

THE BRITISH BEEKEEPERS' ASSOCIATION

Founded in 1874

Registered Charity No. 212025

EXAMINATION FOR PROFICIENCY IN APICULTURE

MODULE 6 HONEYBEE BEHAVIOUR

21st March 2015

Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B or 30 minutes on Section C.

Unless stated otherwise questions apply to Honeybees.

Use **BLACK** pen for text. **Black** pencil may only be used for diagrams. **DO NOT USE COLOURS.**

Examiner Use Only

Question	Sec A	B11	B12	B13	B14	B15	C16	C17	Total
Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers. Please write your answers on the question paper.

- Q1 At what age is drone sexually mature?
- Q2 What is the name given to a place where drones meet and mate with queens?
- Q3 What term is used for the mechanism of controlling the environment within the hive?
- Q4 What is sucrose?
- Q5 Name a use of the Nasonov pheromone.
- Q6 What causes eversion in the drone?
- Q7 When normally in the year does the brood exceed the numbers of adult bees?
- Q8 Name one major factor that encourages comb building.
- Q9 When does the process of conversion of nectar to honey commence?
- Q10 What is the optimum temperature to maintain in the brood nest?

PLEASE HAND IN THIS SHEET AT THE END OF THE EXAMINATION

MODULE 6 HONEYBEE BEHAVIOUR

21st March 2015

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers.

Marks

- | | | | |
|-----|-----|---|----|
| Q11 | (a) | Why might a queen be laying only eggs that develop into drones and how can this be recognised? | 6 |
| | (b) | Why might workers lay eggs and how can this be recognised? | 9 |
| Q12 | | A scout bee finds a new source of nectar. Briefly describe the behaviour: (diagrams are not required in this question); | |
| | (a) | of the scout bee after she has collected the nectar from a plant; | 1 |
| | (b) | of the scout bee after entering the hive; | 7 |
| | (c) | of the house bee. | 7 |
| Q13 | (a) | Describe briefly the behavioural trait that is known as 'worker policing' in honeybees. | 4 |
| | (b) | How is this form of social control of benefit to a queen right colony? | 11 |
| Q14 | (a) | List the sequence of the tasks which on average may be performed by a worker bee after she emerges from a cell. (Specific days allotted to the tasks are not required in the answer). | 9 |
| | (b) | What conditions cause variations in these tasks? | 6 |
| Q15 | (a) | What is hive odour and what factors affect it? | 3 |
| | (b) | How do bees recognise and react to potential intruders? | 6 |
| | (c) | How can the response to intruders vary during the season? | 6 |

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

- | | | | |
|-----|-----|---|----|
| Q16 | (a) | Describe the conditions that can lead to swarming. | 10 |
| | (b) | Describe how a swarm prepares and leaves the hive. | 10 |
| | (c) | How do bees in a temporary cluster find and select a new permanent home? | 10 |
| Q17 | (a) | Describe the behaviour of bees involved in pollen collection from the time they collect pollen from the anthers of plants and explain how and why pollen is used and stored in the colony. (The process of pollen packing is not required). | 18 |
| | (b) | Describe the effects of Nosema on honeybee behaviour. | 12 |

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EXAMINATION FOR PROFICIENCY IN APICULTURE

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14th November 2015 Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B or 30 minutes on Section C.

Unless stated otherwise questions apply to Honeybees.

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Question	Sec A	B11	B12	B13	B14	B15	C16	C17	Total
Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers.

Please write your answers on the question paper.

- Q1 Name one condition managed through homeostasis in a honeybee nest.
- Q2 How does a fertile queen determine whether she lays a worker or drone egg within a cell?
- Q3 What colony activity is believed to be associated with the Dorsoventral Abdominal Vibrating Dance?
- Q4 Is hydrolysis employed by the honeybee for evaporation of water or the breakdown of sucrose?
- Q5 Where in the colony are you most likely to find cells of pollen?
- Q6 How might a guard bee detect the presence of a mammal?
- Q7 What is the "mating sign"?
- Q8 State one honeybee behaviour that is used as an indication of the possible presence of AFB.
- Q9 Give one characteristic of a swarm cell.
- Q10 Give the full name of the queen pheromone which encourages bees to cluster in a swarm.

PLEASE HAND IN THIS SHEET AT THE END OF THE EXAMINATION

MODULE 6 HONEYBEE BEHAVIOUR

14th November 2015

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers.

Marks

- | | | | |
|-----|-----|---|----|
| Q11 | (a) | Describe briefly 3 dances a worker honey bee could use to inform other workers of a source of nectar. | 12 |
| | (b) | Other than by dances, list 3 means of communication used within the colony? | 3 |
| Q12 | (a) | Describe water collection in terms of preferred sites and regularity of visits. | 4 |
| | (b) | How do honeybees mark a water source? | 1 |
| | (c) | How is water used in the colony? | 4 |
| | (d) | Describe the interrelationship between nectar, honey and water in the colony in summer and winter. | 6 |
| Q13 | (a) | How does learning through observation help a bee to forage? | 10 |
| | (b) | What is the theory behind the saying "either move a colony less than 3 feet or more than 3 miles"? | 3 |
| | (c) | Give an exception to this rule and how a beekeeper may take advantage of this. | 2 |
| Q14 | (a) | Draw a simple table to compare what would be seen in a colony of honeybees with a drone laying queen and one with laying workers. | 7 |
| | (b) | Under what circumstances is each condition likely to occur? | 6 |
| | (c) | Name 1 pathogen that could cause behavioural changes in a queen. | 1 |
| | (d) | Name 1 pathogen that could cause a colony to become queenless. | 1 |
| Q15 | | Describe briefly when and how a honeybee swarm builds comb in a hollow tree. | 15 |

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

- | | | | |
|-----|-----|--|----|
| Q16 | (a) | Why are honeybees known as good pollinators? | 8 |
| | (b) | Discuss the process of nectar collection and how it is converted into honey and stored within the nest. (description of bee dances is not required). | 22 |
| Q17 | (a) | Describe the swarm preparation activities occurring in the colony leading up to a swarm issuing. | 5 |
| | (b) | Describe the process a swarm goes through from how it organises issuing from a hive through to entering a new home. | 25 |

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EXAMINATION FOR PROFICIENCY IN APICULTURE

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19th March 2016

Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B and 30 minutes on Section C.

Unless stated otherwise questions apply to Honeybees.

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Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers. Please write your answers on the question paper.

- Q1 Name the principal component of queen substance required to stabilise a swarm.
- Q2 With how many drones does a queen typically mate?
- Q3 Why does a young worker bee need to consume more pollen than an old worker bee?
- Q4 What part of the worker bee is used to check the thickness and smoothness of wax comb?
- Q5 What term is given to the chemical signal that enables guard bees to recognise intruders from the same locality among the returning foragers?
- Q6 How does a queen determine whether to lay a fertilized or unfertilized egg in a cell?
- Q7 What term is given to the place where drones usually mate with queens?
- Q8 Bees can be trained to extend their proboscis in response to certain substances by offering them sugar solution. What is the term given to this learning process?
- Q9 Name a parasite which induces workers to progress to foraging duties early?
- Q10 What name is given to pollen that is packed and preserved in the comb?

PLEASE HAND IN THIS SHEET AT THE END OF THE EXAMINATION

MODULE 6 HONEYBEE BEHAVIOUR

19th March 2016

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers.

Marks

- | | | | |
|-----|-----|---|---|
| Q11 | (a) | Briefly outline how nectar is converted to honey. | 7 |
| | (b) | What is trophallaxis? | 1 |
| | (c) | Briefly describe how trophallaxis increases water foraging during a prolonged nectar dearth? | 7 |
| Q12 | (a) | Briefly list the factors that would encourage a swarm to occupy a cavity. | 7 |
| | (b) | How might the swarm utilise propolis to overcome deficiencies in the cavity? | 3 |
| | (c) | How does the worker collect and manipulate propolis? | 5 |
| Q13 | (a) | Draw a simple graph showing the worker and brood population throughout the year (assuming the colony does not swarm). Label the graph axes. | 8 |
| | (b) | Briefly explain when the colony would be most likely to swarm and why. | 7 |
| Q14 | (a) | List the activities that a typical worker honeybee may do throughout its life in the active season and at what age it might be expected to do them. | 8 |
| | (b) | What is this age-related division of labour called? | 1 |
| | (c) | Briefly describe how worker activities differ from those above in response to the cold of Winter. | 6 |
| Q15 | (a) | List the factors that may lead to supersedure. | 5 |
| | (b) | Explain why laying workers occur. | 4 |
| | (c) | Outline the honeybee behaviour preventing laying workers becoming a problem in a queenright colony. | 6 |

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

- | | | |
|-----|---|----|
| Q16 | Describe the mechanisms by which a foraging honey bee finds her way back to the colony entrance and how this is affected by experience. | 30 |
| Q17 | Discuss how information about location of nectar sources is communicated by foragers to other honey bees and how this might vary. | 30 |

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EXAMINATION FOR PROFICIENCY IN APICULTURE

MODULE 6 HONEYBEE BEHAVIOUR

12th November 2016 Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B and 30 minutes on Section C.

Unless stated otherwise questions apply to Honeybees.

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Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers. Please write your answers on the question paper.

- Q1 When, for honeybee colonies in the UK, is the population of adult bees at a minimum?
- Q2 Give one way that a colony of honeybees uses propolis.
- Q3 At what point in the development of a queen cell is a prime swarm most likely to leave?
- Q4 Name a process that honey bees use to convert nectar to honey.
- Q5 How do bees use 2-heptanone?
- Q6 Give a behavioural characteristic of a guard bee.
- Q7 Give a condition that can lead to a queen being superseded.
- Q8 Give the technical term for food sharing.
- Q9 Name a behaviour that benefits the honeybee superorganism but not the individual bee.
- Q10 Name a disease that the worker bees attempt to control by removing dead larvae from cells.

PLEASE HAND IN THIS SHEET AT THE END OF THE EXAMINATION

MODULE 6 HONEYBEE BEHAVIOUR

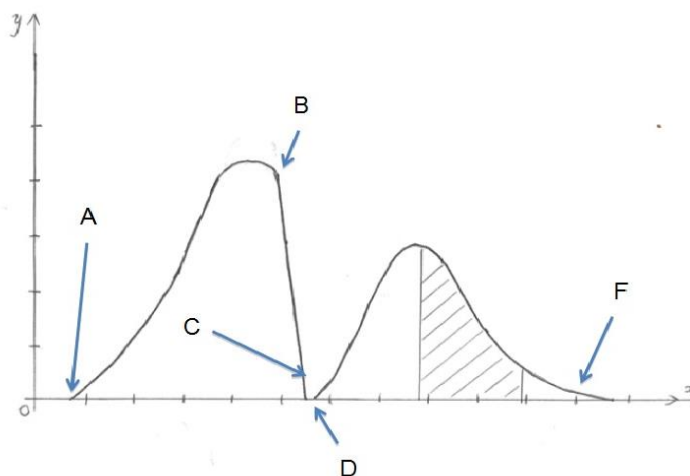
12th November 2016

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers.

Marks

- Q11 (a) Define the term polyethism. 1
 (b) List the duties that a worker honeybee performs between her emergence in April until her death and the average ages these duties occur? 7
 (c) How do these duties differ for a worker honeybee emerging in October until her death? 7
- Q12 (a) Name 5 different dances used by the honeybee. 5
 (b) Briefly describe 2 of the dances involved in locating a new nest site. 10
- Q13 (a) Why is pollen required by honeybee colonies? 5
 (b) Describe the regulatory mechanisms that controls the amount of pollen collected by foragers. 10
- Q14 (a) What conditions lead to a queen becoming a drone layer? 4
 (b) What conditions lead to laying workers? 3
 (c) Tabulate the characteristics of these two conditions. 8
- Q15 The graph shows the typical variation of an important aspect of the **life cycle** of a honeybee colony.



- (a) Briefly describe what the graph represents. 2
 (b) What does each gradation on the x-axis represent? 1
 (c) What does each gradation on the y-axis represent? 1
 (d) What happened at the point A? 1
 (e) What happened at the point B? 1
 (f) What happened at point D? 1
 (g) What happened at point F? 1
 (h) Why is the shaded area so important to the survival of the colony? 1
 (i) What would be seen if the colony was examined at point C? 4
 (j) What is the risk involved in opening the colony at that point? 1
 (k) How could this risk be reduced? 1

MODULE 6 HONEYBEE BEHAVIOUR

12th November 2016

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

Marks

- | | | | |
|-----|-----|---|----|
| Q16 | (a) | What are the preferred properties of a cavity that could provide a new home for a honeybee swarm? | 8 |
| | (b) | Why is being draughty not a prohibitive property of a selected cavity? | 1 |
| | (c) | How do scout bees determine the internal capacity of a possible new home? | 3 |
| | (d) | Describe how the swarm selects a new home. | 10 |
| | (e) | Describe how a swarm moves to its new permanent home. | 8 |
| Q17 | (a) | How do honeybees use wax comb? | 6 |
| | (b) | What factors initiate comb building? | 4 |
| | (c) | Describe how bees construct new comb. | 10 |
| | (d) | What would this comb look like? | 10 |

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EXAMINATION FOR PROFICIENCY IN APICULTURE

MODULE 6 HONEYBEE BEHAVIOUR

18th March 2017

Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B and 30 minutes on Section C.

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Question	Sec A	B11	B12	B13	B14	B15	C16	C17	Total
Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers. Please write your answers on the question paper.

- Q1 Give one example of a role performed by only a small proportion of the workers of a particular age.
- Q2 What does the term "trophallaxis" describe?
- Q3 At what age (in days after emergence) does a worker bee typically become a forager?
- Q4 Name the enzyme involved in the conversion of nectar to honey that results in the production of hydrogen peroxide.
- Q5 At what age (after emergence) does a drone become sexually mature?
- Q6 How is propolis unloaded from the forager that collected it?
- Q7 What does the term "Homeostasis" mean as applied to the internal environment of the hive?
- Q8 What hygienic behavioural trait is found in AFB resistant colonies?
- Q9 What do you understand by the term "worker policing"?
- Q10 Give one example of a major change in the behaviour of an adult bee infected with the sac brood virus.

PLEASE HAND IN THIS SHEET AT THE END OF THE EXAMINATION

MODULE 6 HONEYBEE BEHAVIOUR

18th March 2017

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers. Marks

- Q11 (a) Give three reasons why a queen might inspect a cell before laying in it. 3
(b) Outline how a queen's egg laying behaviour varies throughout the year with respect to the changing circumstances both within and outside the hive. 8
(c) Describe three different conditions that can result in a queen becoming a drone layer. 4
- Q12 (a) Outline four different ways foragers collect pollen from the anthers of flowers. 4
(b) Why is pollen turned into bee bread and how is this achieved? 4
(c) State two uses of pollen by honeybees. 2
(d) What factors within the hive regulate the amount of pollen collected? 2
(e) Outline the feedback mechanism involved. 3
- Q13 (a) Describe the characteristic "stance" of a guard bee "on patrol" at the entrance of a hive. 2
(b) Describe how guard bees at the hive entrance recognise nest mates. 2
(c) Having recognised a potential robber or predator describe the aggressive behaviour of a guard bee. 3
(d) List three stimuli likely to cause guard bees to sting an intruder. 3
(e) How are other workers in the colony recruited to join the guards in the defence of the colony. 2
(f) Worker bees may inadvertently drift to the entrance of an adjacent hive. Describe:
(i) the behaviour of a young "intruder" returning from an orientation flight; 2
(ii) the behaviour of a nectar or pollen laden "intruder". 1
- Q14 (a) What do you understand by the term "supersedure"? 1
(b) List the conditions likely to lead to:
(i) supersedure; 7
(ii) swarming. 7
- Q15 The brood nest temperature is around 35°C. How do bees maintain the brood nest temperature when the:
(a) temperature of the external environment rises? 6
(b) temperature of the external environment falls? 9

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

- Q16 (a) List three features of an "ideal" nest site for a swarm? Explain why each of these features is important for the success of the future colony? 3
(b) A colony is about to swarm for the first time that year. Describe the sequence of behavioural events that occur in the colony during the week prior to swarming and over the following week in the swarm. 27
- Q17 Write an account of the role dances play in a honey bee colony. Include in your account descriptions of the dances performed, the information being communicated and the responses elicited in other members of the colony. Credit will be given for diagrams or illustrations where used appropriately. 30

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11th November 2017 Time Allowed 1½ hours

Candidate Number:

Instructions to Candidates

Read the questions carefully. Answer All Sections. It is recommended not to spend more than 10 minutes on Section A, 50 minutes on Section B and 30 minutes on Section C.

Unless stated otherwise questions apply to honey bees.

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Question	Sec A	B11	B12	B13	B14	B15	C16	C17	Total
Mark									
Moderated									

SECTION A (10 marks, 1 for each question)

Answer **ALL** the questions in this section. Use one or two word or short phrase answers. Please write your answers on the question paper.

- Q1 Can laying workers fly?
- Q2 How is propolis carried back to the hive?
- Q3 Give one factor that can reduce the queens egg laying.
- Q4 Which pheromone stabilizes the swarm cluster?
- Q5 What temperature is the core of the winter cluster maintained at if there is no brood?
- Q6 How many days after emergence is the queen likely to take her first mating flight?
- Q7 Which enzyme is used in the breakdown of sucrose to glucose and fructose?
- Q8 Give a reason why a queen may be superseded?
- Q9 State one way a guard bee can recognise an intruder bee.
- Q10 What is bee bread?

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MODULE 6 HONEY BEE BEHAVIOUR

11th November 2017

SECTION B (60 marks, 15 for each question)

Answer any **FOUR** questions from this section. Write short notes for your answers. Marks

- Q11 (a) Briefly describe the factors contributing to swarming. 10
(b) What factors are important in the choice of a new colony home? 5
- Q12 (a) Name 5 different dances used by honey bees. 5
(b) Briefly describe 2 of the dances involved in foraging. 10
- Q13 Briefly describe how laying workers occur in a honey bee colony and the conditions leading to their development. 15
- Q14 (a) What is homeostasis? 1
(b) List 3 conditions controlled by homeostasis. 3
(c) How do honey bees ventilate their nest in summer? 6
(d) How do honey bees in a hive maintain the temperature of the nest in winter? 5
- Q15 (a) Briefly describe how nectar is collected and transported to the hive. 2
(b) How is this nectar processed to provide a food store for later use? 8
(c) To what use is propolis put by the colony. 5

SECTION C (30 marks)

Answer **ONE** question from this section. Give *labelled* diagrams where applicable.

- Q16 (a) Describe the uses of water in a honey bee colony, including what mechanisms regulate it's collection. 10
(b) Describe the effects of the following pathogens on honey bee behaviour:
(i) nosema; 12
(ii) sac-brood virus. 8
- Q17 (a) What factors initiate comb building? 5
(b) Describe, with the aid of diagrams, how comb is constructed. 25