

**Wednesday 18 November 2020 – Morning****GCSE (9–1) Combined Science (Biology) A  
(Gateway Science)****J250/08 Paper 8 (Higher Tier)****Time allowed: 1 hour 10 minutes****You must have:**

- a ruler (cm/mm)

**You can use:**

- a scientific or graphical calculator
- an HB pencil

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

Centre number

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Candidate number

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First name(s)

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Last name

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**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 **60**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has **20** pages.

**ADVICE**

- Read each question carefully before you start your answer.

## SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

**Write your answers to each question in the box provided.**

- 1** A scientist crossed a white flower with a purple flower.  
The white flower is homozygous recessive. The purple flower is heterozygous.

The scientist uses this Punnett square to predict the expected ratio of offspring.

|   |    |    |
|---|----|----|
|   | P  | p  |
| p | Pp | pp |
| p | Pp | pp |

What is the expected ratio of phenotypes in the offspring?

- A** 1 purple : 1 white
- B** 1 purple : 2 white
- C** 2 purple : 1 white
- D** 4 purple : 0 white

Your answer

**[1]**

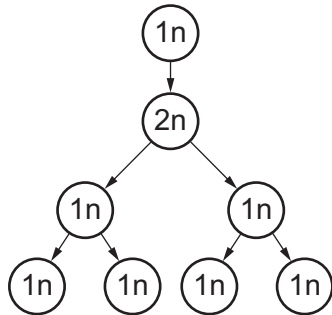
3

2 Meiosis is a type of cell division that is needed to make gametes.

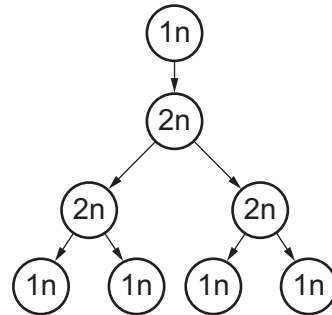
Which diagram shows meiosis?

$n$  = number of chromosomes

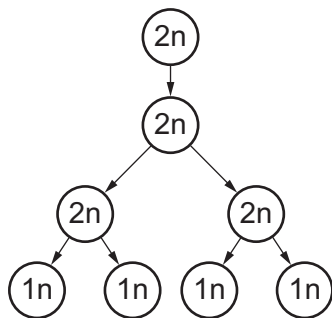
A



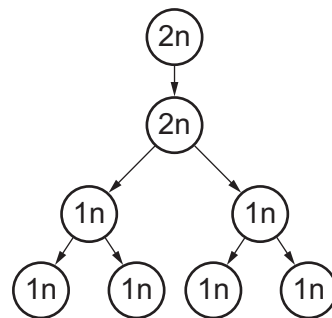
B



C



D



Your answer

☐

[1]

3 Which of these is a **biotic** factor that can affect an ecosystem?

A Acidity of soil

B Bacterial levels in a river

C Carbon dioxide levels in the atmosphere

D Oxygen levels in a river

Your answer

☐

[1]

- 4 Lichens are made up of a fungus and algae living together. The fungus gets nutrients from the algae and algae is sheltered by the fungus.

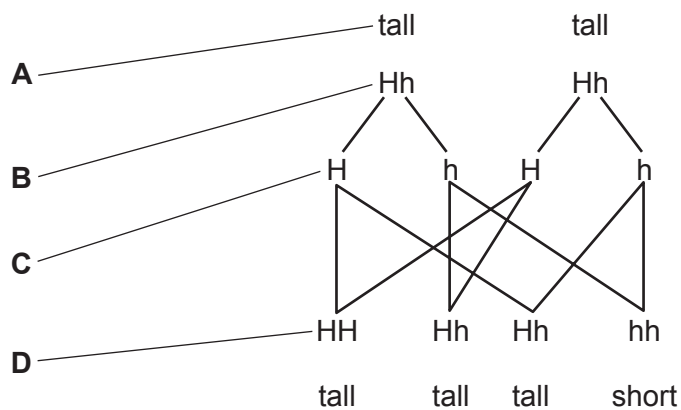
Which term describes this type of relationship?

- A Competition
- B Mutualism
- C Parasitism
- D Predation

Your answer

[1]

- 5 The genetic cross shows how genes are passed from parents to offspring.



Which part of the genetic cross shows the gametes?

Your answer

[1]

- 6 Carbon is recycled in the ecosystem.

Which process helps reduce the level of carbon in the atmosphere?

- A Photosynthesis
- B Respiration
- C Translocation
- D Transpiration

Your answer

[1]

- 7 The phenotype of rabbits can be black or white fur. The allele for black fur is dominant.

Which genetic cross identifies the genotype of a rabbit with black fur (rabbit **X**) as Bb?

- A Cross rabbit **X** with a black rabbit. All offspring have black fur.
- B Cross rabbit **X** with a black rabbit. 50% of offspring have black fur and 50% have white fur.
- C Cross rabbit **X** with a white rabbit. All offspring have white fur.
- D Cross rabbit **X** with a white rabbit. 50% of offspring have black fur and 50% have white fur.

Your answer

☐

[1]

- 8 Chalara ash dieback is a fatal disease affecting ash trees. It is caused by a fungus growing on the leaves.

When the leaves fall to the ground the fungus releases spores spreading the disease.

Which of these would help prevent the spread of Chalara ash dieback?

- A Collecting the fallen leaves to make compost that is then added to the soil.
- B Cutting off infected leaves and branches, and leaving them on the ground to decay.
- C Stopping the import of ash seeds, plants and trees from countries with infected trees.
- D Replanting young ash trees to replace those that have died.

Your answer

☐

[1]

- 9 Which statement about alleles and genes is correct?

- A Alleles are found in the cytoplasm, while genes are only found in the nucleus on the DNA.
- B Allele is just another name for gene, they are both the same codes for a characteristic.
- C Genes are sections of DNA that code for a characteristic, alleles are different forms of a gene.
- D It is possible to have two different genes for a characteristic but only one allele.

Your answer

☐

[1]

10 Phylogenetics is used in the process of classification of organisms.

Which of these is **not** part of Phylogenetics?

- A All species existing today descended from a single common ancestor.
- B Organisms are grouped using characteristics visible to the human eye.
- C Phylogenetics is used to identify common ancestors.
- D Sequencing of DNA can reveal the evolutionary history of an organism.

Your answer

[1]

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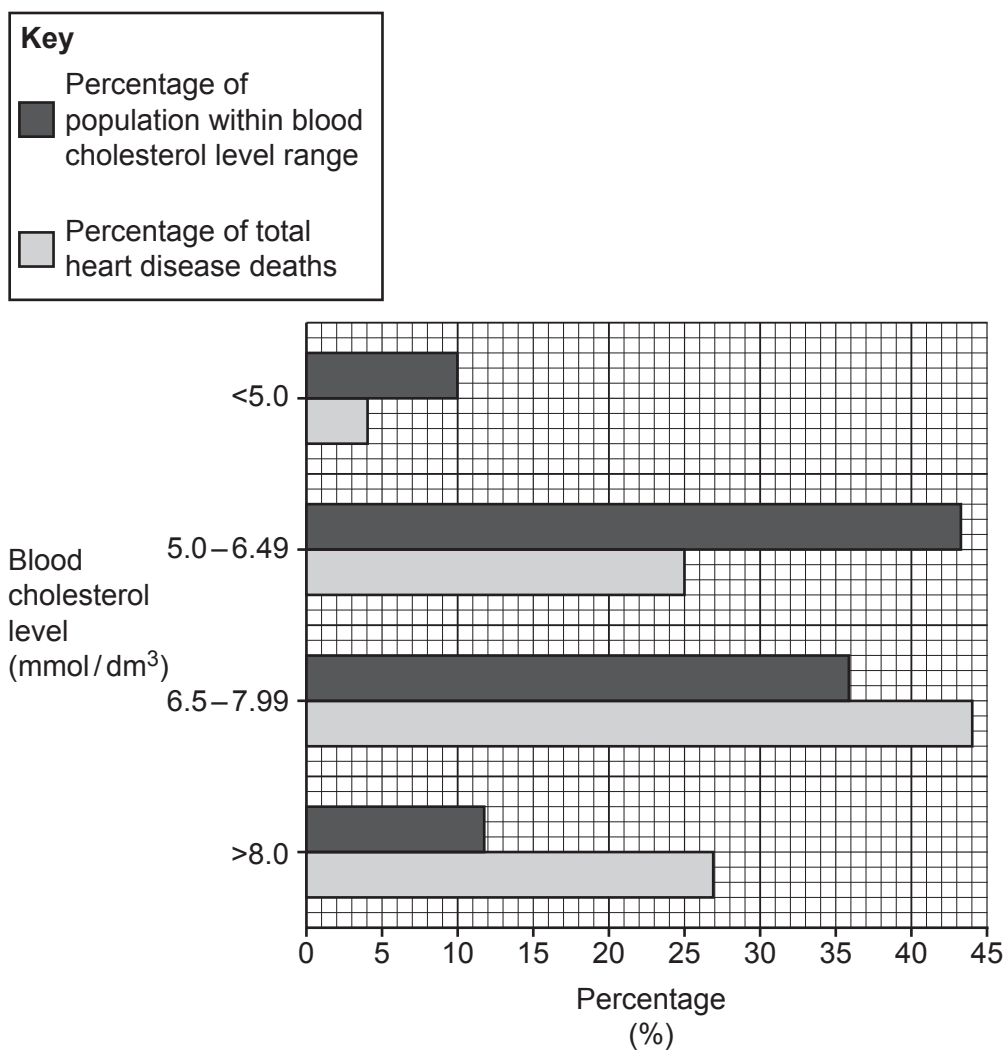
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## SECTION B

Answer **all** the questions.

- 11 Scientists studied a population of men. They grouped the men by their blood cholesterol levels.

The chart shows the percentage of the population in each blood cholesterol level group. It also shows the men in each group that died from heart disease as a percentage of the whole population that died from heart disease.



- (a) (i) What conclusions can be made from the data in the chart?

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.....

.....

[2]



- (ii) Calculate the ratio for percentage of total heart disease deaths for blood cholesterol  $<5.0 \text{ mmol/dm}^3$  compared to those  $5.0 \text{ mmol/dm}^3$  or greater.

Ratio = ..... [2]

- (iii) Health experts encourage people to lower their blood cholesterol to  $5.0 \text{ mmol/dm}^3$  or less.

Analyse evidence in the chart to justify the reason for this.

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

- (b) (i) Hormone replacement therapy (HRT) involves giving oestrogen to women.

A group of scientists did a double-blind study of 643 women given either HRT or a placebo.

The study followed-up these women after five years. It showed reduced build-up of cholesterol in the arteries of women given HRT.

The scientists made this conclusion:

Women on HRT may be at **less** risk from heart disease.

Explain why HRT could reduce the risk of heart disease.

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

- (ii) The reduced build-up of cholesterol observed during the study might not be large enough to have an impact on a person's risk from heart disease.

What change could be made to the study to gain enough evidence to support the conclusion?

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

- (iii) Oestrogen is known to interfere with the cell cycle, increasing the rate of mitosis.

Suggest why HRT might increase the risk of breast cancer.

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- (c) Name **one** lifestyle change someone could make that could also **reduce** the risk of heart disease.

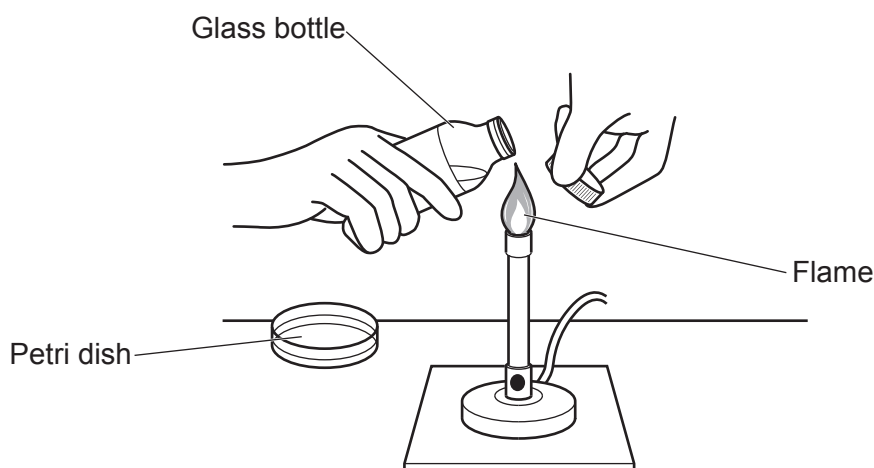
..... [1]

- 12 A patient has a urinary tract infection caused by bacteria. The doctor needs to know the best antibiotic to use to treat the infection.

They send a sample of the patient's urine for testing. The bacteria in the urine are grown on agar jelly plates. On the plates are four different antibiotic discs.

Aseptic techniques are used to prepare the agar jelly plates.

**Fig. 12.1** shows the neck of a glass bottle containing the agar jelly being heated in a flame for 2 seconds. This is done before the agar jelly is poured into the Petri dish.



**Fig. 12.1**

- (a) (i) Suggest why the scientist uses a glass bottle and **not** a plastic bottle.

..... [1]

- (ii) The neck of the glass bottle is heated before transferring the agar jelly to the Petri dish.

Explain why.

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

(b) Fig. 12.2 shows the results of the four different antibiotics A, B, C and D.

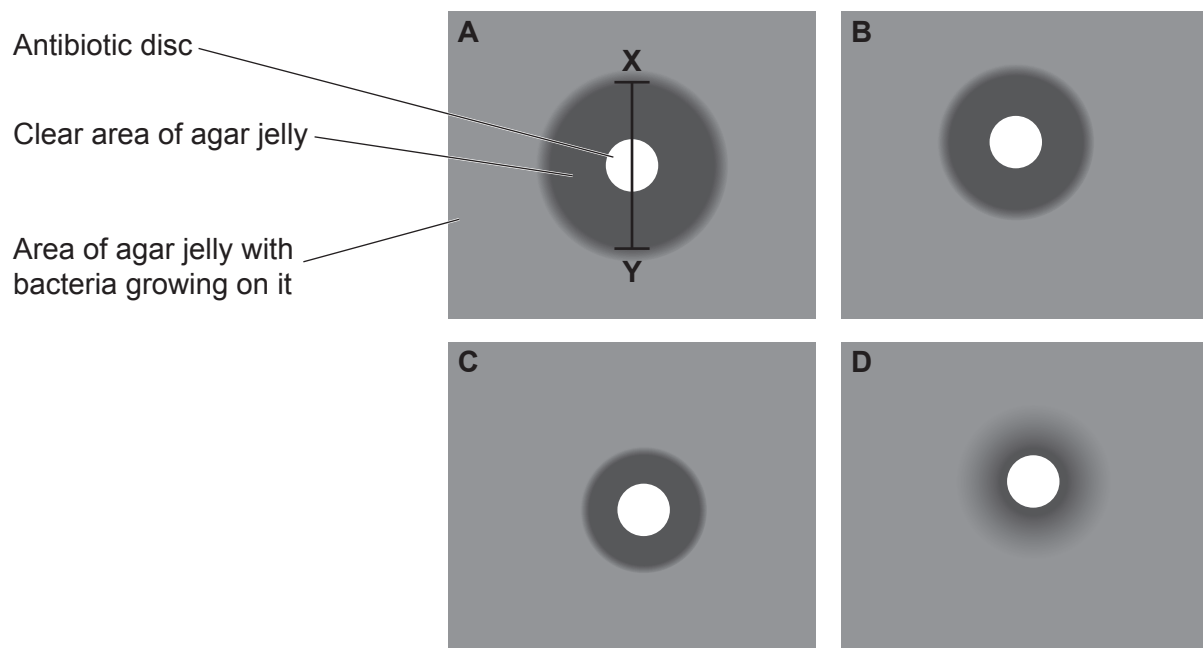


Fig. 12.2

- (i) The line **XY** is the diameter of clear agar jelly for Antibiotic **A**.

Use the line **XY** to calculate the cross-sectional area of clear agar jelly for Antibiotic **A**.

The area of a circle =  $\pi r^2$

$\pi = 3.14$

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

Cross-sectional area = ..... mm<sup>2</sup> [3]

- (ii) The cross-sectional area of clear agar jelly including the antibiotic disc for Antibiotic **C** is 177 mm<sup>2</sup>.

Which antibiotic, **A** or **C**, should the doctor use to treat the patient? Explain your answer.

Antibiotic .....

Explanation .....

..... [2]

- (c) Some bacteria are resistant to antibiotics.

Explain why antibiotic resistant bacteria show evidence of evolution.

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..... [2]

- 13** Algae can photosynthesise and grow rapidly in lakes during the summer.

The growth of algae is affected by abiotic factors.

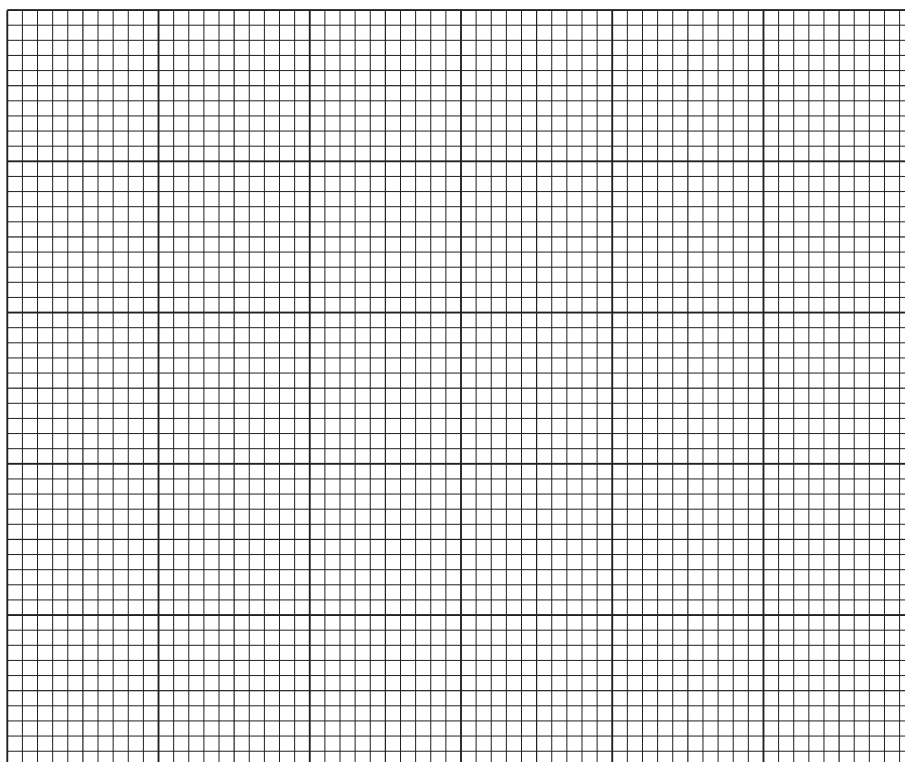
An experiment measured the dry mass of algae at different temperatures for 25 days. Light intensity was kept constant.

**Table 13.1** shows the results for 25 °C and 35 °C.

| Time (days) | Dry mass at different temperatures (g/litre) |         |
|-------------|--|---------|
|             | 25 (°C)                                      | 35 (°C) |
| <b>0</b>    | 0.15   | 0.15    |
| <b>5</b>    | 0.21   | 0.28    |
| <b>10</b>   | 0.30   | 0.42    |
| <b>15</b>   | 0.36   | 0.52    |
| <b>20</b>   | 0.45   | 0.63    |
| <b>25</b>   | 0.50   | 0.74    |

**Table 13.1**

- (a) (i)** Plot the results for 25 °C and 35 °C on the grid, and draw **two** lines of best fit.



**[5]**

(ii) Describe the trends shown in the graph.

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..... [2]

(b) **Table 13.2** shows the dry mass of algae on day 25 for all the temperatures measured in the experiment.

| Temperature (°C) | Dry mass (g/litre) |
|------------------|--------------------|
| 10               | 0.12               |
| 20               | 0.25               |
| 25               | 0.50               |
| 30               | 0.62               |
| 35               | 0.74               |

**Table 13.2**

In some lakes, algae are the main producers.

One year, water temperatures in a lake did not rise above 20 °C.

Use data from **Table 13.2** to explain how this might affect the community of organisms living in the lake.

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..... [3]

(c) The algae produce a toxin. High levels of toxins can kill fish in the water.

Suggest why scientists are concerned about the effects of global warming on algae growth.

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..... [2]

**14** Scientists have used genetically engineered bacteria to produce the human hormone insulin.

**(a)** Describe the main steps in the process of genetic engineering.

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..... [4]

**(b)** Insulin may be used to treat type 2 diabetes.

Describe the interaction between type 2 diabetes and nutrition.

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..... [2]

**(c)** The human genome has been mapped.

Discuss how this could help with the future treatment of type 2 diabetes.

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..... [2]



[2]

Explain why gene therapy could be used to treat lung cancer and discuss the issues involved in using this type of treatment.

..... [6]

[6]

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This image shows a blank sheet of white paper designed for handwriting practice. It features a solid vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced horizontal dashed lines, providing a guide for letter height and placement. There are no other markings, text, or illustrations on the page.



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