Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY

5090/22

Paper 2 Theory

May/June 2019

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions in this section.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **both** questions in this section.
Write your answers in the spaces provided on the Question Paper.

Section C
Answer **either** question 8 **or** question 9.
Write your answers in the spaces provided on the Question Paper.

You are advised to spend no longer than one hour on Section A.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Section A

Answer **all** questions in this section.

Write your answers in the spaces provided.

1 Food supplements are substances that are often added to a person's diet. These supplements may be in the form of a tablet.

The diagram shows the label from a food supplement.

To be taken with a balanced diet.

Components:

- Amylase
- Cellulase
- Lipase
- Protease

This supplement may be taken by a person whose pancreas is not producing enough of some of the components shown on the label.

(a) (i) State the type of chemical that the supplement contains.

Enzymes (biological catalyst) [1]

(ii) Each food group in the diet is the substrate for a specific component of the supplement.

Complete the table by writing the most appropriate word or words in each box.

component of supplement	substrate	end product or products
amylase	Starch	glucose
protease	Protein	amino acids
lipase	lipids (fats and oils)	fatty acids and glycerol

[3]

(iii) Cellulase is a component of the supplement that is **not** usually found in the human body.

Use your knowledge of the structure of a plant cell to suggest the function of the cellulase component of the supplement.

Cellulase helps to digest cellulose into simple sugars [2]

(b) The supplement is taken in the form of a tablet that is swallowed.

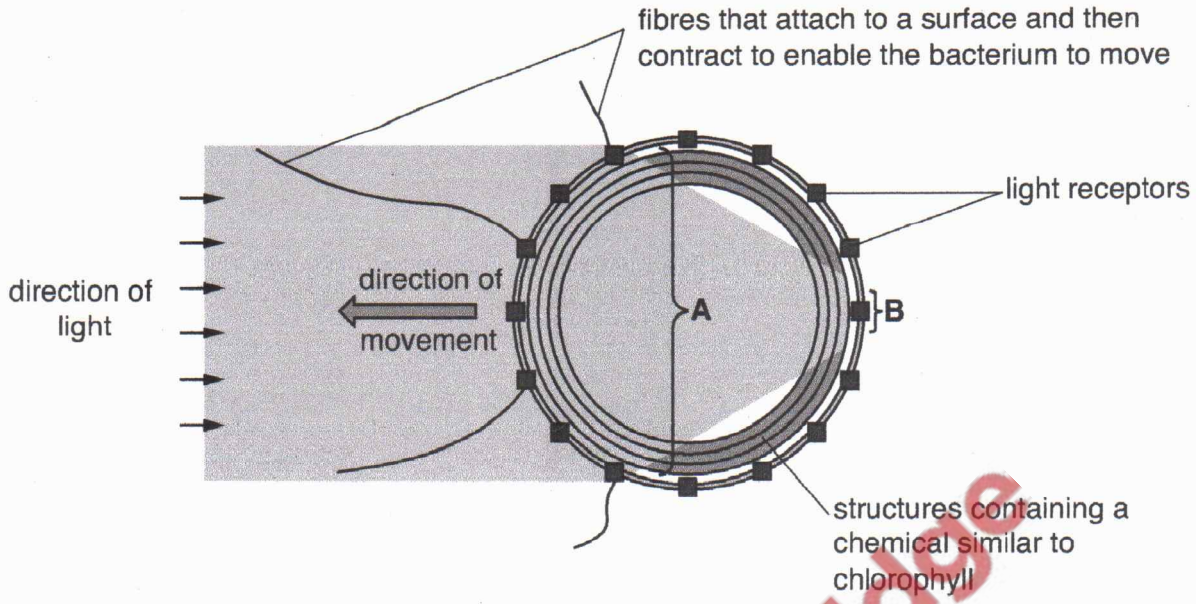
Each tablet is covered in a substance that breaks down **only** in alkaline conditions to release the components of the supplement.

Suggest why this covering is important if the supplement is to work effectively in the alimentary canal.

The pH of the stomach is below 7 due to the presence hydrochloric acid. This implies the tablet does not break down in the stomach. This reduces chances of the destruction of the drug by enzymes.
The tablet breaks down to release its contents at pH above 7 in the duodenum. [3]

[Total: 9]

2 The diagram shows the structure of a type of bacterium and details of the response of the bacterium to light.



(a) Use information in the diagram to suggest:

(i) the sequence of events that takes place when the bacterium is provided with light from the direction shown

Light entering the bacterium is converged and detected by receptors. The fibres attached to a surface contract to enable the bacterium to move towards the light.

[3]

(ii) the advantage to the bacterium of responding to light in this way.

This allows for more light to reach the chlorophyll. The more light is traped by chlorophyll, the greater the rate of photosynthesis. This means more glucose will be produced.

[2]

(b) There are similarities between the functions of parts of the bacterium and the functions of structures found in the human eye.

Suggest which structure in the human eye has a function similar to each of the following regions of the bacterium.

A Lens – bends light (refraction)

B Retina – Screen where images are formed

[2]

(c) The type of bacterium shown in the diagram fixes nitrogen.

Describe the role of bacteria in nitrogen fixation.

They use nitrogen in atmosphere together with air to make ammonium ions.

N_2 Nitrifying bacteria NH_4^+

..... [2]

(d) The enzyme that these bacteria use to fix nitrogen is destroyed in the presence of oxygen.

(i) Suggest why destruction of this enzyme is likely to occur in the type of bacterium in the diagram.

Photosynthesis in the bacteria lead to production of oxygen gas which destroys an enzyme.

..... [2]

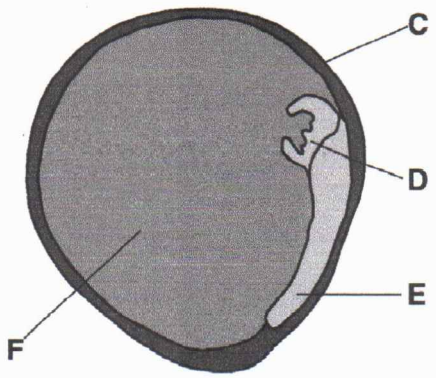
(ii) Suggest **one** adaptation that such bacteria may have developed to prevent the destruction of this enzyme.

Mutation to form form variants that can tolerate presence of oxygen.

..... [1]

[Total: 12]

3 The diagram shows the internal structure of a seed from a pea plant.



Seeds from a pea plant are non-endospermic.

(a) Identify each of parts **C** to **F**.

C testa

D plumule

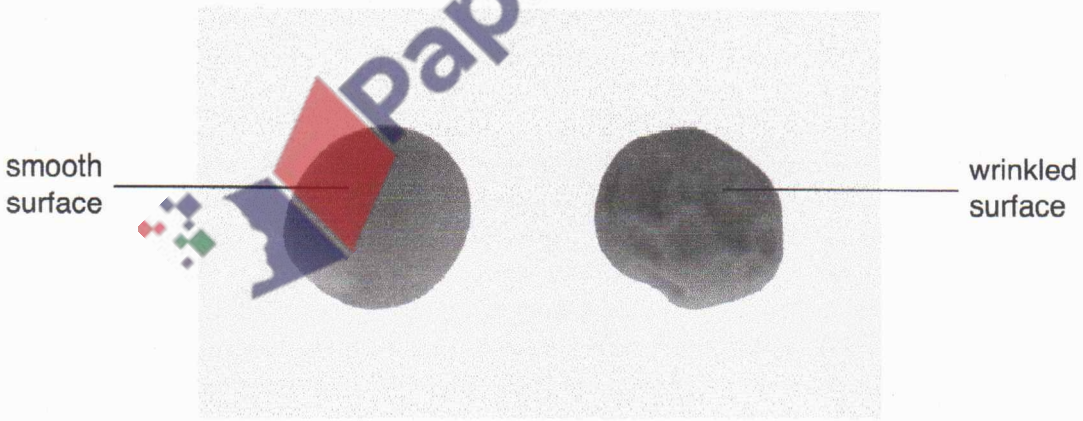
E radicle

F cotyledon

[4]

(b) The diagram below shows two seeds, one from each of two pea plants of the same species.

Seeds from this species of plant have either a smooth surface or a wrinkled surface.



The type of surface of a seed is controlled by a single gene. The allele of the gene that gives the seed a smooth surface (**R**) is dominant to the allele that gives the seed a wrinkled surface (**r**).

(i) Name the part of a cell that contains the genes.

Nucleus

[1]

(ii) Define each of the following terms:

gene Section of the DNA coding for a specific trait. Genes are hereditary; they are passed from parents to offspring

dominant allele An allele is an alternative form of a gene. An allele is dominant if only one copy is present

[4]

(iii) One pea plant, **H**, has a homozygous genotype that develops seeds with a wrinkled surface. Another pea plant, **J**, has an unknown genotype.

When these two plants were cross-pollinated, approximately half of the new plants produced had peas with a wrinkled surface.

Complete the genetic diagram below for this cross **and** state the genotype of pea plant **J**.

gametes of pea plant **J** \ gametes of pea plant **H**	r	r
R	Rr	Rr
r	rr	rr

genotype of pea plant **J**: Heterozygous

[3]

[Total: 12]

4 The photograph shows a species of tree frog.

Each tree frog of this species is either **grey** or **green** in colour.

The following are true for **both** grey and green tree frogs. They:

- eat insects
- live above the ground in vegetation
- live near water and lay their eggs in small pools
- are sometimes eaten by snakes and birds.

Grey tree frogs are more commonly found in areas where there are many trees with grey bark.

Green tree frogs are more commonly found in areas where there are many swamp and marsh plants with green leaves.

(a) State the type of variation shown by the colour of these tree frogs.

discontinous variation

[1]

(b) Tree frogs eat insects which are herbivores.

(i) State the meaning of the term *herbivore*.

Animals that feed on producers [1]

(ii) State the trophic level of the tree frogs.

Secondary consumer [1]

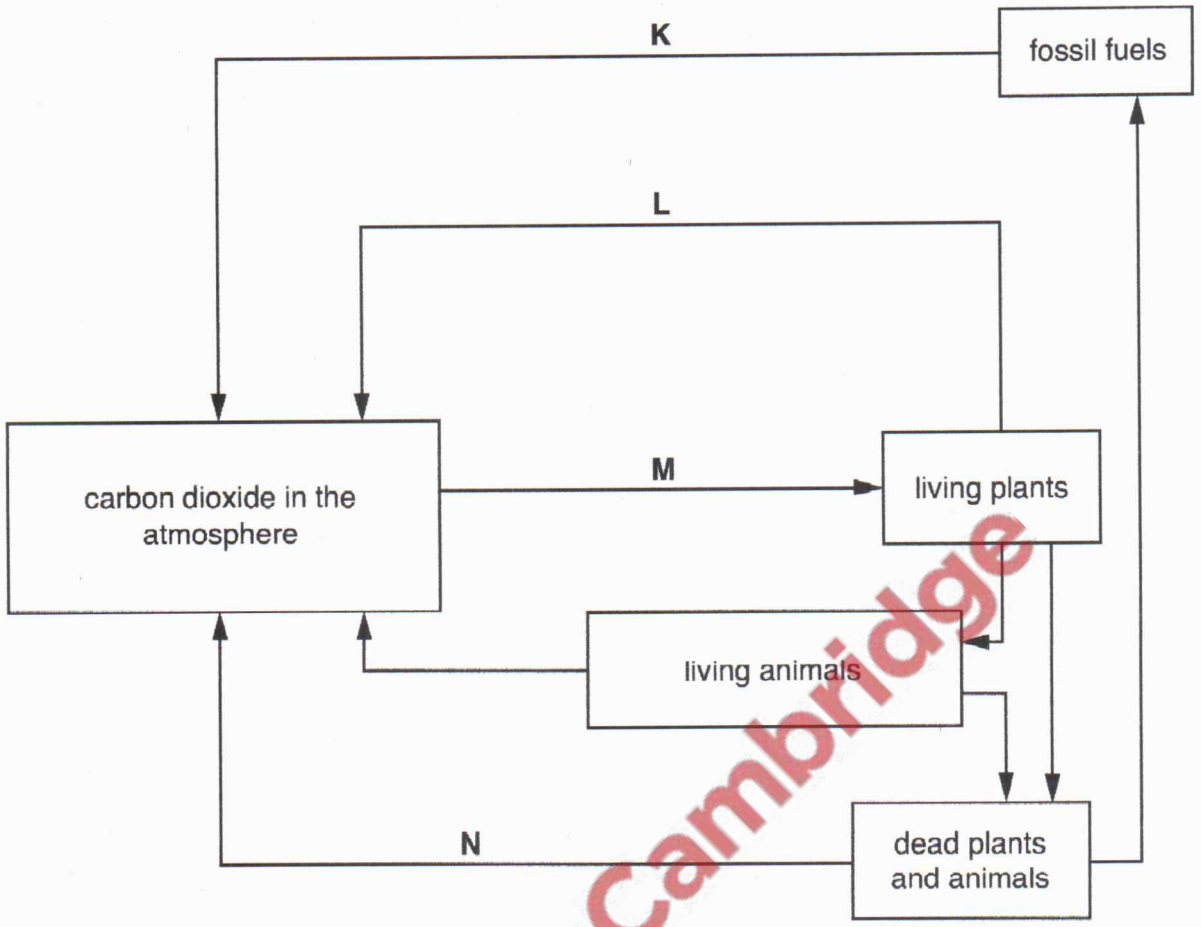
(c) Use your knowledge of the process of natural selection to explain the distribution of grey and green tree frogs in different areas.

The frogs mutated to forms that can camouflage with their environment. This makes them not visible to predators. This will allow them to breed more and get more offspring. This will lead to a rise in populations.

[5]

[Total: 8]

5 The diagram shows the carbon cycle.



(a) Name each of the processes **K** to **N**.

K Combustion

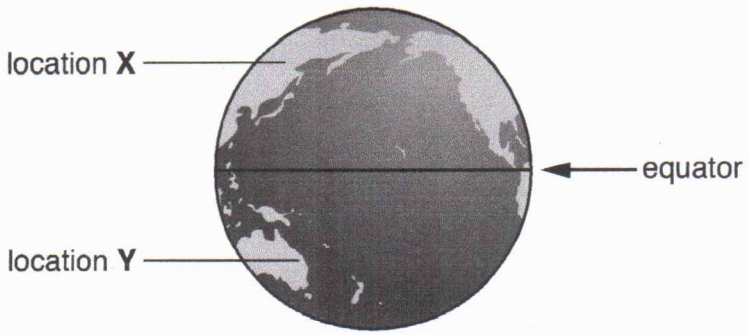
L respiration

M photosynthesis

N decomposition

[4]

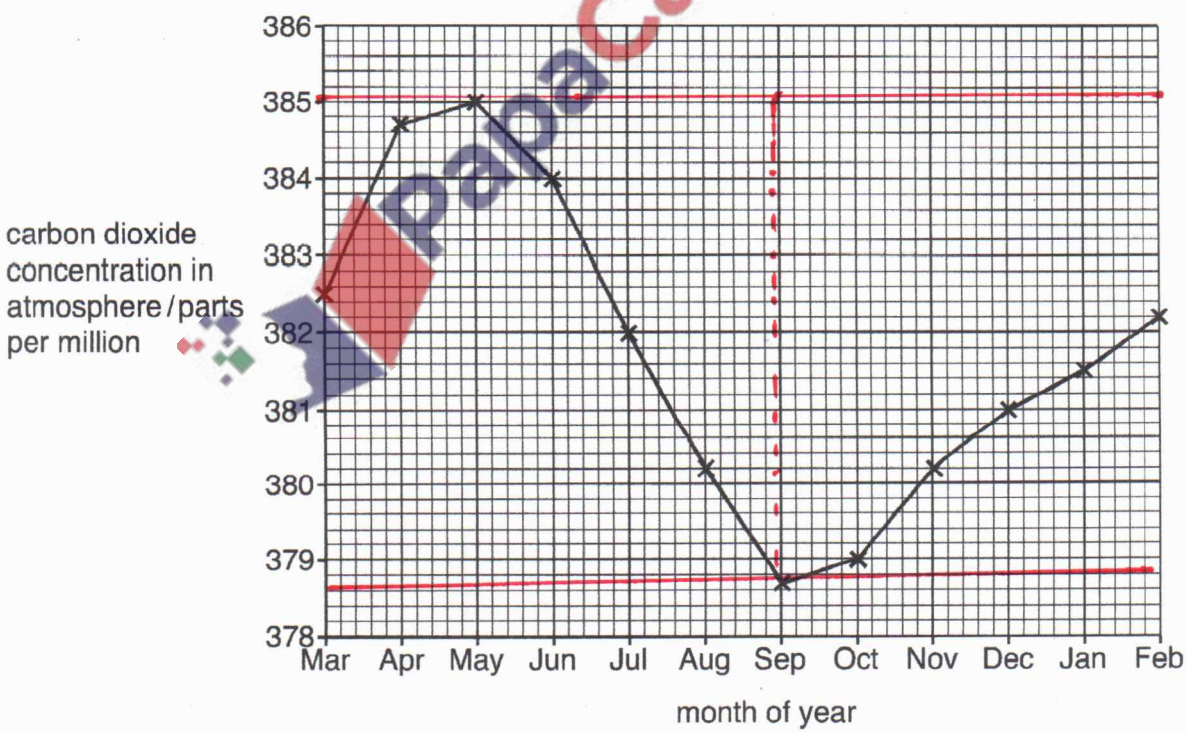
(b) The diagram shows two locations, **X** and **Y**, on the Earth.



The table shows the length of daylight at each location during a year.

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
length of daylight at location X	medium			long			medium			short		
length of daylight at location Y	medium			short			medium			long		

The graph shows the change in carbon dioxide concentration in the atmosphere measured during one year at **location X**.



(i) Suggest an explanation for the pattern of changes in the concentration of carbon dioxide in the atmosphere shown in the graph.

The CO_2 concentration falls from may reaching the lowest concentration in September. CO_2 concentration then increases due to increased rates of photosynthesis. Rates of photosynthesis is faster in more daylight and in plants with broader leaves. Respiration was lower than photosynthesis. Respiration increase CO_2 concentration in air. [3]

(ii) Draw a line on the graph to suggest the change in carbon dioxide concentration in the atmosphere during the year at **location Y**. [2]

[Total: 9]

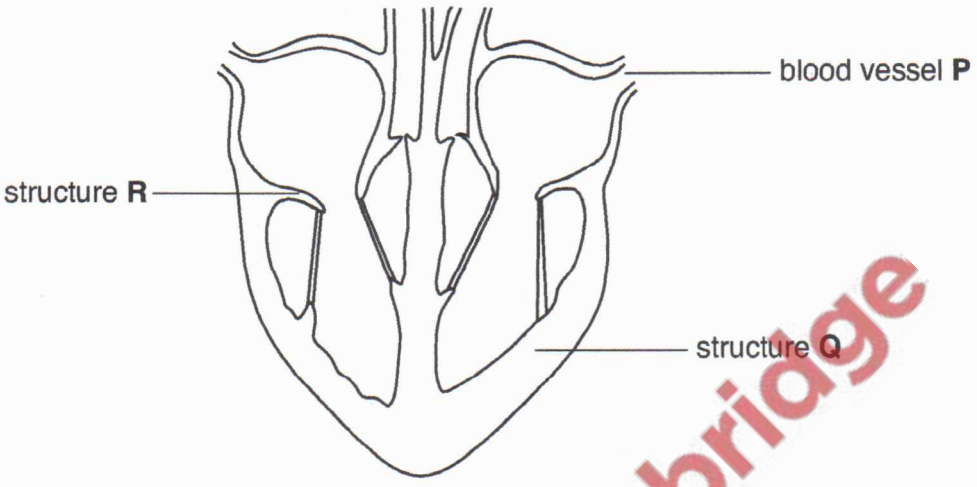
Change in concentration of CO_2 is the difference in the concentration at the peaks and the lowest (trough).

Section B

Answer **both** questions in this section.

Write your answers in the spaces provided.

6 The diagram shows the internal structure of a human heart viewed from the front and its associated blood vessels.



Name and describe the function of each of the following:

(a) blood vessel **P**

Pulmonary vein – transports oxygenated blood from the lungs back to the left atrium of the heart.

[3]

(b) structure **Q**

Left ventricle – Pumps blood at high pressure to the rest of the body. It has values to prevent backflow of blood. Blood is first pumped to the aorta. The aorta is the main artery from the heart transporting blood to the rest of the body. [3]

(c) structure **R**.

Valve(tricuspid valve) – it opens to allow blood into the right ventricle. It closes to allow blood to pulmonary artery that transports blood to lungs for oxygenation. The valves prevent backflow of blood. Blood flows only in one direction. [4]

[Total: 10]

7 The nervous system coordinates body functions.

(a) (i) Name the type of coordinated response that takes place as a result of a specific stimulus, such as the withdrawal of the hand from a hot object touching the skin.

Reflex (involuntary) [1]

(ii) Outline, **in the correct sequence**, the functions of each **named** type of neurone involved in producing this coordinated response.

Impulses generated from the receptors travel along sensory neurone as electrical signals. The sensory neurone then transmits the impulses to relay neurone which is an intermediate motor and sensory neurone. The impulses then reach the central nervous system. The motor neurone will then send impulses to the muscles with corrective measure. The muscles contract to withdraw the hand from the hot object. [7]

(b) Suggest why damage to a person's spinal cord may result in the person not being able to produce coordinated responses.

Spinal cord links nerves (peripheral nervous) to the Central nervous system. If it is damaged there will not be transmission of impulses. [2]

[Total: 10]

Section C

Answer **either** question 8 **or** question 9.

Write your answers in the spaces provided.

8 **(a)** Name **and** describe each process that must take place in order to remove molecules of carbon dioxide from the blood of a person to the air in the atmosphere.

Diffusion - Movement of molecules (CO_2) from a region of high to a region of low concentration down the concentration gradient. The blood plasma transports CO_2 in dissolved form (HCO_3^-). Blood plasma therefore has a high concentration of CO_2. CO_2 diffuses out of the blood flowing in blood capillaries on the walls of the alveoli. The alveoli then removes it during exhalation. During exhalation, internal intercostal muscles contract and the ribs are pulled down. The diaphram becomes becomes relaxed. This cause an increase in pressure. The pressure forces air out of the lungs. [7]

(b) Plants absorb carbon dioxide from the atmosphere.

Outline how plants make the carbon in the molecules of carbon dioxide into a food substance.

Plants make glucose using carbon dioxide, water and light energy. Light (solar energy) combines the water and carbon dioxide in the presence of chlorophyl. Solar energy is trapped by the chlorophyl. This process is called photosynthesis [3]

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyl}]{\text{Light}} C_6H_{12}O_6 + 6O_2$$

(glucose)

[Total: 10]

9 **(a)** Describe the pathway of water molecules from the soil, through a plant and into the atmosphere.

Root hair cells absorb water from the soil by osmosis. Water pass through the cell wall and then through the cell membranes into the root hair cells. The cell membrane is partially permeable. Then water enters the xylem tissue in the stem. Xylem runs upto the veins in the leaf. From here water reaches the leaf mesophyl. Thin water film diffuses out of cells of palisade and spongy mesophylls in form of water vapour. The water vapour pass through the stomata and then finaly evaporates into the atmosphere. [7]

(b) Explain how variation in **one named** environmental factor would lead to an **increase** in the rate of water loss from a plant.

Temperature - The higher the temperature, the faster the rate of water loss. At high temperature, there is increased kinetic energy of the water molecules, so they evaporate faster.

[3]

[Total: 10]