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SENIOR SCIENCE

(Year 12 E411)

Common Assessment Tasks

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Senior Science Year 12 (E411)

Guidelines for the Common Assessment Tasks

This document outlines the requirements for designing a program of Common Assessment Tasks for Year 12 Senior Science. Specific headings are used to provide information to enable teachers to design each task and to ensure relevance to the Senior Science course. However, the tasks described within this document are not, in any sense, mandatory in themselves.

The specific science content of each task may be determined by the teacher. While parameters are set as to the context and specific requirements and expected outcomes of each task teacher is free to determine the content of the task in keeping with their teaching and learning program.

The headings for each task are as follows. The headings provide a framework for teachers to develop their own assessment tasks.

- 1. Task Title**
- 2. Task Description**
- 3. Specific Outcomes**
- 4. Task Parameters**
- 5. Authentication**
- 6. Performance Criteria**

1. Task Title

This section describes, in broad terms the task to be completed. There are seven tasks which together comprise the Assessment Framework. Teachers must incorporate at least one task of each description into their assessment program.

2. Task Description

The Task Description outlines what requirements are necessary for the student to complete the task, and clarifies the major focus of the task for the teacher.

3. Specific Outcomes

A set of outcomes relevant to each task should be listed. These outcomes may be determined by the context of each of the tasks described. Teachers should design tasks with particular outcomes in mind. Conversely the particular set of outcomes will probably vary from those listed in the sample tasks in this document.

4. Task Parameters

This section outlines the specific requirements of the task. Without specifying the actual content of each task, it establishes the specific context in which the task is to be carried out. The parameters ensure, if the guidelines for task parameters are adhered to, that the student is provided with the opportunity to meet the Specific Outcomes listed for the task. Typically, the Task Parameters will link particular observable elements of student behaviour to the achieving of particular outcomes at specified levels.

5. Authentication

Authentication relates to the requirements of the student and the teacher to ensure that the task is the student's own work. It is important that the teacher assessing the student is able to authenticate all work completed by the student. It is equally important for the student to be able to

demonstrate their own contribution to work done. Authentication becomes a challenge in group projects. Teachers will need to be confident of the contribution of group members in such activities. The following guidelines are offered to assist with authentication:

- The teacher will monitor the development of the task by seeing plans and a draft of the student's work. The teacher may want to keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task. Part of a student's final report may include early drafts, plans, etc. of the project reported on.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

6. Performance Criteria

Performance criteria are sets of standards to be used when assessing how well students have met the specific outcomes of each task. Performance criteria are to be used when determining the level to which the student meets the outcomes for the specific task being assessed. The judgement as to the level of student performance is inevitably wholistic. Teachers will need to bring together evidence from the performance of a student over a period of time and a number of tasks to be confident of the level allocated.

Task One: Independently carry out and write conclusions for an experiment

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

Task description:

This task should be designed so that the student has the opportunity to independently carry out and write conclusions for an experiment. In completing the task, the student should be given opportunities to:

- plan a simple controlled experiment, carry it out, collect and tabulate relevant data.
- use mathematical ideas and techniques as appropriate.
- use appropriate sensorimotor skills and equipment to make observations and measurements.

In the sample task which follows:

Specific outcomes are:

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science.

Outcome 2: Plan and carry out short term and extended investigations independently or within a group.

Outcome 5: Use appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Task Parameters: An investigation of brewing

This task requires that the student design an experiment involving respiration rate of yeast. A number of additional investigations are included. The task is described in two stages.

Stages 1: Establishing the problem

The brewery you work for is developing a new type of beer. Beer has a range of ingredients including hops, water and sugar. Beer is given its “fizz” and its alcohol content by using the fermenting action of a special type of **yeast**. The brewery wants to know:

What temperature should the brew be kept at so that the yeast produces the most gas in the shortest time?

The brewery knows that if the brew is kept too cold, the yeast will not work; if the brew is too hot, the yeast will die. They want to find the temperature that is just right for the yeast: They want to find out the *optimum* temperature for brewing

You have been asked to carry out an experiment to find out the optimum temperature to keep the yeast alive and active.

These are important things you should know about the yeast:

- yeast produces the gas carbon dioxide
- the yeast produces more carbon dioxide when it is more active
- the carbon dioxide gas is not readily soluble in water and so can be bubbled through water and collected in a measuring cylinder.

Hints:

Plan to measure the activity of the yeast at **four** different temperatures, use the four conical flasks provided.

Stage 2: Describing the requirements of the task

1. This task requires you to plan and carry out an experiment, take some measurements and then write a conclusion describing what you found. When you are planning your experiment, you should describe the following:
 - what **steps** will you go through to carry out your investigation?
 - what things will you **need to change** in each of the beakers?
 - what things will you need to **keep the same** in each of your beakers?
 - what will you **measure** to find out which of the temperatures is the best for the yeast?

Draw a labelled diagram of what you are going to do.

2. Find a method to work out just how fast the yeast is fermenting the brew at a range of temperatures. You should plan to work out a fermentation rate for the yeast.
3. The technique you have used can then be modified to investigate the effect of a number of substances on yeast respiration rate. Use the optimum temperature as the temperature at which you carry out the investigations. A thermostatically controlled laboratory water bath would be useful. Make sure that the flasks or test tubes you use are clearly identified in some way. Experimental control is important. Some suggestions are:
 - investigate the effect of solutions of different pH. Make up ‘buffer solutions’ or use buffer tablets. Use a standard volume of glucose solution and add a fixed volume of

buffer solution. For a control, replace the buffer solution with a similar volume of distilled water. You may need to find out about buffer solutions in the library.

- investigate the effect of alcohol. Use a standard volume of glucose solution and add a fixed volume of ethanol. For a control you can replace the ethanol with a similar volume of distilled water.
- investigate the effects of carbohydrates other than glucose. For example, as well as glucose, choose from 20% solutions of fructose, mannose, galactose, sucrose, maltose and lactose.

Concluding the task.

Write a report outlining the purpose of your investigation, the production that you used, the reason for any experimental controls, the results that you obtained a discussion of them. Make suggestions for improving the experimental design and technique.

Authentication

- The teacher will need to monitor the development of the task by seeing plans and a draft of the student's work, and should keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

Rating specific performance

Outcome	Criteria	Criteria demonstrated by the following	Satisfactory Performance	High Performance	Very High Performance
2	Controls variables				
2	Describes procedure				
5	Uses scientifically correct terms and names for equipment				
5	Uses equipment proficiently				
7	Completes calculations from data accurately and with appropriate use of units				

Step 2: Performance Criteria.

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in:

- biological science
- physical science
- environmental/earth science.

Satisfactory	High	Very High
Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science recalls most ideas and applies concepts in familiar situations.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in familiar situations and some complex tasks.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in a range of complex tasks.

Outcome 2: Plan and carry out short term and extended investigations independently or within a group.

Satisfactory	High	Very High
Plans a simple strategy which controls most relevant variables and carries out the procedure.	Plans a strategy which controls all relevant variables and carries out the procedure.	Develops a hypothesis, plans a suitable strategy then systematically collects relevant data to test the hypothesis, using the planned procedure.

Outcome 5: Uses appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Satisfactory	High	Very High
Uses simple and familiar apparatus such as balances and timers to make observations and measurements.	Makes efficient use of scientific equipment to make observations and measurements.	Understands and uses more complex scientific equipment effectively to make observations and measurements.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Satisfactory	High	Very High
Performs basic calculations in an appropriate context, and specifically is able to add and subtract with 80 - 100% accuracy.	In addition to the preceding, the student is able to multiply, divide and use simple formulae with 80 – 100% accuracy and report results using correct units.	In addition to the preceding, the student is able to calculate percentages and rearrange and apply formulae and report results using correct units and to an appropriate level of accuracy.

Task Two: Collect information and critically report on a particular area

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

Task description:

This task should be designed so that the student is required to collect information (say on change in a particular area over time) or make observations, collate data or observations, analyse and processes the information and critically report on it.

The task may allow the student to do some or all of the following:

- collect information on an area of interest and report on it
- demonstrate a sound understanding of scientific concepts, laws, procedures and conventions in the area investigated
- present experimental data in a variety of forms as appropriate to the task
- describe patterns and trends in the data they collect and make some valid inferences.

Specific outcomes:

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science

Outcome 3: Present data in a variety of forms (including oral, graphical, tabular, diagrammatic and written forms) as appropriate to the task.

Outcome 4: Describe patterns and trends in data observations and make valid inferences.

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Task parameters: Preparing an Action Proposal

This task requires that the student collect information on a local recreational area and report on its use for conservation and for recreation. The potential conflict between these two purposes is a basis for discussion.

The student is required to prepare an Action Proposal as a result of their investigation.

Conservation Development: A report on the Herdsman Lake area

Stage 1: Establishing the problem

Your task is to collect information about the conservation vs recreation/development argument. as it applies to the Herdsman Lake area.

Part One:

Visit the Herdsman Lake area. While you are there observe the area and its use - as many aspects as you can.

Using a map of the area, explain the use of the Herdsman Lake area.

Part Two:

You are to collect information about the 'conservation vs recreation/development' argument. Using this essay, write a report explaining what you would do with the Herdsman Lake area.

Some methods you might use to gather information are set out below:

Interviews

Contact relevant Authorities (Local City Council, CALM, Ministry of Sport and Recreation..) and ask for an interview on the issue. You will need to:

- Arrange a specific time and give an indication of how much time you would like.
- Give an indication of the type of information you require.
- Have your questions prepared beforehand.
- Don't forget to say 'thank you'. You might also offer to let the person you interview see your final report.

Request for information to be sent to you

Many groups (especially Government departments) are prepared to send information to you. Write to these groups and ask for information.

Requests are best made in writing, so you need to plan ahead and allow enough time to receive a reply. Clearly state your name and address. Be specific about the type of information you need.

Keep a record of your letters and the replies you receive in your files to be included in your final report.

Newspapers

These are a valuable source of current information. Compile a scrap book of articles which are relevant. Make sure that the date is on each article. Look for sources of original information (Local Councils, etc.) It is a good idea to start doing this at the beginning of the Unit. A good scrap book will also be useful when you come to compile your glossary for work requirement 4.

Libraries

These will be a major source of information. Use the catalogue, and if you are not sure, ask for help from the librarian.

Most libraries will have the publication called *Guidelines*, which is an extremely helpful alphabetical index for a wide range of Australian and overseas periodicals (magazines).

Stage 2: The requirements of the task

Taking into account the current passive recreational use of this area, and the biological/ecological significance of the area do **one** of the following. Write an action proposal supporting **one** of the following:

Action Proposal 1:

Public access to the Herdsman Lake area should be restricted and its use as a wetland environment and sanctuary increased to increase its conservation value.

Action Proposal 2:

Public access to the Herdsman Lake area should be increased and its use as a passive recreational area increased to raise public awareness, knowledge and therefore support of its conservation value.

To complete the selected action proposal follow the steps below:

- a) Outline the biological and social principles which underlie the issue from your point of view.
- b) List the arguments in favour of your action proposal, and those against it. Use all your sources of information, and discuss your proposal with other people. Social and economic arguments should be considered as well as biological ones.
- c) State the position you would adopt if you were required as a biologist to give advice on this issue.
- d) If your position as a concerned citizen differs from the advice you gave as a biologist, explain the reasons for the different viewpoint.
- e) Outline in some detail the broader ecological problem of which your issue is a local example.
- f) List the major areas of argument surrounding the problem.
- g) Outline strategies that could be used to address the problem for either proposal.

Authentication

- The teacher will monitor the development of the task by seeing plans and a draft of the student's work, and the teacher will keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

Performance Criteria.

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science.

Satisfactory	High	Very High
Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science recalls most ideas and applies concepts in familiar situations.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in familiar situations and some complex tasks.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in a range of complex tasks.

Outcome 3: Present data in a variety of forms (including oral, graphical, tabular, diagrammatic and written forms) as appropriate to the task.

Satisfactory	High	Very High
Present data using a number of familiar forms.	Presents data in a wide variety of forms, depending on the purpose of the task.	Presents data in a range of forms to reveal patterns and relationships.

Outcome 4: Describe patterns and trends in data observations and make valid inferences.

Satisfactory	High	Very High
Describes trends in tables and graphs and makes simple inferences.	Accurately describes patterns and trends in data and makes valid inferences.	Accurately describes patterns and trends in data and makes valid inferences based on a range of such data and information.

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Satisfactory	High	Very High
Presents simple ideas clearly and uses more common scientific terms such as ‘force’ and ‘energy’ correctly.	Presents ideas and information clearly using appropriate scientific terminology.	Collects information, organises it logically and presents complex ideas and information clearly using less common scientific terminology appropriately.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Satisfactory	High	Very High
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Follows simple safety directions consistently.	Identifies requirements for safety and usually displays responsible behaviour.	Independently implements responsible and safe behaviour
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Task Three: Summarise and evaluate samples of popular writing in science

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

Task description:

This task should be designed to assess the student's ability to analyse samples of popular science writing. The science text to be analysed should reflect the learning outcomes of the course and, in particular, allow the student to demonstrate an understanding of the appropriate science concepts, laws, procedures and conventions.

The task may allow the student to do some or all of the following:

- demonstrate a sound understanding of scientific concepts, laws, procedures and conventions in the area investigated
- present experimental data in a variety of forms as appropriate to the task
- describe patterns and trends in the data they collect and make some valid inferences.

Specific Outcomes

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science

Outcome 3: Present data in a variety of forms (including oral, graphical, tabular, diagrammatic and written forms) as appropriate to the task.

Outcome 4: Describe patterns and trends in data observations and make valid inferences

Task parameters:

This task derives from the aquaculture component of a Year 12 Senior Science Course. The readings given were part of the work requirements, which preceded a marron breeding program. The article which follows, 'Feeding Marron', was given to the students as part of a project in which marron were grown as part of an extended investigation.

Feeding Marron

The type of food, the quantity of food and the time to feed marron are important aspects of the management of a marron farm. The addition of feed to culture ponds not only supplies nutrients (eg nitrogen and phosphorus) and energy (in the form of carbon) to the marron, but it also 'feeds' the pond ecosystem.

Competent management of pond ecosystems and the marron that inhabit them, relies on our understanding of the effect that feeding has on the ponds. Because of the rapid transfer of nutrients and energy from the feed to the ecosystem, the feeding of aquatic animals has the potential to detrimentally affect the structure and function of the ecosystem. Aquatic ecosystems are inherently productive and can change rapidly because the system is confined to a dense medium (water), which can become depleted in oxygen.

The water connects the sediment, the marron and the atmosphere. If a pond or tank ecosystem is overfed, then the population of organisms such as bacteria, will be stimulated. At night-time, a bacterial bloom will absorb the oxygen passing from the atmosphere to marron in the deeper water and those marron may die.

The inter-relationship between feeding and pond management cannot be over-emphasised. For example, a common response to the addition of protein-rich (nitrogen) feed, such as trout pellets, lupins or blood and

bone, is an increase in the population of organisms that live on the carapace of the marron, such as temnocephlids and epistylis. This creates a marketing problem because the pond ecosystems are being fed to encourage organisms which reduce the aesthetic appeal for the marron.

Type of Feed

The type of food required by animals varies according to their age, sex and physiological state. Juveniles require more protein with specific amino acid profiles whereas reproductively active females require high energy feeds. One food source is rarely adequate for a species of an individual; animals enjoy variety in their diet for nutritional reasons.

There are natural and artificial feeds. The natural foods can be generated within the pond. They are cheap, clean and are the food type from which the digestive system of the marron is designed to extract the nutrients and energy required for maintenance, growth and reproduction. With proper management, up to half of the food required can be supplied by natural feeds in a semi-intensive culture pond.

Based on the time it takes for the food to impact on the pond ecosystem, there are three types of artificial feeds:

- short term - (hours) readily available for "fast foods", such as pellets;
- medium term - (days) grains such as barley, oats and corn; and

- long term - (weeks) fibrous food such as coarse vegetable material.

All these foods can be placed into the ponds simultaneously or periodically.

Pelleted Food

Pellets are ideal if the marron are underfed or if the major moult phases are occurring (spring and autumn) Most commercial farms use pellets for at least 1/3 of the artificial food supply. Care should be taken to avoid overfeeding with pellets in the summer months: they can cause oxygen depletion by overstimulating pond productivity.

The pellet designed for 1+ and 2+ marron (manufactured by Glen Forrest Stockfeeds) is a low nutrient, high energy food source with specific natural additives to complement the feeds that would usually be available a productive pond. It is designed for feeding marron in recirculating pond ecosystems and has a low potential to pollute the pond. It breaks down quickly into a fine paste, which mimics the natural food of marron. The pellet does not have binders added because this increases the cost and can interfere with the nutrition and digestibility of the pellet.

Pellets designed for poultry are a reasonable occasional supplement, but should not be the only source of artificial feed. Trout pellets are designed for carnivorous fish and consequently they are a

rich source of protein, which represents an expensive potential pollutant. If trout pellets are used, they should be used sparingly in the cooler months or in new ponds to stimulate biological activity.

Grains

Grains are a good food source. They not only provide a range of nutrients and energy to the marron, but they also assist in the build-up of natural food sources (detritus). Cooked grains, such as steam-rolled barley and oats, are an excellent food source. Grains store well and are easily handled. Some grains float, which allows water birds to consume them. Soaking the grains for a few hours before feeding helps them sink and reduces the quantity available to ducks and other birds. The external “teeth” and the internal grinding apparatus (gastric mill) of the marron are easily capable of reducing whole grain to a pulp.

Vegetable Material

Both green (eg. grass, comfrey, fruit and vegetables) and dried (eg. straw, hay and leaves) vegetable material are important food sources for marron. It also provides shelter for juveniles until it is eaten. The material provides a small quantity of readily available food, but is most useful for stimulating the micro-environment at the sediment/water interface which encourages the growth of other organisms in the pond.

Caution should be applied when using these food sources because they can create major imbalances to the ecosystem if supplied in too large a quantity. If you are unsure how to use them,

the best rule is to add a little at regular intervals, for example; half a bale every second month to a 1,000m² pond. These food types can be used by the experienced farmer to control the productivity of the pond ecosystem.

Time to Feed

Marron feed at dusk by filling the first chamber of their foregut. If food is abundant a marron can fill the foregut within 4 minutes. Because marron require 16 to 20 hours to digest a meal, the best time to feed them is just prior to dusk. If expensive pelleted feeds are being used, it is important to supply the food at the time the marron are feeding. If the pellets are being used, it is important to supply the food at the time the marron are feeding. If the pellets are fed before or after the optimum feeding time, the other organisms (fish and aquatic insects) may make an easy meal of them and thus reduce the quantity of food available to the marron.

Grains do not break down as quickly as pellets and so can be fed at the time most convenient to the farm manager.

The time of the lunar month is equally important when feeding marron. During the full moon, marron are less active along the edge of the pond and so the artificial feeds are usually put in the deeper water and at approximately half the normal rate.

Frequency of Feeding

The frequency of feeding is mostly determined by the water temperature and the

quantity of natural food available. the maximum growth of marron is achieved when the water temperature is between 20-26°C. The faster the growth rate, the more food that is required. Assuming that the ponds are moderately productive, feed is usually supplied three to four times per week in summer and once per week in winter. Spring and autumn feeding occurs two to three times per week. The best rule is to feed small quantities as frequently as is practical.

Quantity to Feed

The first chamber of the marron foregut holds approximately 4% of its body weight. About 1% of this weight is digestive fluid, so approximately 3% of the body weight of marron is ingested each day. The optimum rate to feed a population of marron is 3% of the biomass (the weight of the population of marron) per day. In controlled culture ponds containing single cohorts this figure can readily be estimated.

If the biomass of the marron is unknown, feeding to demand provides a rough guide. Demand feeding along the edge does not allow for marron that mostly inhabit the middle of the pond; demand feeding plus extra feed to the middle of the pond is required.

It is interesting to note that marron have the capacity to go without food for extended periods without dying. This means that underfeeding will not necessarily result in deaths, just slower growth rates.

Care should be taken not to overfeed when the temperatures are above 22°C because warmer water holds less oxygen. This is why the most likely time for oxygen depletion is in summer; particularly at night when microscopic aquatic plants (phytoplankton) are not using the sunlight to produce oxygen in the water. Careful pond management ensures a build up of natural feeds during the cooler months and controlled “under feeding” in the warmer months to ensure that the marron clean up the

pond and reduce the potential for oxygen depletion.

When estimating the quantity to add to the ponds, it is useful to consider that, during a major moult phase, the biomass of the marron in the pond can increase by 30-50% within a few days. This will result in changing what was

the optimum feeding regime to one which supplies only 60-75% of the quantity required within a few days.

Where to Feed

Broadcast feeding over the pond is most effective, with a large amount of the feed being placed in the most biologically active zone - the water edge (20-40cm deep). If overfeeding occurs, then there will be less demand on oxygen in the deep water if the feed is concentrated in the shallow waters.

SOURCE: Brett O’Brien “Feeding Marron” in *Marron Snips - Feeding and Nutrition*, Marron Growers Association of W.A. Permission to copy obtained.

Year 12 Marine Studies

Marron Nutrition Worksheet

Read the articles “Feeding Marron” and ‘The Natural Diet of Marron’ in your aquaculture booklet and answer the following questions.

1. Explain how overfeeding a tank or pond ecosystem can effect marron in deeper water. Refer to the term “bacterial blooms” in your answer.
2. Explain how the addition of rich protein foods can create marketing problems for growers.
3. How do marron food requirements vary with age and sex?
4. How can farmers benefit from encouraging natural foods in their dams?
5. Under what conditions are pellets the best choice or artificial food?
6. Explain the benefits of using grains as a food source.
7. Explain why pellets should be added at dusk.
8. What factors affect the frequency of feeding.
9. What quantity of food should marron be given? What modifications would you make to this for marron in a small tank?
10. How long can marron go without food?
11. Why should over feeding be avoided when water temperatures are over 22⁰ C?
12. How should feeding regimes change during moulting?
13. Where should food be placed in a pond? Why?
14. Using the information, produce a palm card of the significant points of the article for a brief oral report on a selected aspect of the feeding requirements of marron.

Authentication

- The teacher will monitor the development of the task by seeing plans and a draft of the student's work, and the teacher will keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

The student will, in relation to this task:

- indicate, by highlighting or circling, particular points in the articles where information is given
- be able to identify the source paragraphs for information when asked

Performance Criteria

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science

Satisfactory	High	Very High
Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science recalls most ideas and applies concepts in familiar situations.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in familiar situations and some complex tasks.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in a range of complex tasks.

Outcome 3: Present data in a variety of forms (including oral, graphical, tabular, diagrammatic and written forms) as appropriate to the task.

Satisfactory	High	Very High
Presents data using a number of familiar forms.	Presents data in a wide variety of forms, depending on the purpose of the task.	Presents data in a range of forms to reveal patterns and relationships.

Outcome 4: Describe patterns and trends in data observations and make valid inferences.

Satisfactory	High	Very High
Describes trends in tables and graphs and makes simple inferences.	Accurately describes patterns and trends in data and makes valid inferences.	Accurately describes patterns and trends in data and makes valid inferences based on a range of such data and information.

Task 4: Design an experiment or product using scientific principles and conduct the experiment or test the product within appropriate guidelines

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

This task should be designed so that the student makes or produces a product using scientific principles or produces a product and tests it within appropriate guidelines and safety procedures

In the process, the student should be given opportunities to:

- demonstrate an understanding of scientific concepts, laws, procedures and conventions in the context.
- use appropriate skills in operating equipment to carry out scientific procedures to make accurate observations and measurements.
- demonstrate and consistently apply, appropriate safety procedures and responsibility in the designing and testing process.
- perform a range of calculations using mathematical ideas and techniques and scientific units appropriate to their project

Specific outcomes:

Outcome 2: Plan and carry out short term and extended investigations independently or within a group.

Outcome 5: Use appropriate sensorimotor skills to carry out scientific procedures, make accurate observations and measurements.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Task Parameters

Making a boating mark

Stage 1: Establishing the problem.

The task requires the student to make a mark that can be used in a boat course. The mark must be easy to see, durable and have good flotation.

Stage 2: Describing the requirements for the task.

You are required to make a lateral, cardinal or special mark.

You should determine which materials will be used. The finished product must be buoyant and visible.

A scale diagram must be constructed from a picture. This will ensure your mark is the correct size and dimensions.

Before construction begins, make a blueprint of all manufacturing details. Materials needed, sizes, centre of gravity, colours and shapes all need to be specified. All of these specifications should be justified in your report on this product.

The flotation test will need to be conducted in the water. You must plan the test, set specifications, carry the test out and report your results.

Authentication

- The teacher will monitor the development of the task by seeing plans and a draft of the student's work, and the teacher will keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

The student will need to verify the student's involvement in the production and testing components of this task.

The student will need to report to the teacher at various stages in the designing and construction phases of this project.

Marking criteria specific to the performance of this task.

Outcome	Comments	Satisfactory Achievement	High Achievement	Very High Achievement
1. Demonstrates an understanding of Archimedes principle and how it applies to the buoyancy of the mark. Gives an account of choice of materials, dimensions, etc. in construction.				
2. Designs an adequate test of the product, and then conducts the test.				
5. Creates a mark, using appropriate products, in order to achieve appropriate flotation and visibility				
5. Uses multimeter correctly. Other measurements are accurately made and recorded.				
7. Completes relevant calculations using correct units in testing the product.				
8. Implements safe procedures in production with particular awareness of the hazards of electricity				

Performance Criteria

Outcome 2: Plan and carry out short term and extended investigations independently or within a group.

Satisfactory	High	Very High
Plans a simple strategy which controls most relevant variables and carries out the procedure.	Plans a strategy which controls all relevant variables and carries out the procedure.	Develops a hypothesis, plans a suitable strategy then systematically collects relevant data to test the hypothesis, using the planned procedure.

Outcome 5: Use appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Satisfactory	High	Very High
Uses simple and familiar apparatus such as balances and timers to make observations and measurements.	Makes efficient use of scientific equipment to make observations and measurements.	Understands and uses more complex scientific equipment effectively to make observations and measurements.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Satisfactory	High	Very High
Performs basic calculations in an appropriate context, and specifically is able to add and subtract with 80 – 100% accuracy.	In addition to the preceding, students is able to multiply, divide and use simple formulae with 80 – 100% accuracy and report results using correct units.	In addition to the preceding, the student is able to calculate percentages and rearrange and apply formulae and report results using correct units and to an appropriate level of accuracy.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Satisfactory	High	Very High
Follows simple safety directions consistently.	Identifies requirements for safety and usually displays responsible behaviour.	Independently implements responsible and safe behaviour.

Task Five: Present an oral report evaluating the impact of science on society

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

This task should be designed so that the student presents an oral report on the role of science in society or the work place, and in doing so may:

- demonstrate a working understanding of scientific concepts, laws, procedures and conventions in familiar situations
- present data in a variety of forms
- communicate effectively using appropriate scientific terminology
- illustrate how science has had an impact on the environment and our society.

Specific Outcomes

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Outcome 9: Illustrate, with examples, how science has had an impact on the environment and our society.

Work Experience Report

This task begins with an important assumption. That assumption is:

Science plays an important role in any work place.

You have to present an oral report supporting that assumption. The assumption (or hypothesis) can be investigated by asking the following questions:

How is science used in the workplace?

What are the particular applications of science that are evident in this workplace?

To answer this you will need to do the following, before, during and after a period of work experience:

Before your work experience

Complete some research about the work place you are going to. You might begin your research in the library, then by asking people at the workplace. You should try to find out:

- how science affects the work you are going to do
- which people in your workplace use scientific ideas, instruments or techniques in their work
- how will you be using science in your work?

During your work experience

Observe people who are doing day to day work in your workplace. How does science affect the way they work and the things they do? You will need evidence: collect copies of documents, pamphlets, brochures, posters which you think support your argument that there is science in your workplace.

After work experience

Prepare a 5 minute talk about your work experience to present to the class. Use the information you have collected.

Special Note

The nature of the task is such that teachers may judge that only in outcomes 3 and 6 can a student demonstrate 'very high' achievement. Teachers will need to exercise their judgement with respect to outcome 1 and 9.

Task parameters

This particular task should incorporate 3-4 hours in or out-of-class time in preparation. The presentation should be 5–8 minutes, with a mark penalty attached to presentations which are too brief or too long. Group presentations are acceptable if it is clear that group members have contributed to the task in discrete ways.

Authentication:

- The teachers should monitor the development of the task and sight evidence of preparation.
- The student's text should be retained for inclusion in the student portfolio.
- Any audiovisual material should also be retained in the portfolio.
- All work will be assessed only if the teacher can attest that the work is the students own, or is, at the very least, the product of a work group to which this student made a significant contribution.

Assessing the oral presentation

Use this guide to rate the student's presentation

	Rating Scale						<i>Outcome/</i>
1. Content: What the speaker says (25 marks)							
Information (science facts and ideas)	0	1	2	3	4	5	1
Effectiveness (use of examples)	0	1	2	3	4	5	3
Clarity of explanation	0	1	2	3	4	5	
Interest to audience	0	1	2	3	4	5	1
Shows understanding of topic							
2. Organisation of information (15 marks)							
Introduction establish objectives	0	1	2	3	4	5	1,9
Logical organisation of ideas	0	1	2	3	4	5	1,9
Conclusion supports view	0	1	2	3	4	5	1,9
3. Delivery (10 marks)							
Visual Impact (stance, eye contact)	0	1	2	3	4	5	3
Vocal impact	0	1	2	3	4	5	3

Students will need to be given instructions as to the preparation of coherent and logically sequenced presentations.

The following outcome has been taken from the “Senior English” CAF document. It may be useful in providing a slightly different perspective on evaluating a student oral presentation in another Learning Area.

Outcome 5: Speak clearly, fluently and coherently according to purpose, audience and context.

Satisfactory	High	Very High
The student will speak clearly, fluently and coherently in familiar situations, varying language to suit audience and purpose.	The student will speak clearly, fluently and coherently and demonstrate an awareness of the ways in which verbal and non-verbal techniques can be used to engage an audience.	The student will speak confidently and effectively and manipulate verbal and non-verbal techniques to engage an audience, and to achieve specified purposes.

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science.

Satisfactory	High	Very High
Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science recalls most ideas and applies concepts in familiar situations.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in familiar situations and some complex tasks.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in a range of complex tasks.

Outcome 5: Use appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Satisfactory	High	Very High
Uses simple and familiar apparatus such as balances and timers to make observations and measurements.	Makes efficient use of scientific equipment to make observations and measurements.	Understands and uses more complex scientific equipment effectively to make observations and measurements.

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Satisfactory	High	Very High
Presents simple ideas clearly and uses more common scientific terms such as ‘force’ and ‘energy’ correctly.	Presents ideas and information clearly using appropriate scientific terminology.	Collects information, organises it logically and presents complex ideas and information clearly using less common scientific terminology appropriately.

Outcome 9: Illustrate, with examples, how science has had an impact on the environment and our society.

Satisfactory	High	Very High
Recognises the impact of science on their life.	Discusses the impact of science on society, their life and work.	Demonstrates in discussion a high level of understanding of the impact of science on society, their life and work.

Task 6: Design and conduct an extended investigation

a) independently, b) in a group

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

Task description:

This task should be designed so that the student conducts an investigation or series of investigations involving the collection of data over an extended period of time and reports on the findings of their investigation.

The task should allow the student to demonstrate some or all of the following:

- demonstrate an understanding of scientific concepts, laws, procedures and conventions relevant to the field of investigation
- plan and carry out simple controlled experiments
- present experimental data in tables, line graphs and diagrams
- describe patterns and trends in a range of data sets
- use appropriate skills to operate equipment to carry out scientific procedures and make accurate observations and measurements
- communicate effectively using appropriate scientific terminology
- perform simple calculations using mathematical ideas and techniques and appropriate units
- demonstrate safe procedures in investigating scientific issues
- discuss how science has had an impact on the environment and our society.

Specific outcomes:

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science

Outcome 5: Use appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Task Parameters

Sports Science: Fitness Profile Assignment

This task involves:

- a) designing an appropriate fitness test for a small group of subjects, say four (4) primary school students in year 6 or 7.
- b) implementing the test
- c) presenting the results in a 'fitness profile'

You may be testing primary school children, or members of a sporting group, workers in an office, factory or other site or some other group. Select a group that you can keep contact with for a period of some months.

Whatever group you choose you should make appropriate arrangements to meet with your subjects and conduct your tests, after reaching agreement with them or some person responsible for them that you can do so.

Part 1: Selection of tests

Using the ACHPER Australian Schools Fitness Testing book as a resource, choose 45 tests that will adequately cover the areas of fitness you wish to test. You may also find other tests in other texts. Take a note of all the equipment you will need and notify your teacher. You should check that the tests will fit in the time you have with the students and ensure that the students receive clear instructions.

Part 2: Testing

This will be done during class time. You should plan for around 60 minutes of testing. All the equipment you requested should be available and you will need to have identified your four subjects for testing.

Part 3: Working with the data

After you have collected your data you need to draw up a fitness profile for each subject. If you are using school students then a copy of this can be handed back to the school/student to be kept for future comparison. In this you should include;

- students name, age, weight and anthropometric measurements
- a brief description of each test performed
- a table of results
- percentile charts and scores
- a brief summary of fitness level.

An example of an outline for a fitness profile can be found in the appendix of your ACHPER resource.

Part 4: Logistics of the task

This will, of course, be done first. Your teacher will collect your letter and combine it with the class letters and send them to a local primary school. You must, however, submit a copy to your teacher for marking. Include this when handing in your fitness profile.

Part 5: Follow-up

Arrangement in return to retest your four subjects after a period of time - say two months - has elapsed. Prepare a brief follow-up report commenting on the extent of change which has occurred in the subjects over the time period.

Authentication

- The teacher will monitor the development of the task by seeing plans and a draft of the student's work, and the teacher will keep a record of this process.
- The student will produce and maintain appropriate documentation of the development of the task.
- The student must acknowledge all resources used. This will include text and source material and the name(s) and status of the person(s) who provided assistance and the type of assistance received.
- The student will sign a declaration at the time of submitting the completed task. The declaration will state that all unacknowledged work is the student's own.
- The teacher may consider it appropriate to ask the student to demonstrate his or her understanding of the task at or about the time of submission of the work.

Performance Criteria relevant to this task

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science.

Satisfactory	High	Very High
Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science recalls most ideas and applies concepts in familiar situations.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in familiar situations and some complex tasks.	Within relevant areas of each of the fields <ul style="list-style-type: none"> • Biological science • Physical science • Environmental/earth science applies scientific concepts in a range of complex tasks.

Outcome 2: Plan and carry out short term and extended investigations independently or within a group.

Satisfactory	High	Very High
Plans a simple strategy which controls most relevant variables and carries out the procedure.	Plans a strategy which controls all relevant variables and carries out the procedure.	Develops a hypothesis, plans a suitable strategy then systematically collects relevant data to test the hypothesis, using the planned procedure.

Outcome 3: Present data in a variety forms (including oral, graphical, tabular, diagrammatic and written forms) as appropriate to the task.

Satisfactory	High	Very High
Presents data using a number of familiar forms.	Presents data in a wide variety of forms, depending on the purpose of the task.	Presents data in a range of forms to reveal patterns and relationships.

Outcome 5: Use appropriate sensorimotor skills and equipment to carry out scientific procedures, make accurate observations and measurements.

Satisfactory	High	Very High
Uses simple and familiar apparatus such as balances and timers to make observations and measurements.	Makes efficient use of scientific equipment to make observations and measurements.	Understands and uses more complex scientific equipment effectively to make observations and measurements.

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Satisfactory	High	Very High
Presents simple ideas clearly and uses more common scientific terms such as ‘force’ and ‘energy’ correctly.	Presents ideas and information clearly using appropriate scientific terminology.	Collects information, organises it logically and presents complex ideas and information clearly using less common scientific terminology appropriately.

Outcome 8: Demonstrate and consistently apply safe procedures and a high level of responsibility in investigating scientific issues.

Satisfactory	High	Very High
Follows simple safety directions consistently.	Identifies requirements for safety and usually displays responsible behaviour.	Independently implements responsible and safe behaviour.

Task Seven: Test

Curriculum Council requirements for a task of this type are outlined below.

- For students to meet the requirements of the specific outcomes of this task, they must provide evidence that reflects the requirements of the task.
- The sample task shows the requirements for completion and assessment of this category of task. Teachers should use this to model an analogous task appropriate to their teaching program.

Task description: No exemplars are given for this task

This task should be designed so that the student is involved in a formal assessment, which focuses on individual achievement demonstrated within the chosen context.

The category 'test' can be applied broadly in Senior Science. A test can include:

- multiple choice questions
- short answers questions
- calculations
- 'open-book' items
- information retrieval activities
- in-class written exercises
- practical tests for certification, eg TL3, 'First Aid' tests
- laboratory skills exercises

Specific outcomes:

Outcome 1: Demonstrate an understanding of relevant concepts, laws, procedures and conventions within real life and/or work place context, in

- biological science
- physical science
- environmental/earth science.

Outcome 4: Describe patterns and trends in data observations and make valid inferences.

Outcome 6: Communicate effectively using scientific terminology as appropriate to the audience.

Outcome 7: Perform a range of appropriate calculations using mathematical ideas, techniques and scientific units with reasonable accuracy.

Outcome 9: Illustrate, with examples, how science has had an impact on the environment and our society

Note: In this subject, the aggregation of evidence of achievement of these outcomes over time using a number of such tests is acceptable.

Teaching - Learning Program

Interaction of Content and Approaches

Students should take part in a wide diversity of learning activities and be involved with a variety of general science content areas. This will help them to achieve the outcomes of the course. The following courses, (either in total or as a mix and match arrangement) are suitable and acceptable in developing a balanced science program – *Individualised Science Instruction System (ISIS)*, *Unified Science*, and *Working with Science*. Teachers may design their own programs to achieve the outcomes of the course. The science content should cover a program of physical, biological and environmental earth sciences.

Within this general framework, teachers are free to choose the content and learning experiences that best suit the needs of their students and the resources available to satisfy those needs. As this course aims to show science in the context of society as a whole, the community and the local environment should be considered as part of the learning environment. The use of the community as an extension of the school environment should make science more relevant to students. Program may offer students work experience in a science-related technology, business or firm. This should, however, be chosen so as to satisfy the aims of the course.

The following topics are provided as a start-point for course development. Topics are presented in broad outline only, and teachers are encouraged to add or subtract from or redraft as they see fit to meet the needs of their students. The list of topics is neither prescriptive nor complete.

Biological Science

First Aid

On completing this topic, students should be able to:

- recognise the symptoms of, and carry out, the recognised first aid treatment for – resuscitation; unconsciousness; shock and electric shock; bleeding; burns and scalds; fits and convulsions; poisoning; bites and stings; fractures.

Biological Classification

On completing this topic, students should be able to:

- show an awareness of the work of a biologist
- state the reasons for classification and describe how different criteria might be used for classification

- define and state the classification hierarchy: kingdom, phylum, class, order, family, genus, species
- use a simple dichotomous key to describe similarities in a family or genus of plants
- describe the similarities and differences in a class of animals, the concept of species, and the rules for biological nomenclature
- design and use a simple dichotomous key
- describe the necessity for the collection and preservation of plants and animals and make a collection of shells or other animal material
- show a positive attitude towards the conservation of flora and fauna.

Food and Nutrition

On completing this topic, students should be able to:

- describe the importance of food in the development, maintenance and functioning of body cells
- categorise and state the elements contained in each of the food groups
- state what types of food contain sugar, starch, protein and fat; describe and carry out the test used to indicate the presence of each
- define the terms vitamin and mineral, cite good sources of each, name the vitamins and describe the effect they have on the human body
- describe how the energy value of a food is determined, state comparative energy values for carbohydrates, proteins and fats and relate how food energy is used in the body
- describe the need for a balanced diet, and relate the energy requirements of humans with respect to age, sex and activity level
- discuss the eating habits of adolescents with specific reference to "junk foods" and recognise bad dietary habits
- show an awareness of the importance of diet in maintaining good health and the problems which an imbalance between food intake and level of activity might cause.

Human Digestion

On completing this topic, students should be able to:

- state the purpose of what takes place during, and the reason for, digestion
- name, identify, arrange in a logical sequence and relate structure to their function, of the parts of the digestive system
- describe how food moves through the alimentary canal and explain the mechanics of peristalsis
- state what happens during mechanical and chemical digestion and relate the parts of the

digestive system to their role in mechanical and/or chemical digestion

- state what takes place during the digestion of carbohydrates, fats and proteins in the mouth, stomach and small intestine
- describe absorption in the intestines and relate the structure of the small intestine to its function
- describe the differences between the processes of elimination and excretion
- state and describe the symptoms and common treatment of digestive system disorders.

Human Reproduction

On completing this topic, students should be able to:

- show an understanding of the differences between male and female bodies, locate, draw and label the reproductive organs
- describe the functions of the ovaries and testes, state which gamete is produced by each and relate hormonal action to gamete production and secondary sexual characteristics
- recognise and show an understanding of the secondary sexual characteristics which develop among their peer group
- discuss human sexuality, describe the stages in a typical menstrual cycle, relate the changes taking place to hormonal action
- describe meiosis in relation to the production of gametes; where, when and how fertilisation takes place and the development of the embryo
- explain how sex is determined and how identical and fraternal twins occur
- describe the changes in a mother and foetus during gestation
- describe the methods of contraception; the relative advantages, disadvantages, effectiveness, availability and cost of different methods and show an awareness that contraception should be the responsibility of both partners
- discuss the roles of both parents during pregnancy and childbirth.

Interdependence of Physiological Systems

On completing this topic, students should be able to:

- state the major functions of bones, describe their macroscopic structure and relate the structure to their function
- state the major functions of muscles, describe their overall structure and relate the structure to their function and to use common names to label muscles

- describe hinge, ball and socket, sliding, pivot and immovable joints and relate each type to its function
- state the functions of ligament and tendons and explain body movement in terms of interaction between muscles and bones
- describe how receptors and effectors are linked by nerves e.g. simple reflex arc
- describe aerobic and anaerobic exercise and list the short term effects of exercise on muscles and the cardiovascular system
- define fatigue and list its effects on physical and mental performance, capacity for further work and recovery
- measure heart and respiration rate before and after exercise
- list the long term effects of exercise such as improved blood flow and oxygen uptake, increased muscle tone, muscle bulk and endurance
- show an awareness of the importance of exercise in maintaining good health.

Micro-Organisms

On completing this topic, students should be able to:

- name the parts of a microscope and explain their function, prepare a simple mount with and without staining and calculate the approximate size of an organism knowing the magnification of the microscope
- describe the general structure of a cell, identify their component parts and the functions of the major organelles
- distinguish between unicellular algae, fungi, bacteria and protozoa
- describe the main methods of reproduction of micro-organisms
- describe the conditions necessary for culturing bacteria
- prepare, inoculate and dispose of an agar culture correctly and show an appreciation of the dangers of culturing micro-organisms
- describe the use of antiseptics, including disease prevention, and demonstrate their effects
- apply a knowledge of micro-organisms to everyday situations such as food preservation.

Evolution

On completing this topic, students should be able to:

- show an appreciation of the enormous period of time represented by the geological time scale and list the major eras of epochs within it
- define absolute dating using carbon-14 and potassium-argon methods as examples

- define relative dating of rocks, for example, stratigraphy
- describe how variation occurs within a species
- define chromosome, gene and gamete and describe how characteristics are passed from one generation to another
- describe some theories to account for the origin of present day species; for example, natural selection, Lamarckism, creationism
- explain how fossils, comparative anatomy, geographical distribution and embryology can be used as evidence for evolution
- describe two trends in the evolution of a species.

Human Circulation

On completing this topic, students should be able to:

- identify the major blood vessels and chambers on an animal heart or model of a human heart and describe blood flow to, from and through the heart
- describe the structure and function of arteries, veins and capillaries and relate the structure to the function
- explain the meaning of the term 'pulse'; locate a pulse and measure its rate
- state that blood is pumped under pressure; explain the terms 'systolic' and 'diastolic' and state the normal pressure range for adult males and females
- describe the causes and symptoms of cardiovascular ailments, e.g. heart attacks and strokes and describe the basic first aid, long term treatment and rehabilitation of victims
- explain the importance of diet, stress, smoking, alcohol, exercise, heredity and disease as factors affecting cardiovascular function and show a positive attitude towards the maintenance of a healthy cardiovascular system.

Physical Science

Vehicles and Drivers

On completing this topic, students should be able to:

- demonstrate a basic understanding of the road traffic code
- state the major causes of accidents and interpret statistics showing accident causes and effects
- state the effects of alcohol and/or drugs on the nervous system and state the laws and penalties related to driving under the influence of alcohol and/or drugs

- state Newton's first law and describe how it accounts for the effects of vehicle collisions
- state the factors which affect the stopping distance of a vehicle and interpret tables and graphs of reaction time and stopping distance
- state and assess the effectiveness of the commonly used safety features and practices associated with vehicles
- show an appreciation of the impact of vehicle accidents on society and of the responsibility of drivers to their passengers and other road users
- state the safety procedures for the preparation to drive a vehicle.

Simple Machines

On completing this topic, students should be able to:

- define a machine, categorise machines into various applications and list the general ways that machines can be used
- define, identify and give examples of lever, wheel and axle, block and tackle, belt and pulley, chain and sprocket and meshing-cog systems
- describe the relationship between mechanical advantage, load, effort and distance advantage relating to the various types of machines studied
- define the terms "work input", "work output" and "efficiency" and state the relationship between them
- identify efficiency as one of the criteria which are considered when deciding on the suitability of a machine and measure the efficiency of several simple machines
- demonstrate using a bicycle, how some of the simple machines studied can be used, with others, to form a more complex machine
- show an awareness of the impact machines have had on society.

Acids, Bases and pH

On completing this topic, students should be able to:

- define and list the characteristics of acids and bases
- define the term "pH", state the pH range for acids and bases and measure, using universal indicator, the pH of various solutions
- describe several general reactions of acids and bases; for example, acid + metal, acid + base, acid + carbonate
- describe the nature of metallic and non-metallic oxides and their effect on the environment

- describe some common examples of the uses of acids and bases; for example health salts, brick cleaning, refining bauxite, drain cleaners
- describe the reactions which acids and bases take part in during swimming pool maintenance
- show an appreciation of the important role acids and bases play in our society.

Energy Forms and Transformations

On completing this topic, students should be able to:

- define the terms energy, kinetic energy and potential energy and relate them to their associated variables
- define light energy, electrical energy and chemical energy and relate each to its major source
- explain the law of conservation of energy and relate it to energy transfer devices using flow charts
- define efficiency of energy consuming devices using friction as a major source of inefficiency and state that efficiency can be maximised by certain processes
- explain the importance of electrical energy to modern society; state how electricity is made and state the difference between series and parallel circuits
- construct both series and parallel circuits and measure associated currents and voltages
- show an awareness of the cost of domestic electricity and the means by which its wastage can be minimised
- show a positive attitude towards the conservation of energy and the need for efficient energy changing devices.

Sources and Demand for Energy

On completing this topic, students should be able to:

- define and describe the formation of, types, location of WA deposits, methods of exploration and advantages of fossil fuels
- draw and discuss flow charts depicting the domestic and industrial use of fossil fuels and describe the world's present energy demand and relate it to the availability of fossil fuels
- show an awareness of the environmental impact of large scale fossil fuel use and state the alternative sources and their advantages and disadvantages
- describe the quantity and availability of all energy sources and show a willingness to consider their environmental and economic viability
- state the reasons for the increase in world energy demand, now and in the future

- demonstrate an objective approach to the problem of energy consumption and demand in third-world and industrialised countries.

Hydraulics

On completing this topic, students should be able to:

- define pressure and perform calculations based on $p=F/A$
- state in their own words and verify, experimentally, Pascal's principle
- use Pascal's principle to explain the operation of a hydraulic ram and explain how a hydraulic system can produce a force advantage or distance advantage
- give examples of devices based on the application of Pascal's Principle e.g. hydraulic jack or press, tip truck, tractors, automotive braking systems
- state the characteristics required of efficient hydraulic fluids and recognise a suitable fluid for hydraulic systems

Floating, Swimming and Sailing

On completing this topic, students should be able to:

- define density, calculate the density of all three phases of matter and determine, experimentally, the density of a solid and a liquid
- state the difference between floating and sinking in terms of relative density; conduct tests to measure the relative density of solids and liquids and use data to determine whether a solid will float in a liquid
- state Archimedes' principle and demonstrate it by experiment and give applications
- define the terms 'stability', 'centre of gravity' and 'ballast' and experimentally relate the centre of gravity of a boat to its stability
- describe some common methods of propulsion used by animals moving through water relating animal structure to the method of propulsion
- explain how an oar (or paddle) is an application of levers giving a speed and distance advantage
- explain the role of the sails, sail area, keel, centre board and rudder in sailing craft
- describe how a propeller and jet both develop a forward thrust.

Basic Electronics

On completing this topic, students should be able to:

- recognise circuit symbols for common electronic components and match symbols with components

- demonstrate a working knowledge of, and be able to use, the resistor colour code
- interpret circuit diagrams for the position of components and their polarity
- perform simple calculations based on resistors in series and parallel
- use a soldering iron, wire strippers, heat sink to construct a simple circuit containing resistors, capacitors, diodes, transistors and relays
- state the basic function of resistors, capacitors, diodes, transistors and relays
- construct simple circuits designed for a specific task, e.g. flashing lights, siren, metronome
- describe the advances in electronic devices which have been stimulated by the pressure to reduce size and cost
- investigate the effect on society of electronic devices such as computers, calculators, digital clocks, and watches and in areas such as medical and motor vehicle
- define the terms energy and power and state the unit (joule and watt) in which each is measured
- calculate the energy consumed by an appliance given its power rating and running time
- accurately read a household electricity meter to determine the units of electricity consumed
- state and define the kilowatt-hour (kW-h) as the basic unit of electrical consumption
- calculate the total cost of energy consumed by an appliance given the cost per unit. Cost = energy used x cost per unit
- interpret a typical electricity consumption graph
- show an appreciation of the cost of running an appliance when selecting and using electrical appliances
- list and compare the different types of fuels currently used in Australian homes under the headings physical properties, chemical properties, availability, waste products and cost

- select and justify the type of fuel that would be best for a particular use.

Velocity, Distance, Time and Momentum

On completing this topic, students should be able to:

- measure accurately distance, time and mass and list the correct symbols and units for various quantities e.g. length, mass, time, velocity, force, momentum
- define and give examples of vector and scalar quantities
- use the graphical representation of vectors to solve problems involving displacement, velocity, force and momentum
- recall and use the relationship average velocity = displacement/time
- draw and interpret velocity – time graphs with constant acceleration and displacement – time graphs for constant velocity
- state and apply the formula to calculate the momentum of a body and to demonstrate the effects of velocity
- quote practical examples where the effects of momentum change are put to use, e.g. seat belts, recoil of a gun, braking systems
- show a need to consider carefully the effects of momentum of vehicle and drivers, e.g. collision events
- state the law relating to conservation of momentum
- and recognise situations where this law applies

Energy and the Consumer

On completing this topic, students should be able to:

Environmental Earth Sciences

Future Energy Resources

On completing this topic, students should be able to:

- describe the differences between renewable and non-renewable sources and state the renewable sources and their suitability in particular situations
- state the energy sources in common use, explain how the energy is released and describe the effects its use has on the environment
- show a positive attitude towards energy conservation and state the methods of, and reasons for, conservation
- carry out a study of solar energy taking into account its harnessing, exposure time, absorber efficiency and conversion into electricity.

Astronomy

On completing this topic, students should be able to:

- show an appreciation of the fact that bodies other than the planets exist in our solar system
- describe the nature, orbit and appearance of comets and list examples
- describe the theory pertaining to the formation of meteors and how they interact with earth
- describe the advancements made by the use of telescopes, spectroscopes and space

probes and show how they have contributed to the knowledge of distant celestial objects

- state the stages in space exploration – satellites, animals in space, manned flights, deep space probes, human moon exploration, space shuttle and describe the use of satellites in resource detection, map making, weather forecasting, communications technology etc.
- show an awareness of the benefits of space research, future likely events in space exploration and the potential for the exploitation of space.

Pollution

On completing this topic, students should be able to:

- state the effect on the environment of water polluted by oil, chemicals and bacteria and describe two ways of reducing each type of pollution
- carry out simple tests to determine the pH, conductivity and evaporation rate of water samples
- recognise the major causes of air pollution and state the effect of soluble acidic oxide gases, insoluble gases and particles on the environment, and two ways in which air pollution might be reduced
- show an awareness of the degree to which vehicles contribute to air pollution and determine experimentally, the constituents of vehicle exhausts
- state the effects of excessive noise on human health, how noise levels are measured, the legal requirements for noise levels and practical methods for the reduction of noise pollution
- measure accurately the noise levels from several events
- define visual pollution and state examples, supporting claims with logical argument.

Weather

On completing this topic, students should be able to:

- show an awareness of the factors which cause the prevailing weather conditions and relate gathered information to climatic experience
- define the terms, rain, hail, snow, sleet, thunderstorm and describe how thunderstorms can cause local flooding
- describe the nature, cause and effects of cold and warm fronts, their progression through the State and use laboratory equipment to model fronts

- define a cyclone and describe the conditions from which cyclones form, the usual progress of a cyclone and the precautions to be taken during a cyclone
- describe the nature of convection currents, the coriolis effect, land and sea breezes relating the environmental effects
- describe how clouds are formed, describe and identify the cloud types cirrus, stratus, nimbus and cumulus and describe the weather associated with each type
- describe the methods for measuring air pressure, rainfall, relative humidity and wind velocity and carry out measurements of these phenomena
- state the methods used to prepare synoptic charts and weather forecasts, identify the symbols on a synoptic chart, read weather maps, and describe the conditions which should prevail
- show an awareness of the limitations and difficulties in forecasting the weather.

Environmental Chemistry

On completing this topic, students should be able to:

- list fuels and their uses, state the requirements for combustion and the factors affecting the rate of combustion
- light and extinguish a fire safely using several methods and show a positive attitude to fire prevention in the home, workplace and public areas
- describe the products of combustion and relate the heat content and pollutant output to the advantages and disadvantages of different fuels
- state the conditions necessary for corrosion, properties of metals which allow corrosion and describe the corrosion of iron and aluminium and the methods of corrosion prevention
- describe the suitability of corrosion protection methods and the effect on the environment of discarded, corroded items
- state the nature of biodegradability, describe the biodegradability of soaps and detergents and the effect it has on the environment
- describe and identify common plastics and their uses and show a positive attitude for their correct disposal.

Water

On completing this topic, students should be able to:

- cite examples of, and relate the properties of, water to its use as a solvent, medium for

chemical reactions, transport medium, coolant and lubricant

- describe the water cycle
- discuss the availability and quality of underground water resources
- carry out simple experiments to test for dissolved substances in water
- list the factors affecting the hardness of water and describe the treatment of hard water
- explain the treatment used to make water suitable for household consumption e.g. aeration, chlorination
- describe the benefits of fluoridation
- describe common pollutants which affect water quality
- assess the potential for water pollution from industrial plants
- make and record accurate observations about water quality from a collection of water samples.

Oceanography

On completing this topic, students should be able to:

- list and identify from maps, the major oceans of the world and discuss the variation in depth and composition of sea water
- list and recognise the major types of marine plants and animals and relate them to the food chains and food webs found in the oceans of the world
- state and compare the changing environmental conditions experienced by organisms living in different ocean zones, e.g. inter-tidal zone, coastal zone, ocean deeps
- describe some methods of the ways oceans act as a valuable resource, e.g. fishing, mining, recreation, power generation
- describe some methods of marine exploration, e.g. satellite, bathysphere, surface exploration
- describe the formation of waves, ocean currents and tides
- relate the effects of waves, currents and tides on coastal erosion, weather, shipping etc
- show an appreciation for the ocean as a valuable but delicate and limited source.

Geology and Society

On completing this topic, students should be able to:

- describe the causes and effects of movements in the earth's crust in terms of

earthquakes, folding and faulting, volcanoes, landslides and erosion

- define, list and recognise the major ores mined in Western Australia
- explain how an ore is formed and state various methods of extracting metals from their ores
- describe society's dependence on, and use of, metals in a historical context and in modern society
- state the economic importance of minerals to Western Australia
- state, list and locate the various forms of fossil fuels found in Western Australia
- describe society's dependence on fossil fuels and its long term implications
- show concern for human impact on the environment and the long term effects on society.

Soil Science

On completing this topic, students should be able to:

- describe the formation of soils
- state and explain how soils can be classified into several groups according to particle size, organic content, water holding capacity, pH, aeration, and relate soil type to use
- describe, compare and contrast the characteristics of the main soil horizons
- give examples, and state the importance, of solid organisms to the structure and fertility of soils
- carry out simple tests to determine soil characteristics and relate these to plant growth
- describe some methods of improving soil fertility
- describe the problem associated with the application of artificial fertilisers e.g. Peel Inlet, 'algal blooms'
- explain the importance of soil conservation.