Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3400U20-1

Z22-3400U20-1-R1

TUESDAY, 17 MAY 2022 – MORNING

BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms

FOUNDATION TIER

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**10**	
2.	**8**	
3.	**10**	
4.	**8**	
5.	**12**	
6.	**12**	
7.	**9**	
8.	**11**	
Total	**80**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **4**(a) is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions.

1. Cystic fibrosis (CF) is an inherited condition caused by a DNA mutation.

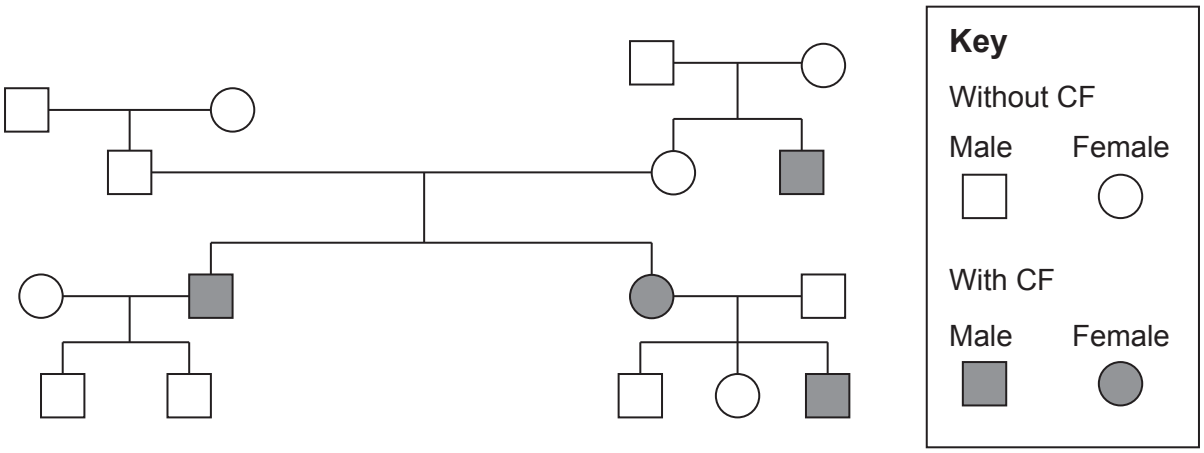
(a) **Complete the sentences** by selecting your answers from the words below. [3]

radiation	**increase**	**random**	**prevent**	**regular**

A mutation is a ..... change in DNA.

Ionising ..... can ..... the rate of mutations.

(b) In the family tree below, some people have CF.



(i) Calculate the **percentage of people** in this family tree who have CF. [2]

Percentage = ... %

(ii) State how many males and females in this family tree have CF. [1]

Males = ...

Females = ...

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(iii) In the whole population of the UK,

- 0.01% of people have CF
- The ratio of males to females is 1 : 1

From your answers to (i) and (ii), give **two** ways in which this family is different from the whole population of the UK: [2]

I. .....

II. .....

(c) CF affects the lungs.

In a treatment, patients with CF are given DNA which does not have the CF mutation.

Complete the following sentences by underlining the correct word. [2]

(i) The treatment is called:

chemotherapy

gene therapy

physiotherapy

(ii) The DNA is given to the patient by:

injection

infusion

inhalation

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2. **Images 2.1A and 2.1B** show the hazel dormouse *(Muscardinus avellanarius)* in winter and summer.

Image 2.1A

winter

thick fur covering the body and long tail

Image 2.1B

summer

grasping feet with claws

large eyes for seeing in dim light

- Dormice are nocturnal (active only at night).
- In summer, they live high up in trees and bushes, eating berries and insects.
- In winter, they hibernate (being completely inactive) and keep warm in nests at ground level.
- Between the years 2000 and 2020 the dormouse population in the UK decreased and it became an endangered species in some areas.
- In 2000, as part of a local action plan, 1 000 dormice were released into an area and their numbers later increased to 1 050.

Use the information to answer the following questions.

(a) State **one** way in which the dormouse **body structure** is adapted to: [3]

(i) survive in low temperatures;

.....

(ii) climb in branches of trees;

.....

(iii) look for food at night.

.....

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(b) State **one** way in which the **behaviour** of the dormouse helps it to survive in its environment. [1]

.....

(c) Using the information, complete the table by writing true or false for each statement. [4]

Statement about the hazel dormouse	True or false
Its habitat is woodland.	true
It eats only plants.	.....
The species became extinct in the UK in 2020.	.....
It does not hunt for food in daylight.	.....
As a result of a local action plan, numbers increased by 5%.	.....
It belongs to the genus *Muscardinus*.	.....

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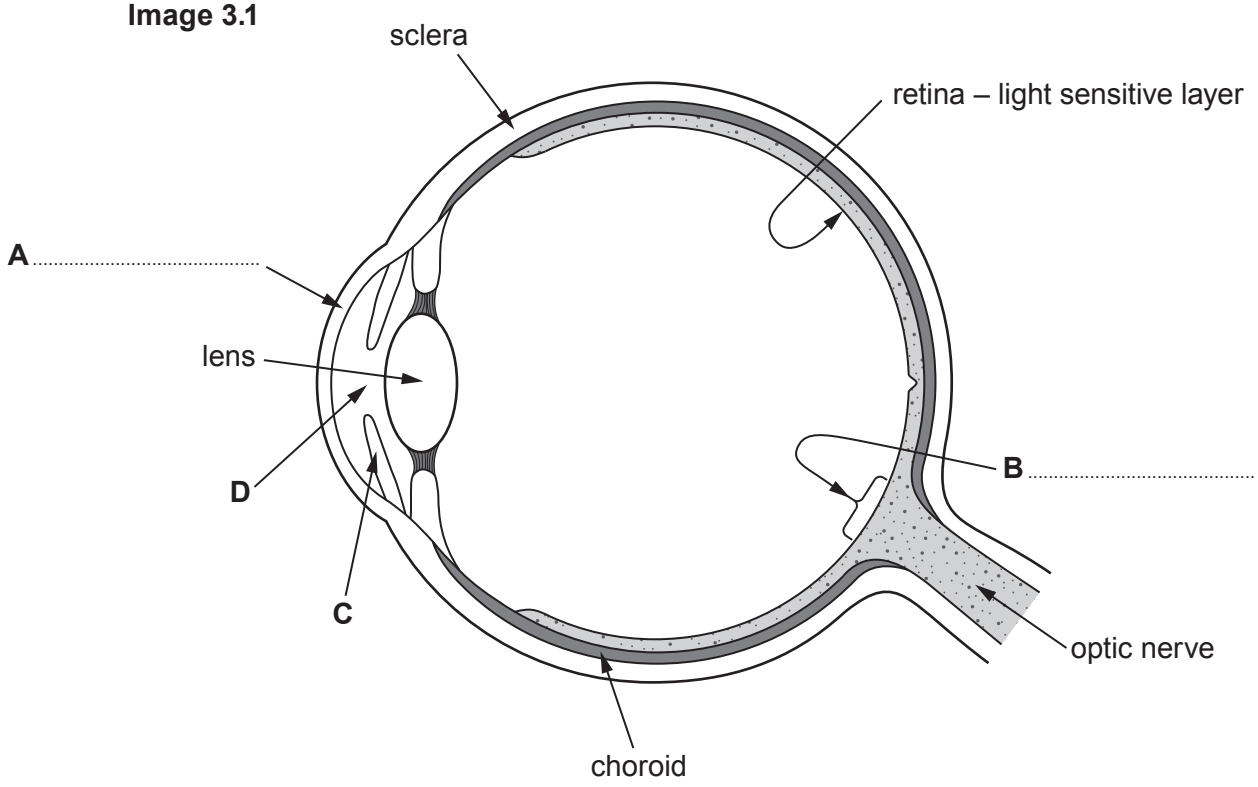
3. (a) **Complete the sentence** by selecting your answers from the words below. [2]

brain	**muscles**	**spinal cord**	**nerves**

The central nervous system consists of the ..... and the ..... .

(b) **Image 3.1** shows a section through the human eye.

Image 3.1



(i) **Label** parts **A** and **B** on **Image 3.1**. [2]

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(ii) Using some labels from **Image 3.1**, **complete Table 3.2** by stating the parts of the eye which match the functions. [3]

Table 3.2

Part of the eye	Function
.....	changes shape to focus light
.....	prevents reflection of light
.....	carries nerve impulses to the brain

(iii) Joanna leaves a dark room and goes out into bright sunlight.

Explain how parts **C** and **D** in **Image 3.1** change in order to control how much light enters her eyes when she goes into bright sunlight. [3]

.....

.....

.....

.....

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Turn over.

4. Serious kidney failure can be treated using a dialysis machine or by a transplant from a donor. **Table 4.1** shows a fact file about the treatment of kidney failure.

Table 4.1

Fact file – Treatment of Kidney Failure		
	Dialysis	Transplant
Percentage of patients surviving after five years	35	97
Waiting time for treatment	2 – 3 weeks	3 – 4 years
Usual time spent in hospital	3 days every week for life	one 5-day stay for an operation
Procedure	needles inserted into blood vessels	major surgery
Drugs	anti-rejection drugs not required	anti-rejection drugs needed for life
Diet	special low-salt foods and restricted fluid intake	normal balanced diet and normal fluid intake
Employment and sports	very limited choice	most types of jobs and many sports can be done

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(a) Using the information in **Table 4.1** and your own knowledge:
Describe the **advantages** of treating kidney failure by a transplant.
Describe the **advantages** of treating kidney failure by dialysis.
Suggest how more people could be encouraged to become donors and explain why this is necessary. [6 QER]

(b) Explain why the tissue type of the patient and the donor kidney must be tested before a transplant operation is carried out. [2]

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5. (a) **Complete the following** description of Type 2 diabetes by filling in the missing words. [3]

In Type 2 diabetes, body cells do not respond to the hormone ..... which is produced by the ..... and so the level of ..... in the blood becomes too high.

(b) Researchers in Spain stated the following hypothesis.

'Drinking coffee reduces the risk of having Type 2 diabetes, high blood pressure and obesity.'

- Scientists working for a large chain of coffee shops carried out an investigation to test this hypothesis.
- They used 2000 volunteers, 1000 of whom drank coffee every day and the other 1000 who never drank coffee.
- They recorded the number of volunteers from each group who had Type 2 diabetes, had high blood pressure or were obese.

The results of the investigation are shown in **Table 5.1**.

Table 5.1

Condition	Number of volunteers with the condition	
	Coffee drinkers	Non-coffee drinkers
Type 2 diabetes	100	100
High blood pressure	280	420
Obesity	340	460

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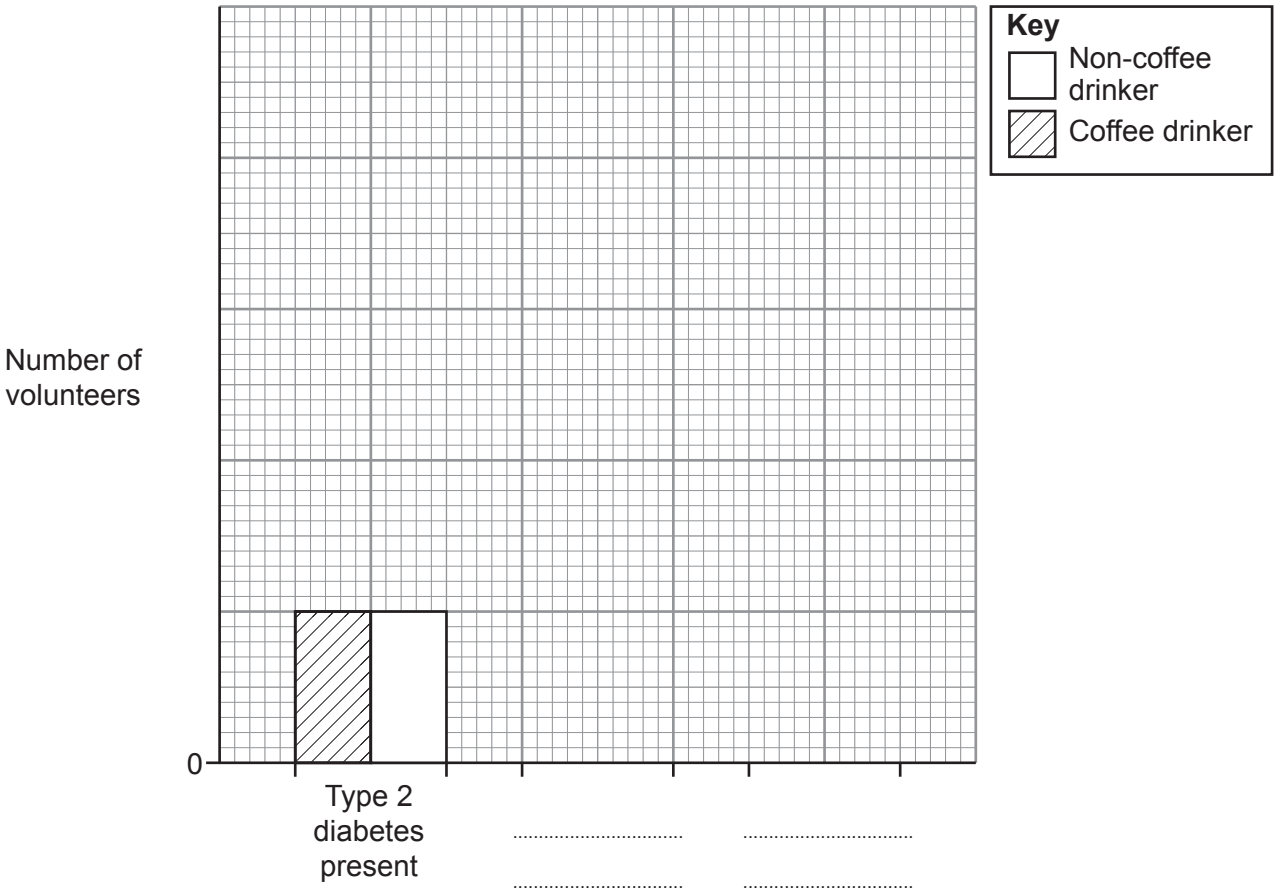
(i) Complete the bar chart in **Graph 5.2** by: [4]

I. adding a scale for numbers of volunteers.

II. drawing bars of the results for high blood pressure and obesity.

III. labelling your bars.

Graph 5.2



(ii) The scientists concluded that the hypothesis was only partly supported. Give the reasons for this conclusion. [2]

.....

.....

.....

.....

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(iii) State **one** way in which the scientists should have ensured that the investigation was a fair test. [1]

.....

.....

(iv) A doctor said that she did not have confidence in the results because the investigation was biased. [1]

Give **one** reason to support this point of view.

.....

.....

(c) In 2019 the cost to NHS Wales of medical treatments for Type 2 diabetes was £500 million.

Suggest **one** lifestyle change which individuals can make to reduce the risk of developing Type 2 diabetes. [1]

.....

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6. Limpets *(Patella vulgata)* are animals without backbones which live on rocky seashores, feeding on plants.

Photograph of limpets

(a) State the scientific term for animals which do not have backbones. [1]

.....

(b) Students investigated the density of limpets (number per m^2) on two rocky shores in Anglesey. One shore was sheltered and one was exposed to heavy wave action.

A sheltered shore

An exposed shore

Students' method:

- Select a section on each shore of 300 m^2.
- Place quadrats, each of area 1 m^2, at 10 random co-ordinates in each of the two shore sections and collect data.
- Compare the data for the two shores.

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(i) **Table 6.1** shows one part of the students' risk assessment for the investigation.

Complete Table 6.1. [1]

Table 6.1

Hazard	Risk	Control measure
Sharp edges on rocks	.....	.....
	.....	.....
	.....	.....

(ii) Describe in detail the techniques the students should use to **place their quadrats at random** and **collect data**. [3]

.....

.....

.....

.....

.....

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The results of the investigation are shown in **Tables 6.2 and 6.3**.

Table 6.2

Number of limpets on exposed shore:

Quadrat number	1	2	3	4	5	6	7	8	9	10	Mean number per m^2	Estimated total number in the 300 m^2 section of shore
Number of limpets	26	21	22	18	5	21	17	23	19	26	19.8	5940

Table 6.3

Number of limpets on sheltered shore:

Quadrat number	1	2	3	4	5	6	7	8	9	10	Mean number per m^2	Estimated total number in the 300 m^2 section of shore
Number of limpets	30	22	26	31	28	25	23	19	31	26	.....	.....

(iii) **Complete Table 6.3 for the sheltered shore** by calculating: [3]

I. The mean number of limpets per m^2.

II. The estimated total number of limpets in the 300 m^2 section of the shore.

Space for working

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(iv) I. From these results, state what the students could conclude about the density of limpets when they compared the two shores. [1]

.....

.....

II. Suggest an explanation for this observation. [1]

.....

.....

(v) State which of the quadrats (1 – 10) from the exposed shore shown in **Table 6.2** had an anomalous result and describe what should have been done to take account of this. [2]

.....

.....

.....

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7. Biological control is used to reduce the numbers of a pest population through the introduction of another species. It has been used with varying success since the 19th century.

(a) (i) State **two** advantages of this method of control. [2]

Advantage 1

.....

.....

Advantage 2

.....

.....

(ii) State **two** disadvantages of this method of control. [2]

Disadvantage 1

.....

.....

Disadvantage 2

.....

.....

(b) The whitefly *(Trialeurodes vaporariorum)* is a pest which damages greenhouse crops such as tomatoes. Whitefly numbers can be reduced by using the biological control agent *Encarsia formosa*.

***Encarsia formosa* fact file**

- *E. formosa* is a tiny wasp that lays eggs inside developing whitefly.
- When the eggs hatch, the young wasps kill the developing whitefly from the inside.
- Optimal conditions for *E. formosa* are temperatures over 20°C.
- When daytime temperatures are less than 17°C, *E. formosa* activity is significantly reduced, making it less effective.

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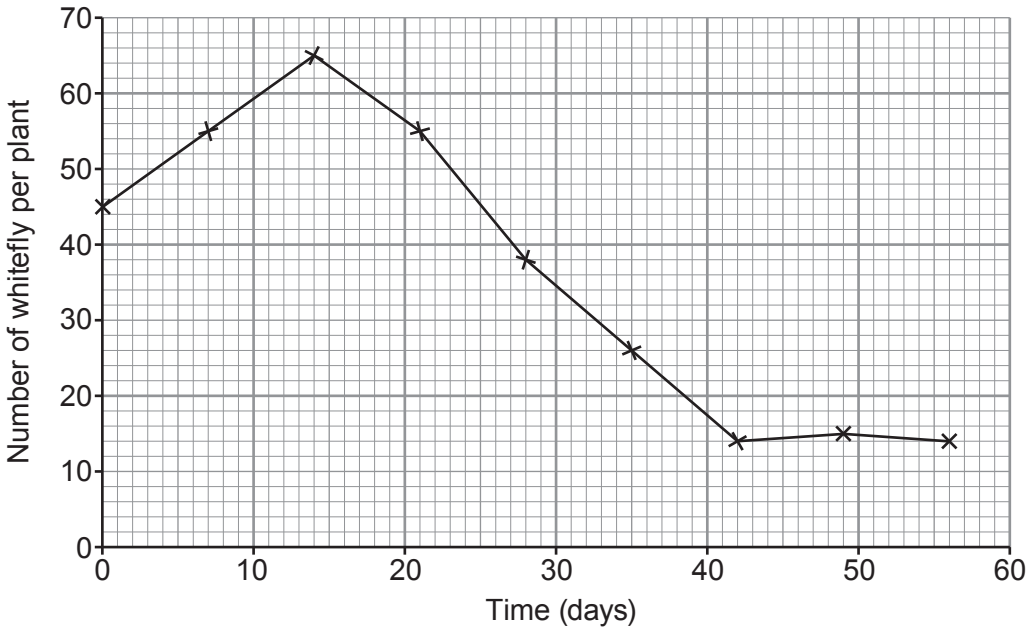
Graph 7.1 shows the number of whiteflies in a greenhouse containing tomato plants. *E. formosa* were introduced on day 7.

Graph 7.1



(i) I. The use of *E. formosa* to reduce the number of whiteflies is considered to be successful when there are 20 or fewer whiteflies per plant. Use **Graph 7.1** to determine how many days it took for the number of whiteflies to fall to 20 following the introduction of *E. formosa*. [2]

..... days

II. Suggest a reason why it took this long for the number to fall to 20. [1]

.....

.....

(ii) Suggest **one** reason why this method of pest control would not be effective to use if whiteflies damaged wheat crops grown in Wales. [1]

.....

.....

.....

.....

(iii) An alternative approach to reducing pest numbers is to use pesticide. State why it is not appropriate to use pesticide along with *E. formosa*. [1]

.....

.....

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Turn over.

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8. Hair length in cats is controlled by a pair of alleles. The allele for short hair **(H)** is dominant to the allele for long hair **(h)**.

(a) State what is meant by the terms:

(i) allele; [1]

.....

.....

(ii) dominant; [1]

.....

.....

(iii) recessive. [1]

.....

.....

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(b) (i) A cat breeder crossed a homozygous short-haired cat with a long-haired cat. **Complete the Punnett square** to show the predicted genotypes of the offspring. Use the letters **H** and **h** for the alleles. [2]

Gametes		

(ii) State the **phenotype** of the offspring in the F1 generation. [1]

.....

(iii) **Complete the Punnett square** to show the possible genotypes of the offspring if two of the F1 offspring were crossed. [2]

Gametes		

(iv) Using the results from (b)(iii), state how many kittens would be predicted to be short-haired in a litter of 8 kittens. [1]

.....

(v) The cat breeder wanted to determine whether one of the short-haired cats was homozygous or heterozygous. She decided to breed the short-haired cat with a long-haired cat. Predict the phenotypes of the offspring you would expect if the short-haired cat was:

I. Homozygous [1]

.....

II. Heterozygous [1]

.....

END OF PAPER

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