

## Unit 2

# The Variety of Living Organisms

Classification & Taxonomy

Practice Exam Questions

(a) Fig. 5.1 shows a section of a leaf from a pear tree that is infected by the mildew fungus.

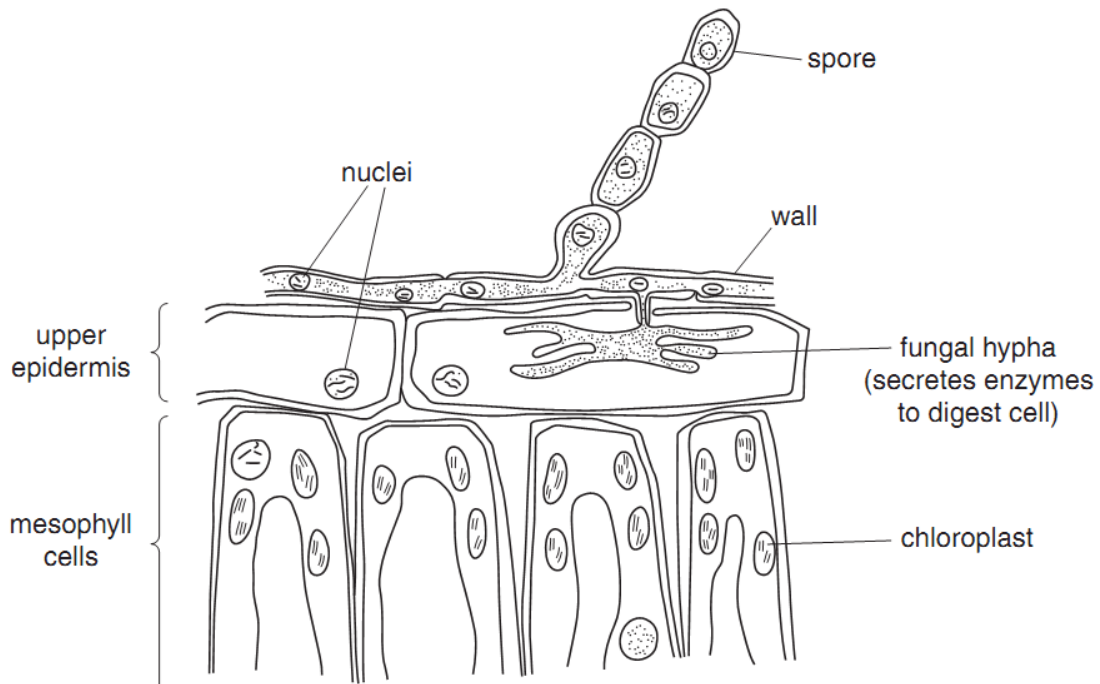


Fig. 5.1

(i) State **one** feature, **shown in Fig. 5.1**, that excludes **both** the pear tree and mildew from the kingdom Prokaryotae.

.....  
 ..... [1]

(ii) State **two** reasons why mildew should be placed in the kingdom Fungi.

.....  
 .....  
 .....  
 ..... [2]

(iii) State **two** reasons why the pear tree should be placed in the kingdom Plantae.

.....  
 .....  
 .....  
 ..... [2]

(iv) Name **two** kingdoms other than Prokaryotae, Fungi and Plantae.

1 .....  
 2 ..... [2]

2 When a new species is discovered, it needs to be classified.

(a) Define the term *classification*.

.....  
 .....  
 .....  
 .....  
 ..... [2]

(b) (i) Suggest what criteria a taxonomist may take into account when classifying a new species.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(ii) Table 2.1 shows the main taxonomic groups. The groups are **not** in the correct order.

**Table 2.1**

	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>
taxonomic group	species	order	class	phylum	genus	kingdom	family

Place the **letters** representing the taxonomic groups into the correct order.

The first one has been done for you.

**V** ..... [3]

In 2002, biologists identified a new group of insects. They called these insects gladiators.

- (a) (i) *Mantophasma zephyra* is one species of gladiator. Complete the table to show how this species is classified.

Kingdom	Animalia
	Arthropoda
	Insecta
	Notoptera
Family	Mantophasmatodae
Species	

(2 marks)

- (a) (ii) This system of classification consists of a hierarchy. Explain what is meant by a hierarchy.

.....  
.....  
.....  
.....

(2 marks)

- (b) In 2002, very few gladiators were available for identification. Scientists around the world used photographs to establish the relationship of gladiators to other insects. Explain how.

.....  
.....

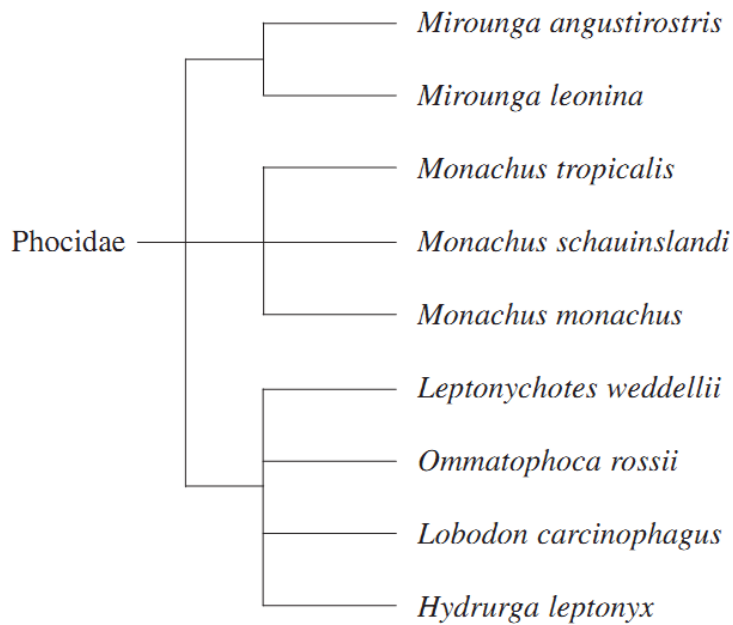
(1 mark)

4

- (a) An order is a taxonomic group. All seals belong to the same order. Name **one** other taxonomic group to which all seals belong.

.....  
 (1 mark)

- (b) The diagram shows how some species of seal are classified.



- (b) (i) How many different genera are shown in this diagram?

(1 mark)

- (b) (ii) All the seals shown in the diagram are members of the Phocidae. Phocidae is an example of a taxonomic group. Of which taxonomic group is it an example?

.....  
 (1 mark)

- (b) (iii) The diagram is based on the evolutionary history of the seals. What does the information in the diagram suggest about the common ancestors of *Mirounga angustirostris*, *Mirounga leonina* and *Monachus tropicalis*?

.....  
 .....  
 .....  
 (1 mark)

Cytochrome c is a protein found in all eukaryotes. In humans it consists of 102 amino acids. Biologists have compared the amino acid sequence in some other species with that in humans. The table shows amino acids 9 to 13 in the amino acid sequences of cytochrome c from four species.

Species	Amino acid in this position in cytochrome c				
	9	10	11	12	13
Human	Ile	Phe	Ile	Met	Lys
Chicken	Ile	Phe	Val	Gln	Lys
Dogfish	Val	Phe	Val	Gln	Lys
Chimpanzee	Ile	Phe	Ile	Met	Lys

- (a) What do the results suggest about the relationship between humans and the other three species?

.....  
.....  
.....  
.....

(2 marks)

- (b) Suggest **one** advantage of using cytochrome c to determine relationships between species.

.....  
.....

(1 mark)

- (c) Comparing the base sequence of a gene provides more information than comparing the amino acid sequence for which the gene codes. Explain why.

.....  
.....  
.....  
.....

(2 marks)

6

Cranes are large birds. One of the earliest methods of classifying cranes was based on the calls they make during the breeding season.

- (a) Explain why biologists could use calls to investigate relationships between different species of crane.

.....

.....

.....

.....

.....

(2 marks)

- (b) More recently, biologists have used DNA hybridisation to confirm the relationships between different species of crane. They made samples of hybrid DNA from the same and from different species. They measured the percentage of hybridisation of each sample. The results are shown in the table.

Species of crane from which hybrid DNA was made			Percentage DNA hybridisation
<i>Grus americana</i>	and	<i>Grus monachus</i>	97.4
<i>Grus monachus</i>	and	<i>Grus rubicunda</i>	95.7
<i>Grus americana</i>	and	<i>Grus rubicunda</i>	95.5
<i>Grus rubicunda</i>	and	<i>Grus rubicunda</i>	99.9
<i>Grus americana</i>	and	<i>Grus americana</i>	99.9
<i>Grus monachus</i>	and	<i>Grus monachus</i>	99.8

- (b) (i) Which **two** species seem to be the most closely related? Explain your answer.

.....

.....

.....

.....

.....

(2 marks)

**(b) (ii)** The biologists measured the temperatures at which the samples of hybrid DNA separated into single strands. Explain why these temperatures could be used to find the percentage of DNA hybridisation.

.....

.....

.....

.....

.....

*(2 marks)*

**(c)** Biologists can also use protein structure to investigate the relationship between different species of crane. Explain why.

.....

.....

.....

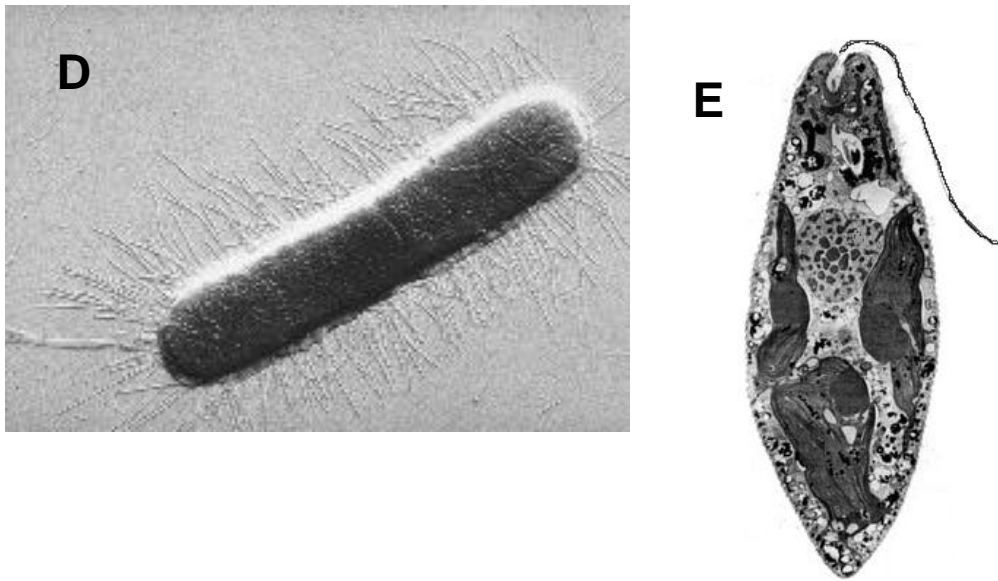
.....

.....

*(2 marks)*



Fig. 4.1 shows two unicellular organisms labelled **D** and **E**. These organisms are members of different kingdoms.



**Fig. 4.1**

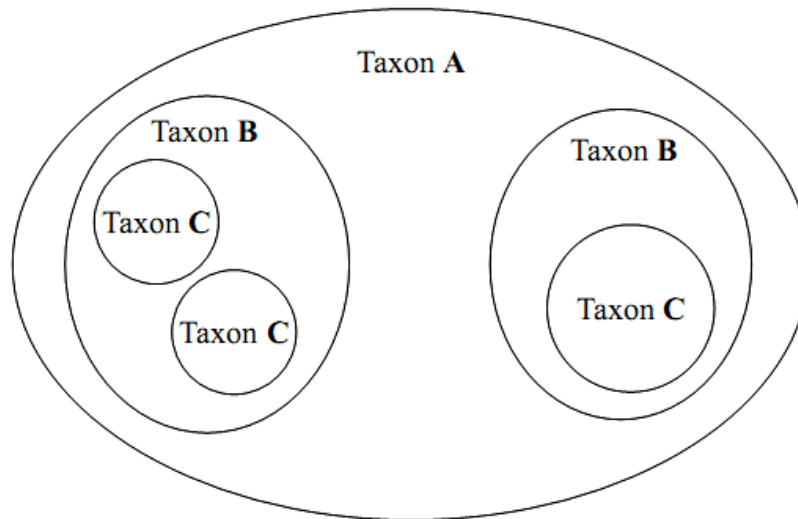
- (a) (i) Study Fig. 4.1 and identify the kingdom to which each organism belongs. Write your answers in the table below.
- (ii) Complete the table by stating two features which are characteristic of the organism in the kingdom you have stated.

	unicell <b>D</b>	unicell <b>E</b>
kingdom		
features	1	1
	2	2

[6]

8

In taxonomy, each of the levels of classification (class, family, genus, kingdom, order, phylum and species) is called a taxon. The diagram represents just three of these levels of classification.



(a) Explain which of these levels of classification could **not** be

(i) a genus; .....

.....

(ii) a phylum. ....

.....

*(2 marks)*

(b) Give **two** features that are characteristic of the kingdom Fungi.

1. ....

.....

2. ....

.....

*(2 marks)*

9

(a) The table gives some features of the cells of organisms from three different kingdoms.

Structure	Animal cell	Plant cell	Prokaryote cell
Mitochondrion			
Cellulose cell wall			
Ribosome			
Large, permanent vacuole			

(i) Complete the table. Put a tick in the box if the structure is present. Put a cross in the box if the structure is not present.

*(3 marks)*

(ii) Give **one** other structure, **not** shown in the table, which is present in cells of organisms in the kingdoms Fungi, Prokaryotae and Protoctista.

.....  
*(1 mark)*

(b) Complete the list to show the different taxonomic groups into which a kingdom can be divided. Write your list in the correct order.

- 1 Kingdom
- 2 .....
- 3 .....
- 4 .....
- 5 .....
- 6 .....
- 7 Species

*(1 mark)*



**Question 2**

Question	Expected Answer	Mark	Additional Guidance
2 (a)	placing, living things / organisms / named organisms, into, groups / categories / taxa / named taxonomic groups ; based on / AW, similarity / difference ;	2	<b>ACCEPT</b> 'grouping living things'  Look for the idea of similar organisms being placed in the same group or different organisms being placed in different groups
2 (b) (i)	<p>1 morphology / anatomy / (observable / physical) features / appearance / AW ;</p> <p>2 biochemistry / cytochrome C ;</p> <p>3 genes / DNA / genetics / RNA ;</p> <p>4 behaviour / physiology / embryology ;</p> <p>5 idea of shared, evolutionary past / phylogeny ;</p>	3 max	<b>ACCEPT suitable examples for mps 1 to 4</b>  <p>1 <b>CREDIT</b> cell features e.g. nucleus / membrane-bound organelles / cell wall / prokaryotic-eukaryotic features / unicellular</p> <p>2 <b>CREDIT</b> component of cell wall</p> <p>3 <b>IGNORE</b> chromosomes</p> <p>4 <b>ACCEPT</b> 'how they feed' / nutrition / 'how they reproduce'</p> <p>5 <b>ACCEPT</b> 'how closely related' <b>IGNORE</b> refs to interbreeding / fertile offspring</p>
2 (b) (ii)	T S R W U Q ; ; ;	3	<b>Mark the order of letters</b> (ignoring the dotted lines) All 6 in correct order = 3 marks If any incorrect, then credit T S in order at beginning = 1 mark U Q in order at end = 1 mark R before W anywhere in the sequence = 1 mark

**Question 3**

Part	Marking Guidance	Mark
(a)(i)	Phylum, Class, Order, Genus;  Mantophasma (M)/(Mantophasma) zephyra;	2
(a)(ii)	Groups within (larger) groups;  No overlap;	2
(b)	Comparison of/look for similar features/structures/appearance;	1

**Question 4**

Part	Sub Part	Marking Guidance	Mark	Comments
(a)		Kingdom/phylum/class;	1	
(b)	(i)	6;	1	
(b)	(ii)	Family;	1	
(b)	(iii)	The two species of <i>Mirounga</i> shared a common ancestor more recently than they did with <i>Monarchus tropicalis</i> ;	1	

**Question 5**

(a)		Most closely (related) to chimpanzee / most recent common ancestor;	1	Allow 'chicken is second' to chimpanzee as equivalent to second mark point.  Allow answers which compare similarity in DNA/genetic material.  Marks should not be awarded for answers which only compare amino acid sequences without any indication of relationships.  Allow 'monkey' for chimpanzee and 'fish' for dogfish
		Least (related) to dogfish / least recent common ancestor;	1	
(b)		Is present in all eukaryotes;	1	
(c)		Reference to base triplet/triplet code / more bases than amino acids / longer base sequence than amino acid sequence;	1	2 max  Different (base) triplets code for same amino acid = 2 marks  Reject different amino acids are formed/produced.  Ignore reference to codon.
		Introns/non-coding DNA;	1	
		Same amino acid may be coded for / DNA code is degenerate;	1	

**Question 6**

(a)	Is species specific / allows recognition of same species;  Greater similarity in calls the closer the relationship (between the species);	2	Accept: 'Similar species have similar calls' as first marking point.  Reference to courtship on its own is not sufficient for a mark.  Must refer to relationship for second marking point.
b)(i)	<i>G. americana</i> and <i>G. monachus</i> ;  Highest percentage (DNA hybridisation) / more bases are similar/complementary / more hydrogen bonds / more base pairings;	2	Second marking point can be awarded without first marking point.
b)(ii)	Higher temperature / more energy (required) the higher the percentage DNA hybridisation / more bases are similar/complementary / more base pairings;  Correct reference to breaking <u>hydrogen</u> bonds / more/less <u>hydrogen</u> bonds being present;	2	Accept: 'The greater the number of hydrogen bonds the higher the temperature/more energy required to break them' for one mark.

**Question 6 continued**

(c)	<ol style="list-style-type: none"> <li>1. More closely related (species) have more similarities in amino acid sequence/primary structure;</li> <li>2. In <u>same</u> protein / named protein e.g. albumin;</li> <li>3. Amino acid sequence is related to (DNA) base/triplet sequence;</li> </ol> <p style="text-align: center;"><b>OR</b></p> <ol style="list-style-type: none"> <li>4. Similar species have a similar immune response to a protein/named protein;</li> <li>5. More closely related (species) produce more 'precipitate' / antibody-antigen (complexes) / agglutination;</li> </ol>	2 max	<p>Accept: 'Similar species have similarities in amino acid sequence' for first marking point.</p> <p>Accept: Converse for marking points 1, 4 and 5.</p> <p>Marking point 5 is for measuring the extent of the immune response.</p>
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**Question 7**

- (a) *kingdoms must match photographs in (i) if bacterium is classified as protocista and Euglena is classified as prokaryote in (i), award marks for features if they are correct for the kingdoms given by the candidate up to max 4 in (ii)*
- (i) *kingdoms*
- |                            |              |          |
|----------------------------|--------------|----------|
| prokaryotae / prokaryotes; | protocista ; | <b>2</b> |
|----------------------------|--------------|----------|
- (ii) *features*
- |   |   |              |
|---|---|--------------|
| no nucleus;<br>no membrane bound organelles;  | nucleus;<br>membrane bound organelles /<br>named membrane bound organelle;                |              |
| no, ER / golgi;   | ER / golgi, present;  |              |
| DNA naked;<br>circular DNA;<br>70S / smaller, ribosomes;<br>cell wall always present; | chromosomes / DNA plus protein;<br>linear/ non circular, DNA;<br>80S / larger, ribosomes; |              |
| pili;<br>diameter cell 0.5 – 5 $\mu\text{m}$ ;<br>mesosome;                           |   | <b>4 max</b> |

**Question 8**

- (a) (i) Taxon **A** – there is more than one level/taxon below it / genus only has species / only has one level / taxon above it;
- (ii) Taxon **C** – there is more than one level/taxon above it / phylum only has kingdom / only has one level taxon above it; **2**
- (b) chitin cell wall; *ignore non – cellulose*  
mycelial habit / hyphae;  
coenocytic / eq.;
- ignore references to being non-photosynthetic, eukaryotic.* **2 max**  
*accept reproduce by spores.*

Total 4

**Question 9**

(a) (i)

Structure	Animal cell	Plant cell	Prokaryote cell
Mitochondria	✓	✓	✗
Cellulose cell wall	✗	✓	✗
Ribosomes	✓	✓	✓
Large, permanent vacuole	✗	✓	✗

1 mark per correct column ;;;

3

(ii) (Cell) (surface) membrane / plasma membrane/ chromosome/ gene;  
*Ignore cytoplasm or named molecules*  
*Reject ER/ Golgi/ lysosomes/nucleus or other eukaryotic organelle*

1

(b) In sequence:

2 Phylum

3 Class

4 Order

5 Family

6 Genus;

1

Total 5