

Gold Paper

Question Paper 5

Level	A Level
Subject	Biology
Exam Board	OCR
Paper	Gold Paper
Booklet	Question Paper 5

Time allowed: 82 minutes

Score: /61

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

(a) An island in the remote Galapagos group could be described as an ecosystem.

- (i) Ecosystems are considered to be dynamic systems. This means that they are always changing.

Suggest **two** ways in which an ecosystem can change over time.

[2]

- (ii) Ecologists study the energy content of each trophic level and the transfer of energy through trophic levels in ecosystems.

Describe how you would measure the energy content, in kJ, in the **producer level** of one square metre of grassland.

[5]

- (b) The Galapagos fauna includes the Galapagos giant tortoise, *Chelonoidis nigra*. *C.nigra* originally colonised one island in the Galapagos group. Accidentally carried on local currents, the tortoise subsequently colonised new islands as they emerged. Restricted gene flow between isolated islands and differing conditions on them has led to the evolution of various subspecies.

- (i) New species may be formed when parts of a population become isolated by a barrier such as sea channels between islands. What name is given to this type of isolating mechanism?

[1]

- (ii) What new sources of evidence, not available to researchers before about 1970, can be used to classify subspecies of the giant tortoise?

[2]

- (iii) Suggest why the different populations of *C.nigra* are classified as subspecies rather than different species. [1]

- (c) The giant tortoise can survive for long periods without food.

Suggest why giant tortoises are able to survive better than mammals for long periods without food. [2]

- (d) A 200 kg tortoise can eat 35 kg of vegetation biomass **per day**. It is estimated that in one year in the 19th Century, 4000 tortoises were removed from the islands.

- (i) Calculate how much extra biomass would be available for other herbivores on the islands in that **year** as a result of the removal of the tortoises. [2]

- (ii) What effect would the removal of the tortoises have on the populations of the other herbivores on the Galapagos islands? [1]

Explain your answer.

- (e) Capturing or killing Galapagos tortoises for any reason is now illegal.

State an economic **benefit** to the islanders of giant tortoise conservation. [1]

[Total: 17]

Question 2

Fig. 4.1 shows a junction between two neurones where the neurotransmitter is dopamine. Fig. 4.2 shows a neuromuscular junction.

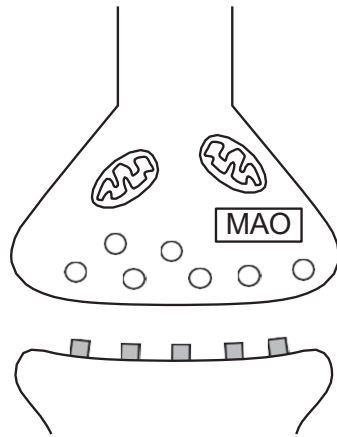


Fig. 4.1

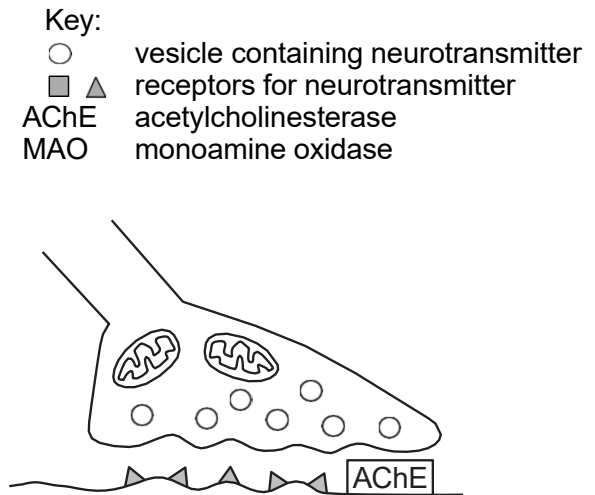


Fig. 4.2

(a) Complete Table 4.1 below to compare the structure and function of the dopamine synapse and the neuromuscular junction.

[4]

Table 4.1

	similarity	difference
structure		
function		

(b) The sequence of events at a dopamine synapse is given below:

- dopamine molecules bind to the protein receptors on the postsynaptic membrane and trigger a response
- dopamine leaves the receptors and moves back into the presynaptic neurone
- some dopamine is repackaged into vesicles
- some dopamine is broken down by the enzyme monoamine oxidase (MAO).

Table 4.2 summarises the action of some drugs that affect dopamine synapses.

Table 4.2

drug	action at synapse
phenothiazine	binds to and blocks dopamine receptors
phenelzine	acts as an inhibitor of MAO
amphetamine	binds to and activates the dopamine receptor and causes release of stored dopamine from vesicles

(i) Use the information in Table 4.2 to suggest which drug molecule could have a shape that **differs** from that of the dopamine molecule. Give a reason for your answer.

[2]

(ii) Schizophrenia is a condition in which there is a higher than usual level of dopamine in certain areas of the brain.

Suggest why phenothiazine is used to treat schizophrenia.

[2]

(c) DRD4 is a dopamine receptor in humans. The DRD4 receptor gene has a large number of alleles, of which a single individual can only have two.

(i) Explain why one individual can only have two of the different alleles of the DRD4 gene.

[2]

(ii) Name a technique that would reveal differences in the lengths of the different forms of the DRD4 receptor gene.

[1]

(d) Three alleles of DRD4 have the following alterations:

- a single base-pair substitution
- a 21 base-pair deletion
- a 13 base-pair deletion.

Suggest which of the three mutations will have the most serious consequences for the structure of the protein receptor. Give a reason for your choice.

[3]

(e) One allele of DRD4 has been found more frequently amongst individuals whose personality is described as 'novelty-seeking' and whose behaviour tends to be exploratory and impulsive.

Suggest how this particular allele of the DRD4 receptor could have become common in the human population.

[4]

[Total: 18]

Question 3

Microorganisms are used to produce useful products in biotechnology.

(a) Two different culture methods are used.

Compare and contrast the processes of continuous culture and batch culture.

[5]



In your answer, you should describe the similarities and differences between the two processes.

(b) Nitrates, phosphates and sulfates are added to the culture in a fermenter. These salts are required by the microorganisms for the formation of biological molecules such as polymers.

Describe which salts are required for the formation of named types of biological polymers in the microorganisms.

[2]

[Total: 7]

Question 4

Respiration is a key process within cells, providing them with energy in the form of ATP.

The potential energy values of three different types of biological molecules used as respiratory substrates are shown in Table 3.1.

Respiratory substrate	Mean energy value (kJg^{-1})
Carbohydrate	15.8
Protein	17.0
Lipid	39.4

Table 3.1

(a) The main respiratory substrate is glucose.

Calculate, using the information in Table 3.1, how many grams of glucose have the same mean energy value as 1 g of lipid.

Give your answer to **one decimal place**.

[1]

(b) Lipid is a respiratory substrate but it needs to be hydrolysed into its constituent molecules so that these can then enter the respiratory pathway.

(i) The hydrolysis of lipid molecules will produce fatty acids.

State the other product of the hydrolysis of lipid molecules.

[1]

(ii) The fatty acids are further broken down into 2-carbon molecules which form acetyl coenzyme A. This results in large numbers of hydrogen ions being produced.

How do these hydrogen ions contribute to the production of a large amount of ATP? [2]

(c) Protein is only used as a respiratory substrate when all other available substrates have been used up. Protein yields less energy per gram than lipid.

A protein molecule cannot enter the respiratory pathway directly and so is converted into a compound that is able to enter the respiratory pathway.

Describe the changes that convert a protein molecule into a compound able to enter the respiratory pathway **and** explain why this substrate yields less energy per gram than lipid.



In your answer, you should use appropriate technical terms, spelled correctly. [4]

Question 5

Termites are highly social insects. They are thought to have evolved from earlier forms of insect at least 150 million years ago, in the Jurassic geological period. They are related to cockroaches.

(a) (i) How might scientists a century ago have known that termites evolved in the Jurassic geological period? [1]

(ii) What new source of evidence might help today's scientists to find out how closely related termites are to cockroaches? [1]

(b) **Fig. 5.1**, on the insert, shows a termite mound, the nest of approximately one million individuals. The photograph was taken in Queensland Australia, about 3000 kilometres south of the equator.

(i) **Fig. 5.1** shows that the interior of the termite mound is full of interconnecting chambers. At the top of the mound some of these chambers open to the air outside.

Worker termites spend all their time working in brood chambers low in the mound, where eggs and larvae develop.

Explain how carbon dioxide produced in the respiring body cells of worker termites is removed to the air outside the termite mound. [4]

(ii) In Africa, closer to the equator, the mounds built by some species of termite are blade-shaped, with the long axis pointing North–South. **Fig. 5.2**, on the insert, shows an example of a termite mound in Africa.

Suggest why the African termites need to build mounds in this shape and orientation. [2]

- (c) Most termites eat only dead vegetable material, so their principle food source is cellulose.

Cellulose is a polymer.

State the name of the monomer in cellulose.

[1]

- (d)

Termites such as the species that built the mound in **Fig. 5.1** on the insert can be classed as 'keystone species'.

Use the information given to state one argument that supports this statement and one argument that does not.

[2]



Fig. 5.1



Fig. 5.2

[Total: 11]