HL Paper 1

Which describes the secretion of hormones in the pancreas in response to low levels of glucose in the blood?

A. Secretion of glucagon from α cells

B. Secretion of glucagon from β cells

C. Secretion of insulin from α cells

D. Secretion of insulin from β cells

Markscheme

A

Examiners report

[N/A]

Where is follicle stimulating hormone (FSH) produced in females and what is its function?

A. Produced by the ovaries and stimulates the growth of follicles

B. Produced by the pituitary gland and stimulates the growth of endometrium

C. Produced by the pituitary gland and stimulates the growth of follicles

D. Produced by the follicles and stimulates the growth of endometrium

Markscheme

C

Examiners report

[N/A]

What structures in the small intestine transport most fats?

A. Collecting ducts

B. Capillaries

C. Veins

D. Lacteals

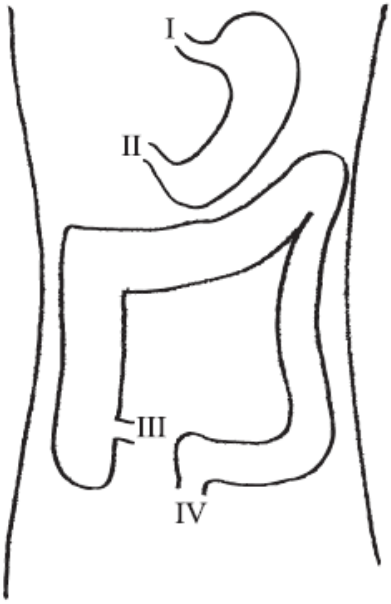
Markscheme

D

Examiners report

There have been complaints about the translation into German of this question.

The diagram below shows parts of the human digestive system.



Which points are linked by the small intestine?
A. I and III
B. II and III
C. II and IV
D. III and IV

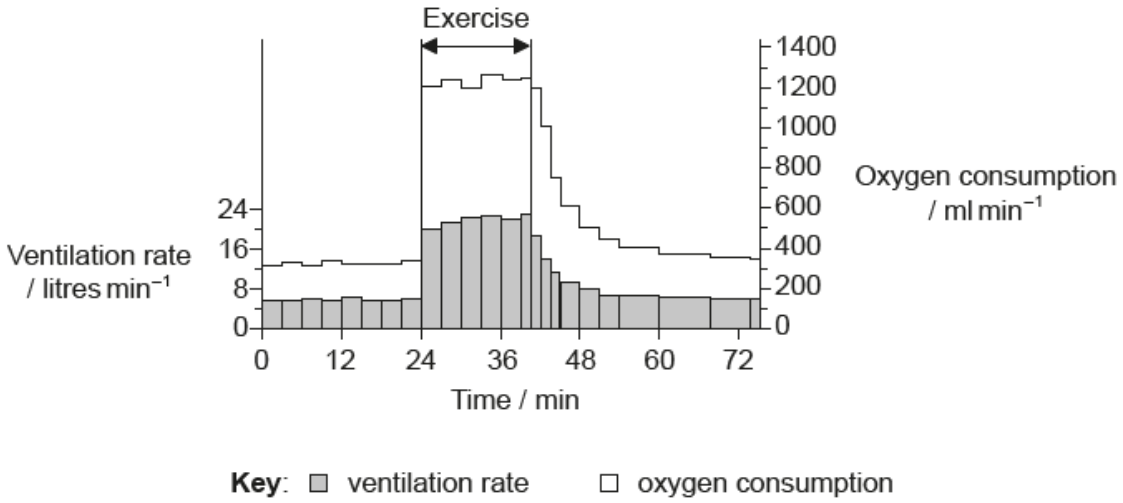
Markscheme

B

Examiners report

[N/A]

The graph shows the ventilation rate and the oxygen consumption of a subject before, during and after a period of exercise.



[Source: adapted from W E Huckabee (1958) *The Journal of Clinical Investigation*, 37 (2), page 256. Republished with permission of American Society for Clinical Investigation, permission conveyed through Copyright Clearance Center, Inc.]

Which could be a reason for the oxygen consumption to remain high for some time after the end of the period of exercise?

A. Epinephrine keeps the ventilation rate high.

B. Part of the exercise was done using anaerobic respiration.

C. A low ventilation rate keeps the consumption high.

D. More ATP is necessary for cross bridge formation while muscles cool down.

Markscheme

B

Examiners report

[N/A]

During the menstrual cycle, what occurs in response to a fall in the progesterone level?

A. Growth of the uterus lining
B. Growth of the follicle surrounding the egg
C. Ovulation
D. Menstruation

Markscheme

D

Examiners report

N/A

Glucose is absorbed through protein channels in the plasma membrane of epithelium cells in the small intestine. Which characteristics of glucose prevent its diffusion through the phospholipid bilayer?

A. It is non-polar and therefore hydrophobic.

B. Its hydrogen bonds link with amino acids in the protein channel.

C. It is polar and therefore hydrophilic.

D. Its covalent bonds interact with the phospholipids.

Markscheme

C

Examiners report

[N/A]

Which structure releases glucagon?

A. α cells of the pancreas
B. β cells of the pancreas
C. Liver cells
D. Hypothalamus

Markscheme

A

Examiners report

This question proved to be a very good discriminator, as most good candidates answered correctly.

What are features of the enzyme amylase?

	Substrate	Source	Optimum pH
A.	starch	salivary glands	7
B.	lignin	pancreas	1.5
C.	cellulose	liver	4
D.	glycogen	kidney	9

Markscheme

A

Examiners report

[N/A]

Which enzyme is amylase?

	Source	Substrate	Product(s)
A.	pancreas	starch	maltose
B.	stomach	protein	peptides
C.	pancreas	peptides	amino acids
D.	small intestine	maltose	glucose

Markscheme

A

Examiners report

Question 20 was criticised because students are only expected to know one source of amylase and this could be the salivary glands, but it if they knew that the substrate of amylase is starch and the product is maltose the only possible answer was the correct one.

What is the role of the pacemaker (SAN)?

A. It controls the release of epinephrine (adrenaline).
B. It sends nerve impulses to the ventricles.
C. It regulates the activity of the medulla.
D. It changes the frequency of muscle contraction in the heart.

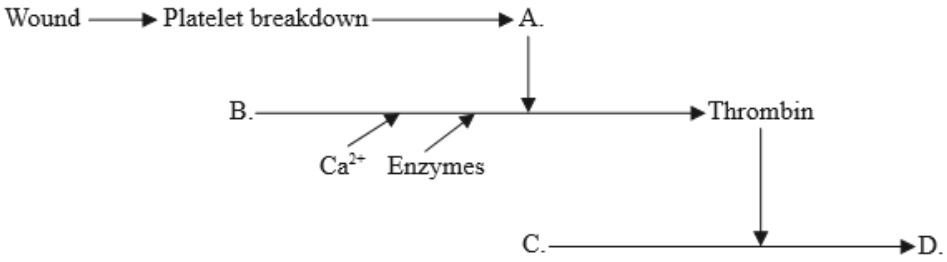
Markscheme

D

Examiners report

There was a complaint on G2s about the use of the SAN in the question instead of the full name of the sinoatrial node. The guide uses the acronym, so it is fair to use it in the exam. This question showed a bad discrimination factor. Many candidates chose answer B instead of D.

Formation of a blood clot by damaged tissue involves the series of steps outlined in the following diagram. Which letter represents a soluble globular protein that will be converted into an insoluble protein during clot formation?



Markscheme

C

Examiners report

N/A

If schizophrenia is caused by an overabundance of the neurotransmitters dopamine and serotonin in the synapses of some areas of the brain, which drug action could work in treating the symptoms?

A. Release of cholinesterase into the synaptic cleft
B. Increased re-uptake of dopamine and serotonin by presynaptic neurons
C. Increased permeability of the presynaptic neuron to sodium
D. Blockage of dopamine and serotonin receptors on presynaptic neurons

Markscheme

B

Examiners report

[N/A]

Why are antibiotics effective against bacteria but not viruses?

A. Viruses can hide inside host cells.
B. Bacteria are recognized as pathogens but viruses are not.
C. The enzymes of bacteria can be inhibited by antibiotics.
D. Viruses are resistant to antibiotics.

Markscheme

C

Examiners report

Many candidates thought that antibiotics are not effective against viruses because these can hide inside the host cell, failing to acknowledge the effect of antibiotics on bacterial enzymes.

What causes the rate of heart contraction to increase or decrease?

A. The heart muscle itself
B. Nerve impulses from the brain
C. A hormone from the thyroid gland
D. The rate of return of blood to the left atrium

Markscheme

B

Examiners report

Three teachers expressed concern over this question. A number chose answer A, suggesting that these students do not understand the concept of the myogenic origin of the heart beat.The role of adrenaline is required, so students should have been able to rule out response C.

Which of the following parts of the digestive system secrete proteases?

	Stomach	Small Intestine	Large Intestine
A.	Yes	No	No
B.	Yes	Yes	Yes
C.	Yes	Yes	No
D.	No	No	Yes

Markscheme

C

Examiners report

Although proteases are not secreted in the small intestine, many years ago it was believed that they were. Proteases are membrane bound in the small intestine (but not secreted there). Considering that some books might still use this concept, both answers A and C were considered as correct in order to make this question fair.

What is a characteristic of axons in motor neurons?

A. When there is a resting potential, the outside of the axon is negative relative to the inside.
B. During an action potential, Na^+ ions diffuse out of the axon.
C. K^+ ions diffusing out of the axon repolarizes it.
D. Impulses in the axon travel towards the cell body.

Markscheme

C

Examiners report

Question 22 was answered relatively unsuccessfully, indicating gaps in candidates' knowledge of the structure and function of motor neurones.

What are functions of the stomach, small intestine and large intestine?

	Stomach	Small intestine	Large intestine
A.	digest proteins	absorb glucose	absorb water
B.	digest starch	digest proteins	digest lipids
C.	digest proteins	assimilate glucose	excrete cellulose
D.	assimilate alcohol	digest starch	absorb water

Markscheme

A

Examiners report

This question was too easy.

Which reaction during blood clotting is catalysed by the enzyme thrombin?

A. Soluble fibrin to fibrous fibrinogen
B. Soluble fibrinogen to fibrous fibrin
C. Fibrous fibrinogen to soluble fibrin
D. Fibrous fibrin to soluble fibrinogen

Markscheme

B

Examiners report

N/A

What is a feature of type I diabetes but not type II diabetes?

A. Target cells become insensitive to insulin.
B. β cells do not produce sufficient insulin.
C. Type I diabetes can be controlled through a low carbohydrate diet.
D. α cells produce excess insulin.

Markscheme

B

Examiners report

N/A

Which response takes place when blood glucose levels are low?

A. Glucagon is released from the α cells of the pancreatic islets.
B. Glucagon is released from the β cells of the pancreatic islets.
C. Insulin is released from the α cells of the pancreatic islets.
D. Insulin is released from the β cells of the pancreatic islets.

Markscheme

A

Examiners report

N/A

Which discovery was an indication that the heart pumps blood to the body through arteries?

A. The amount of blood pumped exceeds that of blood produced
B. Blood could easily be pushed up a limb vein, but not down
C. The observation that there were pores between the right and left atria
D. The heart swelled up when the arteries were tied in an animal experiment

Markscheme

D

Examiners report

This question brought about a lot of controversy. The answer could really be obtained out of common sense.

Which blood vessel directly supplies oxygen to the heart muscle?

A. Aorta
B. Coronary artery
C. Pulmonary artery
D. Pulmonary vein

Markscheme

B

Examiners report

This was another very good discriminator. More candidates than expected thought that the pulmonary vein carries blood to the heart muscle. Perhaps these candidates did not read the question carefully and thought they were being asked which vessel supplies oxygen directly to the heart.

The concentration of which hormone peaks sharply triggering ovulation?

A. FSH
B. LH
C. Estrogen
D. Progesterone

Markscheme

B

Examiners report

This was the question that elicited the smallest percentage of correct answers but it was an excellent discriminator. Knowledge of changes in the LH surge before ovulation is not well known among the weaker candidates.

What is a long-term effect of HIV on the immune system?

A. Increase in leucocytes
B. Reduction in erythrocytes
C. Increase in antibody production
D. Reduction in active lymphocytes

Markscheme

D

Examiners report

N/A

Where is absorption of digested food carried out?

I. Villi

II. Pancreas

III. Small intestine

A. I only

B. I and II only

C. I and III only

D. I, II and III

Markscheme

C

Examiners report

[N/A]

A process occurs in which the inside of a neuron develops a net positive charge compared with the outside. What is the name of this process?

A. Resting potential
B. Repolarization
C. Depolarization
D. Hyperpolarization

Markscheme

C

Examiners report

N/A

What causes heart ventricles to fill with blood?

I. Atrial contraction

II. Closing of atrio-ventricular valves

III. Opening of semilunar valves

A. I only

B. I and II only

C. II and III only

D. III only

Markscheme

A

Examiners report

[N/A]

Which is the correct statement concerning HIV and AIDS?

A. All HIV patients have AIDS.

B. HIV and AIDS are transmitted on the sex chromosomes.

C. All AIDS patients have HIV.

D. HIV and AIDS neutralize antibodies.

Markscheme

C

Examiners report

[N/A]

What is the consequence of insufficient secretion of FSH in women?

A. Embryo implantation fails because the uterus lining is too thin.

B. Mature eggs (oocytes) are not produced.

C. Menstruation starts before embryo implantation occurs.

D. Progesterone secretion is inhibited.

Markscheme

B

Examiners report

[N/A]

Where does the digestion of polypeptides start in humans?

A. Mouth

B. Esophagus

C. Stomach

D. Small intestine

Markscheme

C

Examiners report

[N/A]

What are the conditions of the blood travelling through the pulmonary vein?

	Oxygen level	CO_2 level	Pressure
A.	high	low	low
B.	low	low	high
C.	low	high	low
D.	high	low	high

Markscheme

A

Examiners report

N/A

What will be happening in a person after eight hours of sleep?

A. β cells in the pancreas will be producing insulin.
B. Glucose will be converted into glucagon.
C. α cells in the pancreas will be producing glucagon.
D. Glycogen is being produced and stored in the liver and muscle cells.

Markscheme

C

Examiners report

Candidates seemed to struggle with this. When looking for an explanation as to why so many chose the incorrect response it appears they were confusing glucagon and glycogen.

What is the mechanism of sodium-potassium pumps in neurons that generates a resting potential by active transport?

A. K^+ from cytoplasm binds to the pump and stimulates its phosphorylation by ATP.
B. Phosphorylation of the pump causes its shape change in order to move Na^+ into the cytoplasm.
C. K^+ from inside the cell binds to the pump and causes the release of the phosphate group.
D. Na^+ from cytoplasm binds to the pump and stimulates its phosphorylation by ATP.

Markscheme

D

Examiners report

Many teachers believed this question was beyond the scope of what is needed to be known about the sodium-potassium pump. Although the team agree with them; this question could be answered just by looking at the movement of ions, therefore it is acceptable.

Which hormone shows the greatest fall in blood concentration just before menstruation?

A. FSH (follicle stimulating hormone)

B. LH (luteinizing hormone)

C. Progesterone

D. Estrogen

Markscheme

C

Examiners report

[N/A]

Is the blood in the aorta, left ventricle and pulmonary artery oxygenated or deoxygenated?

	Aorta	Left ventricle	Pulmonary artery
A.	oxygenated	deoxygenated	deoxygenated
B.	deoxygenated	oxygenated	oxygenated
C.	oxygenated	oxygenated	deoxygenated
D.	oxygenated	oxygenated	oxygenated

Markscheme

C

Examiners report

N/A

What are antibodies?

A. Organisms or viruses that cause disease
B. Drugs used to treat bacterial diseases
C. Substances the body recognizes as foreign
D. Proteins that bind to foreign substances

Markscheme

D

Examiners report

N/A

What steps occur in blood clotting?

A. Fibrin is converted to fibrinogen which then alters prothrombin into thrombin.

B. Thrombin is converted to prothrombin which then alters fibrinogen into fibrin.

C. Fibrinogen is converted to fibrin which then alters prothrombin into thrombin.

D. Prothrombin is converted to thrombin which then alters fibrinogen into fibrin.

Markscheme

D

Examiners report

[N/A]

What happens first when a neurotransmitter binds to a postsynaptic neuron?

A. Ions diffuse

B. Electrophoresis begins

C. Ca^{2+} channels open

D. Repolarization

Markscheme

A

Examiners report

[N/A]

Celiac disease causes the destruction of the villi cells. Which of the following is most likely to happen to people with celiac disease?

A. Incomplete digestion of fats
B. Poor absorption of calcium
C. Increased levels of glucose in blood
D. Damage in the esophagus caused by increase in acid content of the stomach

Markscheme

B

Examiners report

This question was not well answered. Some G2 comments regarded the fact that celiac disease is not on the syllabus. That is true but this question is about absorption which is. To answer it does require reasoning but not knowledge of celiac disease.

What is the condition of the valves of the heart when the right ventricle is contracting?

	Atrio-ventricular valve	Semilunar valve
A.	open	open
B.	open	closed
C.	closed	closed
D.	closed	open

Markscheme

D

Examiners report

Some teachers pointed out that in question 19, answer C is correct for a small proportion of the cardiac cycle at the start of ventricular systole. There is an isovolumetric phase when both the atrioventricular and semi lunar valves are closed and contraction of the ventricles causes a very rapid pressure increase. However, D was much the best answer. Most candidates chose it and the question discriminated well.

What muscle actions cause air to be expelled from the lungs?

A. Internal intercostal muscles relax and diaphragm contracts

B. External intercostal muscles contract and abdominal wall muscles contract

C. External intercostal muscles contract and diaphragm relaxes

D. Internal intercostal muscles contract and abdominal wall muscles contract

Markscheme

D

Examiners report

A discriminating question, testing detailed knowledge of ventilation. D was the correct answer, but a very significant number gave C.

What is a feature of alveoli?

A. They occur in all animals because they are needed for gas exchange.
B. They have a higher oxygen concentration than air in the atmosphere to increase the rate of diffusion.
C. They have walls that are one cell thick for faster diffusion.
D. They are small so keep the gases inside them more concentrated.

Markscheme

C

Examiners report

N/A

What occurs during the process of ventilation?

A. Contraction of external intercostal muscles raises the ribcage.
B. Relaxation of the abdominal muscles decreases the air volume in the lungs.
C. Contraction of internal intercostal muscles raises the ribcage.
D. Relaxation of the diaphragm decreases the air pressure in the lungs.

Markscheme

A

Examiners report

N/A

What is a role of the pacemaker or sinoatrial node (SAN)?

A. To initiate contraction of the ventricle
B. To pass the excitation through Purkinje fibres
C. To originate excitation in myogenic muscle
D. To cause the relaxation of the atria

Markscheme

C

Examiners report

N/A

What characterizes type I diabetes?

A. It can be controlled by diet alone.
B. Risk factors such as obesity increase its frequency.
C. The alpha cells of the pancreas are destroyed, usually during adulthood.
D. The beta cells of the pancreas are destroyed, usually during childhood.

Markscheme

D

Examiners report

An easy question.

What is a characteristic of type II diabetes?

A. Liver cells are less sensitive to insulin.
B. Insulin is no longer produced.
C. α cells in the pancreatic islets are destroyed.
D. β cells in the pancreatic islets are destroyed.

Markscheme

A

Examiners report

In contrast Questions 9, 24, 28 and 32 had very high discrimination indices. Each required secure knowledge the details of HL Biology, which diligent and capable students acquire but others tend not to.

What is a feature of the human circulatory system?

A. The wall of the right ventricle of the heart is the thickest of the four chambers.

B. The pulmonary artery and vena cava both carry deoxygenated blood.

C. Valves are found in arteries and veins but not capillaries.

D. Epinephrine acts on the pacemaker to reduce heart rate.

Markscheme

B

Examiners report

[N/A]

In which process is “surface area” of key importance for humans?

A. Reabsorption of glucose in the proximal convoluted tubule
B. Release of surfactants by type I pneumocytes
C. Display of antibodies by red blood cells
D. Secretion of enzymes by villi of the small intestine

Markscheme

A

Examiners report

This question was difficult, but also a good discriminator. Many candidates wrongly believed that surface area affects the secretion of enzymes in the villi. This is not true, as surface area affects the absorption of substances, not the secretion of enzymes.

Which muscles contract to cause air to pass into the lungs through the trachea?

A. Internal intercostal muscles and diaphragm
B. Internal intercostal muscles and abdomen wall muscles
C. External intercostal muscles and diaphragm
D. External intercostal muscles and abdomen wall muscles

Markscheme

C

Examiners report

The guide clearly states that intercostal muscle function in breathing has to be known.

What happens to starch in the small intestine?

A. Endopeptidase secreted by the liver digests starch to enable absorption by the villi.
B. Contraction of intestinal muscle mixes starch with enzymes to accelerate its conversion into amylose.
C. Glycogen secreted by the pancreas hydrolyses starch into glucose, which is eventually transported to the liver.
D. Amylase secreted by the pancreas digests starch to enable absorption by the villi.

Markscheme

D

Examiners report

This question had relatively high discrimination. Some teachers complained that amylose was not in the guide, but it does appear in section 2.3.

What is the state of the atrio-ventricular and semilunar valves when the left ventricle contracts?

	Atrio-ventricular valves	Semilunar valves
A.	open	closed
B.	open	open
C.	closed	closed
D.	closed	open

Markscheme

D

Examiners report

Question 21 was also criticised because there is an iso-volumetric phase at the start of ventricular systole when both atrio-ventricular and semilunar valves are closed. However, the examining team felt that during most of ventricular systole the atrio-ventricular valves are closed so one of the four answers was clearly the best.

What happens when an action potential reaches motor end plates?

A. Calcium ions are absorbed by the muscle fibres.

B. The sarcomeres relax.

C. Neurotransmitter is released.

D. Action potential is passed to the neuron.

Markscheme

C

Examiners report

[N/A]

Which muscle action is associated with an increase in the volume of the thoracic cavity when breathing in?

A. The diaphragm contracts.
B. The external intercostal muscles relax.
C. The internal intercostal muscles contract.
D. The abdominal muscles contract.

Markscheme

A

Examiners report

This question had a high discrimination index. Good candidates realized the function of the diaphragm in breathing in.

Which term describes the phase of rapid entry of sodium ions (Na^+) into an axon during an action potential?

A. Active transport
B. Depolarization
C. Ion pumping
D. Repolarization

Markscheme

B

Examiners report

N/A

What happens when human body temperature rises during exercise?

A. The arterioles move closer to the skin.
B. The hypothalamus decreases cell respiration.
C. The skin capillaries close up.
D. The water from sweat evaporates to cool the body.

Markscheme

D

Examiners report

Many candidates wrongly believed that arterioles move in the body instead of suffering vasodilation. Nevertheless, most candidates had the right answer, proving this question to be too easy.

What is the function of LH (luteinizing hormone) in the menstrual cycle?

A. Development of follicles in the ovary
B. Repair of the uterus lining following menstruation
C. Stimulation of ovulation
D. Preparation of the uterus for implantation

Markscheme

C

Examiners report

The correct answer in Question 25 was contested by some teachers who thought that LH both stimulates follicle development of follicles and ovulation. This view is not supported by the evidence, which shows that LH promotes secretion of estrogen by cells in the developing follicle but that follicle development is stimulated by FSH. The two pituitary hormones FSH and LH have distinctly different roles and it is not correct to lump them together in an explanation of the menstrual cycle. The LH surge is such a good predictor of ovulation for couples wanting to conceive because LH stimulates ovulation.

What is the direction of flow of oxygenated blood during a heartbeat?

A. left atrium → semilunar/aortic valve → left ventricle → pulmonary vein
B. pulmonary vein → left atrium → left ventricle → semilunar/aortic valve
C. left atrium → left ventricle → semilunar/aortic valve → pulmonary vein
D. pulmonary vein → left atrium → semilunar/aortic valve → left ventricle

Markscheme

B

Examiners report

N/A

Which of the following describes arteries?

A. They have thick muscular walls.
B. They usually contain valves.
C. They carry blood towards the heart.
D. They carry blood from the lungs.

Markscheme

A

Examiners report

This question proved to be too easy for these candidates.

What initiates an action potential along a neuron?

A. Potassium and sodium ions diffuse out of a neuron.
B. Potassium and sodium ions diffuse into a neuron.
C. Neurotransmitters cause depolarization of membrane.
D. Acetylcholinesterase breaks down acetylcholine.

Markscheme

C

Examiners report

N/A

What is the function of thrombin in the process of blood clotting?

A. It acts as a catalyst.
B. It criss-crosses the wound to trap blood cells.
C. It changes from a soluble protein to an insoluble fibrous protein.
D. It releases clotting factors from platelets.

Markscheme

A

Examiners report

N/A

What is a role of the coronary arteries?

A. To supply information about blood temperature to the hypothalamus
B. To supply the heart muscle with oxygen and nutrients
C. To carry blood away from the heart
D. To monitor blood pH

Markscheme

B

Examiners report

Most candidates correctly recognised that the function of the coronary arteries is to supply the heart muscle with oxygen and nutrients. Some candidates wrongly believed that they carry blood away from the heart.

Immediately after an action potential, which event causes the neuron membrane to repolarize?

A. Voltage-gated sodium channels open.
B. Voltage-gated potassium channels open.
C. Voltage-gated calcium channels close.
D. Voltage-gated potassium channels close.

Markscheme

B

Examiners report

N/A

Which of the following help to control body temperature on a very hot day?

I. Shivering
II. Sweating
III. Skin arteriole dilation

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

Markscheme

C

Examiners report

This was an example of a question that was too easy; it proved to be the easiest on the paper with candidates only needing to know that we do not shiver on a very hot day.

What happens during synaptic transmission?

A. K^+ enters the postsynaptic membrane.
B. A neurotransmitter is absorbed through the presynaptic membrane.
C. Na^+ is released from the presynaptic membrane.
D. A neurotransmitter binds to a postsynaptic membrane receptor.

Markscheme

D

Examiners report

N/A

What is the main function of the large intestine?

A. Absorption of water
B. Digestion of fats and proteins
C. Absorption of nutrients
D. Recycling of digestive enzymes

Markscheme

A

Examiners report

N/A

Why do nutrient molecules enter the blood?

A. Blood carries nutrients to cells.
B. Blood converts nutrients into energy.
C. Nutrients and oxygen are mixed by blood.
D. Nutrients are stored in blood.

Markscheme

A

Examiners report

Four teachers objected to the wording of the question. 92.5% of students answered correctly so the wording did not appear to affect student performance.

What occurs during the blood clotting process?

A. Prothrombin is converted into thrombin which activates fibrinogen.
B. Prothrombin is converted into thrombin which activates fibrin.
C. Fibrinogen is converted into fibrin which activates prothrombin.
D. Fibrinogen is converted into fibrin which activates thrombin.

Markscheme

A

Examiners report

This question would have read more clearly if instead of "activates" "acts on" had been used. This question did turn out to be a very good discriminator.

Which statement is true for the antibiotic penicillin?

A. Watson and Crick developed the usage of penicillin.
B. Penicillin blocks processes unique to eukaryotic cells.
C. Viruses lack metabolism and penicillin has no effect on them.
D. Florey and Chain sequenced the genome of *Penicillium notatum*.

Markscheme

C

Examiners report

This question was in general well answered, as candidates recognized that antibiotics do not affect viruses.

Why does shivering occur?

A. The body cannot control muscles when they become cold.
B. Shivering informs the brain that the body is too cold.
C. Shivering generates heat and raises body temperature.
D. The body diverts blood away from skin reducing heat loss.

Markscheme

C

Examiners report

N/A

Which of the following statements about antibodies is correct?

A. Antibodies are polypeptides.
B. Antibodies are produced by the bone marrow.
C. Antibodies are pathogenic foreign substances.
D. Antibodies kill bacteria but not viruses.

Markscheme

A

Examiners report

There were several comments about the clarity of the wording of the answers to this question. It is agreed that A could have been worded more clearly as antibodies are proteins with a quaternary structure consisting of four polypeptide chains.

What are the roles of testosterone in males?

A. Stimulation of FSH production and growth in puberty
B. Pre-natal development of genitalia and development of secondary sexual characteristics
C. Development of genitalia and pre-natal secondary sexual characteristics
D. Stimulation of FSH production and pre-natal development of secondary sexual characteristics

Markscheme

B

Examiners report

The roles of testosterone are clearly stated in the teacher notes in the guide.

Which is a valid comparison between arteries and veins?

	Arteries	Veins
A.	carry oxygenated blood	carry deoxygenated blood
B.	return blood to the atria of the heart	blood flows from ventricles to body tissues
C.	blood flows at high pressure	blood flows at low pressure
D.	have thick walls	have permeable walls

Markscheme

C

Examiners report

This question discriminated very well. Good candidates were able to distinguish arteries from veins. Some teachers complained that arteries carry oxygenated blood and veins deoxygenated blood, but this is not true for pulmonary and umbilical arteries and veins.

What is essential for conduction of nerve impulses to be saltatory?

A. Wrapping of myelin around the axon

B. Reaching the threshold potential in dendrites

C. Pumping potassium ions into the neuron

D. Releasing a neurotransmitter at the synapse

Markscheme

A

Examiners report

[N/A]

The decline in European honeybee (*Apis mellifera*) populations may be linked to neonicotinoid pesticides. What effect do these pesticides have on the nervous system of insects?

A. They prevent acetylcholinesterase from breaking down acetylcholine.
B. They inhibit depolarization in the presynaptic neuron which increases the levels of acetylcholine.
C. They produce an inhibitor that promotes the binding of acetylcholine.
D. They block synaptic transmission by binding with postsynaptic acetylcholine receptors.

Markscheme

D

Examiners report

[N/A]

In Florey and Chain's experiment, eight mice were infected with lethal doses of *Streptococcus* bacteria. The four mice given penicillin survived, but the untreated mice died. What can be concluded from these results?

A. The experiment should be repeated with more mice.
B. There is a causal relationship between the use of penicillin and antibiotic resistance in bacteria.
C. Penicillin can be used to treat bacterial infections in humans.
D. Penicillin may have played a role in the recovery of the four mice.

Markscheme

D

Examiners report

[N/A]

How does the hypothalamus respond to a very high body temperature?

A. Increases muscle contraction

B. Stops receiving sensory input

C. Causes dilation of skin arterioles

D. Slows the heart rate

Markscheme

C

Examiners report

Most candidates answer this question well, although the question stated body temperature instead of blood temperature.

What is a feature of neurons?

A. Relay neurons transmit impulses from motor to sensory neurons.

B. The cell body of a motor neuron is in the CNS.

C. Sensory neurons carry impulses away from the CNS.

D. Relay neurons form synapses with receptors.

Markscheme

B

Examiners report

This was a very badly answered question with less than 20% of candidates answering it correctly. This is lower than the expected 25% success rate from guessing. Some teachers felt that it was not part of the HL program, but the correct answer could be deduced from Assessment Statements 6.5.2 and 6.5.3 and the answer could also be identified by eliminating the three distractors using understanding gained from these Assessment statements. Students who had studied Option E were at a slight advantage. Every effort is made to avoid advantages in Paper 1 for those who have studied a particular Option, but in some cases where the Option amplifies part of the Core or AHL it is almost inevitable. The commonest answer was D, which was the incorrect statement that relay neurons form synapses with receptors, but many candidates also chose A which stated that relay neurons transmit impulses from motor to sensory neurons. At least some candidates will have misread the question and chosen it without going on to read the other choices.

Enzymes produced by the pancreas could pass out of the body via the anus. Which route would these enzymes take to do this?

A. pancreas → liver → small intestine → rectum → anus

B. pancreas → gall bladder → small intestine → large intestine → anus

C. pancreas → small intestine → large intestine → anus

D. pancreas → large intestine → small intestine → anus

Markscheme

C

Examiners report

N/A

Which type of cell is specialized to facilitate gas exchange?

A. Type I pneumocytes

B. Type II pneumocytes

C. Internal intercostal muscle fibres

D. External intercostal muscle fibres

Markscheme

A

Examiners report

[N/A]

What prevents antibiotics from being effective against viruses?

A. Viruses have a high rate of mutation.
B. Viruses have no RNA.
C. Viruses have no metabolism.
D. Viruses have a protein shell that protects them.

Markscheme

C

Examiners report

This question turned out to be a very good discriminator. Many candidates believed that due to the high rate of mutation of the virus, the antibiotics are ineffective against them.

What is an important function of the lacteal in the villus?

A. Secretion of mucus
B. Secretion of enzymes
C. Transport of glucose
D. Transport of fats

Markscheme

D

Examiners report

This was the best discriminator on the paper, perhaps surprisingly. Presumably the 62% of candidates that answered it correctly were the ones that had prepared most carefully for their exams and candidates relying on guesswork or intuition were caught out here.

What effect does HIV have on the immune system?

A. It prevents leucocytes from fighting bacteria by phagocytosis.
B. It causes excessive production of leucocytes in bone marrow.
C. It destroys antibodies produced by leucocytes.
D. It lowers the number of leucocytes, reducing antibody production.

Markscheme

D

Examiners report

N/A

Some egg white protein was heated until it turned solid. It was then cooled and cut into four cubes of equal size. Each cube was placed in a test tube containing water and a peptidase which was extracted from the stomach of a mammal. Hydrochloric acid was added to two of the tubes. The tubes were kept at constant temperature for 30 minutes. In which tube was the cube of egg white smallest after 30 minutes?

Test Tube	pH	Temperature / °C
A.	2	90
B.	7	37
C.	2	37
D.	7	90

Markscheme

C

Examiners report

[N/A]

Which organ in the human body secretes lipase, amylase and protease?

A. Pancreas

B. Liver

C. Gall bladder

D. Small intestine

Markscheme

A

Examiners report

[N/A]

Where does **most** assimilation take place?

A. In cells
B. In the mouth
C. In the small intestine

D. In the large intestine

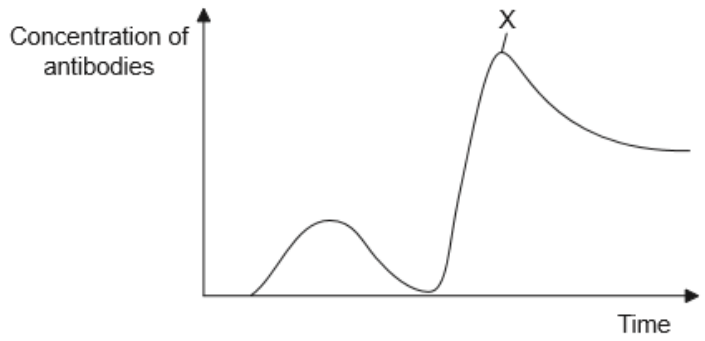
Markscheme

A

Examiners report

N/A

The graph is about defence against infectious disease.



[Source: CAMPBELL, NEIL A.; REECE, JANE B., *BIOLOGY*, 7th Edition, © 2005, p. 908. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ. Used by permission.]

What is likely to be indicated by the letter X?

A. The increase in lymphocytes following HIV infection
B. The peak of the infection
C. The secondary response to a vaccine
D. The first appearance of AIDS symptoms

Markscheme

C

Examiners report

This question was not too clear because the axis in the graph do not say this is showing a vaccination process, therefore confusing candidates.

Which of the following are controlled by homeostasis?

I. Blood pH
II. Water balance
III. Blood glucose concentration

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

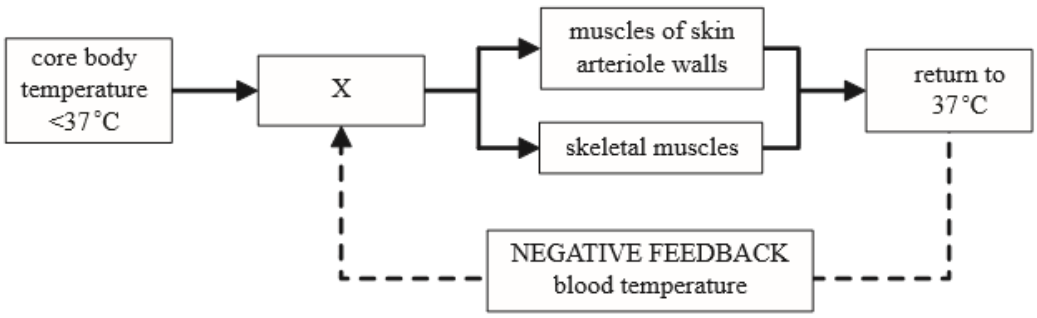
Markscheme

D

Examiners report

Some teachers pointed out that blood pH and other variables are not controlled by homeostasis; their control is a part of homeostasis. This distinction did not seem to worry the candidates, with 70% getting the answer right and the discrimination index indicating that these were largely the stronger candidates.

The diagram below represents the homeostatic control of body temperature. What does the part labelled X represent?



A. Heart
B. Kidney
C. Pituitary
D. Hypothalamus

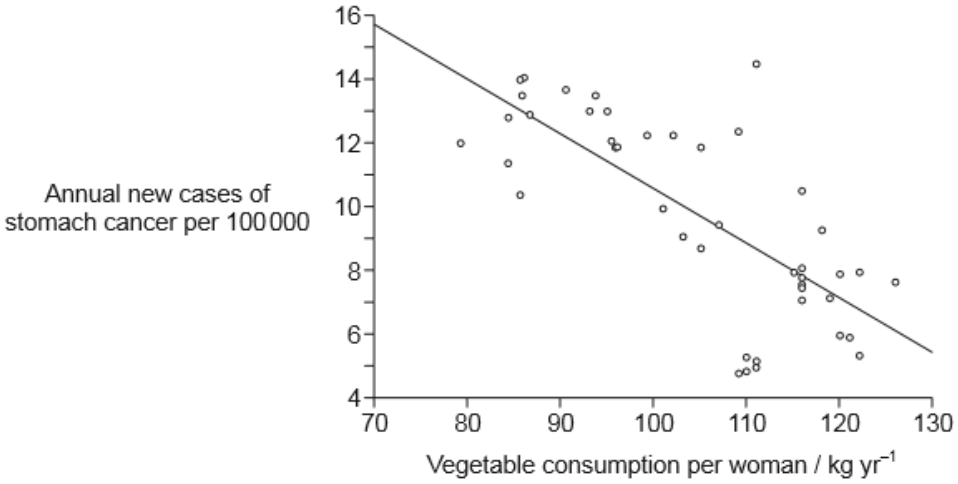
Markscheme

D

Examiners report

N/A

The graph shows a correlation between the number of new cases of stomach cancer and vegetable consumption for women in Poland.



[Source: "Impact of diet on long-term decline in gastric cancer incidence in Poland", Miroslaw Jarosz, Wlodzimierz Sekula, Ewa Rychlik and Katarzyna Figurska. *World J Gastroenterol* **17**(1): 89–97. Figure 4. Published online 2011 January 07. doi:10.3748/wjg.v17.i1.89.]

What can be stated from the graph?

A. Vegetable consumption causes stomach cancer
B. 68 % of the data are gathered around the trend line
C. Causality cannot be stated from the graph alone
D. Only that the correlation is positive

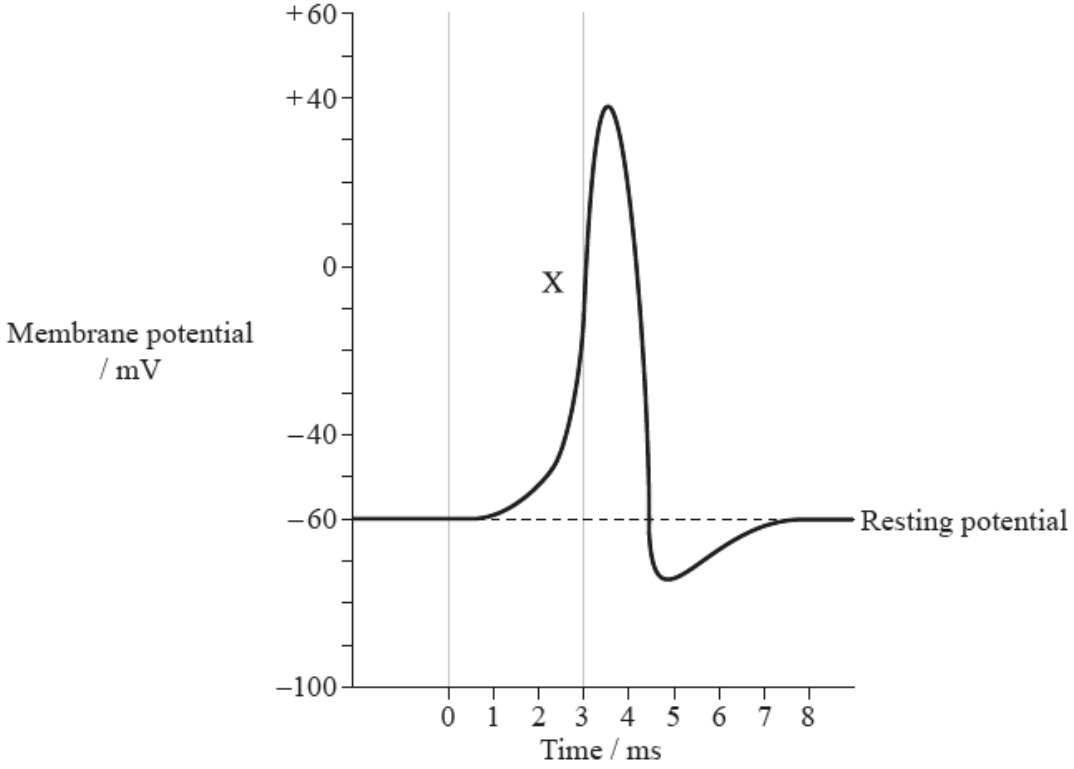
Markscheme

C

Examiners report

There was a complaint on the G2s about the placing of this question. Considering it was based on statistics of stomach cancer, placing it in the digestion system topic seems reasonable.

The diagram below shows the changes in membrane potential during an action potential.



What best describes events indicated by the label X?

A.	sodium ions diffuse out of the neuron	the inside of the neuron becomes more negative
B.	potassium ions diffuse out of the neuron	the inside of the neuron becomes more negative
C.	potassium ions diffuse into the neuron	the inside of the neuron becomes more positive
D.	sodium ions diffuse into the neuron	the inside of the neuron becomes more positive

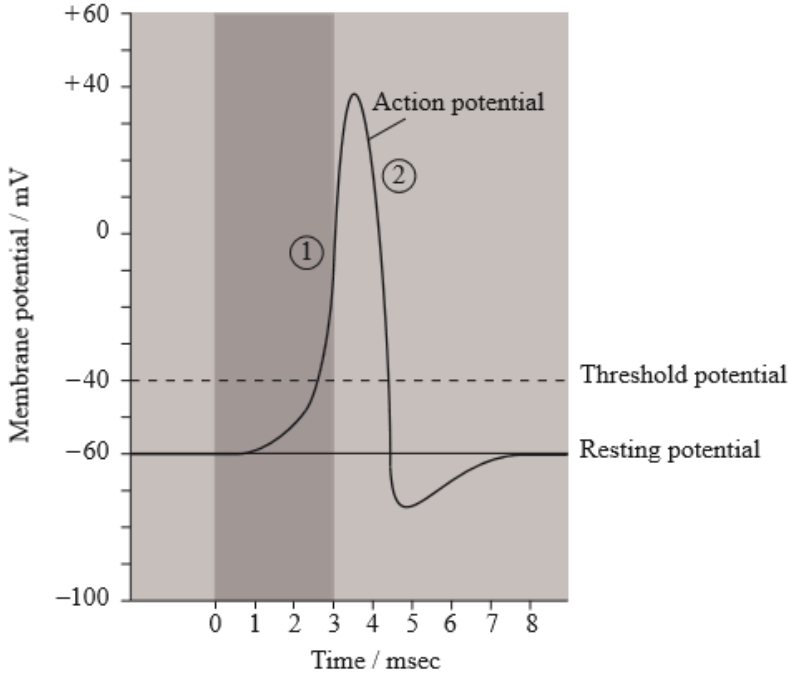
Markscheme

D

Examiners report

[N/A]

The diagram below shows the changes in membrane potential during an action potential. What occurs at the stages labelled 1 and 2?



	1	2
A.	Na^+ ions diffuse in; inside becomes more positive	K^+ ions diffuse out; inside becomes more negative
B.	K^+ ions diffuse out; inside becomes more negative	Na^+ ions diffuse in; inside becomes more positive
C.	Na^+ ions diffuse out; inside becomes more negative	K^+ ions diffuse out; inside becomes more positive
D.	Na^+ ions diffuse in; inside becomes more positive	K^+ ions diffuse in; inside becomes more negative

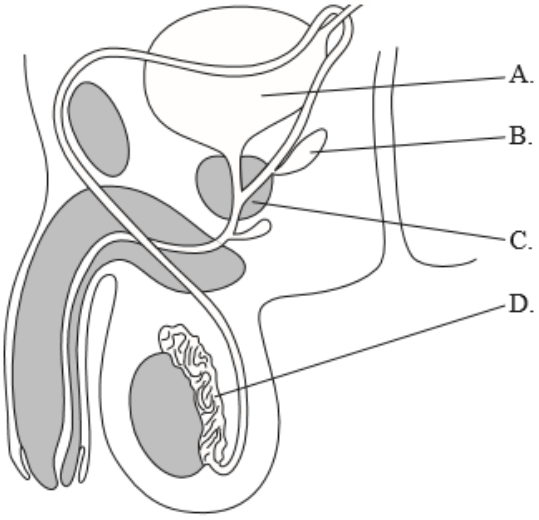
Markscheme

A

Examiners report

N/A

The diagram shows a section through the male reproductive system. Which structure represents the prostate gland?



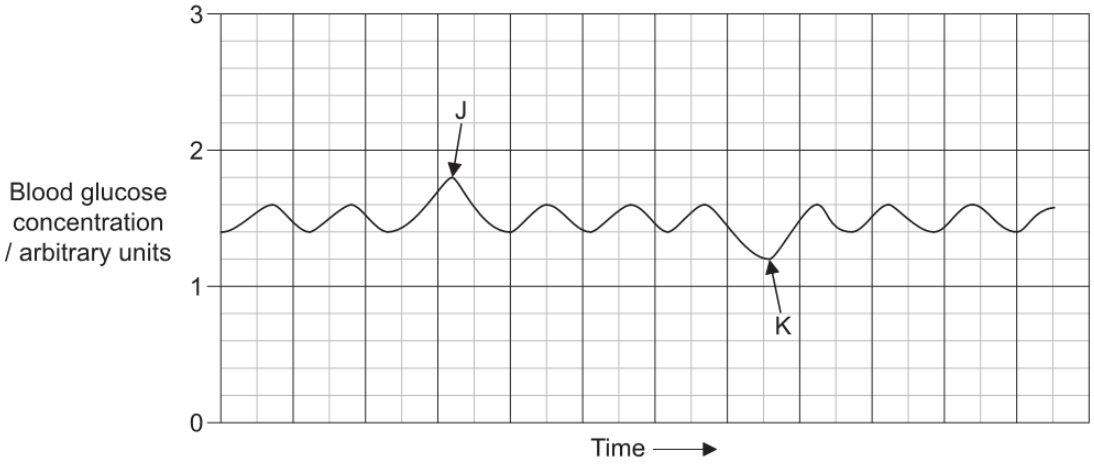
Markscheme

C

Examiners report

N/A

The graph shows changes in an individual's blood glucose concentration over time.



What hormones were secreted at J and K?

	J	K
A.	epinephrine	insulin
B.	insulin	glucagon
C.	glucagon	insulin
D.	thyroxin	epinephrine

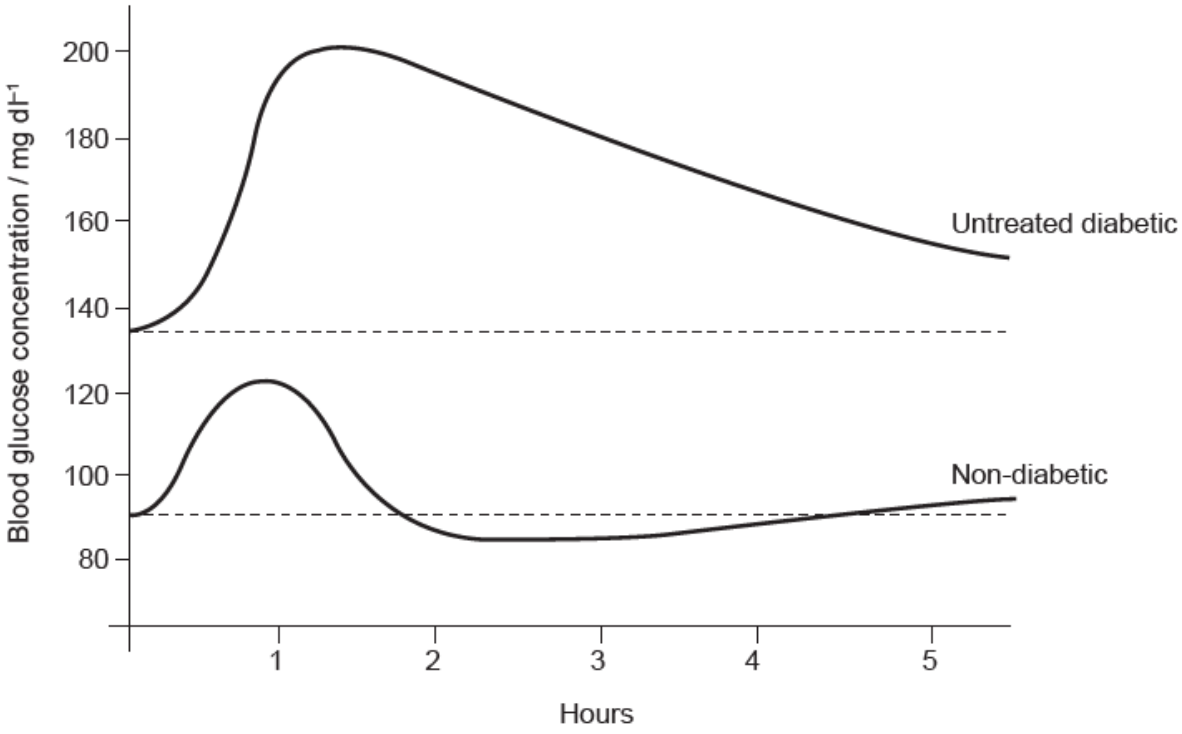
Markscheme

B

Examiners report

[N/A]

The graph shows the changes in blood glucose concentration of an untreated patient with type I diabetes and a non-diabetic person after a meal.



[Source: Reproduced with permission of themedicalbiochemistrypage, LLC]

Which statement correctly describes the events in this untreated diabetic patient immediately after a meal was eaten?

A. Alpha cells of the pancreas secrete too little glucagon.

B. Beta cells of the pancreas secrete too little glucagon.

C. Alpha cells of the pancreas secrete too little insulin.

D. Beta cells of the pancreas secrete too little insulin.

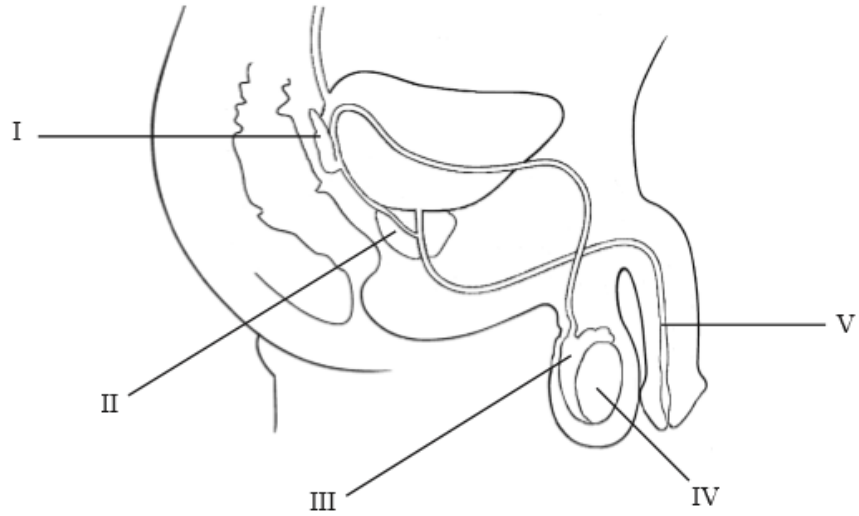
Markscheme

D

Examiners report

[N/A]

The diagram below shows the male reproductive system.



Which are the epididymis and the seminal vesicle in the diagram?

	Epididymis	Seminal vesicle
A.	IV	I
B.	III	II
C.	I	V
D.	III	I

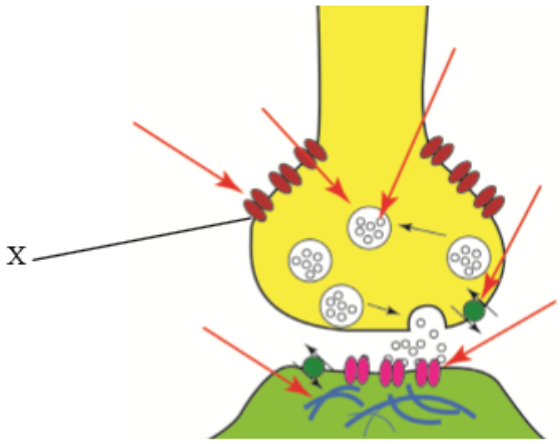
Markscheme

D

Examiners report

N/A

The diagram shows events at a synapse.



[Source: Adapted from: http://en.wikipedia.org/wiki/File:Synapse_Illustration_unlabeled.svg]

What is happening at the point labelled X?

A. Neurotransmitter binding
B. Ca^{2+} diffusing
C. Neurotransmitter moving across synapse
D. Na^{2+} binding

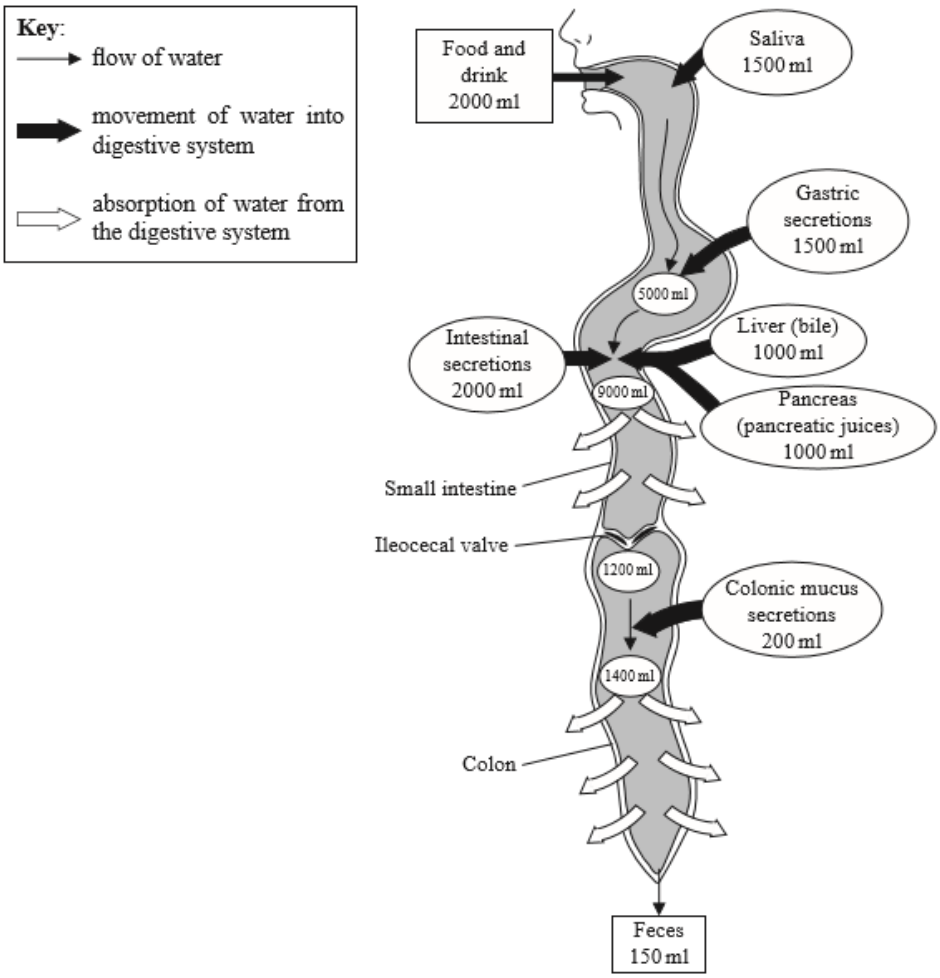
Markscheme

B

Examiners report

N/A

The diagram below shows water in the human body.



Where in the digestive system is the largest volume of water absorbed from?

A. Colon
B. Pancreas
C. Small intestine
D. Liver

Markscheme

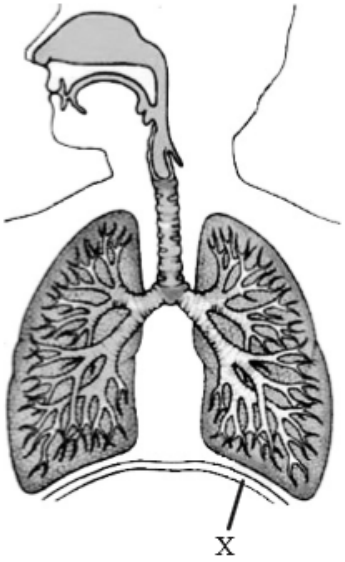
C

Examiners report

This was the most controversial question on the exam and it also proved to be a very poor discriminator with statistics showing little relationship between success in answering correctly and the overall strength of the candidate. This was another question that involved data analysis but in this case the question was not excessively easy. The data was presented in a novel way that needed to be studied carefully.

The candidate first had to deduce which part of the digestive system was the small intestine and which the large, and then deduce that the greatest reduction in volume and therefore the greatest volume of water absorption was in the small intestine. Instead many candidates, including those with good knowledge, immediately looked at the possible answers and chose A because they understood that the colon was the part of the intestine responsible for water absorption. The lesson for candidates is that when data is presented it must be carefully considered before choosing an answer and the lesson for examiners is that data questions should not be constructed in such a way that candidates with knowledge are disadvantaged!

The diagram shows the ventilation system in humans.



What is the function of the structure labelled X?

A. Protect the lungs
B. Contract to cause inhalation
C. Become flatter to move the ribcage up
D. Relax in order to increase the thoracic capacity

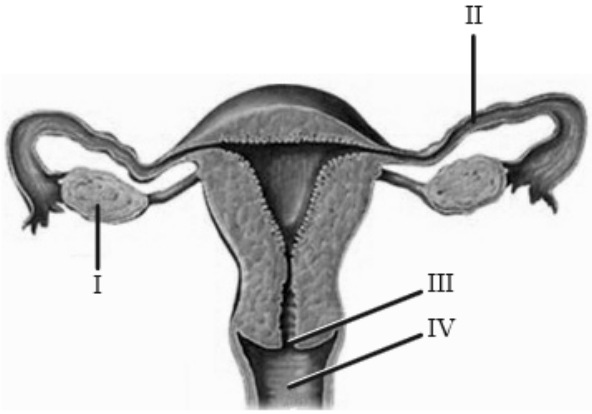
Markscheme

B

Examiners report

N/A

The diagram shows the adult female reproductive system. Which label shows the cervix and which shows the usual site of fertilization?



	Cervix	Site of fertilization
A.	I	II
B.	II	IV
C.	III	II
D.	IV	III

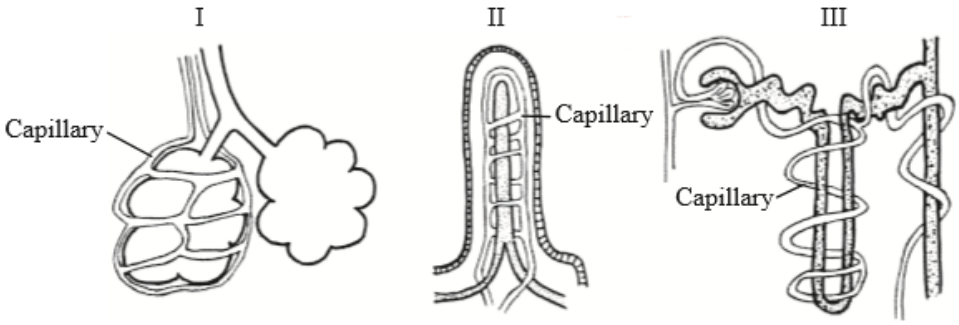
Markscheme

C

Examiners report

N/A

Where are structures I, II and III found in the human body?



	I	II	III
A.	kidney	large intestine	brain
B.	lungs	small intestine	kidney
C.	lungs	large intestine	kidney
D.	kidney	small intestine	brain

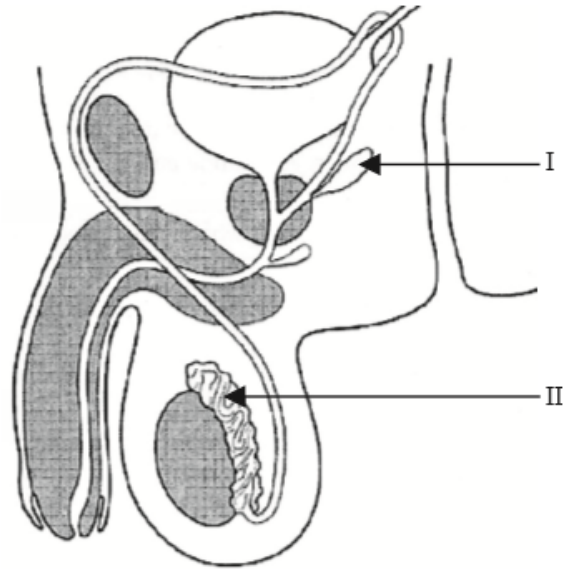
Markscheme

B

Examiners report

N/A

What are the structures labelled I and II on the diagram of the male reproductive system?



	I	II
A.	Testis	Seminal vesicle
B.	Vas deferens	Testis
C.	Seminal vesicle	Epididymis
D.	Seminal vesicle	Prostate gland

Markscheme

C

Examiners report

N/A