OCR
Oxford Cambridge and RSA

Friday 10 May 2024 – Morning

GCSE (9–1) Biology B (Twenty First Century Science)

J257/01 Breadth in biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

F

You must have:
- a ruler (cm/mm)

You can use:
- an HB pencil
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **28** pages.

ADVICE
- Read each question carefully before you start your answer.

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1

(a) Draw lines to connect each **organ system** to its **function**.

Organ system	Function
Digestive system	Produce and release hormones
Endocrine system	Gaseous exchange
Nervous system	Coordinate fast responses to stimuli
Respiratory system	Absorb dissolved food molecules

[3]

(b) Which structure is the **smallest**?

Tick (✓) **one** box.

- Cell ☐
- Nucleus ☐
- Organ ☐
- Tissue ☐

[1]

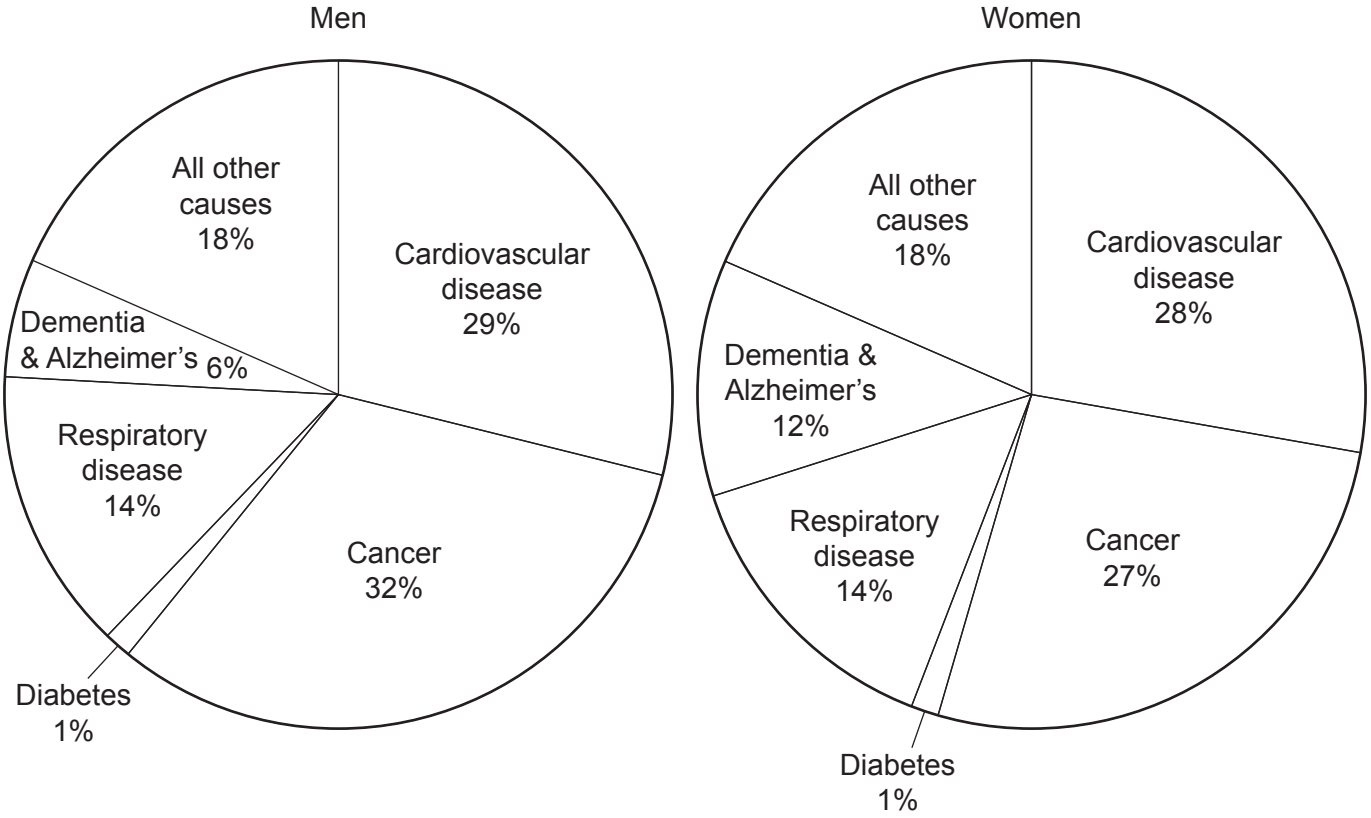
(c) Which structure is the **smallest**?

Tick (✓) **one** box.

- Cell ☐
- Chromosome ☐
- Gene ☐
- Nucleus ☐

[1]

2 The pie charts show data about the cause of death for men and women in the UK in 2012.



(a) Which statements about the causes of death in men and women are **true** and which are **false**?

Tick (✓) **one** box in each row.

	True	**False**
A bigger proportion of men died of dementia and Alzheimer's than women.		
A bigger proportion of women died of cancer than men.		
The same proportion of men and women died of other causes.		
The same proportion of men and women died of respiratory disease.		

[2]

(b) State **two** lifestyle factors that increase a person's risk of developing cardiovascular disease.

1 .....

2 .....

[2]

(c) Complete the sentences to describe the circulatory system.

Use words from the list.

alveoli	**blood**	**capillaries**
impulses	**nerves**	**valves**

The job of the human circulatory system is to transport ..... around the body. It is made up of the heart and blood vessels.

There are 3 types of blood vessels: arteries, veins and ..... .

The heart contains ..... to make sure the blood flows in the correct direction.

[3]

(d) Which **two** substances do the kidneys filter from the blood to form urine?

Tick (✓) **two** boxes.

Carbohydrates ☐

Fats ☐

Protein ☐

Urea ☐

Water ☐

[2]

3 A student is investigating the distribution of stomata on leaf surfaces.

The student removes 3 leaves from the same plant.

Leaf 1 – they cover the lower surface of the leaf in waterproof grease.

Leaf 2 – they cover the upper surface of the leaf in waterproof grease.

Leaf 3 – they cover both surfaces of the leaf in waterproof grease.

The results of the experiment are shown in the diagram.

Leaf 1	**Leaf 2**	**Leaf 3**
Slight wilting	**Significant wilting**	**No sign of wilting**
		

(a) Which conclusion can be made from the results of the investigation?

Tick (✓) **one** box.

There are no stomata on the lower surface of the leaf. ☐

There are less stomata on the lower surface of the leaf. ☐

There are the same number of stomata on the upper and lower surface of the leaf. ☐

There are more stomata on the lower surface of the leaf. ☐

[1]

(b) Explain why **leaf 3** did **not** wilt.

.....

.....

.....

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

(c) Describe a control experiment you could perform alongside this experiment.

Method .....

.....

Expected result .....

.....

[2]

(d) Which statements about stomata are **true** and which are **false**?

Tick (✓) **one** box in each row.

	True	False
Mineral ions move into the leaf via the stomata.		
Stomata allow water to enter the leaf.		
Stomata are needed for the exchange of gases.		
The size of the stomata is controlled by guard cells.		

[2]

(e) Which process in plants uses water as a reactant?

Tick (✓) **one** box.

Photosynthesis ☐

Reproduction ☐

Respiration ☐

[1]

(f) Which structure transports water up the plant?

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

4

(a) Which scientists developed the theory of evolution by natural selection?

Tick (✓) **one** box.

Charles Darwin and Alfred Russel Wallace. ☐

Charles Darwin and Gregor Mendel. ☐

Gregor Mendel and Alfred Russel Wallace. ☐

[1]

(b) Rats are considered a pest to many farmers as they eat their crops.

A chemical called warfarin can be used to kill rats.

Put statements **A** to **E** in the correct order to describe why many rats are no longer killed by warfarin.

A A mutation gave some rats resistance to warfarin.

B More rats became resistant to warfarin over time.

C Resistant rats were more likely to reproduce.

D Resistant rats were more likely to survive.

E The allele for resistance was passed to offspring.

Write **one** letter in each box.

[4]

(c) Warfarin prevents blood clotting.

What is the role of red blood cells?

.....

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

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Turn over for the next question

5 Sex determination in birds is controlled by two chromosomes:
- chromosome Z
- chromosome W.

Male birds have two Z chromosomes.
Female birds have one Z chromosome and one W chromosome.

(a) Complete the Punnett square to show that a bird breeder has a 0.5 probability of each offspring being male or female.

		Sperm cells	
Egg cells			

[3]

(b) Complete the table to compare sex determination in birds and humans.

Tick (✓) **one** box in each row.

	Only birds	**Only humans**	**Both birds and humans**
Sex is determined by two different chromosomes.			
Males are produced when there are two copies of the same chromosome.			
In females, sex is determined by the presence of two different chromosomes.			

[2]

(c) Describe how a human male baby develops male characteristics.

.....

.....

.....

.....

.....

..... **[3]**

(d) The diagram shows the structure of DNA.

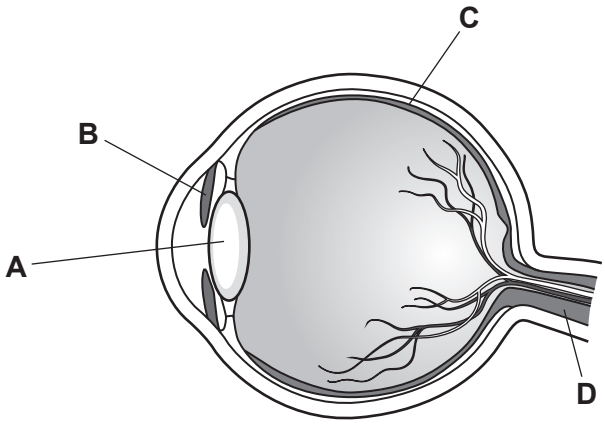
What are the **two** components of the part labelled **A** on the diagram?

1 .....

2 .....

[2]

6 The diagram shows the human eye.



(a) Which letter shows the retina? ..... **[1]**

(b) Which letter shows the iris? ..... **[1]**

(c) What role does the optic nerve have in the functioning of the eye?

Tick (✓) **one** box.

Bends light to focus it on the retina. ☐

Controls the amount of light that enters the eye. ☐

Controls the diameter of the pupil. ☐

Transmits nerve impulses to the brain. ☐

[1]

(d) Some babies are born with cataracts.

Cataracts affect the lens.

Explain how cataracts would affect a baby's vision.

.....

.....

.....

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

(e) Surgical removal of cataracts in babies can be done, but there may be problems after surgery.

In a study, scientists removed the lens from 12 babies with cataracts but left behind the stem cells.

All the babies grew a new lens within 3 months.

Should more babies with cataracts be offered this treatment?
Explain your answer.

.....

.....

.....

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

7 Foot and Mouth is a disease found in cattle, sheep and pigs.

It is caused by a virus.

(a) Name another type of organism that causes disease.

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

(b) Foot and Mouth is spread between animals directly by contact and indirectly through transmission on equipment and people.

In 2001 there was an outbreak of Foot and Mouth in the UK.
The virus spread across the country very rapidly.
The government made the decision to destroy animals that had the disease.

Suggest why the government decided to take this approach.

.....

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

(c)
(i) Other than destroying their animals, suggest how farmers can prevent the spread of the disease between two animals on their farms.

State **two** ways.

1 .....

.....

2 .....

.....
[2]

(ii) Suggest how vets visiting many farms can prevent spreading the disease to animals on different farms.

.....

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

(d) Animals can be vaccinated against Foot and Mouth.

Describe how a vaccination against Foot and Mouth would provide immunity.

.....

.....

.....

.....

.....

..... **[3]**

(e) Suggest why vaccinating animals when the outbreak happened was **not** a solution to the problem.

.....

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

8

(a) Cells can divide by meiosis or mitosis.

Tick (✓) **one** box in each row to show whether the statement describes **meiosis** or **mitosis**.

	Describes meiosis	**Describes mitosis**
Cells formed are gametes.		
Cells formed contain half the number of chromosomes.		
Cells formed contain identical genetic information.		
There are two cell divisions.		

[3]

(b) Sperm cells are adapted to allow them to swim.

Suggest why sperm cells need a lot of mitochondria.

.....

.....

.....

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

(c) Different species of squirrels can be found on either side of Arizona's Grand Canyon.
A canyon is a deep, narrow valley with steep sides.

When the Grand Canyon formed, the squirrels that lived on either side of the canyon evolved to become two different species.

Explain how the formation of these two new species happened.

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.....

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

(d) Squirrels that inhabit Canada are starting to emerge from hibernation early.

These squirrels are producing sperm that cannot swim.

What effect will this have on the squirrel population in Canada?

.....

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

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Turn over for the next question

9 The normal range for a dog's body temperature is between 38.3 °C and 39.2 °C.

Vets suggest that owners measure their dog's temperature so that they are aware of their dog's normal body temperature.

(a) Why would it be helpful to know what their dog's normal body temperature is?

.....

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

(b)

(i) An owner measures their dog's temperature 3 times.

	Temperature (°C)
1	38.7
2	38.9
3	38.7

Calculate the mean body temperature.

Give your answer to **1** decimal place.

Mean body temperature = ... °C **[3]**

(ii) Why is it sensible to measure the dog's temperature a few times and then calculate the mean?

.....

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

(c) Dog owners are advised to take their dog to the vet if its temperature is consistently over 40 °C.

A different owner is worried about their dog.

They measure their dog's temperature every hour for 7 hours.

Hour	1	2	3	4	5	6	7
Temperature (°C)	39.0	39.2	39.4	40.1	40.0	39.4	39.0

Should the owner take the dog to the vet?
Explain your answer.

.....

.....

.....

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

(d) In hot weather dogs find it difficult to cool down.

Explain why this could be harmful to the dog's health.

.....

.....

.....

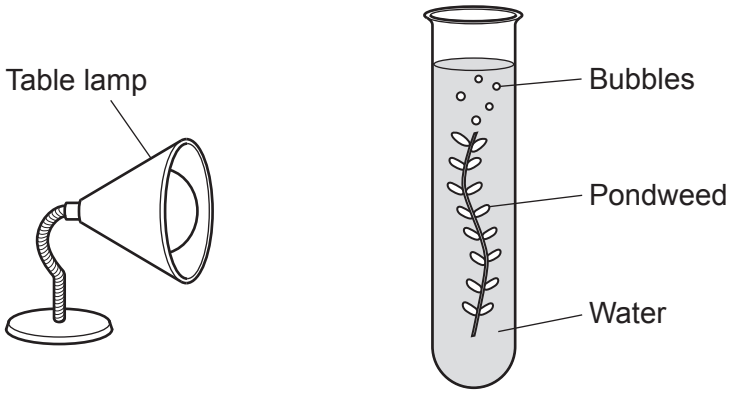
..... **[2]**

10 A student is investigating how light intensity affects the rate of photosynthesis.

(a)

(i) **Fig. 10.1** shows the equipment the student sets up.

Fig. 10.1



Describe the method the student will use with the equipment in **Fig. 10.1** to find how light intensity affects the rate of photosynthesis.

Include in your answer:
- what they will change
- what they will keep the same
- what data they will record.

.....

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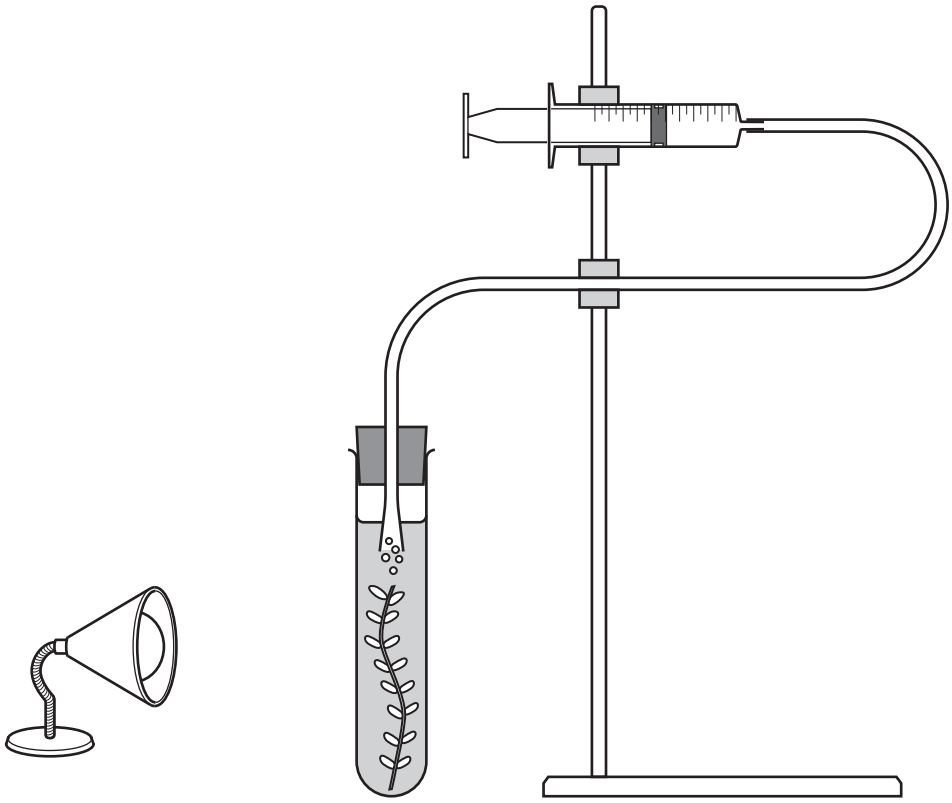
..... **[3]**

(ii) **Fig. 10.2** shows a different set of equipment that can be used.

Fig. 10.2



A second student suggests that the equipment shown in **Fig. 10.2** will improve the investigation.

Explain why.

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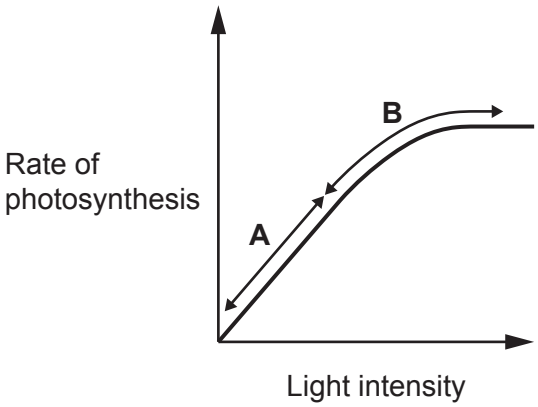
..... **[2]**

(b) **Fig. 10.3** shows the effect of changing the light intensity on the rate of photosynthesis.

Fig. 10.3



Which section or sections of the graph in **Fig. 10.3** show the relationship $y = mx + c$?

Tick (✓) **one** box.

Section **A** ☐

Section **B** ☐

Sections **A** and **B** ☐

[1]

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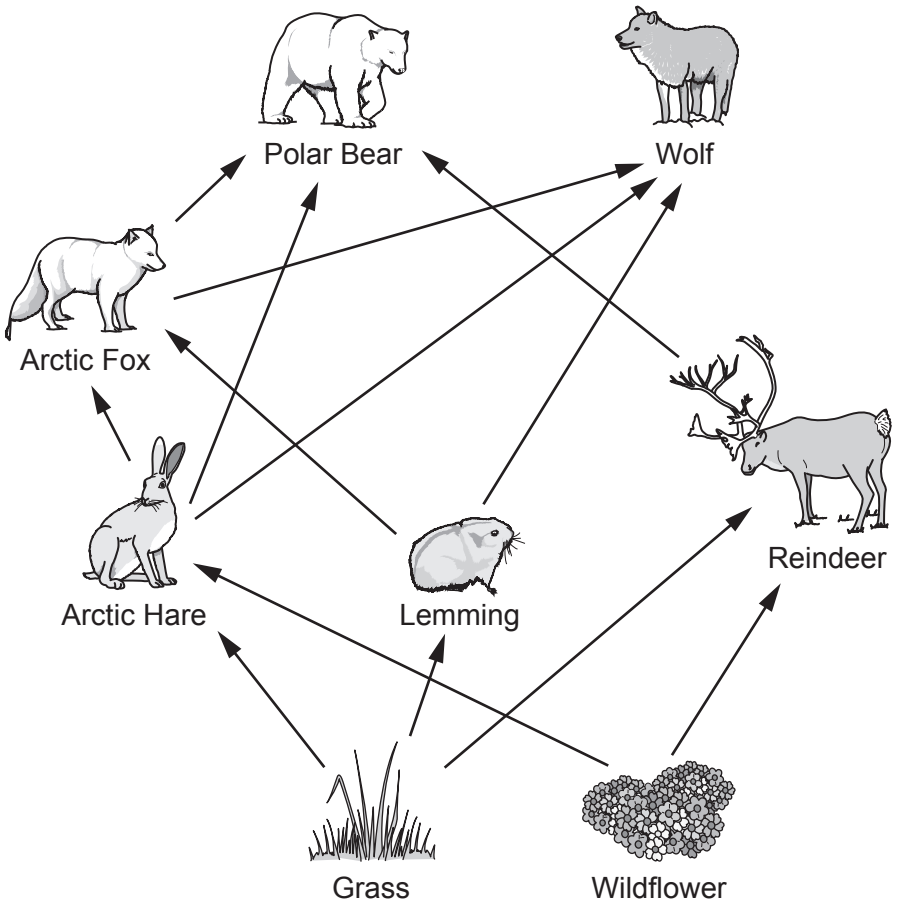
Turn over for the next question

11 The diagram shows the feeding relationships of some of the organisms that live in an Arctic ecosystem.



(a) What does each picture in the food web represent?

Tick (✓) **one** box.

A community ☐

A population ☐

An individual ☐

[1]

(b) Complete each sentence by writing in the correct number.

There are ..... producers in the food web.

There are ..... herbivores in the food web.

The arctic fox is in trophic level ..... .

[3]

(c) A lemming has a mass of 82 g.
An arctic fox eats the lemming, but only consumes 75 g of the lemming.

Calculate the percentage mass the arctic fox has consumed.

Give your answer to **3** significant figures.

Percentage mass consumed = ... % **[3]**

(d) When lemmings are in short supply, the arctic fox will eat eggs.

(i) Eggs contain protein.

Which reagent is used to test for protein?

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

(ii) The yolk of the egg contains lipids.

Put a (ring) around the **two** components that make up a lipid.

amino acids **fatty acids** **glucose** **glycerol**

[2]

(iii) A student calculates the surface area and volume of an egg.

Surface area of the egg = 67.5 cm^2

Volume of the egg = 50 cm^3

Show that the surface area to volume ratio of the egg is 1.35 : 1.

[2]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.