SL Paper 1

The cell membrane model proposed by Davson–Danielli was a phospholipid bilayer sandwiched between two layers of globular protein. Which evidence led to the acceptance of the Singer–Nicolson model?

A. The orientation of the hydrophilic phospholipid heads towards the proteins
B. The formation of a hydrophobic region on the surface of the membrane
C. The placement of integral and peripheral proteins in the membrane
D. The interactions due to amphipathic properties of phospholipids

Markscheme

C

Examiners report

[N/A]

What is osmosis?

A. The movement of water through a membrane from a low to a high solute concentration

B. The movement of solutes through a membrane from a high to a low water concentration

C. The movement of water through a membrane from a high to a low solute concentration

D. The movement of solutes through a membrane from a low to a high water concentration

Markscheme

A

Examiners report

[N/A]

What route is used to export proteins from the cell?

A. Golgi apparatus → rough endoplasmic reticulum → plasma membrane
B. Rough endoplasmic reticulum → Golgi apparatus → plasma membrane
C. Golgi apparatus → lysosome → rough endoplasmic reticulum
D. Rough endoplasmic reticulum → lysosome → Golgi apparatus

Markscheme

B

Examiners report

N/A

How do cells in multicellular organisms differentiate?

A. Some cell types divide by mitosis more often than others.
B. They express some of their genes but not others.
C. Some of their proteins denature but not others.
D. Their DNA content changes with time.

Markscheme

B

Examiners report

This question discriminated well, and many candidates chose option A, which is a correct statement, but is not answering the question asked.

Which process requires channel proteins?

A. Simple diffusion
B. Facilitated diffusion
C. Binding of hormones
D. Exocytosis

Markscheme

B

Examiners report

This question was too easy for candidates and not a good discriminator. This shows most candidates were familiar with the process of facilitated diffusion.

What feature do plant cells have but not animal cells?

A. Plasma membranes

B. Mitochondria

C. Cell walls

D. 80S ribosomes

Markscheme

C

Examiners report

[N/A]

Which movement occurs by osmosis?

A. Oxygen from alveoli into the blood
B. Water from a leaf into the atmosphere
C. Water from soil to root
D. Nitrate ions from soil to root

Markscheme

C

Examiners report

There similar complaints from a few teachers about Question 9. At Standard Level students are not expected to have studied transpiration, but the examining team felt that the answer referring to water moving from a leaf into the atmosphere could have been eliminated without knowing details of transpiration because movement of water molecules from a liquid state inside the leaf to the gases of the air outside cannot be osmosis.

What provides evidence for the endosymbiotic theory?

A. Mitochondrial DNA in eukaryotic cells
B. 70S ribosomes in prokaryotic cells
C. Gene transfer from prokaryotic cells to eukaryotic cells using plasmids
D. Prokaryotic cells (*Escherichia coli*) in the large intestine digest proteins

Markscheme

A

Examiners report

[N/A]

Which structure is found in *E. coli*, but **not** in a eukaryotic cell?

A. Cell wall
B. Endoplasmic reticulum
C. Cytoplasm
D. Pili

Markscheme

D

Examiners report

N/A

How can cells in a multicellular organism differentiate?

A. They express some of their genes but not others.
B. They all have a different genetic composition.
C. Different cells contain a different set of chromosomes.
D. Different cells do not have some of the genes.

Markscheme

A

Examiners report

Some teachers commented that answer D was not quite specific and could confuse the candidates. This was the least chosen option. Most

candidates went for the correct answer, making this question quite an easy one for most and a very good discriminator.

If there are 16 chromosomes in a cell that is about to divide, what will be the number of chromosomes in a daughter cell after division by mitosis or meiosis?

	Mitosis	Meiosis
A.	16	16
B.	16	8
C.	8	16
D.	8	8

Markscheme

B

Examiners report

N/A

Which process contributes to growth of a multicellular body?

A. Exocytosis
B. Meiosis
C. Mitosis
D. Osmosis

Markscheme

C

Examiners report

N/A

Which property makes stem cells suitable for therapeutic use?

A. They can divide by meiosis to form gametes.
B. They contain chemicals that can kill bacteria.
C. Their chromosomes are suitable for gene transfer and cloning.
D. They can differentiate into specialized cells.

Markscheme

D

Examiners report

N/A

A botanist measures a leaf and finds it is 24 cm long and 8 cm wide. His drawing of the leaf is 4 cm wide. Which was the magnification and length of his drawing, assuming that the proportions of the drawing were correct?

	Scale	Length / cm
A.	×2	48
B.	×2	12
C.	×0.5	48
D.	×0.5	12

Markscheme

D

Examiners report

[N/A]

Why do crop plants dry out when a field is irrigated with water contaminated by sea water?

A. The plants lose water by active transport.
B. The plants gain salt by osmosis.
C. The plants gain salt by diffusion.
D. The plants lose water by osmosis.

Markscheme

D

Examiners report

N/A

Which of the following characteristics found in a structure necessarily indicates that it is alive?

A. The presence of genetic material
B. The presence of a lipid bilayer
C. Metabolism
D. Movement

Markscheme

C

Examiners report

Some teachers commented that the wording of the question was awkward but this question proved to be one of the easiest in the examination.

Which structure is present in a prokaryotic cell?

A. Plasma membrane
B. 80S ribosome
C. Nucleus
D. Chloroplast

Markscheme

A

Examiners report

N/A

Which events occur during both mitosis and meiosis?

A. Production of haploid cells from diploid cells

B. Crossing over

C. Separation of the chromatids from each chromosome

D. Production of genetically different cells

Markscheme

C

Examiners report

[N/A]

Which of the following structures does *Escherichia coli* have?

I. Ribosomes
II. Pili
III. Nucleus

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

Markscheme

B

Examiners report

[N/A]

The statement relates to Pasteur's experiments.

> In his experiments, Louis Pasteur demonstrated that:
> - if broth was boiled to kill all organisms and was then kept in swan-necked flasks, preventing the entry of organisms, no organisms grew in the broth
> - if the swan-necked flask was broken, mold soon started to grow in the broth.

What did this statement suggest?

A. Mold evolved by endosymbiosis.
B. Oxygen is required for anaerobic respiration.
C. Cells can only be formed by division of pre-existing cells.
D. Nutrients are a requirement for mold growth.

Markscheme

C

Examiners report

This question was answered well by good candidates, therefore was a good discriminator.

Cells in the adrenal gland produce the hormone epinephrine and store it in vesicles. To release epinephrine these vesicles are carried to the plasma membrane and fuse with it. What process is occurring?

A. Expulsion

B. Exchange

C. Excretion

D. Exocytosis

Markscheme

D

Examiners report

[N/A]

What is a role of cholesterol in animal cells?

A. It increases body fat.

B. It controls membrane fluidity.

C. It lines the inner wall of capillaries.

D. It is a constituent of bile.

Markscheme

B

Examiners report

[N/A]

Which events occur during the G_1 phase and S phase of the cell cycle?

	G_1 phase	S phase
A.	DNA replicates	cell grows
B.	mitosis begins	cell divides
C.	cell divides	mitosis begins
D.	cell grows	DNA replicates

Markscheme

D

Examiners report

N/A

What are characteristics of eukaryotic cells?

	Nucleus	Mitochondria	Ribosomes
A.	present	present	80S
B.	present	absent	70S
C.	absent	present	80S
D.	absent	absent	70S

Markscheme

A

Examiners report

N/A

Which organism has DNA located in three organelles?

A. A sponge

B. A fern

C. A flatworm

D. A bacterium

Markscheme

B

Examiners report

[N/A]

What is a function of the plant cell wall?

A. Formation of vesicles for transport of large molecules

B. Prevention of excessive water uptake

C. Communication with other cells by means of glycoproteins

D. Active transport of ions

Markscheme

B

Examiners report

The guide clearly states that the cell wall is an extracellular structure; therefore candidates could not have confused the intracellular space with it.

Which of these processes require mitosis?

A. Embryological development
B. Reducing surface area to volume ratio
C. Maintaining cell size
D. Cell growth

Markscheme

A

Examiners report

Most candidates recognized that the embryological development required mitosis. Many weak candidates believed it was cell growth.

What is the principal mode of division for the prokaryote *Escherichia coli*?

A. Endocytosis
B. Binary fission
C. Cytokinesis
D. Meiosis

Markscheme

B

Examiners report

N/A

During which stage does the cell surface area to volume ratio decrease?

A. Interphase

B. Metaphase

C. Telophase

D. Cytokinesis

Markscheme

A

Examiners report

A high difficulty index shows this question proved to be too difficult to many candidates in SL.

Which of the following does **not** occur during interphase?

A. Replication
B. Translation
C. Cytokinesis
D. An increase in the number of mitochondria

Markscheme

C

Examiners report

A teacher commented that ‘negative’ questions are not meant to be in IB examinations. This is generally preferred, but candidates found this to be an easy question.

The salt concentration inside an animal cell is 1.8 %. The salt concentration in the surrounding medium becomes 5 %. What will be the likely response?

A. The cell will gain water from the medium.

B. The cell will lose salt to the medium.

C. The cell will remain unchanged.

D. The cell will shrink from loss of water.

Markscheme

D

Examiners report

[N/A]

Which functions of life are carried out by **all** unicellular organisms?

A.	photosynthesis	nutrition	homeostasis
B.	nutrition	reproduction	response
C.	metabolism	photosynthesis	growth
D.	growth	reproduction	photosynthesis

Markscheme

B

Examiners report

N/A

Which features are present in prokaryotic cells?

A. DNA, plasma membrane and mitochondria
B. DNA, cell wall and pili
C. ribosomes, chloroplasts and cell wall
D. cytoplasm, ribosomes and rough endoplasmic reticulum

Markscheme

B

Examiners report

N/A

What happens to the surface area to volume ratio as a cell grows?

A. It decreases.
B. It increases.
C. It doubles.
D. It does not change.

Markscheme

A

Examiners report

N/A

Which characteristic of stem cells makes them useful for treating Stargardt's disease?

A. They can differentiate into retinal cells.
B. They are readily available from especially created embryos.
C. They transport white blood cells to the eyes.
D. They divide by binary fission so provide sufficient cells.

Markscheme

A

Examiners report

[N/A]

Why do multicellular organisms have emergent properties?

A. They have more genes than unicellular organisms.

B. Properties of unicellular organisms are enhanced by having many cells.

C. All of their genes are expressed whereas unicellular organisms express only some.

D. They show properties that can only result from the interaction of many cells.

Markscheme

D

Examiners report

[N/A]

Which of the following will contribute to the cell theory?

I. Living organisms are composed of cells.
II. All cells come from pre-existing cells by mitosis.
III. Cells are the smallest units of life.

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

Markscheme

C

Examiners report

This question was a poor discriminator in spite of being relatively easy, and most candidates chose option D instead of the correct response of C. In the G2 forms, some teachers comment that the addition of “by mitosis” at the end of item II could interfere with the assessment of the students" understanding of cell theory. However, it was felt that this had not been a significant problem for the candidates since a large number had chosen the correct answer.

Which functions of life are carried out by all unicellular organisms?

A. Response, homeostasis, growth and photosynthesis

B. Metabolism, ventilation, reproduction and nutrition

C. Response, homeostasis, metabolism and growth

D. Reproduction, ventilation, response and nutrition

Markscheme

C

Examiners report

[N/A]

What is evidence for the endosymbiotic theory?

A. RNA can catalyse metabolic reactions.

B. Meteorites contain organic molecules.

C. Amino acids can be synthesized from inorganic compounds.

D. Mitochondria possess their own DNA.

Markscheme

D

Examiners report

[N/A]

Which process is possible due to the fluidity of cell membranes?

A. Endocytosis
B. Osmosis
C. ATP production
D. Cell recognition

Markscheme

A

Examiners report

N/A

A cell has cytoplasm, a cell wall, naked DNA and ribosomes. Based on this information, what type of cell could this be?

A. A cell from a pine tree
B. A grasshopper cell
C. A human red blood cell
D. A bacterium

Markscheme

D

Examiners report

N/A

Animal cells often secrete glycoproteins as extracellular components. What is a role of these glycoproteins?

A. Adhesion

B. Additional energy reserve

C. Membrane fluidity

D. Water uptake

Markscheme

A

Examiners report

This question was answered well by half the candidates and the discrimination index was very high, this means that capable candidates studied the extracellular function of glycoproteins well.

Which statement is part of the cell theory?

A. Cells are composed of organic molecules.
B. Cells have DNA as their genetic material.
C. Cells have cytoplasm surrounded by a membrane.
D. Cells come from pre-existing cells

Markscheme

D

Examiners report

N/A

During which stage of the cell cycle are the numbers of mitochondria increased in a cell?

A. Cytokinesis

B. Interphase

C. Meiosis

D. Mitosis

Markscheme

B

Examiners report

[N/A]

Which organelle is involved in generating vesicles destined for the cell membrane?

A. Golgi apparatus

B. Smooth endoplasmic reticulum

C. Rough endoplasmic reticulum

D. Lysosome

Markscheme

A

Examiners report

[N/A]

What is the approximate thickness of the plasma membrane of a cell?

A. 10 nm
B. 50 nm
C. 10 μm
D. 50 μm

Markscheme

A

Examiners report

Although this question discriminated well, a large proportion of candidates chose option C instead of the correct response of A (10nm). It was thought that students were confusing the different units used in those two options.

Which of the following structures are found in all cells?

A. Mitochondria
B. Cell walls
C. Chloroplasts
D. Ribosomes

Markscheme

D

Examiners report

N/A

Where in the cell do condensation reactions involving amino acids occur?

A. Nucleus
B. Golgi apparatus
C. Ribosomes
D. Lysosome

Markscheme

C

Examiners report

This question was a good discriminator, which was testing two elements of understanding, those of the condensation process and where in the cell amino acids are assembled into polypeptides. Just over half of candidates gave the correct answer of C, with many being drawn to B, the Golgi apparatus.

Although this question discriminated well, a large proportion of candidates chose option B instead of the correct response of A (endocytosis). It was thought that perhaps students had been drawn by the connection of osmosis and the word “fluidity” in the question.

What feature of cell membranes allows endocytosis to occur?

A. Fluidity of phospholipid bilayer
B. Presence of protein pumps
C. Presence of carrier proteins
D. Glycoprotein binding sites

Markscheme

A

Examiners report

N/A

What occurs during meiosis but not mitosis?

A. Spindles are formed from microtubules.

B. Chromosome number is conserved.

C. Homologous chromosomes pair up.

D. Centromeres split.

Markscheme

C

Examiners report

[N/A]

What happens during the G_2 stage of interphase?

A. Homologous chromosomes pair
B. Synthesis of proteins
C. Homologous chromosomes separate
D. Replication of DNA

Markscheme

B

Examiners report

Some teachers complained that in some books the synthesis of proteins is in G2 not G1. In all sources checked, the synthesis of proteins is shown in G1. There is synthesis of spindle proteins and histones in G2, but this is not the main activity occurring in this gap stage. This question turned out to be a bad discriminator and was the most difficult question on the paper. There was a spread of choices amongst the four options. It is obvious that this topic was not known well, although it is present in the syllabus.

A red blood cell is 8 μm in diameter. If drawn 100 times larger than its actual size, what diameter will the drawing be in mm?

A. 0.08 mm
B. 0.8 mm
C. 8 mm
D. 80 mm

Markscheme

B

Examiners report

N/A

What do prokaryotic cells have that eukaryotic cells do not?

A. Mitochondria
B. 70S ribosomes
C. Histones

D. Internal membranes

Markscheme

B

Examiners report

There were many comments on this question respecting the presence of 70S ribosomes in mitochondria and chloroplasts. Although this is true, B was still the best answer of the available choices, as all others were present only in eukaryotes.

Which structure found in eukaryotes has a single membrane?

A. Nucleus

B. Lysosome

C. Chloroplast

D. Mitochondrion

Markscheme

B

Examiners report

[N/A]

A number of different proteins are involved in nerve function. Which of the following does not require a membrane protein?

A. Active transport of sodium
B. Diffusion of K^+ into the cell
C. Diffusion of the neurotransmitter across the synapse
D. Binding of the neurotransmitter to the post-synaptic membrane

Markscheme

C

Examiners report

As with question 3, this was another ‘negative’ question though it was well answered.

Which pair of features is correct for both a human liver cell and an *Escherichia coli* cell?

	Human liver cell	*Escherichia coli* cell
A.	contains DNA associated with protein	contains naked DNA
B.	has 70S ribosomes	has 80S ribosomes
C.	contains mitochondria	contains mitochondria
D.	contains DNA enclosed by a membrane	contains DNA associated with protein

Markscheme

A

Examiners report

There was a comment that the term ‘correct for both’ could have been confusing for candidates but this proved to be a straight-forward question for most candidates.

If a mitochondrion has a length of 5 μm and a student’s drawing of the mitochondrion is 10 mm, what is the magnification of the drawing?

A. × 0.0005

B. × 0.5

C. × 200

D. × 2000

Markscheme

D

Examiners report

Although this should have been a straight-forward question, candidates found it to be one of the most difficult questions in the examination but it was a good discriminator.

The giant alga *Acetabularia* has a feature that suggests it is an exception to the cell theory. What feature is this?

A. It lacks a nucleus.

B. It lacks a cell wall.

C. It has only one mitochondrion.

D. It lacks subdivision into separate cells.

Markscheme

D

Examiners report

[N/A]

Which sequence shows increasing relative size?

	Smallest ⟶ Largest		
A.	membrane thickness	virus	bacterium
B.	molecule	virus	membrane thickness
C.	bacterium	virus	eukaryotic cell
D.	bacterium	organelle	virus

Markscheme

A

Examiners report

[N/A]

Where can 70S ribosomes be found?

A. On membranes of the Golgi apparatus
B. In prokaryotic cells
C. On membranes of the rough endoplasmic reticulum
D. In nuclei

Markscheme

B

Examiners report

N/A

What do diffusion and osmosis have in common?

A. They only happen in living cells.
B. They require transport proteins in the membrane.
C. They are passive transport mechanisms.
D. Net movement of substances is against the concentration gradient.

Markscheme

C

Examiners report

N/A

What distinguishes prokaryotic cells and eukaryotic cells?

	Prokaryotic cells	Eukaryotic cells
A.	cell wall	plasma membrane
B.	cell structure not compartmentalized	cell structure compartmentalized
C.	smooth endoplasmic reticulum	rough endoplasmic reticulum
D.	no ribosomes	ribosomes present

Markscheme

B

Examiners report

Some teachers complained that eukaryotic cells are not compartmentalized. In section 1.2 of the guide it specifically mentions this as a characteristic to take into consideration.

Which functions of life are found in unicellular organisms?

A. growth, response and nutrition
B. differentiation, response and nutrition
C. metabolism, meiosis and homeostasis
D. growth, metabolism and differentiation

Markscheme

A

Examiners report

In the G2 forms, some teachers comment that answer C is also correct, as there are some unicellular organisms that perform meiosis before cell division. This may be true; nevertheless answer A is more correct as it applies to all unicellular organisms. Most good candidates had this answer correct, this question turning out to be a good discriminator.

If a *Sequoia sempervirens* tree is 100 m tall and a drawing of it is 100 mm tall, what is the magnification of the drawing?

A. ×0.001

B. ×0.1

C. ×1.0

D. ×1000

Markscheme

A

Examiners report

Although many candidates answered this question correctly, some candidates got confused and answered distractor D.

What is the function of the Golgi apparatus?

A. Transport of lipids
B. Synthesis of polypeptides
C. Processing of proteins for secretion
D. Generation of most of the cell's supply of ATP

Markscheme

C

Examiners report

N/A

In a cell, what is the effect of a large surface area to volume ratio?

A. Slower rate of exchange of waste materials
B. Faster heat loss
C. Faster rate of mitosis
D. Slower intake of food

Markscheme

B

Examiners report

Although many candidates realized that a greater surface are to volume ratio increased the rate at which heat was lost, many candidates wrongly believed it slowed down the rate of exchange of waste materials. Some teachers complained that the distracters were ambiguous, but it was believed at the grade award that this was not the case.

Which feature of striated muscle cells allows them to be considered as a possible exception to the cell theory?

A. They are found in multicellular organisms.
B. They contain more than one nucleus.
C. They are specialized for movement.
D. They do not carry out mitosis.

Markscheme

B

Examiners report

[N/A]

What distinguishes prokaryotic cells from eukaryotic cells?

	Prokaryotic cells	Eukaryotic cells
A.	no plasma membrane	plasma membrane
B.	80S ribosomes	70S ribosomes
C.	Golgi apparatus	mitochondria
D.	no internal membrane compartments	internal membrane compartments

Markscheme

D

Examiners report

There is a comment in the G2s about the fact that there are some prokaryotic organisms that do have internal-bound compartments. This is true, but most prokaryotes do not have these compartments, and this is only an exception. In Biology there are many exceptions to the rule. In a multiple choice question one expects the best suited answer, in this case, all the other answers were incorrect, so the fact that prokaryotes do not have membrane bound compartments was the most suitable answer. In all, the question turned out to be an easy question and a good discriminator.

What is the difference between simple diffusion and facilitated diffusion?

	Simple diffusion	Facilitated diffusion
A.	Rate decreases with increasing concentration gradient	Rate increases with increasing concentration gradient
B.	Faster movement of molecules	Slower movement of molecules
C.	Always involves a membrane	Never involves a membrane
D.	Uses any part of a membrane	Uses channels in the membrane

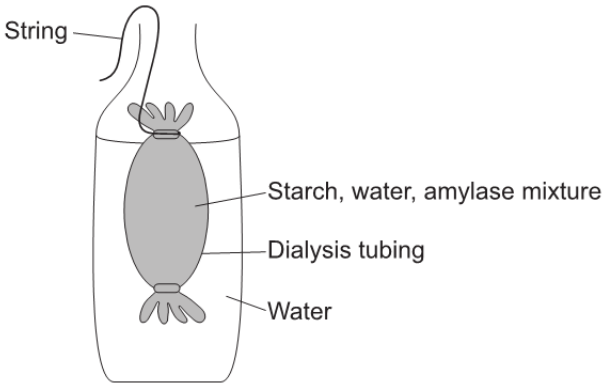
Markscheme

D

Examiners report

Seemed to be an easy question and had a good discrimination index, this means good candidates had it right and weaker candidates were incorrect.

Dialysis membrane was set up to model digestion and absorption in the small intestine.



What is a limitation of this model?

A. There can be no active transport.

B. Maltose will pass through the membrane.

C. Lipase should be present with protein.

D. The membrane is not permeable to starch.

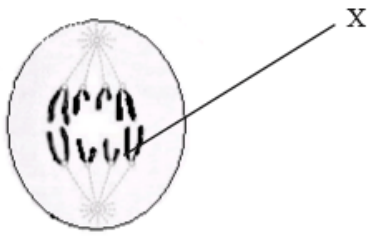
Markscheme

A

Examiners report

[N/A]

In which stage of mitosis is the cell labelled X?



A. Anaphase
B. Interphase
C. Metaphase
D. Prophase

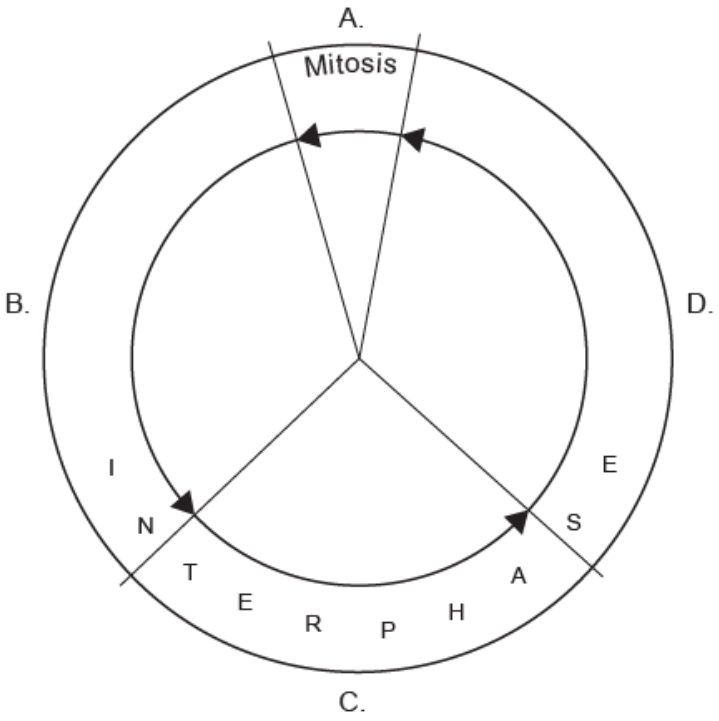
Markscheme

A

Examiners report

N/A

When during the cell cycle does DNA replication take place?



[Source: © International Baccalaureate Organization 2017]

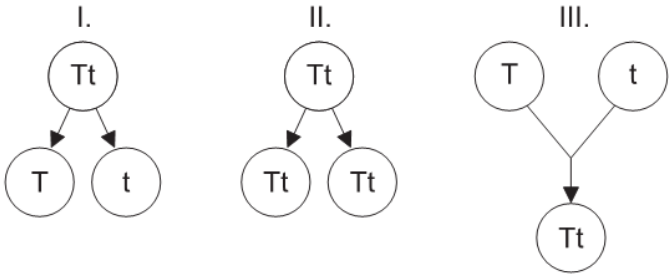
Markscheme

C

Examiners report

[N/A]

Which diagram(s) represent(s) processes used in asexual reproduction?



A. I only

B. I and II only

C. II only

D. I, II and III

Markscheme

C

Examiners report

[N/A]

Which of the following are features of prokaryotes and eukaryotes?

	70S ribosomes	80S ribosomes	Naked DNA	DNA associated with proteins
A.	prokaryote	eukaryote	prokaryote	eukaryote
B.	eukaryote	prokaryote	eukaryote	prokaryote
C.	eukaryote	prokaryote	prokaryote	eukaryote
D.	prokaryote	eukaryote	eukaryote	prokaryote

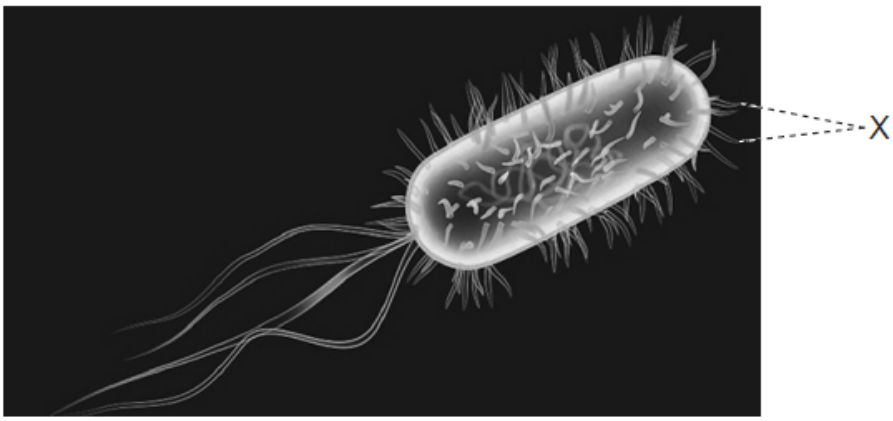
Markscheme

A

Examiners report

This seemed quite an easy question. Many candidates were confused with the 70S and 80S ribosomes. This statement is clearly addressed in the teacher notes.

The image represents an *Escherichia coli*.



[Source: adapted from http://ishbytes.blogspot.co.uk]

What is the function of structure X?

A. Active transport

B. Attachment

C. Binary fission

D. Cell respiration

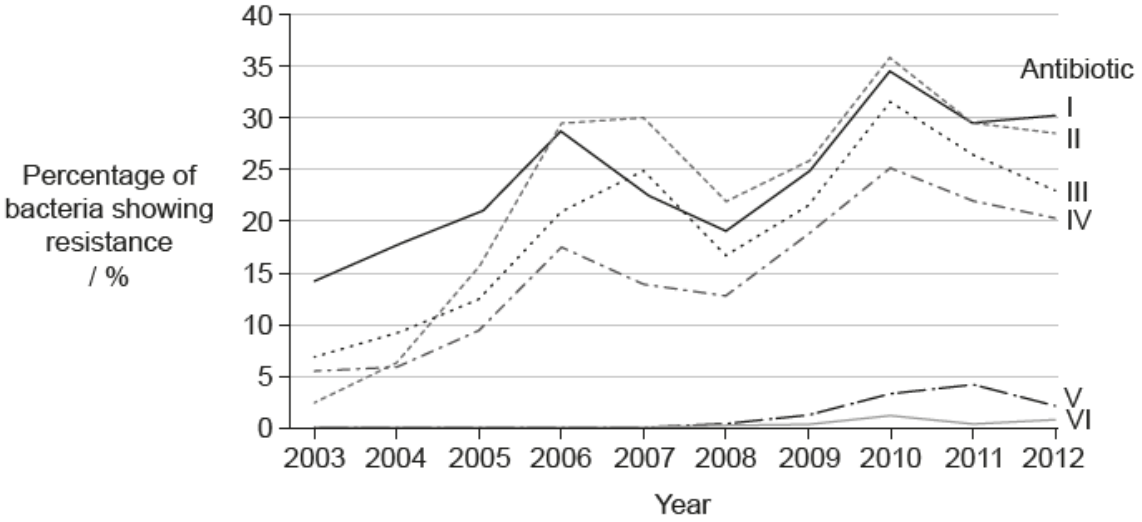
Markscheme

B

Examiners report

This question was too easy so did not discriminate well.

The bacterium *Neisseria gonorrhoeae* causes infections related to the human reproductive system. The graph shows the percentage of samples in which this bacterium showed resistance to six antibiotics over a period of ten years.



[Source: © All rights reserved. National Surveillance of Antimicrobial Susceptibilities of *Neisseria gonorrhoeae* Annual Summary 2012. Public Health Agency of Canada, 2012. Translated, adapted and reproduced with permission from the Minister of Health, 2017.]

What is a possible explanation for the total percentage resistance being larger than 100% in 2010?

A. People do not take the antibiotics as prescribed.

B. More people have been sampled in that year.

C. There was an epidemic of *Neisseria gonorrhoeae* in that year.

D. Some bacteria are resistant to more than one antibiotic.

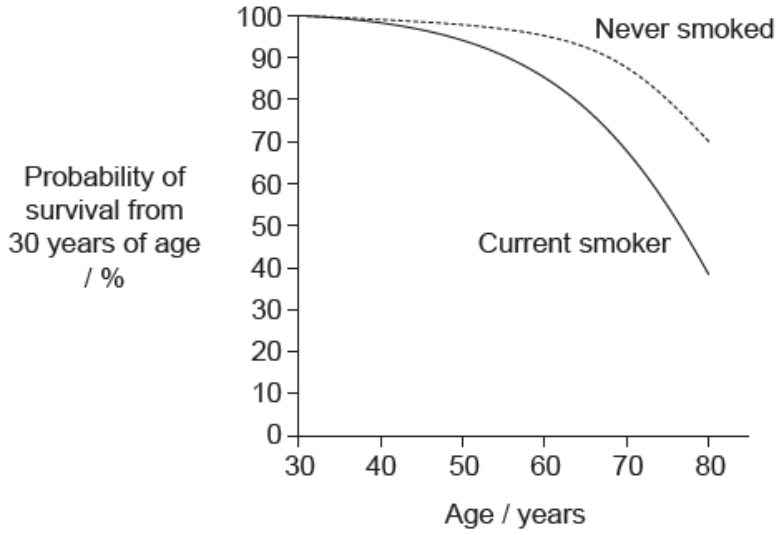
Markscheme

D

Examiners report

[N/A]

The graph shows the survival probabilities for current smokers and for those who never smoked among women 30 to 80 years of age.



[Source: adapted from J Prabhat *et al*. (2013) *The New England Journal of Medicine*, 368 (4), page 347. Copyright ©2013 Massachusetts Medical Society. Reprinted with permission]

What can be deduced from this graph?

A. There is a correlation between smoking and cancer.

B. Smoking reduces life expectancy.

C. Smoking causes cancer.

D. 70 % of smokers survive to 80 years old.

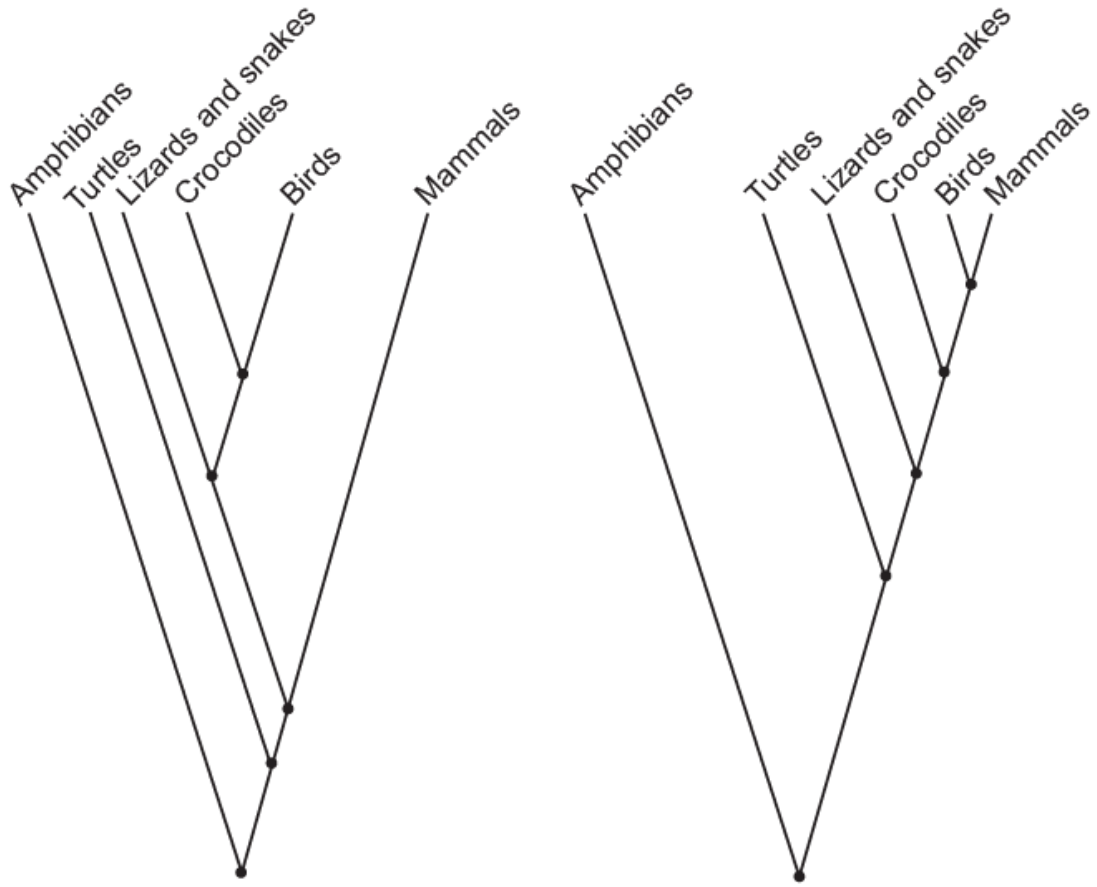
Markscheme

B

Examiners report

[N/A]

Cladograms can be created by comparing DNA or protein sequences. The cladogram on the left is based on DNA sequences and the cladogram on the right is based on comparing protein sequences.



What is the reason that cladograms based on DNA sequences are more reliable predictors of the phylogenetic relationship of species than cladograms based on protein sequences?

A. Amino acids are not as chemically stable as DNA nucleotides.

B. DNA mutates but amino acids do not.

C. Several different triplets of bases can code for the same amino acid.

D. There are 20 different amino acids but only 4 nucleotides.

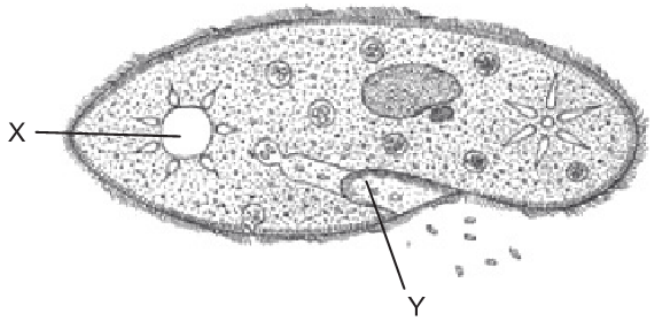
Markscheme

C

Examiners report

[N/A]

The image is of a *Paramecium*



What evidence from the image of *Paramecium* indicates whether the organism is a prokaryote or a eukaryote?

A. Compartments in the cell indicate that it is a eukaryote.

B. No nucleus indicates that the cell is a prokaryote.

C. Lack of a cell wall indicates that the cell is a eukaryote.

D. It is a unicellular organism, so it must be a prokaryote.

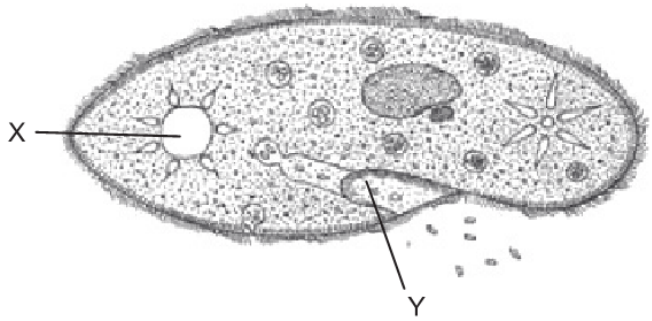
Markscheme

A

Examiners report

[N/A]

The image is of a *Paramecium*



Which function is accomplished by structures X and Y in the *Paramecium*?

	X	Y
A.	excretion	digestion
B.	homeostasis	feeding
C.	movement	food storage
D.	respiration	DNA replication

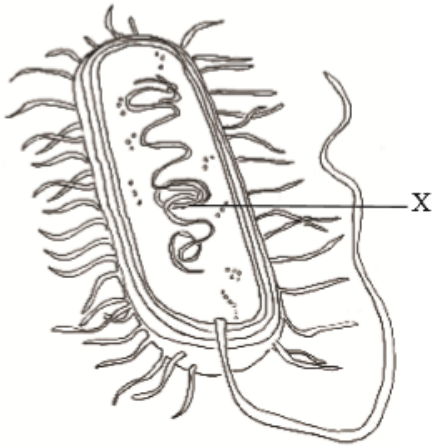
Markscheme

B

Examiners report

[N/A]

The diagram below shows a bacterium.



What structure does the part labelled X identify?

A. Nucleus
B. Nucleoid
C. Nucleolus
D. Nuclear membrane

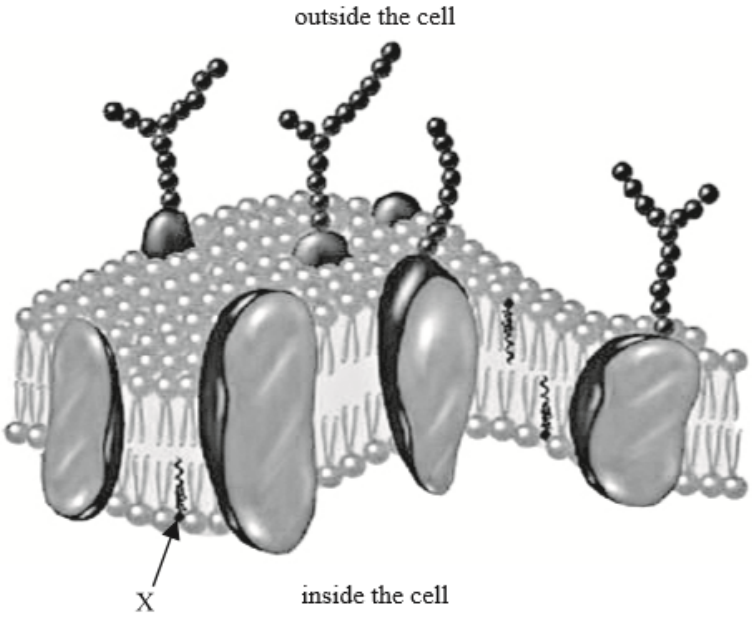
Markscheme

B

Examiners report

A teacher complained in the G2s that a nucleolus is not in the syllabus, therefore an inappropriate distracter. It would be possible to only use terms present in the syllabus, but this is very limiting and sometimes it is not sensible to do so. Very few candidates went for that option. This turned out to be an easy question and a good discriminator.

The diagram below shows a plasma membrane. What is molecule X?



A. Cholesterol
B. Peripheral protein
C. Glycoprotein
D. Polar amino acid

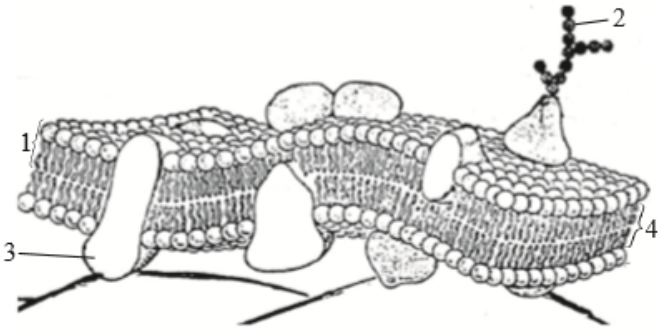
Markscheme

A

Examiners report

Some teachers complained about the quality of the diagram, but the examiners did not agree with this conception.

What are the parts of the cell membrane indicated in the diagram?



	1	2	3	4
A.	phospholipid	glycoprotein	integral protein	hydrophobic layer
B.	hydrophilic layer	carbohydrate	cholesterol	phospholipid
C.	phospholipid	peripheral protein	glycoprotein	cholesterol
D.	hydrophobic layer	carbohydrate	integral protein	phospholipid

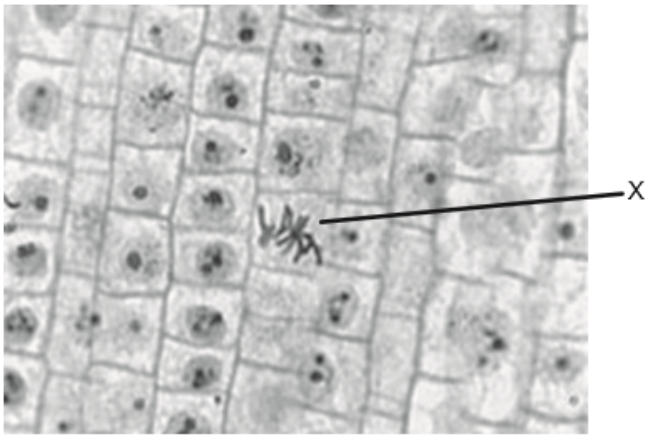
Markscheme

A

Examiners report

N/A

Which mitotic phase is labelled X in the micrograph of an onion (*Allium cepa*) root tip?



[Source: adapted from Microscope-microscope.org (www.microscope-microscope.org)]

A. Prophase
B. Metaphase
C. Anaphase

D. Telophase

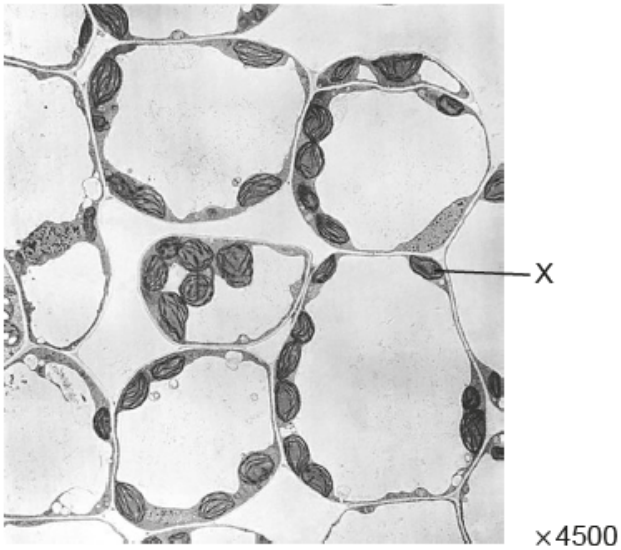
Markscheme

B

Examiners report

[N/A]

The image shows an electron micrograph of mesophyll cells.



[Source: BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY]

What is the name of the structure labelled X?

A. Cytoplasm

B. Mitochondrion

C. Nucleus

D. Chloroplast

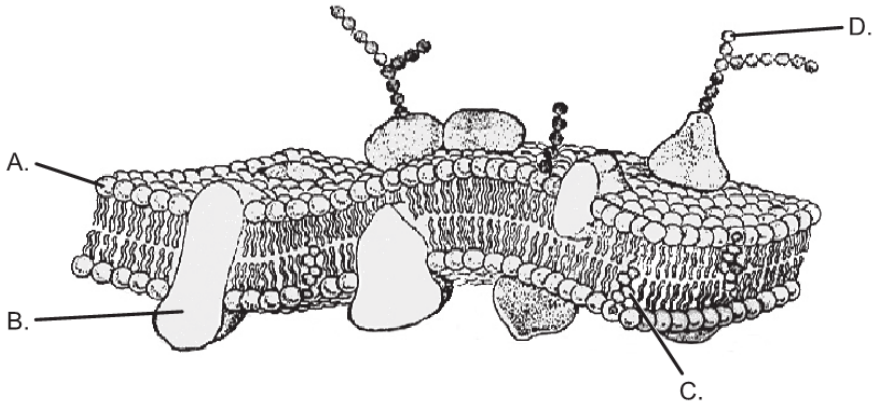
Markscheme

D

Examiners report

[N/A]

A diagram of a membrane



[Source: © International Baccalaureate Organization 2017]

In the diagram, which structure is an intrinsic or integral protein?

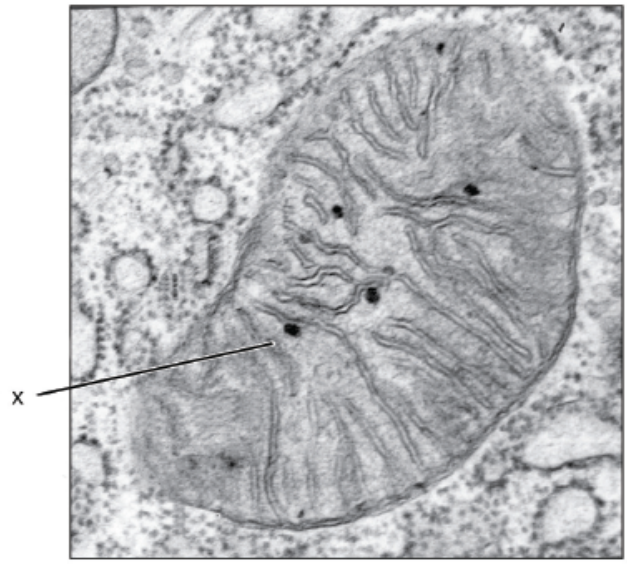
Markscheme

B

Examiners report

[N/A]

What is the structure labeled X in the electron micrograph of a rat liver cell?



[Source: “0315 Mitochondrion new” by OpenStax College - Anatomy & Physiology, Connexions Web site. http://cnx.org/content/col11496/1.6/, Jun 19, 2013.. Licensed under CC BY 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:0315_Mitochondrion_new.jpg#/media/File:0315_Mitochondrion_new.jpg]

A. Ribosome
B. Lysosome
C. Mitochondrion
D. Nucleus

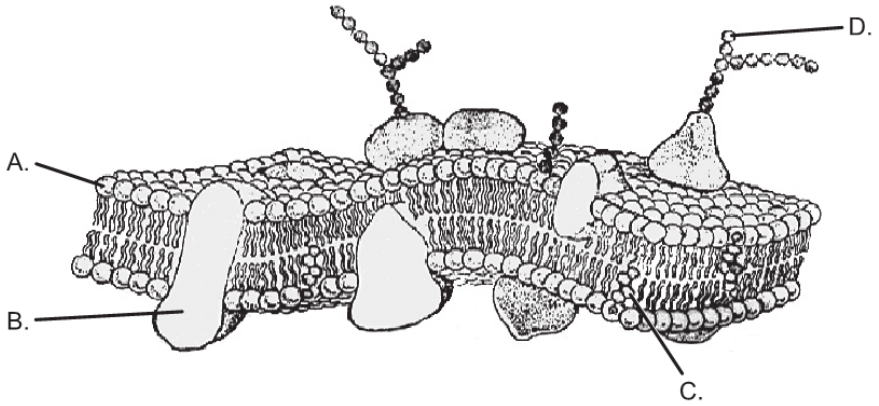
Markscheme

C

Examiners report

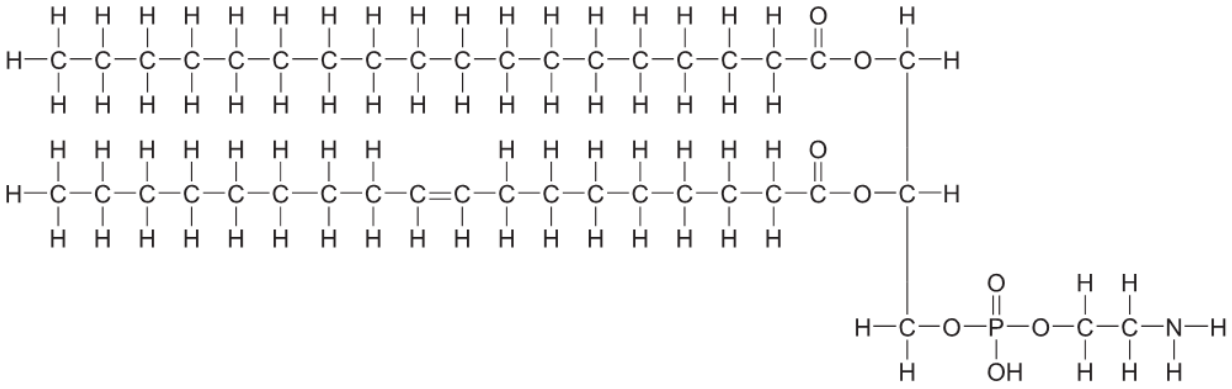
There were comments from some teachers about the electron micrograph used in this question. The mitochondrion that candidates had to identify has a sigmoid shape rather than the classic ovoid shape of a textbook diagram, but the internal structure is clearly the same as ovoid mitochondria elsewhere in the micrograph and cristae are visible, so there should not have been any confusion. Students should be able to recognise mitochondria in micrographs from the densely stained matrix and the invaginated inner membrane. The statistics show that some of the stronger candidates misidentified this organelle as a lysosome, but there are other single-membraned structures visible in micrograph that are more densely stained and nearly circular in outline and these are the lysosomes.

A diagram of a membrane



[Source: © International Baccalaureate Organization 2017]

In the diagram, which part of the membrane structure does the molecule below form?



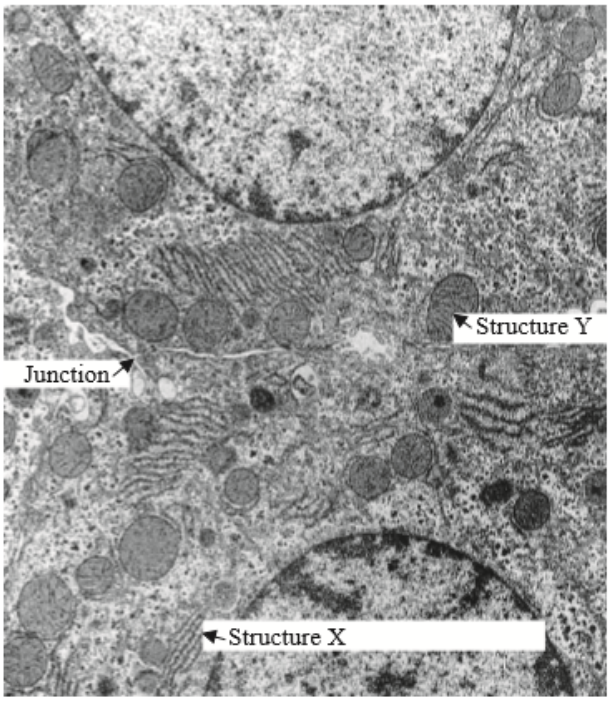
Markscheme

A

Examiners report

[N/A]

The following electron micrograph which shows part of two adjacent liver cells.



[Source: www.relfe.com/Images/ratlivercells.gif]

What is happening at the structure labelled X?

A. Synthesis of proteins
B. Transport of proteins to the nucleus
C. Modification of proteins prior to export
D. Secretion of proteins through the plasma membrane

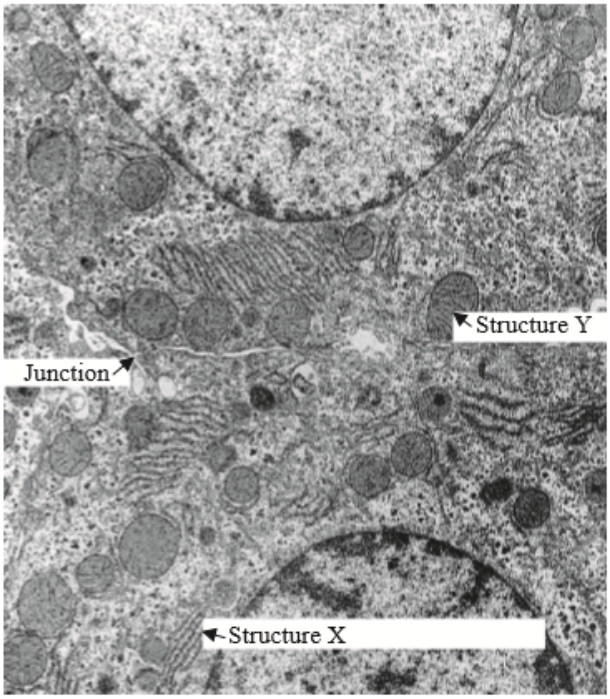
Markscheme

A

Examiners report

There were some comments about the quality of the electron micrograph. Although most candidates answered this question correctly, many believed X was pointing at the Golgi apparatus and others at the endoplasmic reticulum. The discrimination index was poor for this question, as many stronger candidates did not answer it correctly.

The following electron micrograph which shows part of two adjacent liver cells.



[Source: www.relfe.com/Images/ratlivercells.gif]

What is the structure labelled Y?

A. Nucleus
B. Starch grain
C. Lysosome
D. Mitochondrion

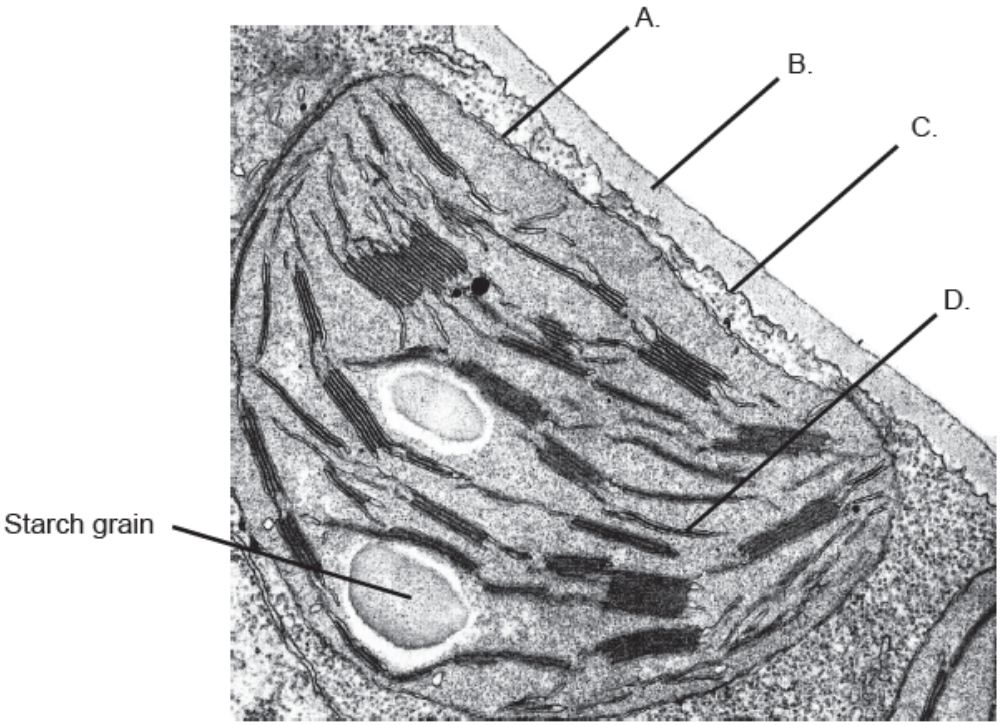
Markscheme

D

Examiners report

This question was well answered by most candidates, showing that they could easily identify the mitochondrion form the micrograph.

The following electron micrograph shows part of a palisade mesophyll cell. Which of the labelled structures controls the exchange of substances to and from the cell?



[Source: adapted from Eldon Newcomb, http://botit.botany.wisc.edu/about.html]

Markscheme

C

Examiners report

[N/A]
