T Level Technical Qualification in Animal Care and Management

Animal Management and Science Occupational Specialism

Synoptic Assignment Guide Standard Exemplification Material Distinction

Version and date	Change detail	Section
V1.0 October 2024	Approved version	

Contents

Introduction

The sample evidence within this document refer to the Animal Management and Science Occupational Specialism synoptic assignment. The aim of these materials is to provide centres with examples of knowledge, skills and understanding that attest to a distinction grade. The evidence presented here has been developed to reflect a distinction grade within each task but is not necessarily intended to reflect the work of a single candidate. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and the standard of performance will vary across tasks. The Guide Standard Exemplification Material (GSEM) illustrates linear performance across all pieces of evidence at the grade. A distinction grade will be based on a synoptic mark across all tasks.

The evidence in this GSEM is separated into the sections as described below. Evidence is presented against tasks from the synoptic assignment. Assessors using the GSEM may find it helpful to review this document along with the sample assessment materials (SAMs).

Task

This section details the evidence to be submitted for marking and any additional evidence required including any photo/video evidence. Also referenced in this section are the performance outcomes and the evidence will be marked against these when completing the tasks within it. In addition, evidence that has been included or not been included in this GSEM has been identified within this section.

In this GSEM there is evidence from:

- Task 1
- Task 2
- Task 3
- Task 4
- Task 5
- Task 6

Evidence

This section includes exemplars of evidence, photo/video recordings of the evidence in production (or completed) and assessor observation records of the assessment completed by centre assessors. This will be exemplar evidence that was captured as part of the assessment and then internally marked by the centre assessor.

Word counts

Typical word counts/page lengths, as indicated in the SAMs, are used as approximates for guidance to support the production of sufficient evidence. The marking will relate to the quality of the evidence produced and not whether the word count/page length has been met and candidates may be under or over the word count without affecting their grade.

Commentary

This section includes detailed comments to demonstrate how the evidence attests to the standard of distinction.

It is important to note that the commentary section is not part of the evidence or assessment but are evaluative statements on how and why that piece of evidence meets a particular standard.

Grade descriptors

To achieve a distinction, a candidate will typically be able to:

Demonstrate an excellent level of performance that consistently meets industry requirements, to be able to enter the animal science industry to begin work in the occupational area.

Demonstrate an excellent understanding of husbandry plans and highly effective technical skills and techniques for carrying out routine health assessments associated with breeding and rearing animals.

Demonstrate an excellent understanding of human-animal interaction, consistently applying safe and welfare orientated techniques when handling, restraining and moving animals, adapting them when necessary.

Accurately interpret technical information to be able to plan and prepare equipment and work areas, assess risk and follow safe working methods appropriately when applying practical skills to an excellent standard and within relevant legislation and regulations.

Produce comprehensive population management plans for the care and monitoring of animals in accordance with relevant legislation, conservation and evolution.

Carry out comprehensive planning and research on reproductive technologies and gene manipulation including thoroughly assessing the validity and reliability of sources.

Carry out comprehensive analysis and evaluation of research to enable effective presentation of results to targeted audiences.

Demonstrate excellent knowledge and understanding of genetics and evolution of common wild and captive animals, health and nutrition for animals and the effects of disease on the animal with reference to veterinary practice and legislation.

Demonstrate excellent knowledge and understanding of fundamental scientific principles relevant to biology and chemistry for animal scientists.

Consistently use technical terminology accurately in plans, reports and documentation.

Task 1 Health, accommodation and feeding plan

Evidence contributes to the following:

Performance outcome(s)
PO2 Observe the behaviour, security and breeding practices of animals PO3 Plan for and manage the good health and welfare of animals PO4 Carry out safe animal handling practices

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Task 1b - Health, accommodation and feeding plan for a mammal during pregnancy and lactation	√		√
Task 1c - Care plan for the first 0-48 hours of the offspring's	√		√

Task 1b) Create a health, feeding and accommodation plan for a mammal during pregnancy and lactation

Candidate evidence – health, accommodation and feeding plan for a mammal during pregnancy and lactation

Introduction

In this husbandry plan I will be discussing requirements to maintain the health and wellbeing of a Guinea Pig that is pregnant to meet "The Animal Welfare Act 2006", ensuring their welfare is maintained during and after pregnancy, preventing any compromises to their welfare as well as promoting good health during the gestation period. The Guinea Pig's health care plan will need to be adjusted while the female (sow) is pregnant and also while lactating. I will also take into consideration the well-being of the babies (pups) for a 48 hour period after birth.

Under the Veterinary Surgeons Act 1966, only a vet can diagnose an animal as pregnant and this is usually done with an ultrasound as this is non-invasive and can be done without sedation. After pregnancy has been confirmed, the care plan can then be adjusted to suit the sow's welfare needs throughout pregnancy and lactation. The gestation period for a Guinea Pig is 63–72 days, which is a relatively long gestation compared to other small mammals because Guinea Pigs give birth to precocial pups. This means that once they are born their

eyes and ears are open, fully covered with fur, teeth present and they are eating solid food from day one. Guinea Pigs give birth to approximately 1-6 well-developed pups and so nutritional and space requirements must accommodate for this number.

Guinea Pigs originate from South America in the Andean region - Colombia, Ecuador, Peru, and Bolivia. In the wild they were often found living in rocky areas and grassy plains. Wild Guinea Pigs are social mammals, living in small groups with one boar (male) and several sows (females) along with any pups (babies). This is why Guinea Pigs should be kept in groups to align with the need to be housed with or apart from other animals.

Taking into consideration of the Guinea Pigs' natural habitat, this plan will be influenced by the Guinea Pigs' natural requirements. There are a variety of considerations that need to be adhered to when caring for a pregnant Guinea Pig, their welfare needs are extremely important during and after pregnancy. If the Guinea Pig's welfare is not considered or adjusted, their health may be compromised through poor diet, poor husbandry care or sickness of the sow and there is the potential that the sow could abort the pregnancy. It is imperative to monitor their health, wellbeing, and nutrition of the sow under the Animal Welfare Act 2006 - five animal welfare needs which are:

- The need to be housed with or apart from other animals – this is to prevent any stress, aggression, ill health, or atypical behaviours occurring if they are inappropriately housed. Guinea Pigs are social mammals; however, it is recommended that the sow is separated for the rest of the group, especially the males (boars) for the health of the sow and pups and to reduce the risk of back-to-back pregnancies.
- The need for a suitable environment – this is to provide them with a habitat and an enclosure to best suit their needs to ensure they can live a healthy life as close to their natural environment as possible. It is recommended that a sow is to be housed indoors to ensure that temperature can be controlled, especially in the winter months.
- The need for a suitable diet – this ensures they are fed and watered daily, ensuring they are on the correct diet and receiving any additional supplements if needed for example Vitamin C and Calcium. A feeding plan can be implemented if it is required.
- The need to be protected from pain. Injury, suffering and disease – this ensures they are free from harm from pathogenic diseases, injuries, poor nutrition and poor husbandry upkeep.
- The need to exhibit normal behaviour patterns – this is because when they are in captivity it important to mimic their natural environment as much as possible to allow them to display natural behaviours, preventing any abnormal behaviour's occurring.

Failure to follow the Animal Welfare Act can lead to consequences such as imprisonment or fines for the keeper of the animals.

<u>Accommodation requirements and maintenance</u>
"Animal Welfare Act 2006" – Need for a suitable environment

The accommodation for a pregnant sow needs to be set up to accommodate the sow during pregnancy, after birth, and for the welfare of the sow and the pups. The accommodation should be in a quiet area with a constant temperature and should be kept inside to limit stress for the sow and pups and it is recommended not to have multi-levels within the accommodation. This could cause injury as their balance can become impaired whilepregnant and as pups become used to their surroundings in early days after birth.

Before setting up an enclosure, it is imperative that you are wearing the correct PPE (Personal Protective Equipment) under the Personal Protective Equipment at Work Regulations 2022. PPE can include disposable gloves, overalls, lab coats or masks. All PPE must have been washed previously at 60 degrees to kill any pathogens and reduce the risk of cross contamination. It is also important to conduct a risk assessment to identify any hazards and to make sure control measures are implemented to reduce any risks in the workplace. This is required to by law under the Health and Safety at Work Act 1974. As well as a risk assessment, a COSHH assessment (Control of Substances Hazardous to Health Regulation 2002) is also required to identify disinfectant, products and agents that will be needed to maintain the accommodation. The COSHH assessment will ensure that you wear the correct PPE for each substance being used as well as keeping you safe from any pathogenic diseases. Using the appropriate disinfectant will also prevent the transmission of zoonotic diseases, which are diseases that can pass from animal to human and human to animal, such as salmonella and campylobacter pathogens. When the risk assessment and COSHH assessments have been carried out, the accommodation can be set up.

Cleaning the housing regularly is extremely important to ensure the prevention of pathogenic disease, build-up of bacteria and general dirt which may cause illness in a pregnant sow or the pups who will all have reduced immunity during this time. A spot clean should be carried out to remove any soiled or damp patches every day, and a full clean of the accommodation around twice a week in order to prevent a build-up of ammonia from urine, which can irritate the lungs of the Guinea Pigs and will predispose the pregnant sows to lung infections. Any anti-bacterial spray used must be specifically made for use on animal housing to prevent harm. An example of this is Safe4 which falls under the COSHH 2002 regulations and is used in a dilution ratio of 1:50 following the manufacturers' instructions. When full cleaning, it is important to not forget any areas such as walls and corners, doors, equipment, enrichment, and transport boxes which could all harbour disease.

Creating a comfortable space in the accommodation will also reduce stress and therefore the risk of miscarriage or reabsorption of the pregnancy. The bedding should be soft and comfortable and spread at least 3 to 4 inches (7.6 to 10 cm) thick, across the entire floor of the hutch. Alfalfa hay should be provided as nutrition and can be used for warmth, but additional bedding such as straw should also be provided. You can also provide a cardboard or wooden box on its side, and this could be placed in a sheltered part of the hutch, away from draughts. The cardboard box will provide the sow somewhere to hide, which will reduce stress and provide a source of enrichment and mental stimulation if they chew the cardboard. A separate nesting area with soft, clean bedding should be provided with materials such as hay, shredded paper, and cloth strips for the pregnant Guinea Pig to build her nest. This will enable the sow to exhibit natural behavioural skills in building a nest 2 to 3 days prior to giving birth.

<u>Health of the Guinea Pig</u>
"Animal Welfare Act 2006" – Protect from pain, injury, suffering and disease.

During the gestation period, it is very important to monitor the sows' health and well-being, and any early signs of ill health or atypical behaviours so they can be reported as soon as possible. A visual health check is to be conducted on a daily basis, and physical health checks can be conducted on a weekly basis, taking care during the handling and restraining process. Incorrect handling of a Guinea Pig through gestation could result in the Guinea Pig aborting the pregnancy.

A physical health check will include checks of all body parts and their health parameters including temperature, pulse, respiration and weight. Due to their size, temperature is not manually checked unless it is suspected that something is wrong as this can cause stress. Their pulse should be around 250 bpm which means it will be too fast to count, but you should be able to tell it is regular. Their respiration rate is easier to check and can be counted for 15 seconds and then multiplied by 4.

One of the main conditions to monitor through the gestation period is toxaemia. This can occur when a Guinea Pig's body produces too many ketones, which are a normal byproduct of metabolism. It is a serious condition that usually occurs in sows in their first or second pregnancy. It is more likely to occur in overweight sows which is why it is important to feed a balanced diet for the Guinea Pig throughout the pregnancy to reduce the risk of poor health and toxaemia. Signs of the condition could include poor appetite, depression, weakness, lack of movement, incoordination, and difficulty breathing, although they may show no signs of the condition, and then suddenly die. There is no single cause for this condition, but stress and obesity are major factor, therefore exercise would reduce the risk of stress and obesity, as well as reducing boredom, and minimising the risk of dystocia (difficulty in parturition).

It is recommended that the sow is not handled in the last two weeks of pregnancy to reduce the chance of stress. The sow's behaviour, food and water intake, weight and general health should be continually monitored and recorded daily to ensure that all care givers are able to look after the Guinea Pig.

Healthy birth weights for pups are between 60-100g (larger litters will have smaller pups), pups under 40g may need some extra supplementation to ensure they have the best chance of survival. They will feed from the sow for the first 21 days and can then be weaned at three to four weeks old, or when they weigh 250g. If there is a large litter, the males should be weaned first, into a separate cage to help reduce unwanted pregnancies and then the females 2 to 3 days later. The pups should be weighed every couple of days after the birth to ensure that they are gaining weight. Any pups not gaining weight in line with the others, not eating suitable amounts or looking unwell should be seen by a veterinary surgeon.

<u>Feeding requirements</u>
"Animal welfare Act 2006" – Need for a suitable diet

Guinea pigs are hindgut fermenters and also practise coprophagia so good amounts of fibre must always be available. The fermentation in the caecum will also help to keep them warm.

Guinea Pigs require grass hay and it must be always available. Hay keeps the Guinea Pig healthy by providing fibre for digestion and it helps grind down their constantly growing teeth. Without grass hay, the Guinea Pigs' teeth may become too long, which may hinder eating and cause other health problems such as malocclusion. Pregnant sows should be supplemented with extra calcium and vitamin C for both themselves and their growing pups. Guinea Pigs cannot naturally produce vitamin C so rely on getting this from their diet to prevent conditions such as scurvy. Scurvy can cause a range of symptoms, including lethargy, poor appetite, weight loss, joint pain, swollen and bleeding gums, and hair loss and if left untreated it can be fatal. During pregnancy, the sow's requirement for vitamin C doubles to 20mg daily, so increased fresh fruit or vegetables must be given daily - fruit and vegetables with the highest amounts of vitamin C are bell peppers (red/green), turnips, lettuce, carrots, cucumber, apples, apricots, bananas, blueberries and many more.

Pelleted/muesli diets should not be given too frequently or in quantities higher than the recommended amount as this can cause large babies which they may struggle to pass. Pellets fed to Guinea Pigs of any age should be free from nuts and seeds which cause obesity as they are higher in natural fats and oils.

Alfalfa hay should be supplemented throughout pregnancy, along with unlimited amounts of normal grass hay because it is high in protein, vitamins and minerals that will help with the development of the pups. The sow's diet may increase or decrease dependent on the stage of gestation she is in and towards the end of the pregnancy the need for calcium will be at its highest to prevent conditions such as eclampsia as the milk is being produced.

Fresh water is to be provided at all times and should be changed at least once daily to stop her becoming dehydrated which may possibly lead to other poor health issues and prevent abnormal growth of the pups.

Once the sow has given birth then the food is increased by three times as much to supplement lactation and because the pups will begin to eat solid food at 2 to 3 days old. Although the sow has only two teats, she will feed several pups quite happily as long as she is well fed. It is recommended to feed *ad lib* pellets and water, and a handful of grass, fruit and vegetables per Guinea Pig (pups included), per day.

The below husbandry plan shows daily, weekly and monthly care of the pregnant Guinea Pig. Designing a husbandry plan for a pregnant Guinea Pig involves ensuring the correct nutrition, environment, and care to support the health and well-being of both the sow and her pups.

Pregnancy plan	**Nutrition**	**Spot/full clean**	**Health checks**	**Exercise/ enrichment**
Daily	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/ alfalfa/pellets (1/8 cup) This could be fed over the day in 2-3 feeds. Fresh water	Spot	Visual health check – movement, behaviour, food and water intake, monitor pregnancy, weight (gain/loss)	Safe, enclosed grassy area. Enrichment activities (wheel, foraged treats, new chews/tunnels).
Weekly	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/alfalfa/pellets (1/8 cup) Fresh water	Full clean (3x per week)	Physical health check – ears, eyes, teeth, skin, coat, genital area, limbs, feet, nails	Safe, enclosed grassy area. Enrichment activities (wheel, foraged treats, new chews/tunnels).
Monthly	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/alfalfa/pellets (1/8 cup) Fresh water	Deep clean	Vet health check	Safe, enclosed grassy area. Enrichment activities (wheel, foraged treats, new chews/tunnels).

Conclusion

By following this husbandry care plan, you will provide the best possible care for the pregnant Guinea Pig, ensuring a healthy pregnancy, delivery, and postnatal care for both the sow and her pups. This also incorporates more than one of the five needs as it shows multiple aspects of the animal's health. If the plan is not followed, then this can have consequences on the Guinea Pigs' health and well-being with possible nutritional deficiencies or reduced milk production. This in turn will affect the health of the pups due to a lack of colostrum which gives antibodies to the pups before their immune system has a chance to develop.

Commentary

The candidate has demonstrated an excellent understanding of husbandry plans by producing a comprehensive and relevant plan for the Guinea Pig, meeting the requirements of the brief and in line with relevant legislations and regulations. The husbandry plan has excellent structure and is displayed in a logical order. For example, the tabular format of the plan at the end of the report ensures that the plan is functional and could be used by any care givers of the Guinea Pig.

Information about the care of the Guinea Pig shows excellent understanding, with a wide range of accurate and relevant welfare considerations demonstrating the depth and breadth of their knowledge. The five needs have been incorporated into each section of the husbandry plan. For example, the candidate explains the feeding plan relates to more than one of the five needs demonstrating knowledge multiple aspects of the animals' health, maximising the health and welfare of the animal with comprehensive detail.

The candidate makes excellent and accurate justifications of husbandry choices throughout the plan to reduce potential risks to the sow and pups such as the cleanliness of the accommodation. For example, the need to reduce stress to the sow during pregnancy and labour is well explained, demonstrating excellent understanding of the consequences to the animal if welfare needs are not met.

Task 1c) Create a care plan for the first 0-48 hours of the offspring's life

Candidate evidence – care plan for the first 48 hours of the offspring's life

Postnatal Care (0-48hrs)

After birth, it is important that the sow and pups are undisturbed for the first few days to allow bonding and nursing to occur and this will also reduce the risk of the sow rejecting the pups. It is important not to interfere with the newborns by physically checking umbilicus or airways in the first 48 hours as this could cause the mother to reject the pups. However, because Guinea Pigs are precocial, a visual check can be done as soon as the pups start to move around, which should be within the first 48 hours. Monitoring the sows and pups' behaviour and condition to ensure that all pups are active and demonstrating normal behaviours (interaction, moving, normal gait) is important to ensure that they are not deteriorating or showing signs of ill health. The most common signs of illness will be lethargy, reduced appetite or isolation from the group. If the pups start to show unwanted changes in behaviour in the first 48 hours, it may mean they are not getting enough milk or colostrum, the sow and pups should be taken to the vet to seek medical attention. The entire family is taken to reduce the risk of the sow rejecting the unwell pup. A lack of colostrum may mean that the pup did not get enough antibodies which has made it more likely to be ill as it has a poor immune system in the first 48 hours of life.

You can start to handle the pups once they are a few days old to socialise them and ensure they are accustomed to human contact. When they are at least a week old, you can then conduct a physical health check on each of the pups to ensure that they are healthy and have no health issues that require veterinary treatment. This can include weighing each pup to monitor its weight gain/loss. Significant changes in weight, particularly if it is weight loss, can be a sign of malnutrition.

For the first 48 hours, a safe and quiet environment is needed to allow the sow to bond with her pups and for them to get used to their surroundings. Set up a warm, quiet, and secure area for the sow to nurse her pups – this can be the nesting box that was set up during pregnancy. If the sow is disturbed during labour, it could lead to her having problems with continuing labour and result in possible caesarean or other issues like rejecting the pups. This may mean that the pups will need to be hand reared and fed a milk replacement to supplement the mother's milk.

Ensure that the cage has clean bedding and is free from drafts or disturbances to prevent illness – dirty bedding is more likely to contain bacteria which is harmful to the pups. Bedding should not be changed in the first couple of days after birth, but more can be added as required. Monitor the sow after birth to ensure she is behaving normally and attending to her pups, including eating, drinking, and nursing properly. Any signs of distress or neglect such as the sow pushing pups out of the nesting area, should be monitored and if the behaviour continues, the pup should be removed to prevent harm to the pup and to allow for hand rearing or medical treatment. The sow will produce milk to feed her pups, so it's essential to provide a balanced diet for her to maintain her health and milk production. The pups are dependent on the sow's milk and colostrum, which is rich in fat and protein, and helps develop their immune system and protect them from diseases. Offer her plenty of fresh hay, vegetables, and a high-quality Guinea Pig pellet food and ensure they have access to fresh water at all times.

Because Guinea Pigs are precocial, the pups will start nibbling on solid food in their first week, sometimes from the first day and so *ad lib* food should be available as shown below. They will continue to nurse for several weeks and the weaning process usually occurs naturally when the babies are around three to four weeks old.

The first 48 hours is when the pups are most likely to show signs of illness and so should be monitored closely but without causing any distress to the sow which could cause her to reject them. Important signs of ill health to look out for are loss of appetite, lethargy, diarrhoea or respiratory distress. If the labour was difficult or the pups were born early, these issues may be increased and so extra care should be taken.

If a pup is rejected or does not bond with the mother, they will need to be hand reared which is difficult and time consuming. Allowing the mother and babies to bond for the first few days is the best way of reducing the likelihood of this happening.

Postnatal plan	**Nutrition**	**Spot/full clean**	**Health checks**	**Exercise/ enrichment**
Daily	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/alfalfa/pellets (1/8 cup) This could be fed over the day in 2-3 feeds but food should always be available when the pups are growing so it may need topping up more regularly Fresh water	Spot	Visual health check – movement, behaviour, food and water intake, weight (gain/loss)	Enrichment activities such as tubes, chews and different hay feeders.
Weekly	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/alfalfa/pellets (1/8 cup) Fresh water	Full clean (2x per week)	Physical health check – sexing, ears, eyes, teeth, skin, coat, genital area, limbs, feet, nails	Enrichment activities.
Monthly	Pears/oranges/apples/bell pepper (1/2 slice)/lettuce/carrots/cucumber/hay/alfalfa/pellets (1/8 cup) Fresh water	Deep clean	Vet health check	Safe, enclosed grassy area. Enrichment activities.

Commentary

The candidate has demonstrated an excellent understanding of husbandry plans by producing a comprehensive, detailed and relevant care plan for the offspring in line with the requirements of the brief and relevant legislations and regulations. The husbandry plan is written in a logical order which makes it easy to follow and where the husbandry need is not possible within the first 48 hours, the candidate has given further explanation. For example, where the pups cannot be handled in the first 48 hours, the candidate explains what to look out for and when they will be able to be handled, ensuring the plan is fully functional.

Information about the care of the pups is excellent with accurate and justified information. They have linked the care of the sow and the pups throughout the plan. For example, the care of the sow during and after labour to provide a calm environment links to her not rejecting her pups, demonstrating the candidates understanding of maximising the health and welfare of the animals with comprehensive detail.

The candidate makes excellent and accurate justifications of husbandry choices to correctly care for the sow and pups. For example, the link between the nutrition of the sow and the production of milk for the pups demonstrates excellent understanding of the consequences to the pups if the welfare needs of the sow are not met.

NOTE: The GSEM evidence for the Threshold Competence and Distinction candidates is showing one example of a precocial species and one example of an altricial species. This is to give examples to centres of the information a candidate would be expected to produce for the very different levels of care required in these species, especially for the care plan for the offspring where the ability to handle the young is very different.

Task 2 Health assessment

Evidence contributes to the following:

Performance outcome(s)
PO2 Observe the behaviour, security and breeding practices of animals PO3 Plan for and manage the good health and welfare of animals PO4 Carry out safe animal handling practices

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Task 2a - Completed risk assessment	√		√
Task 2b - Assessor observation		√	√
Task 2b - Photo(s)		√	√
Task 2c - Assessor observation		√	√
Task 2c - Video(s)		√	√
Task 2d - Health check form	√		√
Task 2d - Written report	√		√

Task 2a) Complete a risk assessment for the handling, restraint, movement and health assessment of the mammal

Candidate evidence – completed risk assessment

Figure 1 - Candidate evidence - Risk assessment

This template may be modified by adding items/rows only.

Candidate's name	A Sample Candidate	Enrolment number	CG12345
Task / Activity	Task 2a	Location	Centre training area
Assessor's name	A Sample Assessor	Date	04/04/2024

Item no.	What are the hazards?	Who might be harmed and how?	What control measures are already in place?	Risk rating (high/medium /low)	What further action is necessary?	Action by who and when?	Residual risk rating (high/medium /low/)
1	The animal's behaviour (ferret)	The handler/keeper/ student Bites and scratches	Visual observation of the animal within its enclosure prior to entering the enclosure. Use of PPE (overalls, gloves). Approach to the animal - ensure not to frighten or startle. Using the appropriate handling and restraint method.	Medium	Provision of additional handling and restraint equipment e.g. towel or blanket. Work in a calm and quiet manner - knowledge of animal's natural circadian rhythm and natural behaviours. Appropriate animal handling and restraint training.	The handler / keeper/student/ manager of the animal collection	Low

2	The animal (ferret)	The handler/keeper/ student Zoonotic diseases.	Use of PPE (overalls, gloves as required, appropriate footwear, face masks, goggles). Hygiene measures (clean PPE, hand washing, equipment cleaning, environment cleaning).	Medium	Knowledge of zoonotic disease transmission (e.g. risk of salmonella, fleas, ringworm). Visual examination of ferret for any bald patches (may indicate ringworm/flea infestation).	The handler/ keeper / student / manager of animal collection	Low
3	The animal enclosure	The handler/ keeper/student Injury from entry or exit from enclosure design (e.g. trip, slips, falls, wound from damaged area of enclosure).	Observation of enclosure prior to entry and exit (identify any damaged areas, location of animal(s)). Appropriate PPE (footwear)- important if enclosure floor is uneven or on several levels.	Medium	Logical and careful approach not to frighten the animals within the enclosure. Any damaged areas noted and reported to the manager immediately to arrange repair. May need to relocate animals.	The handler/ keeper/student/ manager of animal collection	Low
4	The environment (surrounding area)	The handler/ keeper/student/ assessor Trips, slips and falls	PPE (appropriate footwear). Observation of the practical room: removal of any clutter /appropriate equipment storage. Appropriate floor cleaning method: Yellow hazard sign if floor is wet/spillage.	Medium	Safe working practice If the floor is wet: notify manager, use appropriate method to dry (squidgy, paper towels). Appropriate waste disposal (do not let bins overflow or leave black bags around).	Everyone using the practical rooms	Low

5	The environment Location of equipment (manual handling)	The handler/ keeper/student/ assessor Back injury/ muscle strain.	Stool to enable access to higher shelves. Larger equipment stored at lower levels.	Low	Training in accessing equipment/animal carriers from higher levels (ladder training). Health and Safety at Work Act training for manual handling.	The handler/ keeper/student/ manager of animal collection	Low
6	The environment Animal escape	The handler/ keeper/student/ assessor Injury in ‘’running after and capturing animal’’	Ensure all doors to the practical room are 100% secure before opening animal enclosure doors. Ensure all enclosure doors are secure after returning animal.	Low	Report any damaged locks/door handles to the manager as soon as noticed. Relocate any animals in the unsecure enclosure to one that is secure as soon the damage/problem is noticed.	The handler/ keeper/student/ manager of animal collection	Low
7	Moving animal from enclosure to assessment area and returning animal to its original enclosure	The handler/ keeper/student Animal placed in temporary carry box or basket. Injury on lifting, slips, trips, falls.	Correct size of temporary carry box/basket for animal. Weight and size consideration of animal and the temporary carrier.	Low	Plan route from enclosure to the health assessment area. Short distance from animal enclosure to the examination table/assessment area. Health and Safety at Work Act training: Safe manual handling and lifting. Ensure working area is tidy: no clutter, all equipment placed in a safe area, anything not needed is stored correctly.	The handler/ keeper/student/ manager of animal collection	Low

8	Allergies	The handler/ keeper/student To the ferret's coat, bedding, animal substrate.	Appropriate PPE (face mask, goggles, gloves, arm length overalls/scrub tops). Informing the manager/ assessor.	Medium	Handler/student to carry antihistamines. Assessor/manager to complete additional First Aid training (use of adrenaline).	The handler/ keeper/student/ manager of animal collection	Low
9	Equipment damage	The handler/ keeper/student Injury - wound, gash, bruising.	Examine equipment on collection to identify any damage.	Medium	Notify assessor/manager if any equipment that is damaged has been identified or if any equipment becomes damaged when used during the assessment period. Do not return damaged equipment to storage cupboard - place in location for manager to arrange repair or disposal.	The handler/ student/assessor/ manager of animal collection	Low
10							

Date: 04/04/2024	Risk assessment carried out by: *A sample candidate*

Commentary

The candidate has comprehensively assessed risk by completing an accurate risk assessment, showing an excellent understanding of the requirements of hazards, risks and control measures that may occur when carrying out a health assessment within relevant legislation and regulations. The candidate identified a comprehensive range of potential hazards, a wide range of control mechanisms and

demonstrated an excellent understanding of the risks that might occur. For example, referring to safe working practice, manual handling training and types of PPE. The candidate considered the full process for the animal's handling, restraint, movement and physical health assessment.

The candidate demonstrated excellent understanding of the difference between hazards, risks, and control measures, providing a range of detailed precautions to minimise risk to themselves and others. The candidate has made clear links between the risks and suitable precautions and correctly categorised the risk ratings. The candidate was also able to identify how additional control measures may affect the residual risk. For example, controls of wet floor signage have helped to change the residual risk to a low for the surrounding environment hazard.

Task 2b) Handle, restrain and move the mammal

Assessor evidence – assessor observation

Task	Assessment component number
Task 2 – Health check b) Handle, restrain and move	8717-409
Candidate name	**Candidate number**
A Sample Candidate	CG1234
Centre name	**Assessor**
Guilds Centre	A N Assessor

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
b) Handle, restrain and move	Before beginning the activities, the candidate secured the room by closing all internal doors. This allowed the mammals, namely the ferrets, free access to a safe environment while the candidate demonstrated their ferret handling, restraining and moving skills. The candidate: • identified their allocated ferret by examining the charts/information sheet located on the enclosure for a couple of minutes • identified their allocated ferret using the information on the information sheet • wore appropriate PPE (uniform and boots) and washed their hands before starting the activities • collected a suitably sized carry container from the storage room and opened the enclosure door showing consideration of the ferret's location • moved slowly around the enclosure and was careful to observe the location of the ferrets and avoid any interaction • placed the carry container on the floor of the ferret's enclosure and gently encouraged their allocated ferret (an albino ferret) to enter by using their body language to

Assessor observation	Notes – *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	usher it into the carrier. Once the ferret entered the carry container, the door was closed, and the ferret secured inside the carry container • safely lifted, using appropriate manual handling methods, the carry container and transported it, with the ferret secured inside, to the examination table in a smooth and careful manner • opened the door after placing the carry container on the examination table • observed the location of the ferret within the container and slowly, carefully put her hand in to take hold of the ferret • demonstrated a safe and secure method of handling the ferret to remove it smoothly and securely from the carry container. The ferret appeared comfortable when handled showing no obvious indication of discomfort or pain • demonstrated two methods of restraining a ferret safely and effectively for a physical health check using a one handed and a two-handed method. The ferret demonstrated no indication of discomfort during the demonstration • monitored the ferret's response during the task to ensure welfare was adhered to.

Assessor signature	Date
A N Assessor	04/04/2024

Assessor evidence – photo(s)

Ferret handling, supporting under the front limbs and hindquarters

Ferret handling, supporting under the front limbs and hindquarters

Ferret handling, showing the ‘backpack’ restraint

Commentary

The candidate demonstrated highly effective technical skills and techniques when preparing for and carrying out their handling and restraint on the ferret, consistently using safe and welfare orientated working methods. For example, shutting the door and ensuring the carrier was clean and secure, appropriate PPE was worn and suitable hand washing techniques were followed.

The candidate showed excellent handling and restraint skills, with excellent dexterity when removing the ferret from the carrier by placing both hands on the ferret to remove it safely and securely, adapting their grip where necessary to maintain welfare of the ferret. The candidate ensured the ferret was always safe and maintained high welfare standards. For example, they ensured the carry container was secure and monitored the animal during the task to ensure there were no injuries or concerns.

Task 2c) Carry out a physical health assessment on the mammal

Assessor evidence – assessor observation

Task	Assessment component number
Task 2 – Health check c) Physical health check	8717-409
Candidate name	**Candidate number**
A Sample Candidate	CG1234
Centre name	**Assessor**
Guilds Centre	A N Assessor

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
c) Physical health check	The candidate: • commenced the physical health check with examining the nose, whiskers, eyes and ears, touching the ferret where necessary to help them see each body part clearly. They then progressed to examining the coat/ skin condition before examining the ferret's mobility or gait, limbs and feet • altered their handling method at this point to enable a better position and visual assessment of the ferret's reproductive organs. The ferret appeared comfortable as the candidate altered their restraining and handling method • completed the health check by examining the anus and tail • identified each physical parameter they examined and gave a brief assessment. For some of the physical parameters, they gave examples of what aspects were being examined and what may be seen if there was a health-related concern • did not complete a TPR check • demonstrated an adjustment of their handling techniques whilst the ferret was moving. This included supporting the weight of the ferret and handling the ferret around the chest whilst performing the physical health assessment • constantly ensured a consideration for animal welfare and safety by checking on the ferret's response the handling and adapting when necessary

Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	• returned the ferret to the carry container once the physical health assessment was completed. The container door was closed and secured • transported the ferret within the carry container back to its original enclosure • once in the enclosure, the carry container door was opened allowing the ferret to exit • removed the carry container and exited the ferret's enclosure and closed the enclosure door for security • observed the ferret for a few moments after returning to the enclosure • disinfected the carry container and returned it to the storage area.

Assessor signature	**Date**
A N Assessor	04/04/2024

Assessor evidence – video(s)

AMS_GSEM_Synoptic_Assignment_Task_2_Health_assessment_ferret_Distinction.mp4

Commentary

The candidate demonstrated excellent practical skills to undertake a detailed health assessment using highly effective technical skills. The health assessment included both visual and physical checks to assess the health status of the ferret. For example, the candidate examined the coat/skin of the ferret physically to ensure they could see the condition of the skin clearly and make an accurate judgement on the health of the animal.

The candidate maintained excellent handling throughout the health assessment, using safe and welfare orientated techniques and adapting their handling where necessary to ensure the ferret's welfare was not affected. For example, when checking the genital region, the candidate altered their handling to get a better position for visual assessment.

Task 2d) Health check form and written report

Candidate evidence – completed health check form

Candidate's name	**A Sample Candidate**	Enrolment number	**CG1234**
Task / Activity	Task 2d: Health Check form: ferret	Location	Small mammal practical room
Assessor's name	A N Assessor	Date	5/4/24

Health check parameter	Findings	Comments
Nose and nostrils	There was no discharge from the nostril. No swelling around the nasal area. The nose is not wet.	This is normal. Discharge could suggest a respiratory tract infection. For example this could be a sign of distemper. ferrets can be vaccinated against this disease.
Whiskers	The ferret's whiskers are all intact - no frayed or damaged edges. The whiskers move freely while the ferret is being examined.	This is a normal natural behaviour. Whiskers are important as a sensory organ.
Eyes	The eyes are clear, no gunk and no discharge on examination. Both eyes are open. No swelling around the eyes. The ferret's eyes are a red colour.	The red/pink in colour of the eyes is normal as she is an albino. The eyes are healthy and normal. Closed eyes can mean an infection or a painful eye. Cloudiness in the eye can be a sign of cataracts.
Ears	No swelling around the external ear. No ticks present. No discharge from the ear canal. No brown wax visible coming from the ear canal.	Brown ear wax can mean the ferret has ear mites which are a common condition in ferrets. Ear mites are ectoparasites and can spread quickly. The ferret has healthy, normal ears.

Coat	The ferret's coat is nice and shiny, no bald patches to see. No signs of ectoparasites like fleas or ticks. No matted areas.	Looking for any ectoparasites like ticks and fleas. Flea dirt would be a sign of fleas, ectoparasites which can cause the ferret to scratch and cause damage to the skin. Ticks are another ectoparasite that can be seen with the naked eye. The coat condition was normal with no signs of hair loss.
Skin	There were no scratches, wounds or lumps to find on examination of the skin. Skin colour was not red and inflamed.	Skin is normal. If there were scratches, it could mean there had been some fighting with one of the other ferrets in the enclosure. Lumps could mean an abscess and if the lump was painful and this could be from fighting or could be a growth/tumour which would need veterinary treatment.
Gait/mobility	Looking at how the ferret moves around to see if there is any limping or stiffness. No limping, the ferret is using all four limbs when moving around. No signs of limping.	All good the ferret is moving around normally.
Legs	Looking at all four limbs in turn. No swelling, wounds or scratches on the limbs. No sign of pain.	All good and normal.
Toes/Feet	Check the claws - are they too long? The foot pads are pink with no scratches or wounds to see.	The claws are fine. If the claws are long, they can easily be cut. Long claws can get caught in the enrichment or cause problems with the ferrets' movement and make her uncomfortable when walking around. The ferret's foot pads are normal. Wounds or scratches on the foot pads could mean a problem with the substrate used in the enclosure.
Tail	The ferret's tail is nice and straight. No signs of swelling or injury when feeling along the tail.	The tail is normal. If the ferret had a tail injury, she would show signs of pain when I was feeling along the tail during the health check - she may try to bite or wriggle away.
Reproductive area	Nice and clear, no swelling or discharge from the vulva. No wounds or scratches.	The vulva is normal. If there were wounds or scratches on the vulva, this could have been done through interaction with the other ferrets in the enclosure.

Anus	No signs of swelling or redness around the anus. No faecal matter stuck around the anus. No signs of discharge or watery faeces around the anus area.	Anus is normal. If a ferret had faeces stuck around their anus it can cause them to be distressed and uncomfortable and any signs of abnormal faeces e.g. diarrhoea on her anus/tail area, she would need to see a vet. Ferrets can become dehydrated quickly as they will lose a lot of fluid through having diarrhoea.
Body weight	Did not measure the body weight.	
Body condition	Can feel the ferret's spine and it has a good cover of fat. The pelvis is not sticking out and has some fat covering it.	This means the ferret has a good body condition.
Behaviour	Interactive when in the enclosure. Keen to come out of the carry basket.	Ferrets are active at dusk and dawn and have a very inquisitive nature. The behaviour should be checked while the ferret is in the enclosure to check they are moving around and interacting with the enrichment, eating and drinking normally and interacting with the other ferrets. This would be normal behaviour.

Candidate evidence – written report

Adaptations for handling a pregnant ferret
Ferrets are seasonally polyoestrous animals coming into season between March and September, when the daylight length increases. If mating occurs and is successful, the female will become pregnant, giving birth to between 6-8 kits after about 41 days. During her pregnancy monitoring is exceptionally important to make sure both she and her unborn foetuses are healthy. To prevent any injury, stress or pregnancy issues the pregnant ferret is physically handled as little as possible. Poor handling or increased stress can result in her reabsorbing the embryos at the early stage or aborting the foetuses at the later stage of pregnancy. If handling needs to take place it needs to be done as carefully as possible ensuring a calm and quiet approach to minimise stress levels. Rough handling and 'holding or grabbing' the scruff of the neck should be avoided. During pregnancy a lot of information about the female's health can be obtained through visual health checks. For example, her gait, behaviour, appetite, thirst, coat condition can all be assessed by just looking at the female within her enclosure. Ferrets can be trained to walk onto a weighing scale using treats and positive reinforcement, which could be done before her pregnancy. This would then mean handling the pregnant female would not need to take place to monitor her body weight during pregnancy, further reducing stress and unnecessary handling.

Adaptations for handling a breeding male ferret
Entire male ferrets are larger than the females. They are approximately 1.2kg in body weight. During the breeding season (March to April) entire males can become aggressive especially if their enclosure is close to that of the female group. The male will be able to pick up the scent of pheromones expressed by the females in season.

When entering the enclosure, it is important to be cautious, efficient and very observant. This is due to their altered behaviour at this time, the entire male ferret, with his testosterone surges will go to any lengths to escape the enclosure so he can mate with the females.

The increased secretion of testosterone in the male ferret also increases their aggressive behaviours and therefore when handling additional equipment will be required.

When aggressive, the male will bite and hold on causing injury and wounds to the handler. To avoid being bitten, the handler will need to wear either thick gauntlet or gardening type gloves to prevent penetration of the ferret's teeth into the handler's hand/wrist.

Procedure if a congenital issue was identified in the neonate
Congenital conditions are those that are present at birth and can also be hereditary. Examples of congenital conditions include umbilical hernias, cleft palate, deformed limb and spinal abnormalities.

When examining the litter and an abnormality of the limb or spine is observed, it is important to notify your manager or supervisor immediately. Ideally details of the abnormality should also be recorded on the mother's health record sheets. The manager or supervisor will then arrange for the neonate to be examined by the veterinary surgeon, who is able to diagnose the condition and advise on the best course of action, such as treatment or euthanasia. Neonates with some congenital conditions, like umbilical hernia or deformed limbs may be monitored for growth rate and development in the first few weeks until they are large enough to have surgery to repair the abnormality. Other conditions, like severely deformed spine

affecting them moving and getting milk from the mother may be euthanised on welfare grounds.

Commentary

The candidate has filled in the health check form accurately, showing excellent understanding of physical health check parameters used to evaluate and monitor the overall health status of the ferret. For example, for the ferret's skin condition, states their findings, namely no scratches, wounds or lumps and interprets their findings to reach a suitable conclusion of normal skin condition. For some parameters the candidate expands further, demonstrating additional knowledge, understanding and interpretation of the signs of health and ill-health in the animal's examined. For example, nasal discharge in ferrets can be associated with distemper which demonstrates welfare orientated technical information.

The candidate exhibits an excellent understanding of the adaptations to handling required for a pregnant female and breeding male to maintain safe and welfare orientated techniques. They have discussed changes in handling and the equipment used. For example, the candidate considers the effect of poor handling on the pregnant ferret and the implications to her unborn developing litter, demonstrating excellent welfare orientated knowledge.

The candidate shows excellent understanding of congenital conditions and explains the procedure adopted if any of these conditions are detected in a neonatal animal. For example, the candidate lists a few congenital conditions such as cleft palate and spinal deformities and explains the processes involved when they are found demonstrating excellent technical knowledge.

Task 3 Population management report

Evidence contributes to the following:

Performance outcome(s)
PO2 Observe the behaviour, security and breeding practices of animals
PO3 Plan for and manage the good health and welfare of animals
PO4 Carry out safe animal handling practices

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Population management report	√		√

Task 3b) Population management report

Candidate evidence – population management report

Evolution, Conservation and Management of the *Chelonoidis niger sp*

Introduction

Galapagos Tortoises, *Chelonoidis niger sp* are the largest living reptile in the world weighing between 150-400kg and measuring up to 1.2m in length. There are 14 living subspecies of *Chelonoidis niger sp* and they are all endemic to 8 Islands in the Galapagos, where they can be found grazing on vegetation, such as grasses and cacti. Due to their slow metabolism, these Tortoises can spend over 16 hours per day resting and are able to go long periods of time, with up to a year being recorded, without food or water. They are migratory species, moving to secure new vegetation with the season. This migration can take over 2 weeks to cover 7-10km. The ecosystem relies on the Galapagos Tortoise for seed dispersal and the maintenance of vegetation, which would take over the landscape and negatively impact other flora species if they were not naturally managed through the grazing and browsing behaviours of the Tortoise.

Other animals also benefit from the presence of the Galapagos Tortoise with their walkways and wallows. They have a mutualistic relationship with endemic finches, which feed on parasites such as ticks, which can be bothersome and potentially harmful to the Tortoise health.

The Galapagos Tortoise is an example of adaptive radiation, due to having similar traits that pinpoint to a common ancestor, they have also evolved characteristics over 2-3 million years which enable them to gain the most out of the different habitats in the Islands. This report will be looking into the evolution and conservation strategies of the *Chelonoidis niger sp.* These

must be considered for the successful captive management and breeding of the species to boost their population and to secure their future.

Evolution of the Galapagos Tortoise

During a surveying trip in 1835, Charles Darwin identified the physical differences of the Tortoises across the Galapagos Islands, noting saddleback Tortoises such as *Chelonoidis hoodensis* have a carapace which is flared at the front. This adaptation allows them to extend their long necks further, so they can reach vegetation in high places within their dry, coastal habitat. Whereas the domed species of Galapagos Tortoise such as *Chelonoidis niger becki* have rounded shells and shorter necks, which is suited to the low growing, easy access vegetation in their forest and scrubland habitat. These characteristics are only observed on some of the Islands and demonstrates significant relationship between natural selection and the environment.

These differences prompted Darwin's theory of evolution by natural selection. Over time the Tortoises with these advantageous adaptations would have been successful in locating food, becoming bigger and stronger than rivals with smaller necks or rounder shells and therefore becoming more appealing during the breeding season. They would then pass on these traits through their genes, with offspring with these characteristics also becoming more successful, until eventually the subspecies is recognised with these distinctive characteristics. There are different theories about how the Galapagos Tortoises initially travelled between the Islands and then evolved and adapted to their individual environments. A popular theory considers the possibility of these giant ectothermic reptiles swimming across to the different Islands 2-3 million years ago and evolving adapted characteristics, such as shell shape. Attempts were made to disprove this theory by placing a Galapagos Tortoise into the sea, expecting it to sink, however they discovered the Tortoise to be very buoyant, this is due to the small air chambers which support the weight of the carapace and the position of the Tortoises' lungs also enable buoyancy as they are situated near the top of the carapace. This journey across the ocean would have taken a long time to complete. With their slow metabolism and ability to survive for long periods of time without sustenance, suggests this is a plausible explanation of how the 14 subspecies of *Chelonoidis niger sp* can be found across the 8 Islands of the Galapagos and why, over time, they have evolved differences in their appearances enabling them to survive.

Galapagos Tortoise are facing extinction, with 2 subspecies becoming extinct in the last 200 years. Of the species still alive, there are only 17,000 individuals remaining in the wild. Historically, their numbers declined due to hunting for their reportedly ‘delicious’ meat from sailors, pirates and merchants. The Galapagos Tortoises are still at risk due to the introduction of alien species such as cats, rats, goats and pigs, pollution and urbanisation of wild spaces. This is occurring as the human population grows and from increased tourism pressures as the Galapagos Islands increase in popularity with visitors. Illegal hunting for meat, persecution and pet trade is also a problem the Tortoises face. Increasing their population is slow for lots of reasons such as slow rate of growth, reaching sexual maturity at around 25 years old and incubation of a clutch of 2-10 eggs (saddleback species) or 25+ (domed species) and can take up to 8 months, depending on the environmental conditions such as temperature and humidity. It is estimated that only a small percentage will survive past 10 years old.

Hunting the Galapagos Tortoise is illegal under Ecuadorian law, and the Convention of Trade in Endangered Species of Fauna and Flora (CITES) prohibits any international trade of the Galapagos Tortoise species.

Conservation for the Galapagos Tortoise
Including the ethical and legal considerations for the Tortoise.

There are currently 14 remaining subspecies of Galapagos Tortoise, this is only 10% of the original population on the Galapagos Islands. Six of these are classified as critically endangered on the IUCN Red List. Conservation efforts both *in-situ* and *ex-situ,* are working to halt the decline and further extinction, with some positive increases in population numbers being recorded for 7 of *Chelonoidis niger* subspecies.

Efforts to halt the decline of the Galapagos Tortoise has involved a collaborative effort, with legal protection being given to them and their natural habitat, making it illegal to hunt, sell them or their parts under Ecuadorian law. Great effort is being made to educate visitors about ethical tourism, single use plastics and respecting the environment. There is also a governmentally agreed plan, for the ban for all international movement of the species under the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Local organisations such as The Galapagos Conservancy, have worked tirelessly over the last 60 years to protect the Galapagos Tortoise from extinction, having successfully raised over 9,000 *Chelonoid* babies in captivity and released them back into the wild.
These captive rearing programs help increase the Tortoise population and provide a safety net against extinction. The Galapagos Tortoise is a slow reproducer, with a high mortality rate for their offspring, so these programs help to safeguard their survival from non-native, introduced alien species, such as predation from rats, dogs and cats, as well as disturbance/damage from pigs and goats.

However, for this project to be successful, eggs must be removed from a wild nest site. This can have a detrimental effect on biodiversity. For example, a natural predator such as the Galapagos hawk, relies on the Tortoise breeding season for a source of food, removing this could have an impact on their survival rates too. Another ethical consideration of removing wild eggs from their nest site is that it could impact the nesting behaviour of the female, who uses the same nest site every breeding season. Once the hatchlings reach sexual maturity, they also return to the vicinity of the nesting area. Removing them to hatch in captivity could cause confusion and potentially impact on their own breeding success.

Captive breeding programmes in *ex-situ* facilities, such as at ZSL, London Zoo and Crocodiles of the World, establish genetic diversity by carefully managing the keeping and breeding of the Galapagos Tortoise from the recommendations of the International Studbook and European Endangered Species Programme (EEP). An *ex-situ* population is managed through the collaboration and partnership between collections in national organisations such as the British and Irish Association of Zoos and Aquaria (BIAZA) and international organisations; the European Association of Zoo and Aquaria (EAZA) and the World Association of Zoo and Aquaria (WAZA).

This collaboration prevents inbreeding and preserves the genetic diversity of the Tortoises, by transferring individual animals across collections, following recommendations of the EEP, which is crucial for the long-term survival of the species.

Housing *Chelonoidis* in captivity provides opportunities to carry out extensive research through observations of behaviour, social dynamics, breeding factors, diet, health and longevity within a controlled, captive setting. This information can be utilised to maximise the breeding or housing of the Tortoise in other *ex-situ* facilities as well as the direct conservation efforts *in-situ.*

Housing the Galapagos Tortoise in captivity outside of the Galapagos Islands provides an opportunity to raise awareness of the conservation needed to protect the species. Educating the general public about an animal they can see has a much more positive and lasting impact.

The Management Strategies *(keeping and breeding the Galapagos Tortoise)* Including the ethical and legal considerations for the Tortoise.

The Galapagos Tortoise is a diurnal, ectothermic reptile, weighing between 150-200kg. Their diet consists of vegetation, and they are able to safely consume foods toxic to humans. There are currently 6 collections in the UK holding Galapagos Tortoise species. Having such a low number of collections holding the species poses a challenge with competencies, especially in terms of veterinary care and health and safety requirements. The Galapagos Tortoise is an extremely heavy reptile, so safe manual handling and movement are important ethical considerations.

Knowledge of the care and welfare of the Tortoise is shared by national and international collections, with transfer of knowledge supported by BIAZA, EAZA and WAZA.

To effectively manage the captive population of Galapagos Tortoise, there has been an element of trial and error, which could be considered an ethical concern. The management of this species has been transferred from knowledge gained of the management of other, more commonly kept species of Tortoise, such as the Aldabra and Sulcata species. This will have potentially led to inappropriate diet, reproductive factors and health maintenance. However, every successful hatching of a Galapagos Tortoise and the longevity of the species in captivity enables continued up to date information to be gathered and shared, to ensure species appropriate management is provided.

To ensure the captive population of the Galapagos Tortoise remains stable, more collections should become holders, however under the Zoo Licensing Act 1981 any UK collection must have a zoo license to hold these animals. This ensures the collection is regulated and must meet quality inspections to confirm their suitability to manage any species listed. Managing this species in captivity requires specialised management strategies to meet their health and welfare needs.

As part of the Animal Welfare Act 2006, it is a mandatory need for the Tortoise to have appropriate accommodation. This should include a spacious, safe and secure enclosure. ZSL London Zoo currently hold 3 female Galapagos Tortoises in a 322m^2 exhibit. This provides the Tortoises with space to explore, socialise or hide. To mimic their natural environment, the enclosure should be furnished with non-toxic vegetation, a water source deep enough for them to bathe, rocks and logs. These will allow for temperature gradients which should include hots spots of up to 24°C and cooler areas no lower than 15°C, which the Tortoises would access by basking or wallowing, enabling them to thermoregulate. Temperature and humidity are also important considerations if natural breeding is to be encouraged in captivity, as this will inform the incubation period and sex ratio of any hatchlings.

UVB lighting is essential for reptiles, to protect them from the risk of health complications such as metabolic bone disease and meeting the Animal Welfare Act's need to protect from pain, injury suffering and disease. The lighting would need to be set for appropriate lengths to mimic daylight hours and meet the natural circadian rhythm cycle of Tortoises.

Substrates should be a deep layer of sustainably sourced wood chip, sand or peat-replacement such as coir, which will enable and encourage natural behaviours such as nesting excavations in the event of successful breeding, meeting the welfare need to exhibit natural behaviours.

Breeding management of the Galapagos Tortoise can be quite challenging as they are generally inactive for over 16 hours per day. During courtship, the male will follow and intimidate the female until she is immobilised. After internal fertilisation takes place, the female will lay a clutch of 2-10 eggs in a deep underground nest. The female plays no part in rearing the offspring, as they are precocious hatchings with an innate behaviour to leave the nest and search for secure hiding places, avoid predation and find food. In captivity, it is common for the eggs to be removed and artificially incubated, in an attempt to gain more knowledge on the development of the *Chelonoidis* egg and hatchling, potentially maximising breeding success. However, this continues to be trial and error. Crocodiles of the World in Oxfordshire is the only UK collection to successfully hatch 2 Galapagos Tortoises, following a 4-month incubation period. Considering the statistics of removing the eggs and being unsuccessful with incubation, ethically it could be a better option to leave the eggs in the nest site laid by the female, especially as there are no predatory threats in captivity. However, beneficial knowledge is gained through artificially incubating Galapagos Tortoise eggs and from one success, any further attempts could benefit from the knowledge shared.

Conclusion

The population management of the Galapagos Tortoise relies heavily on the evidence gained from research carried out in captivity. The captive breeding and management of these giant Tortoises ensures there will be a back-up population to safeguard the future of the remaining subspecies. Every successful captive breeding ensures knowledge is shared to maximise the support provided in breeding and rearing *in-situ* conservation.

Statistics on the IUCN Red List show numbers are increasing, so the collaboration of governmental legislation, captive breeding, conservation efforts and education are making a positive impact.

Commentary

The candidate has produced a comprehensive population management report for the care and monitoring of the Galapagos Tortoise in accordance with relevant legislation, conservation and evolution. They have consistently used accurate technical terminology throughout their report.

The candidate has provided comprehensive detail for the evolution of the Galapagos Tortoise, describing the links between characteristics, natural history and evolutionary adaptations, showing a holistic knowledge of these factors. They have provided appropriate examples showing how this impacts the IUCN Red List, with excellent ethical considerations provided. For example, they have listed concerns such as alien species, pollution and urbanisation which showing an excellent understanding of human-animal interaction.

The candidate has provided an excellent discussion of the ethical and legal considerations, providing justification for the importance of Tortoise and habitat protection. For example, acknowledging that there is a lack of knowledge about keeping Galapagos Tortoises as a

whole in the industry, which gives some ethical concerns to the public for keeping them with the best welfare in mind.

The candidate shows an excellent understanding of the active conservation efforts in both *in-situ* and *ex-situ* examples. For example, linking how organisations raise awareness of the conservation need and how they have a positive impact on the Tortoise population, both in captivity and in their natural habitat.

The candidate has demonstrated comprehensive knowledge of the management and captive breeding of the Galapagos Tortoise, describing population numbers and the purpose of education in accordance with relevant legislation, conservation and evolution. For example, they have considered the ethics of trial-and-error methods to gain knowledge of the management of the tortoise in substantial detail, showing thorough justification for the benefits of the information they have provided.

Task 4 Plan an investigation

Evidence contributes to the following:

Performance outcome(s)
PO3 Plan for and manage the good health and welfare of animals PO5 Plan, perform, record and communicate findings of scientific investigations in animal science

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Task 4a - Scientific plan	√		√
Task 4b - Equipment list	√		√
Task 4c - Risk assessment	√		√

Task 4a) Create a scientific plan for conducting an investigation

Candidate evidence – scientific plan

Culturing and identification of an unknown pathogenic bacteria.

Introduction

Identifying the cause of the illness in Guilds Animal Science Centre, will be essential in implementing the appropriate response to the disease outbreak and administering effective treatment to the animals there. Under the Animal Welfare Act (2006), there is a legal requirement for the collection to prevent pain and suffering, and so quick action is essential. There is a risk that the unknown pathogen could be a notifiable disease, in which case Guilds Animal Science Centre will need to notify DEFRA (Department for Education, Fisheries and Rural Affairs), under the Animal Health Act (1981). The methods for conducting the investigation to identify and isolate treatments for the unknown pathogen are provided below. In short, this investigation will seek to culture the sample provided by Guilds Animal Science Centre and use that culture to gram stain and view the unknown pathogen, under a microscope, to provide a positive identification. The sample will also be exposed to six known antibiotic samples, to identify which is the most effective.

Aims

- Identify the bacteria in the provided swab

Objectives

- Culture a sample of the unknown pathogenic bacteria, using aseptic technique
- Gram stain the unknown pathogenic bacteria, in preparation for identification
- Identify the unknown pathogenic bacteria, using a microscope and bacterial identification sheet.

Methodology

Culture

- In a fume cupboard, assemble a test tube rack, a test tube with the swabbed bacterial sample, a Bunsen burner on a safety flame, a prepared, labelled agar petri dish and an inoculation loop. Ensure the lid of the labelled petri dish is removed and the lid of the swabbed sample loosened
- Set the Bunsen flame to blue
- Pass the inoculation loop through the flame, to sterilise the loop and remove risk of contamination
- Place the loop into the test tube rack to allow it to cool, to prevent the risk of damaging the sample
- Remove the lid from the swabbed sample, using aseptic technique
- Place the cooled inoculation loop into the sample, to collect bacteria
- Place the end of the loop onto the starting square of the agar plate, and lawn the sample
- Between passes over the agar plate (a total of three), ensure that the inoculation loop is placed into the Bunsen flame, to sterilise the loop and prevent cross contamination from air borne bacteria
- Repeat this a further two times
- Turn the plate upside down, to ensure no contamination from airborne bacteria
- Return the Bunsen burner to a safety flame and turn off
- Incubate the agar plate at a maximum temperature of 25°C for 48 hours.

Justification

Aseptic technique is essential to ensuring that the results are accurate for the rest of the investigation. Aseptic technique involves the implementation of practices to reduce the risk of contamination of a sample. In this experiment the inoculation loop will be passed through a blue Bunsen flame to ensure that it is sterile after each set of streaks has been made on the agar plate; this is to prevent the contamination of the sample with airborne bacteria. A starting square will be made on the agar plate to allow for ease of identification of the starting point of the culture when it is later assessed. The bottom of the petri dish will be clearly labelled to avoid confusion, and the plate placed upside down to prevent contamination from airborne bacteria.

Gram staining

- Set the Bunsen burner to a safety flame
- Add a drop of saline solution, using a pipette, to a prepared microscope slide, to remove contaminants

- Set the Bunsen burner to a blue flame and pass the inoculation loop through the flame to sterilise
- Swab the colony, on the cultured plate
- Place the tip of the inoculation loop on the slide and move it around the slide, to ensure an even distribution of the sample
- Allow the slide to air dry
- Over a sink, and in a slide rack, cover the slide in methanol to fix the sample
- Allow the slide to air dry
- Then cover the sample in crystal violet solution
- Rinse the slide with deionised water, to remove excess Crystal Violet
- Flood the slide with Gram's Iodine solution
- Using decolouriser, tilt the slide over the sink and rinse the slide until it runs clear
- Flush the slide with deionised water
- Flood the slide with Safranin
- Flush the slide with deionised water
- Blot the slide with blotting paper, to dry.

Identification

- Place the prepared gram-stained slide under the microscope
- Use the 40x objective lens to locate the sample on the slide
- Use a pipette to add a drop of immersion oil to the slide
- Change the objective lens to 100x and view again
- Use the bacterial identification sheet, to compare what is seen under the microscope.

Justification

Gram staining samples allows for the observer to visually put bacteria into two categories: gram positive and gram negative. The thickness of the peptidoglycan layer around the cells defines these. A gram-positive bacterial cell has a thicker layer and so shows up as a deep purple colouring, and gram negative bacterial cells have a thinner layer, and so show up as a lighter pink colour. Viewing under the light microscope, at 40x objective lens is important for initial location of cells, but for further analysis, the cells need to be viewed under the 100x objective lens, to isolate key defining components, such as shape.

Antibiotic testing

- Set the Bunsen flame to safety
- Switch the Bunsen flame to a blue flame
- Ensure that the petri dish is labelled
- Pass the inoculation loop through the flame, to sterilise the loop
- Collect the sample onto the inoculation loop
- Pass the loop over the prepared agar plate, to the lawn the sample in one direction
- Repeat two times, rotating the plate to lawn in a further two directions
- Use an antibiotic stamp, to stamp down the sample antibiotics onto the agar plate
- Leave at 25C for 48 hours
- Measure the zones of inhibition around each sample, using electronic callipers.

Justification

The use of the Kirby-Bauer method, which involves the utilisation of the antibiotic stamp is an effective way of establishing the effectiveness of an antibiotic against pathogenic bacteria. It allows for the antibiotic samples to be laid out at set distances aiding the ease of measurement. Once the bacteria has been allowed sufficient time to culture, the zone of inhibition can be easily measured with a ruler. This may need to be repeated if zones of inhibition are unmeasurable due to overlapping.

Repeats

The equipment requested should include multiples to allow for repeats of each step if necessary to ensure accurate results. This may be required if a mistake is made in the preparation of the plates.

Commentary

The candidate has produced an excellent plan with a logical and ordered structure starting with an introduction and including step-by-step methodologies with excellent detail for their investigation. They have used explanatory subtitles and bullet points throughout with good detail. For example, instructions given often have reasoning added to them such as the loop being passed through the flame in order to sterilise it, which supports the functionality of the plan.

The plan is consistently accurate and the candidate has used scientific terminology throughout. The equipment has always been identified correctly. For example, stating the number of passes across the agar demonstrates the accuracy and precision of their methodology.

The candidate has made excellent and relevant justifications for each stage of their scientific plan, showing their depth of knowledge. They have explained why the steps are important for each part of the investigation. For example, when justifying aseptic technique, multiple reasons are given to ensure a safe and fair test and they have explained that this ensures the rest of the investigation is accurate.

Task 4b) Produce a list of equipment needed to carry out an investigation

Candidate evidence – equipment list

Item	Number Required for bacteria identification	Number required for antibiotic investigation	Item	Number Required for bacteria identification	Number required for antibiotic investigation
Safety goggles	1	1	Gloves	1	1
Lab coat	1	1	Safety cabinet	1	1
Stirring rod			Retort stand, boss and clamps		
Sterile water			Measuring cylinder		
Scales			Bunsen burner	1	1
Heat proof mat	1	1	100ml beaker		
250ml beaker			500 ml beaker		
Incubator set to 25C	1		Incubator set to 37C		
1cm3 pipette			5cm3 pipette		
15cm3 test tube	3	3	Test tube rack	1	1
Sterile swab			'L' spreader		
Agar plate with nutrient agar	3		Agar plate with sensitivity agar		
Agar plate with MacConkey agar			Agar plate with blood agar		
Filter paper			Marker pen		
Elastic bands			Spatula		
Forceps/tweezers			Inoculation loop	2	
Sticky tape			Paper towels	1	
Ruler			Graph paper		
Disinfectant	1		Handwash		
Antibiotic stamp		1	Deionised water	1	
Microscope slide	3		Microscope	1	
Slide rack	1		Crystal violet	1	
Gram's iodine	1		Decolouriser	1	
Safranin	1		Immersion oil	1	
Bacteria identification sheet	1	1			
Other item					
Unknown bacteria solution	1		Cultured sample		1

Antibiotics		6	Electronic callipers		1

Commentary

The candidate has filled in the centre devised equipment list with appropriate numbers of each piece of equipment in line with their plan, allowing for repeat tests. For example, multiple microscope slides and agar plates have been requested, which demonstrates excellent preparation of a scientific investigation with equipment for appropriate control measures contributing to a fair test.

Task 4c) Complete a risk assessment

Candidate evidence – risk assessment

Figure 2 - Candidate evidence - Risk assessment

This template may be modified by adding items/rows only.

Candidate's name	Candidate X	Enrolment number	ABC 1234
Task / Activity	Task 4c	Location	Laboratory
Assessor's name	Assessor A	Date	01-02-2024

Item no.	What are the hazards?	Who might be harmed and how?	What control measures are already in place?	Risk rating (high/medium/low)	What further action is necessary?	Action by who and when?	Residual risk rating (High / Medium / Low / Trivial)
1	Exposure to pathogenic bacteria	Candidate Peers Assessor	PPE - lab coat, safety goggles, glove. Laboratory regulations.	High	Review of protocols, to ensure currency. Use of a fume cupboard.	Laboratory technician Candidate Prior to investigation	Medium
2	Antibiotic resistance	Candidate Peers Assessor Public	Follow correct disposal protocols, when discarding samples.	Medium	Review of protocols, to ensure that they match national guidelines.	Laboratory technician Candidate Prior to investigation	Medium
3	Exposure to chemical reagents	Candidate Peers Assessor	PPE - lab coat, safety goggles, gloves. Laboratory regulations.	Medium	Ensure that safety sheets are up to date.	Laboratory technician Candidate	Medium

			Consult CLEAPSS safety sheet for chemicals.			Prior to investigation	
4	Burns	Candidate	PPE - lab coat Training on safe use of Bunsen burner.	Medium	Use of safety flame.	Candidate Prior to investigation	Medium
5	Slips, trips and falls	Candidate	PPE. Maintain a tidy working environment Report all spillages.	Medium	Conduct a visual inspection of the workspace.	Candidate Prior to investigation	Low
6	Fire	Candidate Peers Assessor	Training on the appropriate use of a Bunsen burner.	Medium	Conduct a visual inspection of the workspace. Report all faulty equipment.	Candidate Prior to investigation	Medium
7	Hazardous chemical spills	Candidate Peers Assessor	Labelled locations of spill kits.	Medium	Practice use of spill kit.	Candidate	Medium
8	Allergies	Candidate	PPE. Report any signs of ill health.	Medium	Antihistamine availability. Maintaining safe working practices.	Candidate	Low
9	Sharps	Candidate	PPE. Sharps bins.	Medium	Clear up breakages as soon as they occur.	Candidate	Low
10							

Date: 01/02/2024	Risk assessment carried out by: *A sample candidate*

Commentary

The candidate has comprehensively assessed risk by completing a comprehensive risk assessment, which would keep themselves and others safe, showing an excellent understanding of the requirements of health and safety and safe working methods in a laboratory environment. Multiple correct and relevant hazards have been identified showing a consideration of the laboratory and investigation as a whole. For example, identifying specific PPE for each hazard demonstrates their understanding of the task and the risks to themselves and others.

The risk assessment was completed with an excellent understanding of the difference between hazards, risks and control measures, and correctly categorised risk ratings. The control measures given take into consideration both personal and general precautions. For example, for exposure to chemicals the candidate has given control measures relating to themselves, the environment and legislative requirements.

The candidate considered further control measures that could be applied to reduce the risk ratings. They have shown understanding that other precautions will help to lower the risk ratings. For example, the candidate included actions which should be taken as part of their continual safe working, such as using the safety flame on the Bunsen burner and clearing up spillages as they occur.

Task 5 Carry out the investigation

Evidence contributes to the following:

Performance outcome(s)
PO3 Plan for and manage the good health and welfare of animals PO5 Plan, perform, record and communicate findings of scientific investigations in animal science

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Task 5a - Assessor observation		√	√
Task 5a - Video(s)		√	√
Task 5a - Results	√		√
Task 5b - Assessor observation		√	√
Task 5b - Photo(s)		√	√
Task 5b - Results	√		√

Task 5a) Determine the bacteria

Assessor evidence – assessor observation

Task	Assessment component number
Task 5 – Carry out the investigation a) Identify the bacteria	8717-409
Candidate name	**Candidate number**
A Candidate	CG12345
Centre name	**Assessor**
A Centre	An Assessor

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
a) Identify the bacteria	For the preparation of the culture, the candidate: • began with a fully prepared working area, inside of a fume cupboard. All lids, including those of the swab test tube and the petri dish were either loosened or removed. The Bunsen flame was set to safety showing safe working practice • labelled the petri dish with a starting square clearly marked out • removed and sterilised the inoculation loop, after having turned the Bunsen flame onto a blue flame. The loop was then allowed to cool in the test tube rack ensuring it was not touched against anything that may contaminate it • proceeded to swab the bacterial sample with the sample swab in the starting square and then began to streak the agar plate with the inoculation loop. The lid was replaced back onto the bacteria sampled • streaked four times in one direction, rotated the plate and sterilised the inoculation loop between streaks, keeping the plate solid in the palm of one hand and using the other to manipulate and move the loop • checked that the loop was cooled after sterilisation, before commencing the next set of streaks. The loop was not cool and so the candidate cooled it using the agar, by tapping it against the surface in an area that was not being used in the streaking process

Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	• commenced the next set of streaks, with the now cooled inoculation loop • finished the experiment, by turning the Bunsen burner back on to a safety flame and placing the dish upside down. For the identification of the bacteria, the candidate: • began the gram staining by ensuring that their workstation was fully prepared. They added a drop of saline to a microscope slide, using a pipette • used a sterilised inoculation loop, to swab the edge of the colony on their prepared petri dish, holding the dish solidly in their palm and gently scooping with the loop. They moved the inoculation loop around the slide, ensuring even distribution of the sample • allowed the slide to air dry, before fixing was undertaken by the candidate, using methanol. The slide was again allowed to air dry • moved on to cover the slide in crystal violet solution, not using more chemical than was necessary but enough for an accurate result. The slide was then rinsed with deionised water, to remove the excess dye • flooded the slide with Gram's Iodine • proceeded to flush away the excess iodine with deionised water then angled the slide over the sink and used decolouriser, until the violet colour could no longer be seen • rinsed the slide with deionised water again • flooded the slide with safranin, holding the slide still with one hand (tongs) and switching between chemicals with the other • flushed the slide, using deionised water, and avoiding excess splashing or spilling of chemicals • proceeded to blot the slide dry, with blotting paper, and ensuring this was disposed of correctly and contained within the staining workstation • used the prepared slide, to view under the microscope using the 40x to locate the cells and then the 100x oil immersion lens, after adding the oil to the slide • correctly identified that the slide contained E.coli cells, citing the pink appearance of the E.coli rods, and used the identification sheet to aid their decision.

Assessor signature	Date
An assessor	**22.04.24**

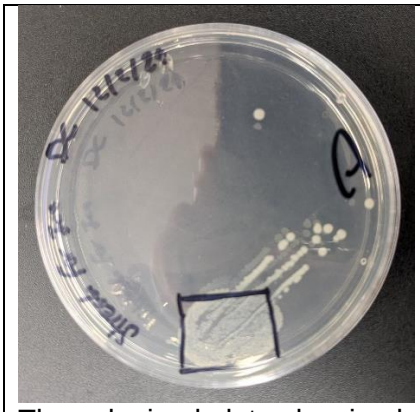
Candidate evidence – results

Sample	Gram Stain Colour	Microscope shape
1	Pink	Rod

Bacteria Identification: E.coli

Assessor evidence – video(s) and photo(s)

AMS_GSEM_Synoptic_Assignment_Task_5_Scientific_Investigation_Distinction.mp4



The colonised plate showing labelling of the starting square.

Task 5b) Determine the best antibiotic

Assessor evidence – assessor observation

Task	Assessment component number
Task 5 – Carry out the investigation b) Best antibiotic	8717-409
Candidate name	**Candidate number**
A Candidate	CG12345
Centre name	**Assessor**
A Centre	An Assessor

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

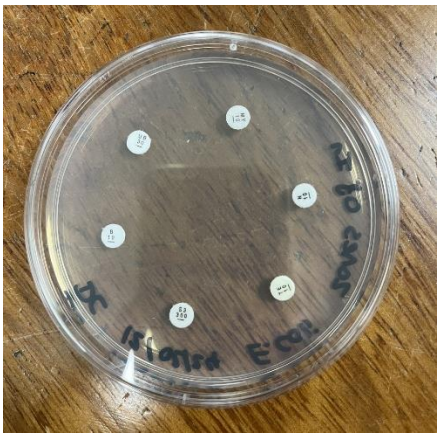
Assessor observation	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
b) Best antibiotic	The candidate: • began by lawning the agar plate by holding the plate solidly, using a sterilised inoculation loop to do this; the plate was initially lawned in one direction, with the candidate then rotating the plate, to lawn in another direction, and rotated again, to make three passes • utilised an antibiotic stamp, to stamp down the 6 antibiotic samples and then replaced the petri dish upside down, at which point one of the samples fell off • used tweezers to affix the sample back into the original position • spaced the antibiotic samples evenly, with the petri dish given detailed labelling before incubation • measured the zones of inhibition to obtain results using electronic callipers very accurately.

Assessor signature	**Date**
An assessor	**22.04.24**

Candidate evidence – results

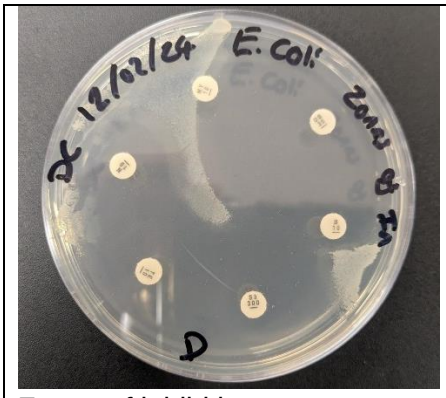
Sample	Zone of Inhibition
UB 30	22.4mm
B 10	2.2mm
S3 300	14.1mm
TE 10	11.7mm
N 10	8.8mm
MY 10	Ineffective.

Assessor evidence – photo(s)



Antibiotics applied with an antibiotic stamp

Labelling of antibiotic culture



Zones of inhibition

Commentary

The candidate accurately used their plan from Task 4 to inform the steps of their investigation, plan and prepare the equipment and work areas to an excellent standard and inform any decisions made during the process, demonstrating consistent safe working techniques which can be seen from the method stated in the observation form.

The candidate carried out the investigation with highly effective practical skill and dexterity throughout. For example, the agar plate was rotated between passes of the inoculation loop, whilst the plate was kept secure in one hand and the loop was moved with the other, demonstrating excellent dexterity and increasing the likelihood of colony isolation.

The candidate ensured that they followed safe working practices at all times, considering their own safety and the safety of others when applying practical skills. For example, keeping the Bunsen on the safety flame before and after use, which demonstrated use of excellent control methods to ensure safe working practices in line with their risk assessment.

The candidate showed excellent aseptic technique by recapping the bacteria when not in use and sterilising the inoculation loop between passes across the agar. Handling of chemicals and microscope technique was excellent showing high level practical skill. For example, using lower magnification to locate the bacteria before increasing magnification to identify the bacteria, achieving excellent results demonstrating excellent practical ability.

The candidate continued to use their methodology for the second part of the investigation, ensuring that accurate measurements were taken and recorded in a suitable table for use in the scientific report in the next task. For example, measurements of the zones of inhibition were given to 1 decimal place, showing a good level of precision and accuracy.

An antibiotic disc fell off the agar plate before the candidate had completed the investigation and they chose to replace this, enabling the full complement of results to be achieved with excellent accuracy. For example, placing it back in the original location enabled all results to be seen clearly to obtain valid results as there was limited overlapping of the zones of inhibition. For best practice, the candidate could have repeated this step as they had asked for multiples of the equipment in their equipment list which would have contributed to higher levels of accuracy and less interference with the discs.

Task 6 Present your findings

Evidence contributes to the following:

Performance outcome(s)
PO3 Plan for and manage the good health and welfare of animals PO5 Plan, perform, record and communicate findings of scientific investigations in animal science

Evidence	Candidate producing	Assessor producing	Included in this GSEM
Task 6b - Scientific report	√		√

Task 6a) Research notes

The research notes provided are one side of A4 exemplar notes of the expected standard to be produced by the candidate but are not marked so no commentary has been provided.

Candidate evidence – research notes

Research Notes

Antibiotics
Antibiotic drugs are either bactericidal or bacteriostatic
Bactericidal = kills the bacteria
Bacteriostatic = prevent the bacteria replicating/ dividing
Effective against Gram positive or Gram negative bacteria - work more effectively in aerobic or anaerobic environments

Antibiotics/antibacterials work in one of 5 ways:

1. Interfere with the formation of the bacterial cell wall - so stop the bacteria from replicating
2. Damaging the bacterial cell membrane permeability - thus resulting in destruction of the bacteria cell
3. Interfere with bacterial protein synthesis
4. Inhibit the bacterial production of nucleic acid- interfering with DNA or RNA synthesis
5. Disruption of the bacteria cell's metabolic activity

Resistance develops because

- Bacteria develop a method of survival in the presence of an antibiotic & they pass this genetic adaptation to the next generation
- Not enough/ insufficient dose or length of course is administered to a patient - so not all the bacteria are ''destroyed'' meaning the bacteria left develop a resistance to that antibiotic

MRSA methicillin resistant staphylococcus aureus - nosocomial transmission between human and animals & vice versa
Currently veterinary medicine - **Responsible** use of all antimicrobial preparations (this includes antibacterial/ antiviral/ antiparasitic drugs/ antifungal preparations) - **For antibiotics/ antibacterial drugs**: reduction or prevention of use in cases that do not require their use / use of more specific narrow ranged antibiotics- specific for the bacteria being targeted (after C & S testing) / accurate dosing / client compliance to complete the course prescribed to prevent development of bacterial resistance.

Antibiotic / disc	Mode of action/ information
Neomycin N10	Interferes with the bacterial protein synthesis by attaching to the ribosomes Bactericidal Used to treat intestinal bacterial infections (with care and alongside a specialised diet and close monitoring of patient response. More effective in aerobic environment. Poor absorption across GIT. Avoid for liver damage/gastrointestinal ulcers.
Flumequine UB30	Inhibition of bacterial nucleic acid production (DNA) gyrase enzyme Bactericidal Wide spectrum of activity (gram positive, gram negative, aerobic, anaerobic, pseudomonas, salmonella.….) Effective against gram negative Mainly used for GIT infections Good absorption in GIT Care in food animals – high resistance risk – mostly used exotics Can affect cartilage growth Sometimes MRSA resistant
Bacitracin B10	Narrow spectrum antibiotic Effective against Gram positive bacteria Gram negative bacteria are resistant to bacitracin Bacteriostatic and bactericidal dependent on use Interferes with cell wall formation

Task 6b) Scientific written report

Candidate evidence – scientific report

Introduction

The aim of the investigation was to identify the bacteria in the swab and then to determine the most effective antibiotic in order to treat an infection of this bacteria if the animals at the Guilds Animal Science Centre were to become sick.

The investigation was carried out in line with the methodology I produced in my scientific plan, including a focus on culturing the bacteria, staining it for identification and testing which antibiotic standards worked against it. This methodology identified the bacteria as E.coli. The methodology identified variations in the effectiveness of the antibiotics against the bacteria.

I will also evaluate the methodologies used in the experiment and make recommendations for improvements. Given the potential risk that E.coli poses to the digestive health of the animals housed in the collection, it is also important to identify the specific antibiotic to combat the E.coli bacteria, to ensure that no further harm is caused to the animals. I am also going to discuss antibiotic resistance and how this may affect the antibiotics used at Guilds Animal Science Centre.

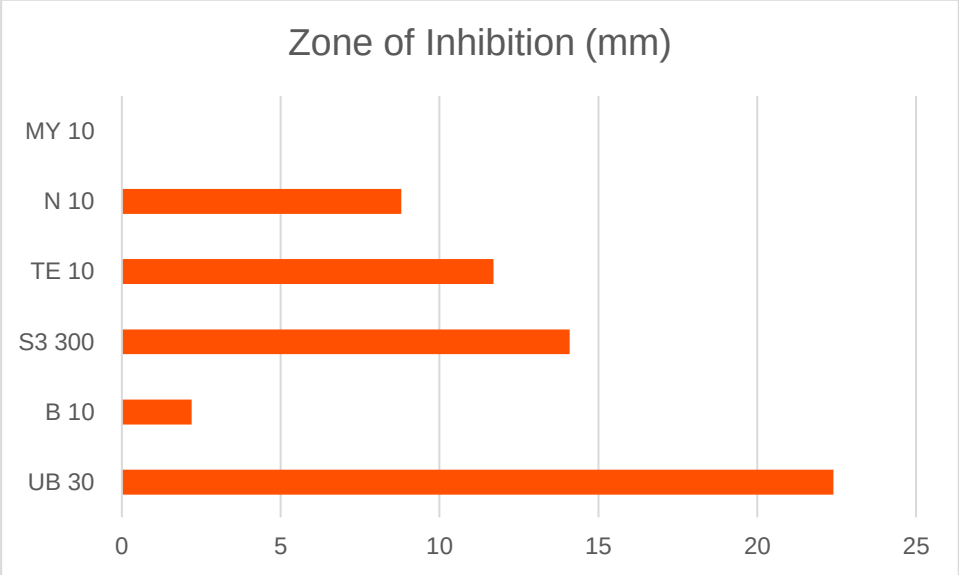
The ultimate aim of this investigation was to identify the pathogen and to make recommendations for the treatment of disease.

Analysis of results

The bacteria was identified by undertaking an investigation to isolate the bacteria using aseptic technique and then using gram staining and a microscope to look at the shape of the individual cells. A bacterial identification sheet was provided which enabled me to use the identification tree to determine that the bacteria was E. coli.

Following on from this, the E. coli was then used to lawn an agar plate which then had six different antibiotic discs added to it to test the effectiveness of each. When incubated, the antibiotic discs prevented growth of the bacteria in zones of inhibition and these were measured to determine their effectiveness. My results can be seen in the table and graph below.

Antibiotic	**Zone of Inhibition (mm)**
UB 30 (Flumequine)	22.4
B 10 (Bacitracin)	2.2
S3 300 (Sulfonamide)	14.1
TE 10 (Tetracycline)	11.7
N 10 (Neomycin)	8.8
MY 10 (Lincomycin)	Ineffective



This shows that the most effective antibiotic was Fluquemine and the least effective was Bacitracin. Lincomycin was completely ineffective and no zone of inhibition was seen. Neomycin, Sulfonamide and Tetracycline all had similar effectiveness.

Implications of antibiotic resistance on Guilds Animal Science Centre

An antibiotic is a drug that is bactericidal or bacteriostatic. A bactericidal drug kills the bacteria, whilst a bacteriostatic drug prevents the bacteria from replicating. They are usually effective against either gram-positive or gram-negative bacteria and may work more effectively in aerobic or anaerobic environments dependent on the drug.

Antibiotics work in one of five ways:

1. Interfere with the formation of the cell wall – which means the bacteria cannot replicate
2. Damage the bacterial cell membrane permeability – which results in the death of the cell
3. Interfere with bacterial protein synthesis – which means the cell cannot repair or replicate
4. Inhibit the production of nucleic acid – which prevents DNA or RNA synthesis and therefore replication
5. Disrupts the bacterial cell's metabolic activity – which results in the death of the cell.

To be effective, an antibiotic must prevent the bacteria replicating, or kill it, but must also be able to get to the location of the infection and be safe to the patient. In this case, it should target the gut as E. coli causes intestinal issues and diarrhoea which can have a devastating effect, particularly on smaller animals and can prove to be fatal, if not treated effectively.

Antibiotic resistance develops by the bacteria being exposed to the antibiotic enough times that it starts to be able to survive in the presence of the antibiotic. This is then passed onto later copies of the bacterial cell during replication that can then also survive, thus making them 'resistant'. This may also occur if a course of antibiotics is not long enough, or not taken for the required amount of time so some bacteria remain surviving and then these will develop a resistance to the antibiotic. This is why it is so important to ensure that antibiotic courses are taken for the entire duration of the prescribed period.

Some bacteria have become ‘superbugs’ where they are resistant to almost every known antibiotic such as MRSA (methicillin resistant staphylococcus aureus).

In veterinary medicine, care is now being taken to ensure responsible use of antibiotics to help limit antibiotic resistance. This may include steps such as:

- Reduction or prevention of use in cases that don’t require it
- Use of more specific or narrow ranged antibiotics
- Accurate dosing
- Education of clients to ensure the whole dose is given
- Food producing animals also have a withdrawal period to prevent antimicrobial residue from entering the food chain and prevent issues in human health.

Antibiotic / disc	Class of antibiotic	Mode of action/ information	Agar plate
Neomycin N10	Aminoglycoside	• Interferes with the bacterial protein synthesis by attaching to the ribosomes • Bactericidal • Used to treat intestinal bacterial infections (with care and alongside a specialised diet and close monitoring of patient response. • More effective in aerobic environments (aerobic bacteria) compared with anaerobic • Poor absorption across the GIT enterocytes - so oral administration means the antibiotic remains in the intestines • Avoid in animals with liver damage/gastrointestinal ulceration	Good zone of inhibition. Effective antibiotic from experiment. Best choice for most species.
Flumequine UB30	Fluoroquinolone (first generation)	• Inhibition of bacterial nucleic acid production (DNA) - specifically DNA gyrase enzyme- so inhibits the DNA strand to unwind at the beginning of the replication process • Bactericidal • Wide spectrum of activity (gram positive, gram negative, aerobic, anaerobic, pseudomonas, salmonella.…) • Effective against gram negative bacteria (some effect/ limited against gram positive bacteria) • Mainly used to treat GIT bacterial infections in animals • Good absorption from the GIT. • Care with use in rapid growth periods (young animals) can affect joint cartilage • Care with use in food producing animals due to high risk of resistance and MRSA ability to stop this antibiotic	Widest inhibition zone. Least resistance. Most effective antibacterial. Use on reptilian species.

		working - potential risk to the food chain • MRSA bacteria have developed a method to inactivate this group of antibiotics - so they are used sparingly in veterinary medicine (reserved for reptile/exotic animal bacterial diseases and humans) • Group of drugs used for treatment of reptile/ exotic animals bacterial infections. Limited use due to responsible antibiotic usage in veterinary medicine	
Bacitracin B10	Old antibiotic - similarities to penicillin - only used as topical treatment (eye/ear treatment) due to nephrotoxicity)	• Narrow spectrum antibiotic • Effective against Gram positive bacteria • Gram negative bacteria are resistant to bacitracin • Bacteriostatic and bactericidal properties depending on the concentration and the bacteria • Interferes with the formation of bacteria cell wall	Limited zone of inhibition: evidence of resistant bacteria; avoid use as treatment.
Sulfonamide S3 300	Sulfonamides	• Bacteriostatic • Broad spectrum antibiotic • Effective against gram positive, gram negative bacteria and protozoa • Disturbs the bacteria cell's metabolic activity by disrupting the enzyme the bacteria needs to synthesise folic acid (used to make nucleic acid/specific proteins) • Well absorbed from the GIT and distributed throughout mammalian tissues (inc foetuses/milk/prostate gland) – safe for pregnancy in most mammals • Adverse reactions common i.e. hypersensitivity (skin reactions usually) • This antibiotic is usually combined with another to be more effective and have a wider spectrum of activity	Inhibition zone good. Effective antibacterial for treatment.
Tetracycline TE10	Tetracyclines	• Rarely used in small animals and equine; used in livestock • Antibiotic interferes with bacterial protein synthesis • Bacteriostatic • Broad spectrum antibiotic • Able to enter mammalian cells and effect intracellular bacteria - preventing their replication	Inhibition zone good. Effective antibacterial for treatment.

		• Good distribution in mammalian tissues once absorbed from the GIT • Bind with calcium - can result in tooth enamel destruction/permanent teeth discolouration in young animals • Tetracyclines interfere with penicillin type antimicrobials and should not be used in combination as ‘’they effectively stop each other working’’	
Lincomycin MY10	Lincosamide	• Bacteriostatic or bactericidal depending on the concentration of bacteria present at infection site • Bacterial protein inhibitors by attaching and damaging the ribosomes • Effective against aerobic gram positive cocci • Not generally used in ruminants & modified monogastric animals as it alters the GIT natural bacteria flora of animals that rely on fermentation	Evidence of bacterial resistance to this antibiotic in the culture and sensitivity plate - no inhibition zone noticed.

The research on each of the antibiotics I used in the investigation shows that there are options for treatment to any animals at the Guilds Animal Science Centre, but also that certain antibiotics are more commonly used in or suited to some species.

As the Guilds Animal Science Centre has a mixture of mammalian, reptilian and avian species, care must be taken to ensure that the antibiotic chosen to treat the E. coli is okay for the species in question. For example, research shows that Tetracycline is rarely used in small mammals and equine but regularly used for livestock species. This may be due to its effectiveness in these species.

It is also noted that although flumequine has the widest zone of inhibition and is the most likely to work, due to its wide-ranging useability, most veterinarians reserve its use in more difficult species such as reptiles to avoid its overuse. This may be the antibiotic needed if the infection was found in the reptilian enclosures. Care must be taken however to not use it in young animals as it can have a detrimental impact on their growth – something a breeding centre should be aware of as they are likely to have young animals. In contrast, the sulfonamide is safe for most pregnant mammals and should be the desired antibiotic if any pregnant animals were to contract E.coli.

Conclusion

In conclusion, this investigation was successful in identifying the bacteria that was causing disease in the Guilds Animal Science Centre as E.coli. In addition, the antibiotic results show that it is important to implement a tailored response’ depending upon the species impacted by disease, which is crucial to avoid both antibiotic resistance and further harm to the species in the collection. This must also be done alongside the enforcement of strict biosecurity measures, to avoid further spread.

There were areas of improvement identified in my laboratory technique, too. In future investigations, I need to ensure that I am more mindful of the way I approach the culturing methodology, to avoid causing damage to the culture.

This report will help Guilds Animal Science Centre inform their husbandry regime and to mitigate the effects of disease in the animals in their care. Furthermore, it has highlighted the importance of effective biosecurity and mindfulness of responsible antibiotic use, to avoid the impacts of antibiotic resistance.

Commentary

The candidate has written an excellent report, which follows a well-ordered structure, comprising of informative headings and associated content. The headings given are detailed and allow for easy navigation of the report.

The candidate's analysis of results is comprehensive and tied together their research around the topic and their primary research, to meet the requirements of the brief and the Centre. For example, the antibiotic recommendations were given based on the animals at the Centre demonstrating excellent research and consideration of the scenario in the brief and showing good consideration of animal welfare.

The candidate has given excellent consideration of their results in order to give clear and defined recommendations for areas for improvement in their own laboratory practice. The reasoning provided is consistent with the results of the experiment demonstrating an excellent level of technical accuracy. For example, the candidate identified that they needed to be more careful when carrying out the investigation to avoid damage to the culture.

The candidate has consistently used accurate and appropriate technical terminology throughout the report. For example, discussions about the mechanisms of the antibiotics were described as bactericidal or bacteriostatic, demonstrating an excellent understanding of the content.