### VCE Biology Unit 2 - Organisms and their environment - Area of Study 1 - Adaptations of organisms

<table>
<thead>
<tr>
<th>Week</th>
<th>Area of Study: Outcome</th>
<th>Key knowledge</th>
<th>Possible activities and assessment tasks</th>
<th>Key skills addressed</th>
</tr>
</thead>
</table>
| 1    | Environmental factors. | • Differing environments: cold, hot, rain etc.  
     | Students will be given an overview of organisms and their environment. Week 1 looks at the environment and how it has an effect on how things live.  
     | • Identify adaptations in the environment that cause health issues or helps health. Ie. Snow and hibernation.  
     | • Relate these adaptations to other adaptations.  
     | • Discussion about biotic and abiotic factors and how various living things are affected as such.  
     | • Field trip to local eco-systems with report written with results.  
     | • Investigate and inquire scientifically  
     | • formulate questions and construct hypotheses appropriate for conducting first-hand and second-hand investigations.  
     | • Communicate biological information and understandings  
     | • interpret, transpose and communicate information and ideas effectively. |
| 2    | Structural adaptations | • Structural adaptations: relating major features of organisms to survival value.  
     | The week looks at the structural adaptations that have a bearing on living things. This outcome will flow on and be linked over the following weeks.  
     | • Determine the importance of structural adaptations.  
     | • How varying structures keep the thing safe. Ie hermet crab etc.  
     | • Identify a structural adaptation and write a mini report on the structure and what the living thing would/would not do without it.  
     | • Communicate biological information and understandings  
     | • use techniques of communication appropriate to different audiences and purposes  
     | • Apply biological understandings  
     | • apply understandings to familiar and new contexts; make connections between concepts; solve problems; |
| 3 & 4| Physiological          | • Methods of heat  
     | • Annotated posters for the differences  
     | • Investigate and inquire |

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The outcome is for students to develop a thorough understanding of physiological adaptations that animals and plants make in order to ensure survival in their individual environments.

**Thermoregulation in animals**
- Identify adaptations in animals that limit heat loss or limit heat gain (fur, feather, counter current heat exchange, distribution of fat)
- Osmoconformers and osmoregulators how they differ.
- Describe differences in osmoregulation for salt and fresh water fish
- Inputs and outputs relating to osmoregulation in terrestrial animals

**Osmoconformers and osmoregulators in fish.** Therefore he students are to prepare a poster to display in the room, of the differences in how salt water fish and fresh water fish keep a constant body temperature. At the end students are to present their posters to the class, using correct scientific language to discuss their posters.

- Dissection of fish to understand internal structures in relation to osmosis.
- Experiment with various heat transfer methods investigated.

**Behavioral adaptations**
- Distinguish between innate and learned behaviours
- Identify types of learned behaviours (trial and error, habituation)

**Visual aids to aid in learning and understanding**
- You tube clips to help fund students understanding of behavioural adaptations:

**Communicate biological information and understandings**
- use techniques of communication appropriate to different audiences and purposes

**Investigate and inquire scientifically**
- Collect, process and record information systematically; analyse and synthesise data; draw
<table>
<thead>
<tr>
<th>6</th>
<th><strong>Reproductive adaptations</strong></th>
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<tbody>
<tr>
<td>The outcome of week 6 learning is to learn about reproductive strategies and difference within animal, plants and humans. How they work and interrelated, further students need to begin to really make the connections.</td>
<td>• Distinguish between direct and indirect development</td>
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<tr>
<td></td>
<td>• Lifecycle of the frog</td>
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<td></td>
<td>• Distinguish between internal fertilisation and external fertilisation (advantages and disadvantages)</td>
</tr>
<tr>
<td></td>
<td>• Reproductive behaviours (courtship)</td>
</tr>
<tr>
<td></td>
<td>• Parental care advantages and disadvantages</td>
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<tbody>
<tr>
<td>• Circadian rhythms, feeding patterns, territorial behaviour, migration</td>
<td>• <a href="http://www.youtube.com/watch?v=PkQpZUXj-ck">http://www.youtube.com/watch?v=PkQpZUXj-ck</a></td>
</tr>
<tr>
<td>• Activity patterns (diurnal, nocturnal, crepuscular)</td>
<td>• <a href="http://www.youtube.com/watch?v=GPbWJPsbPdA">http://www.youtube.com/watch?v=GPbWJPsbPdA</a></td>
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<tr>
<td>• Signals and communication (sounds, visual cues, chemicals)</td>
<td>• <a href="http://www.youtube.com/watch?v=6hREwakXmAo">http://www.youtube.com/watch?v=6hREwakXmAo</a></td>
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<tr>
<td>• These clips all provide additional strategies to assisting in student's ability to learn and understand the concepts of animal behavioural adaptations.</td>
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<tr>
<td></td>
<td>conclusions consistent with the question under investigation and the evidence obtained</td>
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<tr>
<td></td>
<td>Communicate biological information and understandings</td>
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<tr>
<td></td>
<td>• Interpret, transpose and communicate information and ideas effectively</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apply biological understandings</td>
</tr>
<tr>
<td></td>
<td>• Analyse issues and implications relating to scientific and technological developments</td>
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<tr>
<td></td>
<td>• Analyse and evaluate the reliability of information and opinions presented in the public domain.</td>
</tr>
<tr>
<td></td>
<td>Communicate biological information and understandings</td>
</tr>
</tbody>
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**VCE Biology Unit 2 - Organisms and their environment- Area of Study 1 - Adaptations of organisms**

<table>
<thead>
<tr>
<th>7</th>
<th><strong>Revision week</strong></th>
<th>All current chapters (ch13-18) and concepts covered for unit 2 AOS 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAC- appendix 2</td>
<td><strong>Human intervention in reproduction (IVF)</strong></td>
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<tr>
<td></td>
<td></td>
<td>Revision mind map linking all major concepts from every chapter to ensure full understanding across the class. Create activity to check student's ability to not just learn concepts but to be able to apply the concepts into other areas of content, making connections.</td>
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<td>Unit 2 AOS1 Test that involves the following format- multiple choice questions, short answer and extended response.</td>
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<td><strong>Use scientific terminology and conventions appropriately.</strong></td>
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<td></td>
<td><strong>Apply biological understandings</strong></td>
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<td></td>
<td></td>
<td>Apply understandings to familiar and new contexts; make connections between concepts; solve problems</td>
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</table>

- The weekly lesson sequence would ideally be four 50 minute lessons each week with two of these lessons being single lessons where more theory based content is covered and the other two lessons would be a double lesson where a practical demonstration would occur with the content covered in the theory class being linked with a practical demonstration or skill.
VCE Biology Unit 2 - Organisms and their environment- Area of Study 1 - Adaptations of organisms

3.1:
The unit chosen is Area of Study 1 – Unit 2 – Adaptations and Organisms
‘On completion of this unit the student should be able to explain and analyse the relationship between environmental factors, and adaptations and distribution of living things.’ (VCAA, 2012)

At the completion of this area of study students should be able to identify and explain:
• environmental factors: biotic and abiotic factors; availability of resources;
• structural adaptations: relating major features of organisms to survival value;
• physiological adaptations
  – tolerance range of organisms; maintaining equilibrium by detecting and responding to changes in environmental conditions
  – nerve control in complex multicellular organisms: major sense organs and pathways of transmission of nerve impulses
  – hormonal control in complex multicellular organisms
  – regulating water balance and controlling temperature;
• plant tropisms: growth responses, rhythmic activities;
• behavioural adaptations: individual and group behaviours of animals including rhythmic activities, feeding behaviours; communication; social and territorial behaviours;
• reproductive adaptations: systems and strategies; development and life cycles;
• techniques used to monitor environmental change and species distribution. (VCAA, 2012)

Students will demonstrate their depth of knowledge and understanding of the content covered via School Assessed Coursework (SAC). This will take place during a 100min lesson at the completion of the 6 week sequence of teaching. This SAC which is attached as Appendix 2 includes a range of questions in forms such as multi choice and short and long answers. In this time students will have various opportunities to learn and explore concepts via way of video, experiments, practical’s etc. and as well will be given time for revision of the content. In this time it is expected students will further improve their key biological skills of being able to investigate and inquire scientifically, apply biological understandings and communicate biological information and understandings.

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3.2 Rationale:

This unit study has been designed in a particular manner to which we believe will have the greatest positive effective on student’s ability to learn, develop and grow on biological information, due to the manner in which it is presented. It has been structured to demonstrate a flow on effect, that meaning that each topic relates to the pervious topic just taught, therefore demonstrating the closest links to a concept for student to understand and learn from. For example, with the adaptations the most effective sequence that was found was to begin with physiological factors, of humans and plants, then this topic runs seamlessly into the next on being behavioural adaptations, where they expand and determine the difference between the behavioural and physiological adaptations.

3.4 Resources:


Unit 2 AOS1 SAC, Annalene Davis, Parade College Bundoora.

Appendix 1-

Male contraceptive pill on the horizon

A CONTRACEPTIVE pill for men may finally be on the horizon, after scientists reported promising results from a chemical that appears to allow a reversible suppression of sperm production in mice without reducing the animals' sex drive.

The chemical changes the way DNA is formed inside developing sperm cells, leaving them unviable and causing them to die off.

While some sperm continue to be produced, they do not swim as well, greatly reducing their ability to seek out and fertilise eggs.

The team of scientists from the US, Canada and Britain say the effects of the drug, known as JQ1, last only as long as it is taken. Although the findings are based on mice, the authors, from the Dana-Farber Cancer Institute in Boston, Britain's Oxford University, Harvard Medical School and other institutions, say the biological systems involved are so similar to those in humans that there is a good chance the technique could also work in men.

"This compound produces a rapid and reversible decrease in sperm count and motility with profound effects on fertility," said James Bradner, lead author of the research published yesterday in the journal Cell.

If the treatment ever fulfils its promise and ends up being successfully developed for human use, it could end the centuries-old hunt for a male contraceptive that provides an effective protection against pregnancy without dulling sensation or causing physical changes that can be difficult to reverse, as occurs with vasectomy.

Australian experts yesterday welcomed the findings, with one, Moira O'Bryan, head of the male infertility and germ cell biology laboratory at Melbourne's Monash University, describing the study as "an exciting report that could have major scientific and social impacts".

However, she added it would take many years to develop the product.

"Such a goal is, however, well worth the effort. The medical and social costs of unplanned pregnancies are enormous, and studies ... have repeatedly shown there is a strong desire for male-based contraceptives."
Unit 2
Biology

Assessment Task 2

Area of Study 1

Test 2012

Name: __________________________

<table>
<thead>
<tr>
<th>Part A:</th>
<th>/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part B:</td>
<td>/10</td>
</tr>
<tr>
<td>Part C:</td>
<td>/30</td>
</tr>
<tr>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: /60
Section A: Multiple choice questions

1. Physical characteristics or behaviours that help an organism live in a particular environment are called:
   a. attributes  
   b. adaptations  
   c. instincts  
   d. camouflage

2. The plant hormone responsible for the ripening of fruit is
   a) Auxin  
   b) Gibberellin  
   c) Abscisic acid  
   d) Ethylene

3. Possums tend to sleep during the day and forage for food at night. Most possum predators are asleep at this time and hence it is a much safer proposition for the possums. Animals that are active at night are known as:
   a) Diurnal  
   b) Nocturnal  
   c) Daily  
   d) Crepuscular

4. Which of the following is NOT an adaptation to living in a mix-sexed group
   a) The penguin huddle  
   b) Co-operative behaviour  
   c) Territorial behaviour  
   d) Dominance hierarchy

5. The following experiment was set up to investigate the effect of light on the growth of grass seedlings.
The statement that best describes the result is:
A plants grow towards the light.
B plants need light for photosynthesis.
C light increases the rate of production of auxin.
D the tip of the seedling is the receptor for the stimulus of light.

6. The table below shows three different turtle species living in different conditions and the percentages of nitrogen waste they excrete as urea, uric acid and ammonia.

<table>
<thead>
<tr>
<th>Turtle species</th>
<th>Habitat</th>
<th>Urea</th>
<th>Uric acid</th>
<th>Ammonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Predominantly aquatic</td>
<td>46</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>2</td>
<td>Damp places</td>
<td>80</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Desert conditions</td>
<td>15</td>
<td>75</td>
<td>10</td>
</tr>
</tbody>
</table>

Using the above data and your knowledge, it is reasonable to conclude
a) All turtles conserve water by excreting ammonia
b) Turtles can change the way they excrete
c) Water is required to excrete uric acid
d) Water is required to excrete urea

7. Which structure of leaves controls the amount of water that is lost from a leaf?
   a) Transpiration
   b) Stomata
   c) Cuticle
   d) Cell wall

8. Many Australian plant species are adapted to living in a hot dry environment. Which one of the following adaptations would not assist plants in living in this type of environment?
   a) A large number of stomata on the upper epidermis
   b) A thick cuticle
   c) Stomata sunken deep within the epidermal layer
   d) A reduced number of stomata

9. A tomato plant would wilt from water loss most quickly in conditions of:
   a) Wind, high humidity and high temperature
   b) Wind, low humidity and low temperature
   c) Calm, high humidity and moderate temperature
   d) Wind, low humidity and high temperature
10. You place your hand onto a hot saucepan lid and then quickly remove your hand before too much damage is done to the underlying skin. In this example:
   a) Heat is the stimulus, your skin is the receptor, glands are the effector
   b) Heat is the stimulus, your skin is the receptor, muscles are the effector
   c) Heat is the stimulus, your skin is the effector, glands are the receptor
   d) Heat is the stimulus, your skin is the receptor, muscles are the effector

11. The primary organ of regulation of water loss from a human is the:
   a) Kidney
   b) Skin
   c) Lungs
   d) Bladder

12. A similarity between the nervous system and the endocrine system is that they both:
   a) Secrete chemicals across synapses
   b) Work to maintain homeostasis
   c) Are composed of neurons
   d) Transmit messages from effectors to receptors

13. A female silk worm moth releases a chemical that is so powerful that it can attract males from a distance of 4 kilometres. Male moths have been known to respond to less than 0.000 000 01 gram of this chemical by moving towards the female. This type of chemical is known as a:
   a) Pheromone
   b) Hormone
   c) Histamine
   d) Moth attractant

14. Canada geese migrate south from Alaska to southern Mexico as the winter months approach. Which one of the following is thought to trigger the migration?
   a) Increase in temperature
   b) Scarcity of nesting sites
   c) Change in light intensity
   d) Need to reproduce

15. Plants have adapted strategies to survive during times of physiological stress. Plants that are under physiological stress due to a lack of water
will close their stomata to conserve water within the plant and reduce water loss. The hormone responsible for this is:

a) Abscisic acid  
b) Gibberellin  
c) Cytokinins  
d) Ethylene

16. In cold environments animals can increase heat production by:
   a) Restricting blood flow to the body’s extremities (eg ear tips)  
b) Raising body hairs to trap heat  
c) Drinking warm fluids  
d) Increasing the rate of shivering

17. An example of a structural adaptation to low temperature is:
   a) Hibernation  
b) Thick layer of fur  
c) Living underground in a burrow  
d) Migration to a warmer region

18. In the later afternoon of a sunny summer day a student noticed that all the sunflowers in a paddock were facing away from the road. The student correctly decided that the most likely explanation for this observation was that:
   a) The flowers were facing south as a response to gibberellins  
b) The flowers were facing north in response to the drought  
c) The flowers were facing west in response to positive tropism  
d) The flowers were facing east in response to auxins

19. Elephant ears are large and thin, and well supplied with blood vessels. This makes them very well adapted to living in hot conditions because:
   a) It enables them to absorb as much water from the atmosphere as possible  
b) It helps to provide shade for the delicate skin of their face  
c) It aids the removal of excess salts from the elephant’s blood stream  
d) It provides a large surface area for heat loss

20. Frogs lay hundreds of eggs into the watery environment where the tadpoles will hatch. Birds lay a small number of eggs into a nest where the chicks will hatch. This is because:
a) Tadpoles need safety in numbers to survive, whereas baby birds look after each other
b) Tadpoles can look after themselves as soon as they are born, but baby birds need their parents to look after them
c) Parent frogs do not protect and feed their tadpoles, whereas parent birds protect and feed their chicks
d) Many tadpoles are likely to be eaten by predators, whereas there are no predators that eat baby birds

Section B:
Answer the following statements using True or False

1. Biotic factors are physical and chemical factors such as temperature, light intensity, texture and pH of soil.

2. Learned behaviour is often advantageous as it can be modified if the environment changes.

3. A hormone is a chemical produced by cells in one part of an organism and transported throughout the organism to sites where it affects cells capable of responding.

4. Aquatic organisms are under continual water stress. They are about 70% water and therefore tend to lose water by evaporation to the environment.

5. Homeostasis is the maintenance of constant internal conditions such as the concentration of calcium and glucose in the blood.

6. Short day plants flower when day length drops below a critical minimum.

7. Hibernation is when an animal goes into long-term torpor, usually with the onset of cold winter conditions, often in the protection of a den or burrow.

8. A lignotuber is a swelling at the base of a stem that is a source of dormant buds.
9. Negative feedback systems are stimulus/response mechanisms in which the response produced increases the effect of the original stimulus.

10. Vernalisation is the period of winter cold that stimulates the production of seeds.

**Section C**

Short answer questions

**Question 1.**
The table below gives information about the urine and sweat produced by a person on two different days. On one day the weather was cold and on the other it was hot. The person did the same amount of exercise, and ate and drank the same on each day.

<table>
<thead>
<tr>
<th></th>
<th>Cold day</th>
<th>Hot day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of sweat in dm³</td>
<td>0.62</td>
<td>1.22</td>
</tr>
<tr>
<td>Volume of urine in dm³</td>
<td>1.50</td>
<td>0.90</td>
</tr>
<tr>
<td>Concentration of salt in urine in grams per dm³</td>
<td>9.50</td>
<td>12.80</td>
</tr>
</tbody>
</table>

a. The person sweats more on the hot day. Why is this helpful?
   ____________________________
   ____________________________
   ____________________________

b. Why is the volume of urine lower on the hot day?
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   c. The person took in the same amount of salt in food and drink on both days. Why is the salt concentration of the urine higher on the hot day?
      ____________________________
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   d. Give one other way by which a large amount of water is lost from the human body each day.
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marks
Question 2

a. Describe two major differences between the Nervous system and the endocrine system.

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b. What is the function of the CNS compared to the PNS?

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The CNS is responsible for 


c. Eyes and ears have sensory receptors which detect light and sound. List two other sensory receptors found in the body.

_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

These receptors include the


d. Thermoregulation can be controlled by homeostatic mechanisms as well as by physiological and behavioural means. When an eastern grey kangaroo (Macropus giganteus) is hot it will lick its forearms. Is this method of cooling physiological or behavioural? Explain your answer.

_____________________________________________________________________________
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8 marks

Question 3

Scout honeybees have the ability to inform workers in the hive of the quality of a food source and its direction and distance from the hive. When the scout bee initially discovers a food source she feeds first, returns to the hive, feeds several bees and then performs a ‘round’ dance on the surface of the honeycomb. The ‘round’ dance consists of circling first to the right, then to the left and repeating this pattern over and over with great vigour.

_____________________________________________________________________________

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a. What type of signal does the scout honeybee give to other workers to alert them of the presence of food nearby?
_____________________________________________________________ 1 mark

b. What possible survival value does this dance behaviour give to the honeybees?
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2 marks

c. Devise an experiment which could be carried out to determine whether the ‘round’ dance is learnt behaviour or innate (inborn). Explain what results would support the hypothesis that it is an innate behaviour.

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4 marks

Question 4
Consider the following diagram of a nerve cell.

a. Identify this cell. Your answer must be specific.

_________________________________________________________________________________
b. Identify structure 5 and explain its role in the cell.

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

______________________________________________________ 5 marks

Question 5
Plant A

Plant B
Some plants live in water and others live in dry places. Plant B shows a cross section through the leaf of a plant that lives in or close to water. Plant A shows a cross section through the leaf of a plant that lives in a dry area.

Note the location of the stomata on the leaves

a. On the diagram of Plant B indicate and label the stomata.
   1 mark

b. Explain the advantage of stomata located on the upper surface rather than the lower surface of leaf B.

_____________________________________________________________________________________
_____________________________________________________________________________________

c. If plant B was a plant that lived in a pond, what would the function of the large air spaces in the leaves be?

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_____________________________________________________________________________________

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d. Explain the advantage of the stomata in plant A being at the base and sunken.

_____________________________________________________________________________________


e. What is the function of the thick cuticle of plant A?

_____________________________________________________________________________________
_____________________________________________________________________________________

Question 6
Australia has a wide range of waterfowl that are responsible for causing a number of problems including: grazing of pasture and crops, interrupting filtration plants involved in treating wastewater, pulling up grass in leisure areas such as golf courses, depositing droppings in areas such as fairways, lawns and lakes and fouling domestic swimming pools. In past times these birds might have been killed, however, for many years various organisations have been trying to perfect exclusion and scare off devices. One of the earliest methods of scaring off water fowl involved shooting with cracker guns. Initially the birds were scared by the noise but soon found out that the noise was not dangerous and ignored it.

a. What type of behaviour is being described in this example?
Australian black swans have white wing tips which flash when they take off. When swans flying above see this flashing they interpret it as a warning and don’t land. Ethologists (people who study animal behaviour) used this information to make model swans that had a similar ability to produce white flashes. These models were placed on the ground in places where people do not want the swans to land.

b. What kind of signal is described in this example?

c. Explain why this device was ineffective against swans already on the ground.

Total = 60 marks