Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | Candidate Number

Biology B

Advanced Subsidiary

Paper 2: Core Physiology and Ecology

Specimen Paper for first teaching September 2015

Time: 1 hour 30 minutes

Paper Reference

8BI0/02

You may need a ruler, a pencil and a calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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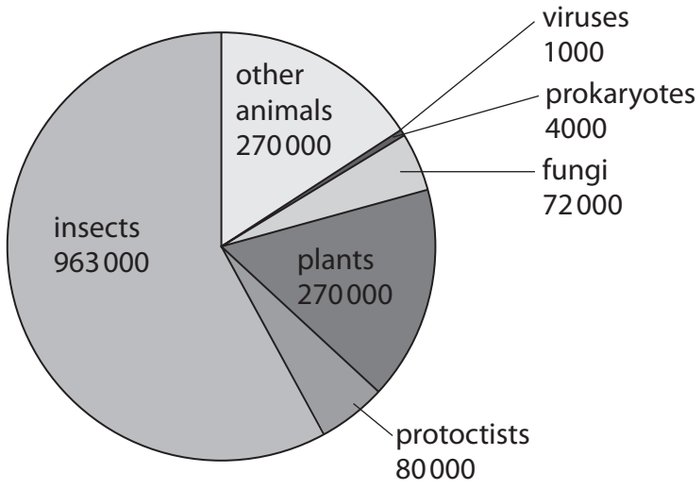
Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The chart shows the estimated number of different species of all organisms currently known.



(a) (i) Which of the following is the number of species in this chart that belong to the domain Eukarya?

(1)

☒ **A** 1 000

☒ **B** 85 000

☒ **C** 503 000

☒ **D** 1 655 000

(ii) Which of the following is the best definition of a species?

(1)

☒ **A** a group of organisms that produce fertile offspring

☒ **B** a group of organisms that occupy the same habitat

☒ **C** a group of organisms that have the same adaptations

☒ **D** a group of organisms that share common characteristics

(b) The chart was published in a journal.

Explain why the chart was peer reviewed before it was published.

(2)

(c) The following statement was written in the journal:

'It is thought that the process of speciation will generate even more species in the future'.

Explain what is meant by this statement.

(3)

(Total for Question 1 = 7 marks)

2 The fungus, *Cephalosporium maydis,* infects corn plants. This infection affects crop production.

Scientists obtained some young corn plants that had been grown in sterile soil and some young corn plants that had been grown in soil containing the fungus.

The scientists made a variety of measurements that are shown in the table.

Measurement	Plants grown in sterile soil	Plants grown in soil containing the fungus
Total number of vascular bundles containing phloem and xylem in stem samples	341	141
Mean cross sectional area of phloem per unit leaf area / $\mu m^2 cm^{-2}$	2500	700
Mean diameter of xylem vessels / μm	57.5	40.8
Mean transpiration rate of plants / $m\ s^{-1} \times 10^{-8}$	4.0	2.6

(a) Explain why infection by the fungus affects crop production.

(4)

(b) In this investigation, variables such as temperature and light intensity need to be controlled.

(i) Explain how temperature affects transpiration rate.

(2)

(ii) Explain how light intensity affects transpiration rate.

(2)

(Total for Question 2 = 8 marks)

3 Some snakes bite their prey and inject venom. The venom is sometimes lethal.

(a) A man was bitten by a snake. The snake venom circulated in his blood.

(i) Which of the following shows the flow of blood through his heart?

(1)

☒ **A** left atrium → bicuspid valve → left ventricle

☒ **B** left atrium → tricuspid valve → right ventricle

☒ **C** left ventricle → bicuspid valve → left atrium

☒ **D** left ventricle → tricuspid valve → left atrium

(ii) The snake venom circulated in the man's blood by mass transport.

Explain why this is more effective at killing prey than diffusion.

(3)

(b) In an investigation, scientists estimated the toxicity of venom from different species of snake. They did this by measuring the dose that can kill 50% of mice after injection with the venom.

This dose is called the LD_{50}.

Two scientists, P and Q, investigated the LD_{50} values for the venom produced by each snake.

Their results are shown in the table.

Scientist	Species of snake	LD_{50}
P	*Ophiophagus hannah*	0.125 mg kg^{-1}
	Oxyuranus scutellatus	0.013 mg kg^{-1}
Q	*Crotalus scutulatus*	30.0 μg kg^{-1}
	Daboia russelii	80.0 μg kg^{-1}

Scientist P measured the toxicity in mg kg^{-1} and scientist Q measured the toxicity in μg kg^{-1}.

(i) Name the species with the most toxic venom.

(1)

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(ii) The venom of one species of snake can kill a human by activating a substance called factor X. This causes prothrombin in the plasma to change to its active form.

Explain why this venom can be lethal.

(4)

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(Total for Question 3 = 9 marks)

4 A student investigated the effect of ethanol on beetroot cell membranes.

The following method was used.

- a beetroot was cut into small cubes
- one of the small cubes of beetroot was then placed into a test tube of ethanol solution
- this test tube was incubated for 20 minutes
- a colorimeter was used to measure the absorbance of the red pigment released from the beetroot tissue into the ethanol solution
- this procedure was repeated using four other ethanol concentrations
- a control was also carried out using water alone
- the investigation was repeated three times

The table shows the results obtained.

Ethanol concentration (%)	Mean absorbance
0	0.14
2	0.17
5	0.15
10	0.25
20	0.26
40	1.65

(a) Analyse the data to explain the effect of ethanol on beetroot cell membranes.

(3)

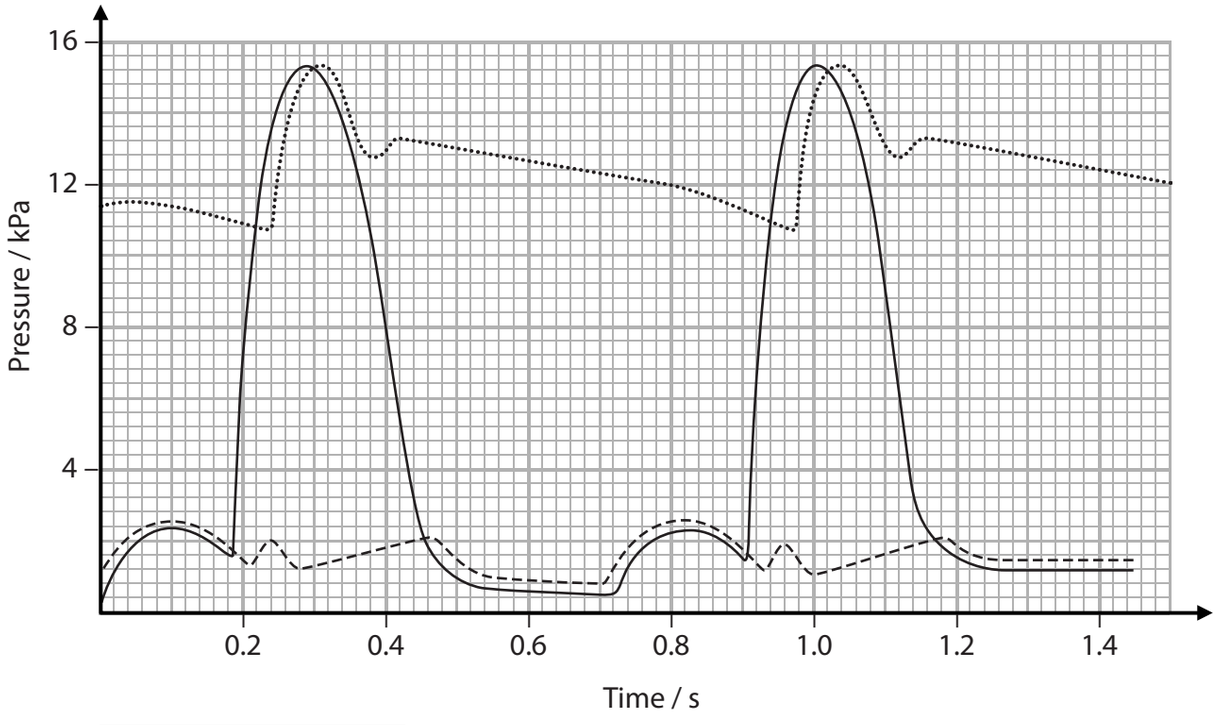
(b) Describe how this method could be improved so that a valid conclusion can be made.

(4)

(Total for Question 4 = 7 marks)

5 During the cardiac cycle, there are pressure changes in the left atrium, left ventricle and aorta.

The graph shows these pressure changes.



Key

..... aorta

——— left ventricle

– – – – – left atrium

(a) (i) Which of the following statements is correct?

(1)

☒ **A** the pressure in the left ventricle is always higher than in the aorta

☒ **B** the highest pressure in the left atrium causes an increase in pressure in the aorta

☒ **C** the time taken for the pressure to change from its lowest value to its highest value is greatest in the left ventricle

☒ **D** the increase in pressure in the left atrium at 0.24 s causes the increase in pressure in the left ventricle

(ii) Which of the following is occurring in the heart at 1.0 s on the graph?

(1)

		Semilunar valve	Atrioventricular valve
☒	**A**	closed	closed
☒	**B**	closed	open
☒	**C**	open	closed
☒	**D**	open	open

(iii) Use the information in the graph to calculate the heart rate of this person.

(2)

Answer ..... beats per minute

(b) When the heart valves close, they make a sound. Doctors listen to this sound using a stethoscope.

(i) State a time from the graph when the sound of a semilunar valve closing would be heard.

(1)

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(ii) Explain why the semilunar valves close.

(2)

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(Total for Question 5 = 7 marks)

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6 An investigation was carried out to study the effect of dietary salt on systolic blood pressure.

A group of people had the salt content of their diet changed during a 12-week period.

The people had a diet containing 8 g day^{-1} of salt for four weeks. Their blood pressure was then measured.

The diet was then changed to 6 g day^{-1} of salt for four weeks. Their blood pressure was measured again.

Finally, the diet was changed to 4 g day^{-1} of salt for four weeks. Their blood pressure was measured again.

The table shows the results of this investigation.

Mass of salt in diet / g day^{-1}	**Mean systolic blood pressure / kPa**
8	17.7
6	17.3
4	16.8

(a) Which of the following is the best explanation of the data in the table?

(1)

☒ **A** less salt decreases the water potential of plasma

☒ **B** less salt increases the water potential of plasma

☒ **C** less salt decreases the water potential of erythrocytes

☒ **D** less salt increases the water potential of erythrocytes

(b) Explain how an increase in dietary salt can lead to the development of atherosclerosis.

(5)

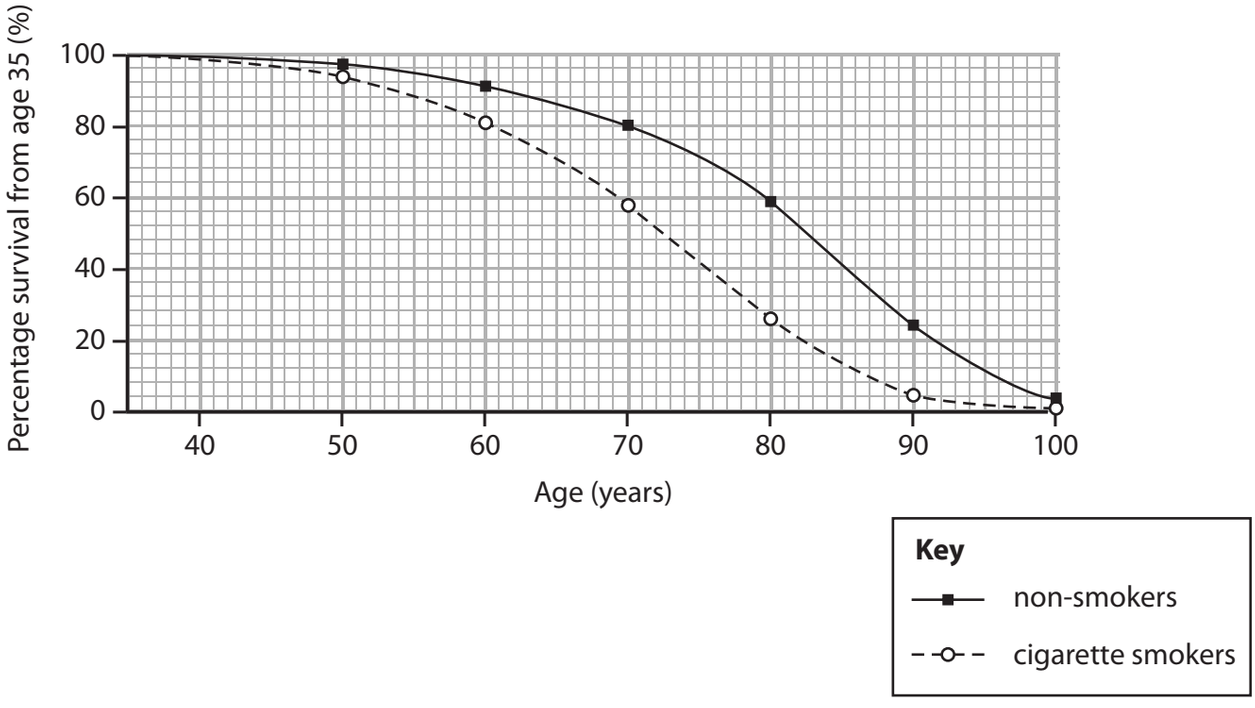
(c) The development of atherosclerosis can affect life expectancy.

Cigarette smoke is another factor that increases the risk of developing atherosclerosis.

A study investigated the effect of cigarette smoking on the life expectancy of 35 year old males.

The percentage survival of 17000 male smokers and 17000 male non-smokers was measured for a period of 65 years.

The graph shows the results of this study.



(i) The probability of death for non-smokers before the age of 70 is 1 in 5.

Calculate the probability of death before the age of 70 for smokers.

(2)

Answer .....

(ii) It was concluded from this study that smoking decreases life expectancy.

Criticise the validity of this conclusion.

(4)

(Total for Question 6 = 12 marks)

7 (a) Body size can affect gas exchange in insects.

The photograph shows a great green bush cricket, *Tettigonia viridissima*.

This animal is 4.5 cm long and is the largest insect found in the UK.

Explain why the gas exchange system in insects limits their maximum body size.

(2)

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(b) A student investigated the effect of oxygen and carbon dioxide on the breathing rate of an insect.

The insect was placed in either atmospheric air, exhaled human air, pure oxygen or a gas mixture. Its breathing rate was then measured.

The table shows the results of this investigation.

	Atmospheric air	**Exhaled human air**	**Pure oxygen**	**Gas mixture**
Oxygen (%)	21.0	16.4	100.0	94.0
Carbon dioxide (%)	0.1	4.1	0.0	6.0
Breathing rate / breaths min^{-1}	52.6	97.4	15.4	90.6

(i) The data suggests that the breathing rate in this insect is increased by

(1)

☒ **A** carbon dioxide

☒ **B** oxygen

☒ **C** carbon dioxide and oxygen

☒ **D** neither carbon dioxide nor oxygen

(ii) Describe how the student should treat this insect in an ethical manner during this investigation.

(2)

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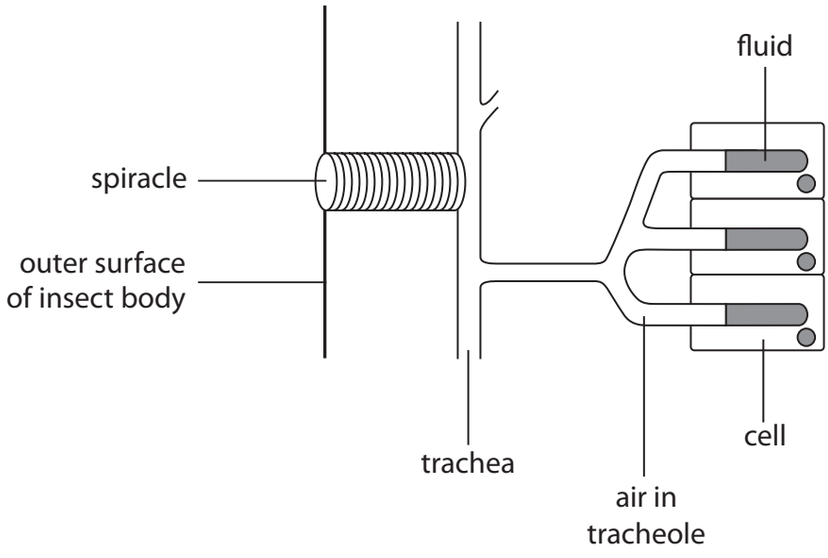
(c) Each individual cell in an insect's body is supplied with oxygen from a tracheole.

The diagram shows the appearance of tracheoles in a resting insect.



(i) The diameter of a tracheole is 1μm.

Calculate the magnification of the tracheoles in this diagram.

(2)

Answer .....

(ii) The concentration of lactic acid in the cytoplasm of the cells is higher when the insect is active.

This can change the volume of fluid in the ends of the tracheoles.

Explain how an increase in the concentration of lactic acid will affect gas exchange between the tracheoles and the cells in an active insect.

(5)

(Total for Question 7 = 12 marks)

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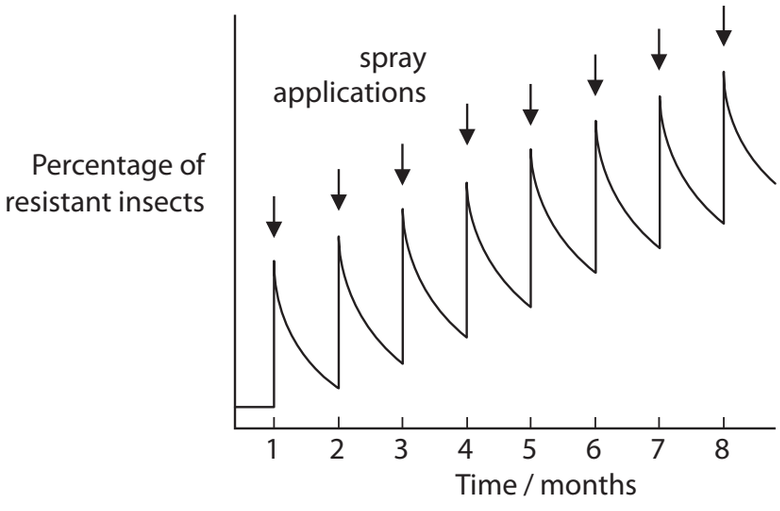
8 Insect pests feed on crops. Insecticides are chemicals that are sprayed onto fields to kill these insect pests.

Some of these insects are not killed by insecticide. These insects are said to be resistant.

In an investigation into insect resistance, an insecticide was sprayed onto fields at monthly intervals for eight months.

The percentage of resistant insects in the population was calculated during the eight months.

The graph shows the results of this investigation.



(a) Analyse the data to explain the change in the percentage of resistant insects in the population during the eight months.

(5)

(b) The use of insecticides can affect the species biodiversity in a habitat.

A student investigated the effect of an insecticide on the species biodiversity in a hedge.

She counted the number of individuals of four different species, P, Q, R and S, found in a section of the hedge.

She then sprayed this section of hedge with insecticide. After a period of time, she counted the number of individuals of the same four species.

She repeated this for other sections of this hedge.

The table shows the results of this investigation.

Species	Mean number of individuals in section of hedge before insecticide	Mean number of individuals in section of hedge after insecticide
P	23	2
Q	28	2
R	22	1
S	27	93
Total	100	98

The student used these data to calculate an index of diversity, (D).

$$D = \frac{N(N-1)}{\Sigma n(n-1)}$$

N = total number of organisms of all species

n = total number of organisms of a particular species

(i) The calculated value of D before spraying with insecticide was 4.08.

Calculate the index of diversity after spraying with insecticide.

(2)

Answer .....

(ii) The student concluded that spraying with insecticide will reduce species diversity.

Describe **two** features of this investigation that affect the validity of this conclusion.

(2)

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(Total for Question 8 = 9 marks)

9 Deer mice, *Peromyscus maniculations*, are small mammals.

The photograph shows a deer mouse.

http://pixgood.com/peromyscus-maniculatus.html

(a) Which row in the table describes the correct classification of a deer mouse?

(1)

	Domain	Genus
☒ **A**	Archaea	*Peromyscus*
☒ **B**	Eukarya	*Peromyscus*
☒ **C**	Archaea	*maniculations*
☒ **D**	Eukarya	*maniculations*

(b) Red blood cells in deer mice contain haemoglobin to transport oxygen in the blood.

(i) Describe the structure of haemoglobin.

(2)

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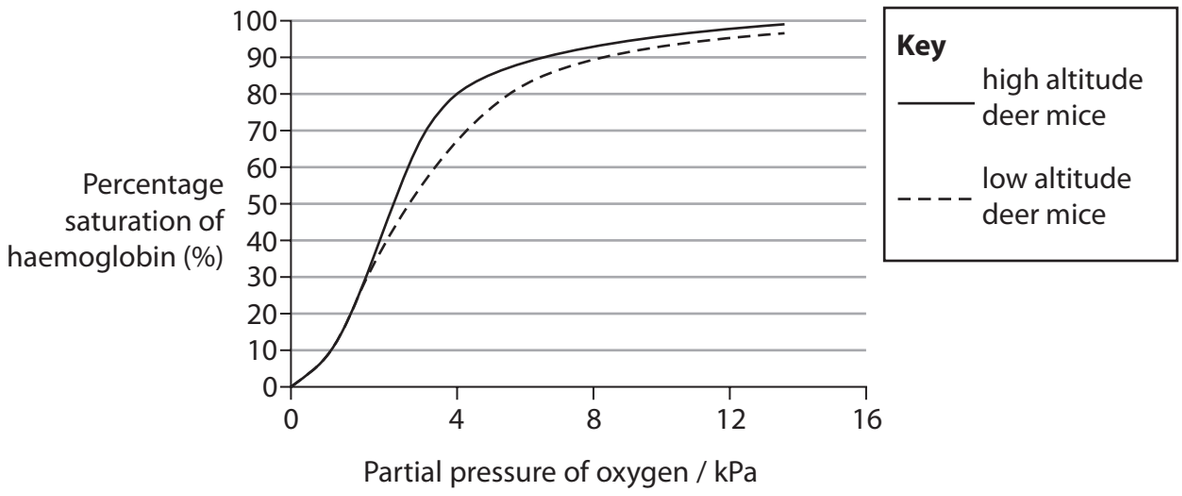
*(ii) Deer mice can live at high altitude or at low altitude.

The graph shows the oxygen dissociation curves for haemoglobin in deer mice that live at high altitude and for deer mice that live at low altitude.



Compare and contrast the shape of these oxygen haemoglobin dissociation curves.

(6)

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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