

Classification & Dichotomous Keys

Key ideas

Taxonomic levels: Domain → Kingdom → Phylum → Class → Order → Family → Genus → Species ("Dear King Philip Came Over For Good Soup")

Binomial nomenclature: *Genus species*: genus capitalized, species lowercase, italicized when typed (underlined when handwritten).

Three domains: Bacteria, Archaea, Eukarya · **Six kingdoms:** Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia

Dichotomous key: pairs of opposite statements about one trait; follow the one that fits until you reach a name.

A The taxonomic hierarchy

3 marks

1. List the eight taxonomic levels from broadest to most specific.

2. Which level contains the most kinds of organisms, and which contains the fewest?

3. Two organisms belong to the same family. Which other levels must they also share?

B Binomial nomenclature

4 marks

4. Which are written correctly? (a) *Homo sapiens* (b) *canis lupus* (c) *Ursus Americanus* (d) *Acer saccharum*

5. What is the genus of the grey wolf, *Canis lupus*?

6. Which pair is more closely related: grey wolf (*Canis lupus*) and coyote (*Canis latrans*), or grey wolf and red fox (*Vulpes vulpes*)? Explain.

7. Rewrite correctly: *ursus Americanus* (American black bear).

C Domains and kingdoms

6 marks

Fill in the cell type and nutrition for each kingdom (1 mark per row).

	Kingdom	Domain	Cell type	Nutrition	Example
8.	Archaeobacteria	Archaea			Methanogens
9.	Eubacteria	Bacteria			<i>E. coli</i>
10.	Protista	Eukarya			Amoeba
11.	Fungi	Eukarya			Mushroom
12.	Plantae	Eukarya			Sugar maple
13.	Animalia	Eukarya			Grey wolf

D Use a dichotomous key: Ontario trees

6 marks

Use the key to identify each specimen. Record the name and the steps you followed.

Specimen A



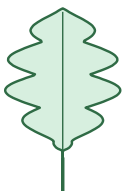
Specimen B



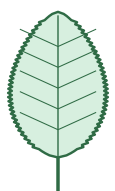
Specimen C



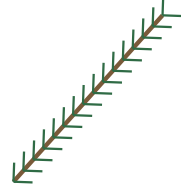
Specimen D



Specimen E



Specimen F



- | | |
|---|---|
| <p>1a Leaves are needles</p> <p>1b Leaves are broad and flat</p> <p>2a Needles grow in bundles of 5</p> <p>2b Needles are attached singly to the twig</p> <p>3a Leaf is compound (made of several leaflets)</p> <p>3b Leaf is simple (one blade)</p> <p>4a Leaf edge is toothed, with no lobes</p> <p>4b Leaf has lobes</p> <p>5a Lobes are pointed and spread from one point</p> <p>5b Lobes are rounded, along a central vein</p> | <p>..... go to 2</p> <p>..... go to 3</p> <p>..... Eastern white pine</p> <p>..... White spruce</p> <p>..... White ash</p> <p>..... go to 4</p> <p>..... Paper birch</p> <p>..... go to 5</p> <p>..... Sugar maple</p> <p>..... White oak</p> |
|---|---|

	Specimen	Tree name	Steps followed (e.g. 1b → 3a)
14.	Specimen A		
15.	Specimen B		
16.	Specimen C		
17.	Specimen D		
18.	Specimen E		
19.	Specimen F		

E Build your own key

4 marks

20. Build a dichotomous key that separates these four Ontario animals: **beaver** (fur, four legs), **Canada goose** (feathers, two legs), **wood frog** (moist skin, four legs) and **garter snake** (dry scales, no legs).

1a _____

1b _____

2a _____

2b _____

3a _____

3b _____

F Why classify?

2 marks

21. Why do scientists use scientific names instead of common names?

22. Archaea and Bacteria are both prokaryotes. Why are they placed in separate domains?

G Spot the mistake

2 marks

23. A student writes the couplet: "1a Has fur → bear; 1b Is large → moose." Explain the error and correct it.

24. A student writes the wolf's scientific name as *Canis Lupus*. Explain the error and correct it.

Classification & Dichotomous Keys**ANSWER KEY**

Date: _____ Score: ____ / 27

Key ideas

Taxonomic levels: Domain → Kingdom → Phylum → Class → Order → Family → Genus → Species ("Dear King Philip Came Over For Good Soup")

Binomial nomenclature: *Genus species*: genus capitalized, species lowercase, italicized when typed (underlined when handwritten).

Three domains: Bacteria, Archaea, Eukarya · **Six kingdoms:** Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia

Dichotomous key: pairs of opposite statements about one trait; follow the one that fits until you reach a name.

A The taxonomic hierarchy**3 marks**

1. List the eight taxonomic levels from broadest to most specific.

Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species

2. Which level contains the most kinds of organisms, and which contains the fewest?

Domain contains the most; species contains the fewest (the most specific).

3. Two organisms belong to the same family. Which other levels must they also share?

Domain, kingdom, phylum, class and order

B Binomial nomenclature**4 marks**

4. Which are written correctly? (a) *Homo sapiens* (b) *canis lupus* (c) *Ursus Americanus* (d) *Acer saccharum*
(a) and (d)

5. What is the genus of the grey wolf, *Canis lupus*?

Canis

6. Which pair is more closely related: grey wolf (*Canis lupus*) and coyote (*Canis latrans*), or grey wolf and red fox (*Vulpes vulpes*)? Explain.

Wolf and coyote: they share the same genus, *Canis*, so they share more classification levels.

7. Rewrite correctly: *ursus Americanus* (American black bear).

***Ursus americanus* (genus capitalized, species lowercase, italicized)**

C Domains and kingdoms**6 marks**

Fill in the cell type and nutrition for each kingdom (1 mark per row).

	Kingdom	Domain	Cell type	Nutrition	Example
8.	Archaeobacteria	Archaea	Prokaryotic	Autotroph or heterotroph	Methanogens
9.	Eubacteria	Bacteria	Prokaryotic	Autotroph or heterotroph	<i>E. coli</i>
10.	Protista	Eukarya	Eukaryotic	Autotroph or heterotroph	Amoeba
11.	Fungi	Eukarya	Eukaryotic	Heterotroph (absorbs food)	Mushroom
12.	Plantae	Eukarya	Eukaryotic	Autotroph (photosynthesis)	Sugar maple
13.	Animalia	Eukarya	Eukaryotic	Heterotroph (ingests food)	Grey wolf

D Use a dichotomous key: Ontario trees

6 marks

Use the key to identify each specimen. Record the name and the steps you followed.

Specimen A



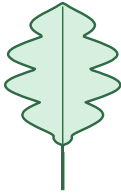
Specimen B



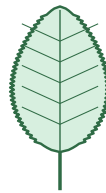
Specimen C



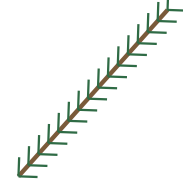
Specimen D



Specimen E



Specimen F



- | | | |
|----|---|--------------------------|
| 1a | Leaves are needles | go to 2 |
| 1b | Leaves are broad and flat | go to 3 |
| 2a | Needles grow in bundles of 5 | Eastern white pine |
| 2b | Needles are attached singly to the twig | White spruce |
| 3a | Leaf is compound (made of several leaflets) | White ash |
| 3b | Leaf is simple (one blade) | go to 4 |
| 4a | Leaf edge is toothed, with no lobes | Paper birch |
| 4b | Leaf has lobes | go to 5 |
| 5a | Lobes are pointed and spread from one point | Sugar maple |
| 5b | Lobes are rounded, along a central vein | White oak |

	Specimen	Tree name	Steps followed (e.g. 1b → 3a)
14.	Specimen A	Sugar maple (<i>Acer saccharum</i>)	1b → 3b → 4b → 5a
15.	Specimen B	Eastern white pine (<i>Pinus strobus</i>)	1a → 2a
16.	Specimen C	White ash (<i>Fraxinus americana</i>)	1b → 3a
17.	Specimen D	White oak (<i>Quercus alba</i>)	1b → 3b → 4b → 5b
18.	Specimen E	Paper birch (<i>Betula papyrifera</i>)	1b → 3b → 4a
19.	Specimen F	White spruce (<i>Picea glauca</i>)	1a → 2b

E Build your own key

4 marks

20. Build a dichotomous key that separates these four Ontario animals: **beaver** (fur, four legs), **Canada goose** (feathers, two legs), **wood frog** (moist skin, four legs) and **garter snake** (dry scales, no legs).

Sample key: 1a Has fur or feathers → go to 2; 1b No fur or feathers → go to 3; 2a Has fur → beaver; 2b Has feathers → Canada goose; 3a Has legs and moist skin → wood frog; 3b No legs, dry scales → garter snake. Award marks for paired, opposite statements about one trait each, with every animal keying out.

F Why classify?

2 marks

21. Why do scientists use scientific names instead of common names?

Common names change between regions and languages (cougar, puma and mountain lion are all *Puma concolor*); a scientific name is unique and used worldwide.

22. Archaea and Bacteria are both prokaryotes. Why are they placed in separate domains?

They differ in cell wall and cell membrane chemistry and in their ribosomal RNA, which shows they are distantly related.

G Spot the mistake

2 marks

23. A student writes the couplet: "1a Has fur → bear; 1b Is large → moose." Explain the error and correct it.

The two statements must be opposites of the same trait. Correct: 1a Has fur / 1b Does not have fur.

24. A student writes the wolf's scientific name as Canis Lupus. Explain the error and correct it.

The species name is lowercase and the whole name is italicized (or underlined): *Canis lupus*.