BIOLOGY

UNIT 1 ANSWERS

CHAPTER 1

1 ▶ D **2 ▶** A **3 ▶** B **4 ▶** C

5 ▶ a i Fungi **ii** Protoctists
iii Plants **iv** Bacteria

b Like most protoctists, *Euglena* is a microscopic, single-celled organism. It has features of both plant and animal cells: like plants, it contains chloroplasts; like animals, it can move.

6 ▶ a Diagram should show a core of DNA or RNA surrounded by a protein coat.

b A virus can be considered either as living or as a chemical. It does not have any of the normal characteristics of living things, except that it is able to reproduce.

c Viruses can reproduce only inside a host cell, by taking over the cell's genetic machinery to make more virus particles. So viruses are all parasites.

7 ▶ a Cells of bacteria, which are small and do not have a nucleus or membrane-bound organelles such as mitochondria and chloroplasts.

b Fine, thread-like filaments forming the feeding network of cells of a fungus.

c A type of nutrition used by most fungi and some bacteria, where the organism feeds on dead organic material by digesting it using extracellular enzymes.

UNIT 1 EXAM PRACTICE

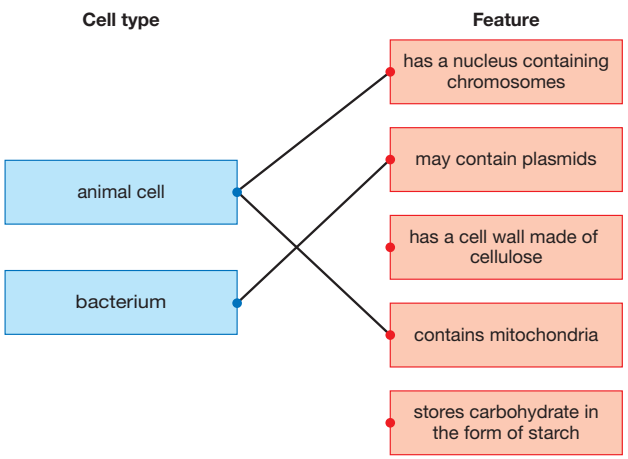
1 ▶ D (1)

2 ▶ (1 mark for each correct row)

Feature	Type of organism		
	Plant	Fungus	Virus
they are all parasites	✗	✗	✓
they are made up of a mycelium of hyphae	✗	✓	✗
they can only reproduce inside living cells	✗	✗	✓
they feed by extracellular digestion by enzymes	✗	✓	✗
they store carbohydrate as starch	✓	✗	✗

3 ▶ (1 mark for each correct underlined term)
Plants have cell walls made of cellulose. They store carbohydrate as the insoluble compound called starch or sometimes as the sugar sucrose. Plants make these substances as a result of the process called photosynthesis. Animals, on the other hand, store carbohydrate as the compound glycogen. Both animal cells and plant cells have nuclei, but the cells of bacteria lack a true nucleus, having their DNA in a circular chromosome. They sometimes also contain small rings of DNA called plasmids, which are used in genetic engineering. Bacteria and fungi break down organic matter in the soil. They are known as decomposers / saprotrophs. Some bacteria are pathogens, which means that they cause disease.

4 ▶



(1 mark per correctly drawn line, deduct 1 mark for each incorrectly drawn line)

CHAPTER 2

1 ▶ B

2 ▶ A

3 ▶ a i cell wall
ii mitochondrion
iii chloroplast
iv vacuole

b A tissue is a collection of cells with a similar function – muscle tissue consists of many muscle cells, all adapted to carry out contraction. A muscle is an organ, because it contains several types of tissue, including muscle, blood and nerves.

4 ▶ a Diagram should show each part of a plant cell and its function, e.g. cell wall (maintains shape of cell), cell membrane (controls entry and exit of substances), cytoplasm (where metabolism/reactions take place), vacuole (stores dissolved substances), nucleus (controls activities of cell), chloroplasts (photosynthesis), mitochondria (respiration).

b An animal cell lacks a cell wall, a large permanent vacuole and chloroplasts.

CHAPTER 3

1 ▶ D **2 ▶** A

3 ▶ Description, in words or diagrams, should include the following points:

- enzymes are biological catalysts
- they speed up reactions in cells without being used up
- each enzyme catalyses a different reaction
- the production of enzymes is controlled by genes
- enzymes are made of protein
- the substrate attaches to the enzyme at the active site
- the substrate fits into the active site like a key in a lock
- this allows the products to be formed more easily
- intracellular enzymes catalyse reactions inside cells
- extracellular enzymes are secreted out of cells (e.g. digestive enzymes)
- enzymes are affected by changes in pH and temperature.

4 ▶ a About 75 °C.

b At 60 °C the molecules of enzyme and substrate have more kinetic energy and move around more quickly. There are more frequent collisions between enzyme and substrate molecules, so more reactions are likely to take place.

c The micro-organism lives at high temperatures, so it needs 'heat-resistant' enzymes with a high optimum temperature.

d It is denatured.

CHAPTER 4

1 ▶ D **2 ▶** B **3 ▶** C

4 ▶ a They carry out most of the reactions of respiration in the cell, providing it with energy.

b Active transport. This uses the energy from the mitochondria.

c Diffusion. The removal of glucose at A lowers the concentration inside the cell, so that the concentration at B is higher than inside the cell. Therefore glucose can diffuse down a concentration gradient.

d It increases the surface area for greater absorption.

CHAPTER 5

1 ▶ A **2 ▶** B **3 ▶** D

4 ▶ a Iodine solution, turns from yellow–brown to blue–black.

b Only the green areas that are not covered would contain starch.

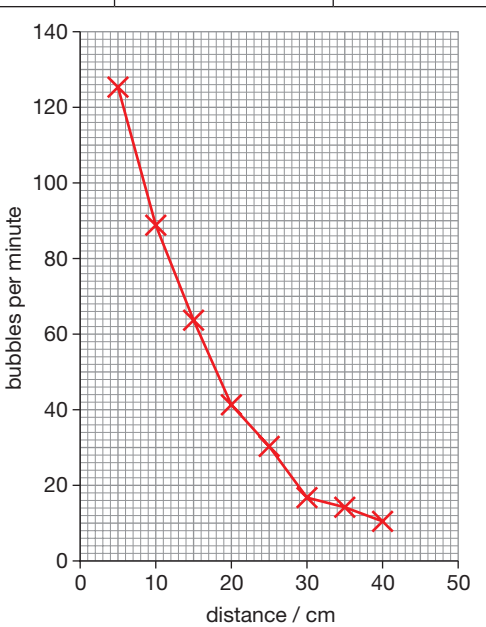
c Photosynthesis needs light and chlorophyll. These are only both available in green, uncovered areas.

d A storage carbohydrate. It is insoluble, so can be stored in cells and has no osmotic effects.

5 ▶

Part of leaf	Function	How the part is adapted for its function
palisade mesophyll layer	(main site of photosynthesis)	(cells contain many chloroplasts for photosynthesis)
spongy mesophyll layer	gas exchange surface: uptake of CO_2 and release of O_2 during photosynthesis; some photosynthesis	air spaces allow gases to diffuse in and out of the mesophyll. Large surface area of cells for gas exchange. Many chloroplasts for photosynthesis (but fewer than palisade layer).
stomata	pores which exchange gases (CO_2, O_2 and water vapour) with the atmosphere	pores formed between two guard cells; guard cells can change shape to open and close pores
xylem	transport of water and minerals	cells consist of dead hollow vessels forming a continuous transport system throughout the plant
phloem	transport of products of photosynthesis	phloem contains living cells forming continuous tubes supplying all parts of the plant

6 ▶ a



b About 54 bubbles per minute.

c
- The gas is not pure oxygen, although it has a high oxygen content.
- The bubbles may not be all the same size.
- The water in the test tube may have increased in temperature as the lamp was brought nearer to the tube.

7 ▶ a Starch: Take a sample of the water in a spotting tile and add a drop of iodine solution. If starch is present, the colour will change from yellow–brown to blue–black.

Glucose: Take a sample of the water in a test tube and add blue Benedict's solution. Place the tube in a water bath and heat until it boils. If glucose is present, a brick-red precipitate will form.

b The starch molecules are too large to pass through the holes in the Visking tubing. Glucose molecules are smaller, so they can pass through.

c The blood

d Large, insoluble food molecules are broken down into small, soluble ones.

8 ▶ a It is body temperature.

b It had been broken down into smaller molecules called peptides (short chains of amino acids) forming the clear solution.

c The enzyme pepsin does not work in alkaline conditions: it is denatured.

d The experiment is looking at the effects of pepsin on the egg white. The Control is carried out without the enzyme; all other factors are the same. This shows that it is the enzyme that breaks down the protein. In other words, the egg white does not break down by itself.

e The enzyme works more slowly at a lower temperature. There are fewer collisions between enzyme and substrate molecules, because they have less kinetic energy.

f Hydrochloric acid kills bacteria in the food entering the stomach.

g By alkaline secretions in the bile and pancreatic juice.

9 ▶

Enzyme	Food on which it acts	Products
(amylase)	starch	maltose
(trypsin)	protein	peptides
lipase	lipids / fats	(fatty acids and glycerol)

CHAPTER 6

1 ▶ C **2 ▶** A

3 ▶ a $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

b Anaerobic respiration produces less energy than aerobic respiration.

c Exercise causes lactate to build up in the muscles and blood. The lactate is broken down aerobically. The oxygen needed to do this is called the oxygen debt.

CHAPTER 7

1 ▶ C **2 ▶** A **3 ▶** B

4 ▶

	Action during inhalation	Action during exhalation
external intercostal muscles	(contract)	relax
internal intercostal muscles	relax	contract
ribs	move up and out	(move down and in)
diaphragm	contracts and flattens	relaxes and becomes dome-shaped
volume of thorax	increases	decreases
pressure in thorax	decreases	increases
volume of air in lungs	increases	decreases

5 ▶ When we breathe in, the external intercostal muscles between our ribs contract, pulling the ribs up and out. The diaphragm muscles contract, flattening the diaphragm. This increases the volume in the chest cavity (or thorax), lowering the pressure there, and causing air to enter from outside the body, through the nose or mouth. This is called ventilation. In the air sacs (or alveoli) of the lungs, oxygen enters the blood. The blood then takes the oxygen around the body, where it is used by the cells. The blood returns to the lungs, where carbon dioxide leaves the blood and enters the alveoli. When we breathe out, the external intercostal muscles relax and the ribs move down and in. The diaphragm muscles relax, and the diaphragm returns to a dome shape. These changes decrease the volume of the chest cavity, increasing the pressure in the thorax, pushing the air out of the lungs.

6 ▶ a When the volume of the chest is increased by the movements of the ribs and diaphragm, the drop in pressure in the chest cavity draws air into the pleural cavity through the puncture in the chest wall, instead of through the mouth or nose into the lung.

b Each lung is isolated from the other by being in a separate pleural cavity, so a pneumothorax on one side will not affect the opposite lung.

c A tube is inserted through the chest wall into the pleural cavity on the side of the injured lung. This stops ventilation in that lung, while the other lung is ventilated normally.

CHAPTER 8

1 ▶ B **2 ▶** C **3 ▶** A **4 ▶** B

5 ▶ a A red blood cell has a large surface area compared with its volume; contains haemoglobin; and has no nucleus, so more space is available for haemoglobin.

b i Oxygen dissolves in the liquid lining the alveoli and then diffuses down a concentration gradient through the walls of the alveoli and capillaries into the plasma and into the red blood cells.

ii Oxygen dissolves in the plasma and then diffuses down a concentration gradient through the walls of the capillaries into the muscle cells.

c Dissolved in plasma

6 ▶ a Arteries have thick walls containing much muscle tissue and elastic fibres. These adaptations allow their walls to stretch and recoil under pressure.

b Veins have valves, thin walls with little muscle, and a large lumen; arteries have no valves (except at the start of the aorta and pulmonary artery), thick muscular walls with many elastic fibres, and a narrow lumen.

c Capillaries have thin walls / walls one cell thick, to allow exchange of materials. They have a very small diameter to fit between other cells of the body.

7 ▶ a A = left atrium, B = valves, C = left ventricle, D = aorta, E = right atrium

b They ensure blood keeps flowing in one direction / prevent backflow of blood

c i A **ii** E

8 ▶ a i A (red blood cell), identified by its colour (red) and biconcave disc shape

ii B (lymphocyte), identified by its colour (white) and large round nucleus valves

iii C (phagocyte), identified by its colour (white), irregular shape and lobed nucleus

b Platelets – blood clotting

UNIT 2 EXAM PRACTICE

1 ▶ a The artery is an organ because it is made of several tissues (1); the capillary is made up of only one type of cell / one tissue (1).

b i Two from: Breaks down large insoluble molecules (1) into smaller soluble molecules (1) that can be absorbed (1)

ii (1 mark for organ, 1 mark for function)

Three from:

- mouth: chews / breaks down food into smaller pieces / produces saliva
- oesophagus (gullet): moves food from mouth to stomach
- stomach: produces digestive enzymes
- pancreas: produces digestive enzymes
- liver: makes bile
- ileum (small intestine): produces digestive enzymes / absorbs products of digestion
- colon (large intestine): absorbs excess water
- rectum: stores waste (faeces).

iii (1 mark for system, 2 marks for organs)

Two from:

- gas exchange / respiratory system: trachea, lung, diaphragm
- circulatory system: artery, vein, heart
- musculoskeletal system: muscle, joint, (named) bone
- nervous system: brain, spinal cord
- reproductive system: testis, ovary, uterus, penis
- excretory system: kidney, bladder.

2 ▶ a i 4 g (1). Mass at start was 100 g, decreased to 96 g due to oxygen lost (1).

ii Half this mass = 2 g (1). This loss in mass occurs by (approximately) 0.5 minutes / 30 seconds (1).

iii At the start there are a lot of enzyme and substrate molecules, so there are a lot of successful collisions (1). As the reaction proceeds, the number of substrate molecules decreases, so there are fewer successful collisions (1).

b i There would be no difference / 4 g formed (1); because the temperature affects only the reaction rate, not the end point (1).

ii The time would be shorter (1) because the rate of reaction is speeded up by the increase in temperature (1).

3 ▶ a 1 mark for each correct row in the table

Feature	Active transport	Osmosis	Diffusion
movement of particles results from their kinetic energy	✗	✓	✓
movement of particles needs a supply of energy from respiration	✓	✗	✗
particles move down a concentration gradient	✗	✓	✓

b i (As the temperature rises) ions gain kinetic energy (1), so they move faster (1).

ii Above this temperature the cell membranes are being denatured (1) so are more permeable to ions (1).

4 ▶ a i To remove any water / sap on the outside of the cylinder (1)

ii To allow an average to be calculated / to check reliability of results (1)

iii So they all had the same surface area to volume ratio (1)

b i 3 mol per dm^3 sucrose solution has a higher concentration of solutes / lower concentration of water than potato cells (1), so water moves out of the cells by osmosis and into the sucrose solution (1), resulting in a decrease in mass of the cylinder (1).

ii (Approximately) 0.75 mol per dm^3 (1), because there is no change in mass (1), as there is no net movement of water (1).

5 ▶ a i Any four points from:

As light intensity increases, the rate of photosynthesis increases (1). The rate of increase is faster at high CO_2 concentration than at low CO_2 concentration (1).

(At both CO_2 concentrations) the rate of photosynthesis reaches a plateau / maximum / levels off (1). At low CO_2 concentration this happens below light intensity X (1) whereas at high CO_2 concentration it happens at / above light intensity X (1).

The maximum rate of photosynthesis is higher at high CO_2 concentration than at low CO_2 concentration (1).

ii Up to X the limiting factor is light (1), because increasing light intensity increases the rate of photosynthesis (1). Beyond X the limiting factor is CO_2 (1), as increasing light intensity has no effect on the rate of photosynthesis (1) whereas increased CO_2 increases the rate (1).

b i Temperature (1), water availability (1)

ii Reactions are slow at low temperatures (1), because the molecules have little kinetic energy (1) and therefore there are fewer successful collisions between enzyme molecules and substrates (1). Water is a raw material for photosynthesis (1).

c The photosynthesis reaction uses / takes in light energy (1) and converts it into chemical energy stored in the glucose / starch produced (1).

6 ▶ a i A = stomach (1) because the enzyme acts at an acidic pH (1). B = small intestine (1) because the enzyme acts at an alkaline pH (1).

ii Proteins (1)

b Maximum 3 marks from:

The enzyme works best at its optimum pH (1). Away from the optimum / at extremes of pH, the pH affects the structure of the enzyme/protein molecule (1) and changes the shape of its active site (1), so that the substrate will not fit (the active site) so well (1).

7 ▶ Any six for 6 marks, from:

- use solution of ATP, compare with (Control using) water (1)
- same type of meat fibres / named type (1)
- several replicates / number of replicates suggested, e.g. 10 (1)
- measure length before treatment (1)
- measure length after treatment / change in length / % change (1)
- other controlled variables: temperature / volume of solutions / starting length (max. 2).

8 ▶ a (1 mark for each correct row)

Gas	Inhaled air / %	Exhaled air / %
nitrogen	(78)	(79)
oxygen	21	16
carbon dioxide	0.04	4
other gases (mainly argon)	(1)	(1)

b It increases (in exhaled air) (1) because carbon dioxide is produced by respiration (1).

c i Short distance (1) allows rapid / efficient diffusion of gases / oxygen and carbon dioxide (1).

ii Blood brings carbon dioxide and takes away oxygen (1) maintaining a diffusion gradient (1).

iii Increases the surface over which diffusion of oxygen and carbon dioxide can occur (2).

9 ▶ a Labels: cell membrane (1), lobed nucleus (1), cytoplasm (1)

b One from: has a nucleus (1), irregular shape / not biconcave (1), no haemoglobin (1)

c Two from: ingest / engulf / surround (bacteria) (1), digest / break them down (1), using enzymes (1)

d Three from: lymphocytes (1), make antibodies (1), against / in response to antigens (1), form memory cells (1)

10 ▶ Any six for 6 marks, from:

- rats given protein supplement / range of amounts of protein supplement, and rats given no supplement (Control) (1)
- rats same age / same sex / same health / same variety (1)
- several rats in each group (allow 6 or more per group) (1)
- weigh before and after treatment / take other suitable measurement before and after treatment, such as circumference of leg muscles (1)
- suggested time period for treatment (minimum one week) (1)
- calculate (mean) % change in mass (1)
- same diet (apart from supplement) (1)
- same water / same amount of exercise / other suitable controlled factor (1).

CHAPTER 9

1 ▶ D **2 ▶** B **3 ▶** A

4 ▶ a Stigma

b Any two from: coloured petals, scent, nectar

c Pollen tube should be shown growing down through the rest of the style and entering the ovary.

5 ▶ a Method A. Fruits are produced in flowers by sexual reproduction, which introduces genetic variation.

b Insect-pollinated. The flower has large, brightly coloured petals to attract insects.

6 ▶ **a** A **b** B **c** C **d** A

7 ▶ There is evidence for and against the involvement of pollutants in lowering the sperm count, and indeed whether or not the count has become lower at all. A good account of the student's findings should be a balanced one, giving both sides of the argument. It should be illustrated with some graphs or tables of data.

CHAPTER 10

1 ▶ D **2** ▶ A **3** ▶ D **4** ▶ D

5 ▶ B

6 ▶ **a** They must both be heterozygous. Let S = allele for short hair and s = allele for long hair.

	S	s
s	SS	Ss
	Ss	ss

There is a 1 in 4 chance of producing a long-haired guinea pig (ss).

b The short-haired parent has the genotype Ss. The long-haired guinea pig has the genotype ss. The cross is:

	S	s
s	Ss	ss
s	Ss	ss

You would expect short-haired (Ss) and long-haired (ss) guinea pigs in the offspring (with the expected ratio 1 : 1).

7 ▶ **a** All tall

b All tall

c All tall

d 3 tall : 1 dwarf

e 1 tall : 1 dwarf (or 2 : 2)

f All dwarf

8 ▶ **a** Gametes of parents = R and r
Genotypes of F_1 = Rr
Genotypes of F_1 parents = Rr and Rr
Gametes of F_1 parents R, r and R, r
Genotypes of F_2 =

	R	r
R	RR	Rr
r	Rr	rr

b A, B and C are red, D is yellow

9 ▶ **a** Genetic – eye colour is inherited and not affected by the environment.

b Genetic – it depends on inheriting XX or XY chromosomes.

c Environmental – the pH of soil is a feature of the plant's environment.

d Both – genes determine whether a plant falls into the tall or dwarf category, but environmental factors affect how well each plant grows.

e Both – genes affect the risk level, but environmental factors such as diet, smoking, etc. also have an effect.

10 ▶ **a** Rats with the mutant allele, that made them resistant to warfarin, survived and reproduced, so now many more rats carry the allele. Rats without the allele did not survive to reproduce.

b It would decrease as it would not give an advantage; rats that do not have the allele will breed equally well. (In fact, rats with the warfarin-resistant allele have a selective disadvantage when warfarin is not being used, although students will not know this.)

11 ▶ **a** As a result of (random) mutations

b **i** Selection pressure: a factor in the environment that affects the fitness of an organism. In this case the presence of toxic metals means that the non-tolerant plants will be killed and so do not reproduce to pass on their genes.

ii Selective advantage: varieties that survive in the presence of a selection pressure are said to have a selective advantage. In this example the plants that are tolerant to toxic metals have a selective advantage when compared with the non-tolerant plants.

iii Natural selection: the overall process that, when metals are present, results in fewer non-tolerant plants and an increase in the number of tolerant plants. If it continues, natural selection results in evolution.

c When there are no toxic metals, the metal-tolerant plants must have some sort of selective disadvantage over the non-tolerant ones. For example, they may need to use metabolic energy (ATP) to protect their cells against metals or get rid of metal ions. If there are no metal ions in the soil, this is a waste of resources.

UNIT 3 EXAM PRACTICE

1 ▶ **a** Method B (1). In method B the formation of a new *Hydra* / the bud does not involve sex organs / sex cells (1).

b All the cells of the new *Hydra* are produced from just one body cell of the adult / there is no fertilisation (1). When the cell divides the new cells that are produced are exact copies of the original cell (1).

c Sexual reproduction brings together genes from two parents (1). This means that the offspring will be genetically different from each other and the parents (1).

d Maximum 2 marks from:

If *Hydra* is well adapted to its environment, asexual reproduction will produce offspring that are also well adapted (1). Sexual reproduction produces offspring that show variation (1), so some of the new *Hydra* may be better adapted to survive in new conditions (1).

2 ▶ **a** A = stigma (1), B = ovary (1), C = anther (1), D = filament (1)

b Any three for 3 marks from:

- lack of large petals (no need to attract insects) (1)
- lack of brightly coloured petals (no need to attract insects) (1)

- exposed stamens (to catch the wind and blow pollen away) (1)
- exposed stigma (to catch windborne pollen) (1)
- stigma feathery (to catch pollen) (1).

c The pollen grain produces a pollen tube, which grows down through the tissue of the style and into the ovary (1). The pollen tube enters (an opening in) an ovule (1). The tip of the pollen tube breaks down and the pollen grain nucleus moves out of the pollen tube into the ovule, where it fertilises the nucleus of the egg cell (ovum) (1).

d Any four for 4 marks from:

- large petals (1)
- brightly coloured petals (1)
- stamens enclosed within flower (1)
- stigma enclosed within flower (1)
- stigma sticky (1)
- nectaries present (1)
- large, sticky pollen grains (1).

3 ▶ a i Homozygous (1)

ii A dominant allele hides the expression of the recessive allele in heterozygous individuals (1); a recessive allele is expressed only in homozygous individuals (1).

b i B (1) and b (1) **ii** All Bb (1)

c i Heterozygous (1)

ii

	B	b
B	BB	Bb
b	Bb	bb

(2)

Phenotypes = 3 black : 1 red (2).

4 ▶ a Toxic copper ions (1); only copper-tolerant plants will grow and reproduce / non-tolerant plants will die (1).

b Predation by lions (1); only those wildebeest that are fast runners (or equivalent) will survive and reproduce / slow animals will be killed and not reproduce (1).

c Presence of pesticide (1); only those pests resistant to the pesticide will grow and reproduce / non-resistant pests will die (1).

5 ▶ B

6 ▶ a They have a thick / heavy beak (1) which can be used to crush seeds (1).

b They have a long, thin / narrow beak (1) which can be used to probe under the bark of trees (or similar wording) for insects (1).

c Any four for 4 marks from:

- ancestors showed variation (in their beaks) (1)
- variations that allowed birds to get more food increased their survival (1)
- and increased reproduction / survival of the fittest (1)
- reference to mutations (1)
- genes for the adaptation passed on (1)
- over long time / many generations (1)
- birds became so different that they formed a new species (1).

CHAPTER 11

1 ▶ D **2 ▶** B **3 ▶** D

4 ▶ a Habitat: place where an organism lives; community: all the populations of living organisms in an ecosystem; environment: the non-biological components of an ecosystem; population: all the organisms of a particular species in an ecosystem.

b Plants = producers; animals = consumers; decomposers = breakdown of dead material.

5 ▶ a A sampling square used when counting organisms in an ecological survey.

b A part of a population measured in an ecological survey (sample) to give you an estimate of the whole population. Sample made without bias (random).

c Use suitably sized quadrat / stated size, e.g. 25 cm square; place quadrats at random / at random co-ordinates; state number of quadrats (minimum 10) on each side of wall; count moss plants / measure area of moss in each quadrat; calculate mean (number / area) on each side of wall.

CHAPTER 12

1 ▶ A **2 ▶** A

3 ▶ a i Plankton **ii** Krill

b Quaternary consumer / top carnivore

c Very large amounts of photosynthesis / production by the plankton can support this number of trophic levels.

4 ▶ a Any two from:

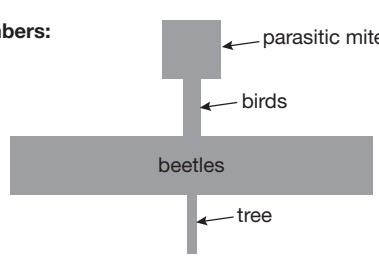
- trees → moths → small birds → owls
- trees → moths → small birds → weasels
- trees → moths → beetles → shrews

b Vole or small bird

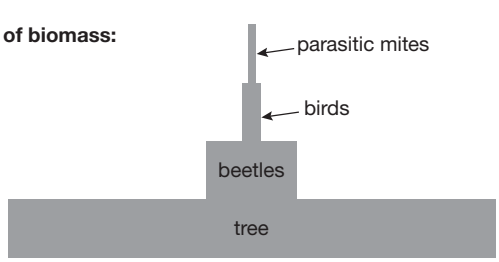
c Reduction in dead leaves means there will be fewer earthworms and beetles, so less food for shrews.

d In the pyramid of numbers there are only 200 trees, compared with hundreds of thousands of small consumers at the higher levels. However, each tree has a huge mass compared with the mass of each insect / bird / beetle, etc. so the overall mass of the trees is much larger.

5 ▶ a **pyramid of numbers:**



pyramid of biomass:



b The pyramid of numbers does not take into account the size (or mass) of each organism. For example, there is only one tree and 200 beetles, but the tree has a much bigger mass.

c Any three from:
- parts of the bird's prey (beetles) not eaten
- parts of food not absorbed / pass out in faeces
- energy lost in excretory products / in urine
- example of excretory product, e.g. carbon dioxide from respiration
- energy lost as heat from metabolic processes
- example of metabolic process, e.g. muscle contraction.

UNIT 4 EXAM PRACTICE

1 ▶ (1)

2 ▶ a i Any of the following for 1 mark:
- plankton → sea butterfly → arrow worm → herring (1)
- plankton → small crustaceans → large crustaceans → herring (1)
- plankton → copepods → sand eel → herring (1)

ii Primary consumer = sea butterfly / small crustaceans / copepods (1 mark for correct organism from food chain used)

Secondary consumer = arrow worm / large crustaceans / sand eel (1 mark for correct organism from food chain used)

iii Herring (1). It is a secondary consumer when it feeds on other small crustaceans or copepods, and a tertiary consumer when it feeds on sand eels, large crustaceans or arrow worms (1).

b i Pyramid drawn correctly, with relative amounts of energy at each trophic level approximately correct (1)

ii $\frac{892}{8869} \times 100 = 10.1\%$ (1 for correct values in calculation, 1 for answer)

iii $\frac{91}{892} \times 100 = 10.2\%$ (1 for correct values in calculation, 1 for answer)

iv Two from: losses from respiration / in movement / as faeces / undigested food (2)

3 ▶ a Plants carry out photosynthesis (1), which converts carbon dioxide into organic carbon compounds (1).

b Combustion of fossil fuels (1).

c i The bodies are broken down by respiration (1), which produces carbon dioxide (1).

ii Insects chew bodies into smaller pieces (1), providing a larger surface area (1) for enzymes produced by decomposers (1).

iii 4 marks for two sensible points from the curve, with reasons, e.g.
- curve 1 rises rapidly to a peak of CO_2 production by 7 days, whereas curve 2 shows little production during this time due to the slower action of decomposers on the intact bodies (2)
- curve 1 falls from the peak after 7 days due to material in the dead bodies being used up (1), while curve 2 shows little CO_2 production in this time (2)
- curve 2 starts to rise only at 9–12 days due to the slower action of decomposers on the intact bodies; CO_2 production in curve 1 has nearly fallen back to zero by 11 days (2).

4 ▶ (1 mark for each correct underlined term)
Plants take up carbon dioxide from the air during photosynthesis, using the carbon to form organic substances such as glucose. Plants are eaten by primary consumers and the carbon is passed along a food chain. Dead organic material and waste / excretory products provide the energy source for decomposers, which are bacteria and fungi. Most organisms pass carbon dioxide to the air by the process of respiration. Burning fossil fuels such as coal, natural gas and oil adds to the level of carbon dioxide in the air.

5 ▶ a $\frac{125}{3050} \times 100 = 4.1\%$ (2)

b As urine / faeces (1) and as heat from metabolic processes / respiration (1)

c Eaten by other herbivores (1), or 'lost' in dead matter (1) / passes to decomposers (1)

CHAPTER 13

1 ▶ A **2 ▶** B

3 ▶ a i Use of artificial lighting (during winter)

ii 'Greenhouse effect' raises temperature / use of heaters

iii Burning fossil fuel / gas produces carbon dioxide.

b Carbon dioxide concentration

4 ▶ a Respiration by the yeast produces carbon dioxide, which makes the dough rise.

b The dough does not rise – this produces unleavened bread (a flatbread).

CHAPTER 14

1 ▶ B **2 ▶** C **3 ▶** A

4 ▶ a 1 = restriction enzyme; 2 = (DNA) ligase

b It is a vector, used to transfer the gene into the bacterium.

c They are grown in fermenters.

d It is identical to human insulin and gives better control of blood glucose levels.

5 ▶ **a** Use *Agrobacterium* to insert plasmids containing the required gene into plant cells, or use a gene gun to fire a pellet of gold, coated with DNA containing the required gene, into the plant tissue.

b The plants are grown on a nutrient medium / by micropropagation.

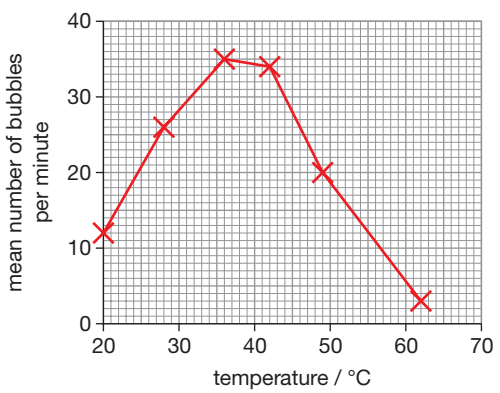
UNIT 5 EXAM PRACTICE

1 ▶ **a** Prevents oxygen entering the mixture of yeast and glucose (1), which ensures yeast respires anaerobically / prevents yeast respiring aerobically (1).

b To remove oxygen from the solution (1), which ensures yeast respires anaerobically / prevents yeast respiring aerobically (1).

c **i** $\frac{(35 + 37 + 33)}{3} = 35$ (1 mark for correct answer)

ii



4 marks for:

- axes drawn correctly, suitable sizes and scales (1)
- all data points correctly plotted (1)
- straight lines drawn from point to point (1)
- both axes labelled correctly (1).

iii Mean bubble rate increases from 20 °C to 36 °C (1). Maximum rate is at 36 °C (1). Rate decreases from 36 °C to 62 °C (1).

iv High temperatures cause denaturing of protein / enzymes (1). Changes shape of active site / substrate will not fit in active site (1). Reduced rate of (enzyme-catalysed) reactions / reactions of respiration (1).

2 ▶ Any six for 6 marks, from:

- compare rate of bubble production in yeast supplied with sucrose solution with rate in yeast supplied with glucose solution (1)
- same variety / batch / age / of yeast (1)
- same amount / mass / concentration of yeast (1)
- several tubes per type of sugar (allow 3 or more per treatment) (1)
- same concentration of sucrose solution and glucose solution (1)
- same temperature / both tubes in same water bath (1)
- suitable temperature stated, near the optimum (e.g. 40 °C) (1).

3 ▶ **a** Yeast / fungus (1)

b **i** F

ii C (2)

c Anaerobic respiration by yeast produces carbon dioxide gas (1) which makes the dough rise / produces 'holes' in the bread (1).

glucose → ethanol + carbon dioxide (1)

4 ▶ **a** A small ring of DNA (1) in (the cytoplasm of) a bacterium (1). Used to transfer genes / as a (gene) vector (1).

b **i** A virus (1) that infects / attacks bacteria (1).

ii They reproduce by injecting their DNA (1) into bacterial cells (1).

iii A (foreign) gene is inserted into the DNA of a bacteriophage (1). Bacteriophage injects its DNA into a bacterium (1). Bacterium makes the product of the (foreign) gene (1).

c **i** Enzymes that cut DNA at specific points (1), used to cut out genes from DNA (1) different restriction enzymes cut DNA at different places (1), use of the same restriction enzyme on a plasmid allows the DNA to be inserted into the plasmid (1).

ii Enzymes that join together cut ends of DNA (1), allowing genes to be put into plasmids (1).