

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

**A221/02**

**BIOLOGY A**

Unit 1: Modules B1 B2 B3 (Higher Tier)

Candidates answer on the question paper.  
A calculator may be used for this paper.

**OCR supplied materials:**

None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Thursday 13 January 2011  
Morning**

**Duration: 40 minutes**



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>surname |  |
|-----------------------|--|----------------------|--|

|               |  |  |  |  |  |                  |  |  |  |  |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre number |  |  |  |  |  | Candidate number |  |  |  |  |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

2

Answer **all** the questions.

1 This question is about genes and proteins.

(a) Complete each sentence by putting a tick (✓) in the box next to the correct option.

|                            |    |  |                      |                               |  |
|----------------------------|----|--|----------------------|-------------------------------|--|
| For each gene a person has | 2  |  | alleles and they are | always the same.              |  |
|                            | 23 |  |                      | always different.             |  |
|                            | 46 |  |                      | either the same or different. |  |

|                                                |         |  |                                           |
|------------------------------------------------|---------|--|-------------------------------------------|
| It is the combination of maternal and paternal | alleles |  | that controls a person's characteristics. |
|                                                | genes   |  |                                           |
|                                                | embryos |  |                                           |

[3]

(b) Genes are instructions for making different proteins.

Explain how the body uses these proteins.

.....

.....

.....

..... [2]

[Total: 5]

3

2 Human characteristics such as eye colour and cystic fibrosis are genetically controlled.

(a) Human eyes can be a wide range of colours.

Cystic fibrosis is different. You either have cystic fibrosis or you do not.

(i) Explain this difference.

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

(ii) Write down two symptoms of cystic fibrosis.

symptom 1 .....

symptom 2 ..... [2]

(b) Adults and fetuses can be tested to see if they have the allele for a genetic disorder.

State **two** possible implications of testing adults and fetuses for a genetic disorder.

1 .....

2 ..... [2]

(c) Four people ask questions about testing fetuses for genetic disorders.

|                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Dan</b></p> <p style="text-align: center;">Is it right to test fetuses for genetic disorders?</p>                   | <p style="text-align: center;"><b>Marvin</b></p> <p style="text-align: center;">Should fetuses be given expensive tests for genetic disorders?</p>       |
| <p style="text-align: center;"><b>Mandy</b></p> <p style="text-align: center;">How likely is it that a genetic test will give accurate results?</p>  | <p style="text-align: center;"><b>Keiko</b></p> <p style="text-align: center;">Where can parents get information leaflets about genetic disorders?</p>  |

- (i) Which person, **Dan**, **Marvin**, **Mandy** or **Keiko**, is asking a question that could be investigated using a scientific approach?

answer ..... [1]

- (ii) Which person, **Dan**, **Marvin**, **Mandy** or **Keiko**, is asking a question that could mean certain actions are never justified because they are unnatural or wrong?

answer ..... [1]

**[Total: 8]**

### 3 Vaccinations help us to resist infection.



(a) A newspaper printed this article about a new vaccine.

The sentences in the article have been numbered.

Two of the sentences contain mistakes.

#### **New vaccine for flu**

- 1 Scientists have developed a new vaccine for flu.
- 2 The vaccine consists of a safe form of the virus.
- 3 It encourages the body to make antigens to destroy the virus.
- 4 The flu virus is then destroyed when it enters the body.
- 5 The new vaccine would enable the body to destroy any other type of virus entering the body.
- 6 The new vaccine will be available after testing.

(i) Write down the numbers of the **two** sentences that contain mistakes.

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

(ii) Rewrite each of the incorrect sentences so that it is scientifically correct.

Rewritten correct sentence .....

.....

.....

Rewritten correct sentence.....

.....

.....

[2]

6

(b) Which of the statements about diseases and vaccines are true?

Put a tick (✓) in the box next to each of the **three** correct statements.

Vaccines can never be completely safe.

☐

Side effects of vaccines are the same in all individuals.

☐

Flu vaccines protect against flu for a long time because the virus changes very slowly.

☐

Vaccines cause red blood cells to produce chemicals that destroy the invading microorganism.

☐

Vaccines are always given after infection by a disease-causing microorganism.

☐

Once the body has made the chemical to kill invading microorganisms it can make it again very quickly.

☐

A vaccine contains a dangerous form of the disease-causing microorganism.

☐

Symptoms of the disease are caused by damage done to cells and by toxins produced by the microorganism.

☐

[3]

(c) To prevent an epidemic of infectious disease it is necessary to vaccinate a high percentage of the population.

Explain why.

.....

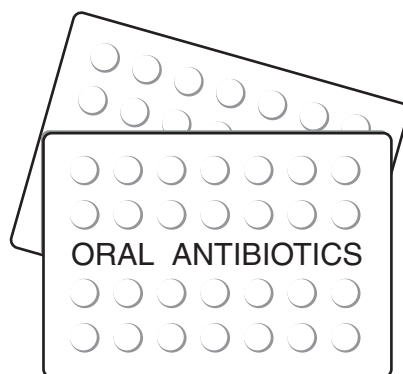
.....

.....

..... [2]

[Total: 8]

4 This question is about antibiotics.



(a) Bacteria can become resistant to antibiotics.

These statements are about antibiotic resistance in bacteria.

Some are correct and some are not.

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

Antibiotic resistance begins with mutations in the genes of bacteria.

☐

The process is helped because bacteria reproduce so quickly.

☐

Only bacteria that do not develop antibiotic resistance can survive a course of antibiotic treatment.

☐

Natural selection ensures resistant bacteria survive.

☐

Sexual reproduction is required to produce variation so that some bacteria are resistant.

☐

It is the antibiotic that causes the genes to mutate.

☐

Mutations are not random and that is why bacterial resistance appears.

☐

[1]

8

(b) New antibiotics are tested using double blind trials.

When taking some drugs the patient cannot exert a placebo effect.

These drugs are tested without using blind or double blind trials.

These tests are called open label trials.

Put a tick (✓) in the box next to any of the following drugs that could be tested using an open label trial.

a new cold cure

☐

a headache tablet

☐

a cream that restores hair in bald men

☐

a drug that shortens the duration of flu symptoms

☐

a drug that increases production of red blood cells

☐

a new contraceptive pill for men

☐

a rub-on cream for back pain

☐

[2]

(c) Placebos are **not** commonly used in human trials.

The statements give reasons why.

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

The doctor would not know if the drug was effective.

☐

It is not morally correct to deceive patients into thinking they are taking an active drug when they are not.

☐

The patient would not know if the drug was effective.

☐

Patients with life threatening illnesses have the right to choose to have the active drug.

☐

It is right that a few patients should suffer so that many patients can benefit.

☐

Neither the patient nor the doctor would know if the drug was effective.

☐

Doctors do not want to give patients a treatment that is not expected to work.

☐

Both the patient and the doctor would know if the drug was effective.

☐

[2]

[Total: 5]

10

5 This question is about the blood system and heart disease.

(a) Fatty deposits in the blood vessels supplying the heart muscle can produce a heart attack.

Which of these statements about fatty deposits and a heart attack are correct?

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

The fatty deposits are poisonous and kill heart muscle.

☐

The blood supply to the heart muscle is reduced.

☐

Fatty deposits reduce the build up of lactic acid in the heart muscle causing pain.

☐

The heart muscle does not get enough oxygen and glucose.

☐

The body stores the fat in blood vessels to act as an emergency supply of energy for the heart.

☐

[2]

(b) Some factors can increase the risk of heart disease.

When epidemiologists study a factor they look for a correlation between the factor and the outcome.

Explain why a correlation between a factor and an outcome does not necessarily mean that one causes the other.

Give an example to illustrate your answer.

.....

.....

.....

.....

..... [2]

[Total: 4]

6 Different parts of our body communicate with each other using the nervous system.

- (a) The nervous system is used to respond to a stimulus.  
A stimulus received by a person's hand is detected.  
The brain produces a response.

Use the letters to complete the pathway for this response in the empty boxes.

**A** sensory neuron

**B** spinal cord

**C** receptor

**D** motor neuron

**E** effector

**F** brain

Each letter can be used **once, more than once, or not at all**.  
One has been done for you.

|  |  |  |          |  |  |  |
|--|--|--|----------|--|--|--|
|  |  |  | <b>F</b> |  |  |  |
|--|--|--|----------|--|--|--|

[3]

- (b) Which of these activities are associated with **both** the nervous system and the hormonal system?

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

rapid responses

☐

communication

☐

supplying the brain with information about external stimuli

☐

homeostasis

☐

long-lasting responses

☐

[2]

[Total: 5]

Turn over

7 This question is about evolution.

(a) Natural selection and selective breeding both produce changes within a species.

Put a tick (✓) in one box in each row to show whether the description applies only to **natural selection**, or only to **selective breeding**, or to **both natural selection and selective breeding**.

| description                                       | natural selection | selective breeding | both natural selection and selective breeding |
|---------------------------------------------------|-------------------|--------------------|-----------------------------------------------|
| performed by humans                               |                   |                    |                                               |
| has only ever produced new varieties, not species |                   |                    |                                               |
| evolution happens due to this process             |                   |                    |                                               |
| takes place over successive generations           |                   |                    |                                               |
| sometimes called "survival of the fittest"        |                   |                    |                                               |
| involves the inheritance of alleles               |                   |                    |                                               |
| usually requires the use of sexual reproduction   |                   |                    |                                               |

[3]

13

(b) Which of these factors could cause a species to become extinct?

Put ticks (✓) in the boxes next to the correct answers.

the introduction of a new predator species into the environment

☐

the seasons of the year

☐

a long period of time

☐

climate change

☐

another species in the food web dies out

☐

a hunting ban

☐

an increase in the number of offspring the species produces

☐

[2]

14

(c) Four people discuss evolution and the origin of life on Earth.

**Ali**

I think life appeared on Earth because DNA fell to Earth from a passing comet.



**Val**

People used to think that fossils were just curious stones. Scientists have shown that older fossils are found in deeper, older rocks. Fossils provide a timeline for evolution.



**Karen**

Life on Earth started because of evolution. Natural selection produced the variety of life we see today.



**Monty**

Life has taken millions of years to evolve.



- (i) Which person, **Ali**, **Val**, **Karen** or **Monty**, is providing an explanation that links things that were previously thought to be unrelated?

answer ..... [1]

- (ii) Which person, **Ali**, **Val**, **Karen** or **Monty**, is using imagination and creativity in the development of an explanation?

answer ..... [1]

[Total: 7]

**END OF QUESTION PAPER**

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