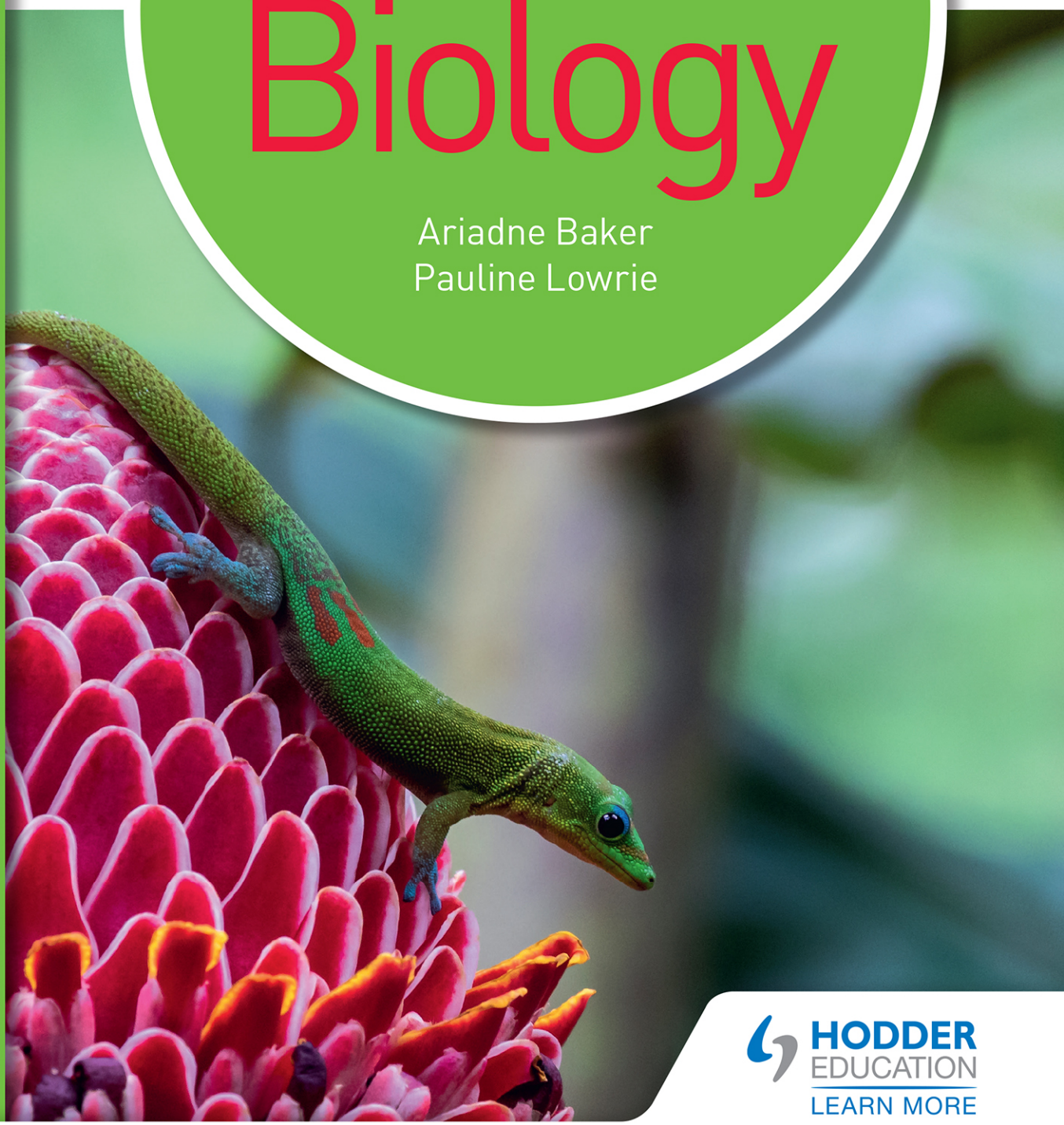
PRACTICE MAKES PERMANENT

400+ questions

AQA A-level Biology

Ariadne Baker
Pauline Lowrie



HODDER EDUCATION
LEARN MORE

Contents

6 Stimuli and responses

7 Genetics, populations, evolution and ecosystems

8 The control of gene expression

Practice exam papers

Answers

1 Biological molecules

Monomers and polymers

Quick questions

SB1 p2 3.1.1

1 What is a monomer?

SB1 p2 3.1.1

2 What type of reaction takes place in order for two biological monomers to join together in a chemical reaction?

Exam-style questions

SB1 p2 3.1.1

3 **Figure 1** shows two monomers. Use an annotated diagram to show how these two monomers could join together by a condensation reaction. *[2]*

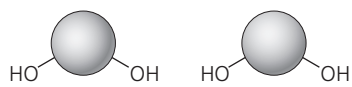


Figure 1

Total: 2

Carbohydrates

Quick questions

SB1 p2 3.1.2

1 Name the **three** main types of carbohydrates.

SB1 p2–3 3.1.2

2 Name **three** disaccharides, and for each one list the monosaccharides they contain.

SB1 p3 3.1.2

3 What type of bond is formed between two monosaccharides?

SB1 p3 3.1.2

4 What is the difference between an alpha glucose and a beta glucose molecule?

SB1 p3–4 3.1.2 ATF

5 If you test a solution containing both glucose and sucrose, you cannot show the presence of sucrose by carrying out the non-reducing sugar test. Explain why.

Exam-style questions

SB1 p2–5 3.1.2 ATF

6–1 Place a tick in the box if the statement applies to the specific carbohydrate. *[4]*

	Contains galactose	Contains alpha glucose	Contains fructose	Contains a glyosidic bond
Maltose				
Lactose				
Sucrose				
Cellulose				

6–2 The test for starch using iodine causes a blue/black colour to form. This happens because the iodine forms an ion that sticks inside the amylose (starch) helix as shown in **Figure 2**. If the starch/iodide complex is boiled, the blue/black colour disappears. Suggest why. *[3]*

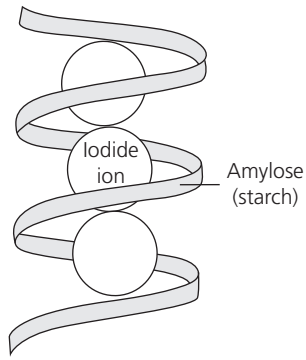


Figure 2

Total: 7

7 Mannan is a polysaccharide. It is a polymer of a hexose sugar, mannose. It is insoluble and forms long straight chains of mannose. It is a storage polysaccharide in some plants. It can also form side-chains, and this branched form of mannan can be found in the cell wall of some yeasts.

SB1 p1–2 3.1.2

7–1 Define what a polymer is. *[2]*

Figure 3 shows a molecule of mannose.

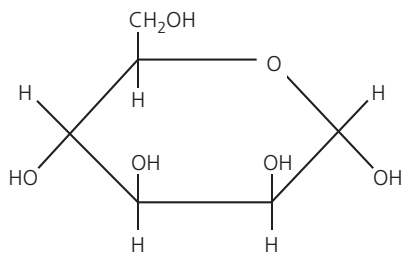


Figure 3

7–2 Use a diagram to show how two molecules of mannose join together. *[2]*

SB1 p3 3.1.2

7–3 Name the bond formed. *[1]*

SB1 p6–7 3.1.2

7–4 Give **one** way in which the structure of mannan is similar to the structure of cellulose and **one** way in which its structure is different**.** *[2]*

Total: 7

SB1 p15 3.1.2 ATc, f

8 A student investigated the minimum concentration of glucose solution needed to produce a positive Benedict's result. Describe how the student could carry out this test using a 1 mol dm^{-3} solution of glucose. *[6]*

Lipids

Quick questions

SB1 p7 3.1.3

1 Give **two** differences between a triglyceride and a phospholipid.

SB1 p8 3.1.3

2 A fatty acid can be represented by the formula R-COOH. What does the letter R represent?

Exam-style questions

3 **Figure 4** shows two different fatty acids.

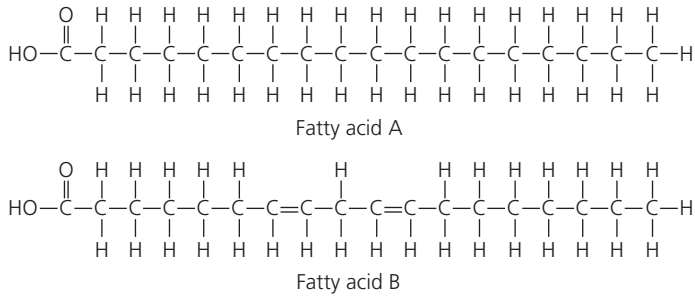


Figure 4

SB1 p7–9 3.1.3

3–1 Identify which of these two fatty acids is saturated. Explain your answer. *[1]*

3–2 Olestra is a fat substitute. It is used in foods for people who are trying to lose weight. It is made from a molecule of sucrose with fatty acids attached. Its structure is shown in **Figure 5**. 'X' represents the positions where fatty acids are attached.

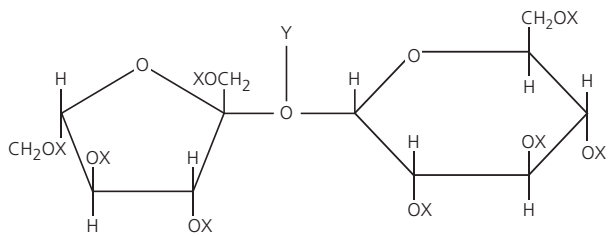


Figure 5

Name the bond at position **Y**. *[1]*

SB1 p2–3 p23–4 3.1.3

3–3 Olestra is not digested in the gut. Explain why. *[2]*

Total: 4

SB1 p8 3.1.3 ATf

4–1 Describe a test you could carry out to show that biscuits have lipids present. *[3]*

SB1 p9 3.1.3.

4–2 Draw a phospholipid molecule and label it to explain why it can be called a polar molecule. *[3]*

Total: 6

Proteins

Quick questions

SB1 p11 3.1.4.1 ATf

1 Describe the chemical test for the presence of proteins. Describe what a positive result would be.

SB1 p11 3.1.4.1

2 What type of bond is formed in the condensation reaction between two amino acids?

SB1 p12 3.1.4.1

3 What is meant by the primary structure of a protein?

SB1 p12 3.1.4.1

4 What type of bond allows for alpha-helices and beta-pleated sheets to form within the secondary structure of a polypeptide?

SB1 p13 3.1.4.2

5 Why is the tertiary structure of a polypeptide so important?

SB1 p13 3.1.4.1

6 Which bonds help to contribute to a protein's tertiary structure?

SB1 p13 3.1.4.1

7 Some proteins do not have a quaternary structure. Explain why.

SB1 p11 3.1.4.1

8 Use a labelled diagram to show the general structure of an amino acid.

Exam-style questions

9 **Figure 6** shows the effect of substrate concentration on the rate of reaction of a particular enzyme.

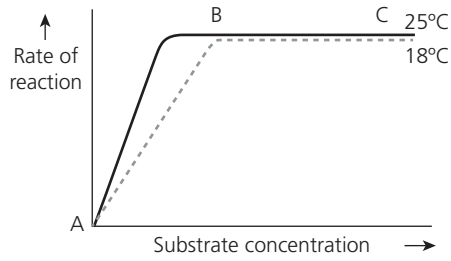


Figure 6

SB1 p31–2 3.1.4.2 PS2.4

9–1 Name **two** variables that should have been kept constant during this investigation. *[1]*

9–2 The graph obtained at 18°C is different from the graph obtained at 25°C. Explain why the two graphs are different between A and B. *[3]*

SB1 p27–8 3.1.4.2

9–3 Explain why the two graphs are the same between B and C. *[2]*

9–4 Sketch the result you would expect if the investigation was repeated at 18°C with a non-competitive inhibitor. *[2]*

Total: 8

10 Keratin is a protein that has large amounts of the amino acid cysteine in its structure.

Figure 7 shows the structure of cysteine.

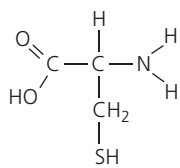


Figure 7

10–1 Draw a circle around the R group. *[1]*

10–2 The R group of cysteine is able to form strong bonds with cysteine elsewhere in the molecule.

1. Name these strong bonds. *[1]*
2. Explain what makes them strong. *[1]*

SB1 p10–13 3.1.4.1

10–3 Keratin is found in hair, fingernails, hooves and claws. The form of keratin in hair is a slightly more elastic form of keratin than that found in fingernails, hooves and claws. Using your understanding of protein secondary structure, suggest how these forms of keratin may differ in structure. *[1]*

Total: 4

SB1 p23–7 3.1.4.2 RP1

11 A student carried out an experiment with two different samples of amylase, enzyme A and enzyme B. The enzymes were mixed with starch and immediately placed in a water bath at 65°C. The rate of reaction was measured over 30 minutes. **Figure 8** shows the results obtained by the student.

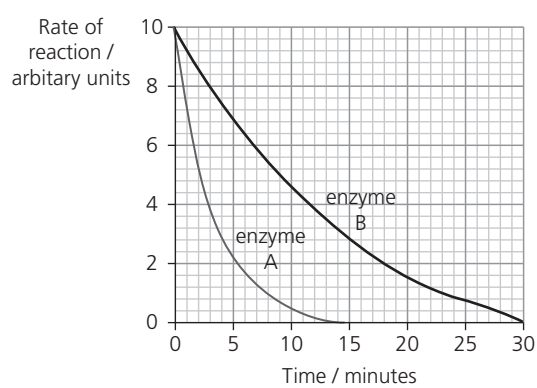


Figure 8

11–1 Describe the results for these two enzymes. *[3]*

11–2 Use your knowledge of enzyme structure to explain these results. *[2]*

Total: 5

12 **Figure 9** shows the energy changes during the course of a specific reaction without an enzyme.

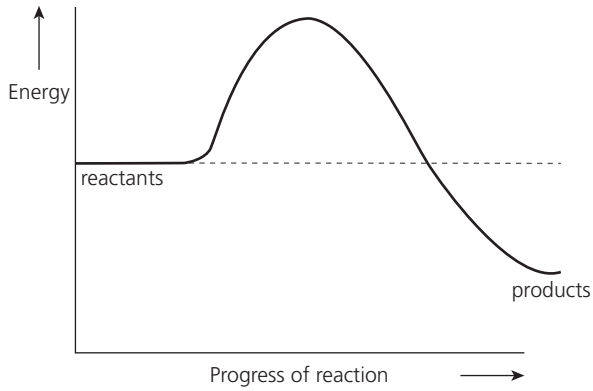


Figure 9

SB1 p20–1 3.1.4.2

12–1 Copy the graph and sketch a line to show the result you would expect if an enzyme was present. *[2]*

12–2 On your graph, use a labelled arrow to show the activation energy when an enzyme is present. *[1]*

Total: 3

13–1 Describe the induced fit model of enzyme action. *[3]*

Erectile dysfunction occurs when the blood flow to the penis is insufficient for a man to maintain an erection. Sildenafil is a drug used to treat erectile dysfunction.

Figure 10 shows some of the steps involved in developing an erection.

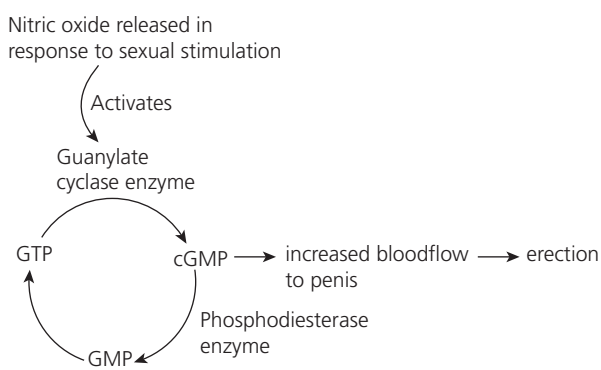


Figure 10

SB1 p27 3.1.4.2

13–2 Sildenafil is similar in shape to cGMP. Explain how sidenafil is effective in treating erectile dysfunction. *[4]*

13–3 Suggest why sildenafil does not cause erections unless a man is sexually aroused. *[1]*

Total: 8

Quick questions

SB1 p57 3.1.5.1 **1** Draw a diagram of a DNA nucleotide.

SB1 p58 3.1.5.1 **2** Explain why DNA is described as a polymer.

SB1 p57 3.1.5.1 **3** Which component of a nucleotide contains nitrogen?

SB1 p57 3.1.5.1 **4** Name the bond formed between two adjacent nucleotides.

SB1 p58–9 3.1.5.1 **5** How does a DNA molecule form a double helix?

Exam-style questions

6 In the 1950s two scientists carried out an investigation to show that DNA replicates semi-conservatively. They used 'heavy' nitrogen atoms that contain an extra neutron, so the atoms are very slightly heavier than normal nitrogen atoms. However, they behave exactly the same as normal nitrogen atoms.

The scientists grew *E. coli* bacteria in a medium containing heavy nitrogen atoms. This meant that all the DNA in the bacteria contained heavy nitrogen. This was called 'generation 0'.

They transferred the bacteria to a medium containing only normal light nitrogen atoms. This meant that all the new DNA formed would contain normal light nitrogen. The bacteria replicated once in this medium. This was 'generation 1'.

They allowed the bacteria to replicate a second time in this medium. This was called 'generation 2'.

The scientists sampled the DNA from each of these generations of bacteria. The extracted DNA was centrifuged and it formed bands in a test tube according to its density. Denser DNA forms a band lower down in the test tube than less dense DNA.

Figure 11 shows some possible results from this investigation.

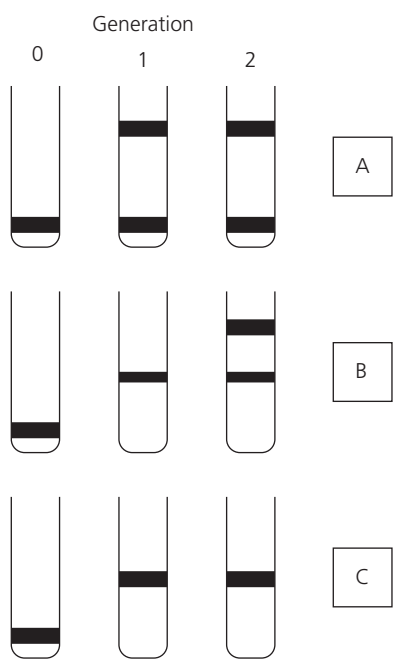


Figure 11

SB1 p77 3.1.5.2 **6–1** Explain which of these results shows that DNA replicates semi-conservatively. *[4]*

SB1 p57–9 3.1.5.1 **6–2** Identify which component(s) of the DNA contains heavy nitrogen. *[1]*

Total: 5

SB1 p57–9 3.1.5.1

7–1 DNA is composed of nucleotides. Identify how many nucleotides there are in the diagram of DNA in **Figure 12**. *[1]*

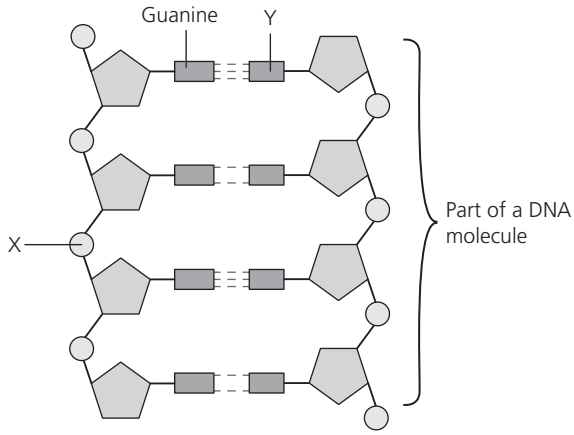


Figure 12

7–2 Name components X and Y. *[1]*

Total: 2

SB1 p75–8 3.1.5.1

8 Cancer is a disease that occurs when cells replicate uncontrollably. Gemcitabine is a drug that is used to treat cancer.

Figure 13 shows gemcitabine as well as cytosine and thymine nucleotides. Gemcitabine is injected into the blood. An enzyme adds a phosphate group at the point shown.

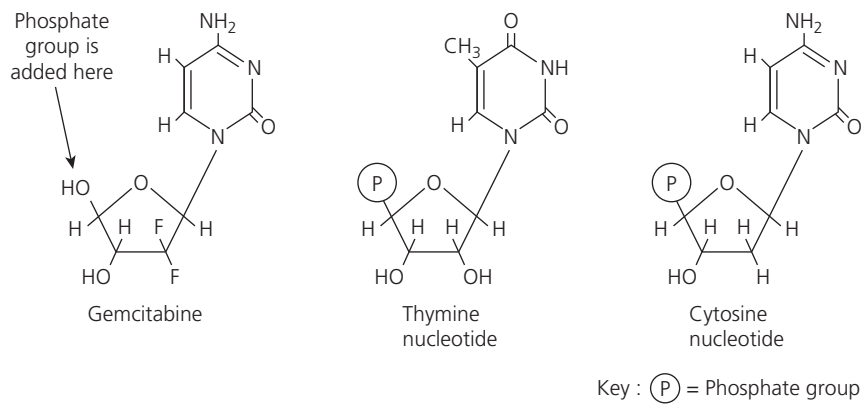


Figure 13

8–1 Gemcitabine stops DNA replication. Explain how. *[3]*

8–2 Women who are taking gemcitabine are warned that they should not become pregnant. Explain why. *[2]*

Total: 5

SB1 p63 3.1.5

9–1 Draw and label a nucleotide of RNA. *[2]*

SB1 p57–63 3.1.5

9–2 Give **three** structural differences between DNA and RNA. *[3]*

9–3 Name the bond formed when two RNA nucleotides bond together. *[1]*

9–4 Scientists believe that the earliest living things had RNA as their genetic material. However, all living organisms today have DNA as their genetic material. Suggest the advantage of this. *[2]*

Total: 8

ATP

Quick questions

SB1 p64 3.1.6

1 Draw and label a diagram of a single molecule of ATP.

SB1 p65 3.1.6

2 What type of reaction resynthesises ATP from ADP and P_i?

Exam-style questions

SB1 p65 3.1.6

3 Give **one** similarity and **one** difference between ATP and a nucleotide in RNA. *[2]*

SB1 p65 3.1.6

4 Give **two** functions of ATP. *[2]*

SB1 p65 3.1.6

5–1 Name the enzyme that produces ATP. *[1]*

SB1 p65 3.1.6

5–2 Name the products of ATP hydrolysis. *[1]*

5–3 The cells of a typical human hydrolyse 50–75 kg of ATP every day. The average body mass of a human is also 50–75 kg. At any given time, the mass of ATP in a person's body is considerably less than this. Explain how it is possible for the body to hydrolyse this amount of ATP every day. *[2]*

Total: 4

Water

Quick questions

SB1 p183–4 3.1.6

1 Water has a number of important properties in Biology.

For each of the following, name the property of water that explains the effect:

a) When a dog is hot, it pants and sticks its tongue out to cool down.

SB1 p183–4 3.1.6

b) Some insects are able to move over the surface of the water without being immersed in water.

c) Blood consists mainly of water. Blood transports nutrients, gases and hormones around the body.

d) A molecule of water is used when a peptide bond is broken.

e) The temperature of a pond fluctuated between 18 and 21°C over a period of several hours. However, the air temperature above the pond fluctuated between 15 and 25°C over the same period.

2 The elements in a water molecule are held together by

A: Hydrogen bonds

B: Covalent bonds

C: Ionic bonds

D: Hydrophobic bonds

3 Water molecules show cohesion because of which type of bond?

A: Hydrogen bonds

B: Covalent bonds

C: Ionic bonds

D: Hydrophobic bonds

4 Which of the following occurs because of the high surface tension of water?

A: Water at the bottom of a lake does not freeze, even though it is very cold

B: Water flows upwards from the roots to the leaves in plants

C: Evaporation of sweat from the body prevents overheating

D: Some insects, such as pond skaters, can walk across the surface of a pond

SB1 p183–4 3.1.6

5 Water has a high specific heat capacity. Explain the main reason for this.

Exam-style questions

SB1 p183–4 3.1.6

6 Give **three** properties of water, and for each explain their importance to living organisms. *[6]*

SB1 p183–4 3.1.6 PS2.4

7 **Table 1** shows the rise in temperature when aluminium and water are heated at the same rate.

Heat added/J	Temperature of aluminium/°C	Temperature of water/°C
25	22	10
50	44	17
55	80	21
100	100	26

Table 1

7–1 The materials were heated in identical containers. What other variable would need to be controlled in this investigation? Explain why. *[2]*

7–2 Explain the results of this investigation. *[3]*

7–3 Explain why the property of water you identified in Question 4 is so important to animals. *[2]*

Total: 7

8 A student investigated whether water from a freshwater lake and water from the sea affected the properties of water. They used a large coin on a table and they counted the number of cumulative drops that could be added to the surface of the coin to form one pool without it splitting into smaller pools.

The results of the investigation can be seen in **Figure 14**.

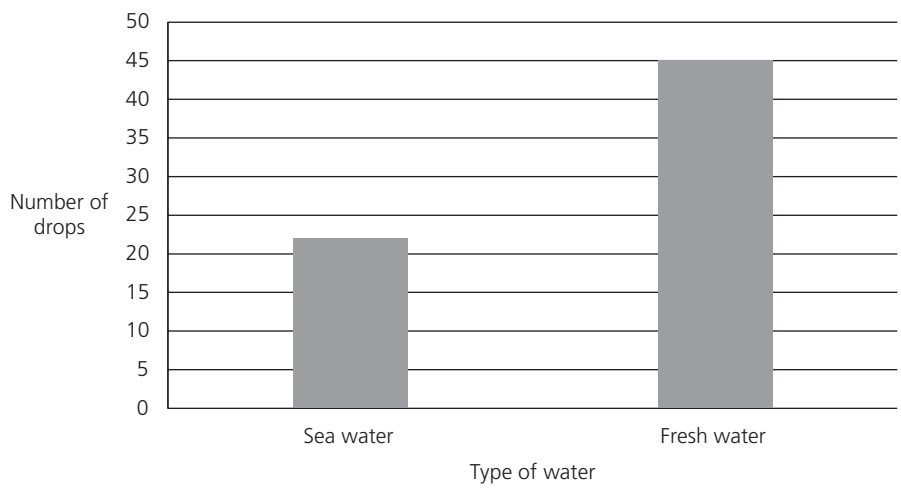


Figure 14

8–1 Deduce what property of water the student was investigating. *[1]*

8–2 Describe what the results show. *[2]*

Total: 3

Inorganic ions

Quick questions

3.1.6

1 Using your understanding of the formulae $pH = -\log_{10}[H^+]$

what is the pH for the following concentrations of H^+?

a) $[H^+]$mol $dm^{-3} = 1 \times 10^{-4}$

b) $[H^+]$mol $dm^{-3} = 1 \times 10^{-7}$

c) $[H^+]$mol $dm^{-3} = 1 \times 10^{-2}$

d) $[H^+]$mol $dm^{-3} = 1 \times 10^{-10}$

Exam-style questions

3.1.6

2 Name each of the ions that has a role in the following:

2–1 pH *[1]*

2–2 Haemoglobin *[1]*

2–3 Co-transport *[1]*

2–4 DNA and ATP *[1]*

Total: 4

3–1 If $[H^+(aq)]$ is 0.25 mol dm^{-3}, what is the pH?

Give your answer to 2dp. *[1]*

3–2 In a solution with a pH of 4.25, calculate the concentration of $H^+(aq)$. *[1]*

Total: 2

Topic review: biological molecules

SB1 p14–15 | 3.1.2 | ATc

1–1 A student has 1M glucose solution. Describe how she could produce a dilution series of four other concentrations of glucose solution. *[4]*

SB1 p14–15 | 3.1.2 | ATc | PS3.2 | PS3.1

1–2 Describe how the student could then use this dilution series and colorimetric techniques to produce a calibration curve. *[5]*

SB1 p14–15 | 3.1.2 | PS3.2

1–3 Describe how the student could then use this calibration curve to ascertain the concentration of glucose in an unknown solution. *[2]*

Total: 11

2 Chromatography is a technique that can be used to separate out components of a mixture. A student set up a paper chromatogram with two standard solutions containing different carbohydrates. She put a spot of each solution on the chromatography paper on the pencil line, left it to dry and suspended it in a solvent. The components of the solutions separated, as shown in **Figure 15**.

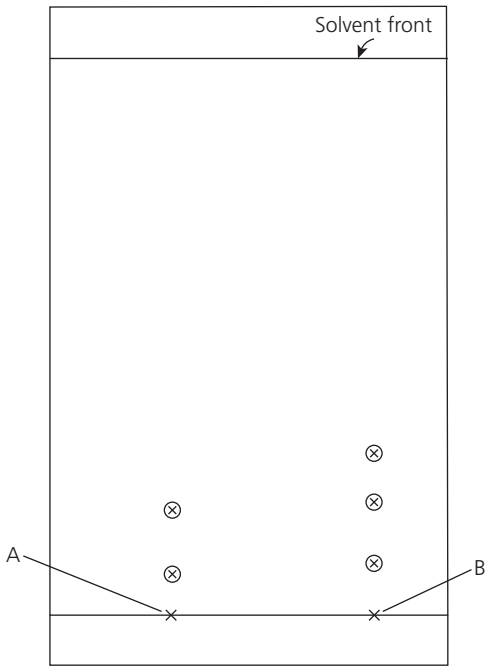


Figure 15

SB1 p2–4, p149 3.1.2 ATg

2–1 The student drew the lines on the paper in pencil and not ink. Explain why. *[1]*

2–2 A locating agent was needed to be able to see the spots after chromatography. Explain why. *[1]*

2–3 **Table 2** shows the R_f value of some sugars.

Carbohydrate	R_f value
Xylose	0.354
Galactose	0.190
Mannose	0.230
Fructose	0.291
Arabinose	0.138
Glucose	0.202
Maltose	0.069
Sucrose	0.093
Lactose	0.150

Table 2

Using **Table 2** determine which carbohydrates were present in Sample A and B. *[2]*

Total: 4

3 **Figure 16** shows three different rates of reaction of Enzyme X.

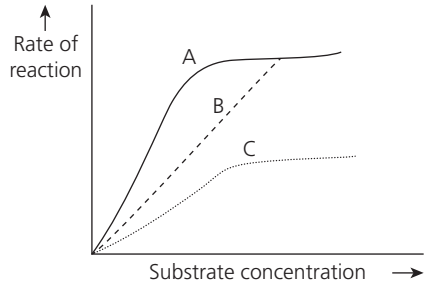


Figure 16

SB1 p26–7 3.1.4.2

3–1 Identify which of the three lines in **Figure 16** represents Enzyme X in the presence of a competitive inhibitor. Explain your answer. *[3]*

3–2 Identify which of the three lines in **Figure 16** represents Enzyme X in the presence of a non-competitive inhibitor. Explain your answer. *[5]*

SB1 p27–9 3.1.4.2

3–3 Explain why, in all three reactions, the rate of reaction levels off. *[2]*

Total: 10

SB1 p57–61 3.1.5.2

4–1 Describe the process of DNA replication. *[7]*

SB1 p57–61 3.1.5.2

4–2 Explain why DNA replication is described as being semi-conservative. *[2]*

Total: 9

SB1 p184–5 3.1.7

5 Pond skaters are a group of insects that are able to walk on the surface of water due to surface tension. Explain what property of water plays a role in surface tension. *[2]*

SB1 p56–65 3.1.6, 3.1.5.1

6 Compare and contrast the structure of ATP and a DNA nucleotide. *[4]*

7 **Figure 17** shows one glycerol and three fatty acid molecules.

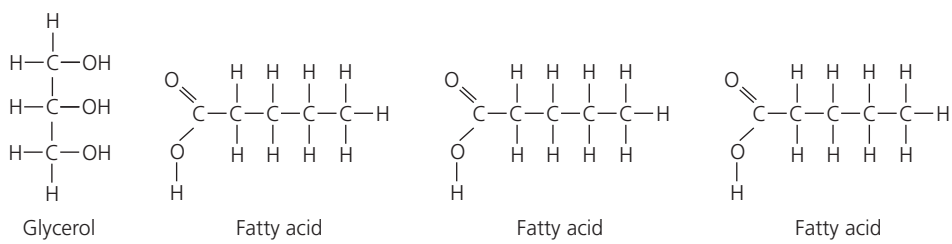


Figure 17

SB1 p7–9 3.1.3

7–1 Draw a circle around the atoms that will be removed when the glycerol joins with the three fatty acid molecules. *[1]*

7–2 Name the molecule formed as a result of the joining of these four molecules. *[1]*

7–3 Give the type of reaction this is and what molecules are formed as a result. *[2]*

7–4 Name the bond formed between the glycerol and fatty acid. *[1]*

7–5 Give the type of fatty acid this is and explain how you know. *[2]*

Total: 7

8 A student investigated the effect of temperature of an enzyme-controlled reaction. The mass of product formed was measured over 15 minutes.

The results are shown in **Table 3**.

Temperature/°C	Mass of product/mg	Rate of reaction/ _____
10	5	
20	14	
30	27	
40	36	
50	23	
60	0	

Table 3

SB1 p19–29 3.1.4.2 PS3.2 **8–1** Complete the units for the 'rate of reaction' column. *[1]*

8–2 Calculate the rate of reaction and complete the table to suitable significant figures. *[2]*

SB1 p19–29 3.1.4.2 PS3.1 **8–3** Plot a graph to show the results in **Table 3**. *[3]*

SB1 p19–29 3.1.4.2 **8–4** Explain the result at 60°C. *[6]*

SB1 p19–29 3.1.4.2 PS2.3 **8–5** The student concluded that this enzyme's optimum temperature was 40°C.

Evaluate this conclusion. *[4]*

Total: 16

9 Catalase is an enzyme found in potato cells. It breaks down hydrogen peroxide to oxygen and water.

$2H_2O_2 \rightarrow 2H_2O + O_2$

A student investigated this reaction. The apparatus she used is shown in **Figure 18**. She cut three cores of potato tissue, each 4 cm long and 1 cm diameter, and placed them in the conical flask. Then she added 20 cm^3 of hydrogen peroxide solution using the syringe.

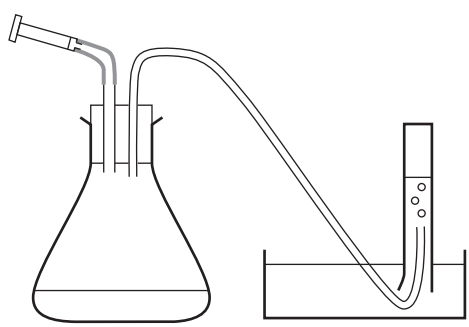


Figure 18

SB1 p19–29 3.1.4.2 PS3.2 **9–1** Describe how the student could find the rate of this reaction. *[3]*

SB1 p111 3.1.4.2 PS1.11.2 **9–2** The student repeated the experiment using the same volume and concentration of hydrogen peroxide solution, but this time she cut the potato cores in half before putting them into the conical flask. Describe how you would expect the results of this second experiment to be different from the first results, giving reasons for your answer. *[2]*

SB1 p19–29 3.1.4.2 PS2.4 **9–3** Suggest a suitable control for this investigation, explaining why it is needed. *[2]*

Total: 7

PRACTICE MAKES PERMANENT

AQA A-level Biology

Practise and prepare for AQA A-level Biology with hundreds of topic-based questions and one complete set of exam practice papers designed to strengthen knowledge and prepare students for the exams.

- **Consolidate knowledge and understanding** with practice questions for every topic and type of question, including multiple-choice, multi-step calculations and extended response questions.
- **Develop mathematical, practical and literacy skills through practice;** key skills are indicated in the margin.
- **Confidently approach the exam having completed one set of exam-style practice papers** that replicate the types, wording and structure of the questions students will face.
- **Identify topics and skills for revision** using the page references in the margin to refer back to the specification and accompanying Hodder Education Student Books for remediation.
- **Easily check answers** with fully worked solutions and mark schemes provided in the book.

HODDER EDUCATION
t: 01235 827827
e: education@bookpoint.co.uk
w: hoddereducation.co.uk

ISBN 978-1-5104-7502-1