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IGCSE BIOLOGY

Unit 2 Answers

Structure & Function of living organisms

Andy Todd

Contents:

b) Cell structure

c) Biological molecules

d) Movement of substances into and out of cells

e) Nutrition

f) Respiration

g) Gas exchange

h) Transport

i) Excretion

j) Coordination and response

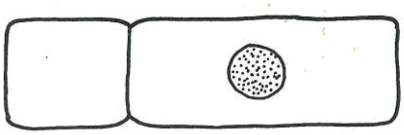
B: Cell structure

Answers

Cells and tissues

1 The section would appear like this

1 Mark



2 The magnification at which plant cells could be seen would be about x 100.

1 Mark

3 Of the choices offered, (b) is the best description of a cell membrane's function: it controls the substances entering and leaving the cell.

1 Mark

4 (a) Plant and animal cells have cytoplasm, cell membrane, mitochondria, nucleus and chromosomes.

5 Marks

(b) Only plant cells have a cell wall, central vacuole and cell sap.

3 Marks

5 If a cell develops in such a way that it does one particular job very efficiently, it is said to be *specialised*. Such a cell is also said to be *adapted* to its function. A nerve cell is *specialised* for conducting impulses. It can do this efficiently because of its *shape* and the chemical reactions in its *cytoplasm*.

5 Marks

6 Cell structure: *nucleus, mitochondrion, cytoplasm*.
Tissue: *bone, nerve, muscle, epithelium*.
Organ: *brain, stomach, lung*.
System: *skeleton, heart and blood vessels, alimentary canal, lungs and windpipe.*

11 Marks

Note: You could reasonably argue that the digestive system includes salivary glands, pancreas and liver, and therefore the alimentary canal is an organ, not a system.

Total = 27 marks

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C: Biological molecules

Answers

Food and diet

1 The body uses food (i) for energy, (ii) for growth (making new cells), (iii) repairing or replacing tissues.

2 Fats and carbohydrates both provide the body with *energy* but fats can provide *twice* as much as carbohydrates. Excess fats can be stored in the body but carbohydrates must be changed into *glycogen* or *fat* before they can be stored. The main types of carbohydrates are *starch*, *sugar* and *cellulose*. Examples of food rich in starch are (e.g.) *potatoes* and *bread*. Foods rich in fats are (e.g.) *butter*, *cheese* or *fatty meat*.

3 Most carbohydrate is taken in as starch.

4 Proteins are made up of about 20 different *amino acids*. One example of a plant product rich in protein is *beans* (or *wheat or maize*). An animal product rich in protein is *meat* (or *eggs* or *cheese* or *fish*). When a protein is digested, it is broken down into its constituent *amino acids* and these are later built up in the body to make new *cytoplasm* (or *cells* or *tissues*). Excess proteins which are not used for making new cells or tissues are converted to *glycogen* which can be stored or used to provide *energy*.

5 Fish, meat and lettuce contain little or no carbohydrate.

6 (a) Carbohydrates contain the elements *carbon* , *hydrogen* and *oxygen*.
(b) Proteins contain these elements but also *nitrogen* and *sulphur.*

7 Vegetable fibre retains water (keeping the faeces soft and bulky), prevents constipation, reduces the chance of disease of the large intestine (*any one*).

9 (a) Vitamin D (calciferol) is necessary for the healthy development of the skeleton.
(b) Butter, milk, cheese, egg-yolk, liver, oily fish (*any two*) are a good source.

10 In addition to sufficient energy, a balanced diet must contain proteins, carbohydrates and fats in the right proportion, and water, vitamins, mineral salts and fibre.

11 It should be possible to survive without carbohydrate as energy can be obtained from fats and proteins.

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12 Western diets are often unhealthy because they contain too much *sugar* and *fat*, and not enough *fibre*.

13 The low temperature of refrigeration slows down bacterial reproduction and enzyme reactions.

14 (a) Heating a food sample with Benedict's solution is a test for *sugar*. (Strictly, it is a test for a reducing sugar.)
(b) A test for starch is to add *iodine* solution to the food.
(c) In the biuret test for protein, *sodium hydroxide* and *copper sulphate* solutions are added to the sample. A *mauve* colour indicates the presence of protein.

Answers

The Chemicals of living cells

1 Cells need to take in water and salts, in addition to food.

3 (a) Cytoplasm, the cell membrane, membrane systems in the cell, the nucleus and mitochondria all contain structural proteins.
(b) Enzymes are the other type of cell proteins.

4 Proteins contain the elements carbon, hydrogen, oxygen, nitrogen and sulphur.

5 All proteins are composed of sub-units called amino acids.

6 (b) A protein which is denatured has changed its shape.

7 A lipid is a fat or oil. It may be combined with other substances, e.g. phospho-lipid or lipo-protein.

8 Lipids are found in cell membranes and other membrane systems in the cell. Some cells may have food reserves in the form of lipid droplets.

9 (a) lipids are formed from the combination of fatty acids with glycerol.
(b) lipids contain the elements carbon, hydrogen and oxygen.

10 (a) Sugars (glucose, fructose, maltose, sucrose), starch, glycogen and cellulose are examples of carbohydrates.
(b) Carbohydrates contain the elements carbon, hydrogen and oxygen.

11 The formula for glucose is $C_6H_{12}O_6$

12 (a) Maltose 

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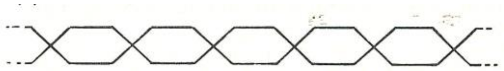
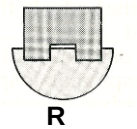
(b) Part of a starch molecule



13 All cells contain *enzymes* which are *proteins* and act as *catalysts* which *speed up* chemical reactions. The reaction does not *use up* the *enzymes,* which can take part in further reactions.

14 Using the lock and key model, enzyme A is most likely to react with substance R.



15 If an enzyme normally works at 10°C, then
(a) a fall in temperature to 2°C will slow down the reaction
(b) a rise in temperature to 20°C will speed up the reaction (by x2)
(c) a rise in temperature to 65°C will denature the enzyme and stop it working (though the reaction may speed up at first).

16 An enzyme which has been denatured has changed its shape and will no longer combine with its substrate (the substance it acts on).

17 (b) The optimum pH is 7 because the rate of reaction is greatest at this pH.

18 (a) A protein-digesting enzyme would have no effect on starch.

19 All enzymes are produced inside *cells*. Enzymes which do their work outside cells are called *extra-cellular*. Enzymes which do their work inside cells are called *intra-cellular* Most of our digestive enzymes are examples of *extra-cellular* enzymes.

20 In the course of brewing, enzymes in the grain catalyse the conversion of starch to maltose; enzymes in yeast catalyse the conversion of maltose to alcohol.

21 Catalase speeds up the breakdown of hydrogen peroxide to water and oxygen.

22 (a) Boiling denatures enzymes. If a substance still works after boiling, it cannot be an enzyme.
(b) If the reaction still worked after A had been boiled, either A is not an enzyme or, if it is, it is not necessary for the reaction.

23 (a) The test for starch is iodine solution, which goes blue.
(b) When no blue colour appears after adding iodine, all the starch has gone and the reaction is complete.

D: Movement of substances into and out of cells

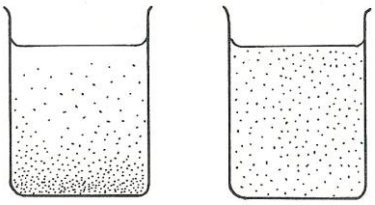
Answers

How substances get in and out of cells

1 (a) The gas will diffuse from Y to X (i.e. from the region of higher concentration to the region of lower concentration).

(b) Eventually, the gas will be evenly distributed between the two containers so each one will contain 0.5g per litre.

2 The salt molecules will move by diffusion till they are evenly distributed.



3 When a cell is respiring aerobically, oxygen will be diffusing into the cell and carbon dioxide will be diffusing out.

4 (a) (i) Inside the cell the substance will diffuse from B to C (i.e. down the concentration gradient).

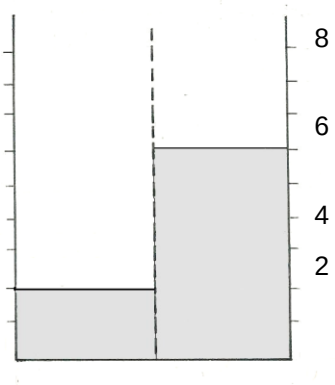
(ii) If the cell membrane were freely permeable, the substance would diffuse out of the cell, from B to A, because its concentration inside is greater than that outside.

(b) If there is no change in the concentration, you might assume that the substance was not free to diffuse across the cell membrane and was being taken up by active transport and diffusing across the cytoplasm by passive diffusion.

5 (a) The best definition of osmosis is (iii) 'The movement of water from a dilute solution to a concentrated solution across a partially permeable membrane'.

(b) An acceptable description of diffusion (at least in solutions) is (ii) 'The movement of a substance from a concentrated solution to a dilute solution'. (The partially permeable membrane is not essential for diffusion to occur.)

6 There will be a rise in level on the right and a corresponding fall on the left as water passes from the dilute to the concentrated solution by osmosis. (The figures need not be the same as shown here.)



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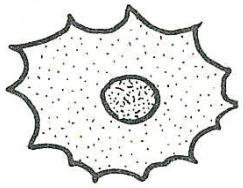
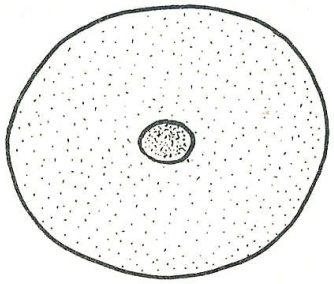
7 (b) A concentrated solution has a low osmotic potential (because it contains effectively fewer free water molecules than a dilute solution).

8 (**a**) Lower osmotic potential (water potential)



(cell loses water to more concentrated solution)

(b) Higher osmotic potential (water potential)



(cell gains water from more dilute solution)

9 If the cell membrane were freely permeable, harmful substances could diffuse in and useful substances could diffuse out.

10 If the tissue fluid became more dilute, the cells would absorb water by osmosis and swell up. If the tissue fluid became more concentrated, the cells would lose water by osmosis, shrink and become dehydrated, possibly to a point where metabolism was no longer possible.

11 The salt lowers the meat's osmotic potential so that water is withdrawn, by osmosis, from bacterial cytoplasm and so kills the bacteria.

E: Nutrition

Flowering plants

Answers

Photosynthesis and nutrition in plants

1 A green plant can make all the substances it needs. It builds up carbohydrates by the process of *photosynthesis*. In this process it combines *water* from the *soil* with *carbon dioxide* from the *air* to form *glucose*. The *energy* needed for this process comes from *sunlight* which is absorbed by the *chlorophyll* in the *chloroplasts* of leaf cells. The waste product of the process is *oxygen.* .

2 $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

3 (a) In darkness a green plant will be taking in oxygen and giving out carbon dioxide.
(b) In bright sunlight a green plant will be taking in carbon dioxide and giving out oxygen.
Note: Water vapour will also be escaping from the leaf; more so in sunlight.

4 A plant respires all the time. During daylight photosynthesis and respiration will be going on at the same time.

5 (a) From glucose, a plant makes the carbohydrates sucrose, starch and cellulose.
(b) Carbohydrate is transported round the plant as sucrose.
(c) The main storage carbohydrate in plants is starch.

6 (a) To make amino acids and proteins from glucose, a plant needs a supply of nitrate (for nitrogen) and sulphate (for sulphur).
(b) These substances come from the soil.

7 (a) To make ATP (adenosine triphosphate) a plant needs a supply of phosphate ions.
(b) To make chlorophyll a plant needs a supply of magnesium ions.

8 NPK compound fertiliser contains nitrogen (N) as nitrate, phosphorus (P) as phosphate and potassium (K) in suitable proportions. Alternatively, ammonium nitrate (NH_4NO_3) may be used as a source of nitrogen, and superphosphates as a source of phosphorus.

9 (a) If a potted plant is kept in darkness for 48 hours, all starch in its leaves should have been converted to sugars and conducted out of the leaves. This is destarching.

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(b) To check on the destarching, one of the leaves or part of a leaf should be tested with iodine to make sure the leaf is free from starch.

10 The accumulation of starch in a previously destarched leaf is accepted as evidence that photo- synthesis has occurred.

11 (a) In an experiment to find out whether light is needed for photosynthesis, light should be excluded from a destarched leaf or part of a destarched leaf. After a few hours of sunlight the covered leaf and an exposed leaf (or simply the partly covered leaf) should be tested for starch. Only the parts which received light should go blue with iodine.

(b) The control is the leaf, or part of the leaf, which has not been exposed to light and does not contain starch. Alternatively, if the exclusion of light from the leaf is thought to be the experiment, the parts of the leaf exposed to light constitute the control.

12 (a) If a (suitably prepared) leaf goes blue with iodine, it tells you that starch is present.

(b) Unless the leaf is known to have been free from starch at the beginning of the experiment you cannot conclude that photosynthesis has occurred. The starch might be permanently present in this leaf. Also, in the absence of an experimental design (with a control), there is no telling where the starch has come from. It might have been produced from sucrose which was transported to the leaf from another part of the plant.

Humans
Answers

Digestion

1 (c) The liver is not part of the alimentary canal.

2 Salivary gland, gastric gland, pancreas (any two).

3 Peristalsis.

4 Digestive enzymes dissolve food, make food soluble, break large insoluble food molecules into smaller, soluble molecules.

5 (a) Proteins are digested to amino acids, (b) fats are digested to fatty acids and glycerol,
(c) starch is digested to glucose.

6 Chewing reduces food to portions small enough to be swallowed and increases the surface area of the food for digestive enzymes to act on.

7 The enzyme in saliva is salivary amylase and it acts on starch.

8 (a) The stomach contents are acid.

9 Proteins are partially digested in the stomach.

10 The enzyme in gastric juice is pepsin.

11 The pancreas produces enzymes which act on proteins (proteases), starch (amylase) and fat (lipase).

12 The pancreas releases pancreatic juice into the duodenum.

13 Bile emulsifies fats (breaks fats into small droplets).

14 The absorbing surface of the small intestine is increased by (a) being very long, (b) having internal folds, (c) having villi, (d) micro-villi on the epithelial cells.

15 (a) Glucose and (c) amino acids enter the blood stream, (b) fatty acids and glycerol may enter the blood or the lymph.

16 The blood from the intestine goes first to the *liver* before entering the general circulation.

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If the glucose concentration in the blood is above a certain level, it is changed to *glycogen*and stored. Glucose which passes into the general circulation is taken up by the body cell and used to provide *energy*.

If there are excess amino acids in the blood from the intestine, the liver converts them to *glycogen* which is stored, and *urea* which is excreted by the kidneys.

17 The liver (a) converts hormones to inactive compounds, (b) oxidises alcohol to carbon dioxide and water, (c) stores vitamin A.

18 (A) gullet (oesophagus), (B) stomach, (C) liver, (D) pyloric sphincter, (E) bile duct, (F) gall bladder, (G) pancreatic duct, (H) duodenum, (I) pancreas.

F: Respiration

Answers

Energy from respiration

1 Respiration is the release of *energy* from *food* and takes place in all *cells* of the body. In the course of respiration, *food* is broken down to *carbon dioxide* and *water.* If oxygen is used for this process, the respiration is called *aerobic*. If oxygen is not used in the process, the respiration is called *anaerobic*. Each stage of respiration is speeded up by a particular *enzyme.*

2 $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 2830\ kJ$

3 The products of alcoholic fermentation are alcohol and carbon dioxide.

4 Respiration in cells takes place mainly in the mitochondria.

5 A person lying quite still needs energy for breathing movements (rib muscles and diaphragm), circulation of blood (heart contraction), temperature maintenance, nerve impulses in the brain and nervous system.

6 Aerobic respiration provides more energy than anaerobic respiration given the same quantity of food.

7 (a) In an active muscle, the intermediate products of anaerobic respiration are pyruvic acid and lactic acid.
(b) lactic acid is associated with oxygen debt.
(c) lactic acid which accumulates in the muscles has to be taken to the liver and oxidised even after the exercise has finished.

8 Statements (a) and (b) are incorrect.
(a) Anaerobic respiration does not use oxygen.
(b) Neither form of respiration produces oxygen.

9 (a) (i) Oxygen being taken up is acceptable evidence of respiration.
(b) (ii) Oxygen is not given out during respiration.
(iii) Water vapour is given off by non-living systems, e.g. wet washing.
(iv) Using up food could be evidence for respiration but the food could be used for growth rather than for energy. Nevertheless, any growth process will almost certainly need energy from respiration, so (iv) is acceptable evidence in most cases.

10 A temperature of 65°C for 10 minutes would denature the enzymes in most tissues, so respiration would cease. Structural proteins in the cell membranes would also be denatured. In short, the tissue would be killed by this temperature.

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11 (a) Basal metabolism refers to the range of chemical activities needed to maintain basic body functions, e.g. during sleep.

12 (a) Lime water is used to test for carbon dioxide.
(b) If carbon dioxide is present, the lime water goes 'milky'.

***Note*: pH indicators, such as hydrogencarbonate indicator are sometimes used to detect carbon dioxide, but they are not specific for this gas. Anything which increased the acidity of the indicator would produce a colour change.**

13 At 4 °C, enzyme activity is slowed down, so the rate of respiration (and hence usage of food and oxygen) in the blood cells is slowed down. This increases the possible storage time.

G: Gas exchange

Answers

Breathing

1 (a) Energy is obtained from food by a process called *respiration* (A).
(b) The intake of oxygen and output of carbon dioxide at a respiratory surface is called *gaseous exchange* (B).
(c) The process of renewing air in the lungs is called *ventilation* (C).
(d) The processes B and C are included in the term 'breathing'.

2 From the nasal cavity the air would pass through the (pharynx, glottis), larynx, trachea, bronchi and bronchioles to reach the alveolus.

3 The cartilage rings hold the air passages open.

4 The lining of the air passages produces *mucus* which traps dust particles. *Cilia* in the lining flick to and fro to carry the mucus up and out of the passages.

5 (b) When we inhale our diaphragm muscles contract and the ribs move up.

6 Blood in the pulmonary artery will contain less oxygen and more carbon dioxide than blood in the pulmonary vein.

7 Exhaled air contains approximately 16% oxygen.

8 *Diffusion* is the process by which oxygen passes from the alveoli to the lung capillaries.

9 (b)Tuberculosis and (d) colds are unlikely to be caused by smoking (but it doesn't help)

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H: Transport

Flowering plants

Answers

Plant structure and function - answers

1 (a) A - upper epidermis, B - chloroplast, C - air space (intercellular space), D - guard cell, E - lower epidermis.

(b) The palisade cells are elongated and have many chloroplasts; the spongy mesophyll cells rounded and have fewer chloroplasts.

(c) The air space C permits the diffusion of oxygen, carbon dioxide and water vapour to or from the cells inside the leaf.

(d) (i) and (ii) The elongated palisade cells allow the sunlight to penetrate without being absorbed by cell walls. The abundant chloroplasts in the palisade cells absorb and use the energy from sunlight. The chloroplasts are more abundant in the upper layers where most sunlight is received, the stoma allows entry of carbon dioxide for photosynthesis; the air space allows the gas to reach the photosynthesising cells.

(e) Most leaves are broad and offer a large absorbing surface to the sunlight, which they need for photosynthesis. They are also mostly thin, a feature which reduces the distance over which carbon dioxide has to diffuse in order to reach photosynthesising cells in the leaf. The branching network of veins in a leaf delivers water to the cells which need it for photosynthesis.

2 When stomata are open the leaf will be (b) giving off water vapour. If the stomata are open, it is likely to be daylight and therefore the leaf will be photosynthesising and thus (c) absorbing carbon dioxide and (e) giving off oxygen.

3 (a) There are twelve stomata in the drawing. (c) None of them is likely to be open at night.

(b) Seven of them are open. (d) The magnification is x200.

4 (a) Diffusion is responsible for the movement of carbon dioxide into a leaf.

(b) Oxygen will diffuse into a leaf when the concentration of oxygen inside the leaf is lower than its concentration in the air outside. This might occur in low light intensities (or darkness) when the rate of respiration exceeds the rate of photosynthesis.

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5 (a) Figure 1 represents a transverse section through a root. The presence of root hairs and the central position of the vascular tissue (xylem and phloem) are the features which identify this structure as a root.

Figure 2 represents a transverse section through a stem. The diagnostic features are the distinct epidermis, the central pith and the distribution of vascular bundles round the periphery.

(b) A-xylem (or vessels), B-phloem, C-cortex, D-root hair, E-epidermis, F-cortex, G-phloem, H-xylem (or vessels), I-cambium, J- pith.

Answers

Transport in plants

1 The most precise statement is (c).

2 The most accurate statement is (c). Statements (a) and (b) are correct but incomplete. Statement (d) is wrong.

3 Food made in the leaves is transported to the roots in the phloem of the vascular bundles

4 (b) An increase is humidity is likely to slow down the rate of transpiration.

5 Transpiration (a) draws water and (b) dissolved salts up the stem, and also (d) has a cooling effect on the leaves.

6 In a mature tree (in full leaf) transpiration makes by far the greater contribution to water movement through the trunk.

7 Statements (a), (b) and (d) are correct.

8 The water retained by a plant is used for photosynthesis and other chemical reactions. It is also used for maintaining cell turgor.

9 By taking the second set of readings 'without delay', the student did not allow time for a new rate to become established. The student should either have waited for 5 minutes or, better, kept taking readings until four of them were nearly the same.

When the apparatus was taken outside, several variables were changed, e.g. light intensity, temperature, humidity and air movement. There is no way of knowing which of these was contributing to the increased transpiration rate. It would have been better to vary just one condition while remaining in the laboratory, e.g. moving the apparatus from shade to sunlight.

10 The large volume of water in the conical flask, connected to a narrow capillary will behave like a giant thermometer. Small changes in temperature will produce large movements in the water column. There is no way of re-setting the water column.

The cork will have to be removed and the apparatus set up again each time a new reading is wanted.

11 (a) The plant lost 32g in 7 hours, so its rate of transpiration was 4.6g per hour.

(b) (i) In daylight, the weight loss due to transpiration will be reduced by a gain in weight resulting from photosynthesis.

(ii) In darkness some of the decrease in weight will be due to the loss of water and carbon dioxide produced by respiration.

(c) (i) If the plant had been short of water, this might have restricted the rate of transpiration.

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(ii) The plastic bag prevented evaporation taking place from the pot or the soil. Had this evaporation not been prevented, the weight loss could not have been attributed solely to transpiration.

Answers

The blood circulatory system

1 (a) White cells have nuclei, red cells do not have nuclei. Some white cells can change their shape, red cells cannot.
(b) White cells ingest bacteria or make antibodies. Red cells carry oxygen.

2 Blood cells are made in the red bone marrow, e.g. in the ribs, sternum or vertebrae.

3 Fibrinogen, albumin and globulin (any two) are plasma proteins.

4 In addition to proteins, plasma contains salts (ions), glucose, lipids and amino acids, hormones, carbon dioxide and urea.

5 (1) Atria fill with blood, (2) ventricles relax, (3) semi-lunar valves close, (4) atria contract, (5) tricuspid and bicuspid valves open, (6) ventricles contract, (7) bicuspid and tricuspid valves close, (8) semi-lunar valves open.

Note: The order of semi-lunar valves and bicuspid and tricuspid valves may be reversed as their action is virtually simultaneous.

6 The missing words are: (A) left, (B) pulmonary, (C) left, (D) aorta, (E) deoxygenated, (F) vena cava, (G) right, (H) pulmonary, (I) lungs.

7 (d) Capillaries are thin-walled, not thick-walled.

8 Arteries carry blood ***from*** the heart. Veins carry blood ***to*** the heart.

9 There are valves in the heart (between each atrium and ventricle, in the aorta and pulmonary artery), in some of the large veins and in some of the lymphatics.

10 Oxygen is transported from the lungs (A) to the whole body. Carbon dioxide (B) is transported from the whole body to the lungs. Urea (C) is transported from the liver to the kidneys. Digested food (D) is transported from the intestine to the whole body (E) (via the liver). Heat is transported from active muscles (F) to the whole body (G).

11 (d) Blood leaving a muscle will have more carbon dioxide, less oxygen and less glucose as a result of respiration.

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I: Excretion

Answers

Excretion and the kidneys

1 Carbon dioxide, urea, uric acid, spent hormones, excess water and salts (any four) have to be excreted from the body.

2 The kidneys, lungs and liver have an excretory function.

3 The missing words are (A) renal, (B) cortex, (C) blood pressure, (D) proteins, (E) Bowman's capsule (or renal capsule), (F) renal tubule, (G) glucose, (H) salts, (I) water, (J) urine, (K) ureter, (L) bladder.

4 (b) In hot weather, urine becomes more concentrated and darker in colour.

5 (c) You would not normally expect to find glucose in a urine sample.

6 (a) Blood in the renal vein will have less oxygen and more carbon dioxide (as a result of the kidney's respiration) and less urea, than blood in the renal artery.

7 Water is lost from the body by evaporation (lungs and skin), urination and defaecation (faeces always contain water).

8 (a) If the concentration of solutes in the blood rises, more water is reabsorbed in the kidney tubules. (This helps to reduce the concentration of the blood.)

9 (c) Water, urea and uric acid can pass through the dialysis tubing into the bathing solution. (You could argue that, if the patient's blood contained excessive salts or glucose, these too would escape.)

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J: Coordination & response

Answers

Co-ordination

1 The nervous system and endocrine system help to co-ordinate the body's actions.

2 The central nervous system consists of the brain and spinal cord.

3 (a) The nerve fibres which carry impulses from the sense organs to the central nervous system are called *sensory* fibres (A).
(b) The nerve fibres which carry impulses from the central nervous system to the glands and muscles are called *motor* (B) fibres.

4 A neurone consists of *a cell body* (A) containing a nucleus surrounded by *cytoplasm* (B). Branching filaments, called *dendrites* (C), extend from the cell surface and make *synapses* (D) with other neurones. In *sensory* (E) and *motor* (F) neurones, one of the filaments is very long and is called a *nerve fibre* (G).

5 Of the three speeds suggested, 50 metres per second is the most likely speed of conduction of a nerve impulse.

6 (b) 'Each part of the body is connected to its own region of the brain', is the best explanation of our ability to identify the source of a nerve impulse.

8 Examples of reflex actions are change in size of the pupil of the eye in response to light intensity, blinking in response to foreign particles on the cornea, coughing or sneezing in response to irritation of the nasal passages and trachea or bronchi, knee jerk in response to a blow on the tendon of the leg extensor muscle, rapid removal of the hand from a hot or sharp object (any three).

9 In a spinal reflex, a *sense organ* (A) is stimulated to produce a nerve impulse which travels in a *sensory fibre* (B) to the *spinal cord* (C). Here, the fibre makes a *synapse* (D) with a relay *neurone* (E) which transmits the impulse to a *motor* (F) fibre. This fibre conducts the impulse to an *effector* (G) organ such as a muscle.

10 In a reflex knee jerk (a) the receptor is a stretch receptor in the leg extensor muscle, (b) the effector is the leg extensor muscle itself.

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11 (a) Cerebellum - (ii) Balance and muscular co-ordination, (b) Medulla - (iii) Control of heart beat and breathing, (c) Cerebral hemisphere - (i) - Memory and reasoning, (d) Mid-brain - (iv) Eye movements.

12

	Nervous system	Endocrine system
Speed of conduction	faster	slower
Route of conduction	nerves	blood system
Area affected	very localised	rather general
Duration of response	short-lived	longer lasting

13 The correct statement is (a). Adrenaline increases the heart rate and the rate at which glucose is released from the liver.

14 The pancreas produces the hormones glucagon and insulin.
(a) Glucagon is produced in response to a fall in the concentration of glucose in the blood; it stimulates the liver to release glucose.
(b) lnsulin is produced in response to a rise in the concentration of glucose in the blood; it stimulates the liver to convert glucose to glycogen.

15 (a) The testes produce testosterone.
(b) The ovaries produce oestrogen and progesterone.

16 (a) Diabetes (insulin-dependent diabetes) is the condition which results from insufficient insulin.
(b)The diabetic is unable to control effectively the glucose concentration of the blood. The glucose concentration therefore fluctuates from dangerously high to dangerously low.
(c) Insulin-dependent diabetes is treated by regular injections of insulin, plus some dietary control.

Answers

The senses

1 A *stimulus* (A) such as touch, is detected by a *receptor* (B) and we may make a *response* (C).

2 The skin can detect heat, cold, touch and pressure.

3 Nerve impulses travelling from a receptor to the brain make us aware of a stimulus.

4 We can distinguish sweet, sour, salt and bitter tastes.

5 A - ciliary muscle, B - iris, C - aqueous humour, D - lens, E - cornea, F - sclera, G - vitreous humour, H - choroid, I - retina, J - fovea, K - blind spot, L - optic nerve.

6 (b) 'The radial fibres in the iris contract' is incorrect

7 (c) There are no sensory cells in the blind spot.

8 (a) The fovea is the region of the retina which gives the most accurate interpretation of the image.
(b) The light-sensitive cells in the fovea are the cones.

9 The curved surface of the cornea, and the aqueous humour enclosed by it, refract the light. The lens also refracts the light.

11 (b) 'The ciliary muscle relaxes and the lens gets thinner' is the correct statement.

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Answers

The skin, and temperature control

1 (a) Our skin protects us against bacteria (A) and ultraviolet light (B).
(b) Our skin helps to control body temperature (C) and evaporation of water (D).

5 The extremities of the body (hands and fingers, feet and toes, ears and nose) are likely to be the coldest parts. The internal organs (particularly the brain and active muscles) are likely to be the warmest parts.

6 The approximate range of normal body temperature is 36-38 °C.

7 The body loses heat by conduction, convection, radiation and evaporation (from skin and lungs).

8 (a) Respiration in the tissues, particularly in the brain and active muscles, is the main internal source of body heat.
(b) Direct sunlight, a hot environment and hot food and drink are external sources of body heat.

9 (a) Vaso-constriction is the reduction in diameter of small arterioles and capillaries.
(b) Vaso-constriction in the skin makes the skin look paler and reduces heat Joss.

10 Respiration in the spasmodically contracting muscles produces heat.

11 (a) Vaso-dilation is an increase in diameter of small arterioles and capillaries.
(b) Vaso-dilation makes the skin go more pink and increases heat loss.

12 For sweat to have a cooling effect, it must evaporate. In doing this it takes heat from the body.

13 Hypothermia is a lowering of the 'core' temperature of the body to below 35°C.

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