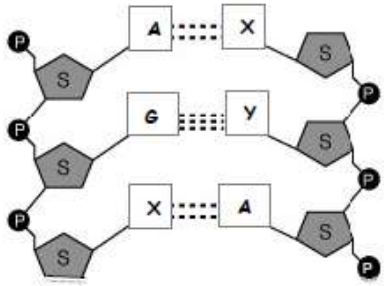
Biology
Leaving Certificate
Ordinary Level

Past Exam Questions on
Genetics, DNA and Evolution

Q10 Section C 2013

10. (a) Explain the following terms used in genetics:
(i) Gene.
(ii) Allele.
(iii) Genotype. (9)

(b) There are four bases in DNA structure.
These are adenine (A), cytosine (C), thymine (T) and guanine (G).



(i) Name the bases at positions X and Y in the diagram.
(ii) Where in a human cell would you expect to find most DNA?
(iii) Proteins are made in the ribosomes using a code from DNA. Name the molecule that carries the DNA code to the ribosomes.
(iv) What is meant by DNA profiling?
(v) In DNA profiling, what is used to cut the DNA strands into fragments?
(vi) Give **two** applications of DNA profiling. (27)

(c) In humans, sex is determined by genes located on pairs of chromosomes called sex chromosomes.

Using a Punnett square or otherwise, show that there is an equal chance of a child being male or female.
In your answer give:
(i) The genotypes and matching phenotypes of the parents.
(ii) The possible genotypes of the gametes that can be produced by **each** parent.
(iii) The genotypes of the offspring. (24)

Q6 Section A 2012

6. In pea plants the allele for tall (T) is dominant over the allele for dwarf (t).
A heterozygous tall plant is crossed with a dwarf plant.

Complete the blank spaces below.

	Genotypes of parents		(Tt)	×	(tt)	
(a)	Possible gametes	( )	( )	×	( )	
(b)	Genotypes of offspring		( )		( )	
(c)	Phenotypes of offspring		----------		----------	

Q11 Section C 2012

11. (a) (i) In genetics, what is meant by the term *haploid*?
(ii) What is a chromosome?

(9)

(b) Read the paragraph below and answer the questions that follow.

The rabbit in the photograph has no pigment in its skin, fur or eyes. This is due to an inherited condition known as albinism. Such animals are unable to produce melanin, a protein pigment that gives colour to the skin, eyes, fur or hair. This condition makes an animal more likely to be preyed upon.
Albinism is caused by genetic mutation. The gene that causes albinism (lack of pigment) is a recessive gene. If an animal has one gene for albinism and one gene for pigmentation, it will have enough genetic information to make pigment and the animal will not have this disorder. However, if both genes are recessive the result is albinism. At least 300 species of animal have albino individuals e.g. rabbits, turtles, squirrels, deer and frogs.

(i) What are the main characteristics of albinism?

(ii) What is meant by the term *recessive* gene?

(iii) What is a mutation?

(iv) Mutations can lead to variation in organisms. Variations that make an organism better adapted to its environment can lead to evolution.

1. What is meant by *evolution*?
2. Name **one** of the scientists who first explained how evolution occurs by natural selection.
3. Give **one** source of evidence for evolution.

(v) People with albinism should always apply a high-factor sunscreen when going outdoors and must avoid strong sunshine. Suggest a reason for these precautions.

(27)

(c) (i) Genetic engineering is regularly used in animals, plants and micro-organisms.
What is meant by genetic engineering?

(ii) List **three** of the main procedures used in genetic engineering.

(iii) Give **two** examples of how genetic engineering is used.

(24)

Q10 Section C 2011

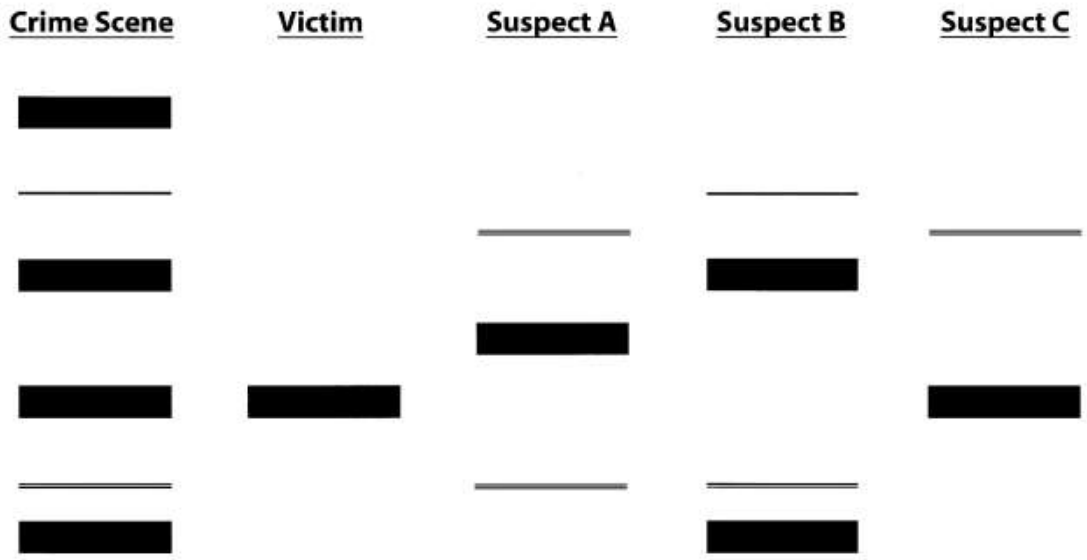
10. (a) Explain the following terms that are used in genetics:

(i) Allele
(ii) Heterozygous
(iii) Phenotype. **(9)**

(b) In humans, brown eye (B) is dominant to blue eye (b). Two parents, one heterozygous for eye colour and the other with blue eyes, start a family.

(i) What is the genotype of the blue-eyed parent?
(ii) What are the possible gametes that **each** parent can produce?
(iii) Using a Punnett square or another method work out the possible genotypes **and** phenotypes of their children. **(24)**

(c) (i) Explain, in terms of what happens to body cells, what is meant by the term *cancer*.
(ii) Give **two** possible causes of cancer.
(iii) Some people choose to be screened to determine their risk of getting a particular type of cancer.
What is meant by genetic screening?
(iv) Blood samples taken from a crime scene were put through a process called DNA profiling. During the process cells were broken down to release the DNA, which was then cut into fragments. The fragments were then separated.
1. What was used to cut the DNA?
2. On what basis were the DNA fragments separated?
3. Give an application of DNA profiling other than solving crime.
(v) The following are the results of the DNA profiling process. Using these results, identify which suspect, **A**, **B** or **C** committed the crime.



(27)

Q4 Section A 2010

4. Choose each term from the following list and place it in **Column A** to match a description from **Column B**. The first one has been completed as an example.

Dominant **Gamete** **Gene** **Mutation** ~~**Genetics**~~ **Genotype**

Column A	**Column B**
Genetics	**The study of biological inheritance**
(i)	The genetic make up of an individual
(ii)	A sex cell
(iii)	A change in the structure of DNA
(iv)	A part of DNA with information to make one protein
(v)	The allele expressed in the heterozygous condition

Q7 Section B 2010

7. In one of your laboratory activities you isolated DNA from a plant tissue.

(a) (i) Where in plant cells is DNA found? _____

(ii) What is meant by DNA profiling? _____

_____

_____

(b) (i) Give **one** reason why you first chopped the plant material into very small pieces.

_____

(ii) Detergent and salt were added to the chopped plant material, which was then heated.

Explain why the detergent was used. _____

_____

(iii) **How** was this mixture heated?

_____

(iv) **Why** was this mixture heated?

_____

(v) Later in the activity the mixture was blended for a maximum of 3 seconds.

What would happen to the DNA if the mixture was blended for longer than 3 seconds?

_____

(vi) Protease was then added to the mixture.

Why was protease added?

_____

(vii) The mixture was then filtered.

After filtration, where was the DNA of your plant tissue to be found?

_____

(viii) What should you do next to make the DNA visible?

_____

Q11 Section C 2010

11. (a) Many characteristics are passed on to children by their parents.

(i) Give **one** example of an **inherited** human characteristic.

(ii) Give **one** example of a **non-inherited** human characteristic.

(iii) Which structures in sperm and egg nuclei are responsible for biological inheritance? (9)

(b) When a pure-breeding black cat was mated with a pure-breeding white cat, all the kittens were black.

(i) Which fur colour, black or white, is **recessive** in these cats?

(ii) Using capital letters for dominant and lower case letters for recessive, give:

1. The genotypes of the parent cats.

2. The genotype of the kittens.

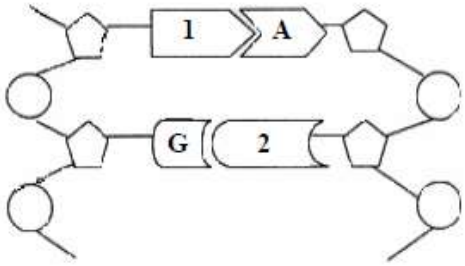
(iii) Is the genotype of the kittens referred to as homozygous or heterozygous?

(iv) Give a reason for your answer to part (iii).

(v) In relation to fur colour, what will be the genotypes of the gametes that these kittens will produce?

(vi) What are *alleles*? (27)

(c) The diagram shows a short section of a DNA molecule.



(i) Name the bases numbered 1 and 2 in the diagram above.

(ii) Protein synthesis involves both transcription and translation.

Where in a cell does **transcription** occur?

(iii) What type of RNA is involved in transcription?

(iv) In what organelle does **translation** occur?

(v) Name the small biomolecules that are joined together to make a protein.

(vi) What must happen to the newly formed protein before it can begin to work?

(vii) Give **one** function of proteins in living organisms. (24)

Q3 Section A 2009

3. Natural selection is an important aspect of the study of evolution. Answer the following parts in relation to evolution and natural selection.

(a) What is meant by natural selection? _____

_____

(b) Name a scientist who is associated with the Theory of Natural Selection.

_____

(c) Variation is essential for natural selection. Mutation can give rise to variation.
Give **two** causes of mutation.

(i) _____

(ii) _____

(d) Give **one** source of evidence for the occurrence of evolution._____

_____

Q11 Section C 2009

11. (a) Explain the following terms as used in genetics:
(i) *heterozygous*
(ii) *incomplete dominance*
(iii) *phenotype*. **(9)**

(b) In snapdragon plants the allele for red flower (**R**) is incompletely dominant to the allele for white flower (**r**). Heterozygous plants have pink flowers.

(i) Using a Punnett square, or otherwise, give the genotypes of the parents and find the genotypes and phenotypes of the offspring of the following cross:

Pink-flowered snapdragon x Pink-flowered snapdragon

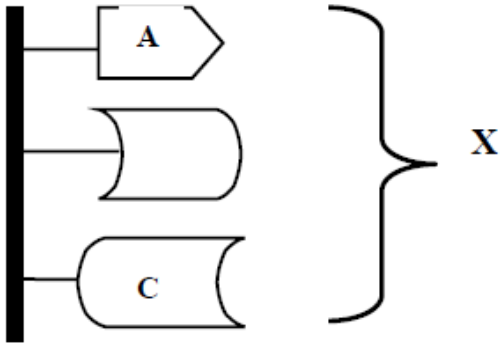
(ii) If 120 new plants were produced in this cross, how many of them would you expect to have pink flowers?
Explain how you got this answer. **(27)**

(c) (i) What is meant by DNA profiling?
(ii) In DNA profiling, what are used to cut DNA strands into fragments?
(iii) On what basis are these fragments then separated?
(iv) Give **two** applications (uses) of DNA profiling.
(v) Name the plant from which you isolated DNA in your practical studies.
(vi) For what precise purpose did you use freezer-cold ethanol (alcohol) in your isolation of DNA?

(24)

Q5 Section A 2008

5. The diagram represents a part of a DNA molecule. A and C represent nitrogenous bases.



Complete the following in relation to DNA.

(a) Name the nitrogenous bases whose first letters are A and C.

A _____ **C** _____

(b) The structure labelled **X** is called a _____

(c) Where in the cell would you expect to find most DNA? _____

(d) DNA contains the instructions needed to make protein.

These instructions are called the _____ code.

Q11 Section C 2008

11. **(a)** (i) What is a chromosome?
(ii) The haploid number of chromosomes is found in the human egg and sperm. Explain the underlined term. **(9)**

(b) Hair colour in humans is genetically controlled. The allele for brown hair (**B**) is dominant to the allele for red hair (**b**).
(i) Explain the underlined terms.
(ii) For hair colour Seán is heterozygous (**Bb**) and Máire is homozygous (**bb**).
1. What colour is Seán's hair?
2. What colour is Máire's hair?

(iii) Use a Punnet square or other means to show the following:
1. the genotypes of all the gametes that Seán and Máire can produce.
2. the genotypes of the children that Seán and Máire may have.

(iv) What is the probability that one of their children may have red hair? (Give your answer as a ratio or a percentage). **(27)**

(c) (i) What is meant by evolution?
(ii) Name **one** of the scientists associated with the Theory of Natural Selection.
(iii) Give a brief account of the Theory of Natural Selection.
(iv) Outline the evidence for evolution from any **one** named source. **(24)**

Q3 Section A 2007

3. Indicate whether the following are true (**T**) or false (**F**) by drawing a circle around **T** or **F**.

Example:	The pulmonary artery carries blood to the lungs	(T)	F
(a)	If the eyepiece lens of a microscope is marked X10 and the objective lens is marked X4, the total magnification is X14	T	F
(b)	Plant cells have chloroplasts, animal cells do not have chloroplasts	T	F
(c)	Humans receive oxygen from the air they inhale	T	F
(d)	Cell membranes let only some molecules pass through	T	F
(e)	Human chromosomes are found in the nucleus	T	F

Q4 Section A 2007

4. Complete the following sentences by adding the missing word **or** symbols **or** number.

(a) Genetics is the study of .....

(b) In a woman the sex chromosomes are XX; in a man they are .....

(c) If the diploid number in a cell is 46, the haploid number is .....

(d) In order to make proteins, DNA is first transcribed as messenger .....

(e) A change in the genetic material of an organism is called a .....

Q11 Part (c) 2007

(c) (i) Explain briefly what is meant by a gene.

(ii) Where in the nucleus would you find genes?

(iii) The <u>allele</u> for brown eye (**B**) is <u>dominant</u> to the allele for blue eye (**b**).
Explain each of the underlined terms.

(iv) Use a Punnet square to find the possible genotypes of children of parents who are both heterozygous for brown eye. State the eye colour resulting from each of these genotypes.

(27)

Q11 Section C 2006

11. (a) Explain the following terms, which are used in genetics: allele, homozygous, genotype. **(9)**

(b) (i) Name or draw the sex chromosomes that are present in a human body cell in the case of:
1. A male,
2. A female.

(ii) Use a Punnet square to show that there is a fifty percent chance that fertilization will lead to a male and fifty percent chance that it will lead to a female. **(27)**

(c) (i) What is genetic engineering?

(ii) Give **one** example of genetic engineering involving an animal and **one** example involving a plant.

(24)

Q13 Section C 2005

13. (a) For each of the following parents give the genotypes of all the possible gametes that it can produce.

(i) Parent Aa.

(ii) Parent AaBb. **(9)**

(b) (i) Name the four bases that are found in DNA.

(ii) These bases form a triplet code. What is meant by a triplet code?

(iii) The triplet code is transcribed into mRNA. What does this statement mean?

(iv) To which structures in the cell does mRNA carry the code? **(24)**

(c) (i) What is evolution?

(ii) What is Natural Selection?

(iii) Name **one** of the scientists who developed the Theory of Natural Selection.

(iv) Give a brief account of the evidence for evolution from **one** named source.

(27)