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# BIOLOGY

## GENETICS, POPULATIONS, EVOLUTION & ECOSYSTEMS

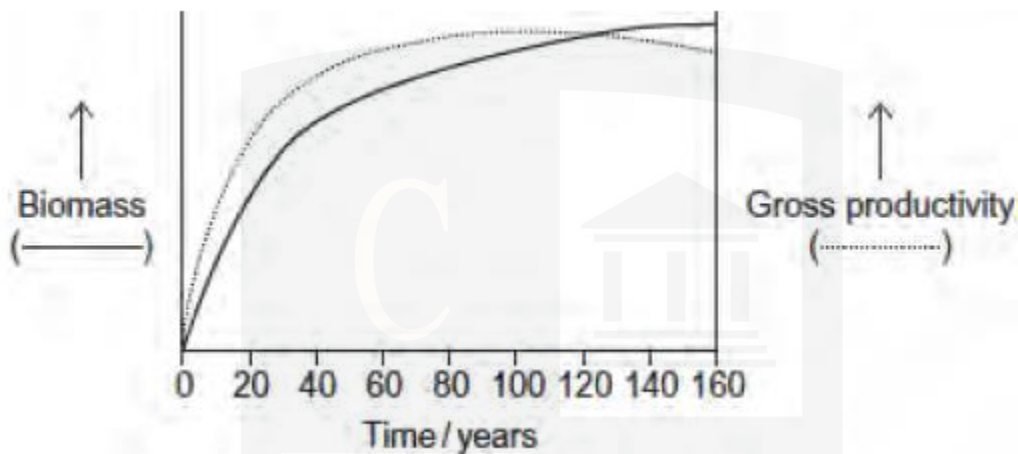
Level & Board	AQA (A-LEVEL)
TOPIC:	POPULATIONS IN ECOSYSTEM
PAPER TYPE:	QUESTION PAPER - 3
TOTAL QUESTIONS	6
TOTAL MARKS	39

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## Populations in Ecosystems - 3

1.

The graph illustrates how an area's biomass and gross productivity evolved over time as it transitioned from bare soil to mature woods.



(a) Provide suitable gross productivity unit suggestions. (2)

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**(b)** Describe why gross output declines with the age of the woodland. **(2)**

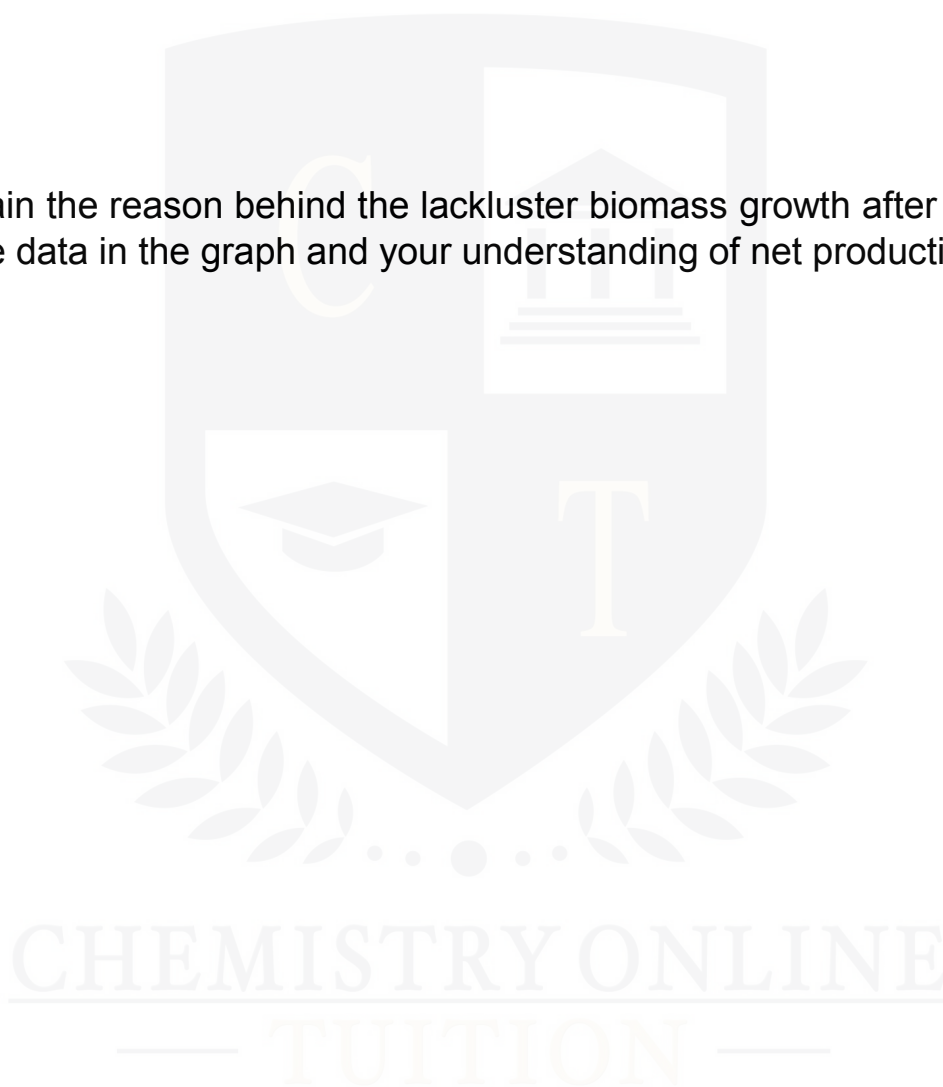
**2.**

**(a)** Apply your understanding of succession to the explanation of the 20-year biomass increase. **(3)**

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**(b)** Explain the reason behind the lackluster biomass growth after a century using the data in the graph and your understanding of net productivity. **(2)**

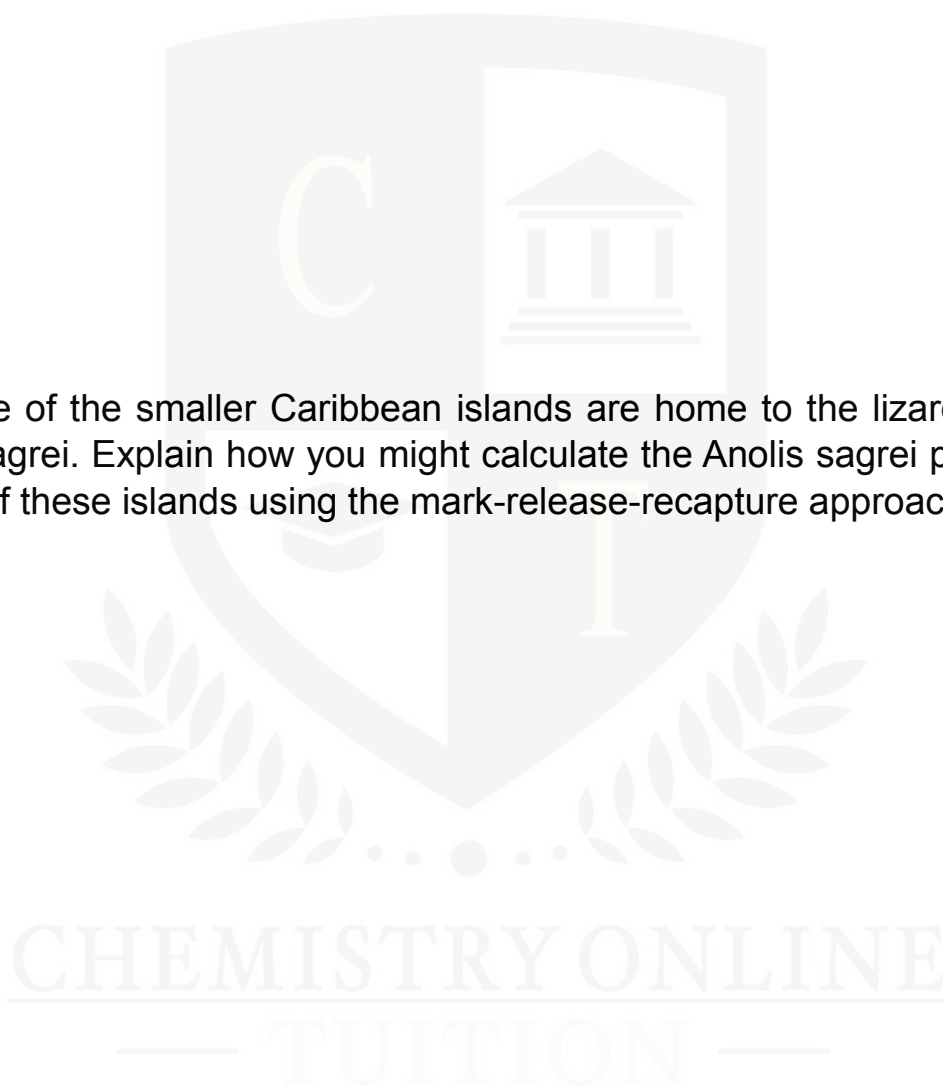


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**(c)** Give one justification for forest conservation. **(2)**

**3.**

**(a)** Some of the smaller Caribbean islands are home to the lizard species *Anolis sagrei*. Explain how you might calculate the *Anolis sagrei* population on one of these islands using the mark-release-recapture approach. **(4)**



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**(b)** On certain Caribbean islands, there are still sizable tracts of tropical forest. These woods' air contains varying amounts of carbon dioxide during the course of a day and at various elevations above the ground.

Describe and explain how the amount of carbon dioxide in the air varies at different elevations above ground and over a 24-hour period using your understanding of photosynthesis and respiration. **(5)**

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**4.**

Some farmers apply pesticides to their crop fields to lessen the harm that insect pests do. It has been demonstrated that several of these pesticides harm the ecosystem.

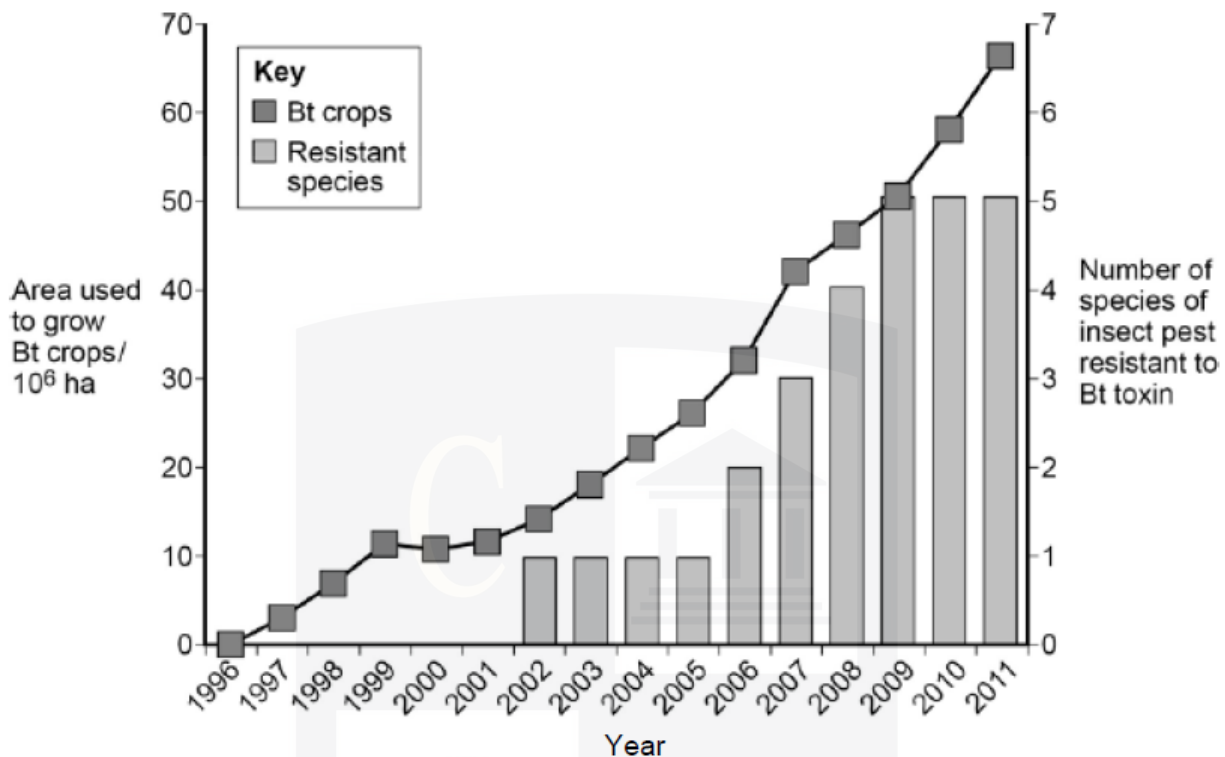
Genetically engineered Bt plants generate a poison that eradicates insect pests. Pesticide use has decreased as a result of the adoption of Bt crop plants.

Researchers have discovered that certain insect pest species have developed resistance to the toxin that Bt agricultural plants generate.

The usage of Bt crops and the number of insect pest species that are resistant to the Bt toxin in a particular nation are depicted in the figure below.

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**(a)** Can you draw the conclusion that the insect pest that was resistant to the Bt toxin was the same species that was discovered between 2002 and 2005? Give an explanation for your response. **(2)**

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**(b)** According to a farmer, the increased usage of Bt crop plants resulted in a mutation in one insect species, which then spread to other insect species. Was he right? Give an explanation for your response. **(4)**



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**(c)** The first insect species that was resistant to the Bt toxin did not emerge right away after Bt crops were introduced. Describe the cause of the delay in time. **(3)**



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To determine the amount of an animal species' population, ecologists employed a technique known as proportionate sampling. This approach relies on conjecture. Below are two of the underlying presumptions.

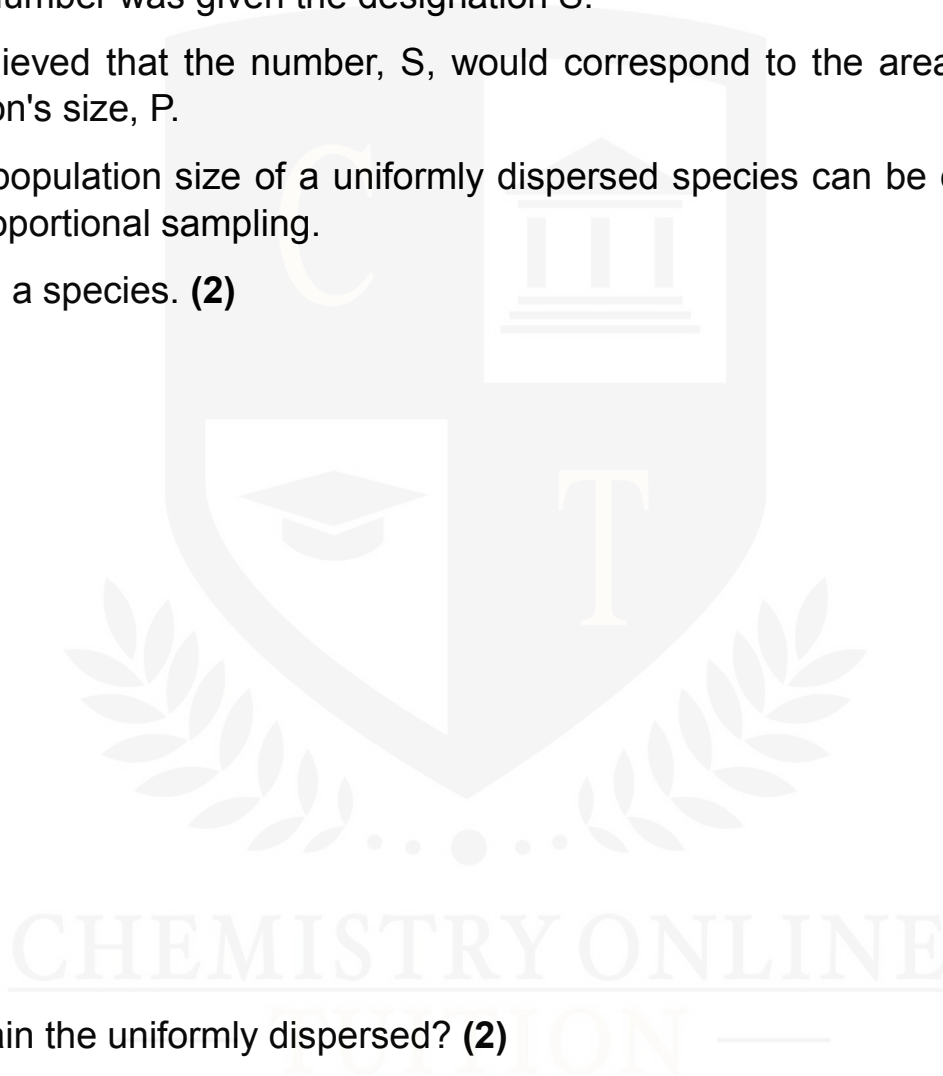
1. They are aware of the area's (A) dimensions, where the animal population resides.
2. The distribution of the animals in this area is uniform.

The ecologists used the following steps to implement the method: • selected a known-size zone, R, inside area A; • tallied the number of animals in region R. This number was given the designation S.

They believed that the number, S, would correspond to the area A's total population's size, P.

**(a)** The population size of a uniformly dispersed species can be estimated using proportional sampling.

Describe a species. **(2)**

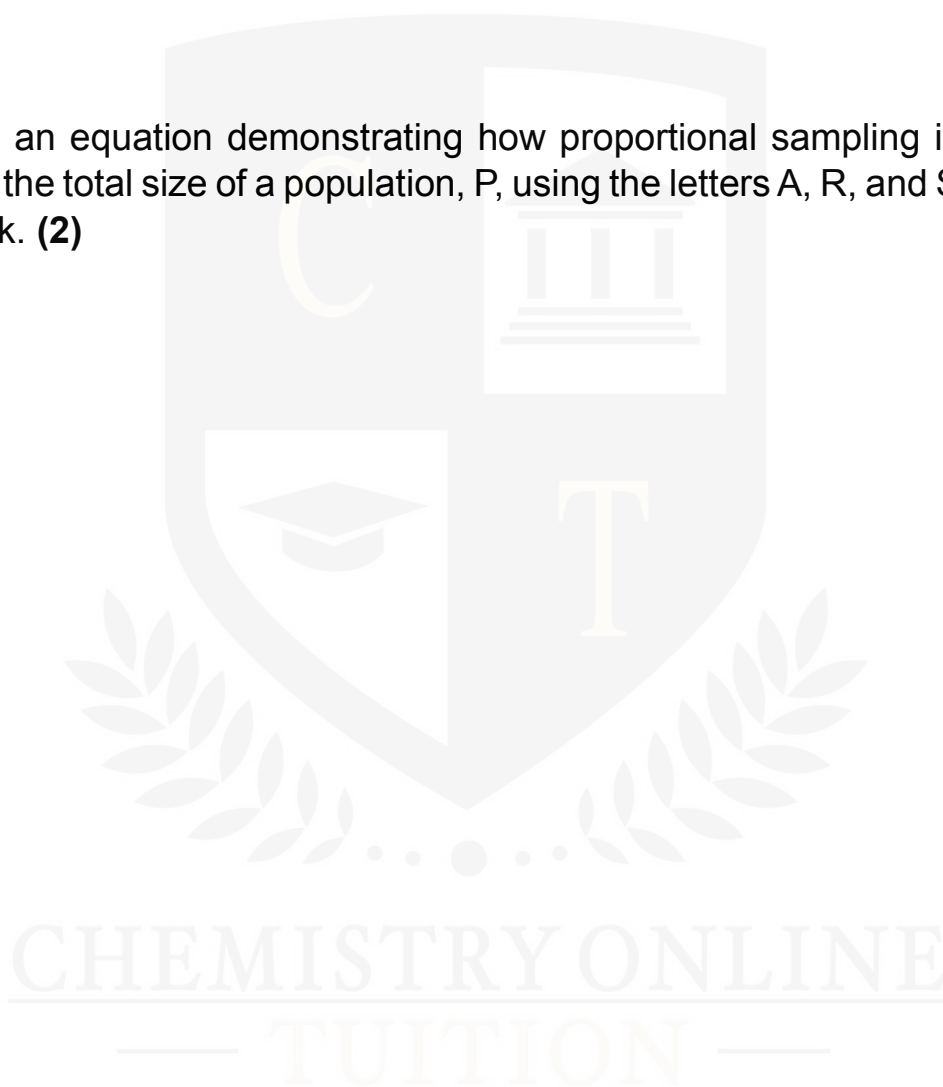


**(b)** Explain the uniformly dispersed? **(2)**

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**6.**

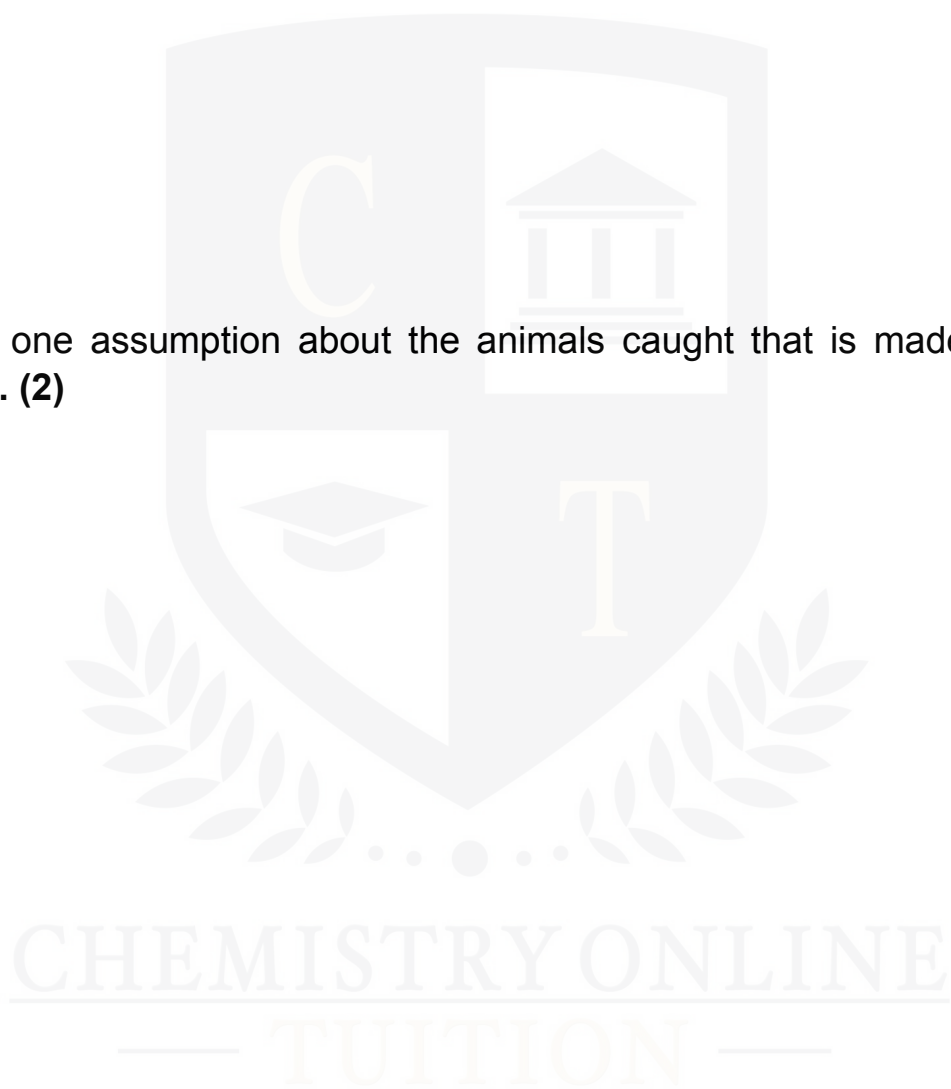
**(a)** Write an equation demonstrating how proportional sampling is used to estimate the total size of a population,  $P$ , using the letters  $A$ ,  $R$ , and  $S$ . Display your work. **(2)**



**(b)** Mark-release-recapture or proportional sampling are two methods for estimating population size.

How are the underlying presumptions of mark-release-recapture and proportional sampling different? **(2)**

(c) Give one assumption about the animals caught that is made in both methods. (2)



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