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# BIOLOGY

## GENETICS, POPULATIONS, EVOLUTION & ECOSYSTEMS

Level & Board	AQA (A-LEVEL)
TOPIC:	POPULATIONS IN ECOSYSTEM
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	6
TOTAL MARKS	36

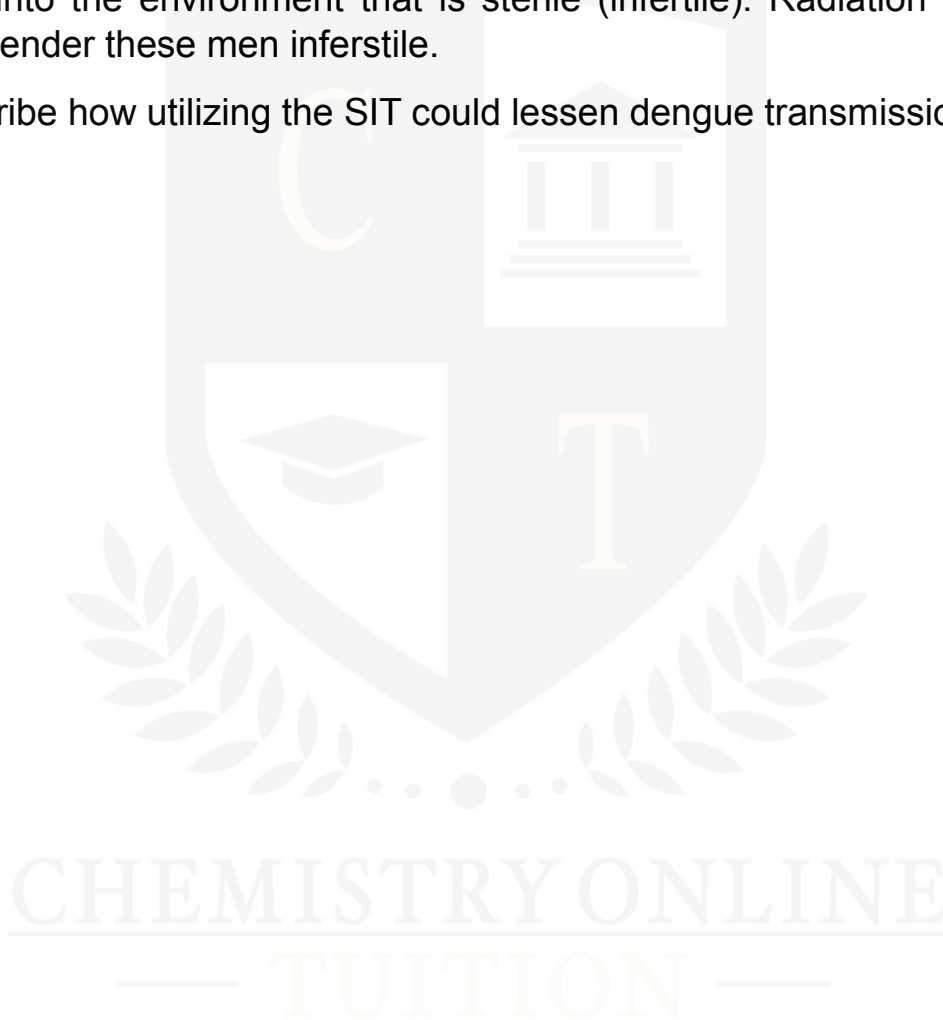
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## Populations in Ecosystems - 2

1.

A virus is the cause of the dangerous disease dengue. The *Aedes aegypti* mosquito is the vector that spreads the virus from one person to another. The Sterile Insect Technique (SIT) is one strategy used to attempt and stop the disease from spreading. This entails dispersing a sizable population of male *Aegypti* into the environment that is sterile (infertile). Radiation has been used to render these men inferstile.

(a) Describe how utilizing the SIT could lessen dengue transmission. (3)



(b) Explain how the population of *A. aegypti* could be ascertained at the beginning of the inquiry using the mark-release-recapture procedure. (2)

**(c)** The discharge of radioactively sterilized It has not proven very effective for *A. aegypti* to stop the spread of dengue.

Give one explanation for this. **(2)**

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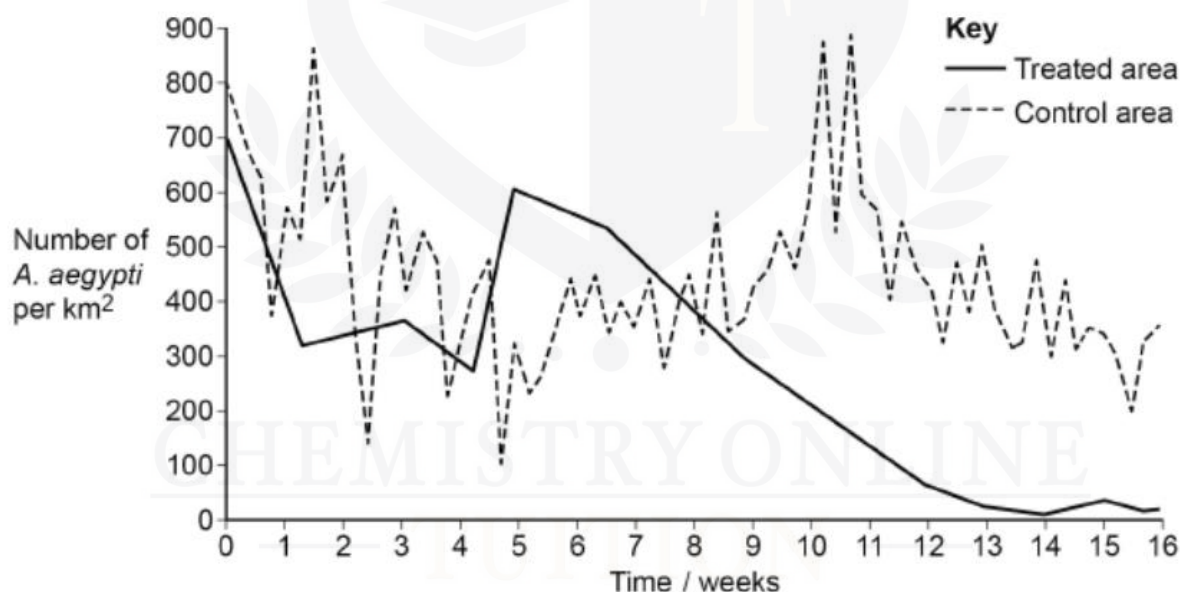
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2.

(a) Recently, a novel approach to the management of *A. aegypti* was created. Scientists generated transgenic guys with a "lethal gene" that prevents them from procreating.

Every week, the scientists released transgenic men into a specific section of a Brazilian city. They counted *A. aegypti* per km<sup>2</sup> at regular intervals in the transgenic male release area and the control area, where no transgenic males were released.

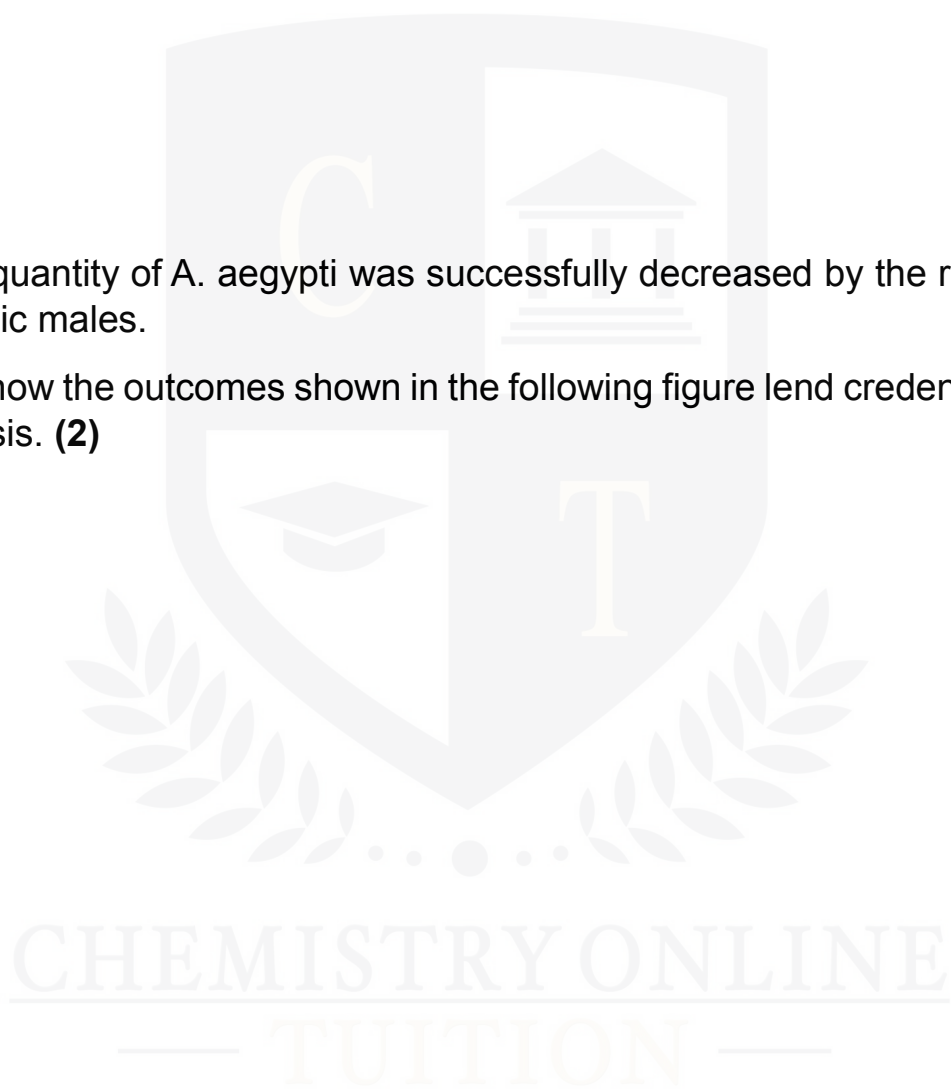
Their results are displayed in the graph.



Explain why each week additional transgenic males are released by the scientists. (2)

**(b)** The quantity of *A. aegypti* was successfully decreased by the release of transgenic males.

Explain how the outcomes shown in the following figure lend credence to this hypothesis. **(2)**



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## 3.

A stream community was observed by ecologists both before and after a flood. Animal numbers in the creek were 98% lower after the flood.

The table displays the changes in six animal species' populations that were found in the stream after the floods.

Animal species	Number of days after flooding						
	1	5	13	22	35	49	63
	Mean number of organisms / thousands m <sup>-3</sup>						
<i>Baetis quilleri</i>	0.03	0.85	2.6	9.3	6.4	0.9	0.3
<i>Leptohyphes packeri</i>	0.0	0.0	0.25	2.5	17.3	18.0	29.5
<i>Helicopsyche mexicana</i>	0.0	0.02	0.2	0.1	0.07	0.03	0.01
<i>Cryptolabis paradoxa</i>	0.0	13.3	21.3	55.8	62.9	168.7	182.6
<i>Pentaneurini guttipennis</i>	0.1	0.5	0.6	1.8	1.0	0.6	0.25
<i>Micropsectra klinki</i>	0.0	0.0	0.0	0.0	0.0	0.2	5.6

(a) Describe how the information in the table shows that there has been succession. (5)

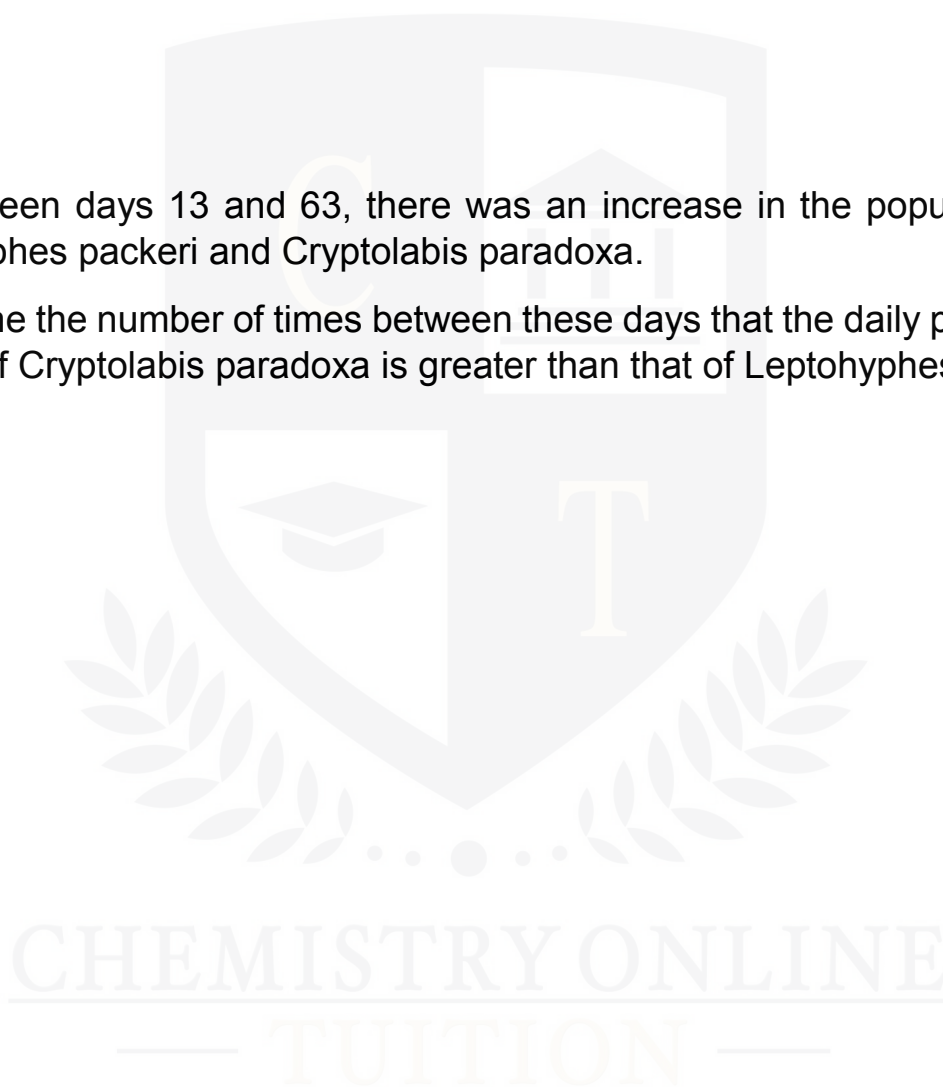
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**(b)** Between days 13 and 63, there was an increase in the populations of *Leptohyphes packeri* and *Cryptolabis paradoxa*.

Determine the number of times between these days that the daily population growth of *Cryptolabis paradoxa* is greater than that of *Leptohyphes packeri*.

**(2)**



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(c) Eventually, the stream rebounded to a climax community.

Describe two characteristics of a peak community. (3)



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4.

Scientists looked into how human-caused changes affected the biodiversity of plants in various communities. They gathered information from numerous published studies that documented shifts in the species richness of plants over an extended period of time.

The effect size was determined by the scientists using information from each experiment.



A measure of how species diversity changes over time is the effect size. A positive score indicates that species richness is increasing over time.

The results of the scientists are displayed in the graph below in the format in which they were published. 95.4% of the data is represented by the horizontal bars, which show  $\pm 2$  standard deviations.

### Human activity that changes community

Land cleared and used by humans and then abandoned

Fire

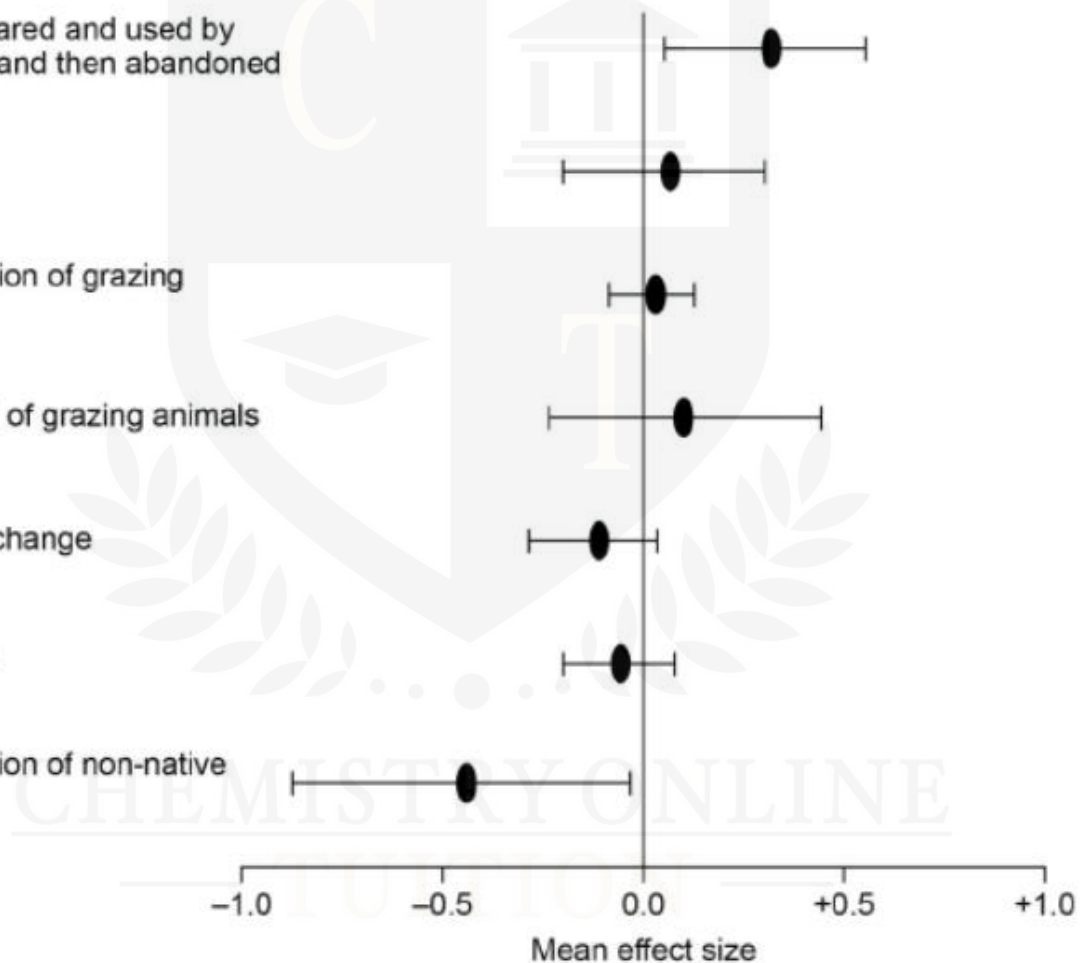
Introduction of grazing animals

Removal of grazing animals

Climate change

Pollution

Introduction of non-native species



**(a)** Based on these statistics, what conclusions can you draw about how human activity affects biodiversity? **(3)**

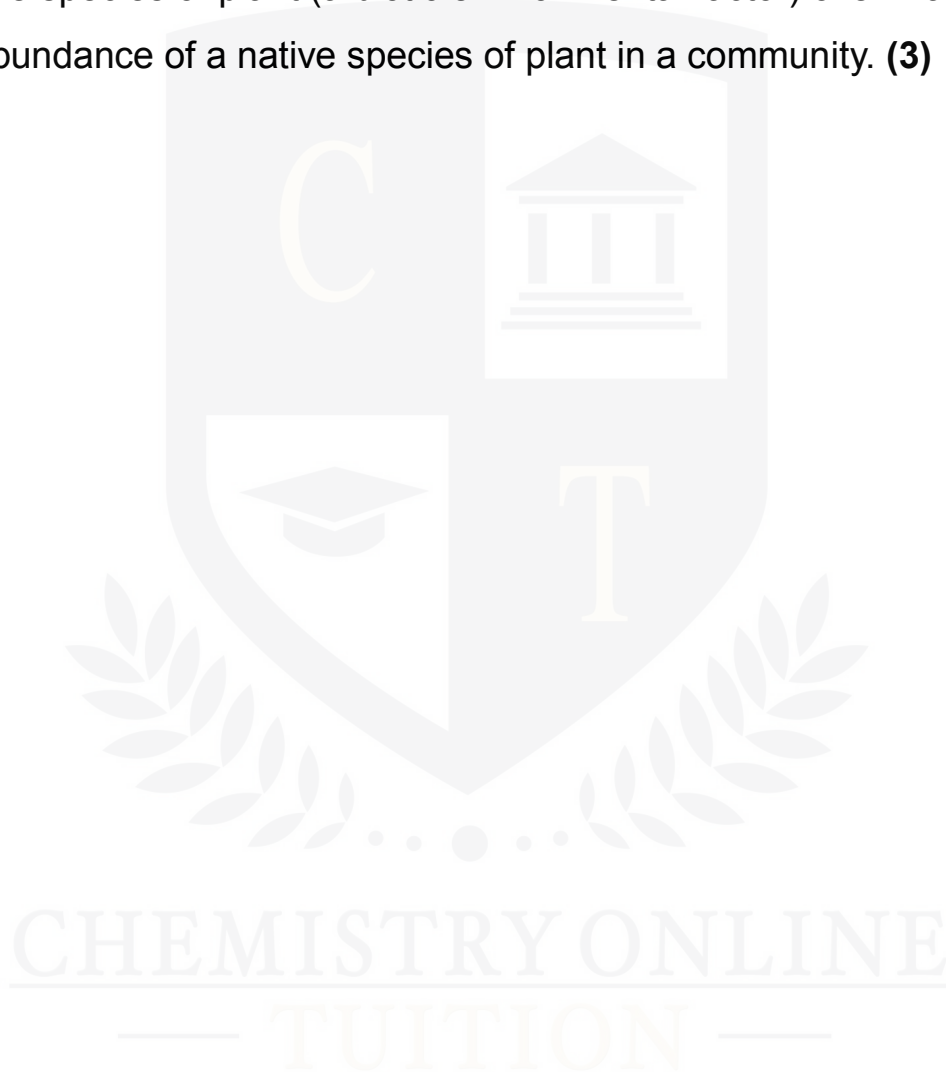


**(b)** Provide a rationale for the impact size of introducing non-native species into populations. **(2)**

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**(c)** Describe how you would investigate the effect of an invasion by a non-native species of plant (a biotic environmental factor) over many years on the abundance of a native species of plant in a community. **(3)**



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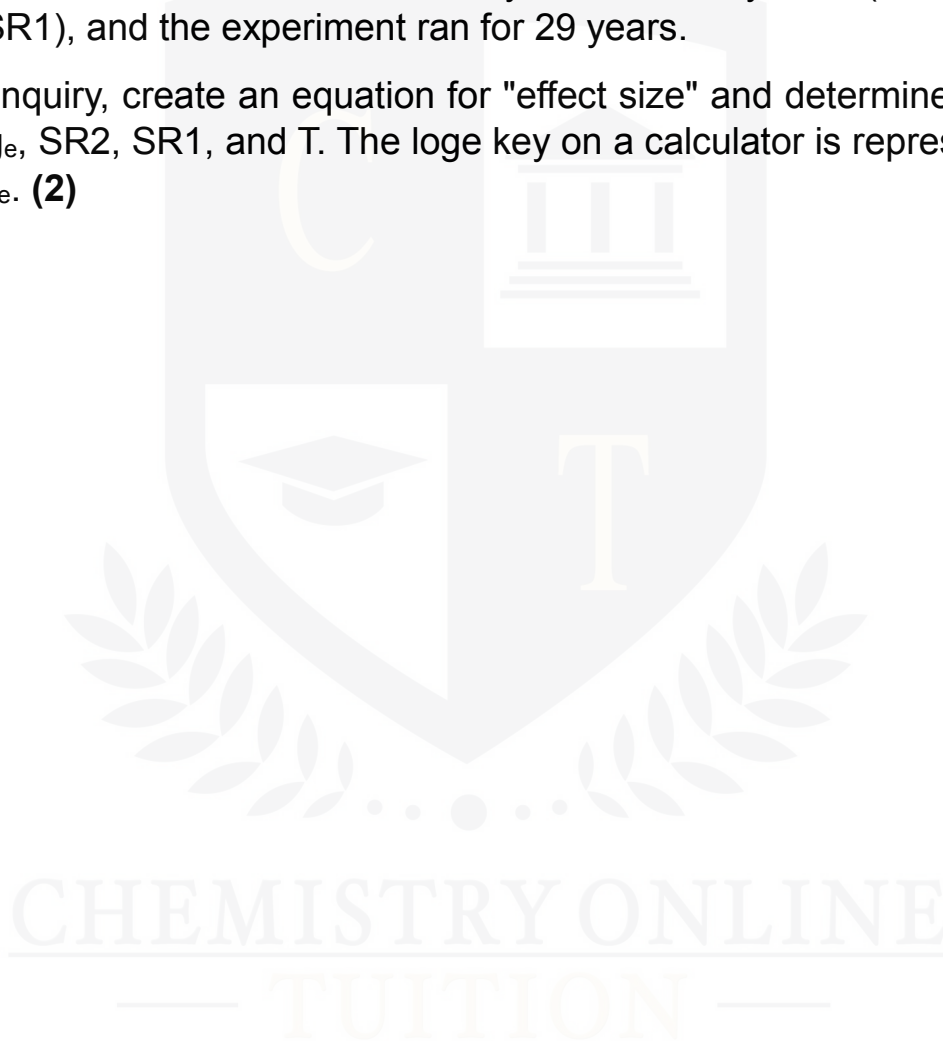
**5.**

**(a)** We compute effect size using the following formula.

1. Split the species richness in the final year of the study (SR2) by the species richness in the initial year of the study (SR1).
2. Determine the outcome's natural log ( $\log_e$ ).
3. Calculate the period (T) in decades that elapsed between the first and last year (1 decade = 10 years).

The species richness in one community was 15.3 in year 2 (SR2), 18.2 in year 1 (SR1), and the experiment ran for 29 years.

For this inquiry, create an equation for "effect size" and determine its value using  $\log_e$ , SR2, SR1, and T. The  $\log_e$  key on a calculator is represented by  $\ln$ , or  $\log_e$ . **(2)**



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There is a conflict of interest in northern India between those who raise livestock, such as cows, and those who work to protect ibex, a kind of wild goat.

Give animals too much food, and their numbers may become so huge as to compete with ibex.

**(a)** Describe the kind of rivalry that exists between ibex and livestock. **(2)**



If livestock and ibex share the same habitat and diet, livestock will outcompete ibex.

Researchers looked into this conflict of interest.

A summary of some of the scientists' findings is provided in the table below.

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Type of livestock	Difference between livestock food and ibex food*	Difference between livestock habitat and ibex habitat*
Cow	1.0	1.5
Horse	0.5	0.0
Yak	0.0	2.0

\* A score of 0.0 means that either the habitat or the food is the same.

**(b)** The requirement for ibex conservation and farmers' desire to raise livestock must coexist in harmony.

Provide three suggestions and an explanation of the steps that the farmers could take to attain this balance using the facts at hand. **(3)**

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