Please write clearly in block capitals.

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Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE

BIOLOGY

Higher Tier Paper 2

Practice Paper Series – Set 2

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 04.2 and 09.3 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully developed
  - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

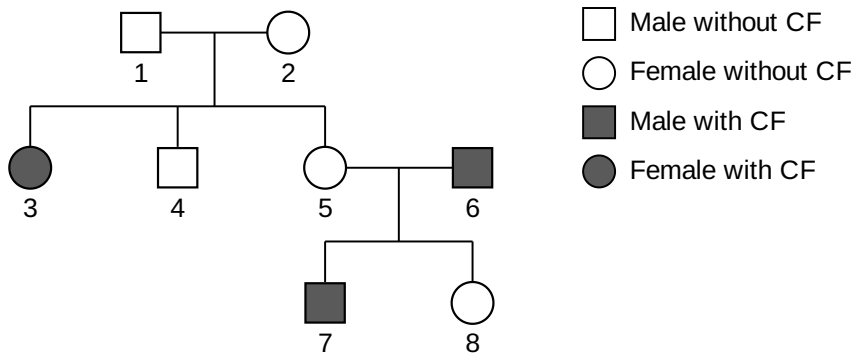
Question	Mark
1	
2	
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8	
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TOTAL	

This is an original practice paper written for sciencegcse.co.uk to match the style and demand of AQA GCSE Biology (8461) Paper 2 (Higher Tier). It is not an AQA examination paper and has not been produced or endorsed by AQA. It is not a prediction of a future examination.

0 1 Cystic fibrosis (CF) is an inherited disorder of cell membranes. CF is caused by a recessive allele.

Figure 1 shows the inheritance of CF in one family.

Figure 1



0 1 . 1 Use the symbols **F** for the dominant allele and **f** for the recessive allele. [1 mark]

What is the genotype of person 3?

Genotype = ...

0 1 . 2 Persons 1 and 2 do **not** have CF. [2 marks]

Explain how **Figure 1** shows that CF is caused by a recessive allele.

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0 1 . 3 Persons 1 and 2 have another child. [3 marks]

Complete the Punnett square to show the possible genotypes of the child.

Give the probability that the child will have CF.

	Gametes from person 1		
Gametes from person 2			

Probability = ...

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0 1 . 4 Person 8 does **not** have CF. [2 marks]

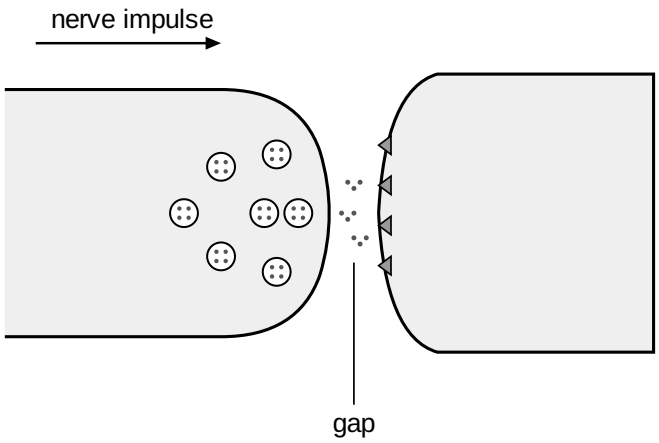
Explain why person 8 must be a carrier of CF.

0 1 . 5 Gametes are produced by meiosis. [1 mark]

Give **one** way in which the cells produced by meiosis are different from the cells produced by mitosis.

0 2 **Figure 2** shows a synapse between two neurones.

Figure 2



0 2 . 1 Describe how a nerve impulse passes across a synapse. [3 marks]

Question 2 continues on the next page

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A student investigated the effect of background music on reaction time.

- Five volunteers each did a reaction-time test on a computer.
- Each volunteer did the test 10 times without music and then 10 times with music.

Table 1 shows the mean reaction time of each volunteer.

Table 1

Volunteer	Mean reaction time without music in s	Mean reaction time with music in s
A	0.24	0.27
B	0.22	0.25
C	0.26	0.25
D	0.23	0.28
E	0.25	0.27

0 2 . 2 The mean reaction time of the five volunteers without music was 0.240 s [3 marks]

Calculate the percentage increase in the mean reaction time of the five volunteers with music.

Percentage increase = ... %

0 2 . 3 The student concluded: [2 marks]

'Background music makes everyone's reaction time longer.'

Give **two** reasons why this conclusion is **not** justified.

Use **Table 1**.

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Question 2 continues on the next page

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0 2 . 4 Every volunteer did the test without music first. [2 marks]

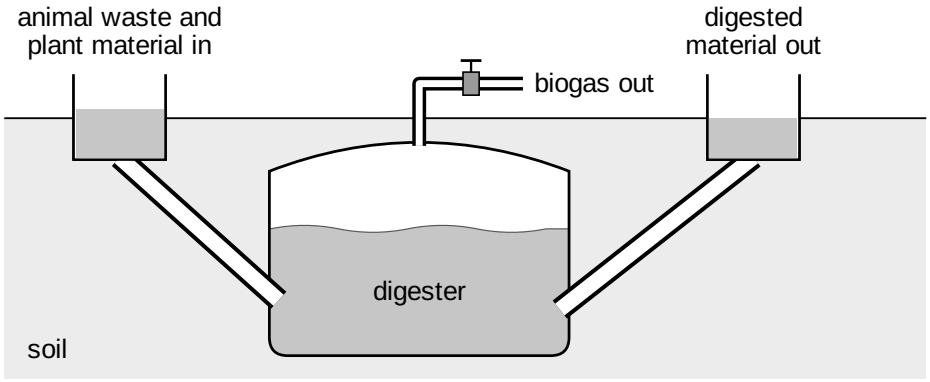
Explain how this may have affected the results.

Suggest how the student could improve the method.

0 3 Some farms use a biogas generator to produce a fuel from animal waste and plant material.

Figure 3 shows a biogas generator.

Figure 3



0 3 . 1 Name the gas in biogas that is used as a fuel. [1 mark]

0 3 . 2 Microorganisms in the digester break down the waste. [2 marks]

The digester is sealed so that no air can get in.

Explain why.

Question 3 continues on the next page

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0 3 . 3 The generator produces less biogas in winter than in summer. [2 marks]

Explain why.

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0 3 . 4 The generator produces 120 m^3 of biogas each day. [2 marks]

65% of the biogas is the fuel gas.

Calculate the volume of the fuel gas produced in one week.

Volume = ... m^3

0 3 . 5 The digested material is spread on fields where crops are grown. [2 marks]

Explain how this helps the crops to grow.

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0 4 Type 1 diabetes is treated with injections of insulin.

0 4 . 1 Explain why people with type 1 diabetes need insulin injections. [2 marks]

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0 4 . 2 Human insulin is made by genetically engineered bacteria. [6 marks]

Describe how bacteria are genetically engineered to produce human insulin.

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0 4 . 3 A tank contains 50 000 dm^3 of a culture of these bacteria. [2 marks]

Each dm^3 of the culture contains 0.75 g of insulin.

Calculate the mass of insulin in the tank.

Give your answer in grams, in standard form.

Mass of insulin = ... g

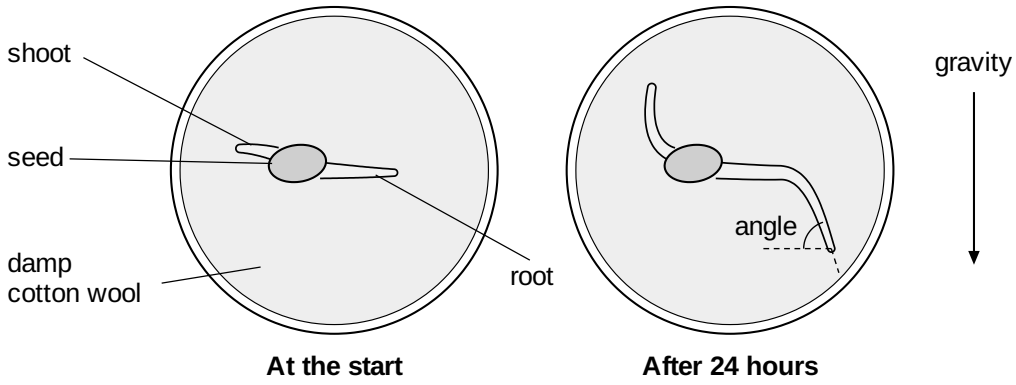
0 5 A student investigated the effect of gravity on the growth of roots.

This is the method used.

1. Pin 6 germinating mung bean seeds onto damp cotton wool in a Petri dish, with each root horizontal.
2. Stand the Petri dish on its edge in a dark cupboard.
3. Every 4 hours for 24 hours, measure the angle between the tip of each root and the horizontal.

Figure 4 shows one of the seedlings at the start and after 24 hours

Figure 4



0 5 . 1 Why did the student put the Petri dish in a dark cupboard? [1 mark]

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Question 5 continues on the next page

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Table 2 shows the results.

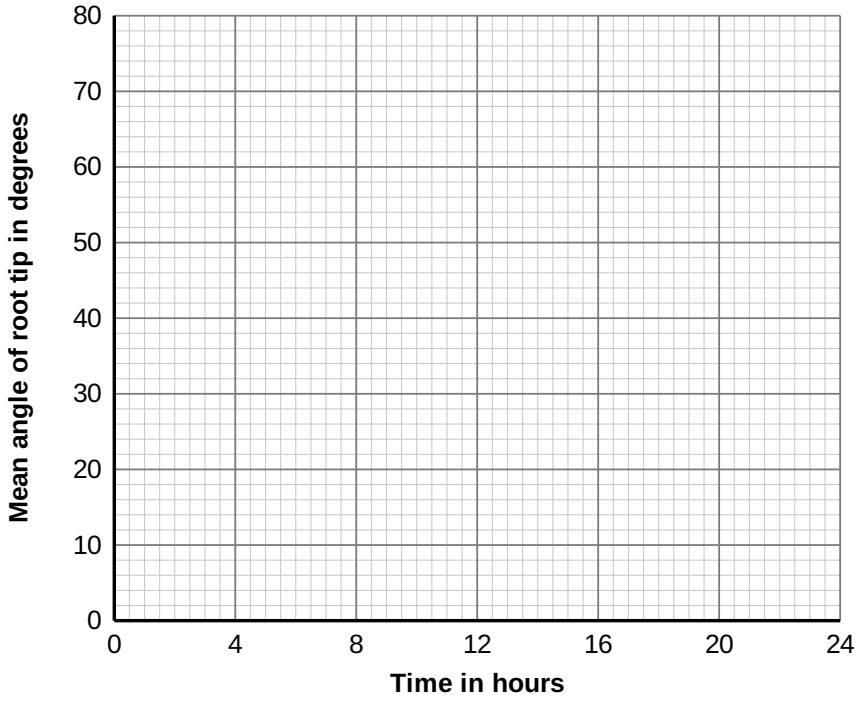
Table 2

Time in hours	0	4	8	12	16	20	24
Mean angle of root tip in degrees	0	10	24	40	55	66	72

0 5 . 2 Complete **Figure 5**: [3 marks]

- plot the data from **Table 2**
- draw a line of best fit.

Figure 5



0 5 . 3 Use your graph to estimate the time when the mean angle of the root tip was 45° [1 mark]

Time = ... hours

0 5 . 4 Explain why the roots grew downwards. [3 marks]

Refer to auxin in your answer.

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0 5 . 5 A clinostat is a machine that slowly turns seedlings round, so that gravity does not act on one side more than another. [2 marks]

Describe how the student could use a clinostat to show that gravity caused the roots to grow downwards.

Give the result you would expect.

0 5 . 6 Auxins are used as weedkillers. [1 mark]

Give **one** other use of auxins.

0 6 The levels of carbon dioxide and methane in the atmosphere are increasing. This contributes to global warming.

Scientists recorded the date when hawthorn trees in one area of the UK first flowered each year.

Table 3 shows the results.

Table 3

Decade	Mean temperature in March to May in °C	Mean date of first flowering in days after 1 January
1970s	8.2	128
1980s	8.5	126
1990s	9.2	120
2000s	9.6	116
2010s	9.9	111

0 6 . 1 Describe the relationship between the mean temperature and the mean date of first flowering. [2 marks]

Use data from **Table 3**.

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0 6 . 2 Calculate the mean change in the date of first flowering for each 1 °C rise in temperature between the 1970s and the 2010s. [2 marks]

Change = _____ days per °C

0 6 . 3 Hawthorn flowers are pollinated by insects. [2 marks]

Suggest how the hawthorn population could be affected if the insects still become active at the same time of year as they did in the 1970s.

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0 6 . 4 The scientists said that the data do not prove that the rise in temperature caused the hawthorn to flower earlier. [1 mark]

Give **one** reason why.

_____

_____

0 6 . 5 Give **three** other biological consequences of global warming. [3 marks]

1 _____

2 _____

3 _____

0 7 Alfred Russel Wallace and Charles Darwin both proposed the theory of evolution by natural selection.

0 7 . 1 Wallace is especially well known for his work on **two** areas of biology. [1 mark]

One area was speciation.

What was the other area?

_____

Question 7 continues on the next page

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0 7 . 2 Darwin published *On the Origin of Species* in 1859 [1 mark]

Give **one** reason why the theory of evolution by natural selection was only gradually accepted.

About 3 million years ago, a narrow strip of land formed between North America and South America.

The land divided a population of snapping shrimps into two populations: one in the Pacific Ocean and one in the Caribbean Sea.

0 7 . 3 The shrimps in the Pacific Ocean and the shrimps in the Caribbean Sea are now different species. [4 marks]

Explain how the two species developed from the original population.

Scientists put pairs of shrimps together in tanks to see whether they would produce offspring.

Table 4 shows the results.

Table 4

Pair of shrimps	Number of pairs tested	Number of pairs that produced offspring
Both from the Pacific Ocean	50	41
Both from the Caribbean Sea	50	39
One from each sea	60	3

Question 7 continues on the next page

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0 7 . 4 Calculate the percentage of the pairs with one shrimp from each sea that produced offspring. [2 marks]

Percentage = ... %

0 7 . 5 A student said: [2 marks]

'The results prove that the shrimps from the two seas are different species.'

Evaluate the student's statement.

Use **Table 4**.

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0 8 Scientists studied a food chain on a rocky shore.

seaweed ⟶ periwinkle ⟶ shore crab

0 8 . 1 What is the trophic level of the shore crab? [1 mark]

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0 8 . 2 The scientists collected all the seaweed, periwinkles and shore crabs from a 1 m^2 area of the shore. [2 marks]

They dried each sample in an oven at 80 °C and weighed it each day until the mass stopped changing.

Explain why the samples were dried until the mass stopped changing.

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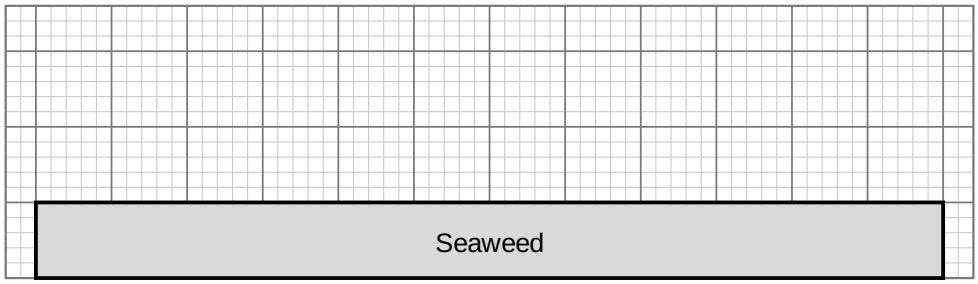
Table 5 shows the results.

Table 5

Organism	Dry biomass in g per m^2
Seaweed	600
Periwinkle	80
Shore crab	10

Figure 6 shows the bar for the seaweed in a pyramid of biomass. The scale is 1 small square = 10 g per m^2

Figure 6



0 8 . 3 Complete **Figure 6** to show the pyramid of biomass for this food chain. [3 marks]

Label each bar.

0 8 . 4 Calculate the efficiency of the transfer of biomass from the seaweed to the periwinkles. [2 marks]

Give your answer to 3 significant figures.

Efficiency = ... %

0 8 . 5 Seaweed that dies is broken down by decomposers. [2 marks]

Describe how decomposers obtain food from the dead seaweed.

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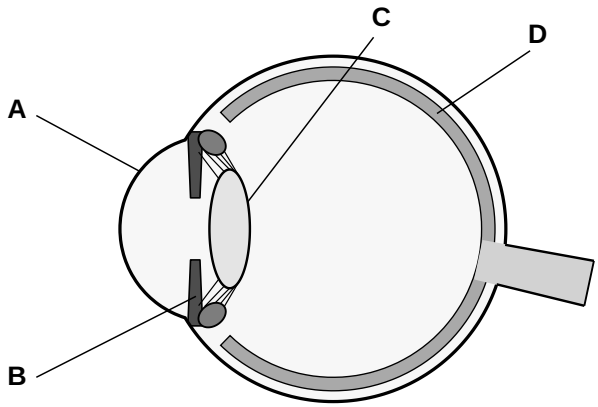
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0 9 **Figure 7** shows a section through the human eye.

Figure 7



0 9 . 1 Name parts **A**, **B** and **D**. [3 marks]

A .....

B .....

D .....

0 9 . 2 Part **C** changes shape when the eye focuses on objects at different distances. [3 marks]

A person is reading a book. The person then looks up at a mountain a long way away.

Describe how the eye changes so that the mountain is in focus.

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Question 9 continues on the next page

Myopia (short sight) is a common defect of the eye. In an eye with myopia, light from a distant object is brought to a focus in front of the retina.

Table 6 gives information about four ways of correcting myopia.

Table 6

Method	Cost	Risk of a serious problem	Other information
Glasses	£150 for each pair; a new pair is usually needed every 2 years	very low	can be lost or broken; can steam up
Soft contact lenses	£25 each month	eye infection in about 1 in 2500 users each year	cannot be seen when worn; must be kept very clean
Laser surgery to change the shape of the cornea	£2400, paid once	about 1 in 1000 operations	permanent; eyes may feel dry for a few months; not done on people under 18
Surgery to replace the lens	£4800, paid once	about 1 in 500 operations	permanent; usually used only for severe myopia

0 9 . 3 A 25-year-old person has mild myopia. [6 marks]

Evaluate the four ways of correcting the person's myopia.

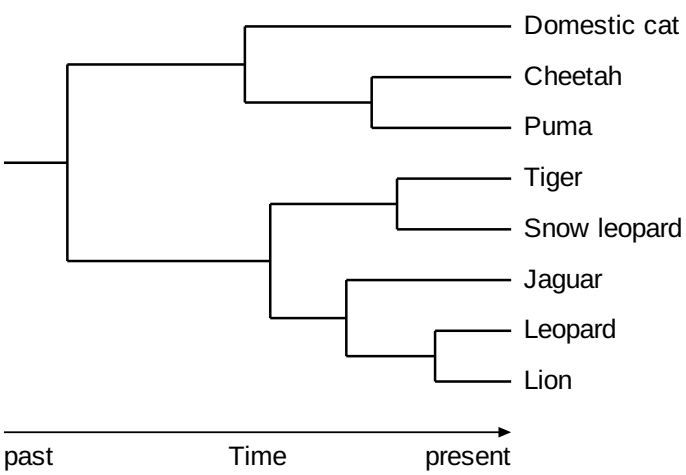
Use information from **Table 6**.

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1 0 **Figure 8** shows an evolutionary tree for some species in the cat family.

Figure 8



1 0 . 1 Which species is most closely related to the lion? [1 mark]

1 0 . 2 Explain how **Figure 8** shows that the cheetah is more closely related to the puma than to the lion. [2 marks]

Question 10 continues on the next page

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1 0 . 3 The scientific name of the lion is *Panthera leo*. [1 mark]

Suggest why scientists use scientific names rather than common names such as 'lion'.

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1 0 . 4 Evolutionary trees use evidence from fossils. [1 mark]

Give **one** reason why there are gaps in the fossil record.

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1 0 . 5 Cheetahs have very little genetic variation. [2 marks]

Explain why this puts cheetahs at risk of extinction.

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1 0 . 6 In 1900 there were about 100 000 cheetahs in the wild. In 2020 there were about 7100 [2 marks]

Calculate the mean decrease in the number of cheetahs each year between 1900 and 2020

Mean decrease = ... cheetahs per year

END OF QUESTIONS

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Additional page, if required.

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