

1 Woese was the scientist who proposed a classification of organisms into three domains called the Archaea, Bacteria and Eukaryota (Eucarya).

(a) The table below shows some of the characteristics of the three domains.

Characteristic	Domain		
	A	B	C
Mitochondria	Absent	Absent	Present
Cell wall containing peptidoglycan	Yes	No	No
Amino acid carried on tRNA that starts protein synthesis	Formylmethionine	Methionine	Methionine
Sensitive to antibiotics	Yes	No	No
May contain chlorophyll	Yes	No	Yes

(i) Using the information in the table, suggest which of A, B and C represents the Eukaryota domain. Give a reason for your answer.

(2)

Domain

Reason

.....

(ii) Many scientists believe that the Eukaryota domain is more closely related to the Archaea domain than to the Bacteria domain.

Using the information in the table, suggest which of A, B and C represents the Archaea domain. Give a reason for your answer.

(2)

Domain

Reason

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(b) Cells of the Eukaryota domain contain rough endoplasmic reticulum and Golgi apparatus.

Both the rough endoplasmic reticulum and the Golgi apparatus are made up of membrane-bound sacs.

(i) Describe how you would recognise the Golgi apparatus as seen using an electron microscope.

(3)

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2 In the 1990s, a scientist called Woese suggested a new way of grouping organisms into domains.

(a) The table below shows Woese's three domains and gives some of the characteristics of each domain.

Domain	Some characteristics of each domain
P	True nucleus absent Small (70S) ribosomes present Smooth endoplasmic reticulum absent RNA polymerase made up of 14 subunits
Q	True nucleus present Large (80S) ribosomes present Smooth endoplasmic reticulum present RNA polymerase made up of 14 subunits
R	True nucleus absent Small (70S) ribosomes present Smooth endoplasmic reticulum absent RNA polymerase made up of 4 subunits

(i) Place a cross in the box which shows the two domains which are most **distantly related**.

(1)

A P and Q

B P and R

C Q and R

(ii) Place a cross in the box which shows the domain that represents eukaryotic organisms.

(1)

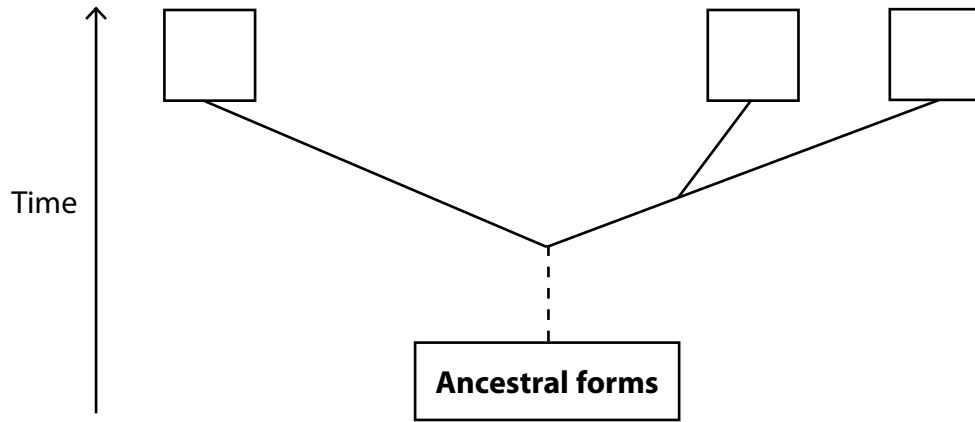
A P

B Q

C R

(iii) The diagram below represents the phylogenetic tree for the three domains.
 Place a cross (×) in the box on the diagram that correctly identifies the eukaryotic domain.

(1)



(iv) Give the name of **one** of the other two domains.

(1)

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(b) One domain includes the plants and these have cells with a cell wall.

*(i) Describe the structure of a plant cell wall.

(4)

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- (ii) A student studied the cell wall arrangement between two adjacent plant cells. He noticed several features which he could not name. Two of these are described in the table below.

Complete the table by writing in the name of each feature described.

(2)

Feature described	Name of feature
Site where there was no cell wall and the cytoplasm linked the two adjacent cells	
Dark line that is the boundary between one cell and the next cell	

(Total for Question 2 = 10 marks)

- 3 Rhododendrons are shrubby plants that are widely distributed throughout the northern hemisphere. The flowering periods and habitats of two species of rhododendron, found on Yakushima Island in Japan, are shown in the table below.

Species	Flowering period	Main flowering period	Habitat
<i>Rhododendron eriocarpum</i>	April to July	May	Rocky areas in lowland regions
<i>Rhododendron indicum</i>	May to July	June	High mountainous regions

Where these populations overlap, hybrid plants are found that have arisen as a result of cross-fertilisation between these two species. These hybrid plants are capable of flowering and producing viable seeds.

- (a) Suggest why some scientists might prefer to classify *Rhododendron eriocarpum* and *Rhododendron indicum* as varieties within the same species rather than as two separate species.

(3)

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- (b) (i) Explain what is meant by the term **genetic diversity** in a species.

(2)

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4 The details of the ultrastructure of a cell can be seen using an electron microscope.

(a) Complete the table below. If the organelle can be present, place a tick (✓) in the box and if the organelle could not be present, place a cross (✗) in the box.

(4)

Organelles	Prokaryotic cell	Eukaryotic cell
centrioles		
flagella		
Golgi apparatus		
ribosomes		

(b) Place a cross ✗ in the box next to the correct word or words to complete each of the following statements.

(i) Plant and animal cells may both contain

(1)

- A** amyloplasts, centrioles and mitochondria
- B** centrioles, mitochondria and rough endoplasmic reticulum
- C** chloroplasts, mitochondria and rough endoplasmic reticulum
- D** mitochondria, rough endoplasmic reticulum and smooth endoplasmic reticulum

(ii) The cytoplasmic connections between one plant cell and another are known as

(1)

- A** middle lamellae
- B** plasmodesmata
- C** pits
- D** tonoplasts

(iii) Prokaryotic cells and plant cells both contain (1)

- A** a cell membrane and chloroplasts
- B** a cell membrane and mesosomes
- C** a cell wall and chloroplasts
- D** a cell wall and ribosomes

(iv) Woese suggested that there are three domains based on evidence from (1)

- A** molecular pharmacology
- B** molecular phylogeny
- C** molecular physiology
- D** phenetic taxonomy

(v) The two domains that contain prokaryotic cells are (1)

- A** Animalia and Bacteria
- B** Archaea and Bacteria
- C** Bacteria and Eukarya
- D** Bacteria and Plantae

(Total for Question 4 = 9 marks)