



**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**BIOLOGY A**

UNIT 1: Modules B1 B2 B3 (Higher Tier)

**MONDAY 23 JUNE 2008**

**H**  
**A221/02**

Morning  
 Time: 40 minutes

Candidates answer on the question paper.

**Additional materials (enclosed):**

None

Calculators may be used.

**Additional materials:** Pencil  
 Ruler (cm/mm)



Candidate  
Forename

Candidate  
Surname

Centre  
Number

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.

**FOR EXAMINER'S USE**

Qu.	Max	Mark
1	6	
2	4	
3	5	
4	9	
5	5	
6	7	
7	3	
8	3	
<b>TOTAL</b>	<b>42</b>	

This document consists of **14** printed pages and **2** blank pages.

2

Answer **all** the questions.

- 1 Philip and Sharon have a son, John. John has cystic fibrosis. Cystic fibrosis is a genetic disorder caused by a single gene. They do not understand why John has cystic fibrosis when they do not.

- (a) They visit a doctor. She explains using some technical terms.

Draw a straight line from each **technical term** to its correct **description**.

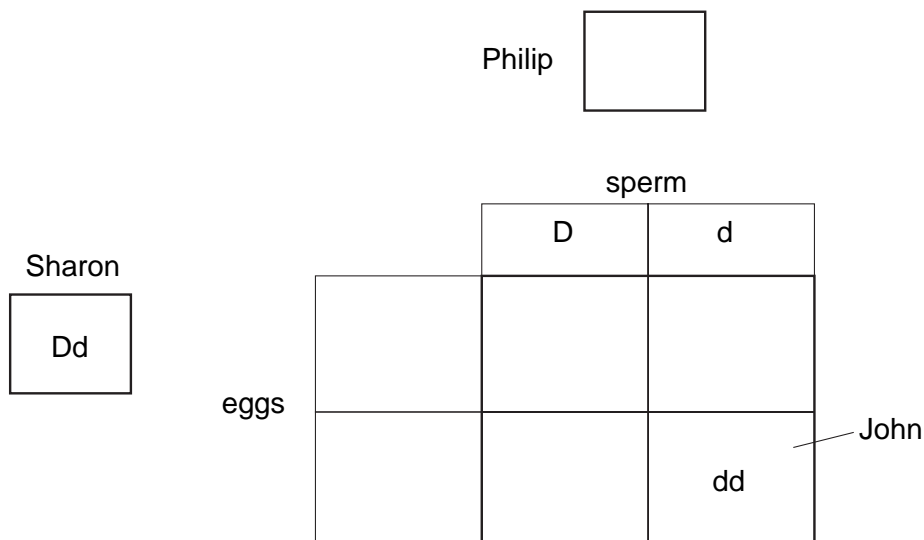
technical term	description
gene	long strand of DNA
dominant allele	two copies needed to have the feature it produces
recessive allele	only one needed to have the feature it produces
chromosome	instructions for a cell that describes how to make a protein

[3]

- (b) The doctor shows Philip and Sharon a genetic diagram.

Complete the genetic diagram to show why John has cystic fibrosis.

Use the symbols **D** and **d**.



[3]

[Total: 6]

3

2 This question is about gene therapy.

SCID is an inherited disorder.

Children with SCID cannot make a particular protein.

Without this protein the immune system does not work properly.

The stages of the gene therapy are:

1. Blood stem cells are removed from bone marrow.
2. The stem cells are infected with a harmless virus carrying the 'working gene'.
3. The modified cells are put back.
4. The modified cells reproduce causing the immune system to work.

(a) How does gene therapy make the immune system work properly?

Put a tick (✓) in the box next to the **best** explanation.

**The modified cells ...**

... only last for a short time.

☐

... make the missing protein.

☐

... are larger than the old stem cells.

☐

... are made from the missing protein.

☐

[1]

4

- (b) Gene therapy is not the only available treatment for SCID.  
Some doctors are discussing the treatment of patients with SCID.

**Jim**  
Drugs can provide the missing protein. Patients must take them for the rest of their lives.

**Caroline**  
Bone marrow transplants can cure SCID in 90% of cases.

**Julian**  
Bone marrow transplants are serious operations. Only 30% of families have a well-matched donor.

**Marion**  
Gene therapy could be a step towards 'designer babies'.

**Robert**  
1 in 33 babies born in the UK is affected by a genetic disorder. Gene therapy research could help many people.

- (i) Which doctor is describing a treatment which is **not** a cure?

answer ..... [1]

- (ii) Which **two** doctors are talking about the ethics of gene therapy?

..... and ..... [2]

[Total: 4]

- 3 (a) Doctors hope to use **embryonic stem cells** to cure diseases such as diabetes.

Complete these sentences about embryonic stem cells.

Embryonic stem cells can grow into any type of cell in the human body.

This means they are ..... cells.

The cells need to have the same genes as the diabetic's own cells.

This can be done by removing the nucleus from a donor egg cell and replacing it with the

..... from one of the diabetic's cells.

The new cell then reproduces by mitosis to form many identical cells.

This group of identical cells is called a ..... [3]

- (b) Sometimes human embryos are destroyed in the process of producing new cells to treat disease. This raises ethical issues.

Read these statements.

- A Adults also have some types of stem cells.
- B Early embryos have no nervous system.
- C Early embryos may develop into human beings.
- D Many embryos die of natural causes.
- E Tens of thousands of people suffer from incurable disorders.
- F Taking human life is wrong.

- (i) Some people argue that research using embryonic stem cells should be **stopped**.

Write down the **two** statements which, when taken together, support this view.

..... and ..... [1]

- (ii) Some people argue that research using embryonic stem cells should **continue**.

Which **two** statements help to support this view.

..... and ..... [1]

[Total: 5]

- 4 Karen is pregnant.  
She reads this newspaper story about vaccination.

### Flu-jabs for pregnant women

If a woman gets flu during pregnancy, it may double the risk of her child having leukaemia.

Flu vaccine may be offered free of charge to pregnant women next winter.

Flu vaccine does not cause flu.

Vaccination has a risk of side effects.

- (a) The research showing a link between flu and leukaemia is new.

Scientists usually report new findings in **peer reviewed** journals.

Draw **one** straight line from the **reason** for using peer review to the best **description**.

#### reason

#### description

so the findings will be accepted by other scientists

work checked by scientists who study other areas of biology

work checked by brothers and sisters of the author

work checked by other scientists who study vaccination and childhood disease

[1]

- (b) In the UK:

- The population is 60 000 000.
- 15 000 people a year die from flu.
- 14 000 000 people are vaccinated against flu every year.
- There is a 1 in 1 000 000 chance of a serious side effect from a flu vaccination.

- (i) How many people each year in the UK are likely to suffer a serious side effect from a flu vaccination?

answer ..... [1]

- (ii) Calculate the percentage of the UK population that dies from flu every year.

Show your working.

answer ..... % [2]

7

- (c) Karen is trying to decide whether or not to be vaccinated against flu.

She is concerned about the risk of side effects.

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

The risk of death from flu is greater than the risk of side effects from the vaccination.

☐

The risk of side effects from vaccination is greater than the risk of death from flu.

☐

If vaccinated, you are equally likely to suffer from flu or side effects.

☐

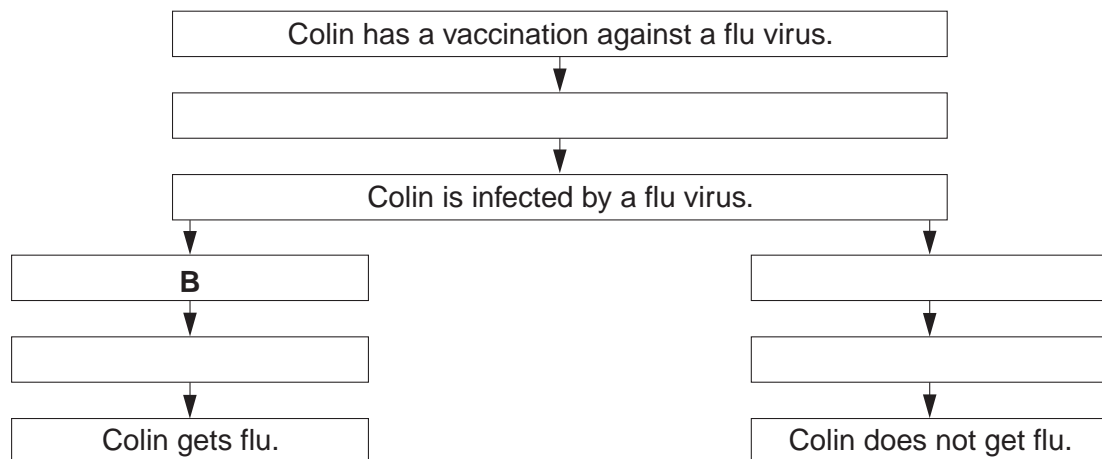
[1]

- (d) Colin's doctor recommends he has a flu vaccination.  
The vaccine is not always successful.  
It may or may not protect him from getting flu.

Use the letters **A**, **B**, **C**, **D** and **E** to complete the flow chart which explains this.

- A** Viruses attack unprotected body cells.
- B** The flu virus has a high mutation rate.
- C** A vaccination stimulates the production of specific antibodies.
- D** Specific antibodies are made very quickly.
- E** Antibodies destroy the flu virus.

Put the correct letter, **A**, **B**, **C**, **D** or **E**, in each box. One has been done for you.



[3]

- (e) Complete the sentence about HIV.  
It is difficult to produce an effective vaccine against HIV because the virus

attacks cells of the ..... system.

[1]

[Total: 9]

- 5 Read the information on gum disease and heart attacks.

## Gum disease and heart attacks

There is a correlation between gum disease and heart attacks.

One investigation showed that twice as many people with gum disease died of heart attacks compared with people who had no gum disease.

In their investigation, scientists allowed for age, diet, exercise, smoking and alcohol use.

- (a) Put a tick (✓) in the box next to the statement which is the **best** conclusion.

### People with gum disease ...

... will get heart attacks.

☐

... are at no risk of heart attacks.

☐

... are at greater risk of heart attacks.

☐

... are at lower risk of heart attacks.

☐

[1]

- (b) Why did the scientists allow for age, diet, exercise, smoking and alcohol use?

Put a tick (✓) in the box next to the **best** explanation.

They all cause gum disease.

☐

They all cause heart attacks.

☐

They all have a correlation with heart attacks.

☐

[1]



9

- (c) The investigation does not **prove** that gum disease can cause heart attacks.  
Extra information is needed to prove the link between gum disease and heart attacks.

Put a tick (✓) in the box next to the statement which would give this extra information.

investigations using people who already have heart disease

☐

a description of the types of microorganisms causing gum disease

☐

an investigation including more people with poor dental hygiene

☐

a mechanism linking the microorganisms causing gum disease with heart disease

☐

[1]

- (d) Heart attacks can be caused by changes to the blood vessels which supply the heart muscle.

- (i) What type of blood vessel carries blood to the heart muscle?

answer ..... [1]

- (ii) Blood vessels which carry blood away from the heart have thick walls.

Put a tick (✓) in the box next to the **one** statement which describes why these thick walls are necessary.

The blood is moving very quickly.

☐

The blood is moving very slowly.

☐

The blood is at high pressure.

☐

The blood is at low pressure.

☐

This allows the oxygen to diffuse out.

☐

This prevents the oxygen diffusing out.

☐

[1]

[Total: 5]

**6** Read the information about microbes from space.**Microbes ride in**

1. The space shuttle Columbia broke up on re-entering Earth's atmosphere in 2003.
2. It was carrying a box containing species of bacteria.
3. This box was found after the crash.
4. One of the species survived the crash.

(New Scientist p6 4<sup>th</sup> March 2006)**(a)** There are many theories about how life on Earth may have started.

Read the information on two theories.

**Theory 1:** Life started elsewhere in the solar system and was brought to Earth on a comet or meteorite.**Theory 2:** Life started on Earth, at the bottom of the oceans.Put a tick (✓) in the box next to the **one** correct statement.

The article provides evidence for theory 1.

☐

The article provides evidence for theory 2.

☐

The article disproves theory 1.

☐

The article disproves theory 2.

☐

[1]

**(b)** Complete the sentences.

Scientists believe that life on Earth began about ..... million years ago.

The first living things developed from molecules like DNA that could  
..... themselves.

[2]

11

- (c) Multicellular organisms have developed systems for communication and coordination among cells.

- (i) Name the two coordination systems in humans.

..... and ..... [2]

- (ii) The two coordination systems work in different ways.

Draw **two** straight lines from **each** way of working to its **two** correct descriptions.

way of working	descriptions
uses electrical impulses	rapid
	slow
uses chemicals transported in blood	short-lived
	long-lasting

[2]

[Total: 7]

## 7 Read the information about dodos.

1. Dodos were large flightless birds found on the island of Mauritius.
2. Dodos lived in the forests of Mauritius.
3. Humans first visited Mauritius in 1507.
4. Humans cut down the forests to make homes and farms.
5. With humans came dogs, pigs, cats and rats.
6. Humans hunted dodos.
7. By 1693, dodos were extinct.
8. Of 45 species of birds found on Mauritius in 1507, only 21 species have survived.

- (a)** The dodo became extinct due to direct and indirect human activities. Examples of both are given in the information about dodos.

Write down **all** the sentence numbers that describe:

**(i)** direct human activities .....

**(ii)** indirect human activities ..... [2]

- (b)** Complete the sentence.

Sentence 8 in the article is an example of a decline in ..... diversity. [1]

[Total: 3]

## 8 Read the information about fossil fish.

**Scientists find missing link**

Scientists think that millions of years ago some fish moved from water onto land.

These 'missing link' fish would have had fins like feet. Scientists had no fossils to prove this.

Their theory told them how long ago these fish should have lived.

The scientists examined rocks of this age and found this 'missing link'.

(New Scientist editorial 09.09.06. "Now that's what you'd call an intelligent theory")

**(a)** Finish the sentences. Choose words from this list.

**certain**  
**confident**  
**doubtful**  
**guess**  
**prediction**  
**theory**

Most scientists agree that living things have changed over time. This is called evolution.

Most scientists also agree that this change is due to natural selection.

The scientists in the article used these ideas to make a .....

They found a new fossil species. This finding agreed with their ideas and makes scientists

more ..... about their ideas.

[2]

**(b)** The change from fish to amphibians depended on variation.

Put ticks (✓) in the boxes next to the **two** sources of variation.

sexual reproduction

☐

asexual reproduction

☐

mutations in sex cells

☐

mutations in body cells

☐

[1]

[Total: 3]

**END OF QUESTION PAPER**

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