

# Model Exam Question Booklet

## Combined Science

This booklet is split into 3 parts.

### Part 1

A selection of short response questions and answers that are likely to come in the exam paper. Spend time learning the answers to these questions, for example you could produce flash cards. You should self quiz yourself on these questions regularly!

### Part 2

Selection of extended response questions (4 to 6 marks) that are likely to be on your paper this year, either because they have not been assessed in the last couple of years, or because they come up most years in exams. Prepare and practice your responses to these questions.

### Part 3

Required practical section. In this section you will find step by step guidance for each practical. This is followed by a page of short response questions and answers to learn for each of the practicals. There are also some extended response questions (4 to 6 marks).

## Biology Paper 2

Topics in the Paper:

<b>B10</b>	Human Nervous System
<b>B11</b>	Hormonal Coordination
<b>B13</b>	Reproduction
<b>B14</b>	Variation and Evolution
<b>B15</b>	Genetics and Evolution
<b>B16</b>	Interdependence and Competition
<b>B17</b>	Organising an Ecosystem
<b>B18</b>	Biodiversity and Ecosystems
<b>RP6</b>	Reaction Times
<b>RP7</b>	Measuring Population Sizes

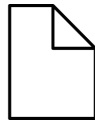


# **Part 1**

# **Short Response**

# **Questions**

# B10: Nervous System

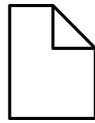


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1. What is the function of the nervous system?
2. What does CNS stand for?
3. What is the CNS made up of?
4. What is the function of the CNS?
5. How is information passed from receptors to the CNS?
6. State examples of effectors.
7. What do muscles do to bring about a response?
8. What does a gland do to bring about a response?
9. Outline the stages in a reflex arc.
  
10. What is a stimulus?
11. What is a sensory neurone?
  
12. What is a motor neurone?
  
13. What is a reflex action?
  
14. Why are reflex actions important?
15. What is a synapse?
16. What happens at the synapse?

1. Enable humans to react to their surroundings and to coordinate their behaviour.
2. Central nervous system.
3. Brain and spinal cord.
4. Coordinate the response of effectors.
5. As electrical impulses.
  
6. Muscles and glands.
7. Contract
8. Secrete hormones.
  
9. Stimulus → Receptor → Sensory Neurone → Relay Neurone → Motor Neurone → Effector → Response
10. Change in environment.
11. A neurone in which an impulse is transmitted from the receptor to nervous system.
12. A neurone in which an impulse is transmitted from the central nervous system to effector.
13. A response that is automatic and rapid that does not involve the conscious part of the brain.
14. They are quick responses that help with survival.
15. It is a gap in which two neurones join together.
16. The electrical impulse arriving at the end of a neurone causes chemicals to be released into the synapse. These diffuse across the gap and bind to receptors on the other side generating a new impulse.

# B11: Hormonal Coordination

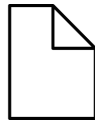


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1. What is the endocrine system?
2. How does the hormonal system compare to the nervous system?
3. What is the pituitary gland?
4. Why is the pituitary gland known as a master gland?
5. What is blood glucose concentration monitored and controlled by?
6. What happens if blood glucose is too high?
7. What happens if blood glucose is too low? (HT)
8. What is type 1 diabetes?
9. How is type 1 diabetes treated?
10. What is type 2 diabetes?
11. How is type 2 diabetes treated?
12. What is a risk factor of type 2 diabetes?
13. What happens during puberty?
14. What is ovulation?
15. What is testosterone?
16. What is the role of follicle stimulating hormone?
17. What is the role of luteinising hormone?
18. What is the role of oestrogen and progesterone?
19. How do oral contraceptives work?
20. How does the injection, implant or patch work?
21. How do barrier methods work?
22. How do spermicidal agents work?
23. How do intrauterine devices work?
24. What happens in IVF? (HT)
25. What are the problems of IVF? (HT)

1. It is a system composed of glands which secrete chemicals called hormones directly into the blood stream.
2. It is much slower and involves the blood stream rather than nerves to produce an effect.
3. It is a master gland which secretes several hormones into the blood.
4. It releases hormones that stimulate other hormones to be released from other glands.
5. The pancreas.
6. Insulin is released that moves glucose into muscle and liver cells and converts it into glycogen for storage.
7. The pancreas releases glucagon that converts glycogen into glucose and releases it into the blood.
8. A disorder in which the pancreas fails to make enough insulin. It causes uncontrolled high blood glucose levels.
9. Insulin injections.
10. A disorder in which the body cells no longer respond to insulin produced by the pancreas.
11. A carbohydrate-controlled diet and an exercise regime.
12. Obesity
13. Reproductive hormones cause the development of secondary sex characteristics.
14. The release of an egg.
15. The main male reproductive hormone produced by the testes and it stimulates sperm production.
16. Causes maturation of an egg in the ovary.
17. Stimulates the release of an egg.
18. Maintain the uterus lining.
19. They contain hormones to inhibit FSH production so that no eggs mature.
20. They release progesterone to inhibit the maturation and release of eggs for a number of months or years.
21. Prevent the sperm meeting the egg.
22. Kill or disable sperm
23. Prevent the implantation of an embryo or the release of hormones.
24. The mother is given FSH and LH to mature several eggs, these eggs are collected and fertilised before one or two embryos are inserted into the mother's womb.
25. It is emotionally and physically stressful, the success rate is not high and it can lead to multiple births.

# B13: Reproduction

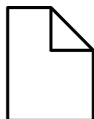


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1. How are non identical cells formed?
2. How are identical cells formed?
3. What happens during sexual reproduction of animals?
4. What happens during sexual reproduction of plants?
5. How sex cells (gametes) formed?
6. What happens during asexual reproduction?
  
7. What happens during sexual reproduction?
  
8. How do gametes form through meiosis?
  
9. What is DNA?
  
10. What is the genome?
11. Why is knowledge of the genome important?
  
12. What characteristics are controlled by one gene?
13. What is an allele?
14. What is a dominant allele?
15. What is a recessive allele?
16. What is phenotype?
17. What does it mean if an organism is homozygous for a trait?
18. What does it mean if an organism is heterozygous for a trait?
19. What is polydactyly?
20. What is cystic fibrosis?
  
21. How many chromosomes does a normal body cell contain?
22. What sex is someone if they have XX chromosomes?
23. What sex is someone if they have XY chromosomes?

1. Meiosis
2. Mitosis
3. Sperm and egg fuse together during fertilisation.
  
4. Pollen and egg fuse together during fertilisation.
  
5. Meiosis
6. There is one parent and no fusion of gametes. There is no mixing of genetic information and genetically identical clones are produced.
7. There are two parents and the fusion of gametes. There is mixing of genetic information which leads to variation in offspring.
8. Copies of genetic information are made, the cell divides twice to make 4 gametes, each with a single set of chromosomes.
9. It is a polymer made up of two strands forming a double helix. The DNA is contained in chromosomes.
10. It is the entire genetic material of that organisms.
11. Helps us understand and treat inherited disorders and trace human migration patterns from the past.
12. Fur colour in mice and red-green colour blindness in humans
13. A variation of a gene.
14. An allele that is always expressed, even if only one copy is present.
15. An allele that is only expressed if there are two copies present.
16. The characteristic that presents because of the genotype.
17. The organism has two of the same alleles for the trait.
18. The organism has two different alleles for the trait.
19. A disorder that causes extra fingers or toes. It is caused by a dominant allele.
20. A disorder of the cell membranes that is caused by a recessive allele.
21. 23 pairs.
  
22. Female
  
23. Male

## B14: Variation and Evolution

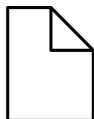


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1. What can cause differences in characteristics in individuals?
2. How do variants arise?
3. What are mutations?
4. What is evolution?
5. How does evolution occur through natural selection?
6. How does a new species form?
7. What is selective breeding?
8. What does selective breeding involve?
9. What characteristics are desirable when carrying out selective breeding?
10. What problems can selective breeding cause?
11. What is genetic engineering?
12. How have plant crops been genetically modified?
13. How have bacterial cells been genetically modified?
14. What are the potential benefits of genetic engineering in agriculture?
15. What are the potential disadvantages of genetic engineering in agriculture?
16. What are the potential benefits of genetic engineering in medicine?
17. What are the potential disadvantages of genetic engineering in medicine?
18. What are GM crops?
19. What happens in the process of genetic engineering? (HT Only)

1. The genes the organisms have and the conditions that they have developed in.
2. Mutations
3. A change in genes which can lead to a new phenotype.
4. A change in inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.
5. There is genetic variation in a species, the best adapted for the environment survive, breed and pass on their genes to their offspring.
6. When two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring.
7. The process by which humans breed plants and animals for particular genetic characteristics.
8. Parents with desired characteristics are selected and they are bred together, the offspring with desired characteristics are then bred together and this continues for many generations.
9. Diseases resistance in crops, animals that produce more milk or meat, domestic dogs with a gentle nature, large or unusual flowers.
10. It can lead to interbreeding where some breeds are prone to disease or inherited defects.
11. A process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.
12. To be resistant to diseases or to produce bigger better fruits.
13. To produce human insulin.
14. Plants have been produced that are resistant to insect attack or to herbicides. Crops have also been produced that have increased yields.
15. There is a concern that the gene could spread wild into the population and so the plants have been made sterile. This means that farmers need to rebuy seed each year.
16. It can be used to potentially treat genetic diseases.
17. Ethical issues such as fears around genetically modifying people to produce designer children.
18. Crops that have been genetically modified.
19. Enzymes are used to isolate gene, which is inserted into vector which is then used to insert the gene into the required cells. The genes are transferred to the cells of the organism as an early stage of development.

# B15: Genetics and Evolution

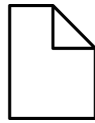


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1. What evidence do we have for evolution?
2. Why is Darwin's theory for evolution now widely accepted?
3. What are fossils?
4. How can fossils form?
5. Why is there little fossil evidence for early life forms?
6. What can we learn from fossils?
7. What is extinction?
8. What factors may contribute to the extinction of a species?
9. Why do bacteria evolve rapidly?
10. What are antibiotic resistant bacteria?
11. Why do resistant bacteria spread?
12. How can we reduce the development of antibiotic resistant strains?
13. Why are we unlikely to keep up with the emergence of new resistant strains?
14. Who developed our traditional classification system?
15. How did Linnaeus classify living things?
16. How are organisms named?
17. Why were new models of classification proposed?
18. Who developed the 3-domain system?
19. How are organisms divided in this 3-domain system?
20. What are archaea?
21. What are eukaryota?
22. What can we use evolutionary trees for?

1. Fossils and antibiotic resistance in bacteria.
2. It has been shown how characteristics are passed on to offspring in genes, there is further fossil evidence and we have knowledge about antibiotic resistance in bacteria.
3. The remains of organisms from millions of years ago, which are found in rocks.
4. From parts of animals that have not decayed as a conditions needed for decay was absent, when parts of the organism are replaced by minerals as they decay, preserved traces such as footprint, burrows and rootlet traces.
5. Early life forms were soft bodies which meant they left few traces. Any traces have been destroyed by geological activity.
6. How much or how little organisms have changed as life developed on Earth.
7. When there are no remaining individuals of a species still alive.
8. New predators, new diseases, new competitors, volcanic eruption, asteroids, loss of habitat.
9. They reproduce at a fast rate.
10. Bacteria that are not killed by antibiotics.
11. People are not immune to it and there is no effective treatment.
12. Antibiotics should not be prescribed for a viral infection or non serious bacterial infection; patients should complete their course and the use of antibiotics in agriculture should be restricted.
13. The development of new antibiotics is expensive and slow.
14. Carl Linnaeus
15. Animals classified into kingdom → Phylum → Class → Order → Family → Genus → Species.
16. Binomial system of genus and species.
17. Evidence of internal structures became more developed due to improvements in microscopes and the understanding of biochemical processes.
18. Carl Woese
19. Achaea, Bacteria, Eukaryota.
20. Primitive bacteria usually living in extreme conditions.
21. Organisms which include protists, fungi, plants and animals.
22. A method used by scientists to show how they believe organisms are related.

# B16: Adaptation and Interdependence and Evolution



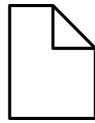
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1. What is an ecosystem?
2. What do plants compete for?
3. What do animals compete for?
4. What is a stable community?
  
5. What do different species depend on each other for?
6. What is interdependence?
7. What are examples of abiotic factors?
  
8. What are examples of biotic factors?
  
9. What are adaptations?
10. What are extremophiles?
11. What are examples of extreme environments?
  
12. What adaptations do animals that live in cold environments typically have?
13. What adaptations do animals that live in hot environments typically have?
  
14. What adaptations do plants that live in dry conditions typically have?

1. The interaction of a community of living organisms with the non-living parts of their environment.
2. Light, space, water and mineral ions.
3. Food, mates, territory.
4. A community in which all the species and environmental factors are in balance to the population sizes remain fairly constant.
5. Food, shelter, pollination, seed dispersal.
  
6. Where different species rely on each other for different things.
7. Light intensity, temperature, moisture levels, soil pH, soil mineral content, wind intensity and direction, carbon dioxide levels for plants and oxygen levels for aquatic animals.
8. Availability of food, new predators arriving, new pathogens, another species outcompeting the other.
9. Features an organism has to survive in conditions they usually live in.
10. Organisms that live in extreme conditions.
11. High temperature, pressure or high salt concentration.
12. They are large with short legs and small ears to reduce surface area to volume ratio. They have a thick layer of fat and thick fur
13. They have thin bodies with longer legs and longer ears to increase surface area to volume ratio. They have a thin layer of fat and thin fur. Normally they produce very concentrated urine and don't sweat. They are normally more active in the night and early morning and evening. They rest in burrows and shady areas during hot days and cold nights.
14. Small leaves and thick cuticles to reduce water loss. Long shallow roots to absorb water quickly from rainwater and deep roots to absorb water from deep underground. Cells in stem are able to swell to store water when it is available.



# B17: Organising an Ecosystem

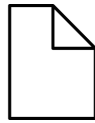


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1. What are producers?
2. How can feeding relationships within a community be represented?
3. What are primary consumers?
4. What are secondary consumers?
5. What are consumers?
6. What are predators?
7. What are prey?
8. Why is it important that materials are cycled?
9. What is the carbon cycle?
10. What are some of the processes that cycle carbon?
11. What is the word equation for photosynthesis?
12. What is the word equation for respiration?
13. What is the word equation for combustion?
14. How is carbon returned to the environment when an organism dies?
15. What happens during the water cycle?

1. Photosynthetic organisms that are the producers of biomass. They are the start of a food chain. Examples include a green plant or alga.
2. Food chains.
3. Organisms that eat producers.
4. Organisms that eat primary consumers.
5. An animal that eats.
6. Consumers that kill and eat other animals
7. Consumers that are hunted and killed by other animals.
8. To provide the building blocks for future organisms.
9. It is the way that carbon is returned from organisms to the atmosphere as carbon dioxide to then be use by plants in photosynthesis.
10. Photosynthesis, respiration, combustion
11. Carbon Dioxide + Water  $\rightarrow$  Glucose + Oxygen
12. Glucose + Oxygen  $\rightarrow$  Carbon Dioxide + Water
13. Fuel + Oxygen  $\rightarrow$  Carbon Dioxide + Water
14. Microorganisms such as bacteria feed on the organic compounds in the dead material and respire releasing carbon dioxide.
15. It provides fresh water for plants and animals on land before draining into the sea. The water is continuously evaporated and precipitated.

# B18: Biodiversity and Ecosystems



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1. What is biodiversity?
2. Why is biodiversity important?
3. Why are we producing more waste?
4. What are examples of pollution in water?
5. What are examples of pollution in air?
6. What are examples of pollution on land?
7. What are the problems of waste?
8. How have humans reduced the amount of land available for other animals?
9. What problems does destroying peat bogs cause?
10. Why has deforestation occurred in tropical areas?
11. What are the problems of deforestation?
12. What are the consequences of global warming?
13. What is contributing to global warming?
14. What can we do to reduce the negative effect of humans on biodiversity?

1. The variety of all the different species of organisms on earth, or within an ecosystem.
2. It ensures the stability of ecosystems by reducing dependence on one species.
3. Rapid growth in the human population and an increase in the standard of living.
4. In water from sewage fertiliser or toxic chemicals.
5. Smoke and acidic gases.
6. Landfill and toxic chemicals.
7. It kills plants and animals reducing biodiversity.
8. Building, quarrying, farming and dumping waste.
9. It reduces the area of the habitat and reduces the variety of different plants, animals and microorganisms that live there. The decay or burning of peat also releases carbon dioxide.
10. To provide land for cattle and rice fields and to grow crops for biofuels.
11. Loss of biodiversity, releases carbon dioxide into the atmosphere and reduces the rate carbon dioxide is removed from the atmosphere.
12. Loss of habitats, changes in distribution in animals, changes in migration patterns, reduced biodiversity.
13. Increasing levels of carbon dioxide and methane.
14. Breeding programmes, protection of rare habitats, reintroduction of field margins, reduction of deforestation, recycling resources.

**Part 2**  
**Extended**  
**Response**  
**Questions**

<b>Topic</b>	B10 Nervous System
<b>Qu</b>	Describe how an organism is able to respond to _____.
<b>Info</b>	<p>You could be asked this question for any stimulus for any organism. Past examples that have come up in exams include:</p> <ul style="list-style-type: none"> <li>• Sharp point touching the skin</li> <li>• Mouse responding to a dropped pin</li> <li>• Knee jerk reflex</li> <li>• Touching a hot plate</li> <li>• Mouse detecting and responding to food</li> </ul> <p>To answer this question, you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Receptor detecting stimulus</li> <li>2. Generating impulse</li> <li>3. Impulse travelling along sensory neurone</li> <li>4. Chemical transmitter diffusing across synapse</li> <li>5. Impulse generated on relay neurone</li> <li>6. Impulse moves to motor neurone</li> <li>7. Identifying the effector that brings about the response(muscle or gland)</li> <li>8. Describing the response.</li> </ol>
<b>Top Tip</b>	<p>The examiner is looking for an answer in a logical sequence</p> <p style="text-align: center;"><b>Receptor → Sensory → Synapse → Relay → Motor → Effector</b></p> <p>Before you begin write a plan that includes just the first letter for each of these words to help you structure your answer. R, S, S, R, M, E</p> <p>Other key words to use are <b>synapse</b> and <b>electrical impulse</b>.</p>
<b>Model Answer</b>	<p><b>Describe how an organism is able to respond to a sharp pin touching the skin.</b></p> <p><i>The sharp pin is detected by pressure receptors in skin, this generates an electrical impulse which travels along a sensory neurone. This impulse causes neurotransmitters to diffuse across the synapse to generate another impulse on the relay neurone. The impulse travels to the motor neurone to the effector. The effector is a muscle which contracts to move the hand away from the pin.</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn model answers to describe how an organism responds to a dropped pin, knee jerk reflex and touching a hot plate.</li> </ol>

<b>Topic</b>	B11 Hormonal Coordination
<b>Qu</b>	Explain what happens when blood glucose levels _____.
<b>Info</b>	<p>You could be asked this question for blood glucose rising after eating a meal or if you are sitting the Higher exam, you could also be asked how the body responds to low blood glucose levels due to not eating in a while.</p> <p>To answer either of these questions you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Identify what detects the change in glucose levels.</li> <li>2. Identify what the response is which would mean you need to identify the hormone released and from where.</li> <li>3. Describe what this hormone does.</li> <li>4. Describe what this response does to blood glucose levels.</li> </ol>
<b>Top Tip</b>	Be prepared in your exams that there could be links made to diabetes or cell transport. The examiner has asked in the past why insulin continues to be released for someone who has type 2 diabetes (answer glucose is not removed from the blood and so more insulin is released). The examiner has also asked in the past what could happen to cells if blood glucose is high (answer water leaves cells) or too low (answer water enters cells)
<b>Model Answer</b>	<p><b>Explain what happens when blood glucose levels rise.</b></p> <p><i>When blood glucose levels rise this is detected by the pancreas. In response the pancreas secretes insulin. This insulin causes glucose to be enter muscle and liver cells where it is converted into glycogen. The glycogen is stored by the cells and the blood glucose levels fall.</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. HT Only: Prepare and learn model answers to explain what happens when blood glucose levels fall.</li> </ol>

<b>Topic</b>	B11 Hormonal Coordination
<b>Qu</b>	Hormones are used in IVF treatment. Explain how different hormones are used to help a woman become pregnant. Describe the process of IVF. Adrenaline causes changes in the body to prepare for a 'fight or flight' response. What changes does it cause in the body?
<b>Info</b>	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
<b>Top Tip</b>	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
<b>Model Answer</b>	<b>Hormones are used in IVF treatment. Explain how different hormones are used to help a woman become pregnant. (H)</b>  <i>FSH is given to <b>stimulate the maturation of an egg</b>, while LH is given to <b>stimulate ovulation</b>. This causes the release of more eggs which <b>increases the chance of fertilisation</b>.</i>
<b>Model Answer</b>	<b>Describe the process of IVF (H)</b>  <i>The woman is given <b>FSH</b> and <b>LH</b>. The FSH causes <b>eggs to mature</b> while the LH <b>stimulates these eggs to be released</b>. The higher levels of hormones increases the number of mature eggs that can be collected. The eggs are <b>fertilised</b> and given time to develop into small balls of cells. Some of these eggs are then transferred into the woman's <b>uterus</b> to be <b>implanted</b>.</i>
<b>Model Answer</b>	<b>Adrenaline causes changes in the body to prepare for a 'fight or flight' response. What changes does it cause in the body? (H)</b>  <i>It increases the supply of <b>oxygen and glucose</b> to the <b>brain and muscles</b>. It also <b>increases heart rate, blood pressure and breathing rate</b>. All of these changes prepare the body for fight or flight.</i>
<b>Practice</b>	1. Learn and practice the model answers above.

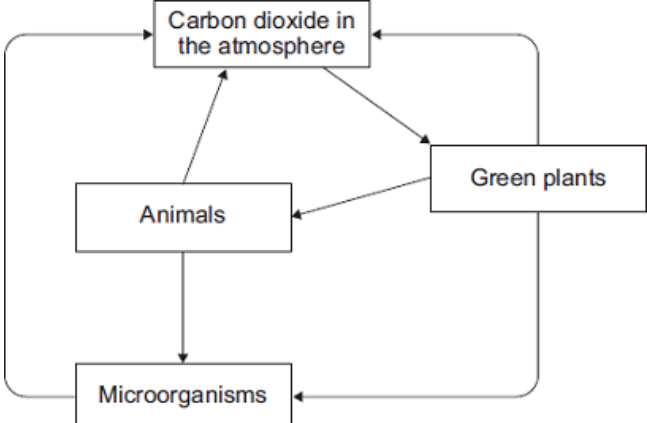
<b>Topic</b>	B13 Reproduction
<b>Qu</b>	Evaluate the use of embryo screening.
<b>Info</b>	<p>You could be asked this question for any genetically inherited disease at all. Genetic diseases that have come up in the GCSE exams in the past include:</p> <ul style="list-style-type: none"> <li>• Cystic Fibrosis</li> <li>• Polydactyly</li> <li>• CRAM</li> <li>• PKU</li> <li>• Breast Cancer</li> </ul> <p>Apart from cystic fibrosis and polydactyly you are not expected to have any prior knowledge about the disease, but you may be expected to interpret information</p> <p>To answer this question, you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Describe the advantages of screening</li> <li>2. Describe the disadvantages of screening</li> <li>3. State a conclusion</li> <li>4. Give at least 1 statement to support your conclusion</li> </ol>
<b>Top Tip</b>	If they give you information in the exam question interpret it and discuss it, but make sure that you use your own knowledge as well. This is important as you won't get many marks (if any) by just repeating what they have given you in the question.
<b>Model Answer</b>	<p><b>Evaluate the use of embryo screening during pregnancy.</b></p> <p><i>Advantages of embryo screening include that you can find out if the child will have a genetic disorder. This means that parents are able to plan and make decisions. For example, they may choose to not have the child if they choose to continue with the pregnancy they can start to prepare financially and emotionally. If the parents find out that the child does not have a genetic disorder this can lead to reassurance for the parents. However, the disadvantages of embryo screening include that the procedure for genetic testing has a risk which can cause miscarriage, there is risk of infection, the procedure can be expensive and can lead to false positive/negative results. As well as this there are ethical implications because some people may choose to abort the pregnancy. In conclusion I think that _____ because _____</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Construct your own conclusion for this model answer.</li> <li>2. Learn and practice the model answer above.</li> </ol>

<b>Topic</b>	B14 Variation and Evolution
<b>Qu</b>	Describe how the _____ evolved over time
<b>Info</b>	<p>You could be asked to describe how any animal evolved to live in a particular habitat. There is no way of predicting which animal you may be questioned on. Animals that have come up in exam questions in the past include:</p> <ul style="list-style-type: none"> <li>• Butterfly's with warning signals on wings.</li> <li>• Larger voles that survive in colder environments.</li> <li>• The dark moth that survives in polluted environments.</li> <li>• Snails with brown shells that live in hedgerows.</li> <li>• Island Foxes that live in slightly different habitats.</li> <li>• Antibiotic resistance in bacteria</li> </ul> <p>To answer this question, you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Identify there is genetic variation in the species.</li> <li>2. Identify that some organisms are better adapted that others.</li> <li>3. Give a suggestion of how/why the organism is better adapted.</li> <li>4. Identify that the animal is better adapted for more likely to survive</li> <li>5. Identify that the genes are more likely to be passed onto offspring.</li> <li>6. Identify that the beneficial gene becomes more common within each generation</li> </ol>
<b>Top Tip</b>	Remember you are not expected to have in depth knowledge about all animals. You will just be expected to give a sensible suggestion for why the animal is better adapted for its habitat.
<b>Model Answer</b>	<p><b>Describe how butterfly's with warning signals have evolved over time.</b></p> <p><i>There is genetic variation in the species of butterfly. Some of these butterfly would have warning signals that make them less likely to be eaten by predators. These butterfly would be more likely to survive and pass on their beneficial genes to their offspring. This means that the beneficial genes become more common within the population.</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn model answers to describe how large voles, dark moths, snails with brown shells, island foxes and antibiotic resistance in bacteria have evolved over time.</li> </ol>



<b>Topic</b>	B15 Genetics and Evolution
<b>Qu</b>	Describe the evidence for evolution Describe how fossils may form Describe factors which contribute towards extinction
<b>Info</b>	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
<b>Top Tip</b>	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
<b>Model Answer</b>	<p><b>Describe the evidence for evolution.</b></p> <p><i>There is different evidence to support the theory of evolution. The first piece of evidence is that we have <b>fossil evidence</b> in which we can see gradual changes happening to animals over thousands of years. As well as this we can see evolution in action with <b>antibiotic resistance</b>. Bacteria divide incredibly quickly, and we have seen advantageous genes within the bacteria become more common leading to changes in the bacterial population.</i></p>
<b>Model Answer</b>	<p><b>Describe how fossils may form.</b></p> <p><i>Fossils may form in three different ways. Firstly, we have fossils from parts of animals that have <b>not decayed</b> as conditions such as a <b>warmth moisture or oxygen</b> were missing. Fossils have also formed when parts of the organism have been <b>replaced over time by minerals</b> as they decayed. A final way fossils formed was through the <b>preserved traces</b> of footprints, burrows and rootlets.</i></p>
<b>Model Answer</b>	<p><b>Describe factors which contribute towards extinction.</b></p> <p><i>There are many different factors that can contribute towards extinction. Examples of factors include <b>new predators</b> which hunt the organism until no more survive, there could be an introduction of a <b>new disease</b> that kills all of the animals or the introduction of <b>new competitors</b> which outcompete the animal for resources that they need. In the past <b>volcanic eruptions</b> and <b>asteroids</b> have also caused extinction of animals. Extinction can also occur due to a <b>loss of habitat</b>, this can occur due to different reasons including deforestation or climate change, humans have a large influence on this also.</i></p>
<b>Practice</b>	1. Learn and practice the model answers above.

<b>Topic</b>	B16 Adaptations, Interdependence and Competition
<b>Qu</b>	Describe how the _____ is adapted for its environment.
<b>Info</b>	<p>You could be asked to describe how animal or plant is adapted to live in a particular habitat. There is no way of predicting which animal or plant you may be questioned about. Animals and plants that have come up in exam questions in the past include:</p> <ul style="list-style-type: none"> <li>• Desert animals such as a camel.</li> <li>• Angler fish</li> <li>• Archaeopteryx (prehistoric bird)</li> <li>• Tapeworm that lives in the small intestine</li> </ul> <p>To answer this question, you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Identify an adaptation that the animal has.</li> <li>2. Describe how this adaptation helps it survive.</li> <li>3. Repeat steps 1 and 2 until you can think of more adaptations.</li> </ol>
<b>Top Tip</b>	Remember you are not expected to have in depth knowledge about all animals and plants. You will just be expected to give a sensible suggestions how it is adapted for its habitat.
<b>Model Answer</b>	<p><b>Describe how animals are adapted to survive in dry conditions such as deserts. For each adaptation that you give, describe how the adaptation helps the animal survive in dry conditions.</b></p> <p><i>Animals that live in dry conditions have several adaptations including a large surface area to volume ratio achieved by having long limbs and longer ears. This increases heat lost to the environment. Animals typically have long eye lashes to prevent dust getting into their eyes and tend to have little body fat and thin fur to reduce insulation around the body. They also have wide feet to reduce pressure on the sand so that they don't sink and tend to be nocturnal so that they are not most active when it is most hot.</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn model answers to describe how animals are adapted to survive in cold conditions and how plants are adapted to survive in dry conditions.</li> </ol>

<b>Topic</b>	B17 Organising an Ecosystem
<b>Qu</b>	Explain how _____ is cycled in the environment.
<b>Info</b>	<p>You could be asked how the following is cycled in the environment:</p> <ul style="list-style-type: none"> <li>• Carbon</li> <li>• Water</li> <li>• Nutrients (if you are doing separate science)</li> </ul> <p>To answer this question, you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Identify all the different ways in which the substance is moving from one place to another.</li> <li>2. Describe these processes</li> </ol>
<b>Top Tip</b>	<p>For these questions you will often be given a diagram to help you structure your answer. For example, this is a diagram given for a carbon cycle question. Before you begin label your diagram with key words that describe how the substance is moving from one place to another.</p>  <pre> graph TD     A[Carbon dioxide in the atmosphere] --&gt; B[Green plants]     B --&gt; A     B --&gt; C[Animals]     C --&gt; A     C --&gt; D[Microorganisms]     D --&gt; A     D --&gt; B   </pre>
<b>Model Answer</b>	<p><b>Explain how carbon is cycled in the environment.</b></p> <p><i>Green plants remove carbon dioxide from the atmosphere by photosynthesis, they also release carbon dioxide into the atmosphere when they respire. When plants are eaten by animals the carbon is transferred from the plant to the animal. When the animal respire carbon dioxide is released into the environment. When both plants and animals die, they are broken down by microorganisms. These microorganisms also respire and release carbon dioxide back into the atmosphere. Finally, if plants are burned then carbon dioxide can be released back into the atmosphere in this way also.</i></p>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn model answers to explain how water is cycled in the environment and if you are doing separate science explain how nutrients are cycled in the environment.</li> </ol>

<b>Topic</b>	B18 Biodiversity and Ecosystems
<b>Qu</b>	<p>Explain why when fertiliser goes into a river, the concentration of oxygen dissolved in the water decreases.</p> <p>Explain the possible consequences of a future increase in carbon dioxide emissions.</p> <p>Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.</p>
<b>Info</b>	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
<b>Top Tip</b>	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
<b>Model Answer</b>	<p><b>Explain why when fertiliser goes into a river, the concentration of oxygen dissolved in the water decreases.</b></p> <p><i>The fertiliser causes growth of algae. The algae blocks light which causes death. Microorganisms break down the dead matter and respire aerobically. Aerobic respiration uses oxygen and so oxygen levels decrease.</i></p>
<b>Model Answer</b>	<p><b>Explain the possible consequences of a future increase in carbon dioxide emissions.</b></p> <p><i>Carbon dioxide is a greenhouse gas that <b>absorbs radiation</b>. This causes an increase in temperature which will lead to <b>global warming</b> and <b>climate change</b>. This could mean that ice caps will melt causing sea levels to rise and flooding. It will also cause <b>habitat destruction</b> which can lead to <b>extinction</b> reducing biodiversity.</i></p>
<b>Model Answer</b>	<p><b>Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.</b></p> <p><i>A rise in carbon dioxide will lead to <b>global warming</b>. This can cause <b>sea levels to rise</b>, a <b>change in rainfall</b>, an <b>increase in droughts and storms</b>. These can all <b>damage habitats</b> which can lead to <b>extinction</b>. It can also cause a change in the distribution of plants and animals and <b>disrupt food chains</b>.</i></p>
<b>Practice</b>	1. Learn and practice the model answers above.

# **Part 3**

# **Required**

# **Practical's**

1.

Person catching sits down, rests weaker arm across the table, with the hand overhanging the edge.



2.

Person dropping the ruler holds it so that the bottom end of the ruler is in line with the catches thumb and forefinger.



3.

Without warning the ruler is dropped.



4.

The other person catches the ruler and the distance the ruler fell is recorded.



5.

Repeat this several times.



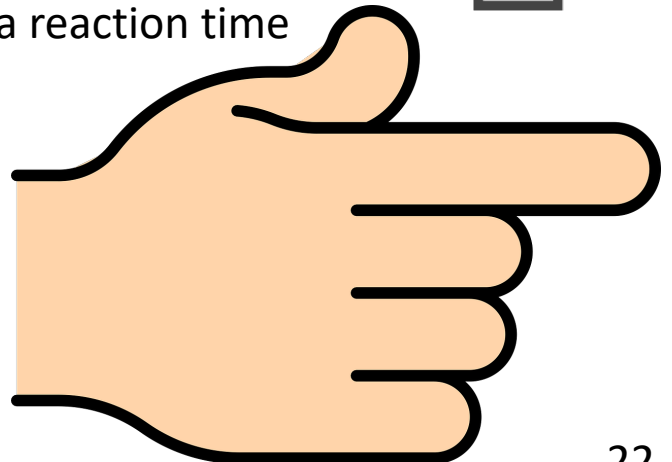
6.

Identify outliers and calculate an average distance dropped.

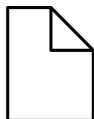


7.

Convert this distance dropped to a reaction time using a table.



## RP6: Reaction Time



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1. What are the control variables when investigating reaction time?
2. How would you ensure valid data is collected?
3. What is the advantage of doing repeats?
4. How could you improve the equipment used in the ruler drop test?
5. When testing reaction time using the ruler drop test you aren't testing reflex actions. Why not?
6. Why would using a computer to determine reaction time be a more valid method?
7. When determining reaction time using a ruler drop what do you measure?
8. How do you use the ruler drop test to determine reaction time?
9. How could you use a computer to determine reaction time?
10. What should caffeine do to reaction time?
11. What should distractions do to reaction time?

1. Age, practice, warning before the drop, tiredness, amount of caffeine, position of the hand, start position of the ruler, weight of ruler.
2. Control all other variables and do repeats.
3. You can identify outliers.
4. Use a ruler with a finer scale in mm.
5. It involves the conscious part of the brain.
6. The measurement of time is more precise and you will be less able to tell when the computer screen is about to change colour.
7. The distance the ruler fell.
8. Convert the distance the ruler fell into a reaction time using a conversion table.
9. Use a program in which the screen changes colour and the time to click a button when this happens is recorded.
10. Reduce it.
11. Increase it.



<b>Topic</b>	RP6 Reaction Times
<b>Qu</b>	Plan an investigation to determine the effect of caffeine on reaction time.
<b>Info</b>	<p>You could be asked this question investigate the effect that different factors have on reaction time. Examples that have been assessed in the past include:</p> <ul style="list-style-type: none"> <li>• Practice and reaction time.</li> <li>• Caffeine and reaction time.</li> <li>• Distractions and reaction time.</li> </ul> <p>To answer either of these questions you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Describe a test that you will do.</li> <li>2. Identify what you will measure</li> <li>3. Describe how you will obtain valid results. (Repeats and control variables)</li> </ol>
<b>Top Tip</b>	Take care giving a clear description of how you carry out the experiment.
<b>Model Answer</b>	<p><b>Plan an investigation to determine the effect of caffeine on reaction time.</b></p> <ol style="list-style-type: none"> <li>1. Student <b>A</b> rests their elbow on the edge of a table while student <b>B</b> holds a ruler between student <b>A's</b> thumb and forefinger.</li> <li>2. Student <b>B</b> drops the ruler without warning.</li> <li>3. Student <b>A</b> catches the ruler and record the distance the ruler fell.</li> <li>4. Repeat this 5 more times, identify outliers and calculate an average.</li> <li>5. Convert the distance into a reaction time using a conversion chart.</li> <li>6. Student <b>A</b> drinks a caffeinated drink and waits 15 minutes.</li> <li>7. Repeat steps 1-5.</li> <li>8. Compare the reaction time between no caffeine and caffeine.</li> <li>9. Control variables include same student in both trials, the ruler will be positioned the same way before each drop and the same ruler will be used each time.</li> </ol>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn a model answer to plan an investigation to investigate the effect of practice on reaction times.</li> </ol>



## Quadrats

1.

Place 5 quadrats randomly in an area in which conditions of a particular factor are similar. For example, quadrats are placed in high light intensity.



2.

Count the number of the organism growing within that quadrat.



3.

Identify outliers and calculate an average.



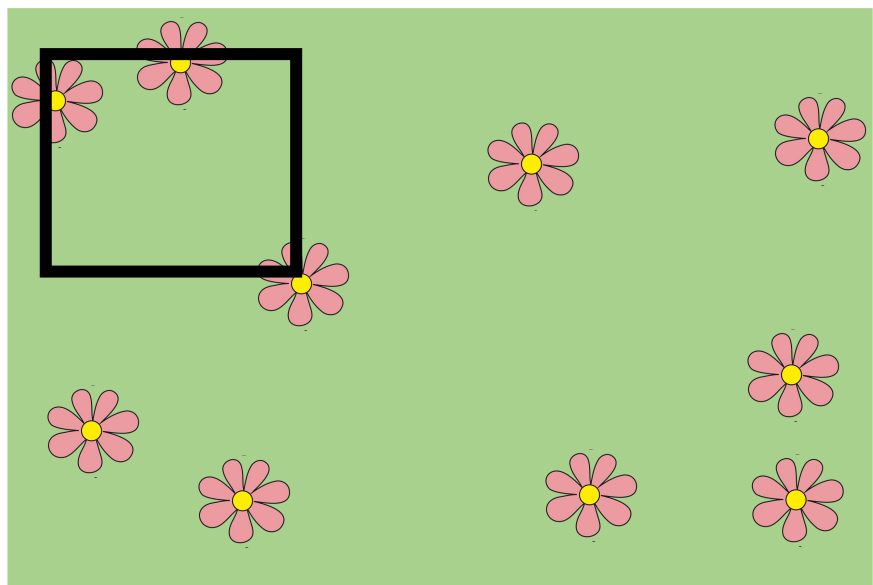
4.

Repeat by placing 5 quadrats in contrasting conditions. For example, quadrats are placed in an area of low light intensity.



5.

Compare data from the different environments.



## Transects

1.

Place a tape measure the length of the area being investigated.



2.

Put the quadrat at the 0cm mark and count how many of that organism are within the transect.



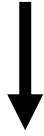
3.

Record the abiotic conditions.



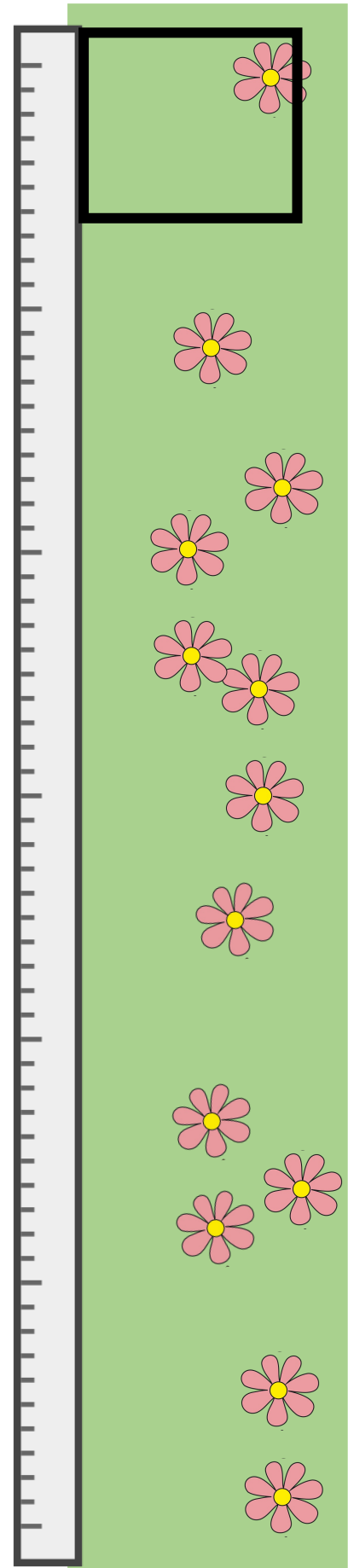
4.

Place a quadrat every 5m and count the number of organisms within the quadrat.  
Record the abiotic factors.

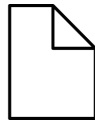


5.

Repeat these steps with 4 more transects.




## RP7: Sampling



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1. Why should quadrats be placed in random positions?
2. How could you position a quadrat randomly?
3. When investigating distribution using quadrats how could you ensure results are valid?
4. When using a transect how could you ensure results are valid?
5. How could you estimate % cover using a quadrat?
6. How would you calculate the area of a rectangular field?
7. What piece of equipment would you use to measure distance?
8. How could you estimate the number of organisms in a field.
9. What is a transect?
10. When would you use a transect?
11. What sampling technique would you use to approximate the number of plants in a habitat?

1. To avoid bias.
2. Throw over shoulder or with eyes shut or use a random number generator to create coordinates.
3. Repeat using more quadrats.
4. Repeat using a transect line in a different position
5. Count the number of squares within the quadrat more than 50% covered, divide by the total number of squares in the grid and multiply by 100.
6. Measure the length and width and multiply these together.
7. Measuring tape.
8. Find the area of the field and the number of organisms found in  $1\text{m}^2$ . Multiply these numbers together.
9. A line across a habitat.
10. To investigate a gradual change in a habitat.
11. Random placement of a quadrat.

<b>Topic</b>	RP7 Sampling
<b>Qu</b>	Plan an investigation to estimate the number of _____growing/living in _____
<b>Info</b>	<p>You could be asked this question to estimate the number of different plants/animals or insects in different habitats. Examples that have been assessed in the past include:</p> <ul style="list-style-type: none"> <li>• Number of ragwort in a field.</li> <li>• Dandelions in a field</li> <li>• Number of daphnia in a pond.</li> </ul> <p>To answer either of these questions you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Describe how to find the area of the habitat.</li> <li>2. Describe how you will use a quadrat to find the number of organisms in a given area.</li> <li>3. Explain how you will use your results to estimate the population in the entire area.</li> </ol>
<b>Top Tip</b>	Make sure that you include in your method how you will collect valid data. For sampling using quadrats this is lots of repeats, calculating an average and a description of how the quadrat will be placed randomly
<b>Model Answer</b>	<p><b>Plan an investigation to estimate the number of dandelions growing in a square field.</b></p> <ol style="list-style-type: none"> <li>1. Determine the area of a field. To do this measure the length by the width and multiply these numbers together.</li> <li>2. Place 10 <u>1m<sup>2</sup></u> quadrats randomly in the field and count the number of dandelions in the quadrat.</li> <li>3. Calculate an average.</li> <li>4. Multiply the average in 1m<sup>2</sup> by the total area of the field to find an estimate.</li> <li>5. To place the quadrat randomly I will split the field into a grid and use a random number generator to create random coordinates.</li> </ol>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn a model answer to estimate the number of daisies in a field with the following shape. </li> </ol>

<b>Topic</b>	RP7 Sampling
<b>Qu</b>	Plan an investigation to compare the number of _____growing/living in _____ and _____
<b>Info</b>	<p>You could be asked this question to compare the distribution of an organisms in different habitats/conditions within that habitat. Examples that have been assessed in the past include:</p> <ul style="list-style-type: none"> <li>• Bluebells growing in fields/woodland</li> <li>• Limpets living in a sheltered bay and non sheltered bay.</li> <li>• Dandelions growing in full sunlight and in shade.</li> </ul> <p>To answer either of these questions you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Describe how you will use a quadrat to find the abundance in each location</li> <li>2. Describe what you will do with your results.</li> </ol>
<b>Top Tip</b>	Make sure that you include in your method how you will collect valid data. For sampling using quadrats this is lots of repeats, calculating an average and a description of how the quadrat will be placed randomly.
<b>Model Answer</b>	<p><b>Plan an investigation to compare the number of dandelions growing in full sunlight and in a shady woodland.</b></p> <ol style="list-style-type: none"> <li>1. Place 10 <u>1m<sup>2</sup></u> quadrats randomly in the field and count the number of dandelions in the quadrat.</li> <li>2. Repeat this in the shaded area</li> <li>3. Calculate an average for each each area.</li> <li>4. Compare the averages from the field in full sunlight and shady woodland to form a conclusion</li> <li>5. To place the quadrat randomly I will split the sample areas into a grid and use a random number generator to create random coordinates.</li> </ol>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn a model answer to compare the number of limpets on a sheltered shoreline and an exposed shoreline.</li> </ol>



<b>Topic</b>	RP7 Sampling
<b>Qu</b>	Plan an investigation to investigate the distribution of _____ using a transect line.
<b>Info</b>	<p>In this question you could be to investigate the distribution of different organisms in different habitats using transects. Examples that have been assessed in the past include:</p> <ul style="list-style-type: none"> <li>• Seaweed along a seashore.</li> <li>• Plants growing along a stream.</li> <li>• Dandelion distribution.</li> <li>• Plants growing along a lake.</li> </ul> <p>To answer either of these questions you will need to do the following:</p> <ol style="list-style-type: none"> <li>1. Identify where the transect will be placed.</li> <li>2. Describe the placement of the quadrats.</li> <li>3. Identify what you will be recording.</li> <li>4. Identify repeats that you will do in different locations.</li> </ol>
<b>Top Tip</b>	When placing quadrats along a transect you will use regular intervals. This is so that you will get data for the position of the organism you are investigating at different distances along the varying conditions of the habitat.
<b>Model Answer</b>	<p><b>Investigate the distribution of seaweed from the sea up to the rocks.</b></p> <ol style="list-style-type: none"> <li>1. Place a transect line at a right angle from the sea.</li> <li>2. Place the quadrat at the point closest to the sea.</li> <li>3. Record the abundance of different seaweeds.</li> <li>4. Repeat placing the quadrat at regular intervals up the shoreline.</li> <li>5. Repeat placing the transect several more times at different positions along the shore.</li> </ol>
<b>Practice</b>	<ol style="list-style-type: none"> <li>1. Learn and practice the model answer above.</li> <li>2. Prepare and learn a model answer to investigate the abundance of plants along a stream, from the shore of a lake and the abundance of dandelions from the edge of a woodland.</li> </ol>