**SECTION B – VIRTUAL POPULATION STUDIES INVESTIGATION**

In this investigation an experiment was conducted in which two species of the protozoan *Paramecium*, were grown alone or together. The interactions between the two species and their influence on each other were investigated.

**Objectives**:

- To determine how competition for natural resources in the environment can affect population growth.
- To investigate how availability of resources, such as food, can be a limiting factor for population growth.

***TABLE A : Growth of two species of Paramecium alone or in mixed culture over a period of 16 days***

| DAY | *P. aurelia* grown alone (cells/mℓ) | *P. caudatum* grown alone (cells/mℓ) | *P. aurelia* grown in mixed culture (cells/mℓ) | *P. caudatum* grown in mixed culture (cells/mℓ) |
|---|---|---|---|---|
| **0** | 2 | 2 | 2 | 2 |
| **2** | 8 | 12 | 8 | 12 |
| **4** | 48 | 28 | 34 | 22 |
| **6** | 82 | 48 | 66 | 20 |
| **8** | 96 | 60 | 78 | 16 |
| **10** | 98 | 56 | 90 | 8 |
| **12** | 96 | 58 | 96 | 4 |
| **14** | 98 | 60 | 98 | 0 |
| **16** | 96 | 56 | 94 | 0 |

**Now answer the following questions**:

1.1. Write a possible hypothesis for this investigation. (2)

_____

_____

_____

1.2. What is the …

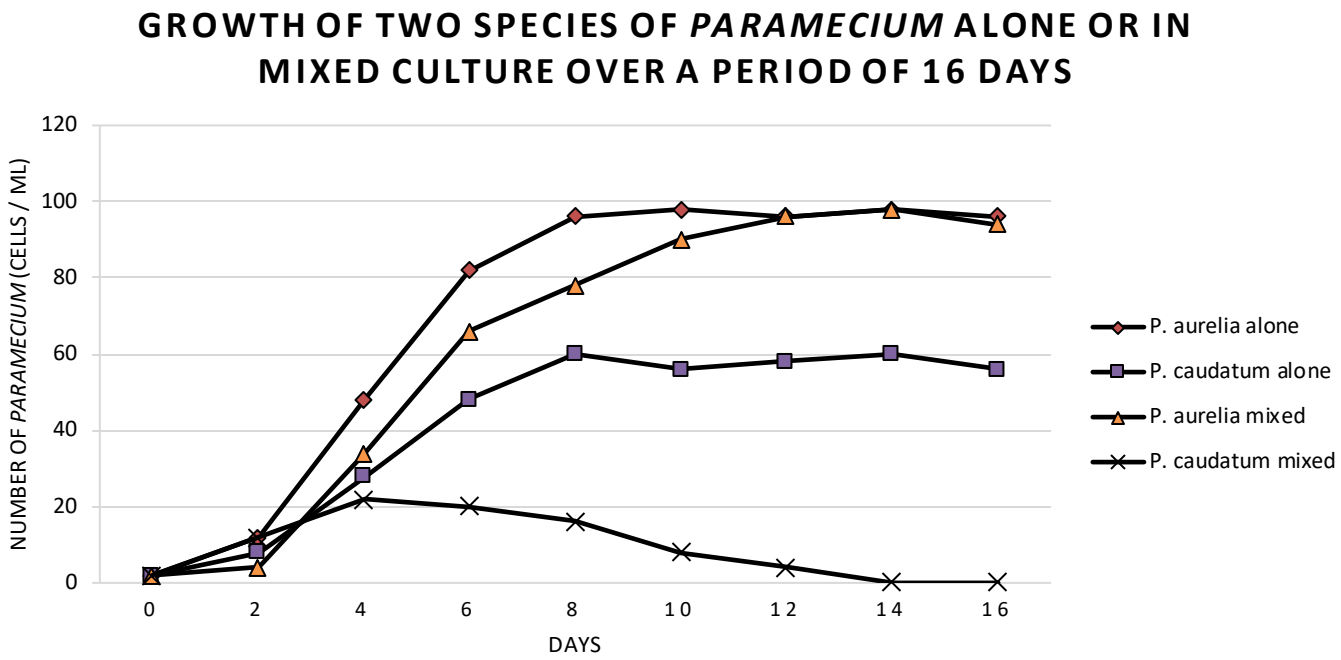
(a) Independent variable: _____

(1)

(b) Dependent variable: _____

(1)

The data in the table can be graphically represented as follows:




1.3. On which day did the *Paramecium caudatum* population reach the carrying capacity of the environment when it was grown alone? Motivate your answer? (2)

_____

_____

1.4. On which day did the *Paramecium aurelia* population reach the carrying capacity of the environment when grown alone? _____ (1)

1.5. Explain the differences in the population growth patterns of the two *Paramecium* species when grown alone in comparison to when they were grown together. (4)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

1.6. Which **ecological principle** is displayed here? (2)

_____

1.7. According to this study, which species of *Paramecium* is the dominant species in this ecosystem?

_____ (1)

1.8. What will happen to the non-dominant *Paramecium* species in this investigation?

_____ (1)

**TOTAL SECTION B: [15]**

## SECTION B - MEMORANDUM

1.1. ***The Paramecium aurelia*** and *caudatum* species **will grow better in isolation** compared to a **mixed culture**.

OR

When **two *Paramecium* species** are **grown together** the **one will outcompete the other** through competitive exclusion.

OR

**Competitive exclusion** will lead to **one *Paramecium* species outcompeting the other** in a mixed culture.

OR

As a result of **limiting factors**, e.g. food, the **two *Paramecium* species** will not be able to **survive in the same environment**, the one species will outcompete the other. (2)

1.2. (a) culture conditions / growing together or apart✓ (1)
(b) number of *Paramecium* species✓ / interaction between *Paramecium* species with regards to the sharing of resources (1)

1.3. Day 8 ✓
**ANY ONE:**
this is where a **maximum number is indicated,** and **it decreases** thereafter ✓
Fluctuate around a maximum number ✓ (1+1)

1.4. Day 10 ✓ (1)

1.5. When the species was **grown alone** (any 2):
each one **flourished**✓under their own conditions and ***P. caudatum* reached higher numbers**✓ but *P. Aurelia* was still more ✓.
When they were **mixed** (any 2):
Competitive exclusion✓ occurs and ***P. aurelia* suppressed the growth of *P. caudatum***✓ / outcompeted/ no resource partitioning occurs ✓ (2+2)

1.6. **Competitive exclusion** ✓✓ (2)

1.7. *Paramecium aurelia* ✓ (1)

1.8. It will go extinct / die ✓ (1)

**TOTAL SECTION B: [15]**