

**Round: 3A**  
**Category: Chemistry**  
**Time: 3 minutes**

The dominant forms of nitrogen and phosphorous in the ocean are nitrate ( $\text{NO}_3$ ) and phosphate ( $\text{PO}_4^{3-}$ ) respectively.

1. You analyze surface seawater from the equatorial Pacific and find it contains  $5 \mu\text{mol/L}$  nitrate and  $1 \mu\text{mol/L}$  phosphate.
  - a) If you take this seawater, give it plenty of light, and remove the grazers, which nutrient, N or P, do you expect to be used up first by phytoplankton? Why? (8 pts)
  
  
  
  
  
  
  
  
  
  
  - b) What would you expect to observe in terms of nutrient concentrations if the experiment were performed in the dark? (4 pts)
  
  
  
  
  
  
  
  
  
  
2. When you perform the experiment described above in Question 1a, you may not observe any growth or depletion of N or P. Give two explanations for this. (8 pts)

ANSWER

ANSWER

ANSWER

**Round: 3A**

**Category: Chemistry**

**Time: 3 minutes**

The dominant forms of nitrogen and phosphorous in the ocean are nitrate ( $\text{NO}_3$ ) and phosphate ( $\text{PO}_4^{3-}$ ) respectively.

1. You analyze surface seawater from the equatorial Pacific and find it contains  $5 \mu\text{mol/L}$  nitrate and  $1 \mu\text{mol/L}$  phosphate.

a) If you take this seawater, give it plenty of light, and remove the grazers, which nutrient, N or P, do you expect to be used up first by phytoplankton? Why?

*Nitrate will be used up first (3 pts).*

*Explanation (5 pts total):*

*1  $\mu\text{mol/L}$  phosphate uses up 16  $\mu\text{mol/L}$  nitrate (2 pts). Since there are only  $5 \mu\text{mol/L}$  nitrate in the sample of seawater, N will be the limiting nutrient (2 pts). Calculations are based on the Redfield Ratio (106:16:1)(1 pt)*

b) What would you expect to observe in terms of nutrient concentrations if the experiment were performed in the dark?

*Light is needed for phytoplankton growth (2 pts); in the dark, nutrients will be underutilized (2 pts)*

2. When you perform the experiment described above in Question 1a, you may not observe any growth or depletion of N or P. Give two explanations for this.

- *Sample may have come from a depth where light was not available for phytoplankton growth (4 pts)*

- *The area of the equatorial Pacific could lack the nutrient iron (Fe limiting). (4 pts)*