

Specification

Focus Questions

Every line of the AQA GCSE Biology specification, rewritten as a question with the answer directly underneath. This free sample shows seven real pages from the full pack.

What's in this sample

- 4.1 Cell biology — questions and answers straight from the specification
- 4.1 Culturing microorganisms — aseptic technique and required practical 2
- 4.2 Organisation — enzymes, digestion and the food tests
- 4.5 Homeostasis — the brain, the eye and accommodation
- 4.6 Inheritance — DNA structure and genetic crosses
- 4.7 Ecology — trophic levels and biomass transfer
- A 6-mark practice question with its mark scheme

The full pack: 7 booklets, 91 pages

583 questions & answers · 40 worked examples · 41 exam tips

All 10 required practicals · 21 six-mark questions with mark schemes

4.1.1.1 Eukaryotes and prokaryotes

Q1. What do plant and animal (eukaryotic) cells have?

A cell membrane, cytoplasm, and genetic material enclosed in a nucleus.

Q2. How do bacterial (prokaryotic) cells compare in size with eukaryotic cells?

They are much smaller.

Q3. Describe the structure of a bacterial cell.

Cytoplasm and a cell membrane surrounded by a cell wall. The genetic material is not enclosed in a nucleus: it is a single DNA loop, and there may be one or more small rings of DNA called plasmids.

Q4. Give the main difference between a eukaryotic and a prokaryotic cell.

Eukaryotic cells have their genetic material enclosed in a nucleus; prokaryotic cells do not.

Q5. What do the prefixes centi, milli, micro and nano mean?

centi = 10^{-2} , milli = 10^{-3} , micro = 10^{-6} , nano = 10^{-9} .

Q6. Give typical sizes for an animal cell, a bacterial cell and a mitochondrion.

Animal cell: about 20 μm . Bacterial cell: about 2 μm . Mitochondrion: about 1 μm .

WORKED EXAMPLE 1 · Order of magnitude

Question: A plant cell is 100 μm across and a bacterial cell is 2 μm across. How many times larger is the plant cell?

Step 1: Both are in the same units, so divide

Step 2: $100 \div 2 = 50$

Answer: 50 times larger

WORKED EXAMPLE 2 · Standard form conversion

Question: Write 0.008 mm in metres in standard form, and in micrometres.

Step 1: $0.008 \text{ mm} = 8 \times 10^{-6} \text{ m}$

Step 2: $1 \mu\text{m} = 10^{-6} \text{ m}$

Answer: $8 \times 10^{-6} \text{ m} = 8 \mu\text{m}$

EXAM TIP

Say “**the genetic material is not enclosed in a nucleus**” rather than “bacteria have no DNA” — they do have DNA, as a single loop plus plasmids.

WORKED EXAMPLE 5 · Image size in standard form

Question: A mitochondrion is 2 μm long and is viewed at $\times 10\,000$. Calculate the image size in mm.

Step 1: Convert: $2\ \mu\text{m} = 2 \times 10^{-3}\ \text{mm}$

Step 2: image size = $10\,000 \times 2 \times 10^{-3}$

Answer: 20 mm

EXAM TIP

Convert both measurements to the **same unit first** ($1\ \text{mm} = 1000\ \mu\text{m}$). Magnification has no units, so an answer like “ $\times 800\ \text{mm}$ ” loses the mark.

4.1.1.6 Culturing microorganisms

Q40. How do bacteria multiply, and how fast?

By simple cell division (binary fission) as often as once every 20 minutes, if they have enough nutrients and a suitable temperature.

Q41. What can bacteria be grown in?

A nutrient broth solution, or as colonies on an agar gel plate.

Q42. What do the nutrient broth and agar provide?

Carbohydrate as an energy source, and various minerals, and sometimes supplementary nutrients such as proteins and vitamins.

Q43. Why must uncontaminated cultures be prepared?

So that the effect being investigated is due to the microorganism under study, and not to unwanted microorganisms from the air, skin or equipment.

Q44. How are Petri dishes and culture media sterilised?

By heating to a high temperature, for example in an autoclave or oven, before use.

Q45. How is the inoculating loop sterilised?

By passing it through a hot Bunsen flame until it glows red, then letting it cool before use.

Q46. Why is the lid of the Petri dish secured with adhesive tape?

To prevent microorganisms from the air contaminating the culture, and to stop the lid falling off — but it is not sealed all the way round, so that harmful anaerobic bacteria cannot grow.

Q47. At what temperature are cultures incubated in school laboratories, and why?

A maximum of $25\ ^\circ\text{C}$, which greatly reduces the likelihood of growth of pathogens that might be harmful to humans.

Q26. Required practical 5: outline the method.

Mix amylase, starch and a pH buffer in a test tube in a water bath at a set temperature. Every 30 seconds, take a drop and add it to iodine solution on a spotting tile. Record the time when the iodine stays orange-brown, showing all the starch has been digested. Repeat for a range of pH values.

Q27. Required practical 5: why must temperature be controlled?

Temperature also affects enzyme activity, so it must be kept constant with a water bath for the test to be fair.

Q28. Required practical 5: how is the rate calculated?

Rate = $1 \div \text{time taken for the starch to disappear}$.

WORKED EXAMPLE 1 · Rate of an enzyme reaction

Question: At pH 6 the starch disappears after 50 s, and at pH 7 after 25 s. Calculate both rates and state which pH is closer to the optimum.

Step 1: rate = $1 \div \text{time}$

Step 2: pH 6: $1 \div 50 = 0.02 \text{ s}^{-1}$

Step 3: pH 7: $1 \div 25 = 0.04 \text{ s}^{-1}$

Answer: 0.02 s^{-1} and 0.04 s^{-1} ; pH 7 is faster, so it is closer to the optimum

EXAM TIP

Never say an enzyme is “killed” by heat — it is **denatured**: the active site changes shape so the substrate no longer fits.

EXAM TIP

Bile is not an enzyme. It neutralises stomach acid and emulsifies fat; lipase does the digesting.

4.2.2.2 The heart and blood vessels**Q29. What is the function of the heart?**

It is an organ that pumps blood around the body in a double circulatory system.

Q30. What does the right ventricle do?

It pumps blood to the lungs, where gas exchange takes place.

Q31. What does the left ventricle do?

It pumps blood around the rest of the body.

Q32. Why is the left ventricle wall thicker than the right?

It must generate a higher pressure to pump blood all the way around the body, not just to the lungs.

Q52. What happens if blood glucose concentration is too high?

The pancreas produces insulin, which causes glucose to move from the blood into the cells. In liver and muscle cells, excess glucose is converted to glycogen for storage.

Q53. What happens if blood glucose concentration is too low? [HT only]

The pancreas produces glucagon, which causes glycogen to be converted into glucose and released into the blood.

Q54. Explain negative feedback in blood glucose control. [HT only]

A rise in glucose triggers insulin, which lowers it; a fall triggers glucagon, which raises it. Each response reverses the change, so the level stays within narrow limits.

Q55. What is Type 1 diabetes, and how is it treated?

A disorder in which the pancreas fails to produce sufficient insulin, giving uncontrolled high blood glucose. It is normally treated with insulin injections.

Q56. What is Type 2 diabetes, and how is it treated?

A disorder in which the body cells no longer respond to the insulin produced by the pancreas. It is treated with a carbohydrate-controlled diet and an exercise regime.

Q57. What is a risk factor for Type 2 diabetes?

Obesity.

EXAM TIP

Insulin **lowers** blood glucose by moving it into cells and storing it as glycogen; glucagon raises it. Glycogen and glucagon are different things, so write them carefully.

4.5.3.3 Maintaining water and nitrogen balance

Q58. How is water lost from the body without control?

Water leaves the body via the lungs during exhalation, and water, ions and urea are lost from the skin in sweat. There is no control over these losses.

Q59. How are excess water, ions and urea removed?

Via the kidneys in the urine.

Q60. What is the effect on cells of osmotic changes in body fluids?

If body cells lose or gain too much water by osmosis they do not function efficiently.

Q61. What happens to excess amino acids? [HT only]

The digestion of proteins produces excess amino acids, which are deaminated in the liver to form ammonia. Ammonia is toxic, so it is immediately converted to urea for safe excretion.

Q62. How do the kidneys produce urine?

By filtration of the blood and selective reabsorption of useful substances such as glucose, some ions and water.

WORKED EXAMPLE 4 · Cross with a homozygous recessive

Question: A heterozygous brown mouse (Bb) is crossed with a white mouse (bb). Predict the offspring.

Step 1: Bb × bb: the Bb parent gives B or b; the bb parent always gives b

Step 2: Offspring: Bb, Bb, bb, bb

Answer: 1 brown : 1 white (a 50% chance of each)

WORKED EXAMPLE 5 · Probability as a percentage

Question: Two carriers of a recessive allele (Cc × Cc) have a child. What is the percentage chance the child is a carrier but not affected?

Step 1: Offspring: CC, Cc, Cc, cc

Step 2: Carriers (Cc) = 2 out of 4

Answer: 50%

EXAM TIP

Use capital letters for dominant alleles and the same letter in lower case for recessive. Label the parents' genotypes on the Punnett square and give the answer in the form the question asks for.

4.6.1.7 Inherited disorders

Q33. What causes polydactyly, and what is it?

Having extra fingers or toes, caused by a dominant allele.

Q34. What causes cystic fibrosis, and what is it?

A disorder of cell membranes, caused by a recessive allele.

Q35. Why can two unaffected parents have a child with cystic fibrosis?

Both parents can be heterozygous carriers. Each can pass on the recessive allele, so there is a 1 in 4 chance the child inherits two copies and is affected.

Q36. What is embryo screening?

Testing embryos (for example during IVF) for alleles that cause inherited disorders, so that only unaffected embryos are implanted.

Q37. Give arguments for and against embryo screening.

For: it prevents suffering, and treating a disorder is expensive, so screening saves money.
Against: it implies people with genetic disorders are undesirable, embryos are destroyed, it is expensive, and it could lead to selecting for other characteristics such as appearance.

Equations used in 4.7 Ecology

Set every calculation out in steps, so method marks are available even if the arithmetic slips.

Use it for	Equation
Efficiency of biomass transfer	$\text{efficiency of transfer} = (\text{biomass transferred to the next level} \div \text{biomass available at the previous level}) \times 100$

Required practical checklist

Tick a box each time you can do it: **1** describe the method, **2** state the measurements and equipment, **3** explain the results or calculation, **4** give a source of error and an improvement.

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Required practical 9

To measure the population size of a common species in a habitat, and to use sampling techniques to investigate the effect of a factor on the distribution of this species.

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Required practical 10

To investigate the effect of temperature on the rate of decay of fresh milk, by measuring pH change.

6-mark practice: extended response

These are marked on the quality of the whole answer, not separate points. Plan 3–4 linked ideas, use the correct technical words, and answer every part of the question.

Question 1. Describe the similarities and differences between a plant cell, an animal cell and a bacterial cell. [6 marks]

MARK SCHEME — what a top-level answer includes

- All three have cytoplasm, a cell membrane and ribosomes.
- Plant and animal cells are eukaryotic: their genetic material is enclosed in a nucleus.
- Bacterial cells are prokaryotic and much smaller; their genetic material is a single DNA loop not enclosed in a nucleus.
- Bacterial cells may also contain plasmids — small rings of DNA.
- Plant cells have a cellulose cell wall, chloroplasts for photosynthesis and a permanent vacuole containing cell sap.
- Bacterial cells also have a cell wall, but it is not made of cellulose.
- Plant and animal cells contain mitochondria for aerobic respiration.

Question 2. Describe how you would investigate the effect of two different antiseptics on the growth of bacteria, and explain how you would avoid contamination. [6 marks]

MARK SCHEME — what a top-level answer includes

- Sterilise the Petri dishes and agar before use by heating them to a high temperature.
- Sterilise the inoculating loop by passing it through a hot Bunsen flame and allowing it to cool.
- Spread the bacteria evenly over the sterile agar plate.
- Place paper discs soaked in each antiseptic on the agar, plus a disc soaked in sterile water as a control.
- Secure the lid with adhesive tape, without sealing it completely, and store the dish upside down.
- Incubate at a maximum of 25 °C in a school laboratory, to reduce the growth of pathogens harmful to humans.
- After two days, measure the diameter of the clear zone of inhibition around each disc and calculate its area using πr^2 ; the larger the zone, the more effective the antiseptic.

Question 3. Describe how you would investigate the effect of sugar concentration on pieces of potato, and explain the results. [6 marks]

MARK SCHEME — what a top-level answer includes

- Cut cylinders of potato of equal length and diameter, blot them dry and record the mass of each.
- Place each cylinder in a different concentration of sugar solution, using the same volume of solution each time.
- Leave them for the same time at the same temperature, then remove, blot dry and reweigh.
- Calculate the percentage change in mass, so the different starting masses can be compared fairly.
- In dilute solutions the potato gains mass, because water moves into the cells by osmosis through the partially permeable membranes.
- In concentrated solutions the potato loses mass, because water moves out of the cells by osmosis.
- Where the percentage change is zero, the solution has the same concentration as the cell contents, so there is no net movement of water.

Get the full pack

Seven booklets covering the whole of AQA GCSE Biology 8461, in specification order, so nothing gets missed.

4.1 Cell biology	91 questions · 11 worked examples
4.2 Organisation	103 questions · 6 worked examples
4.3 Infection and response	77 questions
4.4 Bioenergetics	40 questions · 5 worked examples
4.5 Homeostasis and response	102 questions · 4 worked examples
4.6 Inheritance, variation and evolution	92 questions · 6 worked examples
4.7 Ecology	78 questions · 7 worked examples

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