

|                     |  |
|---------------------|--|
| <b>STUDENT NAME</b> |  |
|---------------------|--|



**Victorian Certificate of Education  
2007**

**ENVIRONMENTAL SCIENCE**

**Trial Written Examination 1  
June 2007**

**QUESTION AND ANSWER BOOK**

**Structure of book**

| Section | Number of questions | Number of questions to be answered | Number of marks |
|---------|---------------------|------------------------------------|-----------------|
| A       | 20                  | 20                                 | 20              |
| B       | 6                   | 6                                  | 70              |
|         |                     |                                    | <b>Total 90</b> |

**Materials**

- Question and answer book of 20 pages.
- Answer sheet for multiple-choice questions.
- At least one pencil and eraser.
- One approved graphics calculator (memory cleared) and/or one scientific calculator

**Instructions**

- Write your **student name** in the space provided on this book
- Write your student name in the space provided on your answer sheet for multiple-choice.
- All written responses must be in English.
- Time allowed: 15 minutes reading time, 90 minutes writing time

**At the end of the examination**

- Place the answer sheet for multiple choice questions inside the front cover of this question and answer book

© VICTORIAN ASSOCIATION FOR ENVIRONMENTAL EDUCATION JUNE 2004  
THIS DOCUMENT MUST NOT BE COPIED IN WHOLE OR PART WITHOUT THE WRITTEN AUTHORIZATION OF THE ASSOCIATION

Please note this is a practice exam only and its degree of hardship and content is different to the end of Unit 3 exam. VAEE takes no responsibility for your success in completing the actual VCE Environmental Science Unit 3 exam.

## SECTION A – Multiple-choice questions

### Specific instructions for Section A

Answer all questions.

All questions should be answered on the answer sheet for multiple-choice questions, in pencil.

Choose the response that is **correct** or **best answers** the question, and shade the square on the multiple-choice answer sheet according to the instructions given on that sheet. A correct answer is worth 1 mark; an incorrect answer is worth no marks. No marks will be given if more than one answer is shown for any question. Marks will not be deducted for incorrect answers

#### Question 1

A 15watt globe when switched on consumes

- A. .15 Joules per second**
- B. 15 joules per second
- C. 15000 joules per second
- D. 15 kwh

#### Question 2

The air expired by animals through respiration is enriched in

- A. Carbon dioxide**
- B. Nitrogen gas
- C. Methane
- D. Oxygen

#### Question 3

A smuggler wishes to sell Red Tailed Black Cockatoos from Victoria to international buyers in the US and Europe. An international response to help fight against the trade in endangered wildlife is best known as:

- A. Ramsar
- B. JAMBA
- C. EPBC
- D. CITES**

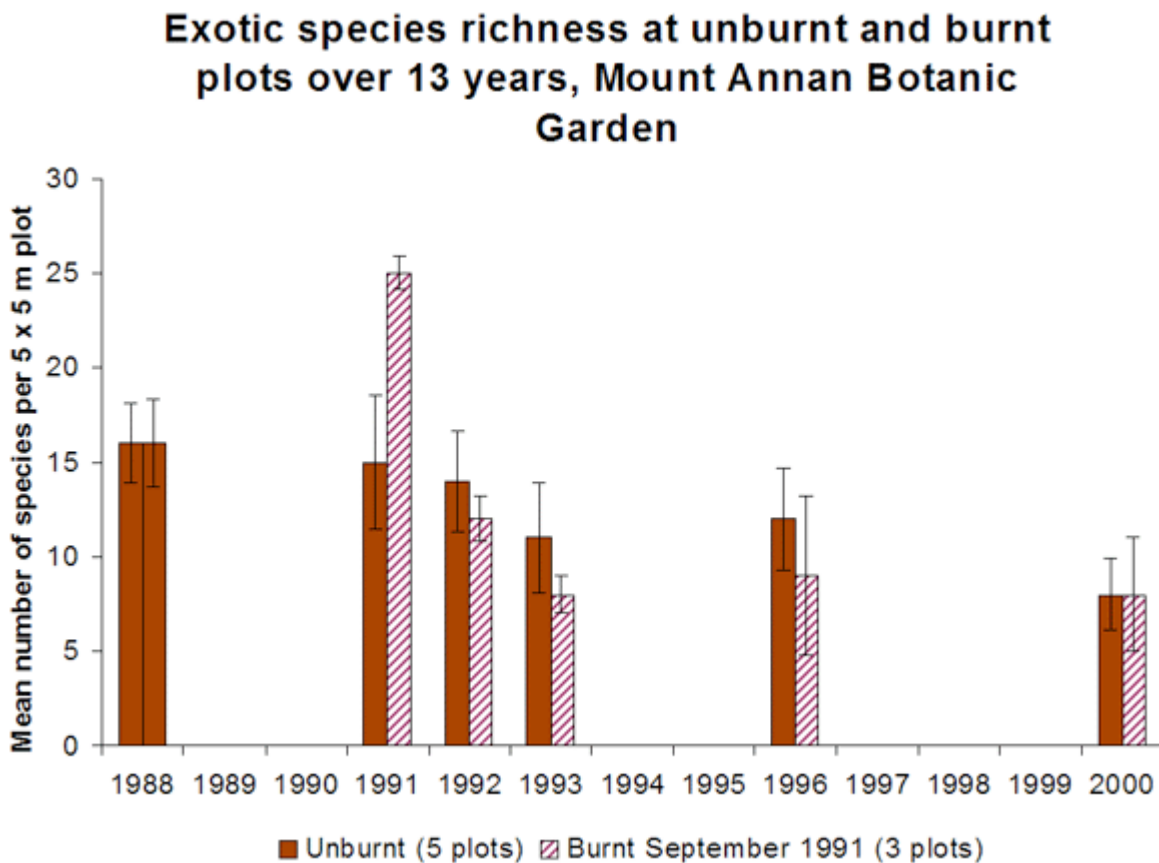
#### Question 4

Carbon dioxide is released primarily through the:

- A. Combustion of coal**
- B. Farming of large numbers of cattle and sheep
- C. Stockpiling large amounts of coal and other fossil fuels
- D. Use of aerosol cans and the leaking of coolants in refrigerator lines

### Question 5

A research centre has been established at Mount Annan, NSW, with a view to better understanding the ecology of woodland ecosystems. Three plots were burnt in September 1991 and several plots were left unburnt to compare responses of these areas to fire. One of the studies focussed on the species richness of introduced plants in response to fire. The results are shown in the table below.



From the graphic data set it would be reasonable to conclude that:

- A. Species of exotic plants invade quickly after fire**
- B. Exotic plants initially colonise burnt sites in large numbers
- C. Burning a site is a good way of reducing the numbers of exotic plants in the long run
- D. Burning a site is a good method for reducing the exotic biodiversity within a site

### Question 6

Which of the following statements is unlikely to be true about a population of inbreeding animals?

- A. Inbreeding decreases genetic diversity of a population
- B. Inbreeding is likely to increase rates of mortality in a population
- C. Inbreeding is most likely to occur in large populations**
- D. Inbreeding can have harmful effects on individuals in a population

### Question 7

Power generated by a wind turbine is best represented by:

- A. Kinetic energy to mechanical energy to electrical energy**
- B. Potential energy to mechanical energy to electrical energy
- C. Kinetic energy to mechanical energy to chemical energy
- D. Potential energy to kinetic energy to electrical energy

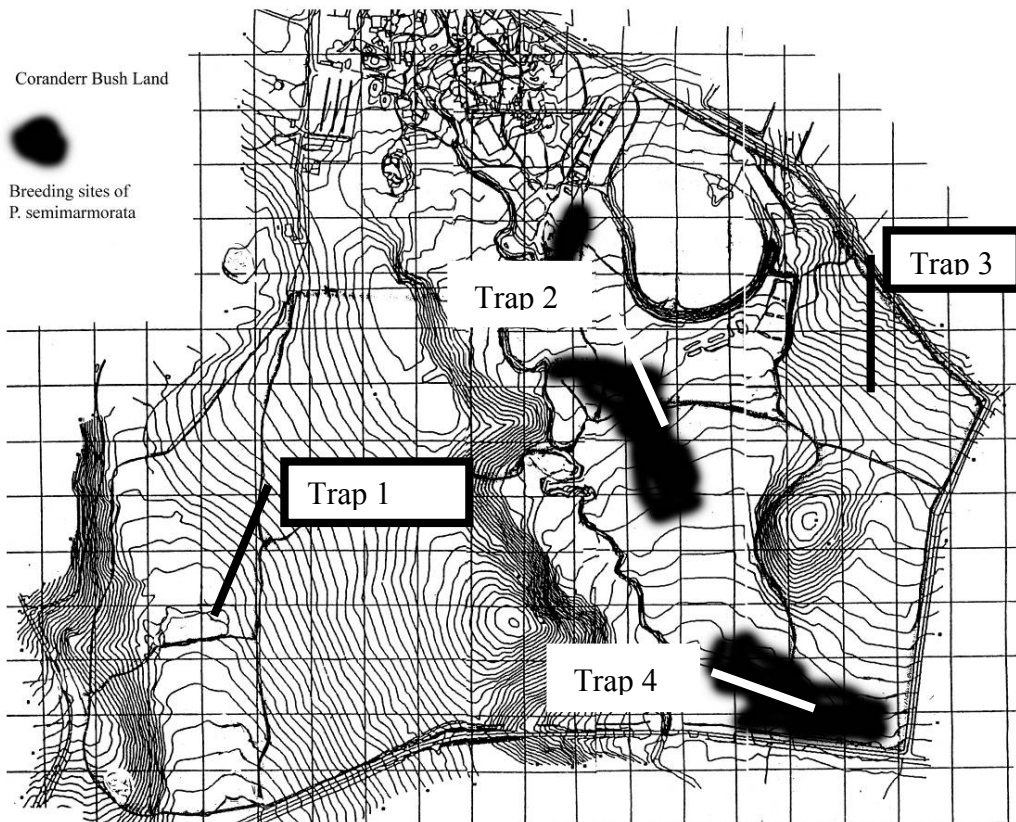
### Question 8

Which of the following energy sources is a non-renewable, non-fossil fuel?

- A. Hydroelectricity
- B. Natural Gas
- C. Wind
- D. Uranium**

Use the following information to help answer questions 8 & 9

The Southern Toadlet, *Pseudophryne semimarmorata*, is a small ant eating frog found in the woodlands of southern Australia. Some scientists have expressed concern about the decrease in both distribution and abundance of this species. In an effort to better understand its ecology a scientist placed a series of ant traps in the forest to see if there is a co-relation between food supply and the distribution of this species.



| Trap Number | Ant species A | Ant species B | Ant species C | Total Number |
|-------------|---------------|---------------|---------------|--------------|
| 1           | 5             | 0             | 20            | 25           |
| 2           | 20            | 30            | 0             | 50           |
| 3           | 10            | 10            | 35            | 55           |
| 4           | 25            | 35            | 10            | 70           |

### Question 9

The best estimate of the average number of ants per trap is:

- A. 200
- B. 50**
- C. 25
- D. 800

### Question 10

Which of the following statements is supported by the evidence?

- A. The target frog species requires a trapping density of ants greater than 55 to survive
- B. The target frog species appears to require ant species B to survive
- C. The target frog species requires all three species of ant to be present
- D. The target frogs species appears to require relatively high numbers of species A & B to survive**

### Question 11

The process of burning coal to heat water to drive steam turbines is a chemical reaction that is best described as:

- A. poikilothermic
- B. homeothermic
- C. exothermic**
- D. endothermic

### Question 12

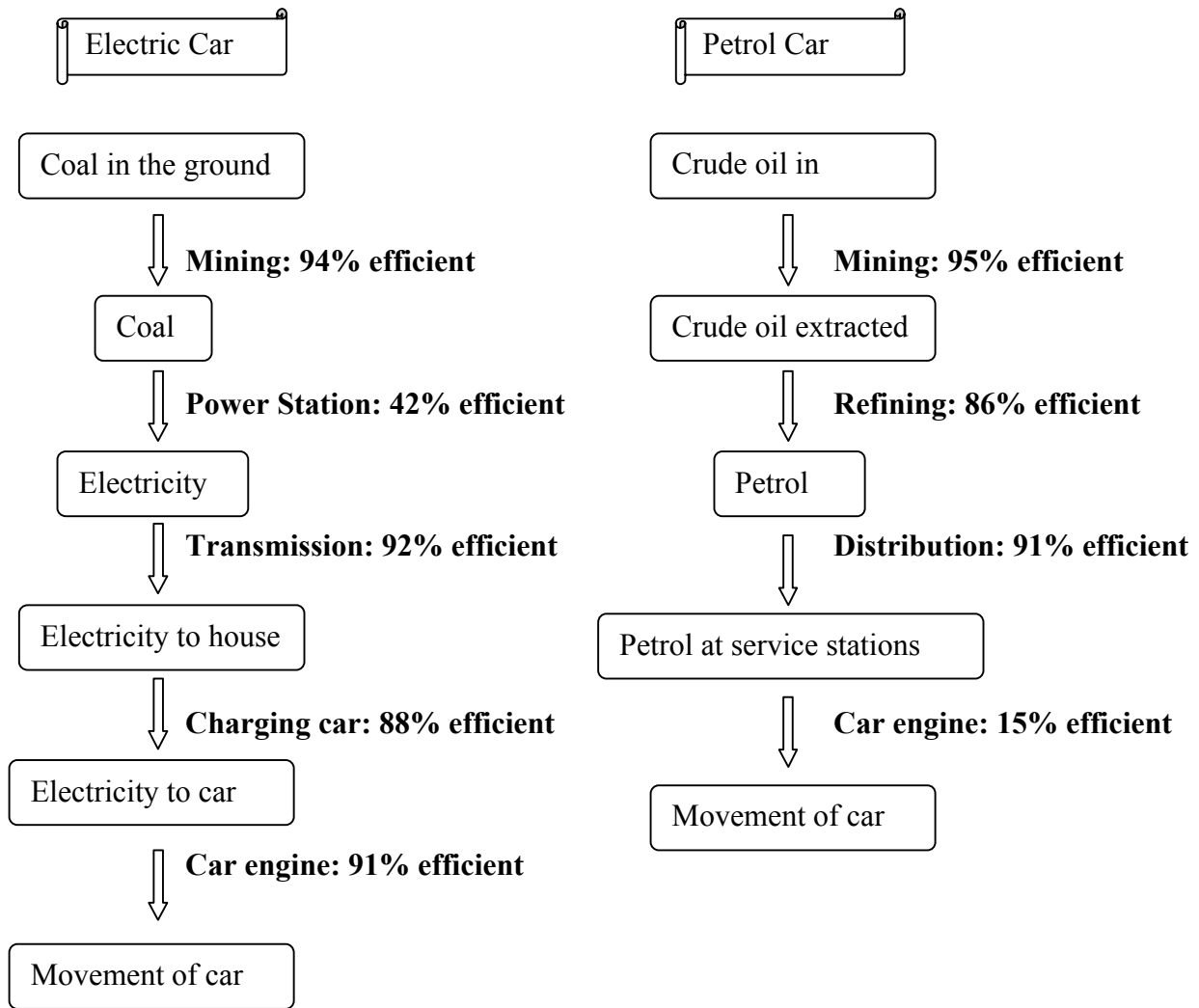
189 countries will be attending the UNFCCC conference in Bali in December of this year. This conference occurs just after the release of the 4<sup>th</sup> IPCC assessment report and is open to all member countries that have ratified this international agreement.

Which of the following statements is mostly likely to be true?

- A. The conference is around the issue of international whaling
- B. The conference is likely to address issues of globalization including poverty in Africa
- C. This conference excludes Australia from attending**
- D. Australia has taken a leading role in this area and is likely to chair this conference

Use the following information to answer questions 13 & 14

This diagram compares the efficiency of an electric driven car that has been charged from a household receiving electricity from a coal burning plant, to that of a traditional petrol driven car. The efficiency of each step in the conversion of raw energy to movement in each car is shown.



**Question 13**

Approximately how much more efficient is the electric car compared to the petrol car

- A. 18%**
- B. 29%**
- C. 11%**
- D. 0.29%**

#### Question 14

If 1 kilogram of Brown Coal has the potential energy of 23MegaJoules, then approximately how much of that energy is wasted in the process of using an electric car.

- A. 670,000J
- B. 16MJ
- C. 6.7Mj**
- D. 1.6MJ

#### Question 15

What is thermal energy actually a form of?

- A. Chemical potential energy
- B. Electrical energy
- C. Gravitational energy
- D. Kinetic energy**

#### Question 16

Genetic diversity is most often used in the context of:

- A. Captive breeding programs**
- B. Protecting ecosystems
- C. Physical variations between a species
- D. Mark recapture studies

#### Question 17

A species that is facing an extremely high risk of extinction in the wild in the immediate future would be classified under a conservation category of:

- A. Vulnerable
- B. Extinct
- C. Critically endangered**
- D. Data deficient

#### Question 18

A developer wishes to construct a series of wind turbines along the Victorian coastline in an area of Gippsland that could also contain some of the very rare Orange-bellied Parrots. A consultant field biologist recommends, in the absence of any detailed study, that the turbines are not located within 100m of any useable Orange-bellied Parrot habitat. This is an example of:

- A. an Environmental Impact Assessment
- B. the Precautionary Principle**
- C. an awareness raising project within the local community
- D. a Population Viability Analysis on the Orange-bellied Parrot

**Question 19**

Which of the following is the best example of a short term carbon sink?

- A. A sugar cane plantation**
- B. an old growth forest
- C. a swamp
- D. a coal fired power station

**Question 20**

A group of people in a Victorian town are concerned about the perceived decline of a particular local plant species. In order to help conserve it they would be best advised to:

- A. nominate it under the Fauna and Flora Guarantee Act**
- B. collect the remaining individuals and try and breed them
- C. do nothing and let nature take its course
- D. experiment with some control burns to see if that stimulates a recovery in the population.

## SECTION B – Short answer questions

### Specific instructions for Section B

Answer all questions in the spaces provided.

Australia will become the first country in the world to phase out conventional incandescent light bulbs within three years and replace them with energy-saving compact fluorescent globes. The table below outlines energy use associated between compact fluorescents, Halogen down lights and a standard incandescent light that are all producing the same amount of light.

| For 10,000 hours of use                |                     |         |                       |
|----------------------------------------|---------------------|---------|-----------------------|
|                                        | Compact fluorescent | Halogen | Standard incandescent |
| number needed                          | 1                   | 5       | 10                    |
| cost per globe                         | \$10                | \$3.50  | \$0.50                |
| energy used to produce light (watts)   | 15                  | 60*     | 60                    |
| *Transformer usage (10 watts) included |                     |         |                       |

### Question 1

- a) Using the information provided, complete the table below.

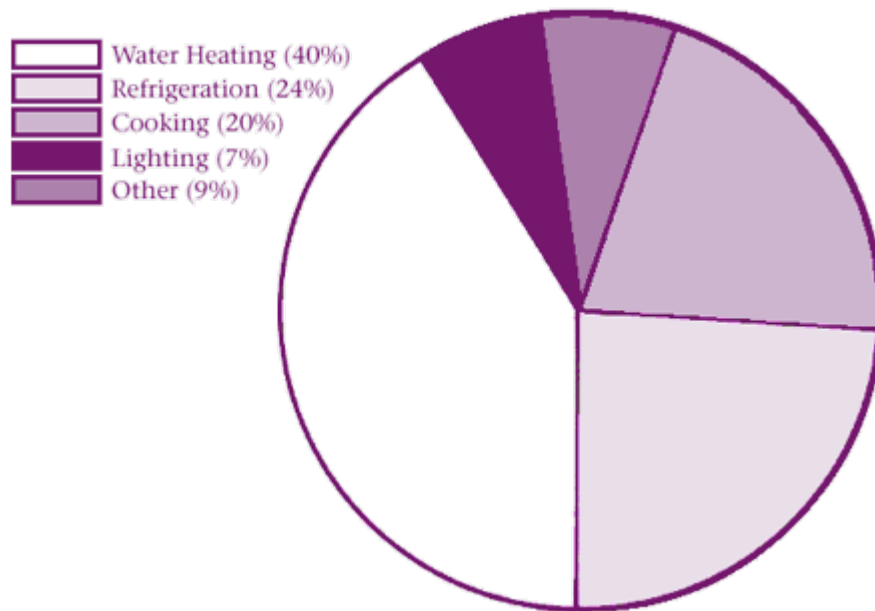
| For 10,000 hours of use                               |                     |                    |                       |
|-------------------------------------------------------|---------------------|--------------------|-----------------------|
|                                                       | Compact fluorescent | Halogen            | Standard incandescent |
| Total globe cost                                      | <b>\$15</b>         | <b>\$35</b>        | <b>\$10</b>           |
| Total energy used (watt-hours)                        | <b>15 X 10,000</b>  | <b>50 X 10,000</b> | <b>60 X 10,000</b>    |
| energy used (kwh)*                                    | <b>150</b>          | <b>500</b>         | <b>600</b>            |
| energy cost (@0.15c/kwh)                              | <b>\$22.50</b>      | <b>\$75</b>        | <b>\$90</b>           |
| <b>Total cost</b><br>Globe cost + cost of energy used | <b>\$37.50</b>      | <b>\$105</b>       | <b>\$100</b>          |
|                                                       |                     |                    |                       |
| *kwh = kilowatt hours = 1000 watt hours               |                     |                    |                       |
|                                                       |                     |                    |                       |

(3 marks)

b) Given that most of Victoria's energy is derived by coal fired power stations and apart from the economic benefits of using energy efficient light globes, what environmental benefits might also flow on from this government initiative for energy consumers in Victoria?

Answer directed toward the environmental impact of global warming but equally less energy demand reduces the need to increase construction of further plants and mines. Any two relevant answers should be awarded full marks as long as it relates back to less energy use and is relevant to Victoria.

(2 marks)



**Graph1: Percentage of energy used around a home**

c) Refer to graph 1 above: Suggest two other changes that can be made around the home that would help reduce our contribution to the enhanced greenhouse effect. Explain how the change reduces our contribution.

Two further changes need to be stated. To get full marks students need to relate each change to the reduced need for energy.

(4 marks)

d) It has been suggested that 90% of the energy we use in our homes has a harmful effect on the environment, and in particular with increasing greenhouse gas emissions. What is one possible impact on the environment of increased greenhouse gas emissions and how is this related to our energy use.

Any effect such as sea level rise, or increased temperatures etc will do as long as it is climate change related and the student makes the connection between energy use, emission of greenhouse gas and climate change

(3 marks)

- e) Name a place in the world that is currently or may be shortly affected by the impact listed in part d). Describe the affect of the impact at that place.

Students need to be very specific about locality and consequence to be awarded full marks

.

(3 marks)

## Question 2

According to the Australian Conservation Foundation, Australia has the fifth highest rate of land clearing in the world. We clear more bush each year than poverty-stricken countries like Burma, Mexico, Zimbabwe, Nigeria and the Congo. Recent estimates place land clearing at about half a million hectares a year with as much land being cleared in the last 50 years, as was cleared in the previous 150 years. The ACF suggest that for every tree planted about 100 are bulldozed.

- a) Outline two ways in which land clearance enhances the Earth's greenhouse effect .

Answers relating to sink loss and as a consequence elevated levels in the atmosphere are acceptable. Similarly land clearance can act as a carbon source through decomposition, and the fossil fuels used to clear the land.

(2 marks)

- b) Woodlands are Australia's most threatened, and least protected, wooded ecosystem yet attract the most land clearance. Land clearance in turn causes habitat fragmentation and the loss of gene flow between isolated populations of plants and animals. Explain how habitat fragmentation can ultimately led to the extinction of a species.

Students need to relate answer to the extinction vortex where populations surviving in fragments has reduced population size and this can cause inbreeding ultimately lowering the genetic diversity of the population. Stochastic events can further accelerate this loss of diversity. This in turn can cause lower fecundity and higher mortality rates which act further to reduce the genetic diversity of a population until it falls below the minimum viable population size and is open to extinction.

(4 marks)

- c) Many land managers attempt to over-come the effects of habitat fragmentation by the creation of habitat corridors. Evaluate the effectiveness of habitat corridors in the conservation of plant and animal species.

To get full marks the students needs to outline at least two points for and against habitat corridors and then provide some person comment about their effectiveness.

(4 marks)

### Question 3

Name one endangered animal species you have studied.

---

- a) Is the species listed under the Fauna and Flora Act in Victoria?

---

What category of threat is it listed as under the Australian Government's EPBC Act?

---

What category of threat is it listed as under the IUCN's Red List?

---

Is the species or any populations of your species effected by the two following international treaties, RAMSAR and CITES? Explain, why or why not for each.

(4 marks)

- b) Describe the current distribution of this species, with reference to population size and contrast this to historical data on past distributions and numbers.

(2 marks)

- c) Describe two key threatening processes operating on the species in the area you have studied?

(2 marks)

- d) Evaluate how important it is that this species is conserved with reference to ecosystem services, biological resources and social considerations.

Students need to show an understanding of these terms and for full marks provide some personal comment about the importance of their selected species.

(4 marks)

- e) Describe one management strategy that has, or could be used, for the protection of this endangered species. Suggest a way in which the effectiveness of this strategy could be monitored and evaluated.

(4 marks)

#### Question 4

a) With the aid of a clearly labelled diagram illustrate the principles by which the enhanced greenhouse effect works.

Your answer should include reference to

- Anthropogenic sources of greenhouse gas and anthropogenic greenhouse gases
- Absorption, re-emission, reflection and dissipation of incoming and outgoing energy as appropriate
- The fate of ultraviolet, visible and infra-red entering and leaving the Earth's atmosphere

(6 marks)

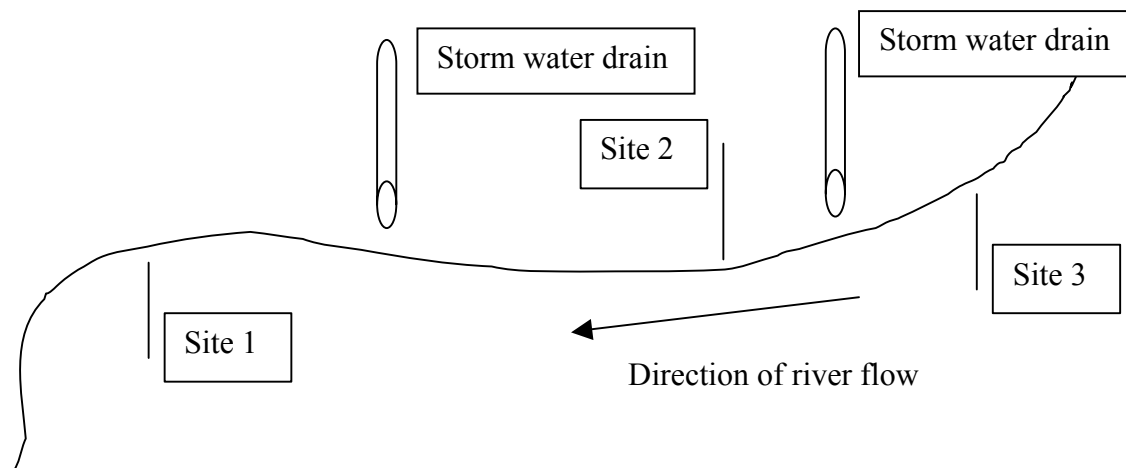
b) Evaluate one fossil and one non-fossil energy source you have studied this year in regards to its contribution to global warming. Students should consider all aspects of the energy sources life cycle in their answer.

Full marks are only awarded if students show an understanding of the life cycle of the energy source. For example the creation and disposal of solar panels could contribute to the greenhouse effect if they were created using fossil fuel energy source. Transportation and installation would similarly have a possible contribution to make.

(4 marks)

#### Question 5

An Environmental Scientist is investigating a possible pollution spill into a local creek and decides to sample the aquatic invertebrates with a sampling net at the 3 locations shown.



- a) In designing the field work, suggest two factors the scientist would need to consider to ensure that the results are accurate, reliable and valid.

Any two plausible answers would be acceptable. For example using a consistent sampling methodology.

(2 marks)

The data collected is shown in the table below

| Organism         | Site 1 | Site 2 | Site 3 |
|------------------|--------|--------|--------|
| Mosquito larvae  | 200    | 300    | 150    |
| Blood warms      | 100    | 150    | 20     |
| Water boatman    | 100    | 150    | 50     |
| Dragonfly larvae | 0      | 0      | 30     |
| Tadpoles         | 0      | 0      | 10     |
| Yabbies          | 5      | 0      | 5      |
| Daphnia          | 20     | 0      | 150    |

- b) According to the data which sampling site had the greatest species richness?

Site 3

(1 mark)

- c) The Shannon-Weiner Diversity Index (H) is used in freshwater ecology to determine the species diversity of an area. The mathematical relationship is:

$$H = - (\text{sum of}) p \ln p$$

where  $\ln$  stands for the natural log

and  $p$  = number of individuals in a species/ total number of individuals across all species

A higher value of H indicates greater diversity than a lower value.

Complete the missing information in the following data tables from the three sampling sites.

| Organism            | Site 1 | p   | $\ln p$                            | $P \ln p$ |
|---------------------|--------|-----|------------------------------------|-----------|
| Mosquito larvae     | 400    | .48 | -.72                               | -.35      |
| Blood warms         | 300    | .36 | -1.01                              | -.36      |
| Water boatman       | 100    | .12 | -2.11                              | -.25      |
| Dragonfly larvae    | 0      |     |                                    |           |
| Tadpoles            | 0      |     |                                    |           |
| Yabbies             | 5      | .01 | -5.11                              | -.05      |
| Daphnia             | 20     | .02 | -3.72                              | -.07      |
|                     |        |     |                                    |           |
| <b>Total number</b> | 825    |     | <b>Sum of <math>P \ln p</math></b> | -1.08     |

**1.08**

Shannon-Weiner Diversity Index (H) =

| Organism               | Site 2     | p         | ln p                           | p ln <sup>p</sup> |
|------------------------|------------|-----------|--------------------------------|-------------------|
| <b>Mosquito larvae</b> | <b>300</b> | <b>.5</b> | <b>-.69</b>                    | <b>-.35</b>       |
| Blood warms            | 150        | .25       | -1.39                          | -.35              |
| Water boatman          | 150        | .25       | -1.39                          | -.35              |
| Dragonfly larvae       | 0          |           |                                |                   |
| Tadpoles               | 0          |           |                                |                   |
| Yabbies                | 0          |           |                                |                   |
| Daphnia                | 0          |           |                                |                   |
|                        |            |           |                                |                   |
| <b>Total number</b>    | <b>600</b> |           | <b>Sum of P ln<sup>p</sup></b> | <b>-1.05</b>      |

Shannon-Weiner Diversity Index (H) =

**1.05**

| Organism            | Site 3     | p          | ln p                           | p ln <sup>p</sup> |
|---------------------|------------|------------|--------------------------------|-------------------|
| Mosquito larvae     | 150        | .36        | -1.02                          | -.37              |
| <b>Blood warms</b>  | <b>20</b>  | <b>.05</b> | <b>-3.03</b>                   | <b>-.15</b>       |
| Water boatman       | 50         | .12        | -2.12                          | -.25              |
| Dragonfly larvae    | 30         | .07        | -2.63                          | -.18              |
| Tadpoles            | 10         | .02        | -3.73                          | -.07              |
| Yabbies             | 5          | .01        | -4.42                          | -.04              |
| Daphnia             | 150        | .36        | -1.02                          | -.37              |
|                     |            |            |                                |                   |
| <b>Total number</b> | <b>415</b> |            | <b>Sum of P ln<sup>p</sup></b> | <b>-1.43</b>      |

(6 marks)

Shannon-Weiner Diversity Index (H) =

**1.13**

d) According to the data which sampling site had the greatest species diversity?

Site 3

(1 mark)

e) From the data, suggest if the level of species diversity is, in this case, a good indicator of polluted water. Justify your response with reference to the data. What else might the scientist do to track down the source of the pollution?

It would appear that species diversity is a good indicator of polluted water as the diversity increased further up-stream past inflow drains. Scientist might sample up the storm water drains, in particular the first storm water drain as the diversity have already significantly reduced post the drain but before the next one.

.

(3 marks)

### Question 6

A population viability analysis was undertaken of a population of Zeegowhats in central Australia. Changes in the cumulative risk assessment of the population were undertaken under two different scenarios (figure two below).

- 1 no change in current management (upper line on graph) and
- 2 if predators for the Zeegowhats were actively removed (lower line on the graph)

a) Outline one advantage and one disadvantage of undertaking population viability analyses (PVR's) for a species?

PVR's are rigorous and analytical models based on input from a variety of sources and modelling a range of outcomes. They are however only as good as the source information and so good ecological and biological information must be known and they tend to be species specific and expensive to create.

(3 marks)

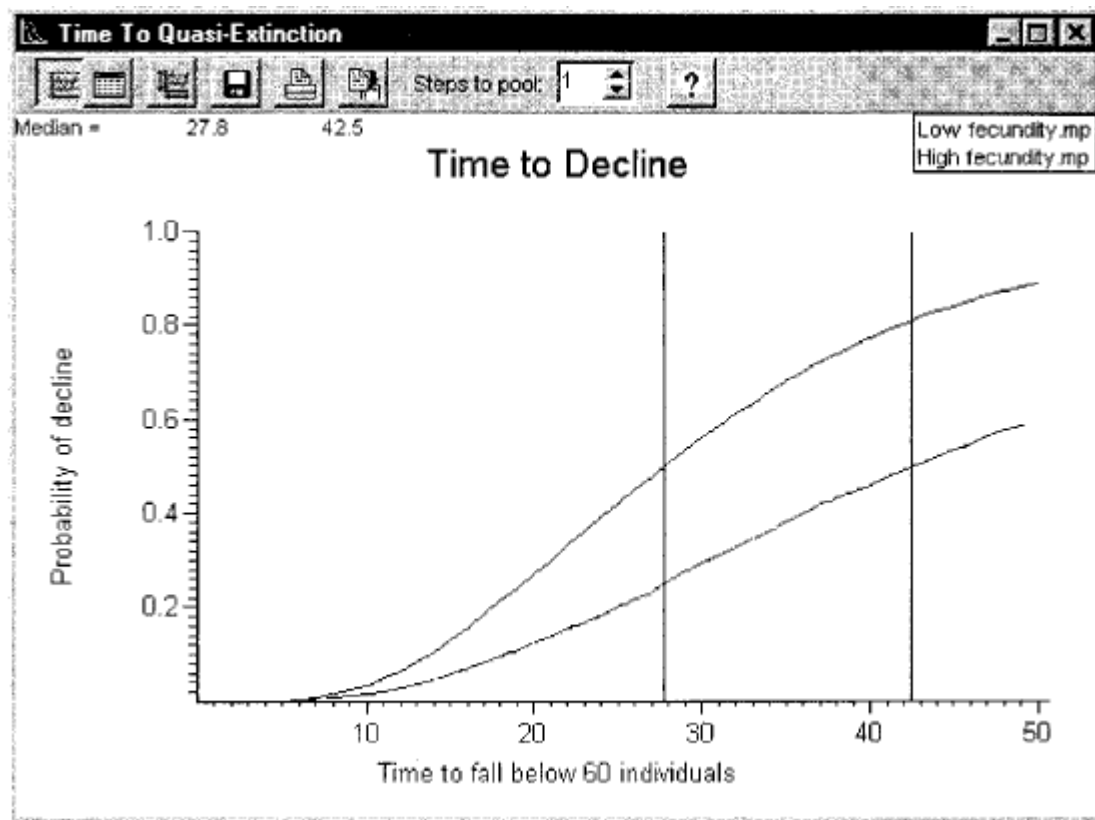


Figure 2. Cumulative probability distribution of time to fall below 60 individuals, under two assumptions. Each point on a curve gives the probability that the metapopulation will fall below 60 individuals at or before the time step (year) indicated on the x axis.

b) Why might the recovery team focus on 60 animals when generating the cumulative probability distribution?

Minimum viable population size

(1 mark)

c) What is the probability the Zeegowhat population will not drop below 60 individuals

i) After 28 years if no change of management is adopted

About 50%

ii) After 42 years if predators are effectively controlled?

About 50%

(2 marks)