

Questions

Q1.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Bacterial DNA is

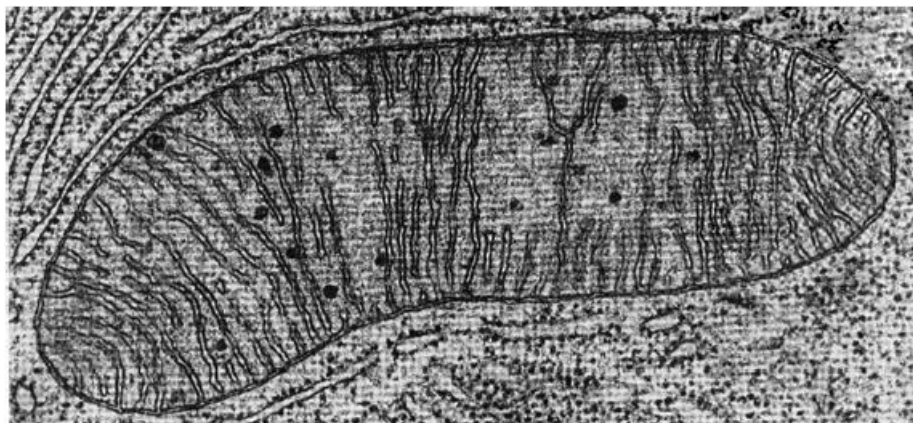
- A circular and surrounded by a nuclear membrane
- B circular with no nuclear membrane
- C linear and surrounded by a nuclear membrane
- D linear with no nuclear membrane

(1)

(Total for question = 1 mark)

Q2.

The photograph shows an electron micrograph of a mitochondrion from a liver cell.



Magnification $\times 20\,000$

Calculate the maximum actual length of this mitochondrion.

(2)

Answer

(Total for question = 2 marks)

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Q3.

DNA synthesis in bacterial cell cultures has been investigated.

Describe how DNA is organised in a bacterial cell.

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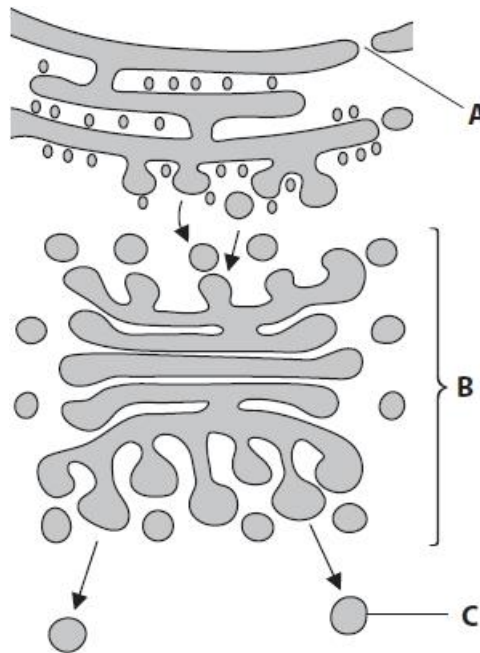
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(Total for question = 3 marks)

Q4.

The diagram shows some of the cell organelles involved in the formation of extracellular enzymes.



Describe the roles of parts **B** and **C** in the formation and transport of extracellular enzymes.

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(Total for question = 4 marks)

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Q5.

Glucosaminoglycans (GAGs) are the by-products of chemical reactions inside cells. GAGs are broken down by enzymes inside lysosomes in cells.

Mucopolysaccharidosis type I (MPS I) is a genetic condition that results in the build-up of GAGs inside cells.

MPS I affects the production of enzyme G that breaks down GAGs inside lysosomes.

Describe what happens to lysosomes once their contents have been digested.

(2)

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(Total for question = 2 marks)

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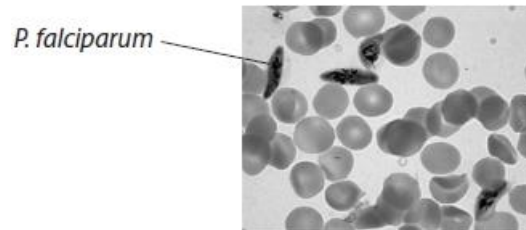
Q6.

Plasmodium falciparum is a single-celled eukaryotic organism. *P. falciparum* causes the disease malaria when it invades red blood cells.

If untreated, malaria can result in a shorter than normal life span.

The high mortality rate of people with malaria has been claimed to be one of the greatest selection pressures on the human genome in recent history.

The photograph shows *P. falciparum* in a sample of human blood.



Describe how scientists could have determined that *P. falciparum* is a eukaryotic organism and not a prokaryotic organism.

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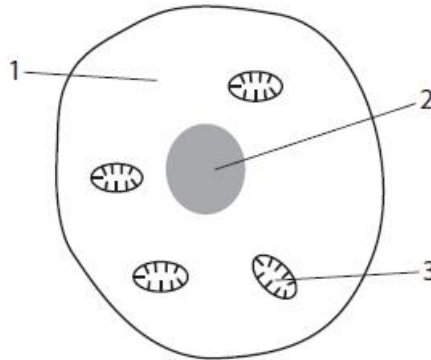
(Total for question = 4 marks)

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Q7.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

The diagram shows some of the features of a human liver cell.



(i) Which of the labelled features in the liver cell contain RNA?

(1)

- A** 1 only
- B** 1 and 3 only
- C** 2 and 3 only
- D** 1, 2 and 3

(ii) Cells produce lactate during anaerobic respiration. Lactate travels in the blood to the liver.

Liver cells can absorb lactate from the blood.
Deduce what happens to the lactate in these cells.

(2)

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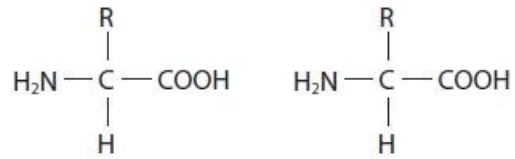
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(iii) During protein synthesis, two amino acids are joined together to form a dipeptide.

The diagram shows two identical amino acids.

Complete the diagram to show how the dipeptide is formed from these two amino acids.

(2)



(Total for question = 5 marks)

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Q8.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Electron microscopes have enabled scientists to view the ultrastructure of cells.

(i) Which of the following structures is found in animal cells?

(1)

- A amyloplast
- B chloroplast
- C mesosome
- D ribosome

(ii) Which of the following structures is found only in plant cells?

(1)

- A amyloplast
- B Golgi apparatus
- C mesosome
- D vacuole

(iii) Which of the following structures is found in both animal and plant cells?

(1)

- A amyloplast
- B cell wall
- C pili
- D smooth endoplasmic reticulum

(Total for question = 3 marks)

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Q9.

Eukaryotic and prokaryotic cells both produce enzymes.

Which of the following pairs of statements is true for eukaryotic and prokaryotic cells?

(1)

	Similarity	Difference
<input type="checkbox"/> A	Both possess ribosomes	Only eukaryotic cells possess plasmids
<input type="checkbox"/> B	Both possess pili	Prokaryotic cells do not secrete enzymes
<input type="checkbox"/> C	Both possess ribosomes	Prokaryotic cells do not possess endoplasmic reticulum
<input type="checkbox"/> D	Both possess pili	Only eukaryotic cells possess ribosomes

(Total for question = 1 mark)

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Q10.

The red squirrel population on Brownsea Island has been affected by a disease caused by a prokaryotic organism.

(i) Woese classified organisms into domains.

Which of the following contain prokaryotic organisms?

(1)

- A Archaea, Bacteria and Eukaryota
- B only Archaea
- C only Archaea and Bacteria
- D only Bacteria

(ii) Scientists took blood samples from infected red squirrels and analysed them using an electron microscope.

Describe the features that could be used to identify the prokaryotic cells in the blood sample.

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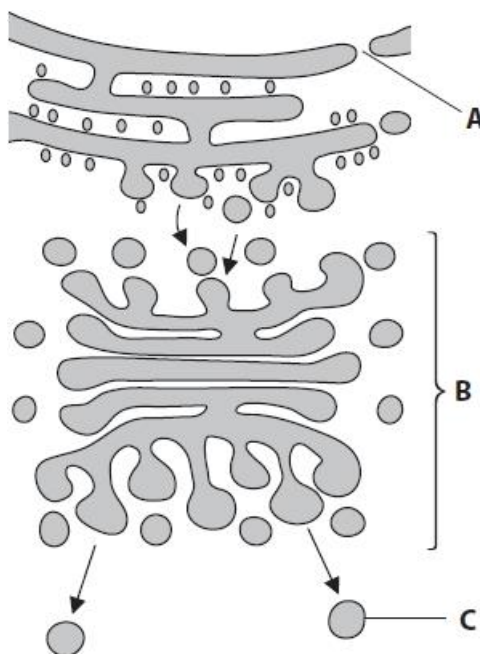
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(Total for question = 5 marks)

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Q11.

The diagram shows some of the cell organelles involved in the formation of extracellular enzymes.



Name the parts of the cell labelled **A**, **B** and **C**.

(3)

A

B

C

(Total for question = 3 marks)

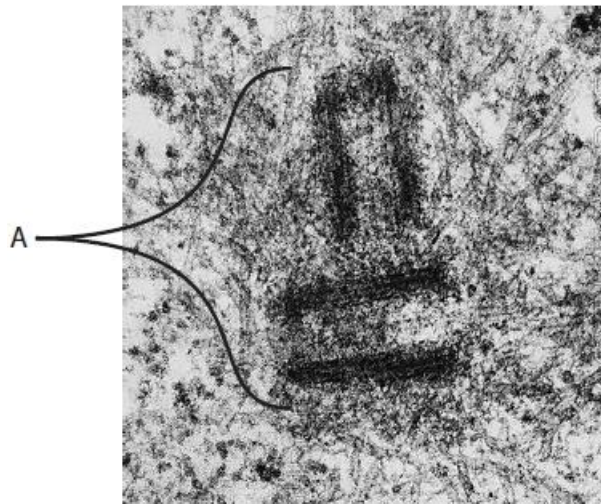
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Q12.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Cells can be observed using electron microscopes and light microscopes.

The electron micrograph shows an organelle in a eukaryotic cell.



(i) Name the organelle labelled A.

(1)

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(ii) The organelle labelled A is involved in

(1)

- A lipid synthesis
- B protein synthesis
- C ribosome production
- D spindle organisation

(Total for question = 2 marks)

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Q13.

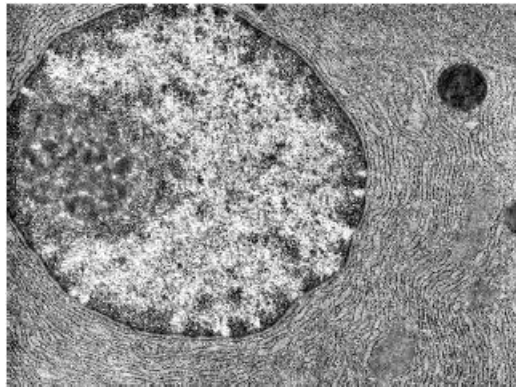
Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

An electron microscope can be used to identify organelles in eukaryotic cells.

The photograph shows part of a eukaryotic cell.

(i) Label the nucleolus on the photograph.

(1)



(Source: AL1379899 – Jose Luis Calvo/Shutterstock/PAL)

(ii) The nucleolus is not found in prokaryotic cells because they

(1)

- A do not contain DNA
- B do not have a nucleus
- C only contain RNA
- D only contain single-stranded DNA

(iii) Explain why the nucleus cannot be observed at the end of prophase in a eukaryotic cell.

(2)

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(Total for question = 4 marks)

Q14.

Wasps are insects that live in groups.

One species of wasp (*Vespula germanica*) has been shown to knock its body repeatedly against a hard surface. This signals the presence and quality of food to other wasps.

When threatened by another animal, it may use its stinger to inject a venom to protect itself.



bugguide.net

Phospholipase in the venom of wasps can cause allergic reactions. Phospholipase can affect the Golgi apparatus in cells.

(i) Give two functions of the Golgi apparatus.

(2)

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(ii) A three-phase protocol will be used when developing the phospholipase inhibitor as a new drug.

Explain the purpose of each phase of this protocol for a phospholipase inhibitor.

(3)

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(Total for question = 5 marks)

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Q15.

Some fish live in very cold parts of the sea where ice can form.

Many of these fish produce anti-freeze proteins, which help to stop ice forming inside the fish.

Anti-freeze glycoprotein (AFGP) is one type of anti-freeze protein.

Messenger RNA coding for AFGP is translated at a ribosome to produce a polypeptide.

Describe how this polypeptide is then processed to make AFGP.

(4)

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(Total for question = 4 marks)

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Q16.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Some diseases are linked to a failure in the endoplasmic reticulum (ER).

Cells of people with these diseases contain proteins that are folded incorrectly.

Some of these proteins are enzymes.

Protein synthesis in eukaryotic cells occurs in

- A 70S ribosomes in the nucleus
- B 70S ribosomes on the endoplasmic reticulum
- C 80S ribosomes in the nucleus
- D 80S ribosomes on the endoplasmic reticulum

(1)

(Total for question = 1 mark)

Q17.

(i) Many of the proteins synthesised become extracellular enzymes.

Describe what happens to these proteins following the process of translation until they are released from the cell.

(3)

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(ii) Cells in people with these diseases produce incorrectly folded enzyme molecules.

Explain why enzymes that are incorrectly folded cannot carry out their function.

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(Total for question = 6 marks)

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Q18.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

In prokaryotic cells, ribosomes are

(1)

- A** absent
- B** larger than ribosomes in eukaryotic cells
- C** smaller than ribosomes in eukaryotic cells
- D** the same size as ribosomes in eukaryotic cells

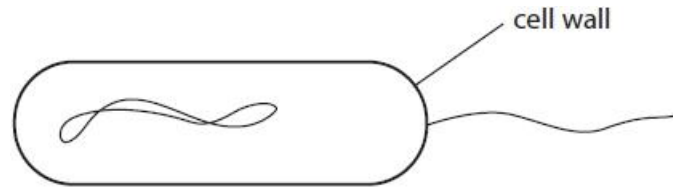
(Total for question = 1 mark)

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Q19.

Bacteria contain structures that are characteristic of prokaryotic cells.

The diagram shows an incomplete bacterial cell.



Complete the diagram by drawing and labelling the cell membrane, a mesosome and a plasmid.

(Total for question = 3 marks)

Q20.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Some bacteria have a capsule that is located

- A between the cell wall and the cell membrane
- B in the cytoplasm
- C inside the cell wall
- D outside the cell wall

(1)

(Total for question = 1 mark)

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Q21.

A newborn baby can respond to infections.

Interferon is involved in the response to viral infections.

(i) The influenza virus can be lethal to mice.

The effects of interferon on influenza infection in mice was investigated.

Mice were infected with influenza virus and then given interferon.

The results of the investigation are shown in the table.

Interferon dose / units per mouse	Median survival time / days
No dose	3.3
8×10^3	4.4
8×10^4	8.5
8×10^5	>42

Explain these results.

(3)

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(ii) Interferon can be used to treat people with viral hepatitis.

Interferon can be made by animal cells or by genetically modified bacteria.

The table shows information about interferon made by these animal cells and genetically modified bacteria.

Source of interferon	Type of molecule	Folding	Antiviral activity
Animal cells	Glycoprotein	Correctly folded	High
Genetically modified bacteria	Protein	Incorrectly folded and needs to be refolded before it can be used	Low

Explain why the interferon made by genetically modified bacteria is different from the interferon made by animal cells.

(2)

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(iii) Glycoproteins made in animal cells are released into the extracellular fluid by

(1)

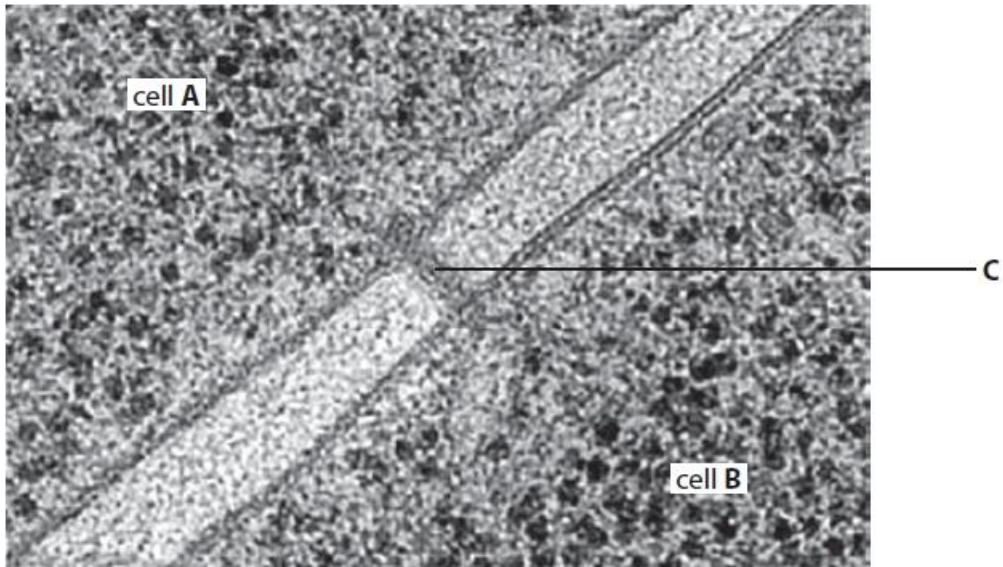
- A endocytosis
- B exocytosis
- C facilitated diffusion
- D phagocytosis

(Total for question = 6 marks)

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Q22.

The electronmicrograph shows the junction between two plant cells, **A** and **B**.



(i) Name the structure labelled **C**. (1)

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(ii) Explain the function of the structure labelled **C**. (2)

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(Total for question = 3 marks)

Mark Scheme

Q1.

Question Number	Answer	Mark
	<p>The only correct answer is – B circular with no nuclear membrane</p> <p>A is incorrect because bacterial DNA is not surrounded by a nuclear membrane</p> <p>C is incorrect because bacterial DNA is not linear</p> <p>D is incorrect because bacterial DNA is not linear</p>	(1)

Q2.

Question Number	Answer	Additional guidance	Mark
	<ul style="list-style-type: none"> length of mitochondrion divided by magnification (1) correct answer with appropriate units (1) 	<p><u>Example of calculation</u></p> <p>$116 \div 20\,000 = 0.0058$</p> <p>5.8 μm</p> <p>ALLOW 5.8 $\times 10^{-3}$ mm / 5.8 $\times 10^{-4}$ cm /</p> <p>0.0058 mm / 0.00058 cm</p> <p>Correct answer with units gains full marks</p> <p>ALLOW 5.75 μm for one mark if length measured as 115mm</p> <p>Correct answer with no working gains full marks</p>	(2)

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Q3.

Question Number	Answer	Additional Guidance	Mark
	<p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none"> • (large) circular DNA (1) • DNA not associated with histone proteins (1) • (small / several) plasmids (1) • located in the cytoplasm / not inside a nucleus (1) 	<p>ALLOW nucleoid NOT two marks for plasmids are circular DNA</p>	<p>3</p>

Q4.

Question Number	Answer	Additional Guidance	Mark
	<p>A description which makes reference to the following:</p> <ul style="list-style-type: none"> • {vesicles fuse with / protein enters} Golgi apparatus (1) • modification of protein inside Golgi apparatus (1) • {protein / enzyme} packaged into (secretory) vesicles (1) • vesicles fuse with cell (surface) membrane (1) 		<p>(4)</p>

Q5.

Question Number	Answer	Additional Guidance	Mark
	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> • lysosome fuses with the cell (surface) membrane (1) • contents of lysosome released from the cell / exocytosis 		<p>(2)</p>

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Q6.

Question Number	Answer	Additional Guidance	Mark
	<p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"> (eukaryotic organisms) have membrane-bound organelles (1) (eukaryotic organisms contain) a named membrane-bound organelle (1) size of ribosomes larger than in prokaryotes (1) (eukaryotic organisms contain) DNA that is {linear / associated with (histone) proteins} (1) (eukaryotic organisms) do not contain plasmids (in cytoplasm) (1) 	<p>ALLOW converse throughout</p> <p>ALLOW nucleus, mitochondria, Golgi, RER, SER, vesicles. ALLOW 80S instead of 70S ribosomes</p> <p>ALLOW DNA not circular</p> <p>ALLOW absence of mesosomes/pili</p>	(4)

Q7.

Question Number	Answer	Mark
(i)	<p><i>The only correct answer is D because there is RNA in the cytoplasm, nucleus and mitochondria 1, 2 and 3</i></p> <p><i>A is incorrect because there is also RNA in the nucleus and mitochondria</i></p> <p><i>B is incorrect because there is also RNA in the nucleus</i></p> <p><i>C is incorrect because there is also RNA in the cytoplasm (as tRNA, mRNA or in ribosomes)</i></p>	(1)

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Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An answer that makes reference to two of the following:</p> <ul style="list-style-type: none"> (lactate is) { oxidized to form / converted to } pyruvate (1) (pyruvate is) converted to { glucose / glycogen } (1) (pyruvate / glucose) used in respiration (1) 	<p>ALLOW glucose produced from the lactate</p> <p>ALLOW correct named stage e.g. glycolysis for glucose or link reaction for pyruvate</p>	(2)

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> dipeptide correctly drawn with peptide bond (1) water molecule released (1) 		(2)

Q8.

Question Number	Answer	Mark
(i)	<p>The only correct answer is D - ribosome</p> <p><i>A is not correct because amyloplasts are only found in plant cells</i></p> <p><i>B is not correct because chloroplasts are only found in plant cells</i></p> <p><i>C is not correct because mesosomes are only found in bacterial cells</i></p>	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is A-amyloplast</p> <p><i>B is not correct because Golgi apparatus is found in plant and animal cells</i></p> <p><i>C is not correct because mesosomes are found only in bacterial cells</i></p> <p><i>D is not correct because some animal cells also have a vacuole</i></p>	(1)

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Question Number	Answer	Mark
(iii)	<p>The only correct answer is D-smooth endoplasmic reticulum</p> <p><i>A is not correct because amyloplasts are only found in plant cells</i></p> <p><i>B is not correct because animal cells do not have a cell wall</i></p> <p><i>C is not correct because pili are only found in bacterial cells</i></p>	(1)

Q9.

Question Number	Answer	Mark
	<p>C - both possess ribosomes - prokaryotic cells do not possess endoplasmic reticulum</p> <p><i>The only correct answer is C</i></p> <p><i>A is not correct because prokaryotic cells can contain plasmids</i></p> <p><i>B is not correct because eukaryotic cells do not contain pili</i></p> <p><i>D is not correct because eukaryotic cells do not contain pili</i></p>	(1)

Q10.

Question Number	Answer	Mark
(i)	<p>C – only Archaea and Bacteria</p> <p><i>The only correct answer is C</i></p> <p><i>A is not correct because Eukaryota are not prokaryotic</i></p> <p><i>B is not correct because Bacteria are also prokaryotic</i></p> <p><i>D is not correct because Archaea are also prokaryotic</i></p>	(1)

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Question Number	Answer	Additional Guidance	Mark
(ii)	<p>A description that makes reference to four of the following:</p> <ul style="list-style-type: none"> • presence of a cell wall (1) • circular DNA / plasmids (1) • {small / 70S} ribosomes (1) • pili / flagellum (1) • capsule / mesosome (1) 		(4)

Q11.

Question Number	Answer	Additional Guidance	Mark
	<ul style="list-style-type: none"> • (A) nuclear pore (1) • (B) Golgi { apparatus / body } (1) • (C) secretory vesicles / lysosome (1) 	ALLOW rER / rough endoplasmic reticulum	(3)

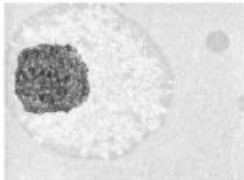
Q12.

Question Number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none"> • centriole 	ALLOW centrosome	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is – D spindle organisation</p> <p>A is incorrect because the centriole is not involved in lipid synthesis</p> <p>B is incorrect because the centriole is not involved in protein synthesis</p> <p>C is incorrect because the centriole is not involved in ribosome production</p>	(1)

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Q13.

Question Number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none"> nucleolus correctly labelled 	 <p>within area shown</p>	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is - B prokaryotic cells do not have a nucleus</p> <p>A is incorrect because prokaryotic cells do contain DNA</p> <p>C is incorrect because prokaryotic cells do not only contain RNA</p> <p>D is incorrect because prokaryotic cells do not only contain single-stranded DNA</p>	(1)

Question Number	Answer	Additional guidance	Mark
(iii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> because the nuclear membrane is broken down (1) because DNA is { coiled / condensed } into individual chromosomes (1) 		(2)

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Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An answer that makes reference to two of the following:</p> <ul style="list-style-type: none"> • modifies proteins (1) • forms vesicles (1) • removes (some) water from the protein / concentrates the { protein / glycoprotein } (1) 	<p>e.g. addition of carbohydrate to protein / formation of glycoprotein ALLOW processes protein IGNORE folds protein</p> <p>e.g. lysosomes / secretory vesicle / vesicle in synaptic knob ALLOW packages proteins into vesicles</p>	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> • (for phase 1) – to make sure the phospholipase inhibitor is not harmful (1) • (for phase 2) – to see if it is effective in { treating the condition / preventing allergic reactions to wasp venom } (1) • (for phase 3) – to gather much data / data for statistical tests / to look for rare side effects (1) • to test for side effects in { phase 1 / phase 2 } (1) 	<p>ALLOW finding safe dosage ALLOW reference to how the drug is absorbed / metabolised</p> <p>ALLOW double blind trials to compare effectiveness with a placebo / previous drug</p>	(3)

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Q15.

Question Number	Answer	Additional Guidance	Mark
	<p>A description that makes reference to:</p> <ul style="list-style-type: none"> the polypeptide chain moves through the endoplasmic reticulum then the Golgi apparatus (1) in the rER, the polypeptide is folded (1) in the { Golgi apparatus / ER } carbohydrate is added (1) the { polypeptide / protein } is transported around the cell in a vesicle (1) 	<p>This mark may be awarded from the sequence of the answer as a whole.</p> <p>ALLOW secondary structure / tertiary structure / three-dimensional shape is adopted in rER</p> <p>ALLOW sugar (group) for carbohydrate</p> <p>IGNORE exocytosis, secretion</p>	(4)

Q16.

Question Number	Answer	Mark
	<p>The only correct answer is D – 80S ribosomes on the endoplasmic reticulum</p> <p><i>A is incorrect because the ribosomes are not 70S</i></p> <p><i>B is incorrect because the ribosomes are not 70S</i></p> <p><i>C is incorrect because protein synthesis does not occur in the nucleus</i></p>	(1)

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Q17.

Question Number	Answer	Additional guidance	Mark
(i)	<p>A description that makes reference to three of the following</p> <ul style="list-style-type: none"> the proteins are folded in the rough endoplasmic reticulum (RER) (1) the proteins are {packaged into/transported in} vesicles (1) the protein is modified in the Golgi apparatus (1) exocytosis (1) 	<p>ALLOW processed/ description of modification ALLOW description of exocytosis</p>	(3)

Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation that makes reference to the following</p> <ul style="list-style-type: none"> (if the protein is not folded correctly) the {tertiary structure / 3D shape} would be different(1) therefore the active site of the enzyme would not { fit / bind with } the substrate / it would not be able to form an enzyme substrate complex (1) therefore it would not be able to catalyse the reaction (1) 	<p>ALLOW not complementary</p>	(3)

Q18.

Question Number	Answer	Mark
	<p>The only correct answer is - C smaller than in eukaryotic cells</p> <p>A is incorrect because ribosomes are present in prokaryotic cells</p> <p>B is incorrect because ribosomes are smaller in prokaryotic cells</p> <p>D is incorrect because ribosomes are smaller in prokaryotic cells</p>	(1)

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Q19.

Question Number	Answer	Additional guidance	Mark
	<p>An answer that includes the following:</p> <ul style="list-style-type: none"> • labelled cell membrane drawn inside the cell wall (1) • labelled mesosome drawn as an infolding of the cell membrane but not connected to the cell wall (1) • labelled plasmid drawn as a circle or continuous shape, smaller than the DNA chromosome (1) 		(3)

Q20.

Question Number	Answer	Mark
	<p>The only correct answer is – D outside the cell wall</p> <p>A is incorrect because the capsule is not between the cell membrane and the cell wall</p> <p>B is incorrect because the capsule is not in the cytoplasm</p> <p>C is incorrect because the capsule is not inside the cell wall</p>	(1)

Q21.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> • increasing dose of interferon increases the survival time of the mice • because interferon inhibits viral replication (inside cells) • the greater the dose of interferon the fewer virus particles {produced / released} (to infect other cells) 	<p>ALLOW positive correlation between interferon dose and survival time</p> <p>ALLOW interferon prevents virus infecting other cells</p>	(3)

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Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation that makes reference to two of the following:</p> <ul style="list-style-type: none"> • bacteria do not possess {rER / Golgi apparatus} • polypeptide chain is not {processed / modified} properly • therefore the protein is {incorrectly folded / carbohydrate is not added} 	<p>ALLOW converse statements for each marking point</p> <p>ALLOW Golgi body</p> <p>ALLOW protein</p> <p>ALLOW is not glycosylated</p>	(2)

Question Number	Answer	Mark
(iii)	<p>B - exocytosis</p> <p><i>The only correct answer is B</i></p> <p>A is not correct because endocytosis is the process used to take particles into cells</p> <p>C is not correct because facilitated diffusion is not used to transport proteins</p> <p>D is not correct because phagocytosis is a process used to engulf large particles such as bacteria</p>	(1)

Q22.

Question Number	Answer	Additional Guidance	Mark
(i)	plasmodesma (1)	ALLOW plasmodesmata	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	<p>An explanation which makes reference to the following:</p> <ul style="list-style-type: none"> • cytoplasmic connection (between cells) (1) • which allows { transport / communication } (between cells) (1) 	<p>ALLOW cytoplasm continuous between the cells</p> <p>ALLOW exchange of materials between cells</p>	(2)