# End of topic quiz

# Topic B5: Genes, inheritance and selection

## Instructions and answers for teachers

These instructions cover the learner activity section which can be found on [page 10](#_Chapter:_P4_of). This end of topic quiz supports OCR GCSE (9–1) Combined Science A (J250), Topic B5.

**When distributing the activity section to the learners either as a printed copy or as a Word file you will need to remove the teacher instructions section.**

### The Activity

This end of topic quiz comprises of 40 marks covering a range of question types. The quiz starts with some multiple choice questions and them moves on to some short answer questions and then finally on to some longer answer questions.

The question worksheet can be used to consolidate understanding at the end of teaching the chapter, to revisit and refresh knowledge at a later point in the course, or during exam preparation.

### Learning Outcomes

This end of topic quiz relates to the specification learning outcomes in Topic B5: Genes, inheritance and selection. The quiz covers the following topics:

B5.1 Inheritance

B5.2 Natural selection and evolution

### Topic: B5 of J250 - Answers

**Total marks: 40**

1. Which of the following shows continuous variation? **[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Ability to roll tongue |  |
| **B** | Blood group |  |
| **C** | Eye colour |  |
| **D** | Weight |  |

Your answer

**D**

1. If a haploid cell has 20 chromosomes.

How many chromosomes will a diploid cell of the same species have? **[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | 10 |  |
| **B** | 20 |  |
| **C** | 40 |  |
| **D** | 46 |  |

Your answer

**C**

1. What is the genome? **[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | The dominant genes which are expressed. |  |
| **B** | The entire genetic material of an organism. |  |
| **C** | The genes in an organism. |  |
| **D** | The length of DNA which codes for the making of a protein. |  |

Your answer

**B**

1. Which column in the table correctly describes the cells involved in meiosis?

| Type of cell | **1** | **2** | **3** | **4** |
| --- | --- | --- | --- | --- |
| body cell | diploid | diploid | haploid | diploid |
| egg cell | diploid | haploid | haploid | haploid |
| sperm cell | haploid | haploid | haploid | haploid |
| zygote cell | diploid | diploid | diploid | haploid |

|  |  |  |
| --- | --- | --- |
| **A** | 1 |  |
| **B** | 2 |  |
| **C** | 3 |  |
| **D** | 4 |  |

Your answer

**B**

1. Which of the following does **not** occur as part of evolution?

|  |  |  |
| --- | --- | --- |
| **A** | A change in inherited characteristics of a population over time. |  |
| **B** | The inheritance of acquired characteristics. |  |
| **C** | The process of natural selection. |  |
| **D** | The formation of a new species. |  |

Your answer

**B**

1. A homozygous black-haired guinea pig was bred with a homozygous brown-haired guinea pig.

All the offspring had black hair.

Assume hair colour is controlled by a single gene.

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** | **(i)** | What is meant by the term homozygous? **[1 mark]** | |
|  |  | has two identical alleles (for a certain characteristic)/has two black/brown alleles 🗸 | |
|  |  |  |  |
|  | **(ii)** | Which is the dominant hair colour in mice and why? **[1 mark]** | |
|  |  | black (no mark) because all offspring had black but were, Bb/heterozygous/had both alleles 🗸 | |
|  |  |  |  |
| **(b)** | **(i)** | One of the heterozygous black-haired mice was bred with a homozygous brown-haired mouse.  Use a genetic diagram to show the outcome of this cross.  Use the symbols B and b to represent the alleles. **[3 marks]** | |
|  |  | black mouse brown mouse  genotype .......Bb.............. ........bb............ 🗸  gametes .....B.... ....b..... ......b... .....b..... 🗸  offspring genotypes ....Bb and bb........................... 🗸. | |
|  |  |  |  |
|  | **(ii)** | What is the ratio of phenotypes in the offspring? **[1 mark]** | |
|  |  | 1:1 / 50% black, 50% brown / ½ black, ½ brown 🗸 | |
|  |  |  |  |
| **(c)** |  | Single gene inheritance was assumed in this example.  Single gene inheritance allows predications based on simple genetic crosses.  Why are most phenotypic features more difficult to predict? **[1 mark]** | |
|  |  | involve multiple genes/involve genetics and environment 🗸 | |

1. There are many possible ways of classifying organisms.

The first person to suggest a classification system was a biologist called Linnaeus in 1735.

He grouped organisms by looking at similarities in their structures, like wings, which were shared by large groups.

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** |  | What type of classification system is this and why? **[2 marks]** | |
|  |  | natural 🗸  because it used important shared features 🗸 | |
|  |  |  |  |
| **(b)** |  | How has classification changed since the use of DNA sequencing? **[3 marks]** | |
|  |  | **Any three from:**  phylogenetics 🗸  similarities in DNA/genes used to group 🗸  creating evolutionary trees/relationship 🗸  differences based on accumulation of mutations over time 🗸  more differences means greater distance away in evolutionary tree/molecular clock 🗸 | |

1. In humans sex is determined by a person’s chromosomes.

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** |  | What is a chromosome? **[2 marks]** | |
|  |  | **Any two from:**  coiled/thread of DNA 🗸  contained in nucleus 🗸  made up of two chromatids 🗸  contains genes/genetic material 🗸 | |
|  |  |  |  |
| **(b)** |  | A couple are expecting a baby.  Use a genetic cross to show that the probability of having a female child. **[4 marks]** | |
|  |  | | parental phenotype | female | male | | --- | --- | --- | | parental genotype | XX | XY 🗸 | | gametes | X (X) | X Y 🗸 | | cross | |  | X |  |  | X | X | | --- | --- | --- | --- | --- | --- | | X | XX | OR | X | XX | XX | | Y | XY |  | Y | XY | XY |   🗸 | |   offspring phenotypes.............. XX – female 50% or XY – male 50% 🗸....................... | |
|  |  |  |  |
| **(c)** | **(i)** | Sometimes offspring can have multiple copies of sex chromosomes due to problems in meiosis.  An individual with XXY chromosomes has a male phenotype. This is called Klinefelter syndrome.  What is meant by the term phenotype? **[1 mark]** | |
|  |  | Characteristics/features shown by an organism 🗸 | |
|  |  |  |  |
|  | **(ii)** | A normal human gamete has 23 chromosomes.  How many chromosomes could be in the gamete which causes Klinefelter syndrome? **[1 mark]** | |
|  |  | 24 🗸 | |
|  |  |  |  |
|  | **(iii)** | Why could this be a problem? **[1 mark]** | |
|  |  | Idea of unequal distribution of genes/missing genes/idea that diploid number will not be maintained 🗸 | |

1. The peppered moth is a possible example of natural selection.

Read the article about the peppered moth.

“Scientists have discovered the specific mutation that turned moths black during the industrial revolution.

A black form of the peppered moth became common during the 1800s. At this time soot blackened the tree trunks and walls of the moth’s habitat. The peppered moth normally has a pale colouring.

The mutation is in a gene called *cortex*. A ‘jumping’ piece of DNA had inserted itself into the gene, causing a change in the order of nucleotides. This change caused the moth to be black.”

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** |  | “The mutation is in a gene called *cortex*.”  What is a gene? **[2 marks]** | |
|  |  | a length of DNA/a section of DNA 🗸  codes for a specific/particular protein 🗸 | |
|  |  |  |  |
| **(b)** |  | Why is the mutation in the *cortex* gene unusual? **[1 mark]** | |
|  |  | affected phenotype/most mutations don’t influence phenotype 🗸 | |
|  |  |  |  |
| **(c)** |  | How has the genome and/or environment influenced the phenotype? **[2 marks]** | |
|  |  | just genome influence/no environmental influence 🗸  *evidence* – discontinuous variation/mutation in (single) gene caused change 🗸 | |
|  |  |  |  |
| **(d)** |  | How has natural selection caused an increase in the number of black moths during the 1800s? **[4 marks]** | |
|  |  | **Any four from:**  variation in population/different forms present 🗸  black form better camouflaged (in soot) 🗸  black form not eaten by birds as much 🗸  black form survives 🗸  passes on genes 🗸  higher frequency of black genes in population 🗸 | |
|  |  |  |  |
| **(e)** |  | Clean air laws came into effect in the 1960s.  Since this time more pale moths have been seen.  Why could this be? **[2 marks]** | |
|  |  | **Any two from:**  less, air pollution/soot 🗸  pale moths better adapted 🗸  change in selection pressure 🗸 | |
|  |  |  |  |
| **(f)** |  | Another example of natural selection leading to evolution is antibiotic resistance in bacteria.  How has antibiotic resistance in bacteria provides evidence for evolution? **[3 marks]** | |
|  |  | **Any four from:**  increased antibiotic resistance in bacteria 🗸  example of bacteria with resistance e.g. MRSA 🗸  high numbers of bacteria make mutation more likely 🗸  bacteria reproduce rapidly so change observable/over shorter time 🗸  **With max 2 from:**  selection pressure due to use of antibiotics 🗸  only those with resistance survive 🗸  pass on genes for resistance when reproduce 🗸 | |

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If you are looking for examination practice materials, you can find the Sample Assessment Materials (SAMs) on the qualification webpage: [Combined Science A (9–1).](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-combined-science-a-j250-from-2016/)

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# End of topic quiz

# Topic B5: Genes, inheritance and selection

## Learner Activity

### Topic: B5 of J250

**Total marks: 40**

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|  |  |  |
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| **A** | Ability to roll tongue |  |
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| **C** | Eye colour |  |
| **D** | Weight |  |

Your answer

1. If a haploid cell has 20 chromosomes.

How many chromosomes will a diploid cell of the same species have? **[1 mark]**

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| **A** | 10 |  |
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1. What is the genome? **[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | The dominant genes which are expressed. |  |
| **B** | The entire genetic material of an organism. |  |
| **C** | The genes in an organism. |  |
| **D** | The length of DNA which codes for the making of a protein. |  |

Your answer

1. Which column in the table correctly describes the cells involved in meiosis?

| Type of cell | **1** | **2** | **3** | **4** |
| --- | --- | --- | --- | --- |
| body cell | diploid | diploid | haploid | diploid |
| egg cell | diploid | haploid | haploid | haploid |
| sperm cell | haploid | haploid | haploid | haploid |
| zygote cell | diploid | diploid | diploid | haploid |

|  |  |  |
| --- | --- | --- |
| **A** | 1 |  |
| **B** | 2 |  |
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Your answer

1. Which of the following does **not** occur as part of evolution?

|  |  |  |
| --- | --- | --- |
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Your answer

1. A homozygous black-haired guinea pig was bred with a homozygous brown-haired guinea pig.

All the offspring had black hair.

Assume hair colour is controlled by a single gene.

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** | **(i)** | What is meant by the term homozygous? **[1 mark]** | |
|  |  |  | |
|  |  |  |  |
|  | **(ii)** | Which is the dominant hair colour in mice and why? **[1 mark]** | |
|  |  |  | |
|  |  |  |  |
| **(b)** | **(i)** | One of the heterozygous black-haired mice was bred with a homozygous brown-haired mouse.  Use a genetic diagram to show the outcome of this cross.  Use the symbols B and b to represent the alleles. **[3 marks]** | |
|  |  | black mouse brown mouse  genotype ..................... ....................  gametes ..................... ....................  offspring genotypes ............................... | |
|  |  |  |  |
|  | **(ii)** | What is the ratio of phenotypes in the offspring? **[1 mark]** | |
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The first person to suggest a classification system was a biologist called Linnaeus in 1735.

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| --- | --- | --- | --- |
| **(a)** |  | What type of classification system is this and why? **[2 marks]** | |
|  |  |  | |
|  |  |  |  |
| **(b)** |  | How has classification changed since the use of DNA sequencing? **[3 marks]** | |
|  |  |  | |

1. In humans sex is determined by a person’s chromosomes.

|  |  |  |  |
| --- | --- | --- | --- |
| **(a)** |  | What is a chromosome? **[2 marks]** | |
|  |  |  | |
|  |  |  |  |
| **(b)** |  | A couple are expecting a baby.  Use a genetic cross to show that the probability of having a female child. **[4 marks]** | |
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| --- | --- | --- | --- |
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|  |  |  | |
|  |  |  |  |
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|  |  |  | |
|  |  |  |  |
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