

Revision Questions

These questions will show you the types of questions that are likely to be on the examination papers. However, some of the questions in later modules may require information from other modules in the AS course. The answers to these questions are at the back of this document.

Some advice on examination technique is given alongside the questions.

Unit 1 Module 1: Cells

- 1 Water lice, *Asellus aquaticus*, are animals very similar to woodlice. They live in pond water. They are between 3 mm and 10 mm long.

If a water louse is placed in water on a glass slide or watch glass, the blood flowing up and down its legs can be observed by means of a light microscope.

- (a) Suggest why you would use a low-power objective lens rather than a high-power lens when using the light microscope to watch the blood flow. [2]
- (b) Explain why it would not be appropriate to observe the blood flow using an electron microscope. [3]
- (c) State the difference between resolution and magnification. [2]

► *This question is asking you to apply your knowledge of microscopes and how they work.*

- 2 (a) Name **three** organelles found within the cytoplasm of eukaryotic cells. [3]

The solution of proteins and other substances that surrounds organelles is often called the cytosol. This solution is criss-crossed by extremely fine filaments made up of protein subunits. The three-dimensional network of these filaments is called the **cytoskeleton**. Two types of filament in the cytoskeleton are **actin filaments** and **microtubules**.

- (b) (i) State **three** functions of the cytoskeleton in animal cells. [3]
- (ii) Suggest why nerve cells (neurones) have an unusually well developed cytoskeleton. [1]

(iii) Suggest why most plant cells have a poorly developed cytoskeleton. [1]

- ▶ *Notice that the question tells you to suggest. This means you must work out a reasonable answer using your knowledge – you are unlikely to have learned the answer to ‘suggest’ questions.*

Unit 1 Module 2: Exchange and transport

1 The mammalian heart is described as a double pump. Heart muscle contracts of its own accord, it does not rely on nerves to initiate a heart beat.

(a) Explain the advantages of having a double pump. [3]

(b) Describe the roles of the sinoatrial node (SAN), atrioventricular node (AVN) and Purkyne tissue in initiating a heart beat. [3]

(c) Describe the events that occur during the cardiac cycle, highlighting the action of the valves. [8]

2 Strawberry plants can reproduce asexually by means of horizontal stems that develop new plants at their tip. Three plants were brightly illuminated, and one of the mature leaves of each plant was enclosed in a flask. The air in the flask contained radioactive carbon dioxide ($^{14}\text{CO}_2$). Each horizontal stem **and** the young developing plant at its tip were in darkness.

- In plant **A**, the horizontal stem and young plant were untreated.
- In plant **B**, a section of the horizontal stem was treated with a substance that prevents aerobic respiration.
- In plant **C**, the young plant at the tip of the stem was treated with a substance that prevents aerobic respiration but the stem was untreated.

After ten minutes exposure to $^{14}\text{CO}_2$, the flasks were removed and parts of the three plants were monitored for radioactivity, showing the presence of ^{14}C atoms. The measurements were repeated after 20 minutes. The results are shown in the table.

Plant	Radioactivity after 10 minutes				Radioactivity after 20 minutes			
	leaf which had been in the flask	another mature leaf	stem beyond the treated section	young plant	leaf which had been in the flask	another mature leaf	stem beyond the treated section	young plant
A	++	–	+	–	++	–	+	+
B	++	–	–	–	++	–	–	–
C	++	–	–	–	++	–	–	–

- ++ high radioactivity
- + moderate radioactivity
- negligible radioactivity

(a) Explain why the enclosed leaf became radioactive. [2]

The results of this investigation support the idea that organic substances are actively loaded into the phloem at a source and actively removed at a sink, but this theory does not fit the result shown by one of the three plants (**A**, **B** or **C**).

(b) Explain how the experiment provides support for the theory that transport along the stem works by active transport of sugar into the phloem at a source and out of the phloem at a sink. [4]

If a small section of the stem is cooled or treated with a chemical so that the tissues in this part of the stem cannot respire, the young plant does not become radioactive.

(c) Explain why this observation is difficult to explain without modifying the most widely accepted theory (mass flow) of how organic substances are transported in plant stems. [2]

Unit 2 Module 1: Biological molecules

1 (a) Copy and complete the table, which lists and compares large molecules that are important in biology. The first row has been completed for you. [13]

- ▶ An AS examination question would not have as big a table as this, but it could test other knowledge, for example which elements are in the molecules. Make your own table up and test a friend.
- ▶ Some of the cells in this table allow you to use ideas from Unit 1.

Name	Monomers (subunits) joined to form the molecule	Function in organisms
Protein	many amino acids	enzymes and antibodies are proteins
	3 fatty acids and 1 glycerol	
	2 fatty acids, 1 glycerol and 1 polar group containing phosphate	
Glycolipids	sugars and a fatty acid	
	this is a single molecule without subunits	controls fluidity of membranes
Amylose	many alpha glucose	
Glycogen		storage in animal cells
Cellulose		
	deoxyribose nucleotides	
	ribose nucleotides	several roles in protein synthesis

(b) State:

(i) three structural differences between a collagen molecule and a haemoglobin molecule. [3]

(ii) one structural similarity between a collagen fibre and a cellulose microfibril from a plant cell wall. [1]

- ▶ In part **(b)**, each answer must be a comparison.

Unit 2 Module 2: Food and health

- 1 *Oryza longistaminata* is a wild species of rice that grows in Mali in Africa. It is useless as a crop plant because of poor taste and low yield, but it is resistant to a large number of different strains of the disease xoo, which is caused by a bacterium. Xoo is common throughout Asia and Africa and can reduce yields by half.

O. longistaminata was used in a breeding programme to improve a cultivated variety of rice, *Oryza sativa*, with no resistance to xoo. The two species were crossed and the resulting hybrid plants were tested for their resistance to xoo and for other desirable features. Selected plants were then crossed with the cultivated variety and the process repeated for five generations.

- (a) State two features, other than resistance to xoo, for which each generation of hybrids would have been selected. [2]
- (b) Explain why the selected hybrids were crossed with plants of *Oryza sativa* in each generation of the breeding programme. [3]
- (c) Explain the advantage of growing rice that is resistant to xoo rather than applying pesticides to control the disease. [2]
- ▶ *A way of answering part (c) is to give the disadvantages of using pesticides to control the disease.*
- (d) Suggest ways, other than those mentioned in this question, in which farmers could improve the yields of cereal crops, such as rice. [3]
- ▶ *Part (d) says '...cereal crops, such as rice'. You do not have to restrict your answer to rice. Think about other cereals, such as wheat, barley and maize. The question only mentions pesticides to control disease; there are other types of pesticide.*

- 2 When the measles virus enters a person's body, as part of the immune response to the disease, some B lymphocytes divide to form plasma cells that secrete antibodies specific to the measles virus.

- (a) Describe how the structure of antibodies makes them specific to the measles virus. [4]

(b) Explain why this immune response to measles is an example of active immunity and not passive immunity. [3]

(c) Explain why vaccination is considered to be *artificial active immunity*. [2]

(d) Explain how vaccination is used to control infectious diseases, such as polio. [4]

3 Lung cancer and coronary heart disease are both smoking-related diseases.

(a) Explain why these two diseases are classified as smoking-related. [2]

The table below shows the estimated mortality from lung cancer and coronary heart disease in some selected countries in the 1990s.

Country	Annual number of deaths per 100 000			
	lung cancer (all ages)		coronary heart disease (people aged 35–74)	
	males	females	males	females
Finland	42	7	340	93
United Kingdom	47	21	314	114
United States	52	27	224	92
Japan	31	9	60	23
France	47	6	92	22

► Study data like this carefully before you read the questions. Make sure you can identify any trends.

(b) Explain why the death rates in the table are expressed 'per 100 000'. [1]

(c) With reference to the table, describe the differences between death rates for men and women in the selected countries. [4]

► Use some data from the table when answering part (c).

(d) Suggest **two** types of epidemiological data that could be collected in these countries to see if there is any link between smoking and heart disease. [2]

(e) Outline the effects of long-term smoking on the cardiovascular system. [6]

► *Remember that the cardiovascular system = heart + blood + blood vessels.*

Unit 2 Module 3: Biodiversity and evolution

1 (a) The table shows the kingdoms into which organisms are most usually classified. Some characteristics used to compare the kingdoms are also shown. Copy the table and fill in each blank cell with an appropriate word or phrase. [9]

► An AS examination question would not have as big a table as this, but it could test other knowledge about the five kingdoms and the features of the organisms that are classified into each kingdom. Make your own table up and test a friend.

Kingdom	Type of DNA	Ribosomes	Mitochondria	Cell wall	Type of nutrition
Prokaryotae					autotrophic or heterotrophic
Protoctista	linear			sometimes present, composition variable	
Fungi		present			
Plantae / plants					
Animalia			present		

[20]

Another way of classifying organisms is the three-domain system.

(b) (i) Name the three domains of this system. [3]

(ii) What characteristics are used as the basis for classifying all organisms into three divisions? [2]

The echidna, *Tachyglossus aculeatus*, and the hedgehog, *Erinaceus europaeus*, are both about the size of a small football when adult. They both feed on insects, are nocturnal and can roll into a defensive ball when they are attacked. In both species, some of the hair develops as sharp spines. Echidnas lay eggs with leathery shells which hatch after ten days. Hedgehogs give birth to young that feed on their mother's milk. Female echidnas also feed their young on milk, but they don't have teats – the milk is produced from pores that resemble sweat glands, located in two patches of naked skin. Echidnas are found in

Australia while hedgehogs are found in Europe. The two species are placed by taxonomists in different orders but the same class – the class Mammalia.

- ▶ *You would not be expected to know about this particular example. There are many others that an examiner might use.*

- (c) (i) Suggest why both species are classified as mammals. [1]
(ii) In what genus are hedgehogs placed? [1]

Similarities and differences are used to classify species into higher taxa, such as orders and kingdoms. Since Darwin's theory of evolution became widely accepted, taxonomists have attempted to achieve phylogenetic classifications.

- (d) Explain what is meant by a phylogenetic classification. [6]

- ▶ *This requires an extended answer that brings in several ideas from the specification.*

- (e) Use the information provided to explain why hedgehogs and echidnas are placed in different orders, even though they have many characteristics that are similar. [4]

- ▶ *Question 1 covers many of the topics in this module. The examples used may be helpful to your understanding of the topics, but are not to be memorised.*

- 2 Humans, *Homo sapiens*, and chimpanzees, *Pan troglodytes*, have completely different scientific names. Dogs, *Canis familiaris*, and wolves, *Canis lupus*, have one scientific name in common.

- (a) Explain this difference in classification. [2]

Penicillium chrysogenum and *Penicillium notatum* are fungi that produce the antibiotic penicillin. Neither fungus has been observed to reproduce sexually.

- (b) Explain why this was a problem for taxonomists when these fungi were classified. [2]

- (c) Suggest **three** reasons why biologists have spent time and effort on the classification of these organisms. [3]

- 3** The Orkneys are a group of islands in the north of the British Isles, between Scotland and Norway. There are populations of voles on several of these islands. A vole is a small mouse-like rodent.

Similar voles, classified as belonging to the same species, are found on the Scottish mainland. The Orkney voles are much larger than those found on the mainland; they also have a different coat colour.

Biochemical analysis of blood proteins and DNA fragments from Orkney voles and mainland voles reveals more fundamental differences between the populations.

- *In the A2 course you will learn about how this biochemical analysis is done by means of electrophoresis.*

- (a)** Explain how both isolation and natural selection have produced these differences. [7]
- (b)** Discuss the idea that voles from Orkney and the Scottish mainland belong to different species. [5]

Answers

In these answers a semicolon (;) separates individual marking points. Notice that in many cases there are more marking points available than there are marks for the question. This means that there are several ways in which you can gain full marks for a question. In some of the answers you will find extra help with the topics in the questions.

Unit 1 Module 1: Cells

- 1 (a)** high power objectives only show, a very small area / a small field of view / part of the leg; it would be more difficult to focus; because the lens must be very close to the, leg / blood / object; the depth of focus would be greater with the lower power; [2 max]
- (b)** electrons / electron microscopes, can only be used to, observe / visualise / produce an image of dead material; animal must be alive to see blood flow; the specimen must be dehydrated; it must be in a vacuum; glass slide / watch glass, would, absorb / block, the electrons; a heavy metal stain would be needed; [3 max]
- (c)** magnification is the number of times larger the image is when compared to the object; resolution is the, detail / clarity, shown by the image or the smallest distance between points or lines that can be seen; [2]
- 2 (a)** any 3 from: nucleus / chloroplast / mitochondrion / ribosome / (rough or smooth) endoplasmic reticulum / Golgi apparatus / lysosome / vesicle / centriole; [3]
Structures such as the nucleolus and cilia or flagella that are not in the cytosol are not valid answers to this question.
- (b) (i)** provides, support / strengthens; supports / holds, the organelles; allows organelles to be moved about (inside the cell); allows the cell surface membrane to be, moved / extended; allows the, cytoplasm / cell, to move or contract; moves chromosomes during, nuclear division / mitosis / meiosis; brings about cytokinesis; [3 max]
- (ii)** the cells are (very), large / long; axons / dendrites, must be, extended / supported; organelles / proteins / substances, must be moved, down the axon / to synapse; [1]
- (iii)** the cell wall provides support; the cell does not, contract / move; the (large) vacuole does not contain, cytoplasm / organelles; [1]

Unit 1 Module 2: Exchange and transport

- 1 (a)** blood to lungs and rest of body; at different pressures; low pressure for oxygenation in lungs; high pressure for delivering oxygen to tissues; high pressure to overcome resistance in systemic circulation [3 max]
- (b)** SAN: pacemaker / sends out impulses to heart muscle; to atria first; AVN: delays impulses; sends impulses to ventricles; Purkyne fibres: transmits impulses to base of ventricles; [3]
- (c)** atria contract; atrioventricular valves (tricuspid and bicuspid) open; blood forced into ventricles; ventricles contract; blood forced into arteries; aorta, pulmonary artery; atrioventricular valves close; semilunar valves open; ventricles relax; fill with blood; semilunar valves close; valves open and close when pressure of blood is greater on one side than the other; [8 max]
- 2 (a)** leaf absorbed $^{14}\text{CO}_2$; used in photosynthesis; so sugars (sucrose) became radioactive; [2]
- (b)** *the radioactivity / radioactive sugar / labelled sugar / sugar / organic molecules, moved down the stem; from high to lower concentration / from source to sink; only if respiration is taking place; phloem transport requires energy / is an active process;* [4]
- (c)** the mature radioactive leaf, is the source / produces sucrose, young plant, is the sink / uses sucrose; both mature leaf and young plant, can respire / can actively transport; so preventing respiration, at treated section / between source and sink, should have no / little effect; [2]

Unit 2 Module 1: Biological molecules

1

Name	Monomers (subunits) joined to form the molecule	Function in organisms
Protein	many amino acids	enzymes and antibodies are proteins
Triglyceride	3 fatty acids and 1 glycerol	storage, thermal insulation, protection
Phospholipids	2 fatty acids and 1 glycerol	forms bilayers in cell membranes
Glycolipids	sugars and a fatty acid	in cell surface membranes / act as receptors
Cholesterol	this is a single molecule without subunits	controls fluidity of membranes
Amylose	many alpha glucose	storage in plant cells
Glycogen	many alpha glucose	storage in animal cells
Cellulose	many beta glucose	plant cell walls
DNA (deoxyribonucleic acid)	deoxyribose nucleotides	storage of genetic information
RNA (ribonucleic acid)	ribose nucleotides	several roles in protein synthesis

[13]

(b) (i) the primary structure / the sequence of amino acids in the polypeptide chains, is (very) different; haemoglobin molecules have 4 polypeptide chains, collagen molecules have 3 polypeptide chains; haemoglobin molecules have haem groups, collagen molecules do not; haemoglobin molecules have a globular structure, collagen molecules have a fibrous structure; haemoglobin has a, complex / three dimensional, tertiary structure (not found in collagen); [3 max]

(ii) both have many molecules arranged in parallel to produce the, fibre / microfibril; there are many hydrogen bonds holding the individual chains in parallel; [1 max]

Unit 2 Module 2: Food and health

- 1 (a)** good taste; high yield; *could be others to do with growth and quality of yield* [2]
- (b)** increase alleles from *O. sativa*; to increase yield; to improve quality of rice; to improve growth; [3 max]
- (c)** use of pesticides can lead to resistance amongst pests and diseases; pesticides become useless; pesticides kill non-target species; accumulate in food chains if not metabolised or broken down; run off into waterways and kill aquatic organisms; farmers may not be able to afford pesticides; reduces farmer's costs; less chance of health problems among farmers from using pesticide; [2 max]
- (d)** apply fertilisers; control weeds (competitors) by using herbicides; control insect pests using insecticides; irrigate at appropriate times of the year; [3 max]
- 2 (a)** measles virus acts as an antigen; antibodies have antigen-binding sites; variable region; antibodies are proteins; with amino acid sequence / primary structure; gives tertiary structure; with specific 3D shape; that 'fits' shape of measles virus; [4 max]
- (b)** there is an immune response; within the body; B cells divide; to produce plasma cells; secrete antibodies; in passive antibodies, are injected / come from another source; [3 max]
- (c)** vaccine contains antigens; put into the body; to stimulate immune response; not 'caught' naturally; [2 max]
- (d)** herd vaccination; vaccinate as many people as possible; usually young children (as with polio); ring vaccination; if an outbreak; to prevent virus spreading in a population that may have people who are not immune; provide boosters to give better secondary responses; [4 max]
- 3 (a)** smoking is a major risk factor in both diseases; in almost all cases it is the cause of lung cancer; it is one of several risk factors of CHD; people who have never smoked are at risk of CHD; [2]
- (b)** to make a valid comparison; [1]
- (c)** death rates are higher among men; for both diseases; in all countries; highest death rates are for CHD; especially in Finland/UK/US; France and Japan have lowest death rates for CHD; use of figures from table in support; [4 max]
- (d)** the number of people who develop CHD who are (or have been) smokers; the percentage of men and women who smoke; [2]
- (e)** raises blood pressure; constricts arteries (e.g. coronary arteries); makes heart work harder; reduces oxygen-carrying capacity of blood; carbon monoxide combines with haemoglobin; reduces supply of oxygen to heart muscle; promotes atherosclerosis; deposits of fat in arteries; promotes blood clotting; leading to thrombosis; if in coronary arteries; leads to, heart attack / angina; [6 max]

Unit 2 Module 3: Biodiversity and evolution

1 (a)

Kingdom	Type of DNA	Ribosomes	Mitochondria	Cell wall	Type of nutrition
Prokaryotae	circular	present	absent	composed mainly of peptidoglycan	autotrophic or heterotrophic
Protoctista	linear	present	present	sometimes present, composition variable	autotrophic or heterotrophic
Fungi	linear	present	present	composed of chitin	always heterotrophic
Plantae / plants	linear	present	present	composed mainly of cellulose	almost always autotrophic
Animalia	linear	present	present	absent	always heterotrophic

[20]

(b) (i) Archaea / Archaeobacteria; Eubacteria; Eukaryota / eukaryotes; [3]

(ii) biochemical differences / the sequence of nucleotides in the ribosomes; presence or absence of a membrane bound nucleus; [2]

(c) (i) they feed young on milk / have hair; [1]

(ii) *Erinaceus*; [1]

(d) Phylogenetic classification shows the (genetic) relationship between, organisms / species / taxa; the hierarchy of the classification shows closeness of the relationship; species with a recent common ancestor are in the same genus; higher taxa are groups of organisms that have common ancestors in the increasingly remote past; some characteristics are believed to be more important indication of relationship than others; similarities in DNA are (especially) important; similar nucleotide sequences show a close relationship; other biochemical similarities / differences are used by taxonomists / named example; [6 max]

(e) echidnas lays eggs (like a reptile); mammary glands not highly developed; so placed in different order from hedgehogs; the similarities between two species often because they have become adapted to similar environment / have similar niche; this is convergent evolution; quoting the passage as examples of convergent evolution;; [4 max]

2 (a) dogs and wolves are in the same genus / chimps and humans in different genera; because dogs and wolves are thought to be, more similar / more closely related; [2]

- (b)** the criterion of a species being a group capable of interbreeding cannot be applied; so less clear-cut evidence of structural and biochemical similarity must be used; difficult to distinguish between varieties and species; [2 max]
- (c)** to understand evolutionary history; help identify specimens / to allow researchers to be confident they are referring to the same type of organism (when discussing / reporting results of investigations); to allow logical and consistent names to be given; to help understand organisms by comparing and contrasting them with others; to encourage conservation; [3 max]
- 3 (a)** environment on Orkney and on the mainland different; colder / windier / more exposed / less fertile / other example; fewer / different, predators on islands; larger voles are, more vulnerable to predators / less vulnerable to cold; differences between the populations arose by mutation; during meiosis; variants best fitted to survive in each environment left more offspring; Orkney voles descended from a small population; differences may have arisen by chance; population on Orkney reproductively isolated; [7 max]
- (b)** a species is a group of similar organisms; can interbreed freely; Orkney voles similar to mainland one, so should be regarded as same species; but have distinctive characteristics, so can be regarded as different species; unknown if they could produce fully fertile offspring if crossed; prefer to mate within their own population; to be certain if two species or one carry out a breeding experiment; for two generations; to see if fertile offspring are produced; [5 max]