



# RADLEY

2023 Academic Scholarship Examination Paper

## **BIOLOGY**

22 – 23 February 2023

Time allowed – 30 minutes

Candidate's name: \_\_\_\_\_

### **PLEASE WRITE IN BLACK INK**

#### **Instructions:**

- You will be given a passage to read on a Biological topic. Please study this carefully and use the information in it, and your own knowledge, to answer the questions which follow.
- Write your answers on lined paper, with your name clearly marked at the top of each page.
- You are expected to be able to write accurate, grammatical, well-punctuated prose throughout.
- Dictionaries / Calculators are (not) allowed.

There are 33 marks available for this Examination.

## Bees – Earth’s Pollinators

Like all insects, a bee’s body is divided into three parts: a head with two antennae, a thorax with six legs, and an **abdomen**. All bees have branched hairs somewhere on their bodies and two pairs of wings. Only female bees have stingers (which are modified **ovipositors**, organs originally used to lay eggs). Many bee species have black and yellow coloration, but many do not—they actually come in a variety of colors, including green, blue, red, or black. Some are striped, and some even have a **metallic** sheen. They range in size from large carpenter bees and bumble bees to the tiny *Perdita minima* bee, which is less than two millimeters long.



There are over 20,000 bee species worldwide, including the honey bee, which originated in Eurasia and has been imported around the globe as a **domesticated** species. Wild bees species live on every continent except Antarctica. In North America there are approximately 4,000 native bee species occupying ecosystems from forests to deserts to grasslands.

Bees feed exclusively on sugary nectar and protein-rich pollen from flowering plants, unlike the carnivorous wasps from which they evolved. Though all female bees can sting, they only do so when threatened. Honey bees, with hives filled with honey and larvae that need protecting, are generally more aggressive and likely to sting when disturbed than solitary **native** bees. Bees begin life as eggs, which hatch into larvae the feed and **pupate** and eventually emerge in their adult form, where they visit flowers to gather nectar and pollen.

Unlike the hive-forming domesticated honey bee or wild bumble bee species, most bees are solitary nesters. They don’t form hives, create honey, or live a communal lifestyle. Instead, they lay their eggs in a series of tiny chambers in tunnels in the ground, in hollow plant stems, or in **decaying** wood. Unlike hive-forming bee species, which collectively care for their young, female solitary bees provision their eggs with a ball of nectar and pollen and leave them to grow and pupate on their own with no parental care. However, some species do not build nests at all. These “cuckoo bees” will lay their eggs in nests built by other species. Cuckoo bees will sometimes kill the **host species’** larvae to ensure their own eggs will have enough food to grow to adulthood.

Queen bumble bees can live for a year and workers for a month. **Solitary** bees also live for about a year, with the majority of that time spent developing in their nesting chamber where they hatch, pupate, and often overwinter. Their adult lives, during which they are active, last approximately three to eight weeks. Females tend to live a bit longer, as they need to build a nest and lay eggs.

Both domesticated honey bees and many native bee species are in decline. In fact some species, such as the once-common rusty patched bumblebee, are now listed as **endangered**. Potential causes of these declines include habitat destruction, disease, agricultural and lawn and garden practices, use of pesticides, habitat fragmentation, changes in land use, invasive species, and climate change. Pollinators, notably native bees, are critical to the survival of native plants, other wildlife, and people alike.

*Adapted from the National Wildlife Federation online.*

Using the information in the passage and your own knowledge, answer these questions:

1. What is meant in the passage by the words underlined as follows:

<p><b>i.</b> Abdomen</p> <p><b>ii.</b> Ovipositors</p> <p><b>iii.</b> Metallic</p> <p><b>iv.</b> Domesticated</p> <p><b>v.</b> Native</p>	<p><b>vi.</b> Pupate</p> <p><b>vii.</b> Decaying</p> <p><b>viii.</b> Host Species</p> <p><b>ix.</b> Solitary</p> <p><b>x.</b> Endangered</p>
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[10]
  
2. Name and describe the three main ways in which bees rear their young. [6]
  
3. Bees are insects. The structure of insects is described in the first paragraph. How would the body structure be different in:

<p>(a) Arachnids</p> <p>(b) Mammals</p>	[2+2]
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4. Mammals, Fish and Amphibians are three classes of vertebrate: name the other two. [2]
  
5. Bears are known for eating honey. Starting with the sun, write down a food chain which includes this and other information mentioned in the passage. [2]
  
6. Explain the purpose of the yellow and black colouration many bees have. [2]
  
7. Explain why there are no bees in Antarctica? [1]
  
8. From what ancestor did bees evolve? [1]
  
9. The final paragraph describes a number of reasons why bees are in decline. Write a paragraph to explain which three of these factors you think are the most important and why? What can we do about them? [5]

**TOTAL = 33 MARKS**