STUDENT NAME	

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
			Total 90

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

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

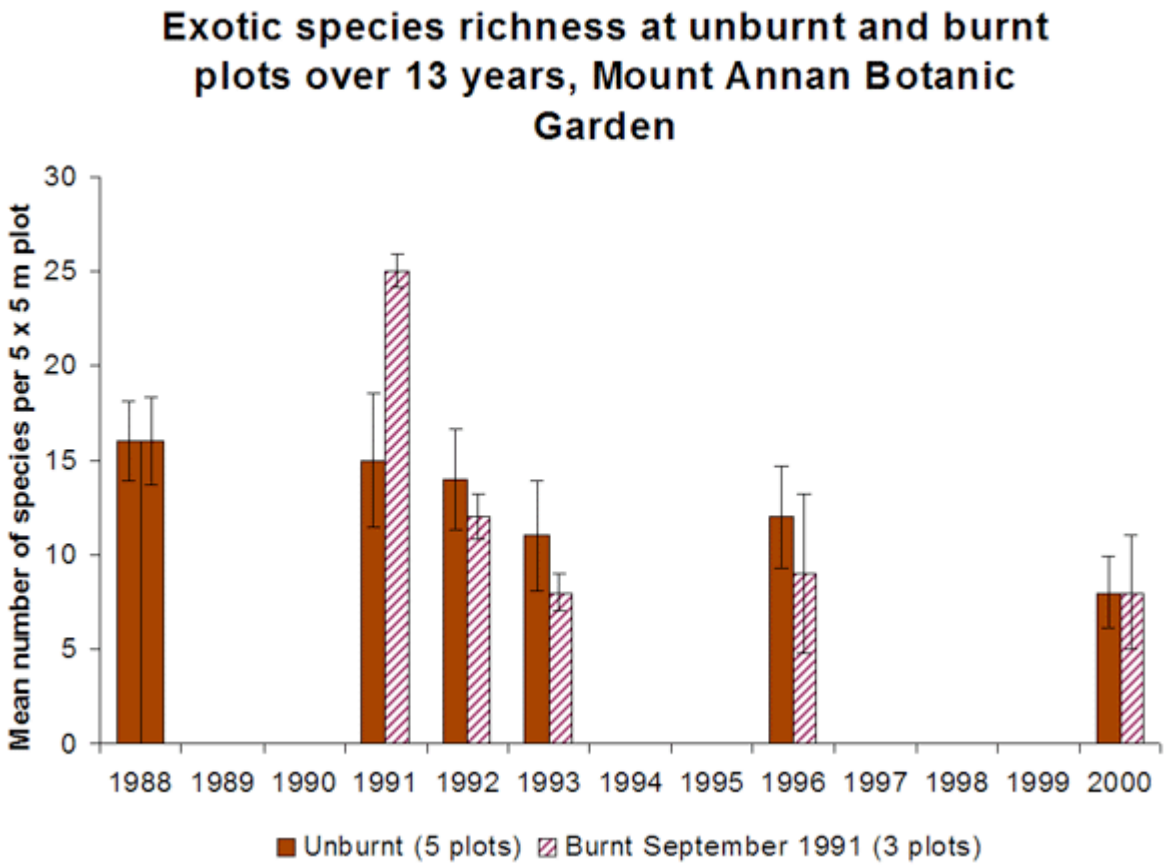
Question 3
A smuggler wishes to sell Red Tailed Black Cockatoos from Victoria to international buyers in the US and Europe. An international response to help fight against the trade in endangered wildlife is best known as:

- **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 unbunt 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:

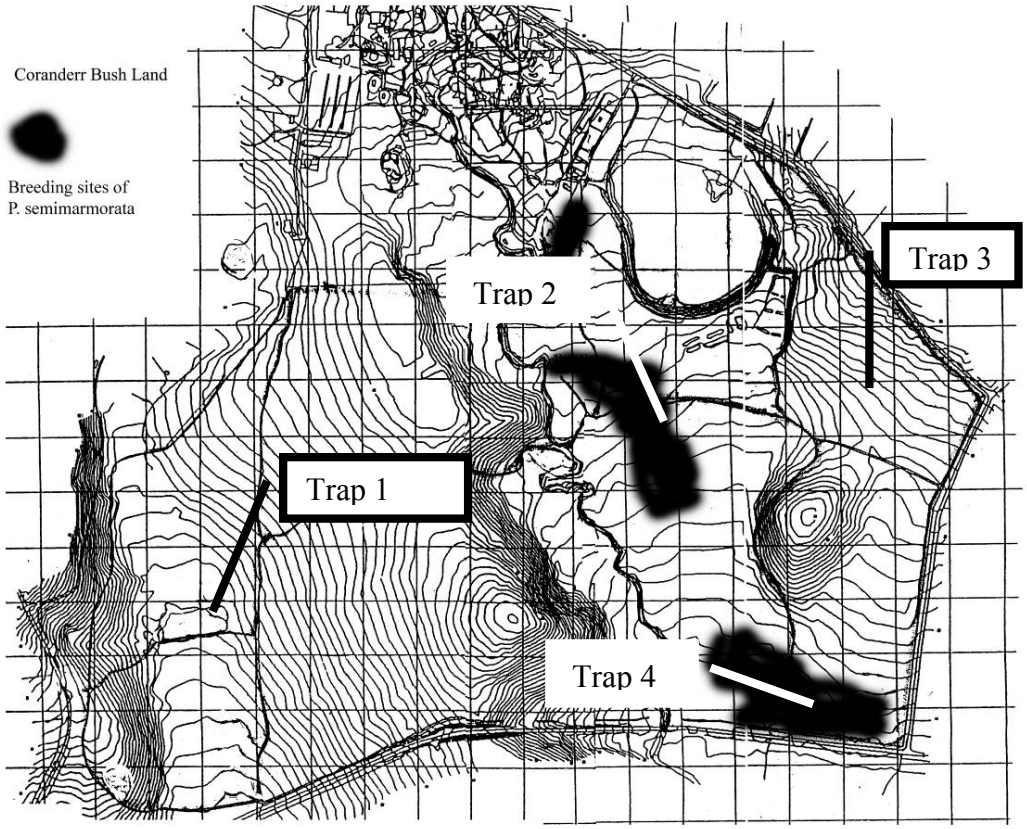
- **A.** Kinetic energy to mechanical energy to electrical energy
- **B.** Potential energy to mechanical energy to electrical energy
- **C.** Kinetic energy to mechanical energy to chemical energy
- **D.** Potential energy to kinetic energy to electrical energy

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, *Pseudophyrne semimarmorata*, is a small ant eating frog found in the woodlands of southern Australia. Some scientists have expressed concern about the decrease is 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 stream turbines is a chemical reaction that is best described as:

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

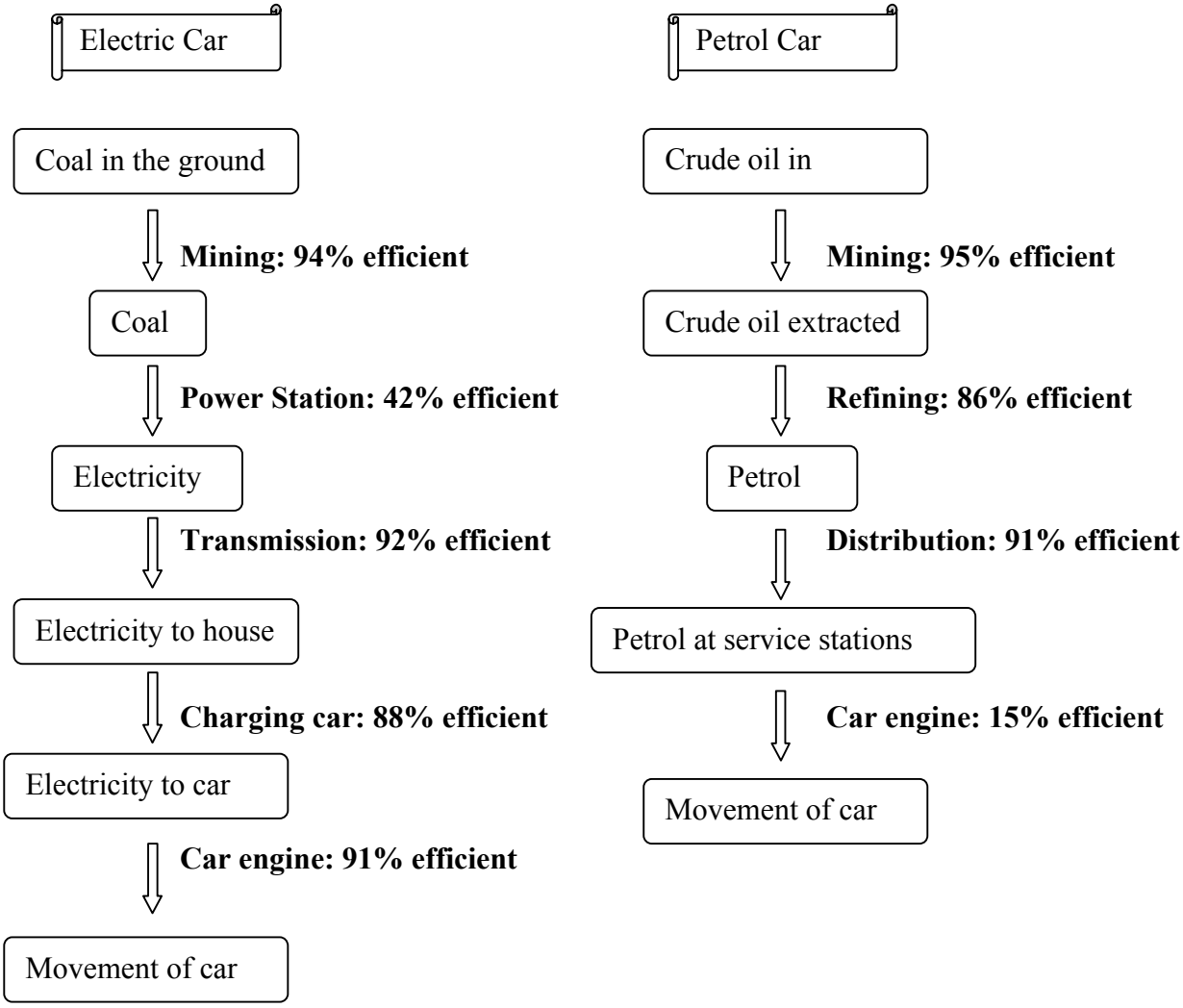
Question 12
189 countries will be attending the UNFCCC conference in Bali in December of this year. This conference occurs just after the release of the 4th IPCC assessment report and is open to all member countries that have ratified this international agreement.

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

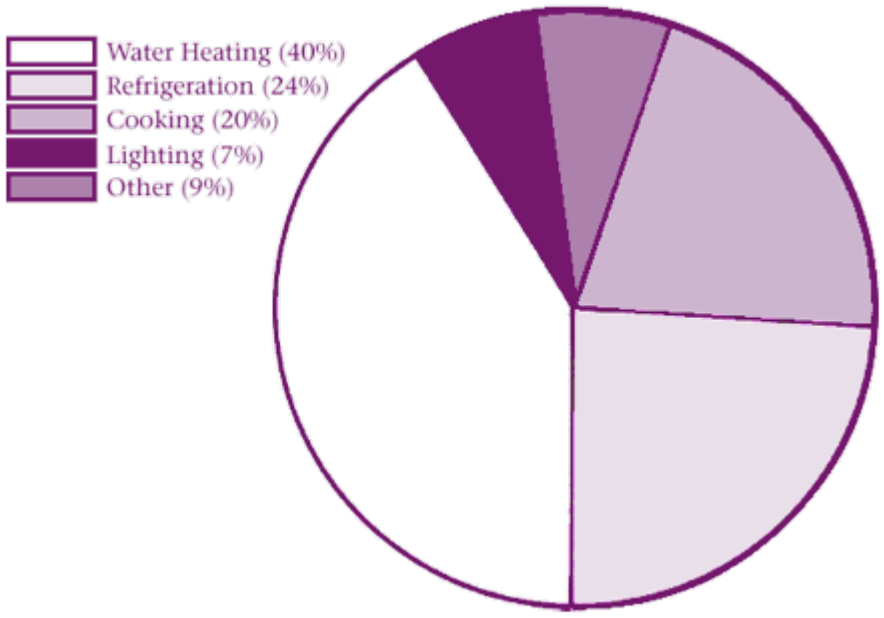
a) Using the information provided, complete the table below.

For 10,000 hours of use			
	Compact fluorescent	**Halogen**	**Standard incandescent**
Total globe cost			
Total energy used (watt-hours)			
energy used (kwh)*			
energy cost (@0.15c/kwh			
Total cost Globe cost + cost of energy used			
*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?

(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.

(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.

(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.

(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 .

(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.

(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.

(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.

(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.

_____.

_____.

_____.

_____.

_____.

_____.

_____.

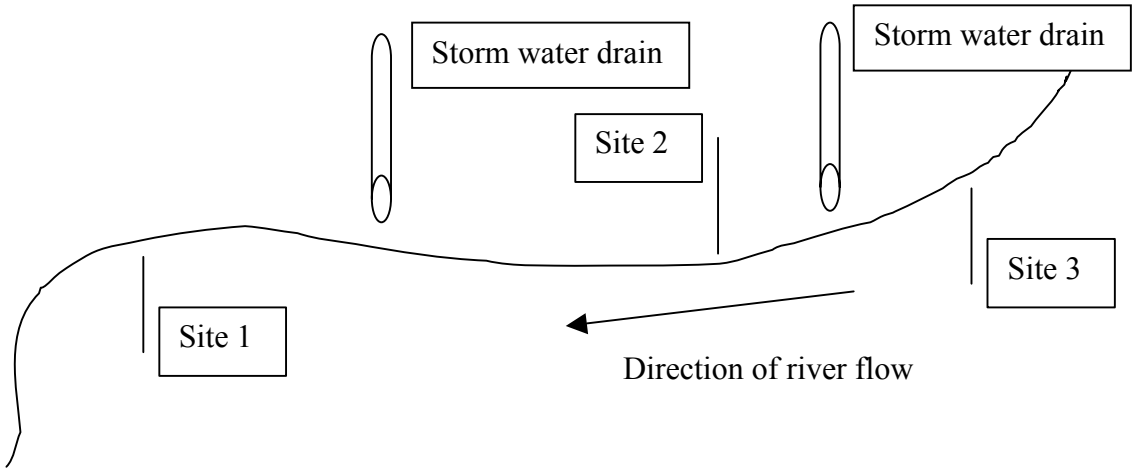
_____.

_____.

(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.

_____.

_____.

_____.

_____.

(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?

_____.

(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:

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

where In 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	In p	P In ^{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
Total number	825		**Sum of P In ^{p}**	-1.08

Shannon-Weiner Diversity Index (H) = **1.08**

Organism	Site 2	p	In p	p In p
Mosquito larvae	**300**			
Blood warms	150	.25	-1.39	-.35
Water boatman	150	.25	-1.39	-.35
Dragonfly larvae	0			
Tadpoles	0			
Yabbies	0			
Daphnia	0			
Total number	600		**Sum of P In p**	

Shannon-Weiner Diversity Index (H) = ☐

Organism	Site 3	p	In p	p In p
Mosquito larvae	150	.36		
Blood warms	**20**			
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
Total number	415		**Sum of P In p**	

(6 marks)

Shannon-Weiner Diversity Index (H) = ☐

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

_____.

(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?

_____.

_____.

_____.

_____.

_____.

_____.

(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 under taken 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?

_____.

_____.

_____.

_____.

_____.

_____.

(3 marks)

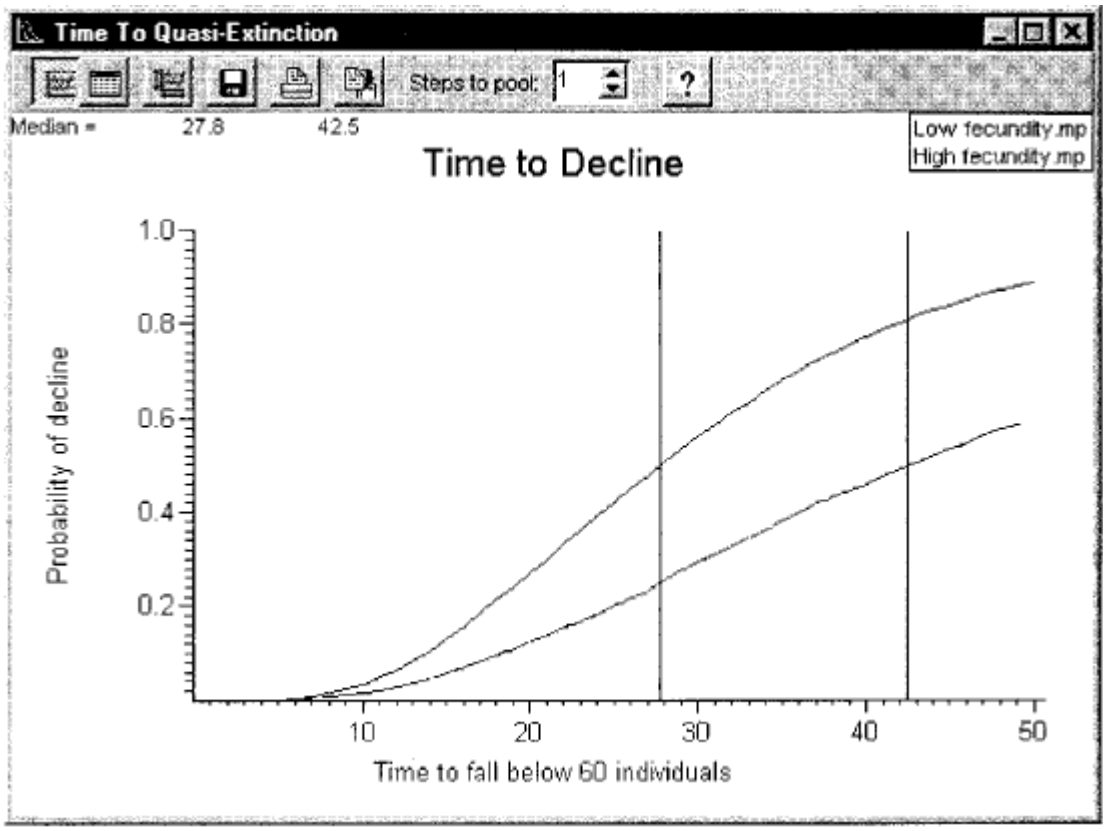


Figure 2. Cumulative probability distribution of time to fall below 60 individuals, under two assumptions. Each point on a curve gives the probability that the metapopulation will fall below 60 individuals at or before the time step (year) indicated on the *x* axis.

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

_____.

_____.

_____.

(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

ii) After 42 years if predators are effectively controlled? .

(2 marks)