 chromosomes divides by meiosis. How many chromosomes are in each cell produced?

- A . ☐ 12
- B . ☐ 23
- C . ☐ 46
- D . ☐ 92

10

Supplement

[4 marks]

(a) Define mitosis. [2] (b) State what happens to the chromosomes before mitosis begins. [1] (c) State one use of mitosis in a plant or animal. [1]

11

Supplement

[3 marks]

(a) Describe what is meant by a stem cell. [2] (b) Name the type of cell division that stem cells use to make new cells. [1]

12

Supplement

[4 marks]

(a) State the type of cell that is produced by meiosis. [1] (b) Describe meiosis in terms of chromosome number. [2] (c) Explain why gametes must be haploid. [1]

13

Supplement

[5 marks]

Compare mitosis and meiosis. [5]

Monohybrid inheritance

Spec 17.4

14

Which genotype is heterozygous?

[1 mark]

- A. ☐ TT
- B. ☐ Tt
- C. ☐ tt
- D. ☐ T

15

(a) Define the term genotype. [1] (b) Define the term phenotype. [1] (c) Two tall pea plants, both with genotype TT, are crossed. Explain why all their offspring will also be tall. [1]

[3 marks]

18

Supplement

[4 marks]

A farmer has a tall pea plant. Tall (T) is dominant to short (t). The farmer does a test cross to find the genotype of the tall plant. (a) State the genotype of the plant that should be crossed with the tall plant. [1] (b) Describe the offspring expected if the tall plant is TT. [1] (c) Describe the offspring expected if the tall plant is Tt. [1] (d) Suggest why the farmer should produce many offspring. [1]

[illegible]

19

Supplement

[5 marks]

A mother has blood group A and genotype IA Io. A father has blood group B and genotype IB Io. (a) Define the term codominance. [1] (b) Draw a Punnett square to show the possible genotypes of their children. [2] (c) State the probability that a child will have blood group O. [1] (d) State the blood group of a person with genotype IA IB. [1]

[illegible]

20

Supplement

[5 marks]

Red-green colour blindness is caused by a recessive allele on the X chromosome. XB is the normal allele and Xb is the colour blindness allele. A woman who is a carrier has children with a man who has normal colour vision. (a) State what is meant by a sex-linked characteristic. [1] (b) Explain why colour blindness is more common in males than in females. [2] (c) State the genotypes of the offspring of these parents. [1] (d) Give the probability that a son of these parents is colour blind. [1]

[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 (1)

2. [3]

- (a) DNA (1)
- (b) an alternative form of a gene (1)
- (c) a length of DNA that codes for a protein (1)

3. [4]

- females have two X chromosomes / are XX and males have X and Y chromosomes / are XY (1)
- all eggs carry an X chromosome (1)
- half of the sperm carry X and half carry Y (1)
- the sex depends on which sperm fertilises the egg / sperm with X gives a girl and sperm with Y gives a boy (1)
- allow marks for a correct genetic diagram or Punnett square showing parents XX and XY, gametes X, X and X, Y, and offspring XX : XY in a 1 : 1 ratio

4. [1] **Supplement**

A A (1)

5. [5] **Supplement**

- the gene (for the protein) stays in the nucleus (1)
- mRNA is a copy of the gene / mRNA is made in the nucleus (1)
- mRNA moves to the cytoplasm (1)
- mRNA passes through a ribosome (1)
- the ribosome assembles amino acids into a protein (1)
- the sequence of amino acids is determined by the sequence of bases in the mRNA (1)
- Max 5

6. [4] **Supplement**

- (a) the gene for insulin is not expressed in the skin cell (1)
- the cell only makes the proteins it needs (1)
- (b) the sequence of bases in the gene (1) allow in the mRNA
- (c) the shape of the protein changes / the protein may not work (1)

7. [3] **Supplement**

- (a) a nucleus containing two sets of chromosomes (1)
- (b) 23 (pairs) (1)
- (c) 23 (1)

8. [1] **Supplement**

A A (1)

9. [1] **Supplement**

B B (1)

10. [4] Supplement

- (a) nuclear division (1)
- giving rise to genetically identical cells (1)
- (b) the chromosomes are replicated exactly / copied (1)
- (c) growth / repair of damaged tissues / replacement of cells / asexual reproduction (1)

11. [3] Supplement

- (a) an unspecialised cell (1)
- that divides to produce daughter cells that can become specialised (for specific functions) (1)
- (b) mitosis (1)

12. [4] Supplement

- (a) gametes / sex cells (1)
- (b) the chromosome number is halved (1)
- from diploid to haploid (1)
- (c) so that the diploid number is restored at fertilisation / so the chromosome number does not double in each generation (1)

13. [5] Supplement

- mitosis produces genetically identical cells but meiosis produces genetically different cells (1) each mark needs a comparison; ignore a statement about only one type of division
- mitosis keeps the chromosome number the same but meiosis halves it (1) allow mitosis: diploid to diploid; meiosis: diploid to haploid
- mitosis is used for growth / repair / replacement of cells / asexual reproduction but meiosis is used to produce gametes (1)
- mitosis makes two cells and meiosis makes four cells (1)
- meiosis happens only in the reproductive organs / testes and ovaries, mitosis happens in body cells (1)

14. [1]

B B (Tt) (1)

15. [3]

- (a) the genetic make-up of an organism / the alleles present (1)
- (b) the observable features of an organism (1)
- (c) both parents are homozygous / can only make T gametes, so all offspring are TT / pure-breeding (1)

16. [5]

- (a) recessive (1) reject dominant
- parents 1 and 2 do not have the condition but their daughter / person 3 does (1) allow the parents carry the allele without showing it
- (b) Dd and Dd (1) both needed
- (c) dd (1)
- (d) 1 in 4 / 25% / 0.25 (1) allow 1/4

17. [4]

- (a) heterozygous parent: B and b; brown parent: b (only) (1)
- (b) Bb, Bb, bb, bb (1)
- (c) 1 black : 1 brown (1) allow 1 : 1
- (d) 50% (1)

18. [4] Supplement

- (a) tt (1)
- (b) all tall (1)
- (c) about half tall and about half short (1) allow 1 : 1
- (d) a small number could all be tall by chance even if the plant is Tt / a larger number is more reliable (1)

19. [5] Supplement

- (a) both alleles in a heterozygous organism contribute to the phenotype (1) allow both alleles are expressed in the heterozygote
- (b) gametes IA, Io and IB, Io correctly placed (1)
- offspring IA IB, IA Io, IB Io, Io Io (1)
- (c) 1 in 4 / 25% / 0.25 (1)
- (d) AB (1)

20. [5] Supplement

- (a) the gene (responsible) is located on a sex chromosome (1) allow on the X chromosome
- (b) males have only one X chromosome / the Y has no matching allele, so one recessive allele causes colour blindness (1)
- females need two recessive alleles / would be carriers with one (1)
- (c) X^B X^B, X^B X^b, X^B Y, X^b Y (1) all four needed
- (d) 1 in 2 / 50% (1)