



Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. colony
2. castes
3. pheromones
4. parthenogenesis
5. royal jelly
6. bee bread
7. nuptial flight
8. spermatheca

K • 4

Each carries 0.5 mark.

2 Label the diagram

- | | | |
|-----------------------|---|-------|
| 1. antenna | 7. fore wing | K • 5 |
| 2. compound eye | 8. hind wing | |
| 3. proboscis (tongue) | 9. sting | |
| 4. head | 10. pollen basket (with a load of pollen,
on the hind leg) | |
| 5. thorax | | |
| 6. abdomen | | |

Each carries 0.5 mark.

3 Multiple choice

- i. c. drone bee

K • 1

Drones grow from unfertilized eggs, so they have only one set of chromosomes (haploid, 16). Queens and workers have two sets (diploid, 32).

- ii. c. in a gland in the head of the worker

K • 1

Young workers (about 7–11 days old) make royal jelly in the **hypopharyngeal glands** in their heads, and feed it to larvae and the queen.

- iii. c. pupa

U • 1

A pale, still bee-shape with legs and wings forming, inside a capped cell, is a **pupa**. A larva is a legless white grub; an adult moves and has dark, hairy coloring.

- iv. b. haploid, fertile, medium-sized, hairy

U • 1

A drone has one set of chromosomes (haploid), can mate (fertile), is between the queen and the worker in size, and is very hairy.

- v. d. collect pollen from flowers

A • 1

The pollen baskets on the hind legs are where pollen is packed and carried home. Nectar travels in the honey stomach, wax comes from the wax glands and royal jelly from the head glands, so those jobs are not affected.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Parthenogenesis.

- b. MARKING SCHEME

K • 1

✓ To mate with (fertilize) a new queen.



- c. MARKING SCHEME K · 1
✓ Second and third segments, two pairs (four wings).

5 Short answers

- a. MARKING SCHEME U · 2
✓ Any one difference, e.g. a drone is male, grows from an unfertilized egg and is haploid (16); a worker is female, from a fertilized egg, diploid (32).
✓ Any second difference, e.g. a drone has no sting, pollen baskets or wax glands and only mates; a worker has them and does all the work.
- b. MARKING SCHEME U · 2
✓ For bees, pasture means plants in flower; bees feed only on nectar and pollen collected from flowers near the hive.
✓ Without enough flowering plants all year, the bees go hungry, make little honey, and the colony weakens or leaves.
- c. MARKING SCHEME U · 2
✓ During mating, the drone's reproductive organ stays attached to the queen.
✓ It is torn out of his body as they separate, tearing his abdomen, so he dies.
- d. MARKING SCHEME A · 2
✓ The workers choose worker larvae less than three days old and feed them only royal jelly, so they grow into new queens.
✓ The first new queen to come out kills her rivals, mates on her nuptial flight and takes over the control of the hive.

6 Long answer

ANSWER

Work is divided first by caste: the queen only lays eggs and controls the colony with her pheromones; drones only mate with queens; workers do all the other work. Among the workers, the work changes with age: days 1–3 they clean the cells and keep the brood warm; days 4–6 they feed bee bread to older larvae; days 7–11 they make royal jelly and feed it to young larvae and the queen; days 12–17 they make wax and build comb; days 18–20 they guard the hive; after about day 21 they fly out to collect nectar, pollen and water.

MARKING SCHEME

- ✓ The queen lays eggs and controls the hive with pheromones; drones mate with the queen.
- ✓ Workers do all the other work, and their job changes with age.
- ✓ Young workers work inside: cleaning cells and warming the brood, then feeding bee bread and royal jelly to larvae.
- ✓ Then they make wax and build comb, guard the hive, and after about 21 days forage for nectar, pollen and water.

7 Numerical problem

ANSWER

- i. $3 + 6 + 12 = 21$ days.
ii. $12 \div 21 = 4/7$ (more than half).
iii. Drone: $3 + 7 + 14 = 24$ days; worker 21 days; so $24 - 21 = 3$ days apart.
iv. $1,500 \times 30 = 45,000$ eggs.

MARKING SCHEME

- ✓ i. 21 days.
- ✓ ii. $12/21 = 4/7$.
- ✓ iii. $24 - 21 = 3$ days.
- ✓ iv. 45,000 eggs.



8 Think

ANSWER

HA - 2

Until day 3 all larvae are fed royal jelly, so a young worker larva is still the same as a queen larva. The workers just keep feeding it royal jelly (and enlarge its cell), and it becomes a queen. After about three days on bee bread, its body has already started to develop as a worker, and it is too late to change.

MARKING SCHEME

- ✓ Until day 3 every larva is fed royal jelly, so a young worker larva is still the same as a queen larva.
- ✓ After about three days on bee bread its body has already started to become a worker's, and it can no longer become a queen.

9 Activity: A bee watch (at home)

(not marked)

WHAT STUDENTS SHOULD FIND

A foraging bee usually stays with one kind of flower on a trip (bees are flower-faithful), which is what the plant needs: its pollen goes to another flower of the same kind. Expect fewer bees on a cold or cloudy day and more in the warm middle of the morning.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **A Giant Pumpkin (exhibit):** This pumpkin grew only because bees carried pollen from a male flower to a female one.
- **Chiuri (Butter Tree) (garden):** Beekeepers move their hives to chiuri in flower; its nectar makes a light honey.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	14	12	7	2	35

