

Candidate Forename						Candidate Surname				
Centre Number						Candidate Number				

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A222/02**

**TWENTY FIRST CENTURY SCIENCE  
BIOLOGY A**

**Unit 2: Modules B4 B5 B6 (Higher Tier)**

**MONDAY 25 JANUARY 2010: Afternoon**

**DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**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)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use 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.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

## **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.**

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**Answer ALL the questions.**

**1 This question is about kidneys.**

**(a) The kidneys excrete excess water from the body in urine.**

**Put a ring around THREE other ways in which water can be lost.**

**BREATHING**

**DRINKING**

**EATING**

**PRODUCING FAECES**

**RESPIRING**

**SWEATING**

**[1]**

**(b) The kidneys filter some chemicals out of the blood.**

**Some chemicals are reabsorbed and others leave the body in the urine.**

**Complete the table to show what happens to each of these chemicals.**

**Put ticks (✓) in the correct boxes.**

**One row has been done for you.**

	<b>FILTERED OUT OF THE BLOOD</b>	<b>FOUND IN THE URINE</b>
<b>salt</b>	✓	✓
<b>sugar</b>		
<b>urea</b>		
<b>water</b>		

(c) Kidneys can produce CONCENTRATED or DILUTE urine.

The concentration of urine is affected by different conditions.

For these two conditions, state the type of urine produced (CONCENTRATED or DILUTE) and explain why this happens.

- HIGH EXTERNAL TEMPERATURE

type of urine produced \_\_\_\_\_

explanation \_\_\_\_\_

- EATING TOO MUCH SALTY FOOD

type of urine produced \_\_\_\_\_

explanation \_\_\_\_\_

\_\_\_\_\_ [2]

[Total: 5]

**2 Steven climbs mountains.**

**The temperature of the atmosphere will drop as he climbs higher and higher.**

**His normal body temperature is 37 °C.**

**He must avoid hypothermia.**

**(a) Complete this sentence**

**Hypothermia is when core body temperature falls**

**below \_\_\_\_\_ °C.**

**[1]**

**(b) What causes HYPOTHERMIA?**

**Use ideas about HEAT BALANCE in your answer.**

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**[1]**

(c) This question is about the maintenance of a constant internal temperature.

(i) Complete this sentence.

Use words from this list.

CEREBRAL CORTEX

EFFECTORS

HYPOTHALAMUS

NEURONS

PITUITARY GLAND

RECEPTORS

The temperature of the blood is detected

by \_\_\_\_\_ in the

\_\_\_\_\_ .

[1]

(ii) Complete these sentences.

Put a ring around the correct UNDERLINED words.

During vasoconstriction, blood flow through the skin capillaries IS DECREASED / IS INCREASED / STAYS THE SAME.

Energy loss from the skin IS DECREASED / IS INCREASED / STAYS THE SAME.

[1]

[Total: 4]

3 Anna is investigating the effect of temperature on enzyme activity.

(a) She asks five of her friends to explain the LOCK AND KEY MODEL.

MILLIE

The enzyme and substrate molecules collide with each other.

JIMMY

Only molecules with the correct shape can fit into the enzyme.

RACHEL

The enzyme is permanently changed by the reaction.

GORDON

Enzymes collide with a range of molecules.

MARIA

Enzyme molecules have an active site.

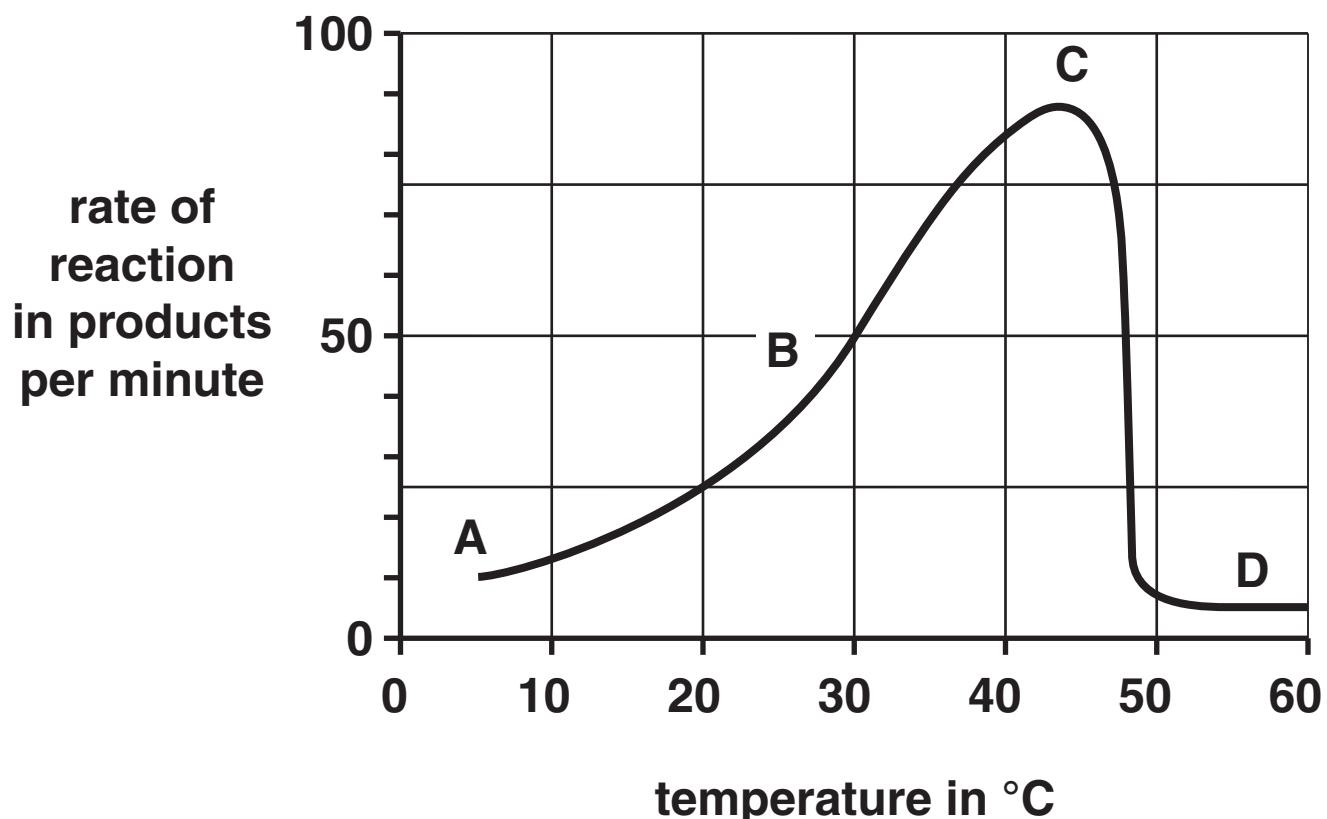
(i) Which friend gives the BEST explanation?

answer \_\_\_\_\_ [1]

(ii) Which friend describes something that does NOT happen?

answer \_\_\_\_\_ [1]

(b) Anna plots a graph showing the results of her investigation.



What is the correct statement for each of the stages, A, B, C and D?

Draw a straight line to link each **STAGE** with the correct **STATEMENT**.

**STAGE**

**STATEMENT**

A

There is a clear positive correlation between temperature and the reaction rate.

B

The collision rate between the enzyme and substrate molecules is at its lowest.

C

The collision rate between the enzyme and substrate molecules is at its highest.

D

Any further increase in temperature will change the shape of the enzyme's active site.

[2]

(c) Over which range of temperatures is the rate of reaction greater than or equal to 50 products per minute?

Use the graph to find the answer.

from \_\_\_\_\_ °C to \_\_\_\_\_ °C [1]

**(d) Temperature can change the shape of the active site.**

**Which other factor can do this?**

**Put a ring around the correct answer.**

**ENZYME CONCENTRATION**

**pH OF THE SOLUTION**

**SUBSTRATE CONCENTRATION**

**TYPE OF PRODUCT**

**[1]**

**[Total: 6]**

**4 Joe is a farmer.**

**He is very proud of his prize cow because she produces good quality milk.**

**Joe would like his cow to give birth to calves that could also produce good quality milk.**

**(a) The cow's egg cells are fertilised by sperm from a bull.**

**Complete the sentences.**

**Use words from this list.**

**ALL**

**FERTILISATION**

**HALF**

**MEIOSIS**

**MITOSIS**

**MOST**

**The egg cells and sperm cells are gametes and are produced by \_\_\_\_\_.**

**An egg cell and a sperm cell fuse to form a zygote.**

**The zygote will contain \_\_\_\_\_ of the chromosomes found in the cow's egg cell.**

**[2]**

**(b) The zygote will grow to form an embryo.**

**Joe finds out that scientists can take individual cells from an embryo and make identical copies of the embryo.**

**This is not successful after a certain stage of embryo development.**

**Why is this?**

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

**The cells have become ...**

**... larger.**

**... older.**

**... smaller.**

**... specialised.**

**[1]**

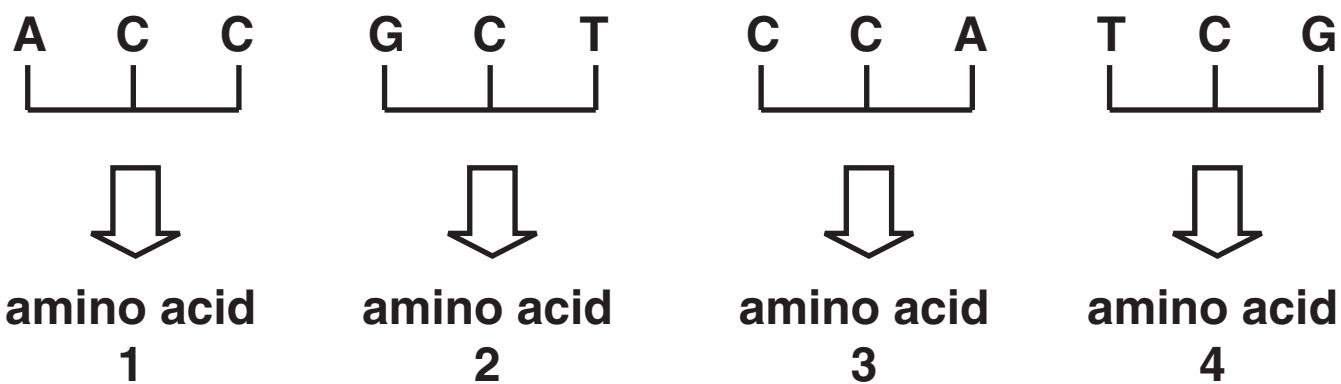
**[Total: 3]**

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## 5 This question is about protein synthesis and the genetic code.

- Genes in a nucleus have a unique sequence of the bases A, T, C and G.
- The bases operate in triplets.
- Each triplet codes for an amino acid.
- The order of the amino acids determines the protein produced.
- This means that genes code for the production of proteins.

The diagrams show how this works.



(a) What would be the order of amino acids forming a protein if the sequence of bases in a DNA molecule was as shown in the diagram?

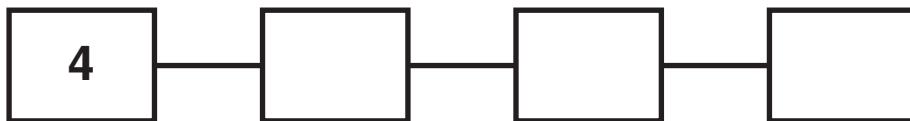
T    C    G    G    C    T    T    C    G    A    C    C

Direction of reading the bases of the DNA molecule (from left to right)



**Write the amino acid numbers, 1, 2, 3 or 4 in the boxes.**

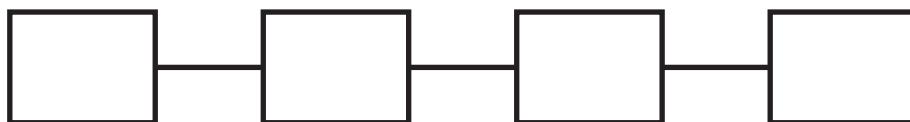
**One has been completed for you.**



**first amino  
acid in chain**

**[1]**

**(b) What would be the amino acid order if the bases of the original DNA molecule were read in the OPPOSITE DIRECTION (from right to left)?**

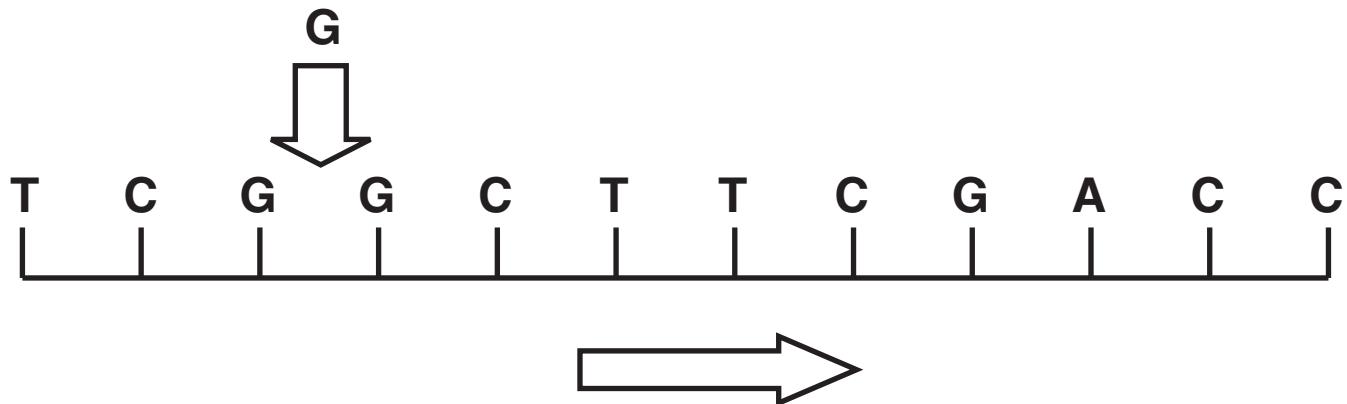


**first amino  
acid in chain**

**[1]**

**(c) MUTATIONS can occur in the genetic code.**

**A mutation could cause another BASE G to be inserted into the original DNA molecule BETWEEN BASES G AND G.**



**The genetic code is read in the original direction (from left to right).**

**How many of the amino acids would NOT be affected by this mutation?**

**answer** \_\_\_\_\_ [1]

**[Total: 3]**

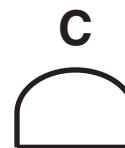
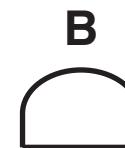
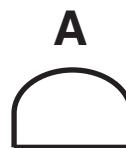
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## 6 Oliver is studying growth in plant shoots.

He sets up three different plant shoots, A, B and C.

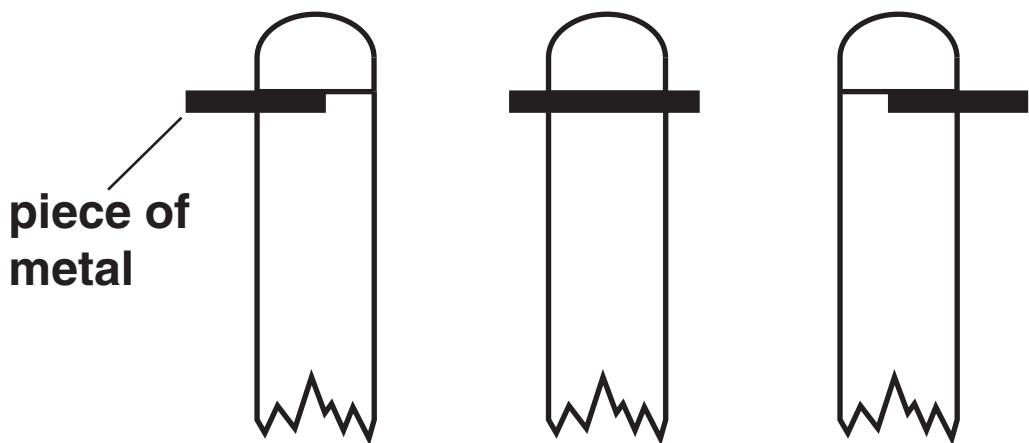
### STEP 1

Oliver cuts the tips off three growing shoots.



### STEP 2

He places the tips back onto the shoots with a thin piece of metal in position.



(a) The three shoots are left in the dark for three days.

What happens to each of the shoots, A, B and C?

(i) Put the correct shoot, A, B or C, next to each statement.

The shoot stops growing.

The shoot grows to the right.

The shoot grows to the left.

[1]

**(ii) Oliver's friends talk about the results.**

**LAANI**

**The metal stopped auxin diffusion.**

**JOE**

**Auxin diffused into the lower stem and spread evenly.**

**LIZ**

**Auxin stopped the growth of shoots.**

**CHRIS**

**Auxin diffused down one side in some shoots and increased the growth on that side.**

**JOAN**

**Auxin collected on one side in some shoots and slowed the growth in the shoot underneath.**

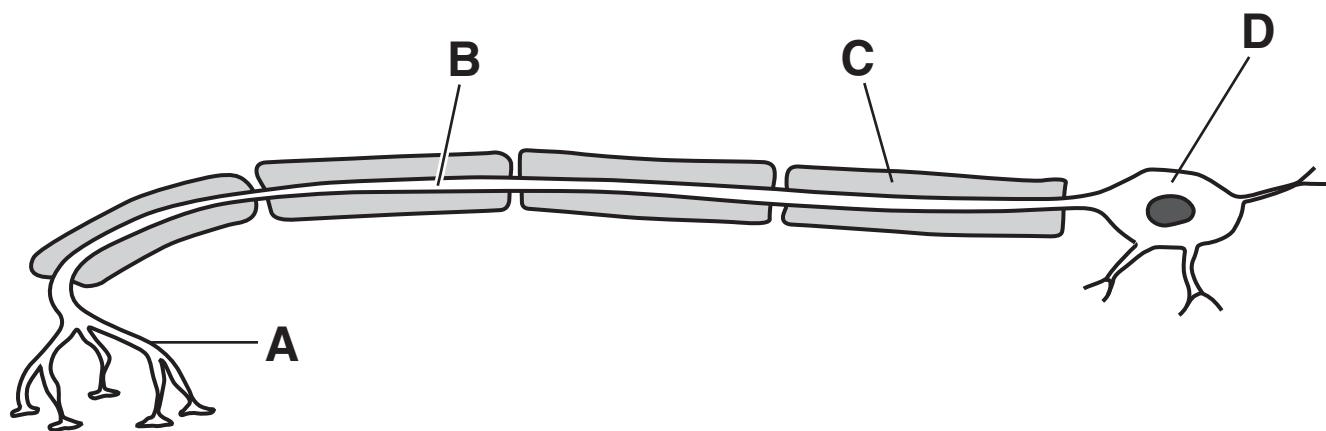
**Which TWO friends' ideas, when put together, correctly explain the results?**

**answer \_\_\_\_\_ and \_\_\_\_\_ [2]**

**(b) What is phototropism and why is it important for plants?**

[Total: 6]

7 The diagram shows a motor neuron.



(a) Which structure, A, B, C or D, is the **AXON**?

answer \_\_\_\_\_ [1]

(b) Write about the fatty sheath.

In your answer include

- where it is
- what job it does.

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[3]

[Total: 4]

## 8 Roger is learning Japanese in an evening class.

(a) Roger must remember some Japanese words for his next lesson.

## **(i) What do you understand by the word MEMORY?**

## Complete the sentence.

## Memory is the and

## of information.

[2]

**(ii) Which part of the brain is the centre for memory?**

- [1]

**(b) Describe THREE ways in which information is more likely to be remembered.**

[3]

(c) Roger asks four students in his class to describe the link between neuron pathways and learning.

**CHRIS**

**Certain neuron pathways become more likely to transmit impulses than others.**

**SARAH**

**During development, new neuron pathways are formed as we interact with the environment.**

**EDWARD**

**Some neurons transmit impulses more quickly than others.**

**CHARLOTTE**

**Some pathways stop working because the neurons are used too often.**

**Which students correctly describe this link?**

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[1]

[Total: 7]

9 The diagram (opposite) shows a synapse between two neurons, A and B, in the brain.

(a) Suggest what happens to the speed of a nerve impulse when it reaches a synapse.

Put a **ring** around the correct answer.

NO EFFECT

SLOWS DOWN

SPEEDS UP

STOPS

[1]

(b) Use the diagram to explain why synapses can only transmit impulses in one direction.

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[2]

(c) Some drugs such as Ecstasy prevent the synapse chemical, serotonin, from returning to neuron A.

How does this affect the concentration of serotonin at the synapse?

Complete this sentence.

The concentration of serotonin at the synapse

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. [1]

[Total: 4]

**END OF QUESTION PAPER**

receptor molecules on  
neuron B recognise  
the chemical

end of neuron A

synapse chemical (serotonin)  
released by neuron A

cell body  
of neuron B

➡ = direction of  
impulse



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