OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



EXAM QUESTION PACK

B1.1 WHAT IS A GENOME AND WHAT DOES IT DO? (HIGHER)

SCORE	PERCENTAGE
/67	%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

1(a). DNA is a nucleic acid. DNA is found in all living cells.

Read these statements about DNA.

Put ticks (✓) in the boxes next to the **two** correct statements.

DNA is made from four different nucleotides. ☐

Half the nucleotides have a common sugar. ☐

DNA is made from a copy of RNA. ☐

Half the nucleotides have a phosphate group. ☐

DNA is a polymer. ☐

[2]

© OCR 2019.

STEMUP.CO.UK

(b). RNA is another type of nucleic acid. It is involved in protein synthesis.

The table shows the nucleotide sequence in RNA that codes for different amino acids in proteins.

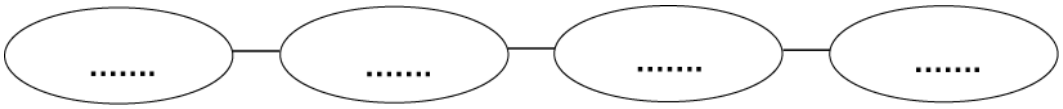
Amino acid	Amino acid abbreviation	Nucleotide sequence
glutamic acid	glu	G A G
leucine	leu	C U G
threonine	thr	A C G
tyrosine	tyr	U A C

Look at the nucleotide sequence in a section of RNA sequence.

G A C U G U A G U A C A C G C C

Write down the sequence of amino acids that this section of RNA codes for.

Use the abbreviation for each amino acid.



[1]

© OCR 2019.

STEMUP.CO.UK

(c). A mutation occurs in the RNA sequence. The nucleotide sequence that results is:

G A C U G U A G U A C A C G C C

Suggest the effect on the production of a protein.

---

[4]

STEMUP.CO.UK

2. To confirm that a female is pregnant a pregnancy test will be done. This test uses monoclonal antibodies.

(i) Describe how monoclonal antibodies are produced.

---

[3]

(ii) Antibodies are proteins.

The statements below describe protein synthesis.

A The mRNA travels to a ribosome in the cytoplasm.

B A copy of the gene is made from messenger RNA.

C The ribosome joins the amino acids together in the correct order.

D The gene that codes for the protein is found in the DNA.

Put the statements in the correct order.

--- --- --- ---

[1]

STEMUP.CO.UK

3(a). James Watson and Francis Crick are famous for identifying the structure of DNA. They wrote a scientific paper about DNA in 1953. Before this, scientists had clues about the parts of the DNA molecule.

One of these clues was the relative amounts of the bases – A, T, C and G. Chemical analysis of DNA from a wide variety of cells showed that:
Total number of A bases and G bases = Total number of T bases and C bases.

What conclusion could early scientists have made from this analysis?

[2]

(b). DNA structure is important in the production of proteins. DNA analysis allows scientists to group organisms based on similarities in their DNA.

Complete the sentences below.

A _____ of bases is required to code for an amino acid.

The properties of the protein made depend on the _____ of the amino acids.

Grouping organisms according to similarities in their DNA or physical characteristics is called

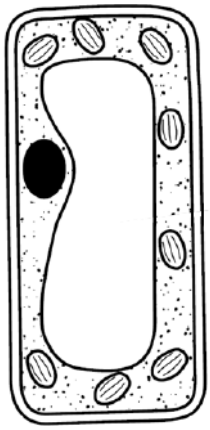
[3]

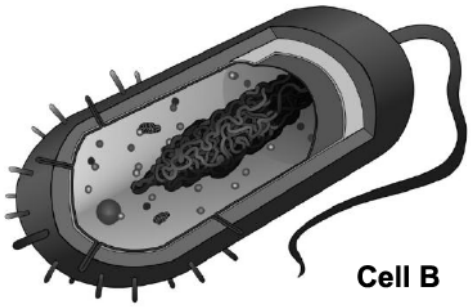
STEMUP.CO.UK

4. Cells of living organisms carry out their functions in a variety of ways.

Cell A and **Cell B** are cells from different types of living organism.

Cell A





Cell B

Explain one **similarity** and one **difference** in the genetic material of the two cells.

Similarity	Difference

[2]

STEMUP.CO.UK

5.

(i) A group of students decide to look at human red blood cells and human egg cells using a light microscope.

Name a structure that would be visible in the human egg cell but **not** in the human red blood cell.

_____ **[1]**

(ii) A human egg cell is approximately 10^2 µm in diameter.

A human red blood cell is approximately 10 µm in diameter.

How many times larger is an egg cell compared to a red blood cell?

_____ X larger **[1]**

(iii) Suggest an advantage of both cells being the size they are.

Human egg cell _____

_____

Red blood cell _____

_____ **[2]**

STEMUP.CO.UK

6(a). Read the article about classification.

Scientists use amino acid sequences to classify living things.

Scientists know that DNA codes for amino acids. They also know that amino acids are joined together to make proteins. By examining the sequence of amino acids in the same proteins in different animals, scientists can work out how closely related the animals are. The more similar the sequence, the more closely related organisms are. This technique is now being used to classify organisms in a completely new and more reliable way.

The table shows the sequence for eleven amino acids in humans and four other organisms.

Organism	Sequence of amino acids in a protein											Number of differences
	1	2	3	4	5	6	7	8	9	10	11	
Human	Gly	Asp	Val	Glu	Lys	Gly	Lys	Lys	Ile	Phe	Ile	
A	Gly	Asp	Ile	Glu	Lys	Gly	Lys	Lys	Val	Phe	Val	3
B	Gly	Asp	Val	Glu	Lys	Gly	Lys	Lys	Ile	Phe	Val	1
C	Gly	Asp	Ile	Glu	Lys	Gly	Lys	Lys	Ile	Phe	Val	2
D	Gly	Asn	Pro	Asp	Ala	Gly	Ala	Lys	Leu	Phe	Lys	7

Look at organisms **A, B C and D**. The shaded boxes show where the sequence of amino acids differs from that found in humans.

The column on the right shows the total number of these differences.

Describe and explain the conclusions that can be made from the data in the table.

Use the information in the article to help you.

---

[3]

© OCR 2019.

STEMUP.CO.UK

(b). Suggest how the data could be improved to make scientists more confident in their conclusions.

---

[2]

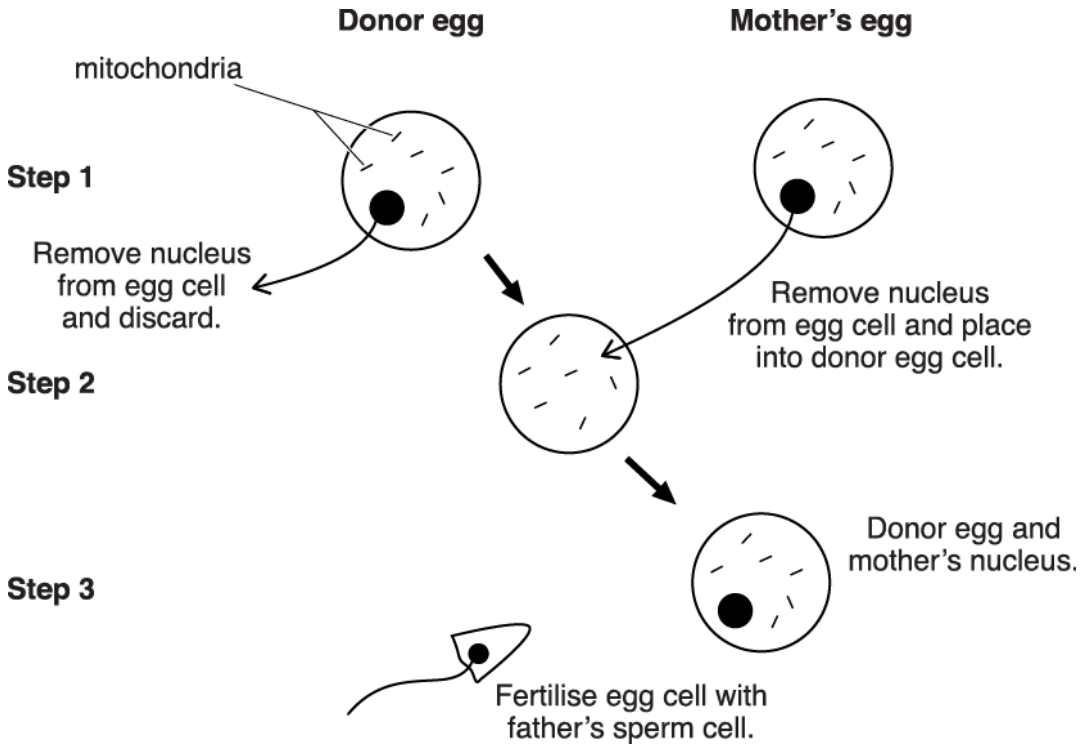
STEMUP.CO.UK

7(a). Scientists use cell structures from three people to make a baby:

- the nucleus from a mother's egg cell
- the nucleus from a father's sperm cell
- the mitochondria from a donor's egg cell.

This technique will help prevent some genetic diseases caused by faulty mitochondria.

The diagram below shows how the process will be done.



Step 4 Fertilised egg cell is then placed in the mother's uterus.

Mitochondria contain 37 genes.

The nucleus of a fertilised egg cell contains 40 000 genes.

What percentage of its genes does the fertilised egg cell receive from the donor?

Give your answer to 2 decimal places.

Show your working.

© OCR 2019.

STEMUP.CO.UK

_____ % [2]

(b). Most of the baby's physical characteristics will be inherited from its father and mother.

Suggest why.

_____

_____

_____ [1]

(c). Genes code for proteins.

What type of protein could the genes in the mitochondria code for?

_____ [1]

(d). Babies created by this new technique will contain the DNA from 3 different individuals.

Some people do not agree with the use of this new technique.

Suggest and explain why.

_____

_____

_____

_____

_____ [3]

© OCR 2019.

STEMUP.CO.UK

(e). Approximately 1 in 200 children have faulty mitochondria.

1 in 6500 children will have serious diseases as a result.

Do you think this justifies the development of this new technique?

Explain your answer.

---

[2]

(f). The DNA in the mitochondria of people affected by mitochondrial disease contains mutations.

A mutation is a change in the base sequence of the DNA.

Explain how these mutations can cause problems.

---

[2]

8(a). Our genes and chromosomes contain genetic information.

Write a word in the gap to complete each sentence.

Genes are instructions for a cell that describe how to make _____.

Genes are sections of long molecules of _____ that make up chromosomes.

The combination of alleles an organism has is called its _____.

The observable characteristics of an organism are called its _____.

[2]

© OCR 2019.

STEMUP.CO.UK

(b). Human body cells usually contain 23 pairs of chromosomes.

In males and females, 22 of these pairs of chromosomes look the same.

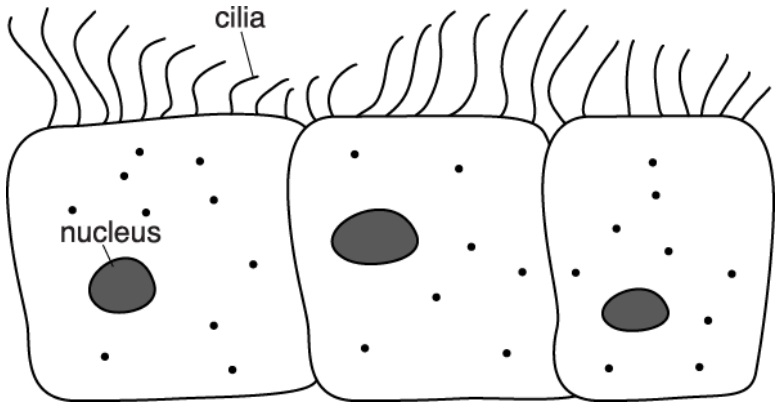
Write down the name of the pair of chromosomes that look different in males and females.

_____.

[1]

STEMUP.CO.UK

9. Some specialised cells have cilia.



Cilia are made from proteins.

Cilia are only made by certain cells.

Explain how the proteins in cilia are made and what prevents these proteins being made by all cells.

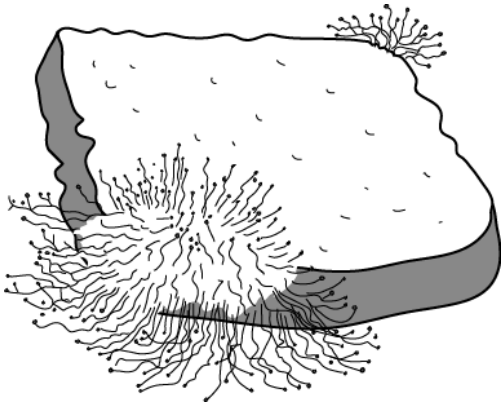
The quality of written communication will be assessed in your answer.

[6]

STEMUP.CO.UK

10. Moulds are living things that can grow on bread.

They make and release a digestive enzyme onto the bread.



Describe how the DNA in the mould codes for the enzyme and how the enzyme is made.

The quality of written communication will be assessed in your answer.

---

[6]

STEMUP.CO.UK

11(a) This question is about DNA and genes.

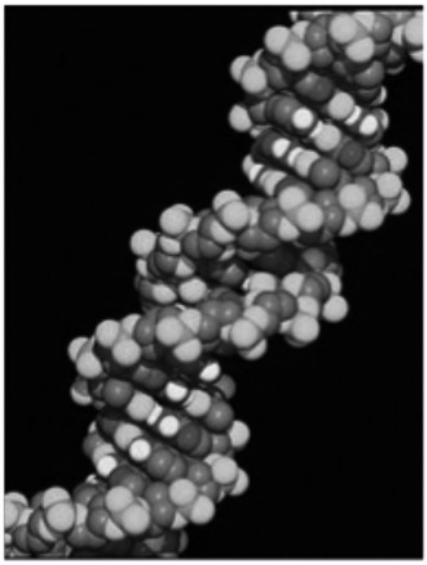
.

DNA is a double helix.

The double helix is divided into genes along its length.

The two strands are held together by bonds between pairs of bases.

The bases always pair up in the same way.



Genes code for proteins.

The bases work in groups of three, called the **triplet code**.

An example of how the bases code for the different amino acids in the protein produced is shown in the tables.

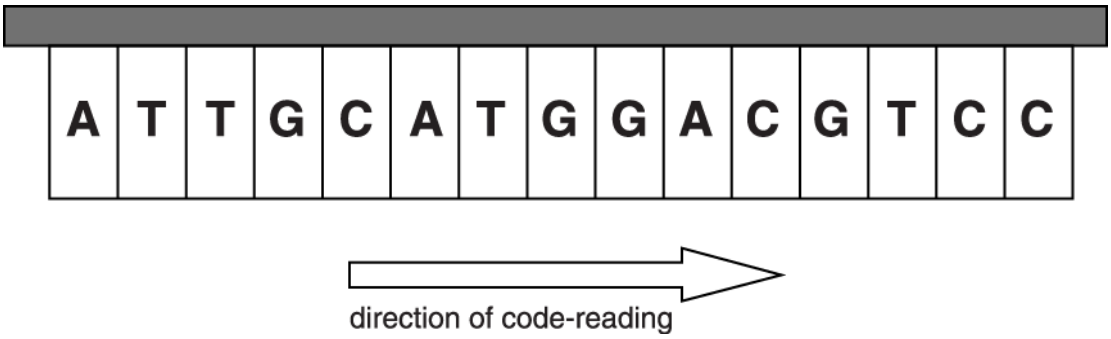
© OCR 2019.

STEMUP.CO.UK

DNA triplet code	Amino acid
ATT	1
TGG	2
CCT	3
AGG	4
GCA	5
GGA	6
TGC	7
TCG	8

DNA triplet code	Amino acid
ATC	9
GGT	10
TCC	11
AGC	12
TTA	13
TAC	14
ACG	15
GAC	16

Look at one strand of bases from part of a gene.



What is the order of amino acids found in the protein coded by this gene?

Write the correct amino acids, 1 to 16, in each box.

One has been done for you.

		2		

[2]

© OCR 2019.

STEMUP.CO.UK

(b). A copy of a gene must leave the nucleus and enter the cytoplasm for protein synthesis.

What is the name of this gene copy?

answer _____ [1]

© OCR 2019.

STEMUP.CO.UK

12.

(i) Plants need to make amino acids.

Which **two** molecules do plants use to make amino acids?

Put a tick (✓) in the boxes next to the **two** correct answers.

Cellulose ☐

Glucose ☐

Nitrate ☐

Protein ☐

Starch ☐

[2]

© OCR 2019.

STEMUP.CO.UK

(ii) Which type of large molecule are amino acids used to make?

Put a tick (✓) in the box next to the correct answer.

Cellulose	☐
Glucose	☐
Nitrate	☐
Protein	☐
Starch	☐

[1]

[Total: 15]

© OCR 2019.

STEMUP.CO.UK

the tongue.

13(a). Amaya reads an article in a magazine which explains that genes code for the production of a taste receptor on Taste receptors are proteins.

Complete the sentences to describe how a protein is made.

Use words from the list.

Each word can be used once, more than once, or not at all.

amino acids bases DNA fatty acids gene

genetic variant mitochondrion mRNA protein ribosome

A copy of the ..... is made from ..... .

This molecule travels to a ..... in the cytoplasm.

Here ..... are joined together to form a protein.

A mutation would create a ..... and therefore a different receptor.

[4]

(b). Scientists think that a mutation created the type of receptor that allows someone to taste a bitter substance.

Explain how a mutation could affect the structure of the receptor protein.

---

[2]

STEMUP.CO.UK

14. Nina is learning about substances absorbed by plants. She finds out that plants absorb nitrate ions from the soil.

Explain why nitrate ions are essential for plant growth and survival.

--- [2]

END OF QUESTION PAPER

STEMUP.CO.UK