NTNU
Det skapende universitet

Norwegian University of Science and Technology (NTNU)
Dept. of Biology

EXAM, BI 3061 – BIOLOGICAL OCEANOGRAPHY
(CONTINUATION)

Contact during the exam: Geir Johnsen, Tel.: 9189 7027

Date of exam: 16 May 2015

Duration: 4 hours

Credits: 7.5

Allowed aids: None

Language: English, 3 pages with 5 themes (answer all sub questions).

No enclosures

Date of censure: 16 June 2015

Note: The following questions are NOT multiple choice. Each item requires an answer. Drawn figures may be used if so wished.

Controlled by:

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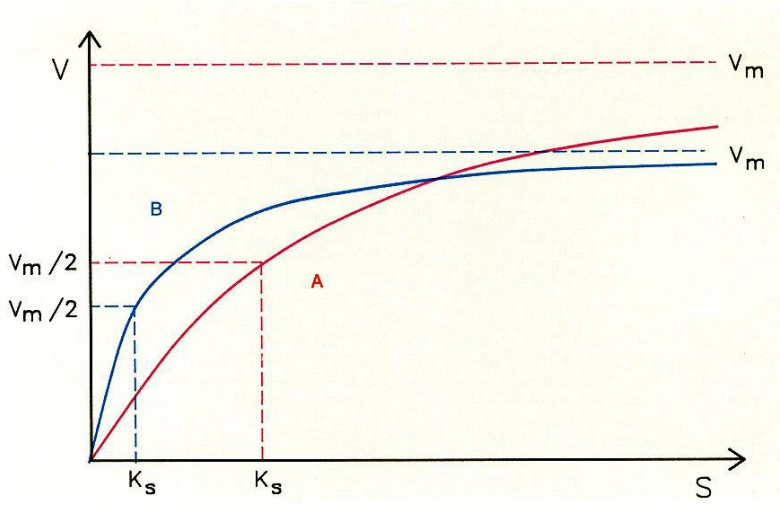
Date Sign

1. Plankton

A. What is the definition of plankton?
B. What are the main groups of heterotrophic plankton?
C. What is the difference between bottom up effects and top down effects?
D. What are the main nutrients potentially limiting the phytoplankton growth in the marine environment?
E. The figure below describes the nutrient uptake (V) of two different species of phytoplankton (A, red graph and B, blue graph) as a function of nutrient concentration (S) as described by the Michaelis-Menten equation. Describe the key parameters of this model (V_m and K_s). Which of the two species will be favoured at low nutrient concentrations?



2. Thermohaline circulation and viscosity of liquids

A. Describe briefly "Thermohaline circulation" (THC)
B. What is the North Atlantic Current?
C. Give a short overview of the viscosity of liquids (definition, what it is, etc.)
D. Where in the oceans does production of bottom water take place?
E. What is the impact of temperature on the viscosity of water?

3. Remote sensing of phytoplankton blooms

A. Why is remote sensing of ocean colour measured in the visible part of the spectrum (400-700 nm)?
B. What are the "pros" (strengths) and "cons" (weaknesses) regarding remote sensing of ocean colour from satellites?
C. Define the 7 different functional phytoplankton groups used in remote sensing.
D. Describe shortly the inherent optical properties (IOP) in the ocean.

4. Marine primary production and marine primary producers.

A. Define/explain the terms gross photosynthesis, net photosynthesis, respiration, gross primary production and net primary production. Show the appropriate equation used to calculate (some of) these terms.
B. What is the marine contribution to the total global annual primary production (% and Pg C $year^{-1}$)?
C. Describe at least two ways of measuring the photosynthetic rate with regards to the following questions:
    - How are measurement done?
    - What is the physiological background for the measurements?
    - Can these measurements be used to measure both the gross and net photosynthetic rates, and the dark respiration rate of the sample?

5. Miscellaneous

A. Describe the Coriolis effect and summarize the underlying factors
B. What are the major light harvesting pigments in phytoplankton?
C. Give a brief physical description of the El Niño phenomenon
D. What is a cyclone?
E. What is the difference between a gyre and an eddy?