

**Answer Guidance for Parts B and C**

**Part B**

<p>1a Why is it desirable to monitor the levels of Varroa mite infestation in a colony of honey bees? (1)</p>	<p>To assess the number of mites in the colony to ensure it does not go to a level which becomes dangerous to the health of the colony.</p>
<p>1b Describe in detail how a sugar roll can be carried out, to monitor for varroa mites. (11)</p>	<ul style="list-style-type: none"><li>• Make sure everything is dry and do not spray the bees, so that icing sugar does not ‘clump’ up.</li><li>• Jar with mesh lid</li><li>• 300 adult bees put into the jar.</li><li>• Handful icing sugar in jar</li><li>• Roll jar for 2 minutes so bees are covered in the icing sugar.</li><li>• Leave in shade for 3 minutes</li><li>• Roll again for 1 minute</li><li>• Tip sugar (and mites) through mesh</li><li>• Into shallow clear glass bowl of water</li><li>• Place Over white surface</li><li>• Count mites</li><li>• Release bees back into the colony.</li></ul>
<p>1c How can the results be interpreted? (3)</p>	<ul style="list-style-type: none"><li>• Results can be fairly accurate.</li><li>• 3 mites per 100 bees or less is acceptable.</li><li>• 5 mites or more per 100 bees is a serious infestation.</li><li>• Plan treatments/manipulations based on the % varroa found.</li></ul>

Module 3 – section 3 – Guide Answers

<p>2a) At what stage in the honey bee's development does Varroa enter a cell? (1)</p>	<p>Just before a brood cell is sealed</p>
<p>2b) State how the mite detects the correct time to enter the cell. (2)</p>	<p>It is able to detect the brood pheromones These peak just before cell sealing, which is signalling to the house bees to come and cap the cell</p>
<p>2c) Describe a method of trapping a queen to ensure that she can only lay on one frame. (2)</p>	<p>Use a Queen excluder frame, this is a container made of queen excluder material big enough to house a brood frame. Place frame of empty drawn comb into the cage and place the queen inside as well.</p>
<p>2d) Describe in detail how this method may be used to substantially reduce the number of mites in the colony without using chemicals. (9)</p>	<ul style="list-style-type: none"> <li>• Trap queen on comb for 9 days using a cage like above.</li> <li>• Queen lays on this frame and after 9 days there is a lot of open brood, ready to be capped.</li> <li>• Remove frame from the hive and destroy or freeze to kill the mites.</li> <li>• Trap queen on a second comb for a further 9 days and again remove and destroy</li> <li>• Trap queen on third comb for a further 9 days and again remove and destroy</li> <li>• There has now been 27 days where all the brood that existed before the queen was trapped has emerged and all brood while the queen has been trapped has been destroyed. This has removed a large portion of the phoretic mites.</li> </ul>
<p>2e) What would govern the timing of this procedure? (1)</p>	<p>Not done at a time of year when the colony is dependent upon winter bees (late spring) nor producing the winter bees (August onwards).</p>

Module 3 – section 3 – Guide Answers

<p>3a) What is understood by the term 'parasitic mite syndrome' (PMS)? (6)</p>	<p>Term originally coined in the USA</p> <p>Collection of signs</p> <ul style="list-style-type: none"> <li>▪ Dead brood.</li> <li>▪ Perforated cell cappings</li> <li>▪ Emerging bees dead with proboscis extended which are badly deformed when examined.</li> <li>▪ Deformed bees.</li> <li>▪ Bees with DWV.</li> <li>▪ May be other diseases eg Sac brood, chalk brood.</li> <li>▪ Dwindling colony.</li> <li>▪ Colony may be bad tempered.</li> </ul>
<p>3b) Suggest reasons why this may occur? (4)</p>	<ul style="list-style-type: none"> <li>• It is thought that the condition is a result of a high Varroa population.</li> <li>• This reduces the immune system of the bees (and the colony)</li> <li>• Colony is stressed.</li> <li>• Effect of severe infestation by Varroa allowing other pathogens to occur</li> <li>• Inadequate treatment for Varroa</li> <li>• Resistance of varroa to chemical treatments</li> </ul>
<p>3c) State various ways in which this condition may be prevented. (5)</p>	<ul style="list-style-type: none"> <li>• Monitor for Varroa</li> <li>• Control Varroa using IPM</li> <li>• Apply chemical treatments at the correct time</li> <li>• Rotate the use of any chemicals so that resistance does not develop</li> <li>• Keep colonies strong and free of other diseases.</li> <li>• Keep colonies stress free eg feed when a dearth of forage, keep queen right, etc.</li> </ul>

Module 3 – section 3 – Guide Answers

<p>4. a) Name three ways in which Oxalic acid can be used to treat for varroa? (3)</p>	<ul style="list-style-type: none"> <li>• Spraying</li> <li>• Trickling</li> <li>• Sublimation</li> </ul>
<p>4b) Why is Oxalic acid used in a broodless period? (1)</p>	<ul style="list-style-type: none"> <li>• Oxalic kills open brood</li> </ul>
<p>4c) Give two examples of when this might be. (2)</p>	<ul style="list-style-type: none"> <li>• Use in winter / in cold period when queen is not laying</li> <li>• To treat recently housed warms .</li> <li>• During an induced brood break /queen caging</li> <li>• After a shook swarm has been done.</li> <li>• On the ‘swarmed’ part of the split colony after a Pagden/artificial swarm has been carried out.</li> </ul>
<p>4d) Name two authorised oxalic acid products. (1)</p>	<ul style="list-style-type: none"> <li>• Apibioxal</li> <li>• Oxybee</li> <li>• Oxuvar</li> <li>• Dany’s Bienenwohl Powder</li> <li>• Varromed is a combination of oxalic and formic acid</li> </ul>
<p>4e) Describe how powdered Oxalic Acid (for example Api Bioxal) is used for the trickling method including how it is made up from the powder, how it is applied to a colony and what precautions should be taken. (8)</p>	<ul style="list-style-type: none"> <li>• The powder needs to be dissolved in a syrup solution.</li> <li>• Make up the syrup solution to the volume and concentration recommended by the manufacturer.</li> <li>• May need to gently heat the solution to completely dissolve the sugar.</li> <li>• Allow the solution to cool.</li> <li>• Add the powder – may need to wear a mask and goggles as the powder is very fine and may rise into the air as it is being added to the syrup.</li> <li>• Stir well to make sure dissolved and evenly concentrated.</li> <li>• Place into a smaller container ready to take to the apiary site.</li> <li>• Keep solution at about 25C so the bees do not get a ‘thermal shock’ when the liquid is used on them. Use a hot water bottle.</li> <li>• Transfer 50ml into syringe/trickle bottle/automatic syringe</li> <li>• Remove roof and crown board.</li> </ul>

Module 3 – section 3 – Guide Answers

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|  | <ul style="list-style-type: none"><li>• Trickle 5mls between the frames (seams) evenly.</li><li>• Do not have hive open longer than necessary.</li><li>• Remove brace comb only if it stopping the crown board sit flat, else leave.</li><li>• Use acid resistant gloves and protective glasses / plus mask when handling the powder</li><li>• Optimal above 3°C</li><li>• Do not use when open brood present</li></ul> |
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Module 3 – section 3 – Guide Answers

<p>5a) Give 3 methods of monitoring mite levels in a colony other than drone uncapping. (3)</p>	<ul style="list-style-type: none"> <li>• Mesh floor – counting dead varroa and working out the natural mortality rate.</li> <li>• Alcohol wash.</li> <li>• Sugar roll.</li> </ul>
<p>5b) Describe how to perform drone uncapping and explain how it is used to monitor varroa levels. (6)</p>	<ul style="list-style-type: none"> <li>• Look for a brood frame which has a good size patch of capped drone brood.</li> <li>• The drone brood needs to have developed to the advanced pupal stage (pink eyes) – about day 20 from egg laid.</li> <li>• Use the uncapping fork to push into the patch of drone brood parallel with the main surface of the comb and at the surface level of the normal drawn comb.</li> <li>• Skewer 20 or 30 drone cells.</li> <li>• Lever the fork upwards, using a side-to-side rocking motion, so the drone cells are broken but a hole is NOT created in the frame.</li> <li>• Inspect the drone pupa carefully, varroa will move quickly to hide.</li> <li>• Not all the varroa will be dark red, some will be white/translucent.</li> <li>• Look for signs of varroa faeces.</li> <li>• Count the varroa seen and count the number of pupa that have been skewered.</li> <li>• Work out the % infestation rate.</li> <li>• If more than 5% - treatment is required. 3% is acceptable.</li> <li>• For accuracy more than 300 drones should be uncapped.</li> </ul>
<p>5c) Explain the disadvantage of this method of monitoring for mites. (2)</p>	<ul style="list-style-type: none"> <li>• Drones are killed.</li> <li>• Not an accurate measure unless more than 300 drones are uncapped.</li> <li>• Gauging the age of the pupa, prior to uncapping can be difficult for the less experienced beekeeper.</li> </ul>
<p>5d) The National bee Unit recommend monitoring at least 4 times a year. List these. (4)</p>	<ul style="list-style-type: none"> <li>• Early spring</li> <li>• After the spring honey flow</li> <li>• At the time of the honey harvest</li> <li>• Late autumn.</li> </ul>

**Part C answers**

<p>1a) Describe the development of a female Varroa mite (<i>Varroa destructor</i>) from the time the egg is laid to when the mature mite is ready to reproduce. Include the time periods at various stages and feeding. (16)</p>	<ul style="list-style-type: none"> <li>• Protonymph emerges from egg</li> <li>• After approx. 1 day</li> <li>• Feeds on fat body of pupa</li> <li>• From hole made by mother</li> <li>• after 1-2 days moults to deutonymph</li> <li>• 3-4 days final moult to adult</li> <li>• Total time 6 – 7 days</li> <li>• Mates with male mite in cell</li> <li>• Exits with bee</li> <li>• Enters phoretic stage</li> <li>• Remains in colony for few days</li> <li>• Attached to adult bee</li> <li>• Favours nurse bees</li> <li>• Usually on ventral side of abdomen</li> <li>• Pierces cuticle of the bee.</li> <li>• Feeds on fat body</li> <li>• Detects brood pheromone from larva that is ready for cell to be capped.</li> <li>• Enters a new brood cell</li> </ul>
<p>1b) How many female varroa mites emerge, on average, from:</p> <p style="padding-left: 40px;">A worker cell (1)</p> <p style="padding-left: 40px;">A drone cell (1)</p>	<ul style="list-style-type: none"> <li>• 1.7 to 2.0</li> <li>• 3 to 4</li> </ul>
<p>1c) What happens to the remainder of the mites produced? (3)</p>	<ul style="list-style-type: none"> <li>• Some early ones simply die</li> <li>• Later ones fail to mature</li> <li>• Male mite dies in cell</li> </ul>

Module 3 – section 3 – Guide Answers

<p>1d) State why the phoretic stage is important to</p> <ul style="list-style-type: none"><li>• The mite (2)</li> <li>• The beekeeper (2)</li></ul>	<ul style="list-style-type: none"><li>• Mite may migrate to another colony</li><li>• Mite may move from bee to bee to find a nurse bee.</li> <li>• Mites are accessible for monitoring</li><li>• Phoretic mites are vulnerable to chemicals</li></ul>
<p>1e) What species of bee was the original host for Varroa and where is it found?</p> <p>How did it transfer to Apis mellifera and move around the world?</p> <p>(5)</p>	<ul style="list-style-type: none"><li>• Apis cerana</li><li>• The far East</li> <li>• When cerana and mellifera colonies were brought into close proximity</li><li>• Beekeepers moved colonies around the world</li><li>• International market in queens and bee packages.</li></ul>



Module 3 – section 3 – Guide Answers

<p>2a) Name the two groups of control methods used against varroa. (2)</p>	<ul style="list-style-type: none"> <li>• biotechnical</li> <li>• medicinal/chemical</li> </ul>
<p>2b) What is the name used when the above two methods are combined? (1)</p>	<ul style="list-style-type: none"> <li>• Integrated Pest management (IPM)</li> </ul>
<p>2c) For the 4 acaricides below state the active ingredient. (4)</p> <ul style="list-style-type: none"> <li>• Apistan</li> <li>• MAQS</li> <li>• Oxuvar</li> <li>• Apivar</li> </ul>	<ul style="list-style-type: none"> <li>• Tau – fluvalinate</li> <li>• Formic acid</li> <li>• Oxalic acid</li> <li>• Amitraz</li> </ul>
<p>2d) Name two varroacides which should not be used in the UK because of resistance</p> <p>and give three ways in which a beekeeper might contribute to the build-up of resistance.</p> <p>(4)</p>	<ul style="list-style-type: none"> <li>• Bayvarol</li> <li>• Apistan</li> <li>• Repeatedly using the same Varroacides.</li> <li>• Using Varroacides which have the same mode of action.</li> <li>• Leaving Varroacides in the hive too long</li> </ul>
<p>2e) Name five aspects of an IPM strategy and say at what point in the season each can be used. (6)</p>	<ul style="list-style-type: none"> <li>• Open mesh floor/all year</li> <li>• Drone brood removal / spring once drones appear</li> <li>• Artificial swarm / spring/ once swarm season begins</li> <li>• Comb trapping/ late May - July /once colony established and before winter bees are produced</li> <li>• Shook swarms late May - July /once colony established and before winter bees are produced</li> </ul>
<p>2f) An artificial swarm can be used to reduce varroa levels. Explain how this is</p>	<ul style="list-style-type: none"> <li>• Only suitable during swarm season</li> <li>• Move parent colony to side approx. 3-4 m</li> </ul>

done, any limitations and any precautions the beekeeper should take.  
(13)

- Place second hive of newly drawn comb on original site foragers will return to this artificial swarm
- Take queen from parent colony and place in swarm brood box on original site

**‘Swarm’ colony (with old queen)**

- As precaution place QE under brood box to prevent absconding
- This has queen, flying bees and no brood.
- Treat the bees using an approved Oxalic acid-based treatment – trickle or sublimation.
- Or place in the hive a frame containing open brood.
- Phoretic larva will go into the open brood cells just prior to capping.
- When all the cells are capped, the frame can be removed and destroyed.
- Remove QE from under brood box after 1 week – when queen is laying.

**Parent colony (with queen cell)**

- After 9 days leave one queen cell in parent colony remove all others
- Colony has queen cell, brood and no foragers, but house bees will become foragers as they age.
- To reduce Varroa population two or three frames of open brood can be removed as it is capped and replaced with foundation. This will remove some of the mites which had been phoretic mites on the house bees.
- Do not remove too much brood as this will weaken the colony too much.