Inheritance and Evolution

GCSE Science • **Combined and Triple** • Grades 4–7

WORKED SOLUTIONS

Name: worked example Class: _____ Total: 51 / 51

Show all your working. Marks are given for correct method as well as the final answer.

1. Name the molecule that carries genetic information. **[1 mark]**

a double helix of two strands

Answer: DNA

2. Define a gene. **[2 marks]**

it codes for a PROTEIN, not for a characteristic

Answer: a section of DNA that codes for a protein

3. Define the genome of an organism. **[1 mark]**

the entire set of DNA

Answer: all of its genetic material

4. Write down the number of chromosomes in a normal human body cell. **[1 mark]**

23 pairs

Answer: 46

5. Write down the number of chromosomes in a human gamete. **[1 mark]**

half the number, so fertilisation restores 46

Answer: 23

6. Give two differences between mitosis and meiosis. **[2 marks]**

mitosis: 2 identical diploid cells
meiosis: 4 genetically different gametes

Answer: meiosis makes 4 non-identical haploid cells

7. Define a dominant allele. **[2 marks]**

written as a capital letter

Answer: it is expressed even if only one copy is present

8. Define a recessive allele. **[2 marks]**

written as a lower-case letter

Answer: it is only expressed when both copies are present

9. Explain the difference between genotype and phenotype. **[2 marks]**

BB and Bb are different genotypes
but can give the same phenotype

Answer: genotype is the alleles, phenotype is the characteristic

10. Write down what *Bb* is called. **[1 mark]**

two different alleles

Answer: heterozygous

11. Write down what bb is called. **[1 mark]**

two identical recessive alleles

Answer: homozygous recessive

12. Two heterozygous parents (Bb) are crossed. Complete the Punnett square. **[2 marks]**

	B	**b**
B		
b		

combine one allele from each parent per box

Answer: BB, Bb, Bb, bb

13. Using that cross, write down the ratio of dominant to recessive phenotypes. **[2 marks]**

	B	**b**
B		
b		

BB, Bb and Bb all show the dominant phenotype
only bb shows the recessive one

Answer: 3 : 1

14. Using that cross, write down the probability of a homozygous recessive offspring. **[2 marks]**

one box out of four is bb

Answer: $\frac{1}{4}$ (25%)

15. A homozygous dominant (BB) is crossed with a homozygous recessive (bb). Write down the genotypes of the offspring. **[3 marks]**

every box gets B from one parent and b from the other
so 100% heterozygous

Answer: all Bb

16. Write down the sex chromosomes of a human male and a human female. **[2 marks]**

the father's gamete determines the sex

Answer: XY and XX

17. Explain why the chance of having a boy is 50%. **[3 marks]**

the mother can only give X
the father gives X or Y, equally likely
so XX and XY are equally likely

Answer: half the father's gametes carry Y

18. Define natural selection. **[3 marks]**

there is variation in a population
those better suited survive to reproduce
organisms do not CHOOSE to adapt

Answer: the best-adapted survive, breed and pass on their alleles

19. A population of beetles lives on dark bark. Most are pale, a few are dark.

(a) Explain how the population could become mostly dark. **[4 marks]**

dark beetles are camouflaged on dark bark
so fewer are eaten by birds
they survive and reproduce more
passing the allele for dark colour to their offspring
over generations the proportion of dark beetles rises

(b) State where the dark colour originally came from. **[2 marks]**

a random mutation
mutation is the source of new alleles

Answer: ____ selection over generations ; a random mutation____

20. Cystic fibrosis is caused by a recessive allele (f). Two carriers (Ff) have a child.

(a) Work out the probability the child has the disorder. **[3 marks]**

FF, Ff, Ff, ff
only ff has the disorder
$\frac{1}{4}$ = 25%

(b) Work out the probability the child is a carrier. **[3 marks]**

Ff appears twice out of four
$\frac{2}{4} = \frac{1}{2}$ = 50%

Answer: _____ 25% ; 50%_____

21. Bacteria can become resistant to antibiotics.

(a) Explain how a resistant population develops. **[4 marks]**

a random mutation makes one bacterium resistant
the antibiotic kills the non-resistant ones
the resistant one survives and reproduces rapidly
so the whole population becomes resistant

(b) Give two ways doctors slow this down. **[2 marks]**

only prescribe antibiotics when they are needed
patients must finish the whole course

Answer: ____ mutation then selection ; prescribe less, finish the course____

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