

Key concepts in biology practice questions

25 questions • 69 marks • mark scheme at the back

For Edexcel GCSE Combined Science 1SC0. **Higher tier** is only on the Higher paper.

Name

Total / 69

Cell structure and specialised cells Spec 1.1-1.2

1 Which structure is found in a plant leaf cell but not in an animal cell? **[1 mark]**

- A. ☐ Mitochondria
- B. ☐ Ribosomes
- C. ☐ Cell wall
- D. ☐ Nucleus

2 A bacterial cell and an animal cell both contain genetic material. (a) Describe two ways the genetic material of a bacterial cell differs from that of an animal cell. (2) (b) State the function of the flagellum of a bacterial cell. (1) **[3 marks]**

3 Explain how each of the following features helps a sperm cell to carry out its function. – the acrosome – the haploid nucleus – the mitochondria – the tail **[4 marks]**

4 Describe three ways in which an egg cell is adapted to its function. **[3 marks]**

- 5** Ciliated epithelial cells line the airways. Describe how these cells are adapted to their function. **[2 marks]**

Microscopy and measuring cells **Spec 1.3-1.6**

- 6** Explain how the development of electron microscopes has increased our understanding of cells. **[3 marks]**

- 7** Explain when it is appropriate to use an estimation in biology. Give one example. **[2 marks]**

- 8** A mitochondrion is 2 μm long. What is this length in nanometres? **[1 mark]**

- A. ☐ 0.002 nm
B. ☐ 20 nm
C. ☐ 2000 nm
D. ☐ 2 000 000 nm

- 9** A student makes a drawing of a plant cell. The drawing is 36 mm wide. The magnification is $\times 400$. Calculate the real width of the cell. Give your answer in μm . **[3 marks]**

Answer =

- 14** A student boiled a solution of an enzyme and then added it to its substrate. No reaction took place. Explain why. **[3 marks]**

- 15** A student measured the volume of product made by an enzyme in 2 minutes at different temperatures. The results are shown in the table. Describe and explain the effect of temperature on the activity of the enzyme. **[4 marks]**

Volume of product made in 2 minutes	
Temperature (°C)	Volume of product (cm ³)
10	2
20	5
30	11
40	18
50	6
60	0

- 16** The rate of an enzyme-controlled reaction stops increasing when the substrate concentration is increased above a certain level. Explain why. **[2 marks]**

- 17** A student investigates the effect of pH on the rate at which amylase breaks down starch. [3 marks]
She tests samples of the mixture with iodine solution. (a) Describe how she could tell that all the starch had been broken down. (1) (b) State two variables she should control. (2)

- 18** An enzyme-controlled reaction produced 21 cm³ of gas in 30 seconds. Calculate the rate of reaction in cm³/s. [2 marks]

Answer =

Biological catalysts, food tests and energy in food Spec 1.12-1.14B

- 19** Which molecules are produced when enzymes break down proteins? [1 mark]

- A. ☐ Sugars
B. ☐ Amino acids
C. ☐ Fatty acids
D. ☐ Glycerol

- 20** Enzymes are biological catalysts. (a) Explain what is meant by a biological catalyst. (2) (b) [3 marks]
Name the smaller molecules that enzymes join together to make a protein. (1)

Transport in cells Spec 1.15-1.17

- 21** Which process needs energy from respiration? [1 mark]

- A. ☐ Diffusion of oxygen into a cell
B. ☐ Osmosis of water into a root hair cell
C. ☐ Active transport of mineral ions into a root hair cell
D. ☐ Diffusion of carbon dioxide out of a cell

[3 marks]

[illegible]

[3 marks]

[illegible]

[3 marks]

[illegible]

[6 marks]

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C cell wall (1)

2. [3]

- the DNA is not enclosed in a nucleus / bacterial cell has no nucleus / DNA is free in the cytoplasm (1)
- the bacterial cell has plasmids / has plasmid DNA (as well as chromosomal DNA) (1) allow small rings of DNA
- (b) to move the cell / to make the cell swim (1) allow for movement

3. [4]

- acrosome contains (digestive) enzymes that digest / break down the outer layer of the egg cell (so the sperm can enter) (1)
- haploid nucleus contains half the number of chromosomes, so the full number is restored when it fuses with the egg nucleus (1)
- mitochondria release energy (by aerobic respiration) for the tail to move / for swimming (1)
- tail moves / whips from side to side to push the sperm towards the egg (1) allow so the sperm can swim

4. [3]

- nutrients / food store in the cytoplasm (1) allow to provide energy / nutrients for the early embryo
- haploid nucleus / half the number of chromosomes (1) allow so the full number is restored when it fuses with the sperm nucleus
- the cell membrane changes after fertilisation (1) allow so that no more sperm can enter

5. [2]

- they have cilia / hair-like projections (on the surface) (1)
- which beat / move to sweep mucus (containing trapped dust and microorganisms) away from the lungs (1)

6. [3]

- electron microscopes have a higher magnification / higher resolution than light microscopes (1)
- so sub-cellular structures can be seen in more detail / more clearly (1) allow example, such as ribosomes or the inside of mitochondria
- so scientists can understand the roles / functions of sub-cellular structures (1)

7. [2]

- when an exact value is not needed / when it is not possible to find an exact value / to check a calculation is sensible (1)
- example, such as estimating the number of cells in a sample by counting a small area / rounding to one significant figure to check an answer (1)

8. [1]

C C 2000 nm (1)

9. [3]

- real size = image size ÷ magnification (1)
- $36 \div 400 = 0.09 \text{ mm}$ (1)
- $0.09 \times 1000 = 90 \text{ } \mu\text{m}$ (1) correct answer in μm gains full marks; 0.09 mm with no conversion gains 2 marks

10. [3] Higher tier

- magnification = size of image ÷ size of real object (1)
- $(6.4 \times 10^{-3}) \div (3.2 \times 10^{-5})$ (1)
- $\times 200$ (1) allow $200 / 2 \times 10^2$; correct answer with no working gains full marks

11. [6]

Level 3 5-6	A detailed, logical description covering preparing the slide, using the microscope correctly and producing a drawing. Correct technical terms are used throughout.
Level 2 3-4	A description that covers two of the three areas with some detail, or all three areas with limited detail. Some correct technical terms.
Level 1 1-2	A few isolated points about the method, with little detail or order.

Indicative content

- put a drop of water or stain (for example iodine solution) on a slide
- peel a thin layer of epidermis and lay it flat on the slide using forceps
- lower the coverslip at an angle (with a mounted needle) to avoid trapping air bubbles
- place the slide on the stage and select the lowest power objective lens
- focus using the coarse focus then the fine focus
- change to a higher power objective and use only the fine focus
- draw with a sharp pencil, clear continuous lines, no shading, drawn large
- label with ruled lines that touch the structures, add a title and the magnification

12. [1]

B B (1)

13. [3]

- the active site of the enzyme has a specific shape (1)
- only a substrate with a complementary shape fits into the active site (1)
- other molecules do not fit, so they cannot form an enzyme-substrate complex / are not catalysed (1)

14. [3]

- the high temperature denatured the enzyme (1)
- the shape of the active site changed (1)
- so the substrate no longer fits / no enzyme-substrate complex can form (1)

15. [4]

- the rate increases as the temperature increases from 10°C to 40°C (1)
- because particles have more kinetic energy / move faster so there are more collisions between enzyme and substrate (1)
- above 40°C / at 50°C and 60°C the rate decreases (1) allow optimum is around 40°C ($35\text{--}45^\circ\text{C}$)
- because the enzyme is denatured / the shape of the active site changes (1)

16. [2]

- all the active sites are occupied / in use (1)
- so extra substrate cannot be converted any faster / the enzyme concentration is now limiting the rate (1)

17. [3]

- (a) iodine solution stays orange-brown / does not turn blue-black (1)
- (b) any two from: temperature (1)
- volume of amylase / enzyme (1)
- concentration of amylase / enzyme (1)
- volume of starch solution (1)
- concentration of starch solution (1) do not accept pH
- Max 3 (max 2 for part (b))

18. [2]

- rate = $21 \div 30$ (1)
- $0.7 \text{ cm}^3/\text{s}$ (1) correct answer with no working gains full marks

19. [1]

B B amino acids (1)

20. [3]

- (a) speeds up a reaction (1)
- without being used up / without being changed (1)
- (b) amino acids (1)

21. [1]

C C (1)

22. [3]

- both involve net movement down a concentration gradient / from high to low concentration (1) allow for osmosis, water moves from dilute to concentrated solution
- neither needs energy from respiration / both are passive (1)
- osmosis is the movement of water only, through a partially permeable membrane, whereas diffusion can involve any particles (1)

23. [3]

- by active transport (1)
- against the concentration gradient / from a low concentration to a high concentration (1)
- using energy from respiration (1)

24. [3]

- change in mass = $2.80 - 2.50 = 0.30 \text{ g}$ (1)
- $0.30 \div 2.50 \times 100$ (1)
- +12% / a 12% gain (1) correct answer with no working gains full marks

25. [6]

Level 3 5-6	A detailed and logical description of the method, with correct control variables, and a clear explanation of how the results are processed and used. Correct scientific terms are used throughout.
Level 2 3-4	A description of the method with some control variables, and some explanation of how the results are used, but with gaps.
Level 1 1-2	A few isolated points about the method or results, with little detail.

Indicative content

- cut cylinders of the same size from one potato using a cork borer
- measure the starting mass of each cylinder
- place each in a different concentration of sugar solution, including pure water, using the same volume
- leave for the same time at the same temperature
- blot dry and measure the final mass
- calculate the percentage change in mass for each solution
- plot percentage change in mass against concentration
- the point where the line crosses the x-axis (0% change) is where the solution has the same concentration as the potato cells, so there is no net movement of water
- repeat and calculate a mean