

THIS IS A NEW SPECIFICATION

**H****Monday 14 January 2013 – Morning****GCSE TWENTY FIRST CENTURY SCIENCE  
BIOLOGY A****A162/02** Modules B4 B5 B6 (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)

**Duration:** 1 hour

|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| 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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- 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 **60**.
- This document consists of **24** pages. Any blank pages are indicated.

## 2

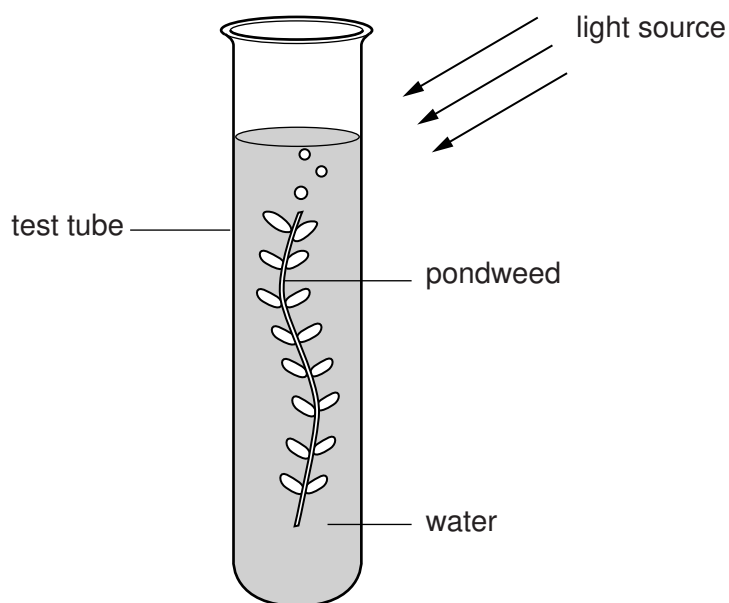
Answer **all** the questions.

1 Photosynthesis takes place in plants.

(a) Write down the **balanced symbol** equation for photosynthesis.

..... + .....  $\longrightarrow$  ..... + ..... [2]

(b) Jason is studying the rate of photosynthesis for pondweed under **low** and **high** light intensities.



- Jason cuts 20 pieces of pondweed and puts each piece in a separate test tube in water.
- He puts 10 test tubes under **low** light intensity and 10 under **high** light intensity.
- He records the number of oxygen bubbles produced by each of the pieces of pondweed during a 1 minute period.
- Jason records the data in **Table 1**.

**Table 1**

| Light intensity | Number of bubbles produced per minute |    |   |    |    |    |    |    |   |    | Mean |
|-----------------|---------------------------------------|----|---|----|----|----|----|----|---|----|------|
|                 | 8                                     | 7  | 5 | 9  | 6  | 10 | 7  | 8  | 6 | 6  |      |
| low             | 8                                     | 7  | 5 | 9  | 6  | 10 | 7  | 8  | 6 | 6  | 7.2  |
| high            | 10                                    | 11 | 9 | 13 | 15 | 8  | 11 | 10 | 9 | 12 | 10.8 |

3

- (i) Another student repeats the experiment using five species of pondweed, **A**, **B**, **C**, **D** and **E**.

The mean number of bubbles produced per minute for each species of pondweed is shown in **Table 2**.

**Table 2**

| Light intensity | Mean number of bubbles produced per minute |          |          |          |          |
|-----------------|--------------------------------------------|----------|----------|----------|----------|
|                 | Pondweed species                           |          |          |          |          |
|                 | <b>A</b>                                   | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> |
| low             | 7                                          | 5        | 7        | 6        | 8        |
| high            | 15                                         | 10       | 11       | 17       | 13       |

Use the results in **Table 1** and **Table 2** to identify which species, **A**, **B**, **C**, **D** or **E**, was the one also used by Jason.

species used by Jason = ..... [1]

- (ii) How confident can you be about your conclusion?

Explain why.

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

- (iii) Jason's experiment can be improved by repeating it and using more species of pondweed.

Suggest **two** further improvements for Jason's experiment.

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

4

- (c) Pondweed cells contain structures that have different roles in photosynthesis.

Write the correct name for each **cell structure** alongside its **role in photosynthesis**.

One has been done for you.

| role in photosynthesis                                  | cell structure |
|---------------------------------------------------------|----------------|
| contains the genetic code for making the enzymes needed | nucleus        |
| allows oxygen to pass out of the cell                   | .....          |
| contains chlorophyll and enzymes                        | .....          |

[1]

- (d) In addition to the substrates needed for photosynthesis, plants need a source of nitrogen to grow.

Plants use **active transport** to absorb nitrogen in the form of nitrates from the soil.

- (i) Complete the sentence about active transport.

Active transport is the overall movement of chemicals across a  
 ..... requiring energy from the process of  
 .....

[1]

- (ii) Some plants cannot grow very well in water-logged soils.

Such soils often **lack oxygen**.

A team of plant scientists conclude that

“Plants growing in water-logged soils have an increased chance  
 of showing signs of nitrogen-deficiency.”

Use your knowledge of active transport to explain this conclusion.

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

[Total: 10]

5

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**Question 2 begins on page 6**

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## 2 Yeast is a single-celled microorganism.

Yeast can be grown in a fermenter.

The yeast cells are grown in a liquid containing nutrients.

The nutrients are needed for them to grow and reproduce.

Yeast can carry out both aerobic and anaerobic respiration.

(a) Complete the **word** equation for **anaerobic** respiration in yeast.

glucose  $\longrightarrow$  ..... + ..... (+ energy released) [1]

(b) How is anaerobic respiration in **animal** cells different from that in yeast?

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

(c) Some yeast cells are put into a solution into two fermenters, **A** and **B**.

The lid is closed tight so that no air can get in or out of fermenter **A**.

Air containing oxygen is bubbled through fermenter **B**.

A scientist counts the number of yeast cells in samples taken from both fermenters.

She records her results in a table.

| Time when samples were taken (hours)                 | Number of yeast cells in 1 mm <sup>3</sup> |             |
|------------------------------------------------------|--------------------------------------------|-------------|
|                                                      | Fermenter A                                | Fermenter B |
| 0                                                    | 100                                        | 100         |
| 1                                                    | 200                                        | 200         |
| 2                                                    | 300                                        | 400         |
| 3                                                    | 350                                        | 800         |
| 4                                                    | 390                                        | 1600        |
|                                                      |                                            |             |
| total % increase in yeast cells in 1 mm <sup>3</sup> | 290                                        | .....       |

(i) Complete the table to show the % increase in yeast cells in 1 mm<sup>3</sup> in fermenter **B**. [1]

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- (ii) The results show that the yeast reproduces faster in fermenter **B** than in fermenter **A**.

Explain why this happens.

.....

.....

.....

..... [2]

- (iii) The scientist adds a chemical called adriamycin to the yeast culture in fermenter **B** after the first 4 hours of the study.

Adriamycin is quick-acting and prevents the copying of chromosomes.

The scientist continues to count the number of yeast cells in samples from this fermenter for a further two hours.

Describe and explain how this chemical will affect the yeast cells during the next two hours of the study.

Use your knowledge of the **cell cycle** in your answer.



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

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

8

(d) Bacteria are also microorganisms.

Biogas production using bacteria is an application of respiration.

Complete the sentences about biogas production.

The production of biogas takes place in the absence of ..... gas.

The gases produced include carbon dioxide and .....

Biogas is used as a .....

[2]

[Total: 13]

**9**

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**Question 3 begins on page 10**

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## 10

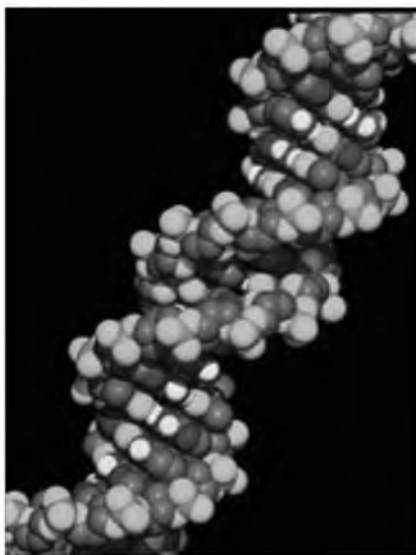
3 This question is about DNA and genes.

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**.

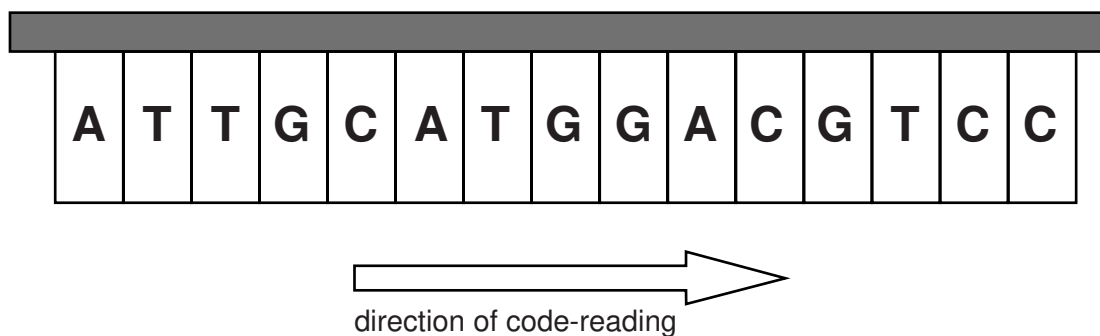
An example of how the bases code for the different amino acids in the protein produced is shown in the tables.

| 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         |

11

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



- (a) 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]

- (b) 36% of the bases found in a particular gene are type **G**.

- (i) What is the percentage of type **C** bases in this gene?

Explain your answer.

.....

.....

.....

..... [2]

- (ii) A second gene has a different percentage of type **G** bases.

Suggest **why** the percentage of type **G** bases is different in this gene.

.....

.....

.....

..... [2]

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

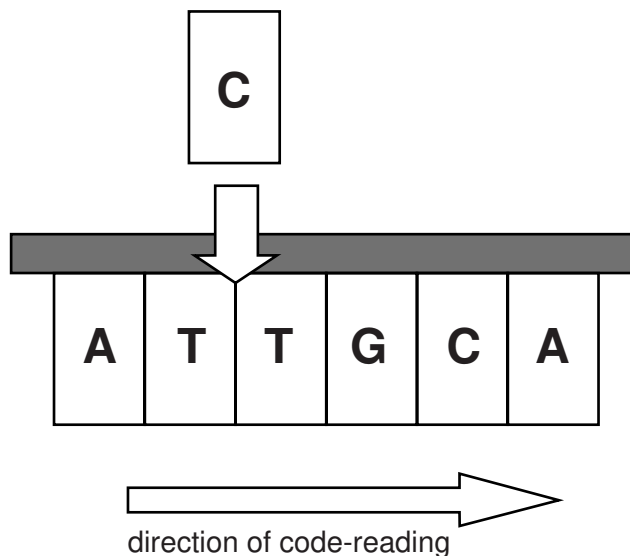
What is the name of this gene copy?

answer ..... [1]

- (d) A **gene mutation** takes place.

A base is inserted in-between two of the original bases in the DNA molecule.

The diagram shows a section of one of the two strands of DNA bases.



A team of geneticists analyse the mutation and predict that

“The mutated gene will affect the type of protein produced.”

Explain why this prediction is likely to be correct.

.....

.....

.....

..... [2]

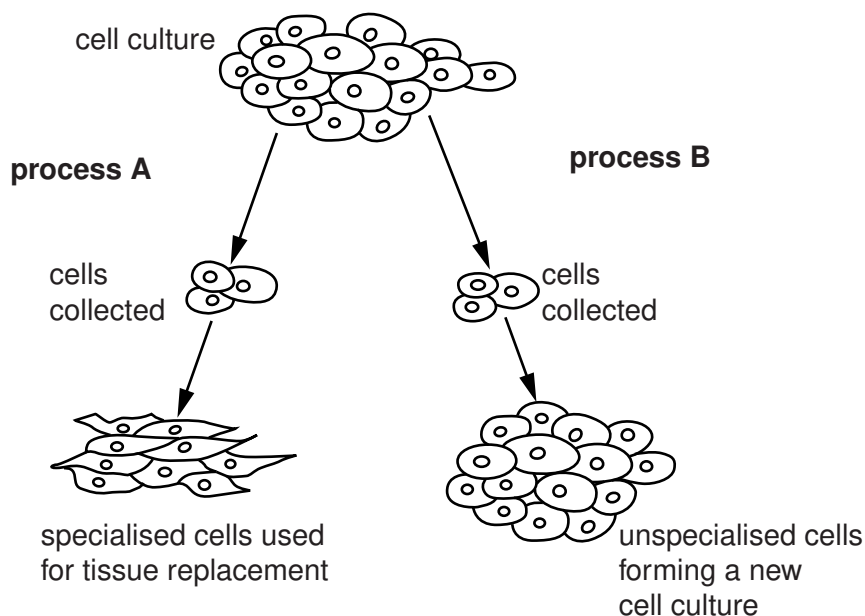
(e) Dr Amrani is a researcher studying embryonic stem cells.

She grows some embryonic stem cells from one embryo in a petri-dish.

These cells are unspecialised.

Dr Amrani removes some of the embryonic stem cells and produces some specialised cells needed to replace damaged tissues (**process A**).

The remaining embryonic stem cells stay unspecialised and are used to create a new cell culture (**process B**).



Use your knowledge of growth and development in cells to explain the differences between the cells produced by processes **A** and **B**.



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

..... [6]

..... [6]  
[Total: 15]

**Turn over**

4 Mirek blinks when he gets dust in his eyes.

(a) Blinking is a reflex action.

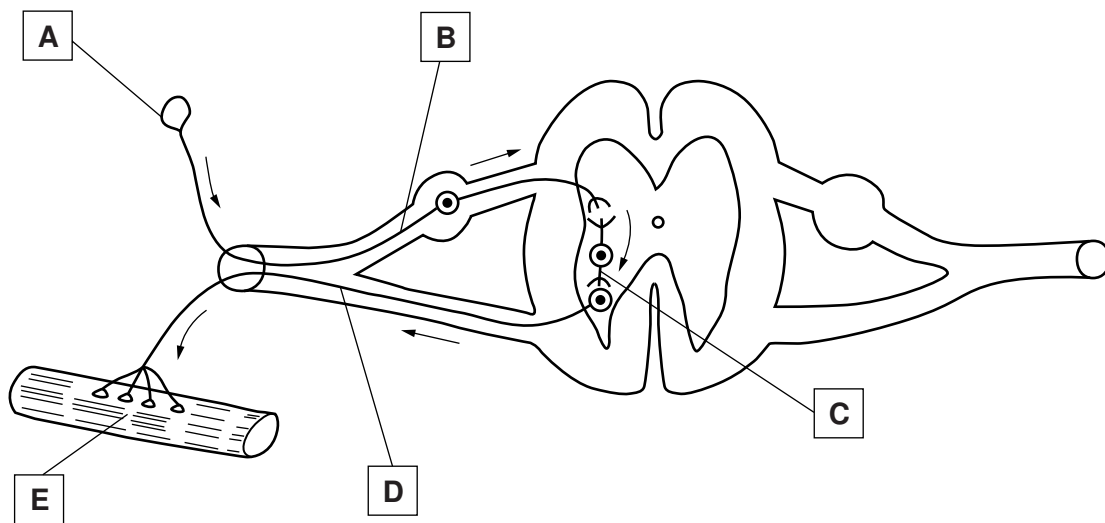
Name two features of blinking that are typical of a reflex action.

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

(b) The spinal reflex arc involves a number of structures.

Look at the structures, **A**, **B**, **C**, **D** and **E**, in the diagram of a spinal reflex arc.

The arrows show the direction of the impulse.



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- (i) What are the structures found in the spinal reflex arc?

Write the correct name of each structure in the boxes next to letters, **A**, **B**, **C**, **D** and **E**, in the table.

|          |       |
|----------|-------|
| <b>A</b> | ..... |
| <b>B</b> | ..... |
| <b>C</b> | ..... |
| <b>D</b> | ..... |
| <b>E</b> | ..... |

[3]

- (ii) The neurons and other structures are arranged in a fixed pathway in the spinal reflex arc.

Why is this an advantage?

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

The fixed pathway is an advantage because ...

... no processing of information is required.

☐

... synapse chemicals are more easily recognised.

☐

... the transmission of impulses cannot be affected by toxins and drugs.

☐

... the neurons are more likely to be better insulated from neighbouring cells.

☐

[1]

(c) Reflex responses can be learned through conditioning.

Read the following information about the 'little Albert' experiment.

The 'little Albert' experiment was a case study of conditioning in humans.

- Albert, aged nine months, was allowed to play with a pet white rat.
- He showed no fear of the rat.
- After a while, researchers made a loud noise behind Albert's back whenever he touched the rat. This made Albert frightened and he cried.
- After this happened a number of times, Albert became upset every time he saw the rat, even without the loud noise.

Explain why this is an example of a conditioned reflex in humans.

.....

.....

.....

.....

..... [3]

[Total: 8]

**5** The human brain has billions of neurons.

Impulses are transmitted across synapses in the brain.

- (a)** Identify **two** features of synapses to explain how impulses travel in only **one direction** between adjacent neurons.

.....

.....

.....

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

- (b)** Ecstasy is a drug.

Complete the sentences about Ecstasy and the brain.

Use words from the list.

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

**blocks**  
**decreases**  
**increases**  
**opens**  
**produced**  
**quickly**  
**removed**  
**secreted**  
**slowly**  
**stays the same**

Ecstasy ..... sites in the brain's synapses.

These sites are where the transmitter substance, serotonin, is .....

As a result, the concentration of serotonin ..... in each synapse.

The frequency of impulses transmitted across each synapse

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

18

- (c) Alzheimer's disease affects the brain.

In early stages of the disease, the most common symptom is the inability to acquire new memories.

Suggest which part of the brain is most directly affected by this disease in the early stages.

answer ..... [1]

- (d) A team of scientists is investigating the ability of humans to remember information.

The scientists ask three groups of people to remember a series of ten numbers.

| List of numbers |    |    |    |    |    |    |    |    |     |
|-----------------|----|----|----|----|----|----|----|----|-----|
| Start           |    |    |    |    |    |    |    |    | End |
| 5               | 10 | 15 | 21 | 24 | 28 | 31 | 34 | 35 | 36  |

One group of ten people is in a quiet room. The second group is in a noisy room and the third group is in a very noisy room.

Each person is given 10 minutes to memorise the numbers in the correct order.

The results are recorded in a table.

| Results recorded                                                       | People in the quiet room | People in the noisy room | People in the very noisy room |
|------------------------------------------------------------------------|--------------------------|--------------------------|-------------------------------|
| all 10 numbers correctly recalled and in the correct order             | 4                        | 2                        | 1                             |
| all 10 numbers correctly recalled but a few in the incorrect order     | 2                        | 3                        | 2                             |
| 5 or fewer numbers correctly recalled and in the correct order         | 3                        | 3                        | 3                             |
| 5 or fewer numbers correctly recalled but a few in the incorrect order | 1                        | 2                        | 4                             |

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The scientists conclude that they cannot be sure of the correlation between noise levels and the ability to recall number sequences.

Use the results in the table to **support** and to **challenge** this conclusion.

.....

.....

.....

.....

.....

..... [3]

**Question 5(e) begins on page 20**

- (e) Different models have been proposed to explain how memory works.

Describe the **multi-store model** for memory and show how the data collected in this investigation supports this model.

You can use the space provided to draw a model if this will help your explanation.



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

[6]

**[Total: 14]**

**END OF QUESTION PAPER**

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