

Unit 3 Biology

Revision Booklet 3

Topics

Respiration

Photosynthesis

&

Enzymes

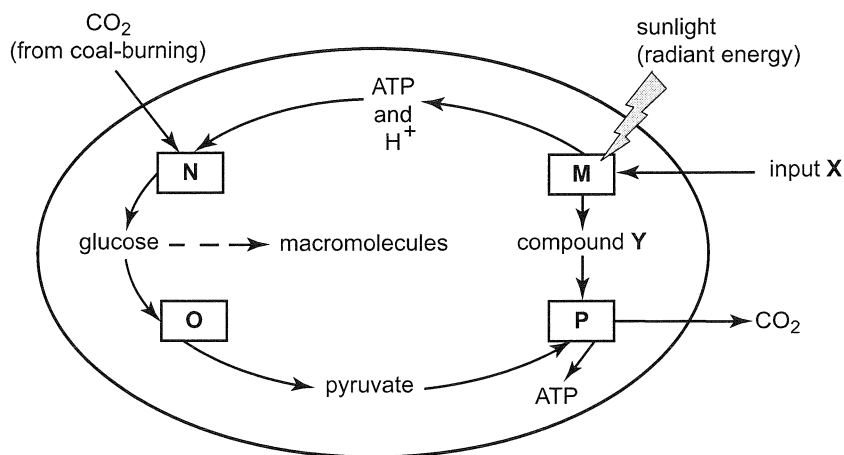
Name:

Question 8 (2012)

Climate change has been linked to an excess of carbon dioxide in the atmosphere. The burning of coal is a major contributor to this excess of carbon dioxide.

Microalgae such as *Chlorella* can use greater amounts of carbon dioxide than land plants and they do not require prime soil, reliable rainfall and a particular climate. *Chlorella* can be grown cheaply in existing or engineered ponds which are supplied with carbon dioxide from a coal-burning power station nearby.

The following diagram represents a summary of the processes (labelled M, N, O, P) occurring in a *Chlorella* cell.



a. Name

i. input X _____

ii. compound Y _____

2 marks

b. With reference to the diagram above, complete the following table.

Process	Name of process	Site of process
M		grana of chloroplast
O	glycolysis	
P	stages of cellular respiration	

3 marks

Question 4~~2008~~

Living organisms cannot survive without the presence of enzymes.

- a. Explain why enzymes are necessary in living organisms.

1 mark

- b. Describe the 'active site' of an enzyme and explain its role.

2 marks

The blood pressure of an individual can change significantly to ensure an appropriate supply of water, nutrients and oxygen to cells and to remove wastes that may be harmful. However, people who have long-term high blood pressure develop characteristics that can be life threatening.

Scientists have decided that they may be able to treat patients suffering high blood pressure by designing and developing a drug to lower high blood pressure. This technique is called 'rational drug design'.

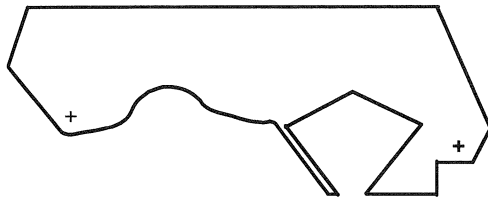
- c. Write a short paragraph to explain the phrase **rational drug design**.

2 marks

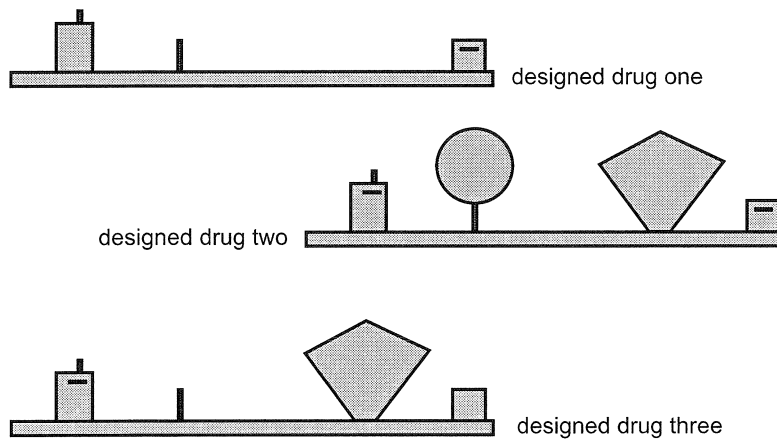
It is known that Angiotensin-converting enzyme (ACE) acts on the polypeptide Angiotensin I to produce Angiotensin II, a powerful blood-pressure raising agent.

People with long-term high blood pressure have raised blood levels of ACE.

The following diagram represents the active site of a molecule of ACE.



A range of drugs was designed and manufactured. A sample of the molecular shape of these is shown below.



d. i. Which drug is likely to be the most effective in preventing excessive high blood pressure?

ii. Give the reasons for your choice in part i.

iii. Explain the process by which this drug would contribute to lowering blood pressure in a person.

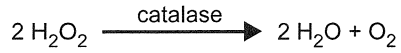
1 + 1 + 2 = 4 marks

Total 9 marks

Question 3 2007

Many living cells produce hydrogen peroxide as a by-product of some metabolic reactions. Hydrogen peroxide is a poisonous substance for these cells and is immediately decomposed into water and oxygen by an enzyme called catalase.

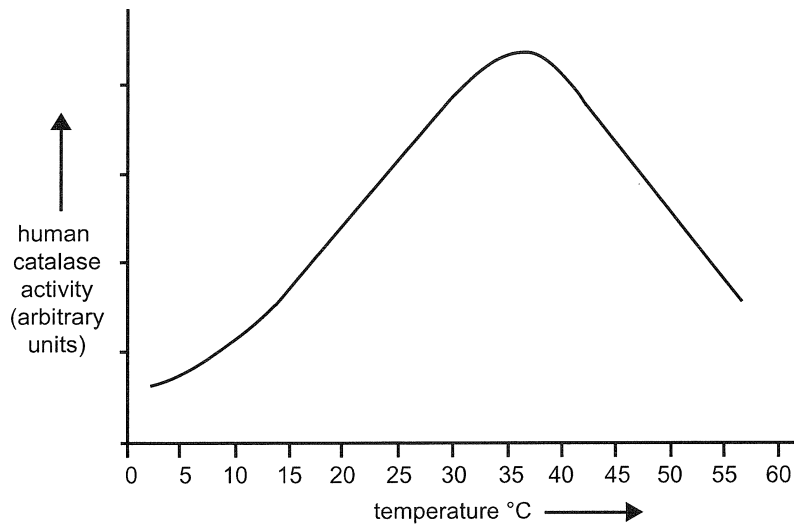
The reaction is represented by the equation



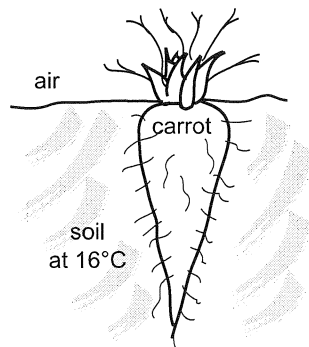
- a. Which is the substrate in this chemical reaction?

1 mark

The activity of catalase in humans was tested across a number of different temperatures and the results graphed. The results are shown below.



Catalase is found in many plants, including carrots.



A student predicted that if a temperature graph was prepared for carrot catalase activity, the optimal temperature would be expected to be much lower than that shown by catalase from humans.

- b. Do you agree or disagree with the student's prediction? Explain the reason for your choice.

1 mark

- c. Describe (or outline) an experiment you would carry out with pieces of carrot to test the accuracy of the student's prediction. Hydrogen peroxide is available as a 3% in water solution.

Explain fully what results would support or negate the student's prediction.

3 marks

Total 5 marks

Question 4 2006

2,4-dinitrophenol is a chemical that is toxic to mitochondria. When added to mitochondria this chemical allows electron transport to occur but prevents the phosphorylation of ADP to ATP. The chemical achieves this by breaking the essential link between electron transport and ATP synthesis. This toxin causes mitochondria to produce heat instead of ATP. The greater the amount of toxin added, the quicker is its action.

- a. If mitochondria are poisoned with 2,4-dinitrophenol by what process could a plant cell produce more ATP?

1 mark

- b. Where in the mitochondria does electron transport and ATP production occur?

1 mark

A researcher wanted to study cellular respiration in insect cells. She cultured some muscle cells from the common field cricket, *Teleogryllus oceanicus*, then studied the effects of adding 2,4-dinitrophenol to these cells. An agricultural company may want to fund this research.

- c. Give one reason why an agricultural company might want to fund research on the effects of this toxin on field crickets.

1 mark

The experiment is summarised in the table below. Temperature observations in each trial were made at equal time intervals.

Observations made at equal time intervals	Temperature °C		
	control (no 2,4-dinitrophenol)	trial 1 (2,4-dinitrophenol added)	trial 2
1 (start)	28	28	28
2	27	28	29
3	28	29	
4	29	31	
5	28	36	
6	28	23	
7	27	21	

- d. In terms of energy production, why did the temperature go up in trial 1 and not in the control?

1 mark

2006

- e. Explain why the temperature went down after the fifth observation in trial 1.

1 mark

- f. Trial 2 had twice the concentration of 2,4-dinitrophenol added. Complete the table by writing in temperatures in the spaces provided to predict the trend.

2 marks

Another researcher suggested adding pyruvate to the cells to cancel out the effects of this toxin.

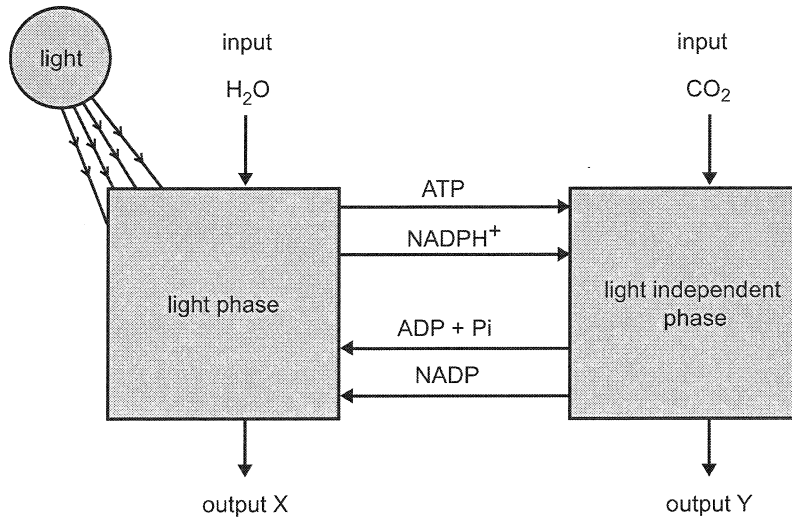
- g. Explain what effect adding pyruvate would have on cancelling out the effect of this toxin.

1 mark

Total 8 marks

Question 3 2005

Although photosynthesis is often summarised by a single equation, in fact the process occurs in two distinct phases; the light phase and another phase called the carbon fixation phase or the light independent phase. These two phases can be summarised in diagrammatic form as follows.



The diagram shows outputs X and Y.

- a. i. What is output X?

- ii. How is output X produced?

1 + 1 = 2 marks

- b. What is output Y?

1 mark

Cellular respiration provides energy for cells. It may be aerobic or anaerobic.

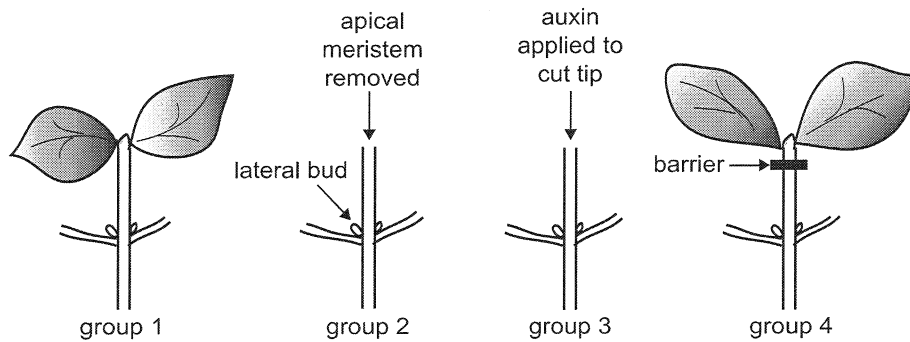
- c. Aerobic respiration in plants and animals ultimately depends on photosynthesis. Explain this dependence.

1 mark

- d. What is an advantage of aerobic over anaerobic respiration?

1 mark

An experiment was conducted to investigate apical dominance in bean plants. Four groups of plants were used.



Group 1: untreated

Group 2: apical meristem was removed

Group 3: apical meristem was removed and auxin applied to the cut tip

Group 4: apical meristem removed and replaced intact but a barrier to the movement of compounds was placed under the tip

The results are shown in the table.

Group 1	Group 2	Group 3	Group 4
untreated	apical meristem removed	apical meristem removed and auxin applied to the cut tip	apical meristem intact but barrier to the movement of compounds was placed under the tip
Growth of apical meristem but not lateral buds	Growth of lateral buds	No growth of lateral buds	Growth of lateral buds

- e. Using the information from the experiments, what are three conclusions you can make about the growth of lateral buds?

Explain how you reached each conclusion.

Conclusion 1 and explanation

Conclusion 2 and explanation

Conclusion 3 and explanation

3 marks

Total 8 marks