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Level: HL IB in Biology

Subject: Biology

Topic: IB HL Biology

Type: Mark Scheme

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All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY

HL - IB

Key skills

Answer 1

The correct answer is D because it shows the artery (X) with thick muscle and elastic tissue and a small lumen compared to the vein (Y). The red blood cells in X will mainly contain haemoglobin that is bound to oxygen, or oxyhaemoglobin.

A is incorrect because X and Y are the wrong way around.

B is incorrect because the trachea is the windpipe down to the lungs and not a blood vessel.

C is incorrect because by the time blood has reached Y it is likely to have given up its oxygen to respiring tissues, and so will contain haemoglobin but not oxyhaemoglobin.

Answer 2

The correct answer is B; arteries have a thick layer of muscle and elastic fibres to withstand high pressure, veins have thinner tissue layers and valves to prevent backflow and capillaries have just one layer of cells to maximise diffusion.

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Answer 3

The correct answer is D because the semilunar valves will close after ventricular contraction when pressure is higher in the aorta than the ventricle; this prevents backflow of blood from the aorta into the ventricle.

A, B and C are all incorrect; A is where semilunar valves open, B is where atrioventricular valves shut, C is where atrioventricular valves open.

Answer 4

The correct answer is B because blood flows into the right atrium (3) of the heart first, followed by the ventricles and then out of the heart via the pulmonary artery (4). Blood then re enters the heart from the lungs via the left atrium (2), moves down into the left ventricle before exiting via the aorta (1).

A, C and D are incorrect because each one involves the blood flowing backward through the heart e.g. from ventricle to atria; this cannot happen.

Answer 5

The correct answer is A because it marks the end of atrial systole when contraction of the atria forces blood into the ventricles so that they become full of blood.

B is incorrect as it shows the ventricular systole when the blood is being pushed out of the ventricles.

C and D are incorrect because they represent diastole when the atria and ventricles are relaxing; at this stage the chambers of the heart begin to fill with blood, but neither are completely full yet.

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Answer 6

The correct answer is B.

$$\begin{aligned} 2 \text{ heart beats in } 2 \text{ seconds} \\ = 1 \text{ beat per second} \\ = \underline{60} \text{ bpm} \end{aligned}$$

↪ beats per minute



Answer 7

The correct answer is D; the hole between the left and right atria shown in the diagram would allow the mixing of oxygenated blood from the left atrium and the deoxygenated blood from the right atrium. The mixing of the blood would reduce the overall oxygen saturation of haemoglobin as deoxygenated blood would be pumped around the body and not just to the lungs.

A and B are incorrect as they are issues which would be caused by problems with the SA or AV nodes.

C is incorrect because the pulmonary artery takes blood from the right ventricle to the lungs; the pressure generated by the right ventricle would not be affected by a fault in the wall between the atria.

Answer 8

The correct answer is B because it is the presence of saturated fats that can contribute to the formation of atherosclerosis, not unsaturated fats.



Answer 9

The correct answer is C because the force of attraction between water molecules is known as cohesion. In this model, cohesion is occurring between water molecules within the capillary tube.

- A is incorrect, as translocation is the biological term used to describe the transport of organic solutes in the phloem tissue
- B is incorrect, as hydrostatic pressure gradients occur in the phloem and are generated by the active transport of sucrose into the sieve tube elements, raising the solute concentration in the sieve tube and causing water to follow the sucrose by osmosis
- D is incorrect, as adhesion does not occur between water molecules but instead refers to the attraction between water molecules and a surface, such as the hydrophilic surface of the cell walls on the interior of xylem vessels or, in this model, the inner glass surface of the capillary tube

Answer 10

The correct answer is B.

As water evaporates from a leaf, water is drawn from the nearest xylem vessels to replace the water lost by evaporation. This water loss from the xylem vessels generates a low pressure within the xylem, which creates a pulling force throughout the xylem vessels that is transmitted, via cohesion between water molecules, through the stem of the plant and to the ends of the xylem in the roots. This is known as transpiration-pull and it allows water to be moved upwards through the plant, against the force of gravity. This continuous upwards flow of water in the xylem vessels of plants is known as the transpiration stream.

Answer 11

The correct answer is B.

- A and C are incorrect, as the transport of organic compounds from source to sink occurs in phloem sieve tubes
- D is incorrect, as it is phloem sieve tubes that are closely associated with companion cells, not xylem vessels

Answer 12

The correct answer is D.

In transverse sections of most plant stems and roots, the xylem vessels are located closer to the centre of the stem or root, with phloem tissue located closer towards the outer edge of the stem or root.

Answer 13

The correct answer is D.

The uptake of water is a passive process and occurs by osmosis as a result of the active transport of mineral ions into root cells. Mineral ion uptake raises the solute concentration, or osmolarity of the root cells, causing water to move (by osmosis) from an area of lower osmolarity in the soil to an area of higher osmolarity inside the root cell.



Answer 14

The correct answer is D because the question asks how mineral ions move towards the root, not how they enter the root. The mass flow of water through the free spaces in the cellulose cell walls (the apoplast pathway of water movement) ensures a continuous delivery of fresh soil solution (containing mineral ions) to the root hair cell plasma membranes.

- A is incorrect, as translocation is the biological term used to describe the transport of organic solutes in the phloem tissue
- B is incorrect, as mineral ions are actively transported into root cells by the action of specific transporter proteins in their cell surface membranes
- C is incorrect, as osmosis is how water uptake into roots occurs

Answer 15

The correct answer is A. A sprouting potato tuber will utilise its starch reserves for the growth and development of the root and shoot and will therefore be considered a source at this stage instead of a sink, unlike a young, growing tuber which will be building up those starch reserves.

- In B, developing fruit will act as a sink while sprouting potato tubers will act as a source for the growing shoots
- In C, the growing potato tubers will act as a sink as starch is stored there, while the mature leaves will have a high rate of photosynthesis and act as a source
- In D, the growing apples will act as a sink as they are utilising resources from the plant

Answer 16

The correct answer is B.

Organic compounds are actively loaded into phloem sieve tubes which increases the solute concentration within the tubes. This draws water in from nearby xylem vessels by osmosis, which increases the hydrostatic pressure at the source. This causes phloem sap to flow towards sinks.

Answer 17

The correct answer is D.

Statement I is incorrect since the transport of organic compounds will always be from the source to sink. Statement II is incorrect as it is xylem vessels that provide mechanical support to plant structures, not phloem sieve tubes.

Answer 18

The correct answer is C.

The conversion of sucrose to starch happens at sinks (such as storage tissues) and requires sucrose to be unloaded from the phloem sieve tubes, which lowers the solute concentration. This causes water to leave the phloem sieve tubes which in turn lowers the hydrostatic pressure.

Answer 19

The correct answer is B.

Xylem forms the inner part of the vascular bundles in the stem of a plant and therefore remains intact during girdling / ring-barking. Water and mineral salts can therefore still be transported from the roots to the leaves. It is the phloem that is removed and therefore the plant cannot transport sugars to the roots anymore, which kills the plant over a period of time.

Answer 20

The correct answer is C.

A represents the cortex of the root while B and D are xylem vessels. Remember that in a dicotyledenous root, the xylem is located at the middle of the centre core of the vascular bundle, while the phloem is located in alternate radial positions on the edges of the centre core.

Answer 21

The correct answer is C as the incompressibility of water, along with the rigid cell wall, contributes to a build-up of pressure in phloem sieve elements near the source.

- A and B are incorrect as the hydrostatic pressure at a sink is low due to the unloading of sucrose out of phloem sieve elements followed by water
- D is incorrect as there is high hydrostatic pressure at the source due to a high solute concentration in the sieve tube elements, which draws water in from nearby xylem vessels

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