

Genetics practice questions

16 questions • 47 marks • mark scheme at the back

For Edexcel GCSE Combined Science 1SC0. **Higher tier** is only on the Higher paper.

Name

Total / 47

Reproduction and meiosis Spec 3.1B-3.3

- 1** A human body cell has 46 chromosomes. (a) State the number of chromosomes in a human egg cell. (1) (b) One cell divides by meiosis. State the number of daughter cells produced. (1) (c) Explain why the number of chromosomes in a human cell does not double each generation. (2) [4 marks]

DNA and the genome Spec 3.4-3.6

- 2** What joins the two strands of a DNA molecule together? [1 mark]
- A. ☐ Strong covalent bonds between sugar groups
- B. ☐ Weak hydrogen bonds between bases
- C. ☐ Strong covalent bonds between phosphate groups
- D. ☐ Weak hydrogen bonds between sugar groups
- 3** Describe the structure of a DNA molecule. [3 marks]

- 4** A section of one strand of DNA has the base sequence A T G C C A. (a) Write the base sequence of the complementary strand. (1) (b) Name the type of bond that holds the two strands together. (1) [2 marks]

- 5** State what is meant by (a) the genome of an organism (1) and (b) a gene (1). [2 marks]

- 6** Describe how DNA can be extracted from a strawberry. [4 marks]

Inheritance Spec 3.11B–3.18B

- 7** Explain the meaning of the terms allele, dominant and genotype. [3 marks]

- 8** In pea plants, the allele for tall (T) is dominant to the allele for short (t). Two heterozygous tall plants are crossed. Use a genetic diagram to work out the ratio of tall plants to short plants in the offspring. [3 marks]

Answer =

[3 marks]

[illegible]

[3 marks]

[illegible]

[6 marks]

[illegible]

Variation, mutations and the Human Genome Project Spec 3.19-3.23

12 Most phenotypic features are the result of **[1 mark]**

- A. ☐ a single gene
- B. ☐ multiple genes
- C. ☐ a single chromosome
- D. ☐ the Y chromosome

13 Identical twins have the same genes. One twin has a scar on her arm and is heavier than her sister. (a) Name the type of variation shown by the scar. (1) (b) Suggest two reasons why the twins have different masses. (2) (c) State one cause of genetic variation between non-identical siblings. (1) **[4 marks]**

14 The masses of five pea seeds were 0.42 g, 0.38 g, 0.45 g, 0.40 g and 0.35 g. Calculate the mean mass. **[2 marks]**

Answer =

15 (a) State how extensive genetic variation arises in a population. (1) (b) Describe the effects mutations can have on the phenotype. (2) **[3 marks]**

16 Discuss the outcomes of the Human Genome Project and its potential applications within medicine. **[3 marks]**

Mark scheme

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

1. [4]

- (a) 23 (1)
- (b) 4 (1)
- (c) gametes have half the number of chromosomes (1)
- fertilisation restores the full number (46) / the zygote gets 23 from each parent (1)

2. [1]

B B: Weak hydrogen bonds between bases (1)

3. [3]

- two strands coiled to form a double helix (1)
- strands linked by complementary base pairs joined by (weak) hydrogen bonds (1)
- made of nucleotides, each consisting of a sugar and phosphate group (1)
- with one of four different bases attached to the sugar (1)
- Max 3

4. [2]

- (a) T A C G G T (1)
- (b) hydrogen (bonds) (1)

5. [2]

- (a) the entire DNA of an organism (1)
- (b) a section of a DNA molecule that codes for a specific protein (1)

6. [4]

- mash / crush the strawberry (1)
- add detergent (and salt) to break down cell membranes / release DNA (1)
- filter to remove solid pieces (1)
- add ice-cold ethanol (1)
- DNA appears as white stringy strands / precipitate (1)
- Max 4

7. [3]

- allele: a different version of the same gene (1)
- dominant: an allele that is expressed in the phenotype even when only one copy is present (1)
- genotype: the alleles an organism has (for a gene) (1)

8. [3]

- gametes from both parents T and t (1)
- offspring genotypes TT, Tt, Tt, tt (1)
- 3 tall : 1 short (1) allow 3:1

9. [3]

- mother's gametes X and X, father's gametes X and Y (1)
- offspring XX, XX, XY, XY (1)
- two out of four are XX / female so probability is 50% (1)

10. [3]

- (a) both parents are carriers / heterozygous (1)
- each has one recessive allele, which is masked by the dominant allele (1) allow: the daughter is homozygous recessive so must have inherited a recessive allele from each parent
- (b) 1/4 or 0.25 or 25% (1)

11. [6]

Level 3 5-6	A clear, logical explanation using correct terms, a correct genetic diagram, and a correct prediction of the proportions with the idea of probability.
Level 2 3-4	Some explanation using some correct terms, a mostly correct genetic diagram, and a prediction with minor errors or omissions.
Level 1 1-2	Simple statements with limited use of terms. The diagram may be missing or incorrect.

Indicative content

- both parents have genotype Pp (heterozygous)
- each parent produces gametes P and p
- gametes combine at random at fertilisation
- offspring genotypes PP, Pp, Pp and pp
- P is dominant so PP and Pp have purple flowers
- pp is homozygous recessive so has white flowers
- ratio 3 purple : 1 white
- probability of purple 75%, of white 25%

12. [1]

B B: multiple genes (1)

13. [4]

- (a) environmental variation / acquired characteristic (1)
- (b) different diet (1)
- different amount of exercise (1) allow other suitable environmental factors
- (c) sexual reproduction / mutation (1)

14. [2]

- $0.42 + 0.38 + 0.45 + 0.40 + 0.35 = 2.00$ (1)
- $2.00 \div 5 = 0.40$ g (1)

15. [3]

- (a) through mutations (1)
- (b) most have no effect (1)
- some have a small effect, and rarely a single mutation significantly affects the phenotype (1)

16. [3]

- the human genome has been mapped / the sequence of bases in human DNA identified (1)
- genes linked to inherited disorders can be identified so people can be tested / their risk predicted (1)
- treatments or drugs can be developed or matched to a person's genes (1)
- concern: genetic information could be used unfairly or cause worry (1)
- Max 3