

18.1 Classification

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS class 纲 • species 物种 • kingdom 界 • taxonomic hierarchy 分类层级 • domain 域

Objective

Build the skills to answer exam questions on **classification** — the meaning of **species** 物种, the three **domains** 域, the **taxonomic hierarchy** 分类层级, the four **kingdoms** 界, and how viruses are classified.

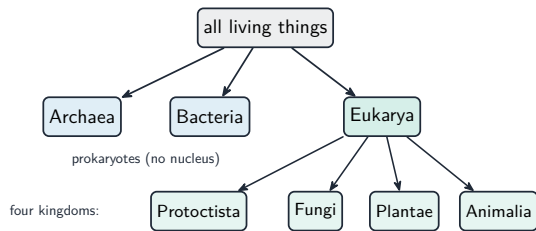
You must be able to:

- discuss the biological, morphological and ecological species concepts
- describe the three domains and the taxonomic hierarchy
- outline the four eukaryotic kingdoms and how viruses are classified

1 Worked examples

■ Species and domains

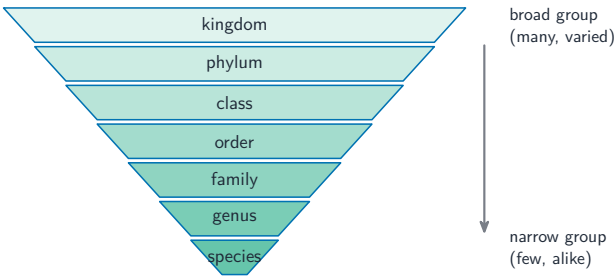
A **species** can be defined by the **biological** (can interbreed to give fertile offspring), **morphological** (look alike), or **ecological** (same niche) concept.



Three domains: Archaea and Bacteria are prokaryotes; the Eukarya split into four kingdoms

Archaea 古菌 and **Bacteria** 细菌 are prokaryotes but differ in membrane lipids, ribosomal RNA and cell-wall make-up. **Eukarya** have a nucleus.

■ The taxonomic hierarchy



Kingdom → phylum → class → order → family → genus → species

The four eukaryotic kingdoms: **Protocista** (mostly single-celled), **Fungi** (absorb food, chitin walls), **Plantae** (photosynthesise), **Animalia** (feed on others). **Viruses** are classified by their **nucleic acid** (DNA or RNA) and whether it is single- or double-stranded.

2 Practice

2.1 State the biological species concept. [1]

2.2 Put these in order from largest to smallest group: family, kingdom, genus, order. [2]

3 Exam-style questions

3.1 To which domain do organisms with a nucleus belong? [1]

- **A** Archaea
- **B** Bacteria
- **C** Eukarya
- **D** Protocista

3.2 Viruses are classified according to:

[1]

- **A** the kingdom they belong to
- **B** the type of nucleic acid and whether it is single- or double-stranded
- **C** their cell wall composition
- **D** the number of chromosomes

3.3 (a) State **two** features that distinguish the kingdom Fungi from the kingdom Plantae.

[2]

(b) Explain why Archaea and Bacteria are placed in separate domains even though both are prokaryotes.

[2]

3.4 Explain a limitation of the biological species concept.

[2]

3.5 The scientific name of the domestic dog is *Canis lupus familiaris*.

(a) Name the taxonomic levels of the hierarchy from domain down to species, in order.

[3]

(b) State the rules of the binomial system, using *Canis lupus* as your example.

[3]

(c) Name the three domains, and give **one** feature that distinguishes each from the other two.

[4]

(d) Explain why classification based on molecular evidence has changed the way organisms are grouped.

[3]

Solutions

2.1 a group of organisms that can interbreed to produce fertile offspring.

2.2 kingdom → order → family → genus.

3.1 C. Organisms with a nucleus are in the Eukarya domain.

3.2 B. Viruses are classified by nucleic acid type and strandedness.

3.3 (a) Fungi feed by absorbing food (not photosynthesis); Fungi have chitin cell walls (Plantae have cellulose).

(b) they differ in their membrane lipids, ribosomal RNA and cell-wall composition, showing they are only distantly related.

3.4 it cannot be applied to organisms that reproduce asexually / to extinct/fossil species / where two groups rarely meet to test interbreeding.

3.5 (a) Domain, kingdom, phylum, class, order, family, genus, species.

(b) The name has two parts: the **genus** first, with a capital letter — *Canis* — and the **species** second, in lower case — *lupus*; the whole name is printed in italics, or underlined when handwritten.

(c) **Bacteria** — prokaryotic, with peptidoglycan in the cell wall. **Archaea** — prokaryotic, but no peptidoglycan and with different membrane lipids and RNA polymerase, closer to eukaryotes. **Eukarya** — cells have a true nucleus and membrane-bound organelles.

(d) Molecular data — DNA and RNA sequences and amino acid sequences — measure ancestry directly, rather than inferring it from appearance; it revealed that the prokaryotes are two deeply distinct groups, which is why the three-domain system replaced the old five-kingdom one; it also separates organisms that merely look alike through convergent evolution from those that are genuinely related.