

Department of biology

Examination paper for BI3061 Biological oceanography

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Examination date: 14.12.2017

Examination time (from-to): 9-13

Permitted examination support material: English dictionary

Language: English (all answers must be given in English)

Other information:

Number of pages (front page excluded): 3

Number of pages enclosed: no enclosures

Informasjon om trykking av eksamensoppgave

Originalen er:

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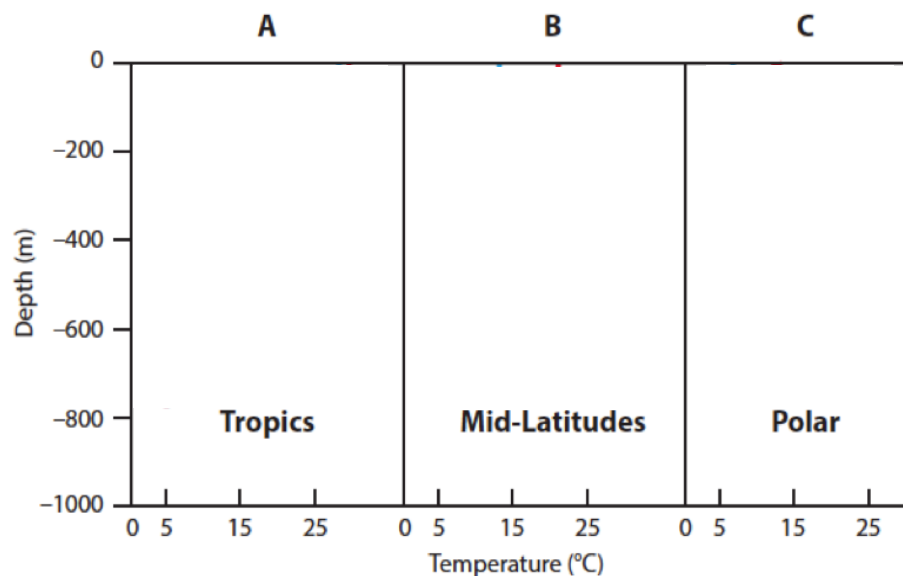
Date

Signature

QUESTIONS

Question 1: Ocean characteristics

- Temperature shows specific vertical distribution patterns in the oceans that lead to a permanent thermocline. Define the term 'permanent thermocline' and explain the factors that lead to a temperature-induced stratification of the water column. (1.5 points)
- The vertical temperature distribution can change with season. Draw the seasonal changes in the thermocline during a summer and a winter situation in the (A) Tropics, (B) Mid-Latitudes and (C) Polar regions into to the respective graphs below. (3 points)
- In some parts of the oceans, seasonal thermoclines establish. Describe where seasonal thermoclines usually occur and name the most important factors that lead to the establishment and the disruption of seasonal thermoclines. (1.5 points)



Question 2: Ocean geography

- Name the five most important oceans and rank them according to their total surface area (10^6 km²) from large (1) to small (5). (1 point)
- The Norwegian Sea is a marginal sea with a characteristic bathymetry. Describe the Norwegian Sea bathymetry and mention which other marginal seas are defined as the borders of the Norwegian Sea to the north and to the south? (2 points)
- The Southern Ocean is connected to three big oceans. To which oceans is the Southern Ocean connected to and how is the border of the Southern Ocean defined? (1.5 points)

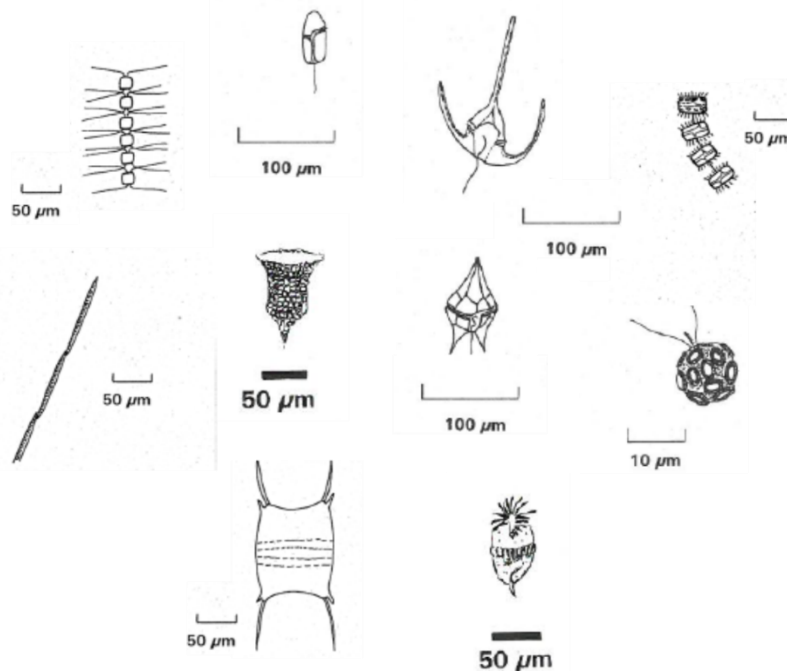
Question 3: Phytoplankton, remote sensing and pigments

- Phytoplankton comprises seven major functional types (PFT). Name three factors used as the basis for the division into specific PFTs based on Le Quéré et al. (2005). (1.5 points)

- B. Algae have a high diversity in pigment composition based on evolution through endosymbiosis. Explain the term 'endosymbiosis' and how pigments evolved from endosymbiosis. (1.5 points)
- C. Remote sensing is a state-of-the-art method to map autotroph biomass in the world's oceans. Explain the difference between remote sensing techniques and classical phytoplankton enumeration by taking the advantages and shortcomings of remote sensing into account. (2 points)
- D. Primary production varies substantially in different regions of the world's oceans. Provide four examples of regions or habitats that are considered as hot spots in primary production? (1 point)

Question 4: Oceans' biological carbon pump

- A. Parts of the biological carbon pump take place within the euphotic zone of the ocean. Describe the key processes happening within the euphotic zone and explain why these processes are relevant for the deeper layers underneath. (3 points)
- B. The microbial loop plays a key role in planktonic processes. Describe the concept of the microbial loop and name the key components contributing to microbial food webs. (2 points)
- C. Diatoms are an important component of the phytoplankton. The graph below shows different phytoplankton (phytoflagellates, diatoms) and protozooplankton species (zooflagellates, ciliates). Please mark three diatom species in the graph below. (1.5 points)



Question 5: Ocean characteristics

- A. Wind-driven surface currents are typical current systems at the western coasts of continents. Describe the principle of wind-driven currents, how surface and deep layers are deflected and characterize the net-water movement. (2 points)
- B. The thermohaline circulation (THC) is a global system of vertical and horizontal ocean currents. Name four major factors for vertical and horizontal water movement that drive the ocean conveyor belt. (2 points)
- C. There are major surface currents relevant for thermohaline circulation (THC) in the world's oceans. Name three major surface currents that are THC-relevant and mention their geographic location. (1.5 points)
- D. The Mediterranean Sea is a relatively land-locked marginal sea with a distinct current system. Describe the in- and outflow characteristics at the Strait of Gibraltar with special emphasis on salinity patterns of the water masses. (1.5 points)

Question 6: Nekton

- A. Nekton is an important component in pelagic systems. Describe the difference between plankton and nekton and name at least 4 major groups included into the nekton. (2 points)
- B. The Peruvian anchovy is one of the most important commercially harvested fish species but stock sizes off Peru vary substantially between years. Provide reasons for dramatic changes in stock sizes of Peruvian anchovy with regard to oceanographic and meteorological phenomena in this region. (2 points)