



Försättsblad Prov Original

Kurskod	Provkod	Tentamensdatum
M Ö 0 0 3 A	T E N T	2 0 1 9 - 0 1 - 1 7
Kursnamn	Miljöteknik AV, Klimatförändringar, påverkan och åtgärdss...	
Provnamn	Tentamen	
Ort	Östersund	
Termin		
Ämne		

Course examination

Course name:	Climate change, impact and action strategies, 7,5 ECTS
Subject:	Environmental engineering
Date and duration:	2019-01-17, 5 hours
Course director:	Anders Jonsson
Support:	English dictionary allowed. No other books, calculators or other support are allowed during the examination.
Questions:	During the first 2 hours of examination, Anders Jonsson can be contacted on telephone: 070-5852972
Please note:	Your personal code must be written on each sheet of paper. Clearly state the number of each question!

- 1) What is the difference between weather and climate? (2p)
- 2) Give a brief description of the global climate system. For full score your description should include the main (five) components of the climate system and you should give examples of significant external forcing factors (natural and/or anthropogenic) which influences the climate system. (10 p)
- 3) The decrease of which emission causes increasing temperatures (increases global warming)? (1p)
 - a. Methane
 - b. Carbon Dioxide
 - c. Dichlorodifluoromethane
 - d. Sulphate aerosols
- 4) Explain in your own words the following terms:
 - a) Global warming potential (GWP)
 - b) Global temperature change potential (GPT)
 - c) Radiative forcing
 - d) Effective radiative forcing
 - e) Climate
 - f) Climate change.(12p)
- 5) Explain the difference between *irreversible* and *abrupt* change of the state of the climate system and give one example each of them. (4p)



- 6) Name the five most significant greenhouse gasses (in terms of Radiative forcing) and state, for each GHG, whether it is a long lived and well mixed or if it is short-lived with highly variable concentration in the atmosphere (10p)
- 7) Define briefly what Carbon Dioxide Removal (CDR) is and give three examples of it. (4p)
- 8) Briefly explain the following three concepts: Vulnerability, Adaptation and Resilience. (3p)
- 9) Why is it that indigenous people in different parts of the world almost always seem to be more exposed to- and affected by climate change? (2p)
- 10) Rural populations, particularly poor areas, are highly affected by climate change (CC), what are the main reasons for this? (2p).
- 11) Give two examples of adaptation to climate change and explain briefly! (4p)
- 12) Describe briefly some pros and cons with Nuclear Power, seen from a climate and human perspective. (3p)
- 13) Long-term climate goals have been expressed both in terms of concentrations and temperature. Article 2 of the UNFCCC calls for the need to 'stabilize' concentrations of greenhouse gases (GHGs). What does 'stabilizing concentrations' when it comes to GHGs mean? (2p)
- 14) Explain what is meant by co-benefits of mitigating climate change and give two examples of such co-benefits! (4p)
- 15) State two geoengineering technologies which are important for mitigation. (2p)
- 16) Describe the purpose of climate change mitigation. (2p)
- 17) There is a difference in per capita GHG emissions levels between low-income and high-income countries, as well as differences in sources from which the most sizable quantities of GHG emissions stem.
 - a) Is the highest quantities of per capita GHG emissions found in low-income or high-income countries today? (1p)
 - b) From which sources do most GHG emissions come from in high-income countries and low-income countries respectively? (2p)



- 18) Adaptive capacity is associated with a number of key factors in society. Name a minimum of five such key factors. (5p)
- 19) What are the main differences between a Numerical Weather Prediction model and climate models? (3p)
- 20) In climate modeling there is always a tradeoff between resolution and computational power. In order to run a climate model more effectively two key concepts are used. Name and explain these two. (4p)
- 21) Say that you would like to improve a climate model by introducing an additional process that you have found to affect the magnitude of the gas transfer velocity. What problems could you encounter? (4p)
- 22) You have a friend that knows nothing about air-water gas exchange. How would you describe the gas transfer velocity to your friend? (3p)
- 23) Ok, interesting your friend says and starts to read the paper by Wanninkhof et al. (2009). But, I don't understand how turbulence in the water enhances the gas transfer velocity. Could you explain that to me? (2p)
- 24) In the climate model "super model" the gas transfer velocity for CO₂ over streams is being parameterized solely on the stream velocity. Discuss on the advantages and disadvantages of that approach. (4p)
- 25) Describe and explain three other processes that can affect the magnitude of the gas transfer velocity for air-river exchange of CO₂. (5p)

Good luck!

Anders and Andreas