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| 1a) Describe in detail the key factors that help identify the Asian Hornet (6) | • Predominantly black insect.<br>• Yellow “Face”<br>• Legs are black near the thorax but yellow at the ends.<br>• Yellow 4th Abdominal Segment.<br>• Length approx. 25mm for worker, 30mm for queen.<br>• Distinctive hawking behaviour at bee hives. |
| 1b) Outline the lifecycle of the Asian Hornet: (9) | • Mated Queen hibernates over winter.<br>• Queen establishes a primary nest<br>• The primary nest is generally low down.<br>• Queen fully supports the first generation(s) of eggs/larva/pupa.<br>• When new workers are sufficient in number, they take over raising the brood.<br>• Larvae are fed meat by the workers and produce a secretion high in nutrients, especially carbohydrate, that feeds the adults.<br>• After pupation and metamorphosis, the adult workers emerge.<br>• The colony may establish a secondary nest, typically high up in a tree and move from the primary nest.<br>• Towards the end of the summer, the colony will start to produce reproductive adults, queens and males (Gynaes) and reduce worker production.<br>• Virgin queens mate and may then relocate a distance away, find a dry, secluded spot and over winter in full hibernation. |

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| 2a) Describe in detail the key factors that help identify the Small Hive Beetle. (5) | **Adult**<br>• Dark brown/Black in colour<br>• approx 6mm long and 4mm wide.<br>• Antennae have very characteristic bulbs at the end.<br>• Adults photophobic, run away from the light, and hide in crevices.<br>**Larva**<br>• Creamy white in colour.<br>• Shaped similar to Wax moth larva<br>• Appro 10mm long<br>• 3 pairs of legs at head end.<br>• Pairs of spines running full way down the dorsal (upper) surface.<br>• Larvae attack both brood and stores of honey & pollen, creating a fermenting mess in the hive. |
| 2b) Outline the lifecycle of the Small Hive Beetle (10) | • The small hive beetle has a classical beetle life cycle, with complete metamorphosis.<br>• Adults fly to find a new host colony (or place where honey is stored), to live in.<br>• Eggs are laid in quiet corners of the bee hive.<br>• Eggs are pearly white and 1.5 – 2.6mm in size<br>• Eggs are laid in clusters and the Queen can lay 1,000 to 2,00 eggs in total<br>• Larvae emerge and will feed on brood pollen and honey, causing considerable damage and destruction to the bee colony.<br>• Larvae undergo several moults during development.<br>• Once mature, the larvae will leave the colony, drop to the ground and move away to pupate in sandy soil.<br>• Larva pupates in the soil.<br>• After metamorphosis the adult beetle emerges from the soil, mates and flies off to find a new 'host' environment. |

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| 3a) Describe in detail the key factors that help identify the Tropilaelaps mite. (5) | • Very small mite, up to 1mm in length, smaller than Varroa.<br>• Legs clearly visible to the side of body.Page **3** of **9**<br>• Body longer than wider (Varroa wider than long)<br>• Brown colour, similar or lighter than Varroa.<br>• Antennae visible at front of body. |
| 3b) Outline the lifecycle of the Tropilaelaps mite (10) | • Its life cycle is very similar to Varroa but faster.<br>• The adult female enters a cell before capping.<br>• 48 hrs after capping, lays 3-4 eggs, one egg at daily intervals.<br>• Male is laid first followed by female.<br>• The mites feed on the bee larva, seriously affecting its development.<br>• These develop more rapidly than varroa - 6 days development to adult.<br>• When the bee emerges all the mites, male and female, leave the cell and look for another 'host' larva.<br>• Adults cannot pierce the cuticle of adult bees so can only feed on bee larvae.<br>• The phoretic stage has to be very short therefore they must rapidly find another open cell with mature larva to feed on.<br>• Gravid adult females will die after 2 days outside a cell. This gives an opportunity for treatment – by causing a brood break. |

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| 4a) Give an account of the legislation relating to the importation and export of honey bees from Britain (8) | Complex combination of UK and retained European law, with advice available on Beebase.<br>Legislation includes:<br>• The Trade in Animals and Related Products Regulations 2011<br>• The Bee Diseases and Pests Control (England) Order 2006<br>• Commission Regulation (EU) 206/2010<br>• Commission Decision 2006/855/EC<br>• Under present policy only queen honey bees and up to 20 attendant worker bees may be imported from Third Countries, including EU countries. The only exception is New Zealand from where import of queen honey bees and package bees (a queen plus 15,000 worker bees) are permitted.<br>• All imports must be notified via the Import of Products, Animals, Food and Feed Service, (IPAFFS). Each consignment must be accompanied by a health certificate which has been obtained from the relevant competent authority. A copy of this certificate needs to be uploaded to the IPAFFS system prior to the import.<br>• Imports of bees from EU countries will be checked at destination, on a risk-based basis.<br>• Imports of bees from non EU countries must be via a Border Control Point.<br>• Imports of bees from Northern Ireland are permissible with no checks.<br>• To export bees from GB, the destination country must permit imports from GB and the GB exporter must comply with their import conditions. For exports to any country without the correct certification, the consignment may be rejected/destroyed by the destination country.<br>• Only queen bees (presumably with attendants) can be exported to Northern Ireland and EU countries. The queen bees must have an Export Health Certificate signed by an Official Veterinarian. |
| 4b) What are the implications, advantages and risks of importing packages of honey bees? (7) | • Under present policy only queen bees and attendant worker bees may be imported from Third Countries, apart from New Zealand from where queens and package bees (a queen plus 15,000 worker bees) are permitted.<br>• This still carries a risk that pests and diseases may come with imports.<br>• Importing packages has the advantage of providing larger colonies sooner than natural build-up of local bees<br>• But (with the long flight from New Zealand), stresses the bees, could spread pests and diseases<br>• May introduce genetic material different from the local genetic material and therefore less likely to survive, necessitating further importation.<br>• Introduced bees may have better temperament and /or better foraging ability than native bees<br>• Introduced colonies may compete with smaller native colonies and reduce their survival |

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| 5a) Outline the history of the detection and identification of Varroa. (2) | • Mite identified on Apis cerana in Java by E Jacobson, who sent it to A C Oudemans who described and named it in 1904.<br>• It was identified on Apis cerana in Eastern Russia in the 1950s and these colonies were in contact with Apis mellifera colonies. A shift to Apis mellifera may have occurred around 1957.<br>• |
| 5b) How and when has Varroosis spread between countries historically. (5) | • The first report that Varroa could be a problem was in 1963. The mite was found in central Europe in the late 1970s and was associated with heavy losses of honey bee colonies.<br>• Varroa spread has since been via human assisted movement of colonies<br>• Varroa spread to North & South America, possibly via Japan and Thailand.<br>• An association with a virus was reported by Ball in 1985.<br>• Found in New Zealand in 2000<br>• Found in Australia in 2022 |
| 5c) When was it first identified in the UK? (1) | • First identified in UK in April 1992, but may have been present for some time. |
| 5d) How have UK beekeepers adapted to the presence of Varroa (7) | • Open mesh floors.<br>• Monitoring varroa levels: natural mite drop, sugar roll, alcohol wash, drone uncapping.<br>• Treating with chemicals, initially such as synthetic pyrethroids Bayvarol, Apistan, but when resistance developed (assessed using Beltsville test) then to others such as amitraz and more natural materials including thymol, formic acid & oxalic acid. Treatments require Veterinary Medicines Directorate authoristaion.<br>• Biophysical methods of control such as Shook Swarm, Brood breaks, restricting queen laying (and destroying frames laid in) and drone comb removal also used.<br>• Some beekeepers are now not treating and aiming to select for varroa resistant bees<br>• Some varied opinions about whether to treat blind, to treat all colonies in an apiary, or only to treat colonies if monitoring indicates concerning varroa levels.<br>• An Integrated Pest Management (IPM) system is recommended by the NBU, where mite levels are monitored and treated appropriately only when necessary. |

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| 1a) Describe the main features of Asian Hornet nests (10) | **Primary nest**<br>• small,<br>• fragile (made from plant-based fibre) &<br>• often within man-made sheltered structure<br>**Secondary nest**<br>• large, up to 80cm diameter, made from plant-based fibre,<br>• often high in tall tree, but can be lower, in hedges or even at ground level.<br>• Multiple entrances - the base of the nest and on the sides.<br>• "Combs" for brood are horizontal, (90 degrees different from the honey bee.<br>• Larvae only face downwards.<br>• Cells are hexagonal made from paper as the rest of the hive.<br>• Pillars support the combs and maintain separation.<br>• "Gynaes" are produced towards the bottom later in the season in bigger brood cells. |
| 1b) Describe the methods the National Bee Unit and the Jersey Asian Hornet Teams use to locate Asian Hornet nests. (15) | • The methods presume a clearly identified Asian Hornet worker has been found feeding in the location started.<br>• Hornets typically forage within 700 – 1000m of their nest.<br>• Bait stations are set up, using *Trappit / Suterra* Wasp / Hornet bait<br>• Continually monitor the stations.<br>• When an AH visits, it is captured using a Queen Marking plunger type cage,<br>• AH is marked with a unique colour / location or combination of colours. This is recorded.<br>• The hornet is released and the time noted accurately. (Currently only NBU officials are permitted to release an Asian Hornet for tracking purposes.)<br>• The direction the hornet flies in is recorded.<br>• When the hornet returns to the bait station the time is again recorded.<br>• The difference between the two times can be used to estimate the distance to the nest.<br>• These measurements are repeated and averaged for individual hornets and the group of hornets.<br>• Once sufficient data is recorded, the bait station is moved. This may be up the line of the flight path, (Jersey method) or to a different location to give a different flight line and allow triangulation. (NBU method)<br>• The exercise is repeated, giving more data on both bearing and distance. This may usually require 3 or more moves |

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| | • It should be now be possible to identify a small enough area to conduct a visual inspection. This requires binoculars and observation from a number of different positions, to locate the nest, and may be very difficult.<br>• Other methods used include the use of Infra Red sensor cameras at night to identify the nest location, and attaching a small electronic tag, to an individual hornet, so that it can me tracked. |
| 1c) Why, when & how are Asian Hornet nests destroyed? (5) | • Destruction of the nest is the best method of reducing pressure on bee hives and preventing permanent establishment of the hornet.<br>• Ideally nests are destroyed before they release mature queens and drones.<br>• As Asian Hornets do not fly at night, nests are best destroyed at night when all hornets have returned.<br>• With extreme care regarding protective suits, working at height and working with chemicals,<br>• Insecticide may be pumped into the nest. Alternatively, the nest may be gassed with $CO_2$ and the adults vacuumed out.<br>• The nest is usually removed for DNA analysis. |

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| 2a) What is the statutory legislation in England relating to honeybee pests and diseases and which diseases and pests are currently notifiable? (NB Varroa is re-portable) (7) | • The Bees Act 1980<br>• The Bee Diseases and Pests Control (England) Order 2006: Statutory Instrument No.342<br>• The Bee Disease and Pests control (England) (amendment) Order 2021.<br>• American foulbrood (AFB)<br>• European foulbrood (EFB)<br>• Aethina tumida (Small hive beetle = SHB)<br>• Tropilaelaps spp. mites |
| 2b) What **must** a beekeeper do if they suspect one of these pests or diseases is present in one of their colonies? (1) | • Contact the APHA NBU to have the colony officially examined by an APHA Bee Inspector |
| What else should they do? (11) | **At the apiary**<br>• Take a photo to send to the Bee Inspector/NBU.<br>• Complete inspection of that colony, replace all parts of the hive.<br>• Reduce the entrance if appropriate to minimise the likelihood of robbing and disease spread.<br>• Clean hive tools, smoker etc.<br>• Make sure nothing lying around apiary that bees could go to to rob out.<br>• Remove PPE and bag it (quarantine it).<br>• Place that Apiary under 'self-imposed' standstill (don't move bees, equipment or hive products from the apiary)<br>**At home**<br>• Wash PPE.<br>• Sterilise hive tool, smoker etc.<br>• Destroy disposable gloves, any wax/frame debris from site.<br>• Look at records to try and establish if any links between 'suspect' colony and others eg splits, swarms etc. |
| 2c) What are the management options if a notifiable brood disease is confirmed? (11) | • Legal Standstill Notice is placed on Apiary.<br>• Bee inspector will decide on the right option, depending on the level of infection and time of year.<br>**EFB**<br>• Honey can be extracted under licence in a beeproof facility.<br>• Colony killed by Bee Inspector<br>• $1m^3$ pit is dug by the beekeeper. |

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| | • bees, frames and other equipment are destroyed by fire.<br>• Shook swarm (Colony or whole Apiary) in cases of light infection and at right time in the season.<br>• Oxytetracycline administered by Bee Inspector (usually only early or late in the season). (Rarely used nowadays.)<br>**AFB**<br>• Honey cannot be extracted.<br>• Bees killed.<br>• $1m^3$ pit is dug by the beekeeper.<br>• Bees, frames and honey destroyed by fire. Burned in a $1m^3$ pit and the remains buried.<br>**For both EFB and AFB**<br>• Brood & Super boxes flamed with blow-torch.<br>• Reinspection of the Apiary after minimum of 6 weeks or at the start of the following beekeeping season.<br>• If clear, standstill notice withdrawn. |