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Wednesday 20 June 2012 – 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.

Duration: 1 hour

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 The human eye is an organ of the nervous system.



(a) The eye is stimulated by light.

Which structure in the eye contains the light receptor cells?

..... [1]

(b) The pupil reflex causes the coloured part of the eye (the iris) to change size. The iris contracts if the light is suddenly switched off.

A scientist showed that this reflex could be conditioned.

- A bell was rung at the same time as the light was switched off.
- Eventually, the iris contracted whenever the bell was rung, even when the light remained on.

Which of the following statements about this experiment is true?

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

The primary and secondary stimuli were the same.

The pupil reflex is a voluntary response.

The reflex response involved only motor neurons.

The bell stimulus was connected to a secondary stimulus.

The light stimulus was connected to a secondary stimulus.

[1]

- (c) Damage to the fatty sheath around neurons leading to and from the eye can cause vision problems.

Complete the sentences to explain this.

The fatty sheath surrounds the of a neuron.

Neurons in the optic nerve that have lost their fatty sheath will transmit nerve impulses

more This could cause vision problems. [1]

- (d) Other reflexes involve the spinal cord. In these reflexes, the impulses travel along a **spinal reflex arc**.

- (i) Write down **two** features of a spinal reflex arc that allow the response to be very fast.

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

- (ii) Rachel has an injury to her spinal cord just above her waist. She cannot walk because she cannot make her legs move.

A doctor tests Rachel's knee jerk reflex and finds that it still works, even though she cannot walk.

Use information about the pathways followed by nerve impulses to suggest an explanation for these observations.



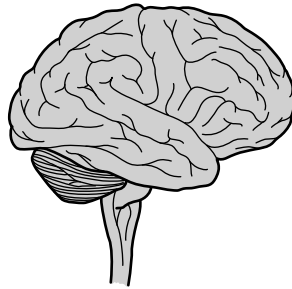
The quality of written communication will be assessed in your answer.

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..... [6]

[Total: 10]

Turn over

2 This question is about the brain.



(a) Oxygen and glucose levels affect brain activity.

Suggest why oxygen and glucose are needed by the neurons in the brain.

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

To bind to receptors in the synapses.

To release energy for the transmission of impulses.

To avoid the build up of carbon dioxide in the neurons.

To allow the diffusion of transmitter substances across the synapses.

[1]

(b) The brain contains billions of synapses.

Suggest why an impulse can only travel in one direction across a synapse.

.....

.....

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..... [2]

(c) Serotonin is a chemical that is released at synapses in the brain.

- When a nerve impulse arrives at a synapse, serotonin is released from the neuron.
- The serotonin allows the nerve impulse to be transmitted across the synapse.
- The serotonin is then reabsorbed into the first neuron so that it can be released again when the next impulse arrives.

A new antidepressant drug stops the serotonin from being reabsorbed into the first neuron. The average (mean) dose of the drug over five days must be **greater than 10 mg** to cause this effect.

A patient takes part in two trials, **A** and **B**.

In trial **A** the patient takes the drug each day for five days. After a rest period of one week, the patient starts trial **B** and again takes the drug each day for five days.

The doses taken in trial **A** and trial **B** are shown in the tables.

trial A	
day	dose of drug in mg
1	6
2	6
3	8
4	9
5	9

trial B	
day	dose of drug in mg
1	14
2	14
3	16
4	18
5	20

(i) In which trial or trials would reabsorption of serotonin be blocked?

Explain your answer.

.....

.....

..... [2]

(ii) At the end of trial **B** the transmission of nerve impulses across the patient's brain synapses increases.

Suggest why.

.....

..... [1]

(iii) It may be possible to change the trials to increase the confidence in the data obtained.

Put ticks (✓) in the boxes next to the suggestions that would improve the trials.

Carry out each trial for a shorter period of time.

Carry out the trials using female patients only.

Compare the drug against a placebo.

Decrease the dose of drug in the second trial.

Give the participants other drugs at the same time.

Use more than one patient.

[2]

(d) Scientists can map the regions of the human brain using different techniques.

Name **one** of these techniques and discuss the **ethical** issues associated with it.

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..... [2]

[Total: 10]

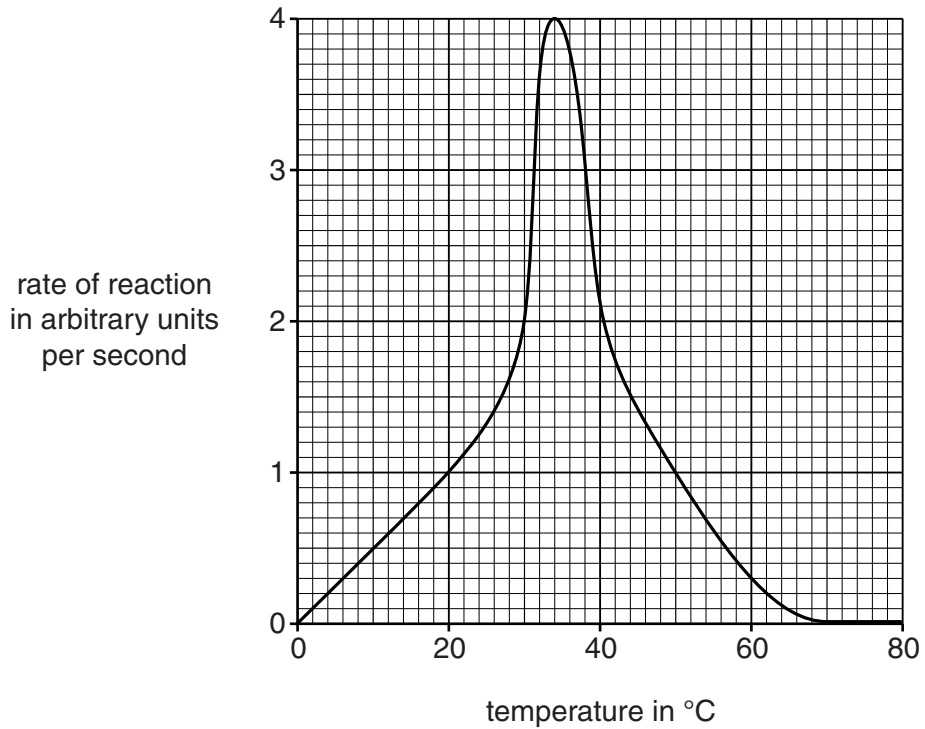
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Question 3 begins on page 8

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3 The activity of enzymes is affected by temperature.

The graph shows the effect of temperature on the rate of a reaction involving the enzyme catalase.



(a) How many times greater is the rate of reaction at 30 °C than the rate of reaction at 10 °C?

answer = times greater [1]

(b) (i) Describe the pattern shown by the graph between 40 °C and 80 °C.

.....
 [1]

(ii) Use information on the graph and your knowledge of enzymes to explain what is happening at temperatures higher than 40 °C.

.....

 [3]

(c) The data in the graph were obtained from a series of experiments.

It is important to control all factors that might affect the results of this type of experiment **other than** the factor being investigated.

The factor being investigated is temperature.

State **one** factor that should be controlled in this experiment and explain how this factor affects the activity of enzymes.

factor

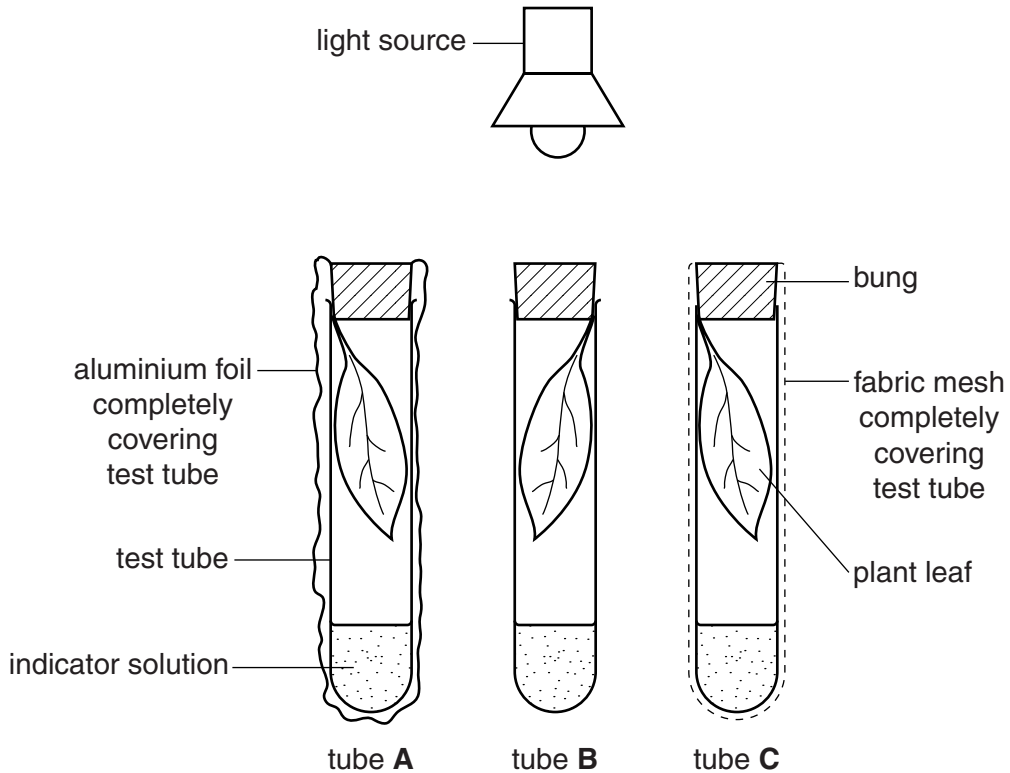
explanation

..... [1]

[Total: 6]

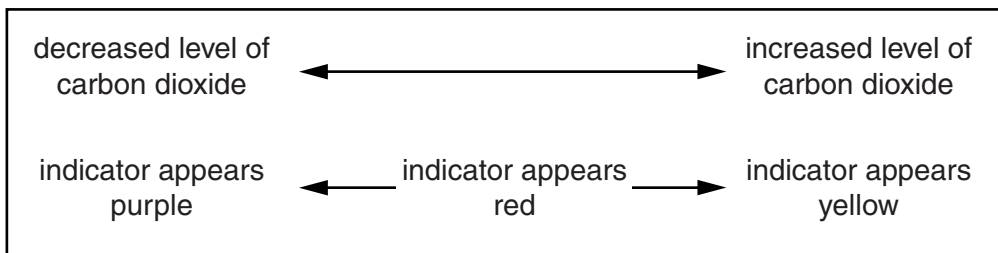
4 Tom investigates photosynthesis and respiration in plant leaves.

He sets up the experiment shown in the diagram.



The indicator solution is **red** at the start of the experiment in all three tubes.

The indicator will change colour if the level of carbon dioxide in any of the tubes changes. The box summarises how the colour of the indicator can change.



After 24 hours Tom observes the colour of the indicator solution in each tube.

Here is his results table.

tube	colour of indicator solution after 24 hours
A
B
C	red

- (a) Complete the table by writing the colour of the indicator solution you would expect to see in tube **A** and in tube **B** after the 24 hour period.

Tube **C** has been done for you. [1]

- (b) Explain why the indicator solution in tube **C** was still red after 24 hours.

.....

 [3]

- (c) Carbon dioxide and light can be **limiting factors** for photosynthesis.

Write down one **other** limiting factor that Tom should control in his experiment.
 [1]

- (d) Tom did the experiment with leaves from a plant that grows in bright sunlight.

He repeats the experiment using leaves from a plant that grows in shaded conditions. This time, the indicator solution in tube **B** changes colour more quickly.

Suggest why.

 [2]

[Total: 7]

Turn over

5 Yeast is a microorganism.

Yeast can respire by using aerobic and anaerobic respiration.

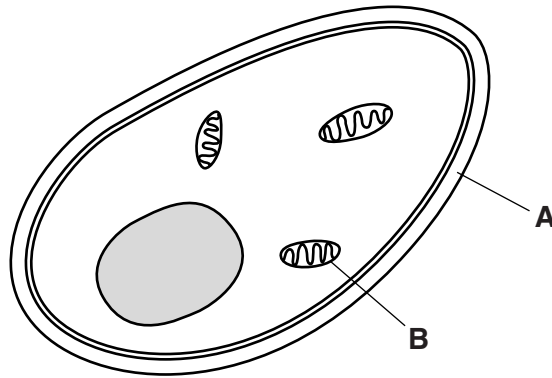
(a) (i) Write a **word** equation for **anaerobic** respiration in yeast.

..... → + (+ energy released)
 [1]

(ii) Write a balanced **symbol** equation for **aerobic** respiration.

..... + → +
 (+ energy released)
 [2]

(b) The diagram shows some structures in a yeast cell.



(i) Write down the names of the structures labelled **A** and **B**.

A

B
 [1]

- (ii) Scientists are investigating some properties of structures in a yeast cell. They are examining the processes of aerobic respiration and anaerobic respiration. Their results are shown in the table.

structure in yeast cell	property
cell membrane	freely permeable to gases
cytoplasm	contains enzymes
mitochondria	contain enzymes
nucleus	holds the genetic code

Explain how the properties of these structures help the yeast cell to respire using aerobic respiration **and** anaerobic respiration.



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

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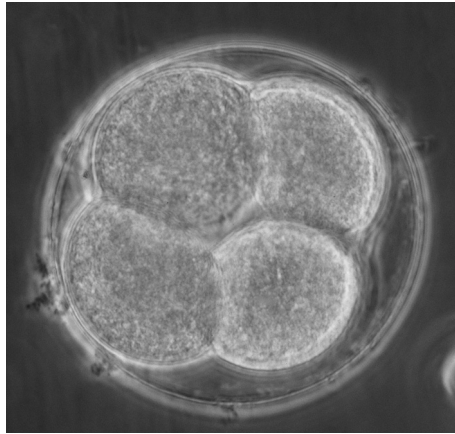
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..... [6]

[Total: 10]

- 6 An embryo develops from a fertilised egg (zygote) in animals.



Scientists have shown that most embryo cells become specialised and form different types of tissue.

Some cells remain unspecialised and are called embryonic stem cells.

- (a) All the embryonic stem cells in a zygote are identical to one another.

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

Embryonic stem cells ...

... are produced by mitosis.

... can switch off any gene during development of the embryo.

... contain different genes to those found in the specialised cells.

... contain half the number of chromosomes found in the zygote.

[2]

(b) The medical use of embryonic stem cells is regulated by the Government.

An embryo is produced from a donor egg and sperm.
Stem cells from this embryo are injected into a patient.

This procedure has ethical issues.

Put a tick (✓) in the box next to each **ethical** issue.

- The patient will contain DNA from another person.
- Embryonic stem cells may be larger than the patient's cells.
- Donated embryonic stem cells may be rejected by the patient's body.
- Embryos may be destroyed to collect the embryonic stem cells.
- Scientists and doctors must decide who receives the embryonic stem cells.
- The donated embryonic stem cells may not survive in the body of the patient.

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[2]

(c) The growth and development of each cell in the embryo is controlled by its DNA.

What are the features of DNA?

Complete the table.

Put a (ring) around the correct box in **each** row.

number of strands	1	2	3	4
number of different types of bases	2	3	4	5
arrangement of bases between the strands	fours	pairs	single	triplets
shape of molecule	circular	cube	helix	sheet

[1]

(d) Use your knowledge of the genetic code to explain where and how proteins are coded for and made.



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

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[6]

[Total: 11]

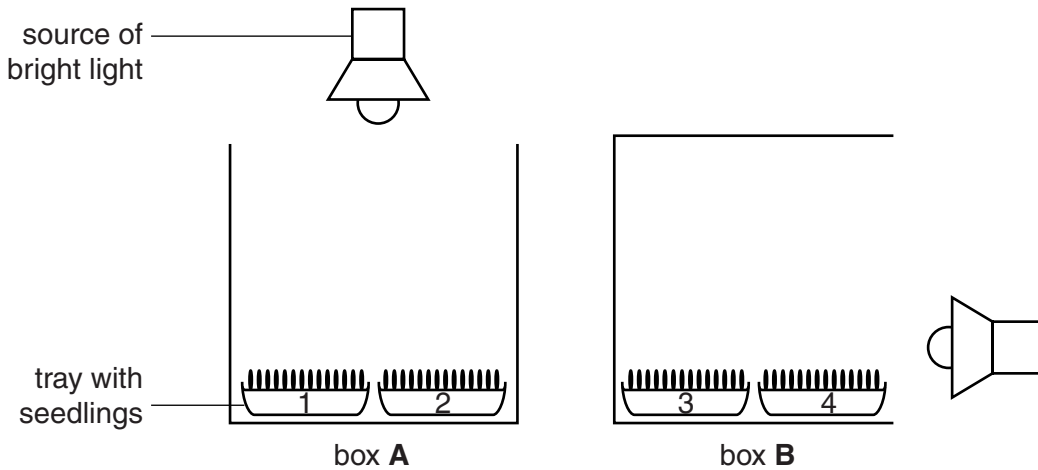
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Question 7 begins on page 18
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7 Ruth wants to develop a model of how plants grow in her garden.

She uses four trays of cress seedlings. There are 100 seedlings in each tray. All the seedlings are approximately 2 cm tall.

- She places two of the trays in an open box, **A**, with a source of bright light above it.
- She places the other two trays in another open box, **B**, with a source of bright light on one side of it.



Ruth records the appearance of the seedlings after 24 hours, and again after 48 hours.

She sees that some of the seedlings have grown with a straight stem but others have grown with a curved stem.

		percentage (%) of seedlings with a curved stem	
		after 24 hours	after 48 hours
box A	tray 1	2	3
	tray 2	1	3
box B	tray 3	48	89
	tray 4	42	81

(a) (i) Explain the results for the cress seedlings grown in box **A**.

Use your understanding of **auxin distribution** in your answer.

.....

.....

..... [2]

(ii) After 48 hours, Ruth changes the position of the trays in box **B**.

She places the trays so that the curved seedlings are facing away from the light source.

Suggest what will happen to the seedlings and explain why.

Use your understanding of auxin distribution in your answer.

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

(b) Does Ruth's experiment accurately represent how plants would grow in her garden?

Give **two** reasons to support your answer.

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

[Total: 6]

END OF QUESTION PAPER

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