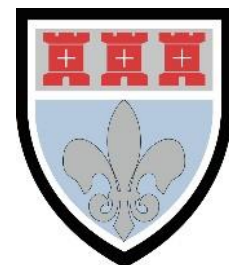


St Mary's Science Department

A level Biology

Homework Book



Cell Structure and Division

Name: _____

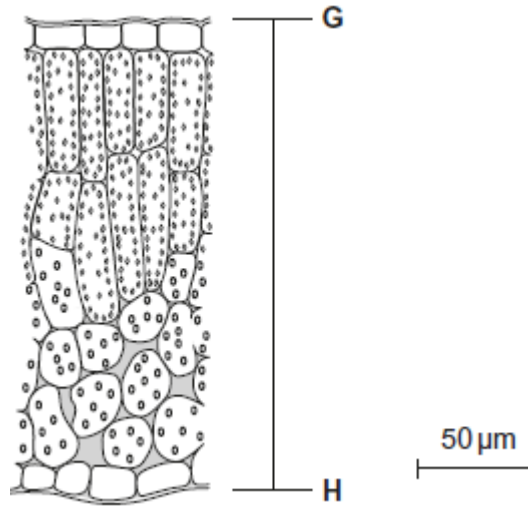
Class: _____

Teacher : _____

Question	Date given	Date due	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
Total Score		Grade	

Q1.

A scientist examined the structure of mustard plant leaves. He viewed temporary mounts of leaf tissues with an optical microscope. The figure below shows a drawing of typical results.



(a) Describe how temporary mounts are made.

(2)

(b) Calculate the distance in micrometres between **G** and **H** on the leaf.

Answer = _____ μm

(2)

(c) Describe how the scientist could have used the temporary mounts of leaves to determine the mean number of chloroplasts in mesophyll cells of a leaf.

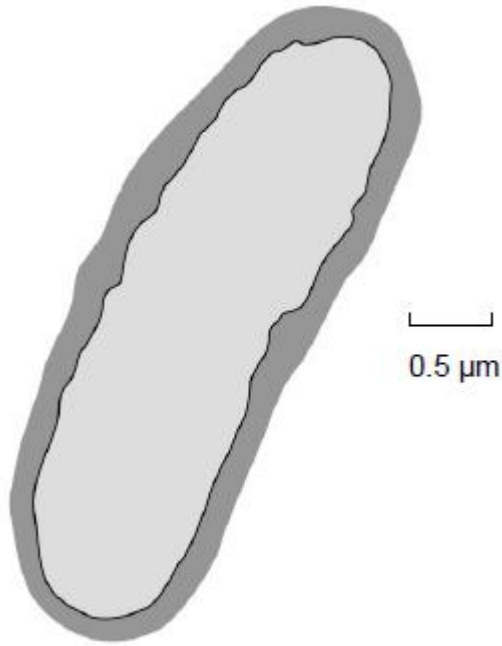
(3)

(Total 7 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q2.

A bacterium is shown in the diagram.



- (a) Calculate the magnification of the image.

Magnification = _____

(1)

- (b) Complete the table to show the features of a bacterium and a virus.

Put a tick (✓) in the box if the feature is shown.

Surface	Bacterium	Virus
Cell-surface membrane		
Nucleus		
Cytoplasm		
Capsid		

(2)

- (c) DNA and RNA can be found in bacteria.

Give **two** ways in which the nucleotides in DNA are different from the nucleotides in RNA.

1. _____

2. _____

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q3.

Read the following passage.

In a human, there are over 200 different types of cell clearly distinguishable from each other. What is more, many of these types include a number of different varieties. White blood cells, Wfor example, include lymphocytes and granulocytes.

Although different animal cells have many features in common, each type has adaptations. 5 associated with its function in the organism. As an example, most cells contain the same organelles, but the number may differ from one type of cell to another. Muscle cells contain many mitochondria, while enzyme-secreting cells from salivary glands have particularly large amounts of rough endoplasmic reticulum.

The number of a particular kind of organelle may change during the life of the cell. An 10 example of this change is provided by cells in the tail of a tadpole. As a tadpole matures into a frog, its tail is gradually absorbed until it disappears completely. Absorption is associated with an increase in the number of lysosomes in the cells of the tail.

Use information from the passage and your own knowledge to answer the following questions.

(a) Explain the link between.

(i) mitochondria and muscle cells (lines 6 - 7);

(3)

(ii) rough endoplasmic reticulum and enzyme-secreting cells from salivary glands (lines 7 - 8).

(2)

(b) Use information in the passage to explain how a tadpole's tail is absorbed as a tadpole changes into a frog.

(2)

- (c) Starting with some lettuce leaves, describe how you would obtain a sample of undamaged chloroplasts. Use your knowledge of cell fractionation and ultracentrifugation to answer this question.

(6)

(Total 13 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q4.

A stomach ulcer is caused by damage to the cells of the stomach lining. People with stomach ulcers often have the bacterium *Helicobacter pylori* in their stomachs.

A group of scientists was interested in trying to determine how infection by *H. pylori* results in the formation of stomach ulcers.

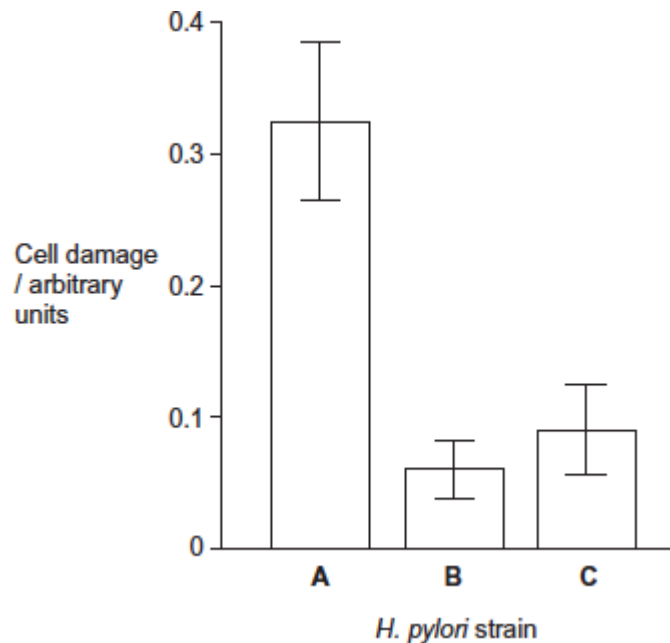
The scientists grew different strains of *H. pylori* in liquid culture.

The table below shows the substances released by each of these strains.

<i>H. pylori</i> strain	Substances released by the <i>H. pylori</i> cells	
	Toxin	Enzyme that neutralises acid
A	✓	✓
B	✗	✓
C	✓	✗

The scientists centrifuged the cultures of each strain to obtain cell-free liquids. They added each liquid to a culture of human cells. They then recorded the amount of damage to the human cells.

Their results are shown below. The error bars show ± 1 standard deviation.



(a) Describe and explain how centrifuging the culture allowed the scientists to obtain a cell-free liquid.

[Extra space] _____

(3)

- (b) The scientists measured cell damage by measuring the activity of lysosomes. Give **one** function of lysosomes.

(1)

- (c) *H. pylori* cells produce an enzyme that neutralises acid. Suggest **one** advantage to the *H. pylori* of producing this enzyme.

(2)

- (d) What do these data suggest about the damage caused to human cells by the toxin and by the enzyme that neutralises acid? Explain your answer.

[Extra space] _____

- (e) The scientists carried out a further investigation. They treated the liquid from **strain A** with a protein-digesting enzyme before adding it to a culture of human cells. No cell damage was recorded.
Suggest why there was no damage to the cells.

[Extra space] _____

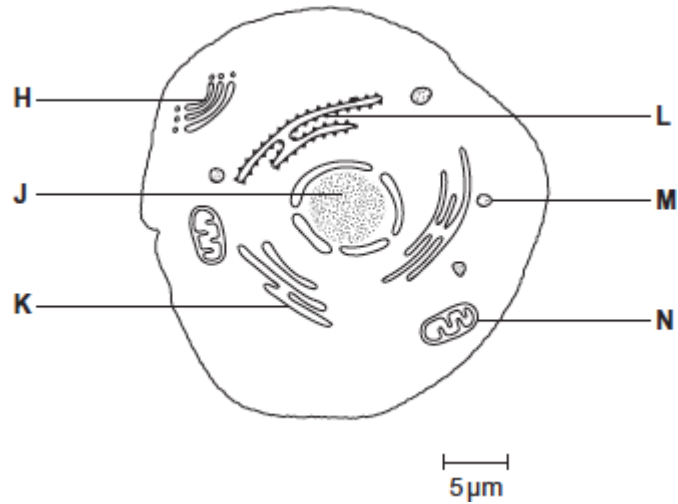
(3)

(Total 12 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q5.

The diagram shows a eukaryotic cell.



- (a) Complete the table by giving the letter labelling the organelle that matches the function.

Function of organelle	Letter
Protein synthesis	
Modifies protein (for example, adds carbohydrate to protein)	
Aerobic respiration	

(3)

- (b) Use the scale bar in the diagram above to calculate the magnification of the drawing.
Show your working.

Answer = _____

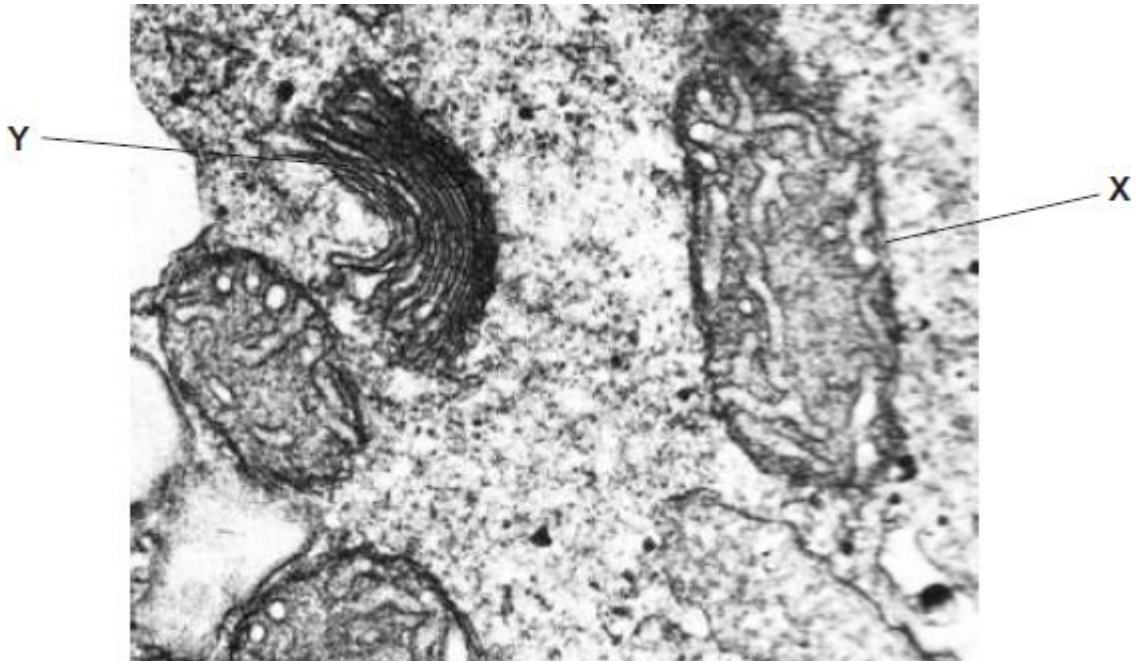
(2)

(Total 5 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q6.

The photograph shows part of the cytoplasm of a cell.



- (a) (i) Organelle X is a mitochondrion.

What is the function of this organelle?

(1)

- (ii) Name organelle Y.

(1)

- (b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical(light) microscope. Explain why.

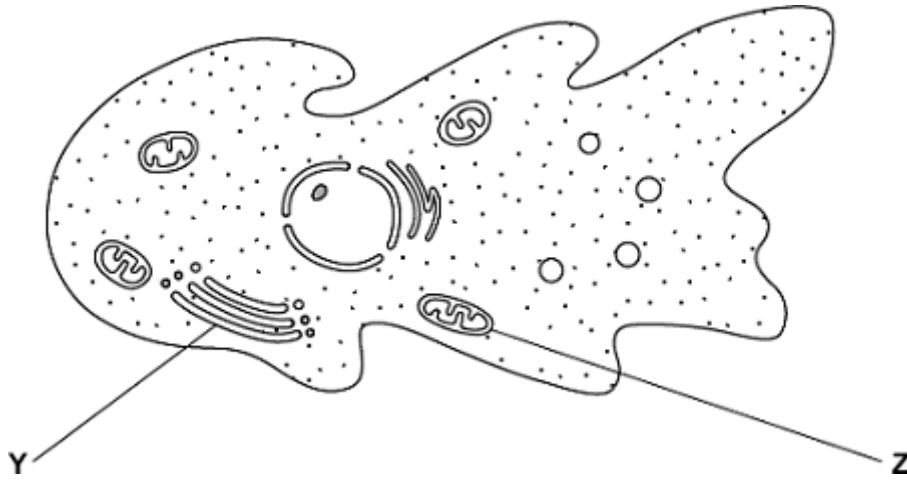
(2)

(Total 4 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q7.

An amoeba is a single-celled, eukaryotic organism. Scientists used a transmission electron microscope to study an amoeba. The diagram shows its structure.



(a) (i) Name organelle **Y**.

(1)

(ii) Name **two** other structures in the diagram which show that the amoeba is a eukaryotic cell.

1. _____

2. _____

(2)

(b) What is the function of organelle **Z**?

(1)

(c) The scientists used a transmission electron microscope to study the structure of the amoeba. Explain why.

(2)

(Total 6 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

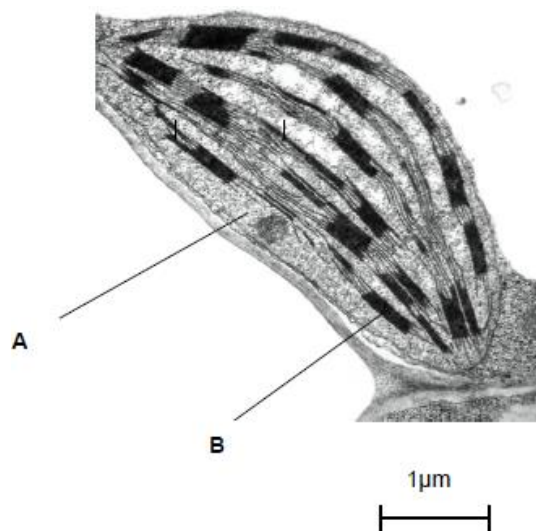
Q8.

- (a) Describe how you could use cell fractionation to isolate chloroplasts from leaf tissue.

(Extra space) _____

(3)

The figure below shows a photograph of a chloroplast taken with an electron microscope.



© Science Photo Library

- (b) Name the parts of the chloroplast labelled **A** and **B**.

Name of **A** _____

Name of **B** _____

(2)

- (c) Calculate the length of the chloroplast shown in the figure above.

Answer _____

(1)

(d) Name **two** structures in a eukaryotic cell that **cannot** be identified using an optical microscope.

1. _____

2. _____

(1)

(Total 7 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q9.

Gorter and Grendel investigated the structure of the surface membrane of cells. They extracted the phospholipids from the surface membranes of red blood cells in 1 cm³ of blood and placed them in the apparatus shown in **Figure 1**.

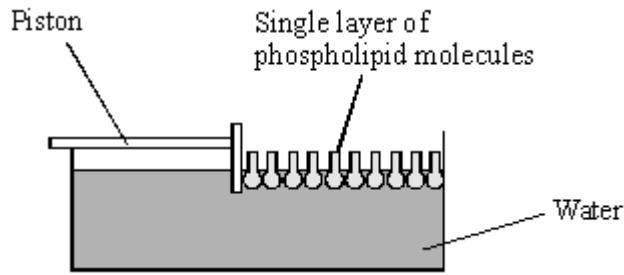


Figure 1

The piston was pushed across the surface of the water until the phospholipid molecules were tightly packed into a single layer. The area covered by the phospholipid molecules was measured. This area was compared with the estimated surface area of the red blood cells from which phospholipids were extracted.

Gorter and Grendel obtained the data shown in the table.

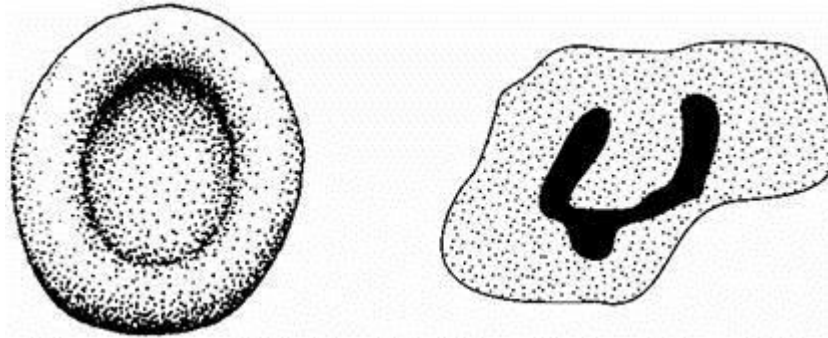
Number of red blood cells per cm ³ of blood	4.74 × 10 ⁹
Estimated mean surface area of one red blood cell	99.4 μm ²
Surface area of membrane phospholipids extracted from 1 cm ³ of blood	0.92 m ²

- (a) Explain what these data suggest about the arrangement of phospholipids in the surface membranes of red blood cells. Support your explanation with suitable calculations.

Show your working.

(3)

(b) **Figure 2** shows a red blood cell and a white blood cell.



Red blood cell

White blood cell

Figure 2

Explain why red blood cells were used in this investigation rather than white blood cells.

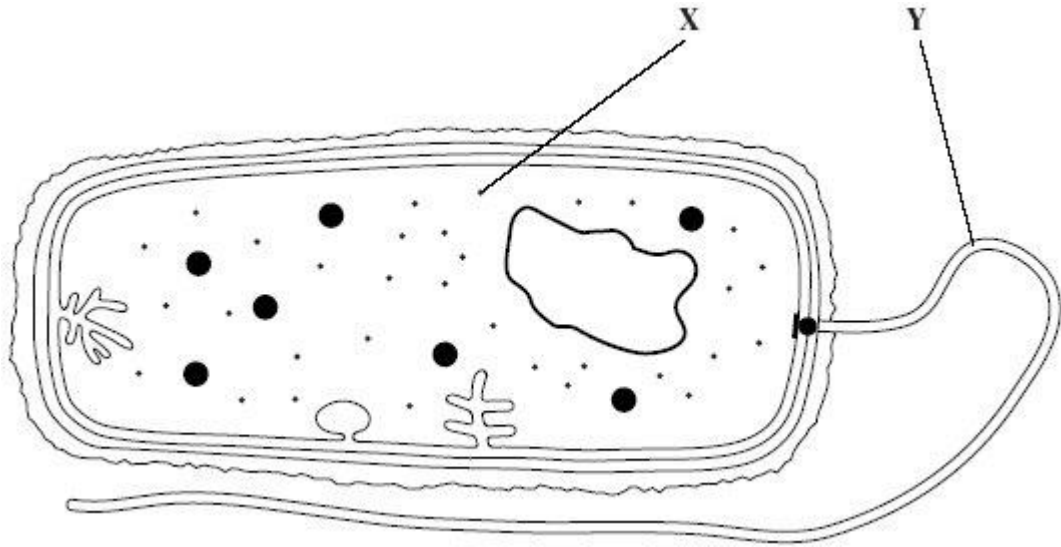
(2)

(Total 5 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q10.

The diagram shows a bacterium.



(a) Give the function of

(i) organelle X;

(ii) organelle Y.

(2)

(b) (i) Give **two** ways in which the structure of this bacterium is similar to the structure of a cell lining the human small intestine.

1. _____

2. _____

(2)

(ii) Give **two** ways in which the structure of this bacterium differs from the structure of a cell lining the human small intestine.

1. _____

2. _____

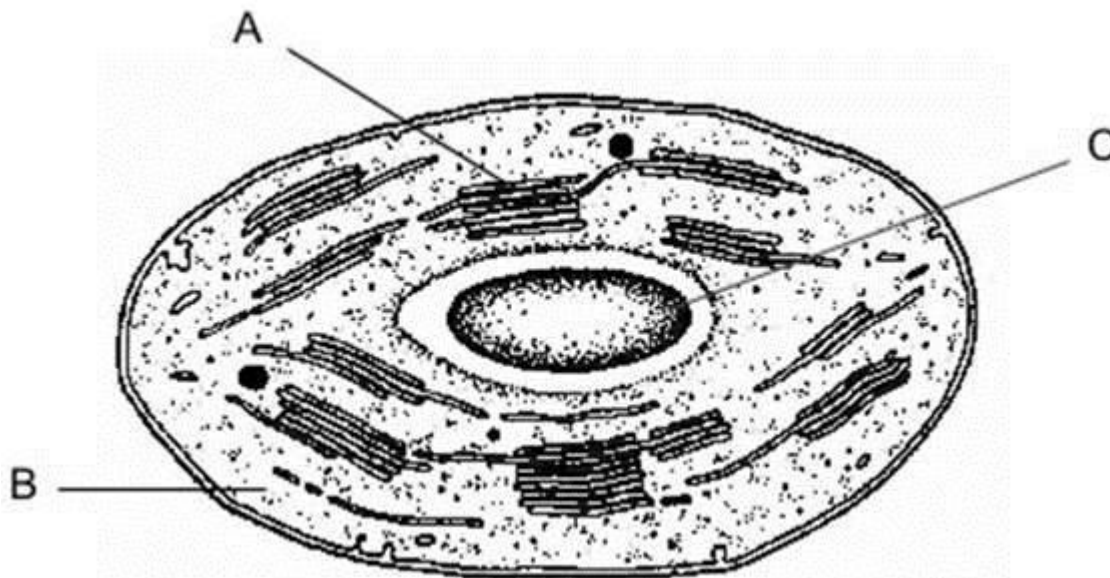
(2)

(Total 6 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q11.

The electron micrograph shows part of a chloroplast.



- (a) Name the parts labelled **A** and **B** and, for each, describe **one** role in the process of photosynthesis.

A Name _____

Role _____

B Name _____

Role _____

(4)

- (b) (i) Name the main substance present in the part labelled **C**.

(1)

- (ii) How is this substance formed?

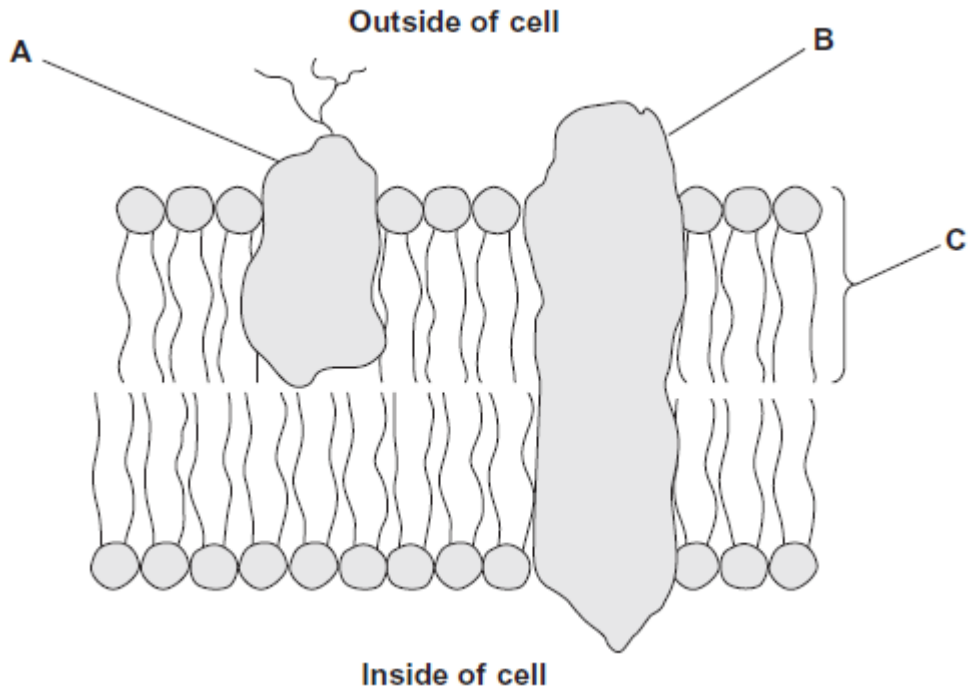
(1)

(Total 6 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q12.

The diagram shows the structure of a plasma membrane.



(a) Name

protein **A** _____

protein **B** _____

molecule **C** _____

(3)

(b) Name **two** structures found in a prokaryotic cell that are **not** found in a human cell.

1. _____

2. _____

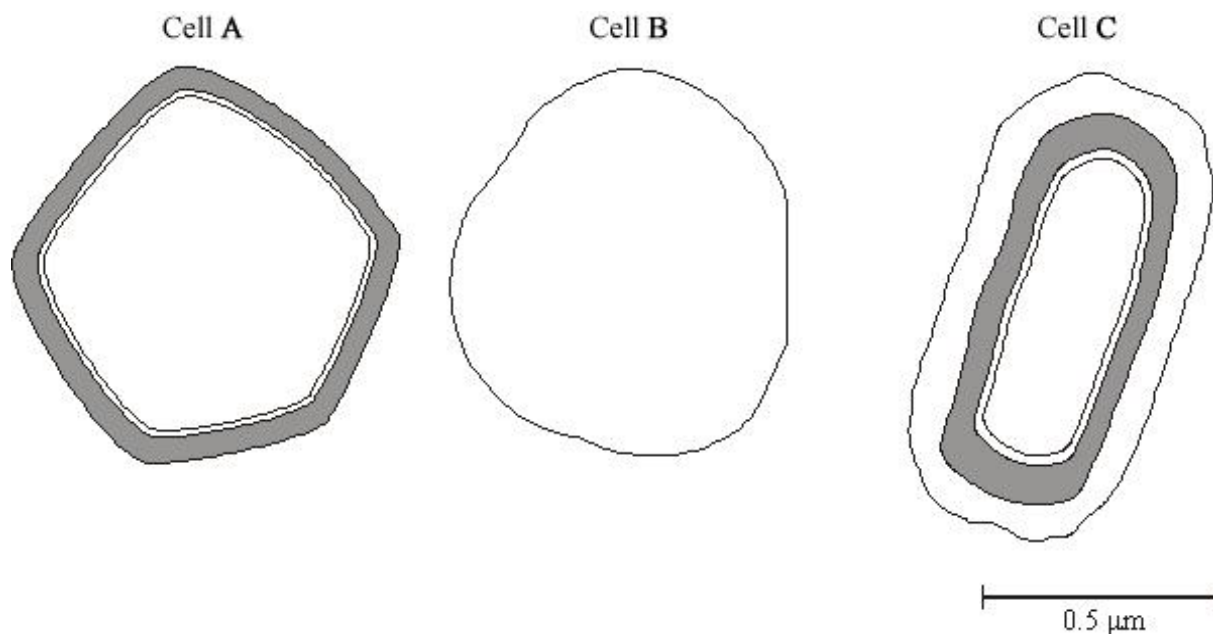
(2)

(Total 5 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q13.

The diagram shows the outer layers of three different cells, **A**, **B** and **C**.



(a) What is the evidence from the diagram that

(i) cell **B** is an animal cell,

(1)

(ii) cell **C** is a prokaryotic cell?

(1)

(b) Explain how you would calculate the magnification of cell **C**.

(1)

(c) Cell **A** is a plant cell. Name a polysaccharide which may be found in cell **A** but would not be found in the animal cell.

(1)

(d) Penicillin is an antibiotic. It prevents the formation of bacterial cell walls. As a result, bacterial cells that have been treated with penicillin swell and burst as water enters.

(i) Explain how water enters a bacterial cell.

(2)

(ii) Suggest why penicillin has no effect on plant cells.

(1)

(Total 7 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

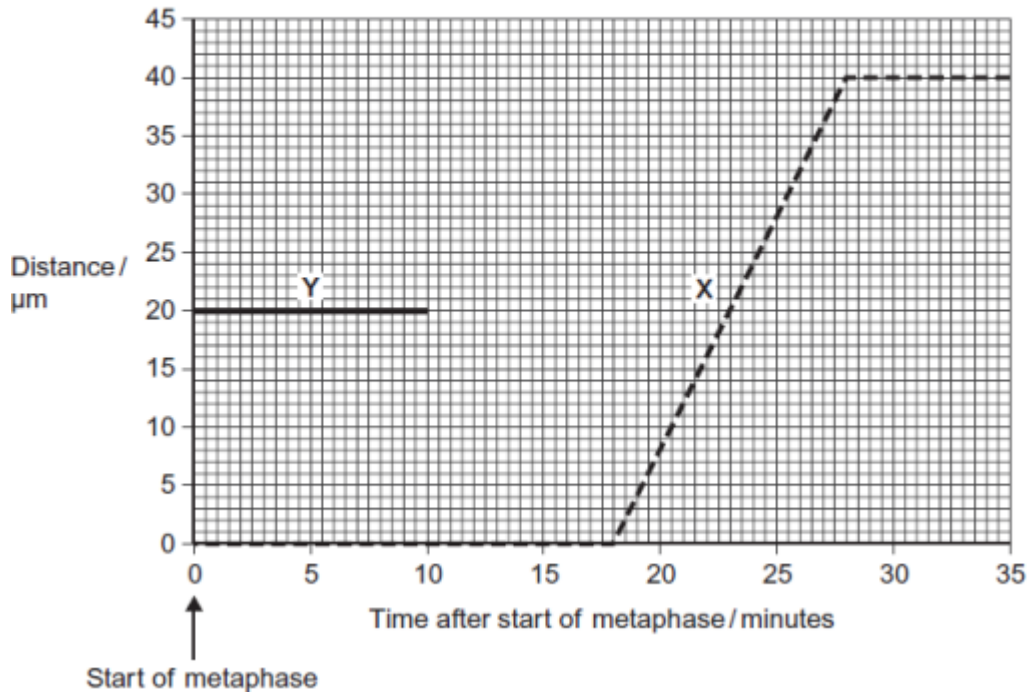
Q14.

(a) Describe how DNA is replicated.

(6)

(b) The graph shows information about the movement of chromatids in a cell that has just started metaphase of mitosis.

Key
 - - - - = distance between chromatids
 ————— = distance between each chromatid and the pole to which it is moving



(i) What was the duration of metaphase in this cell?

minutes

(1)

(ii) Use line X to calculate the duration of anaphase in this cell.

minutes

(1)

(iii) Complete line Y on the graph.

(2)

(c) A doctor investigated the number of cells in different stages of the cell cycle in two tissue samples, **C** and **D**. One tissue sample was taken from a cancerous tumour. The other was taken from non-cancerous tissue. The table shows his results.

Percentage of cells in each stage of the cell cycle

Stage of the cell cycle	Tissue sample C	Tissue sample D
Interphase	82	45
Prophase	4	16
Metaphase	5	18
Anaphase	5	12
Telophase	4	9

- (i) In tissue sample **C**, one cell cycle took 24 hours. Use the data in the table to calculate the time in which these cells were in interphase during one cell cycle. Show your working.

Time cells in interphase _____ hours

(2)

- (ii) Explain how the doctor could have recognised which cells were in interphase when looking at the tissue samples.

(1)

- (iii) Which tissue sample, **C** or **D**, was taken from a cancerous tumour? Use information in the table to explain your answer.

(2)

(Total 15 marks)

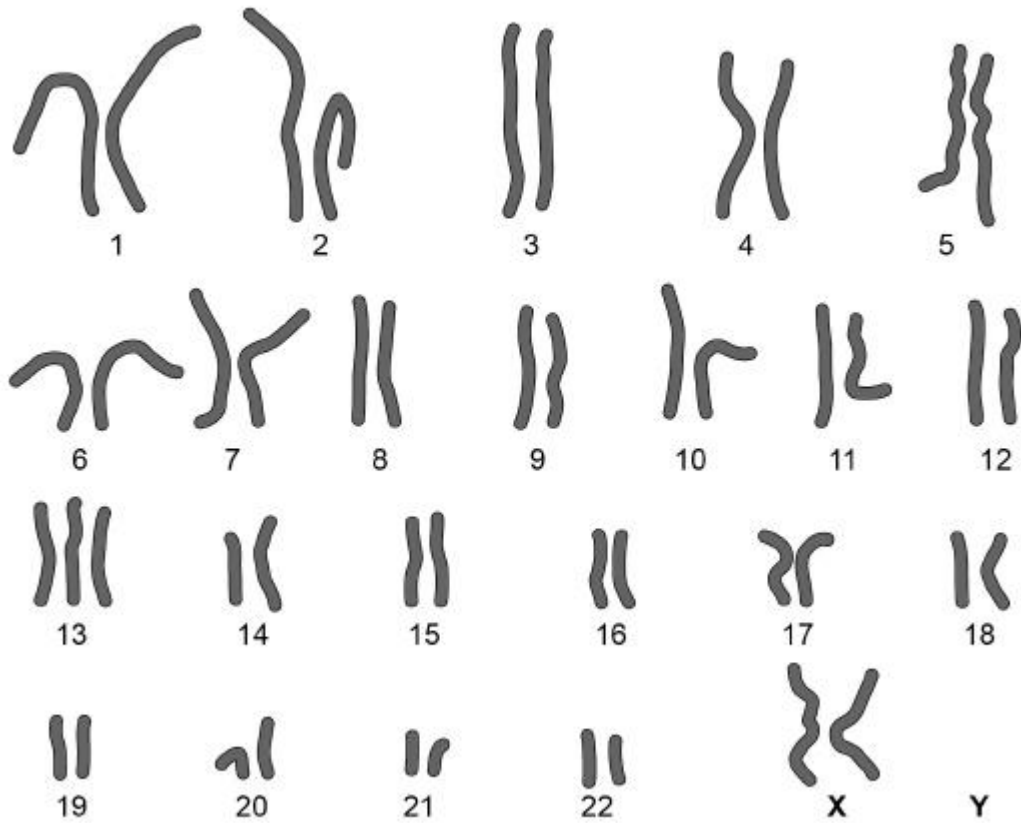
Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q15.

Patau syndrome is a condition caused by a mutation affecting chromosome number. All the cells of the body will have this mutation.

Figure 1 shows the chromosomes from one of the cells of a female who has Patau syndrome.

Figure 1



(a) What is the effect of Patau syndrome on the chromosomes of this female?

(1)

(b) Describe how the change in chromosome number in Patau syndrome was produced.

(2)

(c) Explain why all the cells of the body will have this mutation.

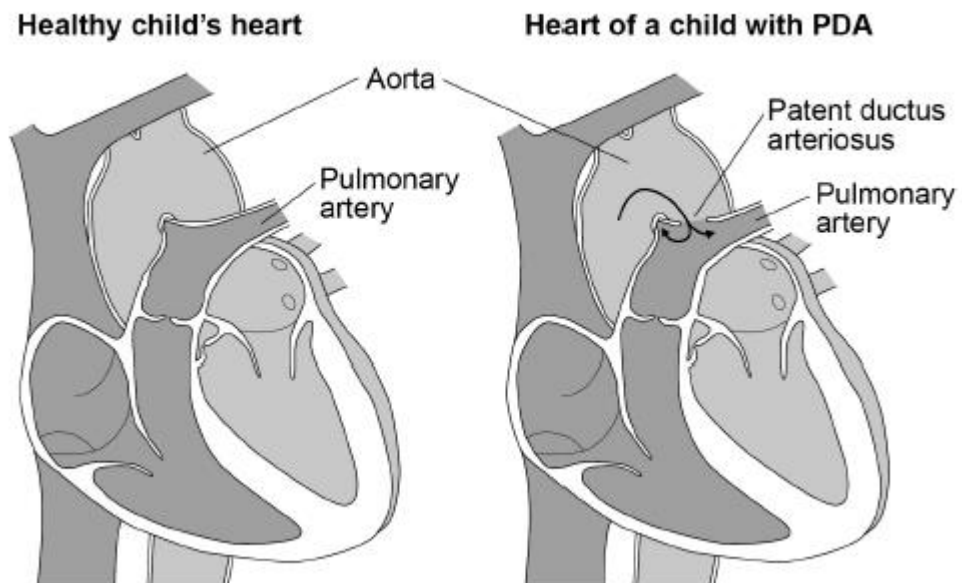
(2)

(d) Most children born with Patau syndrome die in the first 12 months, often due to defects of circulation of blood.

One of these defects is patent ductus arteriosus (PDA). This can result in some of the blood flowing between the aorta and the pulmonary artery.

Figure 2 shows a healthy child's heart and the heart of a child with PDA.

Figure 2



Suggest how the flow of some of the blood between the aorta and pulmonary artery could cause children to die in the first 12 months.

(3)
(Total 8 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q16.

(a) The letters **A, B, C, D** and **E** represent stages in mitosis.

- **A** – anaphase
- **B** – interphase
- **C** – metaphase
- **D** – prophase
- **E** – telophase

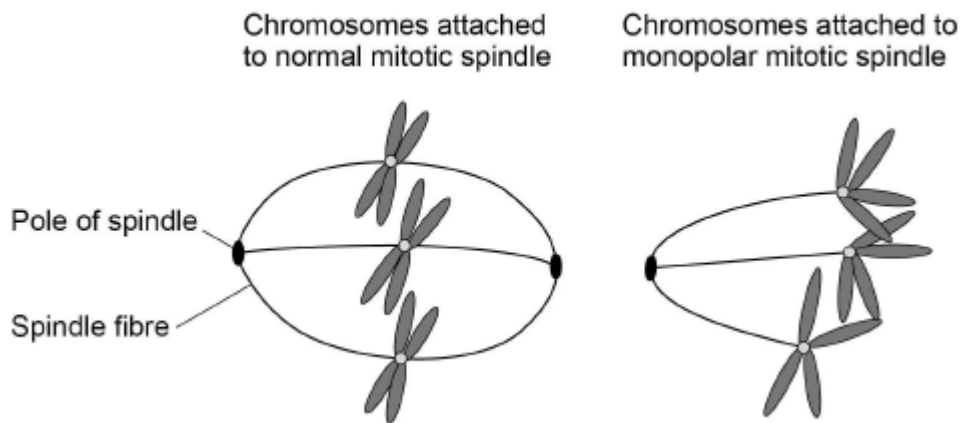
Write **one** of the letters, **A** to **E**, in the box to complete the following statement.

Chromosomes line up on the equator of the mitotic spindle in

(1)

(b) Scientists looking for treatments for cancer are investigating the use of substances called kinesin inhibitors (KI). These inhibitors prevent successful mitosis. Some kinesin inhibitors cause the development of a monopolar spindle in mitosis.

The diagram below shows chromosomes attached to a normal mitotic spindle and to a monopolar mitotic spindle.



Suggest why the development of a monopolar mitotic spindle would prevent successful mitosis.

(2)

- (d) At the start of their investigation, the scientists made a solution of kinesin inhibitor (KI) with a concentration of $10\,000\text{ nmol dm}^{-3}$. They used this to make the other concentrations by a series of dilutions with water.

Describe how they made 100 cm^3 of 1000 nmol dm^{-3} solution of kinesin inhibitor.

(2)
(Total 9 marks)

Feedback	Mark (out of)	Score
Skill	Strength	Could improve
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Mark schemes

Q1.

- (a) 1. Thin slice/section;
 2. Put on slide in water / solution / stain;
 3. Add cover slip;

Accept: 'between two slides'

Max 2

- (b) 200 (µm);;

OR

1. Divide image length by key length eg $64/16 = 4$;
 2. Multiply by 50 eg 4×50 ;

Accept for 2 marks answers in the range of 185-217 (µm)

Max 1 mark for responses not within the range

Accept: measurements in the ranges 63-65mm and 15-17mm

2

- (c) 1. Select large number of cells / select cells at random;

Accept: > 3 for "large number"

Accept: many fields of view for 'large number of cells'

Accept: all cells in field of view

2. Count number of chloroplasts;
 3. Divide number of chloroplasts by number of cells;

Ignore: 'calculate the mean'

3

[7]

Q2.

- (a) $\times 20\,000$

Accept range from 18 000 to 22 000

1

- (b)

✓	
✓	
	✓

1 mark for each correct column

2

- (c) 1. DNA contains thymine **and** RNA contains uracil;
 2. DNA contains deoxyribose **and** RNA contains ribose.

2

[5]

Q3.

- (a) (i) Mitochondria site of respiration;
Production of ATP / release of energy;
For contraction;
Do not award credit for making or producing energy. 3
- (ii) Enzymes are proteins;
Proteins synthesised / made on ribosomes; 2
- (b) Lysosomes produce / contain enzymes;
Which break down / hydrolyse proteins / substances / cells of tail; 2
- (c) 1. Chop up (accept any reference to crude breaking up);
2. Cold;
3. Buffer solution;
4. Isotonic / same water potential;
5. Filter and centrifuge filtrate;
6. Centrifuge supernatant;
7. At higher speed;
8. Chloroplasts in (second) pellet;

max 6

[13]

Q4.

- (a) 1. Large / dense / heavy cells;
2. Form pellet / move to bottom of tube (when centrifuged);
3. Liquid / supernatant can be removed.
Must refer to whole cells. 3
- (b) Break down cells / cell parts / toxins.
Idea of 'break down / digestion' needed, not just damage 1
- (c) 1. To stop / reduce them being damaged / destroyed / killed;
Reject (to stop) bacteria being denatured.
2. By stomach acid.
Must be in context of stomach. 2
- (d) 1. More cell damage when both present / A;
2. Some cell damage when either there on their own / some cell damage in B and C;
MP1 and MP2 – figures given from the graph are insufficient.
3. Standard deviation does not overlap for A with B and C so difference is real;
MP3 and MP4 both aspects needed to gain mark.
4. Standard deviations do overlap between B and C so no real

difference.

MP3 and MP4 accept reference to significance / chance for 'real difference'

3 max

- (e) 1. Enzyme (a protein) is broken down (so no enzyme activity);
Accept hydrolyse / digested for 'broken down'.
2. No toxin (as a result of protein-digesting enzyme activity);
Must be in the correct context.
3. (So) toxin is protein.
This must be stated, not inferred from use of 'protein-digesting enzyme'.

3

[12]

Q5.

(a)

Protein synthesis	L;
Modifies protein	H;
Aerobic respiration	N;

3

- (b) 1800–2200;
1.8, 2.0 or 2.2 in working or answer = 1 mark.
Ignore units in answer.

1 mark for an incorrect answer in which student clearly divides measured length by actual length (of scale).

Accept I / A or I / O for 1 mark but ignore triangle.

Accept approx 60mm divided by 30µm for 1 mark

2

[5]

Q6.

- (a) (i) (Aerobic) respiration;
Accept ATP production / energy release
Reject anaerobic respiration
Reject energy production

1

- (ii) Golgi (apparatus / body);
Ignore smooth ER

1

- (b) ('It' = Optical microscope)
Ignore reference to magnification

1. Has low resolution / not high enough resolution;
Accept converse relating to EM
2. (Because) wavelength of light not short enough / too long;
Accept larger wavelength
Accept statements that microscopes have a wavelength

2

[4]

Q7.

- (a) (i) Golgi (apparatus / body);

1

- (ii) 1. Nucleus;
Accept: nucleolus / nuclear envelope / nuclear membranes
2. Mitochondrion;
Accept cristae / mitochondrial membranes
3. Endoplasmic reticulum / ER;
Ignore reference to rough / smooth
4. Lysosome;
Reject lysozyme

2 max

- (b) (Aerobic) respiration / ATP production / provide energy;
Accept Krebs cycle / electron transport.
Ignore 'produces energy'
Reject anaerobic respiration
Ignore what energy is used for

1

- (c) 1. High / better resolution;
2. Shorter wavelength;
3. To see internal structures / organelles / named organelles;
Accept ultrastructure

2 max

[6]

Q8.

- (a) 1. How to break open cells and remove debris;
2. Solution is cold / isotonic / buffered;
3. Second pellet is chloroplast.

3

- (b) 1. **A** stroma;
2. **B** granum.
Accept thylakoid

2

(c) $\left(\frac{\text{length of chloroplast}}{\text{length of bar}} \right) \mu\text{m}$

1

- (d) **Two** of the following for **one** mark:
Mitochondrion / ribosome / endoplasmic reticulum / lysosome / cell-surface membrane.

1 max

[7]

Q9.

- (a) phospholipids in a double layer / area covered is twice total surface area of red blood cells;
evidence of calculation of number \times surface area ($4.74 \times 10^9 \times 99.4 \mu\text{m}^2$) /

$$\frac{0.92}{4.74 \times 10^{-9}};$$

calculation of area of 1 cell 4.74×10^{-9} ;
 $0.471 \text{ m}^2 \approx 0.5 \times 0.92 \text{ m}^2 / 194 \mu\text{m} \approx 2 \times 99.4;$

3

- (b) EITHER feature + explanation
red blood cells do not contain organelles / nucleus;
so only surface membrane / no internal membranes in macerate;
OR
red blood cells have simple / regular / spherical shape;
so easy to calculate surface area;
OR
any two features, e.g.
simple / regular shape;
all same size;

2

[5]

Q10.

- (a) X protein synthesis / translation;
Y movement;

2

- (b) (i) cytoplasm;
ribosomes;
phospholipid membranes / cell membrane / semipermeable membrane;

(accept folded membrane for two marks)

2 max

- (ii) *(it = bacterium)*
cell wall;
capsule;
flagellum;
mesosome;
no nucleus / nuclear membrane / DNA free;
no mitochondria;
(accept 'no membrane-bound organelles' if neither nucleus nor mitochondria mark scored)

no microvilli;

no Golgi;
no ER;
70S / smaller ribosomes;

2 max

[6]

Q11.

- (a) A – granum / thylakoid;
chlorophyll molecules to trap light / light absorbing pigments /
light dependent reaction / part of light dependent reaction;

2

B – stroma;
(contains enzymes for) carbon dioxide fixation / light-independent reaction /
part of light-independent reaction;
(allow ribosome role of protein in photosynthesis)

2

- (b) (i) C – starch;

1

(ii) from glucose in a condensation / polymerisation reaction / many
glucose molecules joined together;

1

[6]

Q12.

- (a) A – receptor /extrinsic (protein);
Accept glycoprotein/antigen

B – transmembrane/intrinsic/channel/carrier (protein);
Accept hydrophobic tail

C – phospholipid;
Ignore ref. to bilayer

3

- (b) Cell wall;
Accept smaller/70S ribosome(s)

Capsule/slime layer;
Accept DNA without histone

(Bacterial) flagellum;
Reject capsid

Circular DNA/chromosome;

Plasmid;

Mesosome;

2 max

[5]

Q13.

- (a) (i) no cell wall / only has (plasma) membrane; 1
- (ii) has capsule / slime layer; 1
- (b) correct approach which makes use of scalebar; *ignore* reference to units. 1
- (c) cellulose / starch / amylose / amylopectin; 1
- (d) (i) water potential lower / more negative in cell;
(water enters by) osmosis; 2
- (ii) plant cell wall made of a different substance / cellulose / penicillin
does not affect cellulose; 1

[7]

Q14.

- (a) 1. Strands separate / H-bonds break;
1. Q Neutral: strands split
1. Accept: strands unzip
2. DNA helicase (involved);
3. Both strands / each strand act(s) as (a) template(s);
4. (Free) nucleotides attach;
4. Neutral: bases attach
4. Accept: nucleotides attracted
5. Complementary / specific base pairing / AT and GC;
6. DNA polymerase joins nucleotides (on new strand);
6. Reject: if wrong function of DNA polymerase
7. H-bonds reform;
8. Semi-conservative replication / new DNA molecules contain one old
strand and one new strand;
*8. Reject: if wrong context e.g. new DNA molecules contain
half of each original strand*
- 6 max**
- (b) (i) 18;
Do not accept 17.5 1
- (ii) 10; 1
- (iii) 1. Horizontal until 18 minutes;

Allow + / - one small box

2. (Then) decreases as straight line to 0 μm at 28 minutes;
2. Allow lines that start from the wrong place, ending at 0 at 28 minutes

2

- (c) (i) Two marks for correct answer of 19.68 or 19.7;;
Accept 19hrs 41mins

One mark for incorrect answers in which candidate clearly multiplies by 0.82;

Allow one mark for incorrect answers that clearly show 82% of 24 (hours)

2

- (ii) 1. No visible chromosomes / chromatids / visible nucleus;

1

- (iii) **D** (no mark)

1. Lower % (of cells) in interphase / higher % (of cells) in mitosis / named stage of mitosis;

1. Accept: 'less' or 'more' instead of '%'

1. Do not accept: higher % (of cells) in each / all stage(s)

2. (So) more cells dividing / cells are dividing quicker;

2. Accept: uncontrolled cell division

2. Do not award if Tissue **C** is chosen

2

[15]

Q15.

- (a) Three of chromosome 13 / an extra chromosome 13;

Accept trisomy 13

Accept circle around three chromosomes or any other correct indication on **Figure 1**

Do not allow references to any other chromosomes.

Do not accept chromatids for chromosomes.

1

- (b) 1. In meiosis;
2. Homologous chromosomes / sister chromatids do not separate;
2. Accept non-disjunction

2 max

- (c) 1. Mutation / extra chromosome in gamete / egg / sperm (that formed zygote);
2. All cells derived (from a single cell / zygote) by mitosis;

OR

3. All cells derived from a single cell / zygote by mitosis;

4. Mitosis produces genetically identical cells / a clone;

Mark points 1 and 2 **OR** 3 and 4

4. Accept: have same DNA / same alleles

- (d) 1. (Some) oxygenated blood (from the aorta) flows into pulmonary artery;
OR
 Less oxygenated blood flows out through aorta;
OR
 Lower blood pressure in aorta;
2. Less oxygen delivered to cells / tissues / organs / named organ / via named blood vessel;
3. So less / not enough oxygen for aerobic respiration (in cell / tissue / organ);
4. Tissue / organ doesn't grow / develop properly (causing death);
OR
 Tissue dies / organ stops working (causing death);
1. *Accept mixing of deoxygenated with oxygenated blood in pulmonary artery*
 2. *Do not accept "no oxygen"*
 3. *Do not accept "produce energy"*

3 max

[8]

Q16.(a) **C***Auto mark*

1

- (b) 1. No separation of chromatids/chromosomes/centromeres;
Accept anaphase prevented
Accept nondisjunction
Reject homologous pairs
2. Chromatids/chromosomes all go to one pole/end/sides of cell/not pulled to opposite poles;
3. Doubles chromosome number in cell/one daughter cell gets no chromosomes or chromatids;
Accept DNA for chromosomes
Accept ploidy
Ignore references to 'genetic information'
Ignore simple descriptions of what normally happens in mitosis

2 max

- (c) 1. (No, because) at 100 there are still **some** (7%) cancer cells dividing/undergoing mitosis;
Accept idea that all division stops only at 1000
2. So, cancer not destroyed/may continue to grow/spread/form tumours;
Must refer to cancer spreading not cells dividing
3. Best concentration may be between 100 and 1000/need trials between 100 and 1000;
4. This research in culture, don't know effect of KI on people;
Reject 'not tested on humans'
Reject 'done in animals'

5. (Yes, because) above 100 produces little increase in % of cells not dividing/undergoing mitosis/at 100, **most** (93%) cancer cells unable to divide/dead;
Must clearly link lack of monopolar mitotic spindles with cell division
6. Above 100 may be harmful (to body);
Accept 'above 100/high concentrations produce harmful side effects/named effects'
7. Higher concentrations more expensive;
8. (Above 100) will have more effect on (rapidly dividing) cancer cells;
Must relate to 100

4 max

- (d)
1. 10 cm³ of 10 000 nmol dm⁻³/ (original) solution;
 2. 90 cm³ of water;
If ratio correct but make wrong volume e.g. 1 litre, award 1 mark

2

[9]