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Centre number						Candidate number				
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**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 24 JANUARY 2011: 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, centre number and candidate number in the boxes on the first page. 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.**

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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QUESTION 1 STARTS ON PAGE 4

Answer ALL the questions.

1 Lizzie is an astronaut.

She is doing a space walk.

Space is very cold.

(a) Lizzie's body maintains a constant internal temperature.

This is an example of which process?

Put a ring around the correct answer.

DENATURATION

HOMEOSTASIS

HYPOTHERMIA

RESPIRATION

[1]

(b) The temperature of the air inside Lizzie's space suit is maintained at a constant level.

The temperature control system in a space suit is designed to work in a similar way to the body control system in humans.

Draw a straight line to link each PART OF THE SPACE SUIT CONTROL SYSTEM to the matching PART OF THE BODY CONTROL SYSTEM.

Then draw a straight line to link each PART OF THE BODY CONTROL SYSTEM to its FUNCTION.

**PART OF THE
SPACE SUIT
CONTROL
SYSTEM**

**temperature
probe**

**heating
system**

**control
circuit**

**PART OF
THE BODY
CONTROL
SYSTEM**

brain

effector

receptor

FUNCTION

**detects the
temperature**

**processing
centre**

**produces
the
response**

[2]

(c) Lizzie's space suit is not working properly.

The air temperature inside her suit increases.

This causes a small increase in Lizzie's body temperature.

Write down what effect, if any, this has on the rate of reactions in Lizzie's body.

Explain your answer.

effect on rate _____

explanation _____

_____ **[3]**

- (d) The temperature control system in Lizzie's suit is adjusted.

Her core body temperature starts to drop.

This is shown in the table.

TIME AFTER ADJUSTMENT IN MINUTES	CORE BODY TEMPERATURE IN °C
0	39.0
5	38.5
10	37.0
15	36.3
20	35.0
25	34.8
30	34.5

- (i) Calculate the percentage decrease in Lizzie's core body temperature during the 30 minutes.

Show your working.

answer = _____ % [2]

- (ii) During the 30-minute period, Lizzie starts suffering from hypothermia.

After how many minutes does this start to occur?

answer = _____ minutes [1]

[Total: 9]

2 Jake is studying osmosis in ANIMAL CELLS under the microscope.

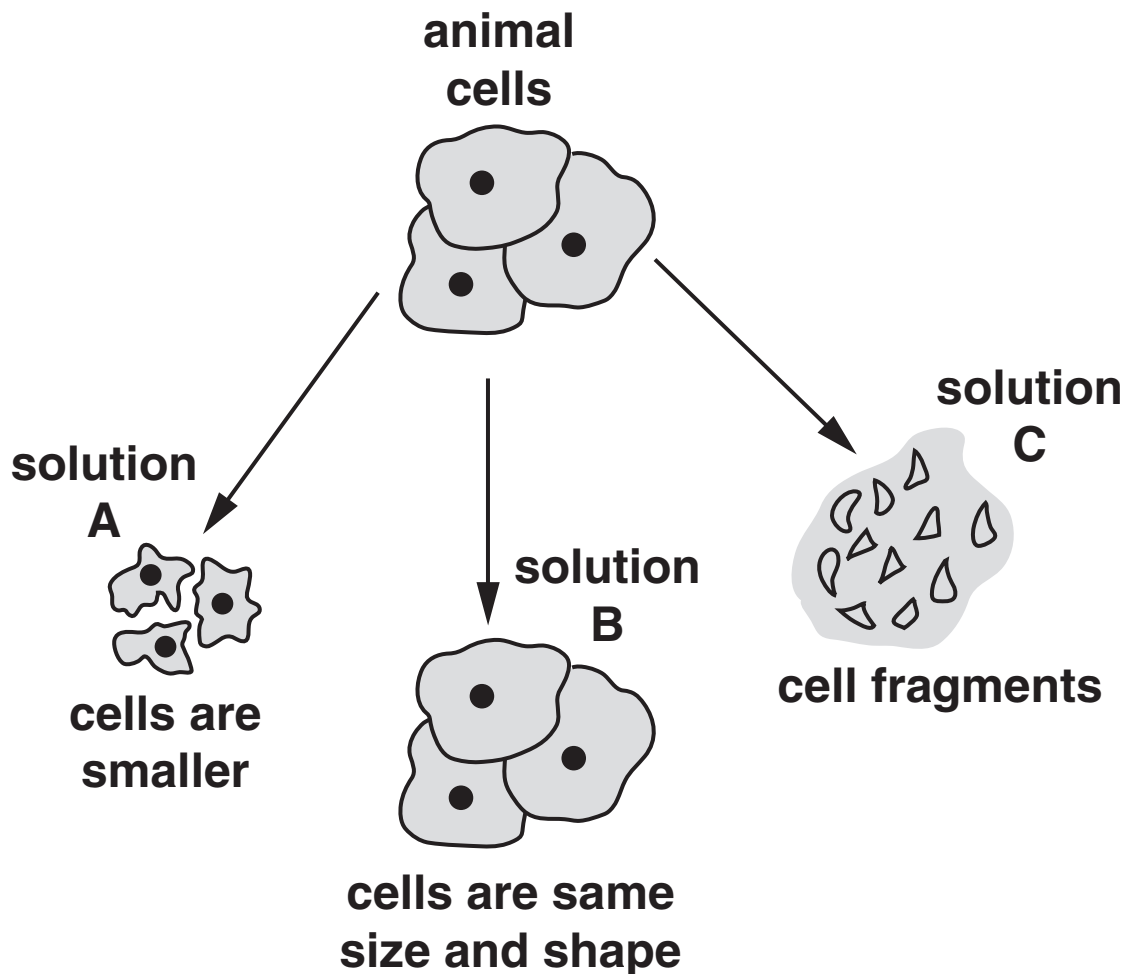
(a) What is osmosis?

[1]

(b) Jake adds some of the cells to each of three different solutions, A, B and C.

They are left for two hours.

The diagram shows the results.



Identify the solutions A, B and C.

Write the correct letter in each box.

SOLUTION	LETTER
concentrated salt solution	
dilute salt solution	
pure water	

[1]

- (c) A large volume of PURE WATER is then added to the three solutions with animal cells or cell fragments in.**

Suggest what would happen to the animal cells and cell fragments in each of the solutions.

[2]

[Total: 4]

3 This question is about the hormone ADH.

ADH is involved in maintaining balanced water levels in the human body.

(a) Which part of the brain releases ADH into the bloodstream?

Put a ring around the correct answer.

CEREBRAL CORTEX

HYPOTHALAMUS

PITUITARY GLAND

MEDULLA

[1]

(b) Alcohol and Ecstasy both affect the production of ADH and urine.

Draw a straight line between each DRUG and its effect on the PRODUCTION OF ADH.

Then draw a straight line between each DRUG and its effect on the URINE.

PRODUCTION OF ADH	DRUG	URINE
decreases	alcohol	greater volume and more dilute
increases		smaller volume and less dilute
stays the same	Ecstasy	greater volume and less dilute
stops		smaller volume and more dilute

[2]

**(c) Describe how ADH secretion is controlled by
NEGATIVE FEEDBACK.**

[2]

[Total: 5]

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QUESTION 4 STARTS ON PAGE 14

4 Two scientists, Watson and Crick, are famous because they discovered the structure of DNA in 1953.

(a) Watson and Crick found that DNA is made from different bases.

Draw one straight line between the correct NUMBER OF TYPES OF BASES and the way in which they are JOINED TOGETHER.

NUMBER OF TYPES OF BASES	JOINED TOGETHER
two	in twos
three	in fours
four	in eights

[1]

(b) Since the 1950s, much more is known about DNA and the cell cycle.

What happens to the strands of DNA during cell growth in the cell cycle?

[2]

(c) DNA is the basis of the genetic code.

Explain the link between the genetic code and protein synthesis.

[2]

(d) MUTATIONS can occur in DNA.

Some mutations result in an EXTRA BASE being added to the base sequence in a gene.

What will happen if this type of mutation takes place?

Put a tick (✓) in the correct box for each row.

	TRUE	FALSE
The sequence of bases in the DNA molecule will stay the same.		
The sequence of amino acids used in the protein molecule will change.		
The protein molecule produced is likely to stay the same.		
Different amino acids may be used in protein production.		

[1]

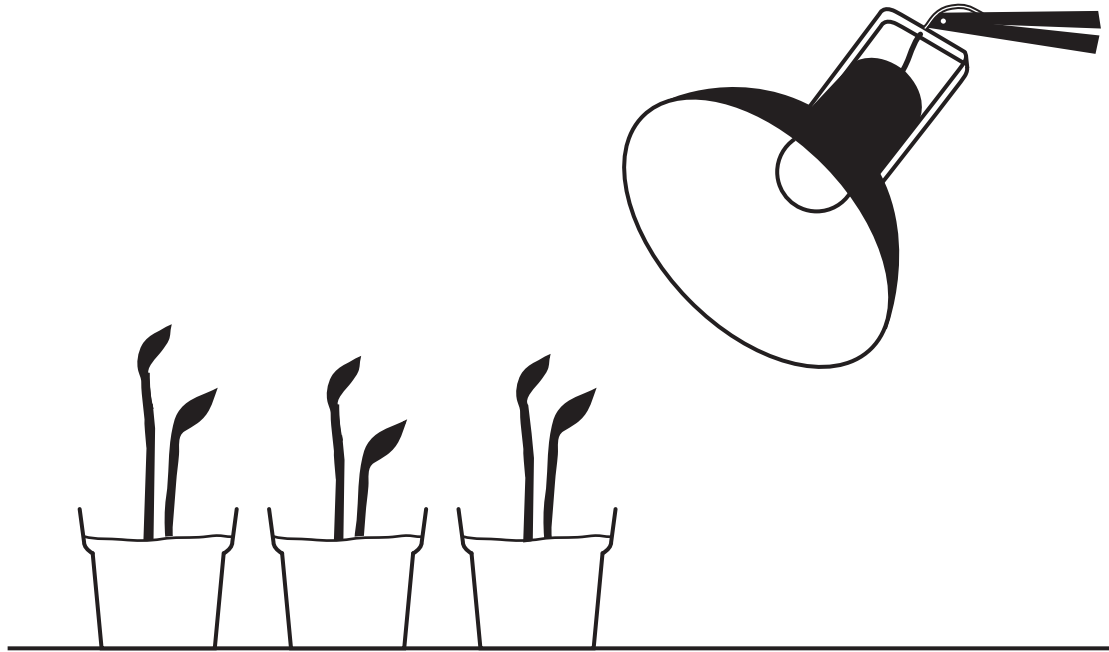
[Total: 6]

5 Emma carries out a simple experiment.

She puts pots of plant shoots next to a light source.

She returns to see what has happened to the plants after 3 days.

The plants are showing phototropism.



(a) The plant shoots grow towards the light source.

Complete the sentences to explain how phototropism increases the plants' chances of survival.

Use words from this list.

LEAVES

ROOTS

PHOTOSYNTHESIS

RESPIRATION

CARBON DIOXIDE

SUGARS

LIGHT

MINERALS

DIFFUSION

OSMOSIS

The curved shoots result in the

_____ getting more

_____ .

The rate of _____ increases,

producing more _____ .

[2]

(b) Which TWO terms can be used to describe the chemical that causes phototropism?

Put a **ring** around the two correct terms.

AUXIN	CHLOROPHYLL	ENZYME
HORMONE	NUCLEOTIDE	SEROTONIN

[1]

(c) How does a SINGLE source of light affect the distribution of this chemical in a shoot tip?

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

The chemical collects ...

... at the tip of the shoot.

... on both sides of the shoot.

... on the side of the shoot in the dark.

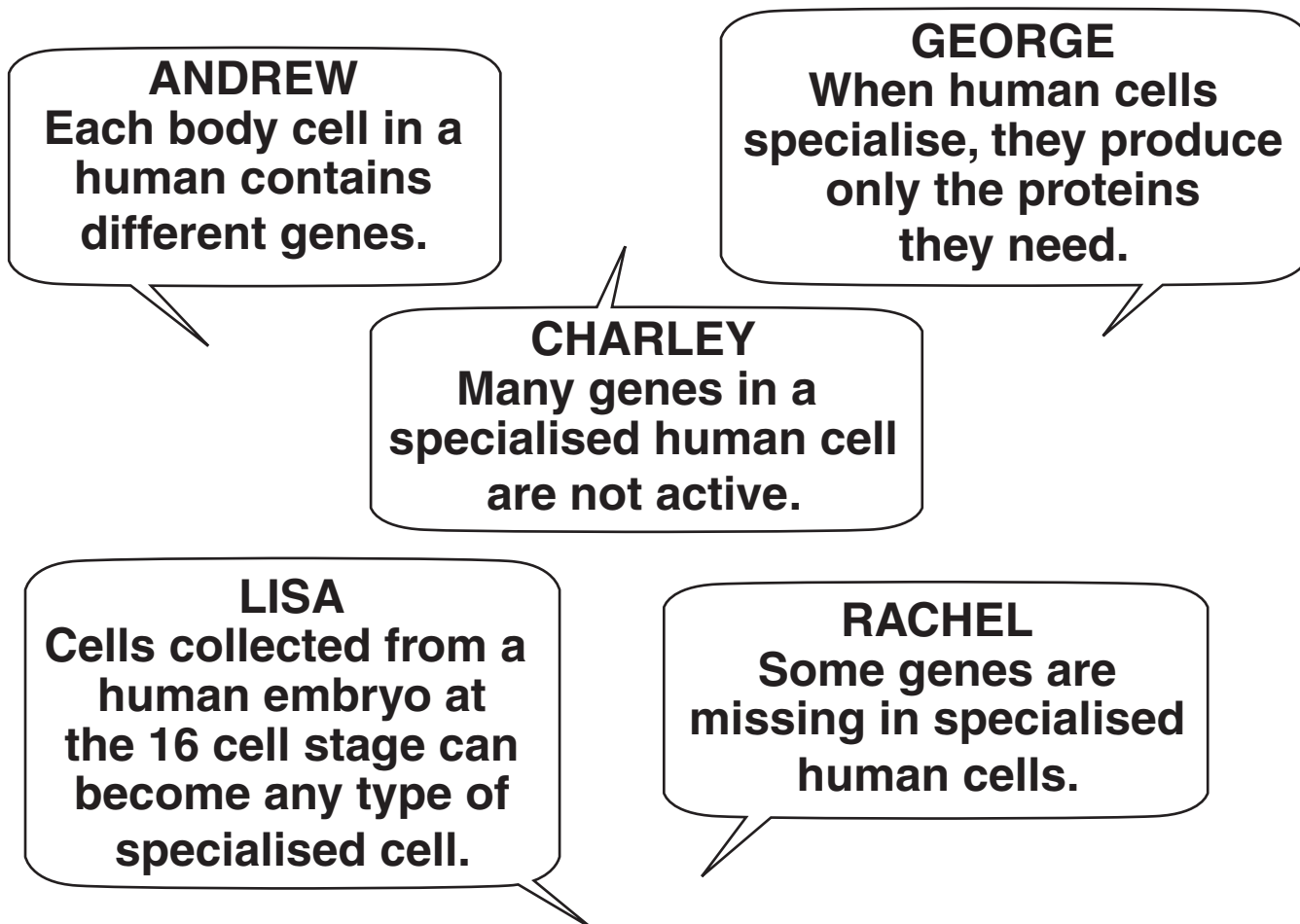
... on the side of the shoot in the light.

[1]

[Total: 4]

6 Some students are talking to a research scientist about specialisation of cells.

(a) The scientist asks the students to give her some ideas about HUMAN cells and their specialisation.



Which TWO students suggest correct ideas?

answers _____ and _____ [2]

(b) Plants also have specialised and unspecialised cells.

Which part of a PLANT contains ONLY unspecialised cells?

answer _____ [1]

[Total: 3]

7 The tiny gaps between adjacent neurons are called SYNAPSES.

Synapses can be found between sensory and motor neurons.

(a) Complete the sentences about nerve impulse transmission and synapses.

Use terms from the list.

Each term may be used once, more than once, or not at all.

ACTIVE TRANSPORT

BREAK DOWN

DIFFUSION

EFFECTOR

FATTY SHEATH

PRODUCTION

RECEPTOR

SPINAL CORD

UNAFFECTED

The nerve impulse starts at the

_____ .

The impulse continues along the sensory neuron.

The impulse is transmitted across the synapse

between the sensory and motor neuron. This

involves the _____ of

chemicals across the gap.

These chemicals then bind with

_____ molecules on the

surface of the motor neuron.

The motor neuron continues to carry the

impulse and triggers the activity of the

_____ .

[2]

(b) Impulses only travel in ONE DIRECTION across the synapse from a sensory neuron to a motor neuron.

Put ticks (✓) in the boxes next to the TWO statements that, taken together, correctly explain this.

Only the sensory neuron releases the synapse chemicals at this synapse.

The synapse chemicals are lost from the site of the synapse.

The chemicals released into the synapse are reabsorbed into the motor neuron.

The chemicals released into the synapse only collide with the membrane of the motor neuron.

The sensory neuron membrane does not contain molecules capable of binding with the synapse chemical.

[2]

(c) The drug Ecstasy affects the sites in the brain's synapses where the chemical serotonin is reabsorbed.

Draw a straight line between ECSTASY and its effect on the REMOVAL OF SEROTONIN IN THE BRAIN'S SYNAPSES.

Then draw another straight line between ECSTASY and its effect on the CONCENTRATION OF SEROTONIN IN THE SYNAPSE.

**REMOVAL OF
SEROTONIN IN
THE BRAIN'S
SYNAPSES**

reduced

increased

not affected

ECSTASY

**CONCENTRATION
OF SEROTONIN IN
THE SYNAPSE**

reduced

increased

not affected

[1]

[Total: 5]

8 This question is about memory.

(a) What is memory?

[1]

(b) Different factors affect a person's memory.

Which FACTORS ENHANCE memory and which INHIBIT memory?

Put a tick (✓) in the correct box in each row.

FACTOR	ENHANCE	INHIBIT
the information has a pattern		
the information is repeated		
the cerebral cortex is damaged		
the information is associated with a colour		

[2]

[Total: 3]

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QUESTION 9 STARTS ON PAGE 26

9 Mark is a newborn baby.

He holds onto his mother's finger very soon after he is born.

He is showing a simple reflex.

(a) Mark will develop conditioned reflexes as he grows older.

What connection is there between the final response in a conditioned reflex and the primary stimulus?

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

The final response only occurs after the primary stimulus.

There is no direct connection between them.

The primary stimulus only occurs after the final response.

They both occur at the same time.

[1]

(b) Mark will be able to MODIFY a reflex response under some circumstances.

Complete the sentences about modifying reflex responses.

Use words from this list.

BRAIN

MOTOR

PITUITARY GLAND

RECEPTOR

SENSORY

SPINAL CORD

The _____ can modify reflex responses.

This process involves the transmission of an impulse along a neuron to the

_____ neuron of the

reflex arc.

[2]

[Total: 3]

END OF QUESTION PAPER



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