OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



EXAM QUESTION PACK

B1.2 WHAT HAPPENS IN CELLS (AND WHAT DO CELLS NEED?)

SCORE	PERCENTAGE
/171	%

STEMUP

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Gateway Biology A (9-1)

What happens in cells (and what do cells need)?

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **171**.
- The total number of marks may take into account some 'either/or' question choices.

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1 How many strands are in a DNA molecule?

A 1
B 2
C 3
D 4

Your answer

[1]

2 In DNA, which base does A (adenine) pair with?

A A
B C
C G
D T

Your answer

[1]

3 Which molecule is **not** a polymer?

A DNA
B lipid
C protein
D starch

Your answer

[1]

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4(a) A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

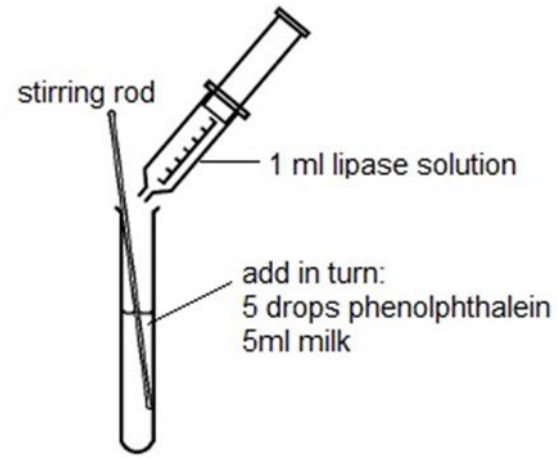
In their investigation they use an indicator called phenolphthalein.

Phenolphthalein is pink in alkali conditions but becomes colourless when the pH falls below pH8.

A student puts 5 drops of phenolphthalein and 5 ml of full fat milk into a test tube.

She adds 1 ml of lipase, stirs the mixture and times how long it takes to lose the pink colour.

Other students repeat this but at different temperatures.



The table shows the group's results.

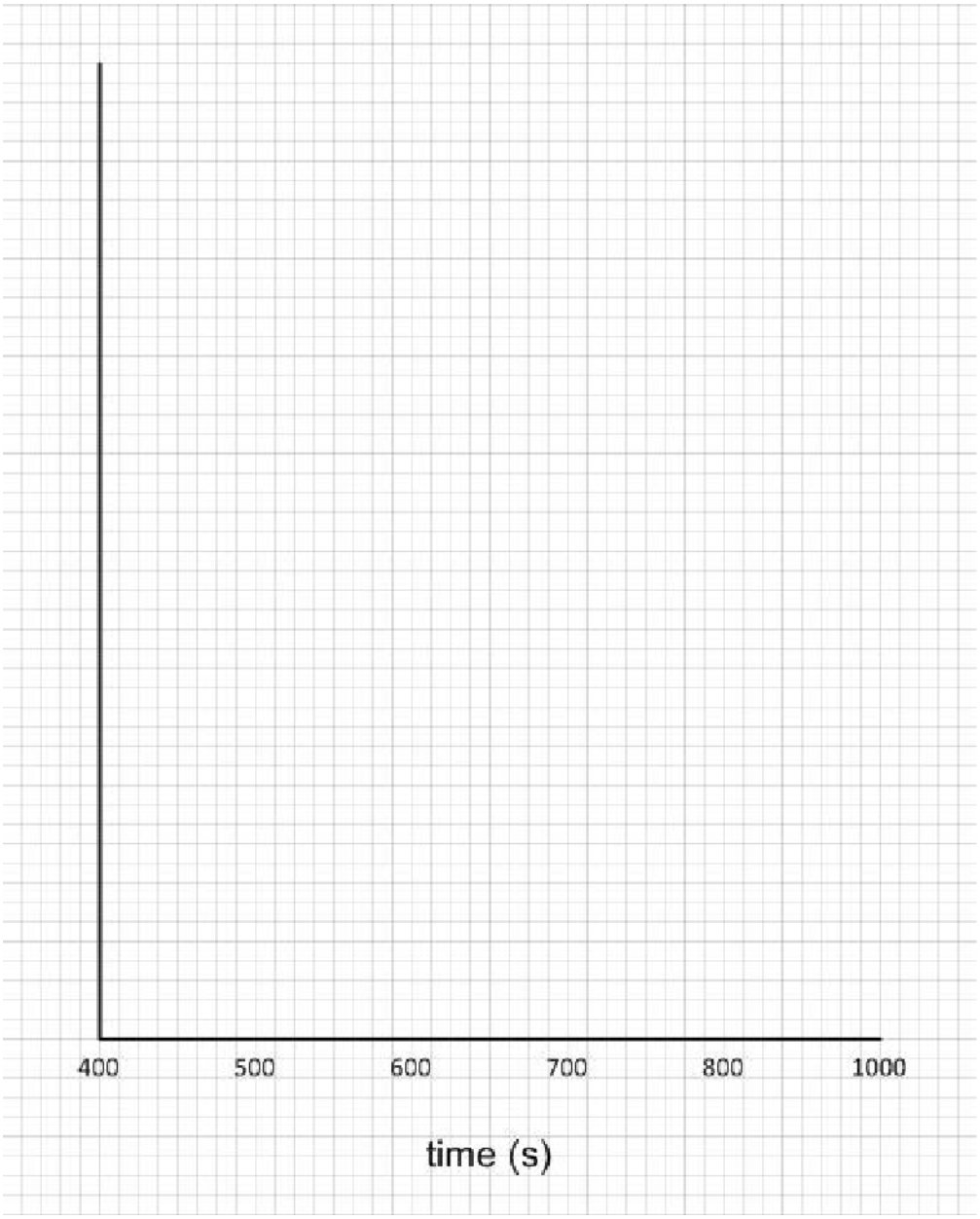
Temperature (°C)	Time for pink colour to disappear (s)
20	480
40	240
60	270
80	960

Plot a graph of the results and draw a line of best fit.

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[5]

(b) Explain the difference between the results at 20 °C and 40 °C.

---

[3]

(c) Explain the difference between the results at 80 °C and 40 °C.

---

[3]

(d)

(i) One student says that the results show that the optimum temperature for the lipase is 40 °C.

The teacher says that she **cannot** say for certain that it is 40 °C.

Explain why.

---

[1]

(ii) Give **two** reasons how the students could modify their method to find out the optimum temperature more accurately.

---

[2]

(e) The students rounded their times to the nearest 10 seconds.

They did this because they found it difficult to judge exactly when the pink colour had disappeared.

Describe and explain **two** ways the method could be improved to give more accurate measurements.

1

2

---

[2]

5 Some students measured the temperature inside a compost heap.

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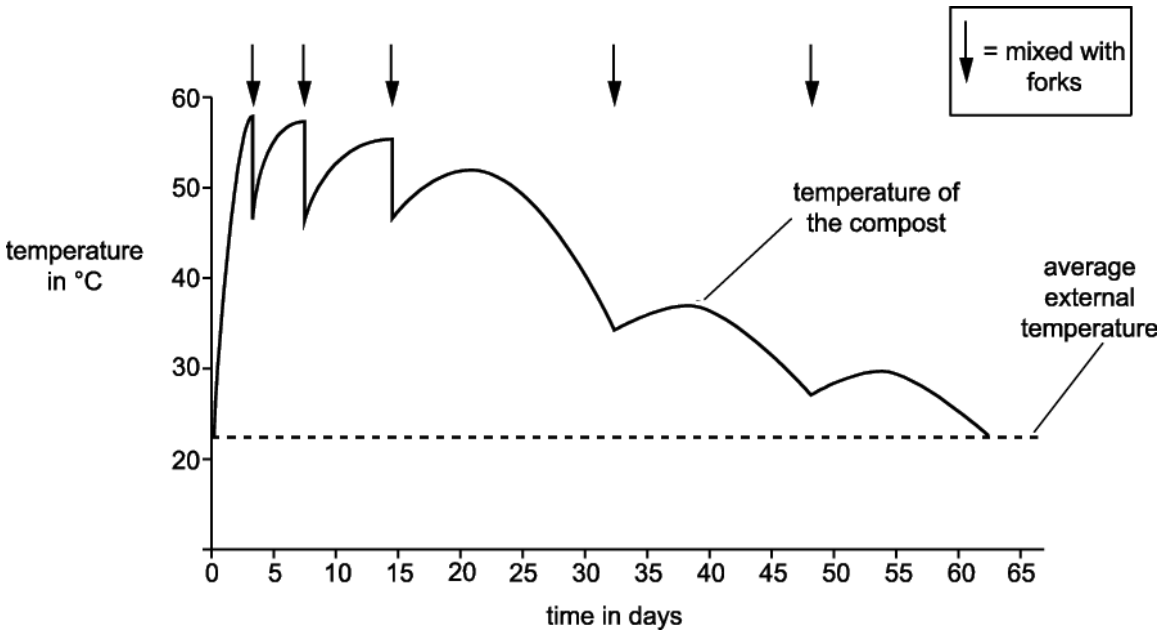
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They also measured the external temperature.

On five occasions they mixed up the compost heap with garden forks.

The graph shows their results.



(i) The compost took 63 days to completely decompose.

Explain how the students could tell this from their graph.

---

[1]

(ii) The rate of temperature increase is greatest before the compost is mixed for the first time.

Explain how the rate of temperature change can be calculated.

---

[1]

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6 In DNA, which base does T (thymine) pair with?

A T
B C
C G
D A

Your answer ☐

[1]

7 Which molecule is **not** a polymer?

A DNA
B lipid
C protein
D starch

Your answer ☐

[1]

8 Insulin is a protein made of 51 amino acids.

How many bases are in the length of DNA coding for insulin?

A 51
B 102
C 153
D 204

Your answer ☐

[1]

9(a) A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

In their investigation they use an indicator called phenolphthalein.

Phenolphthalein is pink in alkali conditions but becomes colourless when the pH falls below pH 8.

A student puts 5 drops of phenolphthalein and 5 ml of full fat milk in to a test tube.

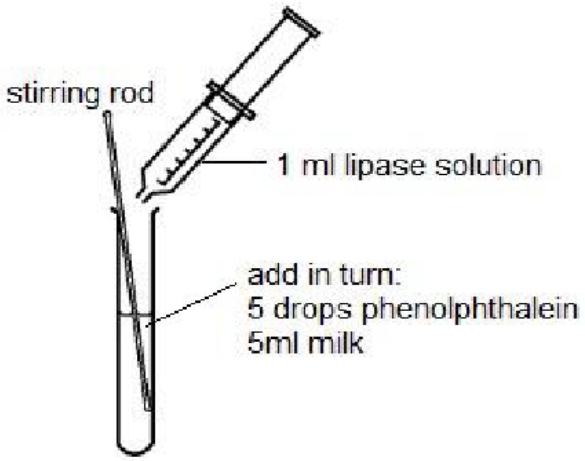
She adds 1 ml of lipase, stirs the mixture and times how long it takes to lose the pink colour.

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Other students repeat this but at different temperatures.



The table shows the group's results.

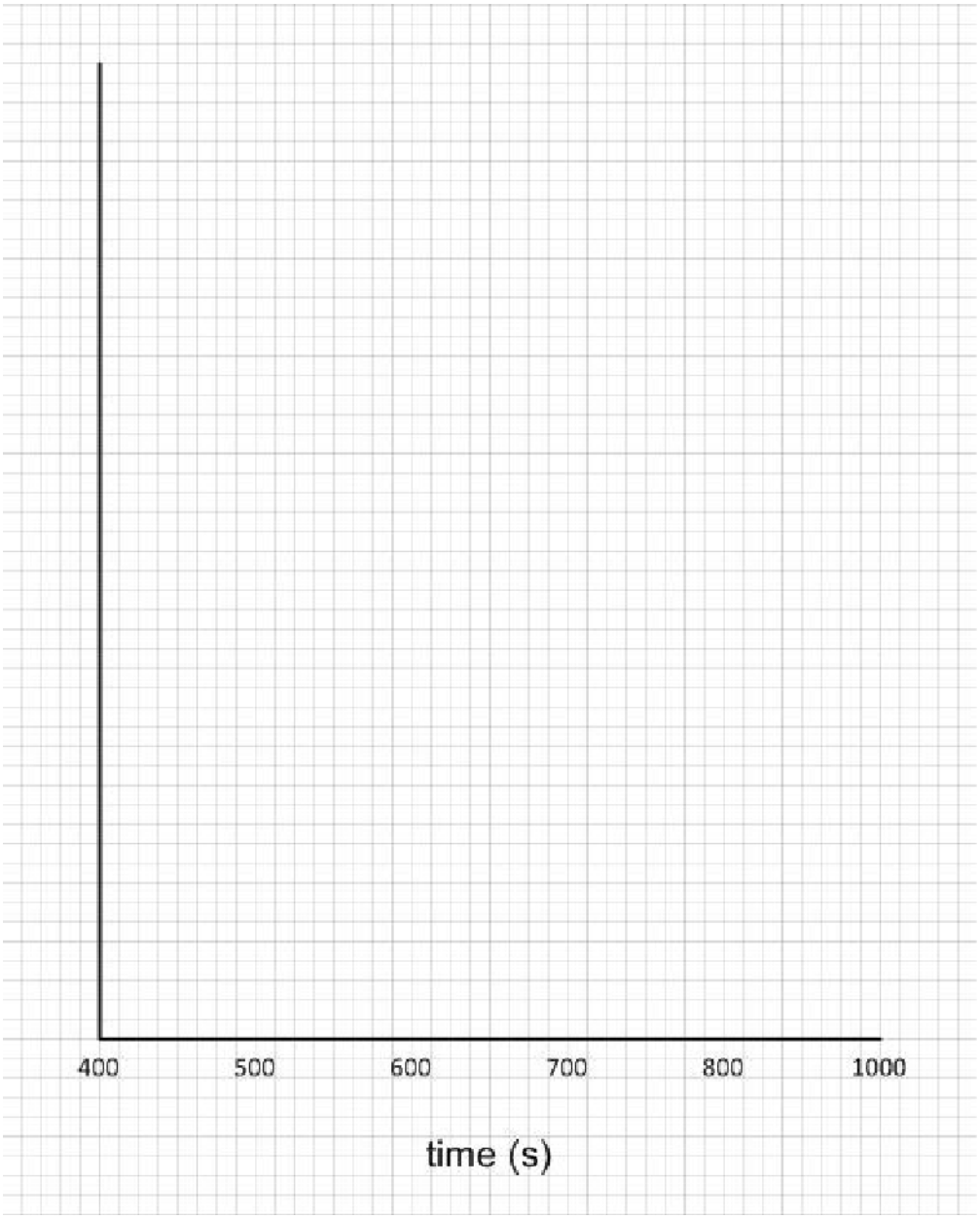
Temperature (°C)	Time for pink colour to disappear (s)
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Plot a graph of the results and draw a line of best fit.

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(b) Explain the difference between the results at 20°C and 40°C.

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[3]

(c) Explain the difference between the results at 80°C and 40°C.

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[3]

(d)

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The teacher says that she **cannot** say for certain that it is 40°C.

Explain why.

---

[1]

(ii) Give **two** reasons how the students could modify their method to find out the optimum temperature more accurately.

---

[2]

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(e) The students rounded their times to the nearest 10 seconds.

They did this because they found it difficult to judge exactly when the pink colour had disappeared.

Describe and explain **two** ways the method could be improved to give more accurate measurements.

1

2

---

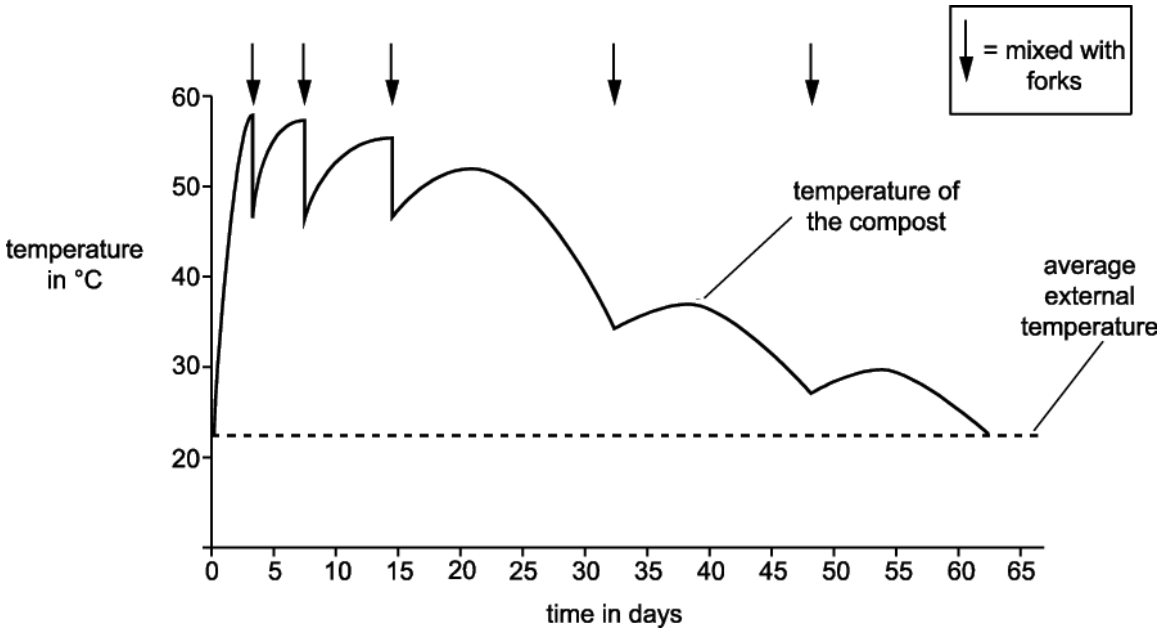
[2]

10 Some students measured the temperature inside a compost heap.

They also measured the external temperature.

On five occasions they mixed up the compost heap with garden forks.

The graph shows their results.



(i) The compost took 63 days to completely decompose.

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Explain how the students could tell this from their graph.

---

[1]

(ii) The rate of temperature increase is greatest before the compost is mixed for the first time.

Explain how the rate of temperature change can be calculated.

---

[1]

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11(a) Erythromycin is an antibiotic drug.

It is important to get the dose of erythromycin right.

Too much erythromycin can be harmful.

However, recently some strains of bacteria have developed resistance to low concentrations of erythromycin.

To see how effective erythromycin is, it is tested using bacteria grown on agar plates.

This method is used:

- A petri dish is used that has the bacteria growing evenly over the surface.
- A disc of filter paper is soaked in erythromycin.
- The disc is placed on the agar in the centre of the petri dish using sterile forceps.
- The dish is incubated at 37°C.

(i) Why did the scientists incubate the dish at 37°C rather than at higher or lower temperature?

---

[2]

(ii) Why is the filter paper disc moved using sterile forceps?

---

[1]

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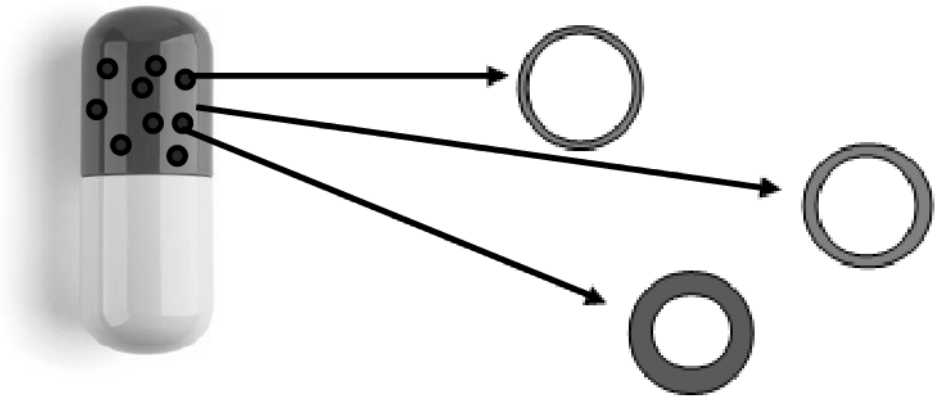
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(b) Erythromycin is usually given to patients in a capsule.

The capsule has lots of small spheres containing the drug.

The walls of the spheres are different thicknesses.

They are made of a carbohydrate polymer.



(i) Explain why the drug is released from the spheres in the small intestine.

---

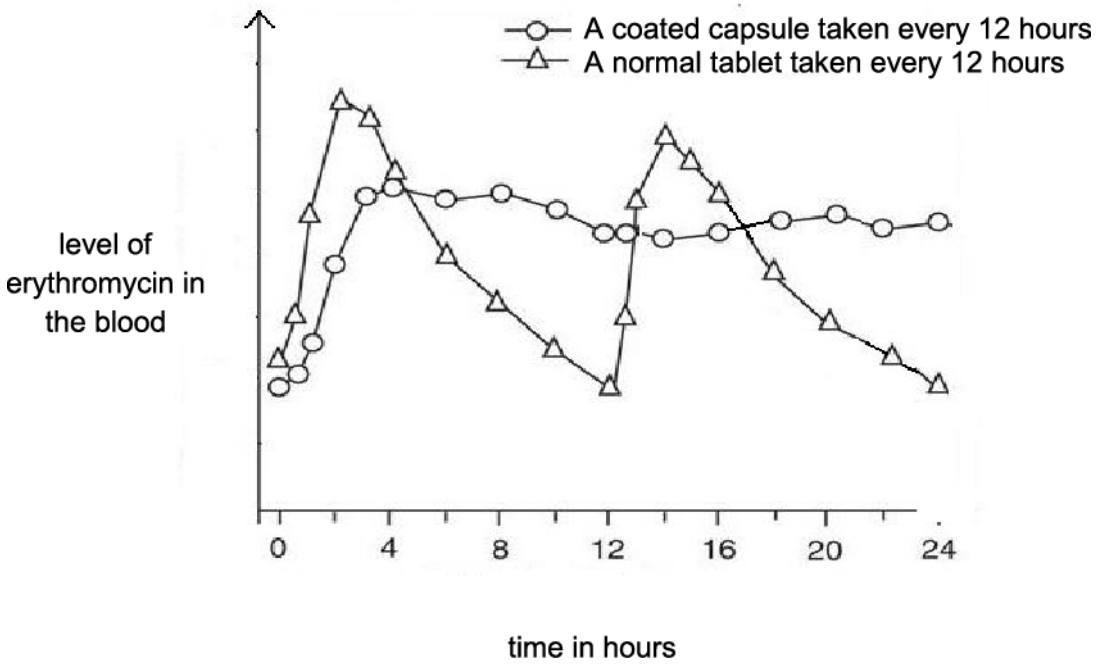
[2]

(ii) * The graph shows the levels of erythromycin in the blood when given using this capsule and in a normal tablet.

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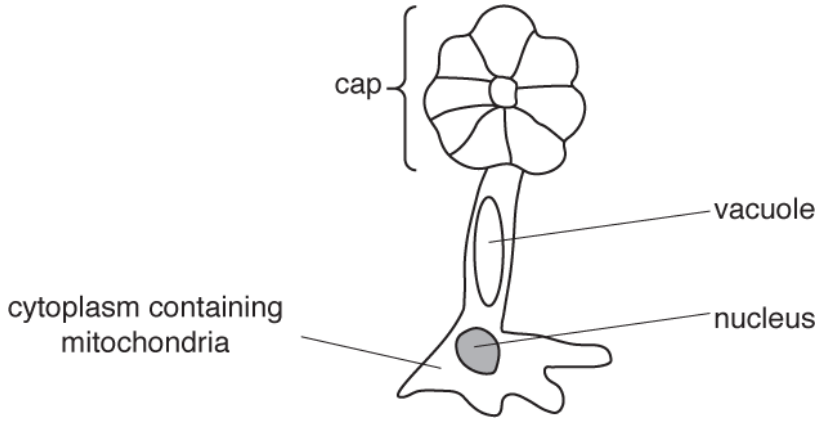
Explain the shape of the two graphs and why it is better to give erythromycin in capsules.

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[6]

12 *Acetabularia* is a single-celled organism that lives in the sea.

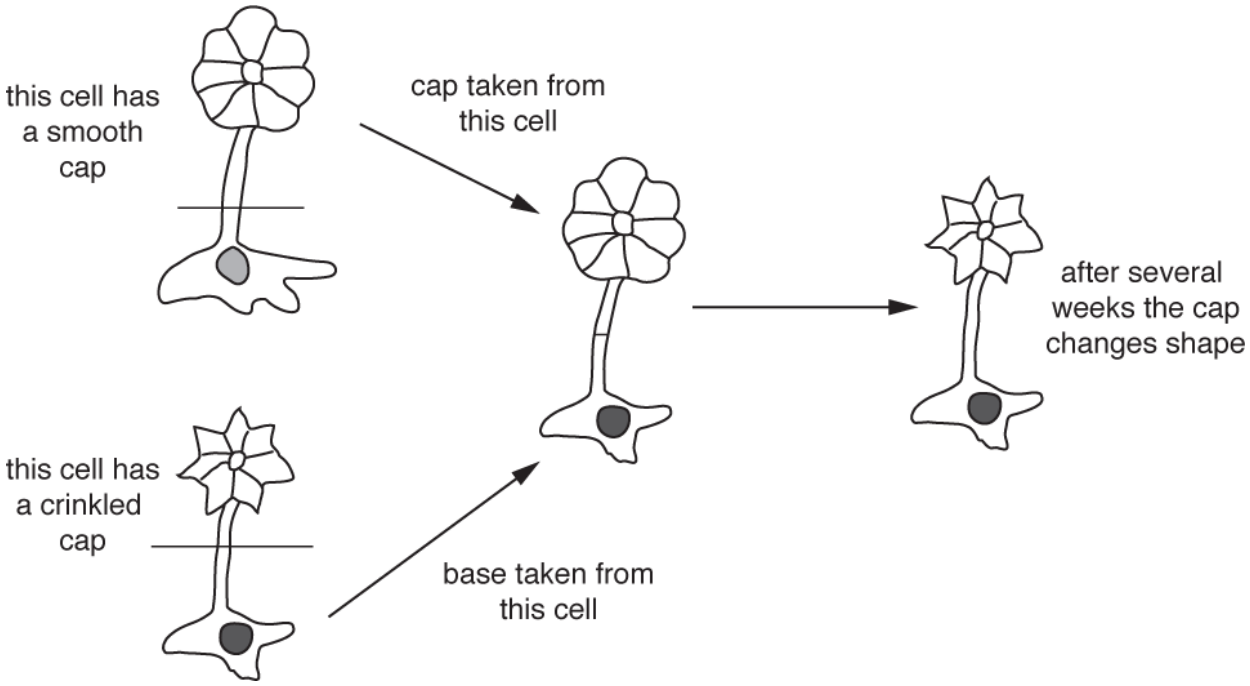
It has rather an unusual shape.



A scientist does an experiment with two types of *Acetabularia*.

The two cells have different shaped caps.

The scientist takes parts from each cell and joins them together.



The shape of the cap depends on which **proteins** are made by the cell.

Write about how the making of proteins is controlled in a cell.

Use this idea to explain the results of the scientist's experiment.



The quality of written communication will be assessed in your answer to this question.

[6]

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13(a) A student answered some questions in a biology test.

His answers contain mistakes.

Explain what they are.

Question: Write down three examples of proteins.

Student's answer: DNA, collagen, insulin

Student's mistake _____

_____ [1]

(b) Question: Why are sperm cells and egg cells different in size?

Student's answer: Egg cells are bigger because they supply all the chromosomes and genes for the zygote.

Student's mistake _____

_____

_____

_____ [2]

(c) Question: How do enzymes work?

Student's answer: An enzyme is like a key that fits into a substrate's active site.

Student's mistake _____

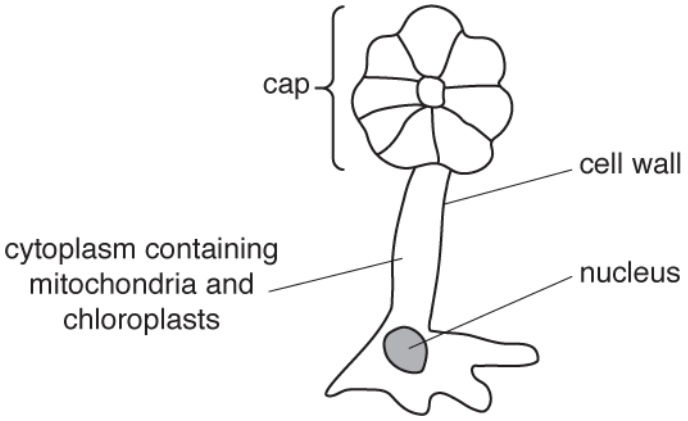
_____

_____

_____ [2]

14 *Acetabularia* is a unicellular organism that lives in the sea.

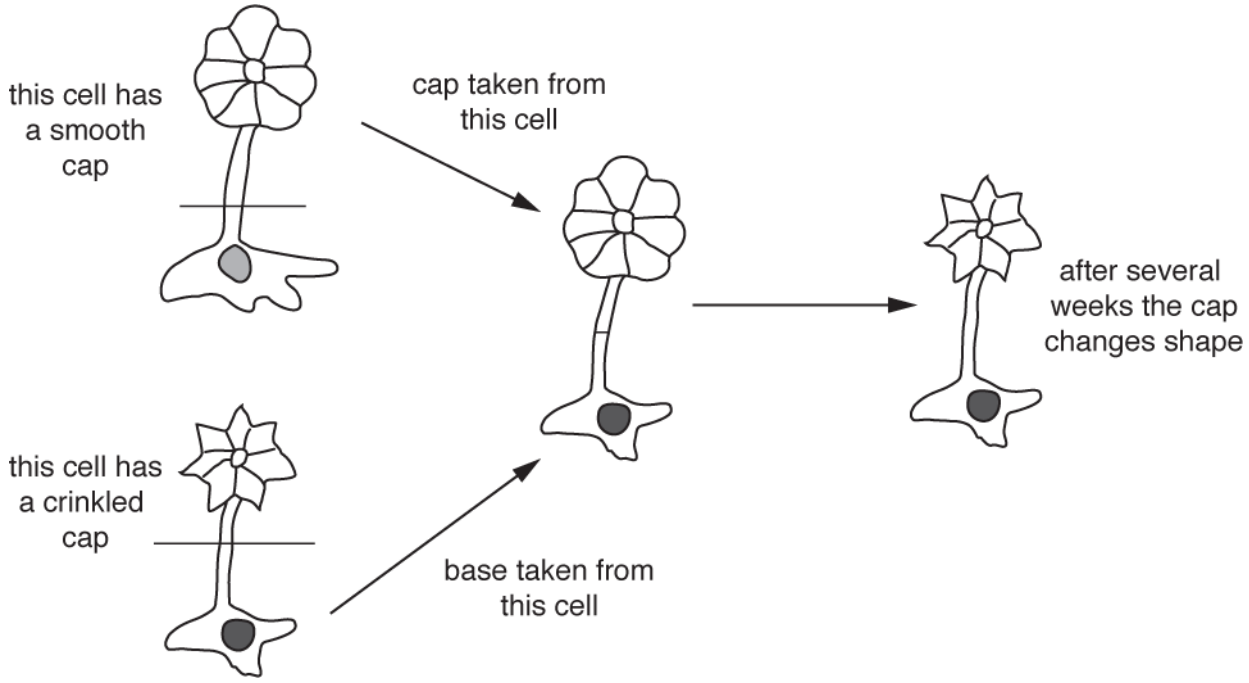
It has rather an unusual shape.



A scientist did an experiment with two types of *Acetabularia*.

The two types of *Acetabularia* had different shaped caps.

The diagram shows the scientists experiment.



The shape of the cap depends on which ***proteins*** *are made by the cell.*

Explain how the nucleus codes for proteins that are made elsewhere in the cell and suggest why it took several

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weeks for the cap to change shape.



The quality of written communication will be assessed in your answer to this question.

[6]

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15(a) A student answered two questions in a biology test.

Both his answers contain mistakes.

Explain the student's mistakes in each answer.

Question one: Write down three examples of proteins.

Student's answer: amino acids, collagen, insulin

Student's mistake _____

[2]

(b) Question two: How do enzymes work?

Student's answer: An enzyme is like a key that fits into a substrate's active site.

Student's mistake _____

[2]

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16 DNA is a polymer.

What is the name of the monomer in DNA?

A Base

B Deoxyribose sugar

C Nucleotide

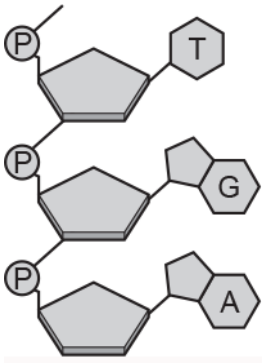
D Phosphate

Your answer [ ] [1]

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17 DNA is made of two complementary strands.

The diagram shows part of one strand of DNA.



Which base sequence would be found on the complementary strand of this DNA?

A A
C
T

B C
A
G

C G
A
C

D T
G
A

Your answer [ ] **[1]**

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18(a) Students investigate how to extract DNA from peas.

Stage 1:

- Chill 10 cm^3 of ethanol. Keep it on ice throughout the method for use in stage 2.
- Make a thick 'soup' by blending 100 cm3 of peas with salt and cold water. Blend for 15 seconds in an electric blender.
- Strain the 'soup' through a mesh strainer and collect the liquid part in a beaker.
- Add 30 cm^3 of washing–up liquid and swirl to mix.
- Let the mixture settle for 5–10 minutes in a water bath at 60°C.

One group of students made a water bath using a beaker of water, thermometer and Bunsen burner. Another group used an electric water bath.

Write down **two** advantages of using an electric water bath.

1 ----------

---

2 ----------

---[2]

(b) Low temperatures protect DNA by slowing down the activity of enzymes that destroy DNA.
High temperatures break down membranes in the cell.

To extract DNA, some methods use a water bath at 60°C but other methods do not use an increased temperature.

Suggest **two** reasons for the different methods.

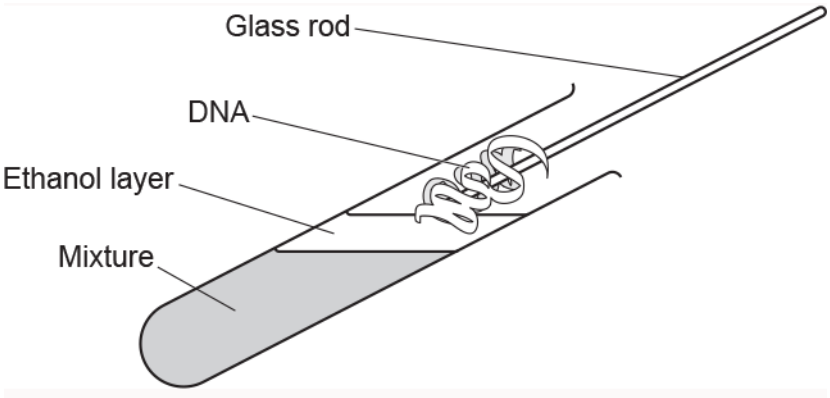
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[2]

(c) Students investigate how to extract DNA from peas.

This is a two stage process.

Stage 2 isolates the DNA.



- Pour the mixture collected from stage 1 into a test tube until a third full. Add protease enzymes to the test tube.
- Slowly pour cold ethanol at an angle of 45° into the tube. Ethanol will float on top.
- DNA is soluble in water, but salted DNA does not dissolve in ethanol and will form white clumps where the water and ethanol layers meet.
- Twirl a glass rod and the DNA will collect on the rod.

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- Dry the sample on a pre–weighed filter paper and measure the mass of product.

Suggest **two** safety precautions which should be taken at stage **2**.

Explain why each safety precaution is needed.

1 Safety precaution: ----------

Explanation: ----------

2 Safety precaution: ----------

Explanation: ---------- [2]

(d) Students investigate how to extract DNA from peas.

Look at the table. It shows the results from the two groups of students in the investigation.

Type of water bath used	Mass of DNA collected (mg)			
	Test 1	Test 2	Test 3	Mean
Beaker of water and Bunsen burner				22.9
Electric	33.6	32.3	33.3	

(i) Calculate the mean mass collected in the investigation using the electric water bath.

Give your answer to 1 decimal place.

Answer = ---------- mg [2]

(ii) The range of the three test readings for the beaker of water and Bunsen burner was 3.4.

Does the evidence support using an electric water bath instead of a beaker of water and Bunsen burner?

Explain your answer.

---[2]

19 During protein synthesis the DNA that codes for a particular protein is copied. This copy is called mRNA.

The diagram below shows the base sequence for a section of DNA.

G G T G C A T A T

What would be the complementary sequence of mRNA for this section of DNA?

A C C A C G T A T A

B C C A C G U A U A

C G G T G C A T A T

D G G U G C A U A U

Your answer ☐ **[1]**

20

(i) An egg develops in a follicle before ovulation. The follicle has a diameter of 25×10^{-3} mm at the start. This follicle grows to 20 mm in diameter just before the egg is released.

Calculate the increase in size of the diameter of the follicle.

Give your answer to **2** decimal places.

Answer = _____ mm **[3]**

(ii) The failure of a follicle to increase in size can result in less production of oestrogen.

Explain what effect this may have on the uterus.

_____ **[1]**

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(iii) Explain how hormones can be used to treat infertility in women.

---

[3]

(iv) Infertility can also be caused by problems in the male.

Plasmin is a protease enzyme important in sperm movement.

Explain how changes to the structure of DNA could result in the plasmin enzyme being faulty.

---

[2]

21(a) Students investigate how to extract DNA from peas.

Stage 1:

- Chill 10 cm^3 of ethanol. Keep it on ice throughout the method for use in stage 2.
- Make a thick ‘soup’ by blending 100 cm3 of peas with salt and cold water. Blend for 15 seconds in an electric blender.
- Strain the ‘soup’ through a mesh strainer and collect the liquid part in a beaker.
- Add 30 cm^3 of washing-up liquid and swirl to mix.
- Let the mixture settle for 510 minutes in a water bath at 60°C.

One group of students made a water bath using a beaker of water, thermometer and Bunsen burner. Another group used an electric water bath.

Write down **two** advantages of using an electric water bath.

1 ----------

---

2 ----------

---

[2]

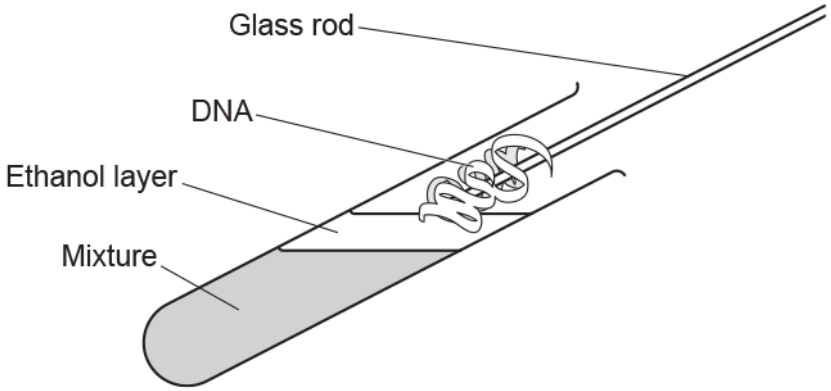
(b) Low temperatures protect DNA by slowing down the activity of enzymes that destroy DNA.
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Suggest **two** reasons for the different methods.

--- [2]

(c) **Stage 2** isolates the DNA.



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Explain why each safety precaution is needed.

1 Safety precaution: ----------

Explanation: ----------

2 Safety precaution: ----------

Explanation: ----------

[2]

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(d) Look at the table. It shows the results from the two groups of students in the investigation.

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(i) Calculate the mean mass collected in the investigation using the electric water bath.

Give your answer to 1 decimal place.

Answer = ---------- mg **[2]**

(ii) The range of the three test readings for the beaker of water and Bunsen burner was 3.4.

Does the evidence support using an electric water bath instead of a beaker of water and Bunsen burner?

Explain your answer.

---**[2]**

22 How many different bases are in DNA?

A 2
B 4
C 23
D 46

Your answer ☐ **[1]**

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23 When the enzyme lipase is mixed with a lipid which of the following will increase in concentration?

A Amino acids
B Fatty acids and glycerol
C Glucose and fructose
D Starch

Your answer [ ] [1]

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24 Switching off the protection mechanism described in part **(b)** involves the plant making a **protein.**

Scientists have put extra copies of the gene for this protein into the plants. This makes the plant make more mRNA molecules.

(i) Explain why making more mRNA will switch off the mechanism faster.

---

[2]

(ii) Scientists have found that the genetically modified plants make 20% more biomass.

Use the agricultural food chain on page 21 to calculate the increase in biomass this would provide for humans.

Answer = ---------- kg **[2]**

(iii) Inserting extra copies of a plant's gene into a plant is a type of genetic modification (GM).

Another example of GM involves inserting a bacterial gene into a plant which makes the plant produce an insecticide.

Suggest reasons why.

---

[2]

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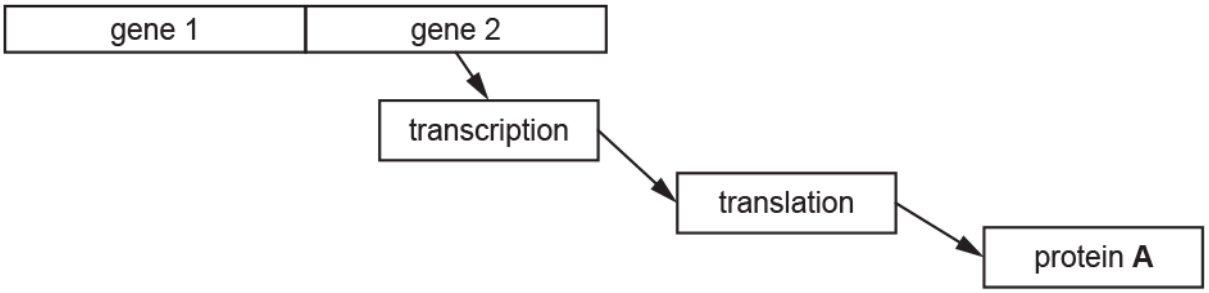
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25 Drugs can be used to treat one type of diabetes. One drug prevents an enzyme working properly.

Suggest how a drug can stop an enzyme working.

[2]

26 Gene **1** and gene **2** are both needed for the production of protein **A**.



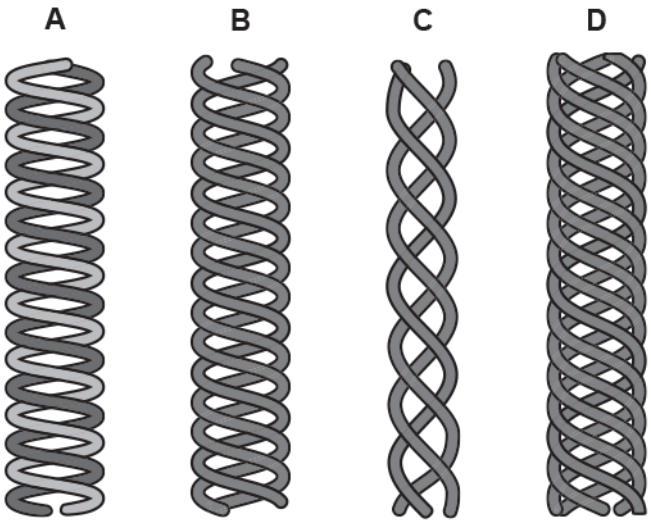
What is the function of **gene 1** in this process?

A It codes for the amino acids in protein **A**.
B It codes for the mRNA needed to make protein **A**.
C It acts as the site for protein synthesis.
D It controls the expression of **gene 2**.

Your answer [1]

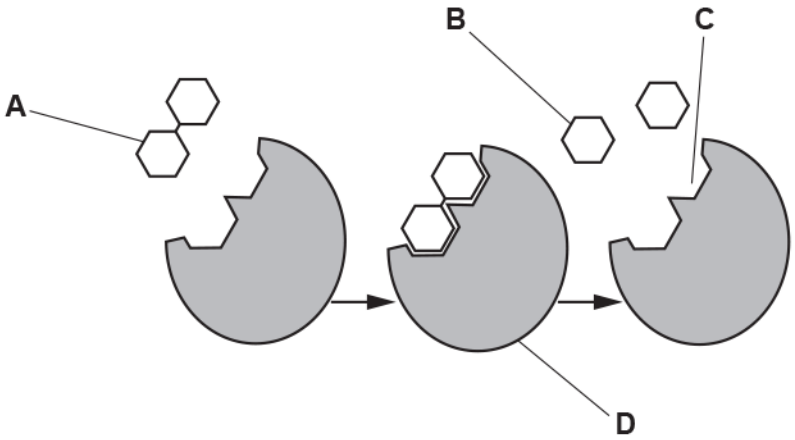
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27 Which structure most closely resembles DNA?



Your answer ☐ [1]

28 Look at the model of enzyme activity.



Which label represents the active site of an enzyme?

Your answer ☐ [1]

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29 Which biological molecule is **not** a polymer?

A Amylase
B DNA
C Nucleotide
D Starch

Your answer ☐ **[1]**

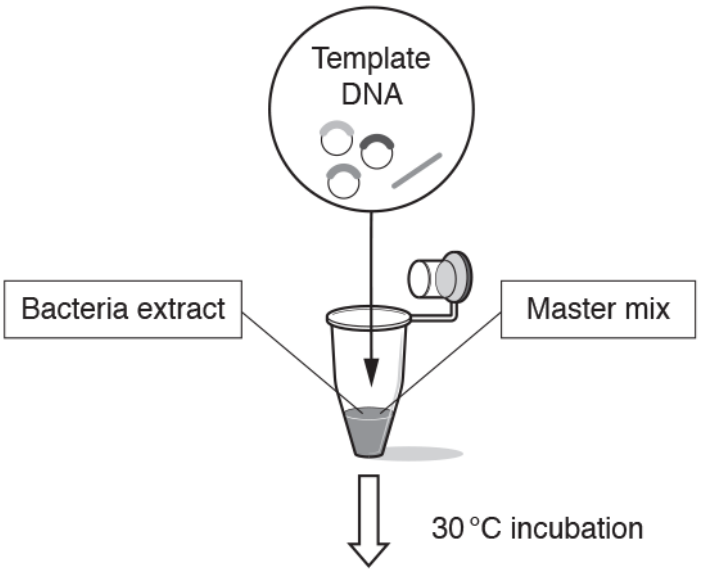
30(a) Scientists can make the proteins they need outside of living cells (*in vitro*).

To do this they use cell free protein synthesis kits.

The kit includes three different parts:

- A template DNA molecule
- An extract from bacteria containing mRNA and tRNA nucleotides
- A master mix containing amino acids, energy sources, enzymes and ribosomes.

To make a protein the three different parts are mixed together and incubated for 3 hours at 30 °C.



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(i) Describe the role of the DNA template and mRNA nucleotides in the production of the protein.

---

[2]

(ii) Describe the role of the tRNA nucleotides and ribosomes in the production of the protein.

---

[2]

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(b) Thirty years ago, identifying a person from their DNA required a large sample of DNA.

Polymerase chain reaction (PCR) is a technique developed in 1983.

PCR allows a single copy or segments of DNA to quickly make multiple copies of a DNA sequence.

(i) Many crimes committed over 30 years ago can now be solved using PCR.

Explain why.

---

[2]

(ii) Which part of the cell cycle takes place in PCR?

---

[1]

(c)

(i) DNA databases involve storing a person's individual DNA profile. The DNA profile identifies DNA sequences present in an individual.

DNA databases are used by many different organisations.

Solving crimes is one use of a DNA database.

Suggest **other** reasons why organisations might need a DNA database.

---

[2]

(ii) Write down **one** reason why people might **not** want to be included on a DNA database.

---

[1]

31 Some students make a model of DNA.

They use four different colours of round sweets to represent the bases and attach them to two candy laces. **Fig. 16.2** shows their model.

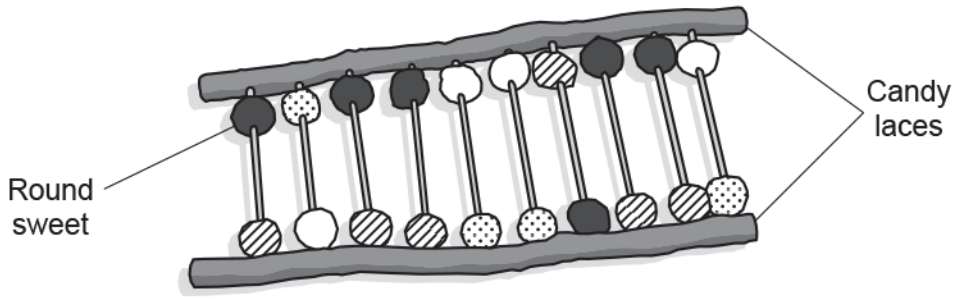


Fig. 16.2

(i) Why did the students use four different colours of round sweets in their model of DNA?

---

[1]

(ii) Write down the names of the **two** types of chemical group represented by the candy laces.

1 ---

2 ---

[2]

32(a) Fermentation involves enzymes breaking down sugar and releasing carbon dioxide gas.

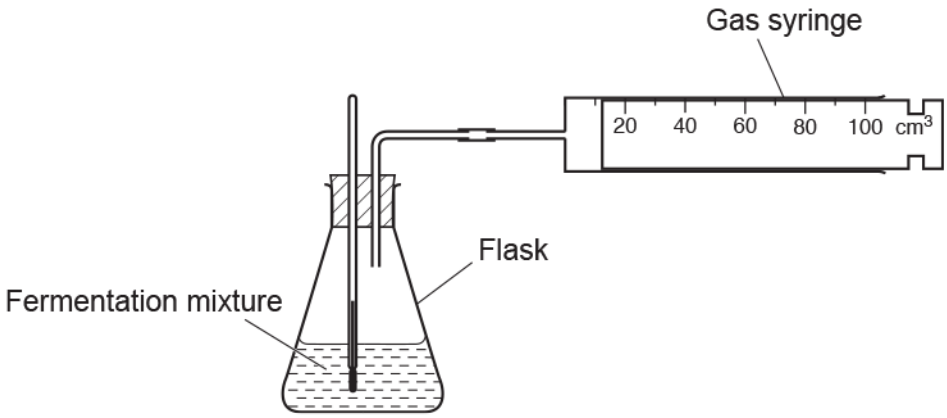
The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.
She measures the volume of carbon dioxide released in 10 minutes.
The diagram shows the apparatus she uses.

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Using a Bunsen burner to heat a water bath is **one** way the student could keep the flask at a constant temperature.

(i) What other way could be used to keep the flask at a constant temperature?

[1]

(ii) She chooses to use a Bunsen burner and water bath.

Give **one** safety precaution she should take.

[1]

(iii) Explain why using a Bunsen burner and water bath may introduce errors into her results.

[2]

(b) The table shows the student's results.

Temperature (°C)	Volume of carbon dioxide gas released in 10 minutes (cm^3)				
	Trial 1	Trial 2	Trial 3	Mean	Range
25	23	25	22	23	22–25

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30	34	29	33	.....	29–34

(i) Calculate the **mean** for the results at 30 °C and **complete the table**.

[2]

(ii) The student repeated the experiment at two more temperatures, 20 °C and 35 °C, to get enough readings to plot a line graph.

Which measurement should the student plot on the **x-axis**?

[1]

(iii) Describe **one** way that the range would improve any conclusions made from the graph.

[1]

(iv) The mean volume at a temperature of 20 °C was 15 cm^3 and for a temperature of 35 °C it was 27 cm^3.

Describe what the student's results show about the effect of temperature on enzyme activity.

[2]

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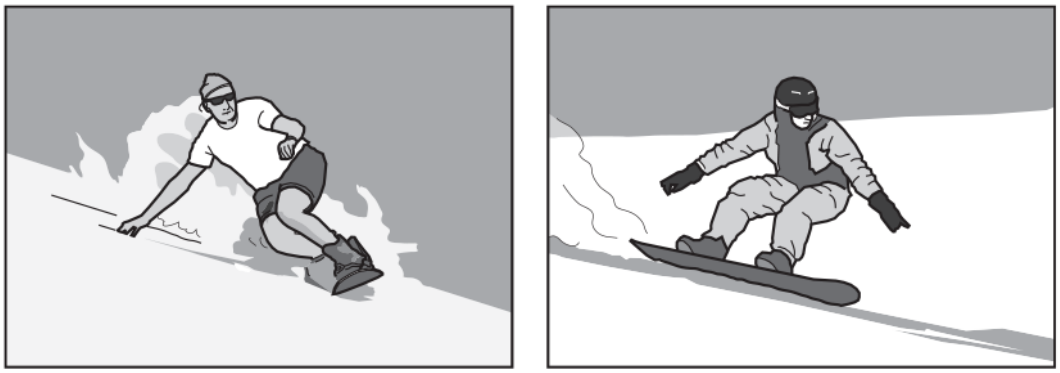
33

(i) Explain why overheating of the body may stop chemical reactions in cells.

[2]

(ii) * Look at **Fig. 20.2** which shows two people riding on boards.

Person A is riding a board on sand in a hot desert. **Person B** is riding a board on snow.



Person A **Person B**

Fig. 20.2

Explain the different problems of temperature regulation for these two people and give examples of the ways their bodies solve these problems.

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[6]

34 Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

Write the words **allele, chromosome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

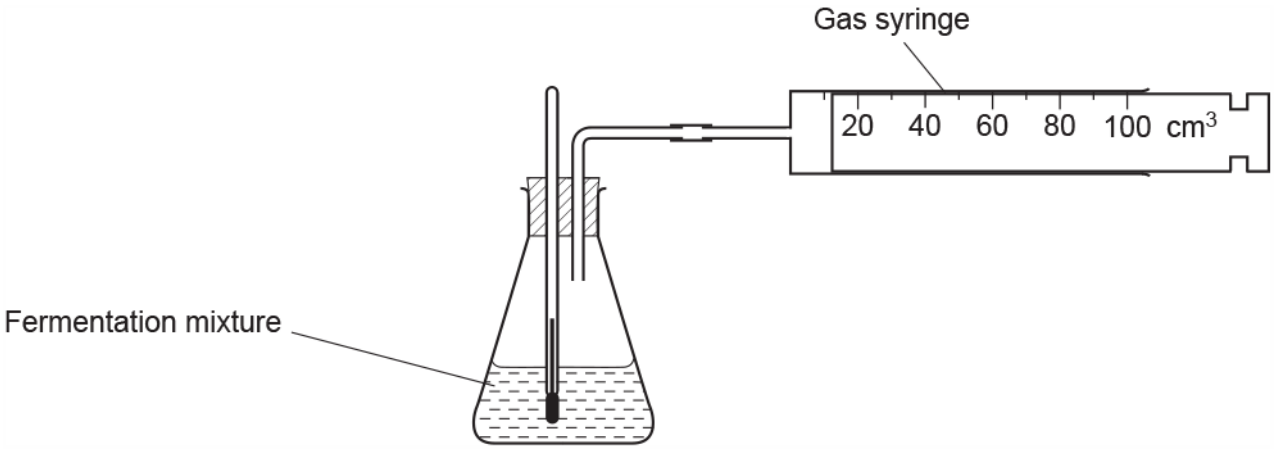
Smallest feature	
Largest feature	

[1]

35(a) Fermentation involves enzymes that break down sugar releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.
She measures the volume of carbon dioxide released in 10 minutes.
The diagram shows the apparatus she uses.



The student could have measured the volume of carbon dioxide by collecting the gas over water in a measuring cylinder.

Why is it better to use a gas syringe?

[1]

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(b) The student's results are shown in the table.

Temperature (°C)	Volume of carbon dioxide gas (cm^3) released in 10 minutes		
	Trial 1	Trial 2	Trial 3
25	23	25	22
30	34	27	33

(i) Calculate the **mean** rate of gas produced at **25 °C** in cm^3 / minute.

Give your answer to **1** decimal place.

Mean rate of gas produced at 25 °C = ... cm^3 / minute **[3]**

(ii) The rate of gas produced at 30 °C is greater than at 25 °C.

Use ideas about enzymes to explain why.

---

[3]

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(c) Phenols are chemicals that inhibit enzymes during fermentation.

They bind to amino acids on enzyme molecules.

Suggest how phenols inhibit enzymes.

[2]

36 Protein synthesis takes place inside cells.

Describe what happens during protein synthesis.

Use terms from the list in your answer.

amino acids DNA mRNA transcription

translation ribosome

[4]

37(a) Hypercholesterolemia (HC) is the result of a mutation in the genome. It is caused by a dominant allele on chromosome 19. The mutation involved causes a change in the DNA nucleotides.

Write the words **allele, chromosome, genome** and **nucleotide** in the boxes to show their size from smallest feature to largest feature.

Smallest feature	
Largest feature	

[1]

(b) One in 500 people are heterozygous for HC.

There are 66 000 000 people in the UK.

Calculate how many people in the UK are heterozygous for HC.

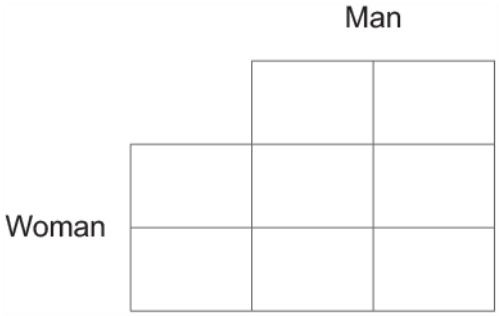
Number of people = ... **[1]**

(c) A woman who does not have HC and a man who is heterozygous are expecting a baby.

What is the probability of the baby having HC?

Complete the genetic diagram to explain your answer.

Use **D** for the dominant HC allele and **d** for the recessive allele.



Probability = ... **[2]**

(d) The allele that is affected by HC codes for a protein called LDL receptor protein.
The faulty allele often has four extra nucleotides, making a total of 2521 nucleotides.

Calculate the number of **amino acids** found in the healthy, **unaffected** protein.

Number of amino acids = ... **[2]**

END OF QUESTION PAPER

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