

NATIONAL UNIVERSITY OF SINGAPORE

ESE2001 – ENVIRONMENTAL PROCESSES

(Semester I: AY2015/2016)

Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. Please write your student number only. **Do not write your name.**
2. This assessment paper contains **THREE** questions and comprises **TEN** pages.
3. Answer **ALL** questions. All questions DO NOT carry equal marks.
4. This is a “**CLOSED BOOK**” assessment.
5. Give your answer in the exam paper.
6. Linear MM graph paper and Reference Booklet will be given during the examination.
7. Programmable calculator is not permitted for this exam.
8. The total maximum mark is **FIFTY (50)**.

Please write your matriculation number below:

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Question	Score
1	
2	
3	
Total	

Question 1 [20 marks]

Circle the correct answer to the following questions [2 mark each]:

- 1) If you double the kinetic energy of the atoms in an object, its rate of energy loss by blackbody radiation
 - A. remains the same
 - B. doubles
 - C. quadruples
 - D. goes up by a factor of 16
- 2) Which of the following is a crop that is efficient at using water for biofuel production?
 - A. Corn
 - B. Soy bean
 - C. Algae
 - D. Poplar trees
- 3) It is more energy efficient to burn biomass directly than to burn gasification products for power generation.
 - A. True
 - B. False
- 4) The battery of the biosphere consists of
 - A. igneous rocks and CO_2
 - B. CaCO_3 rocks and CO_2
 - C. organic carbon and O_2
 - D. organic carbon and CO_2
- 5) What is the best definition of a lifecycle assessment?
 - A. Technique to determine the developmental stages of an organism
 - B. Technique to predict the lifespan of a product
 - C. Technique that determines the total monetary costs associated with a product
 - D. Technique to assess environmental impacts associated with all stages of a product's life
- 6) Algae flowing through an open pond is an example of
 - A. accidental load of a conservative chemical
 - B. accidental load of a reactive chemical
 - C. continuous load of a conservative chemical
 - D. continuous load of a reactive chemical
- 7) Which atmospheric condition will tend to create more air pollution
 - A. superadiabatic conditions
 - B. subadiabatic conditions

- 8) Contaminant transport in the food chain is an illustration of
- A. advection
 - B. diffusion
 - C. dispersion
 - D. I don't know
- 9) The carbonate-silicate cycle regulates atmospheric CO₂ concentrations on a time scale of
- A. Decades
 - B. Centuries
 - C. Millenia
 - D. Millions of years
- 10) Global warming by ____ would stay within the range of the last million years or so.
- A. 1 °C
 - B. 2 °C
 - C. 3 °C
 - D. 5 °C

Question 2 [15 marks]

A target of 80% cuts in CO₂ emissions by the Year 2050 has been floated as a goal that would enable us to avoid the worst consequences of climate change. You have been exposed to that scenario, for example, with the Integrated Science Assessment Model (ISAM), which you have used in the last tutorial.

- (a) Briefly explain the key features of ISAM and its use.

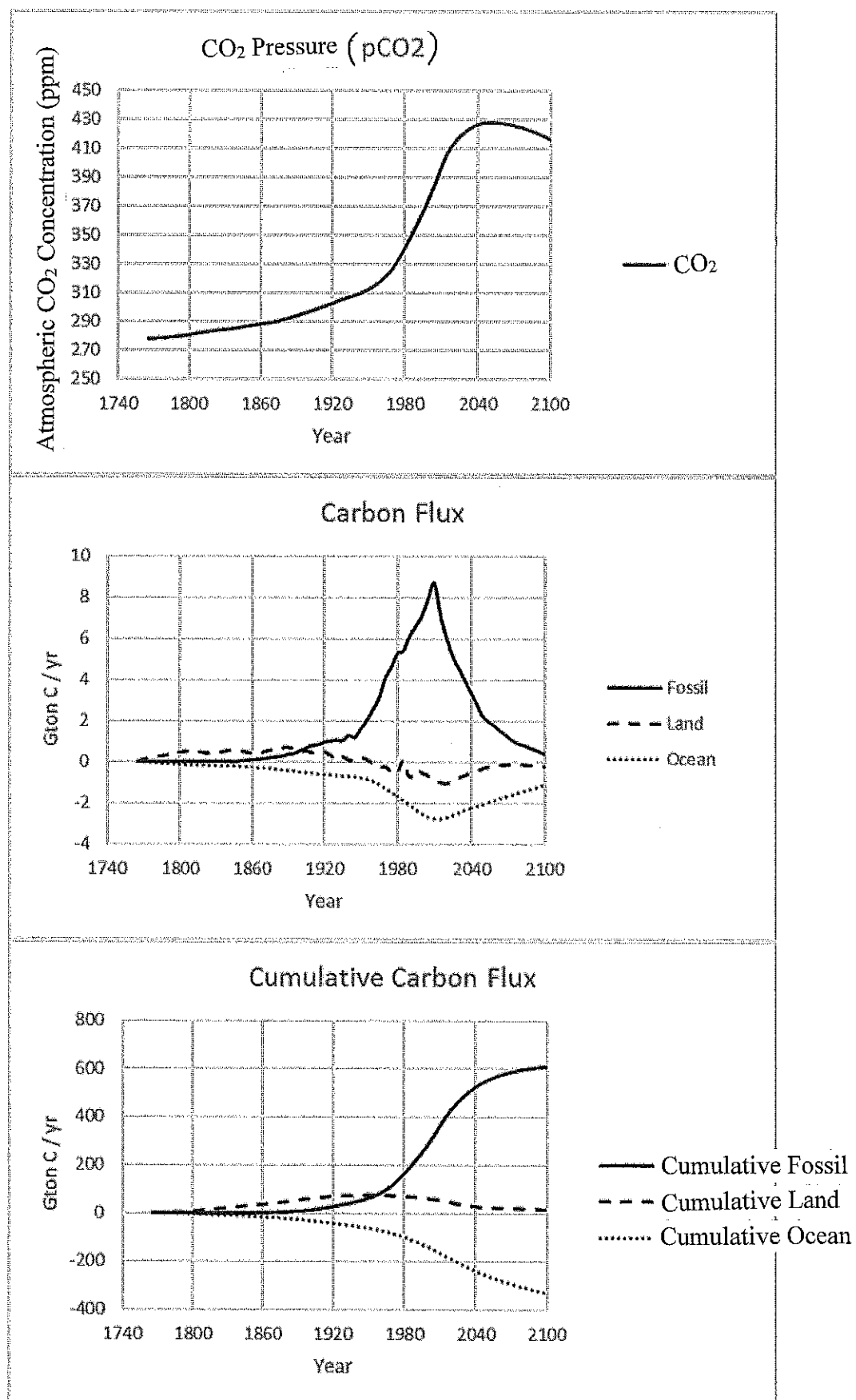
[3 marks]

- (b) Assuming we start in 2016 and reduce CO₂ emissions by 80% by 2050 (in 34 years), what annual rate of emissions cuts would be required, in percent?

[7 marks]

- (c) The output of ISAM for this scenario is shown in the next page (Figures Q2). What roles do the land surface and the oceans play in terms of regulating the perturbed carbon cycle? Why?

[5 marks]



Figures Q2

Question 3 [15 marks]

On Sunday 27 September 2015, Brazil became the first major developing country to pledge an absolute reduction in greenhouse gas emissions for an envisioned global pact against climate change. The world's seventh biggest greenhouse gas polluter said it would cut its emissions by 37% by 2025 from 2005 levels by reducing deforestation and boosting the share of renewable sources in its energy mix. It also indicated an "intended reduction" of 43% by 2030.

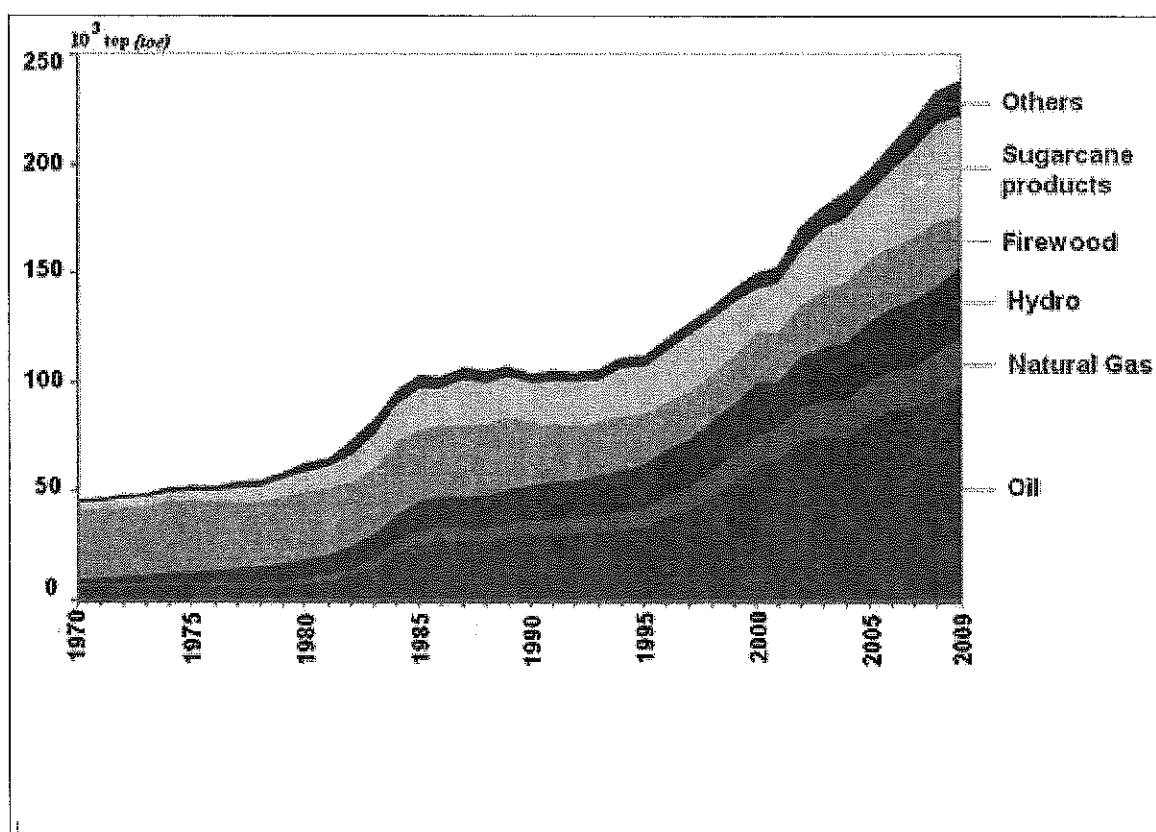
"Our goals are just as ambitious, if not more so, than those set by developed countries," President Dilma Rousseff said as she announced the targets at the UN in New York. However, Márcio Astrini, Brazil public policy coordinator at Greenpeace commented "The government's proposals are a crushing disappointment".

Based on the documents provided in page 8, 9 and 10, fill in the following table about the assets and liabilities of Brazil's environmental governance. Would you say that Brazil a model country in terms of environmental protection?

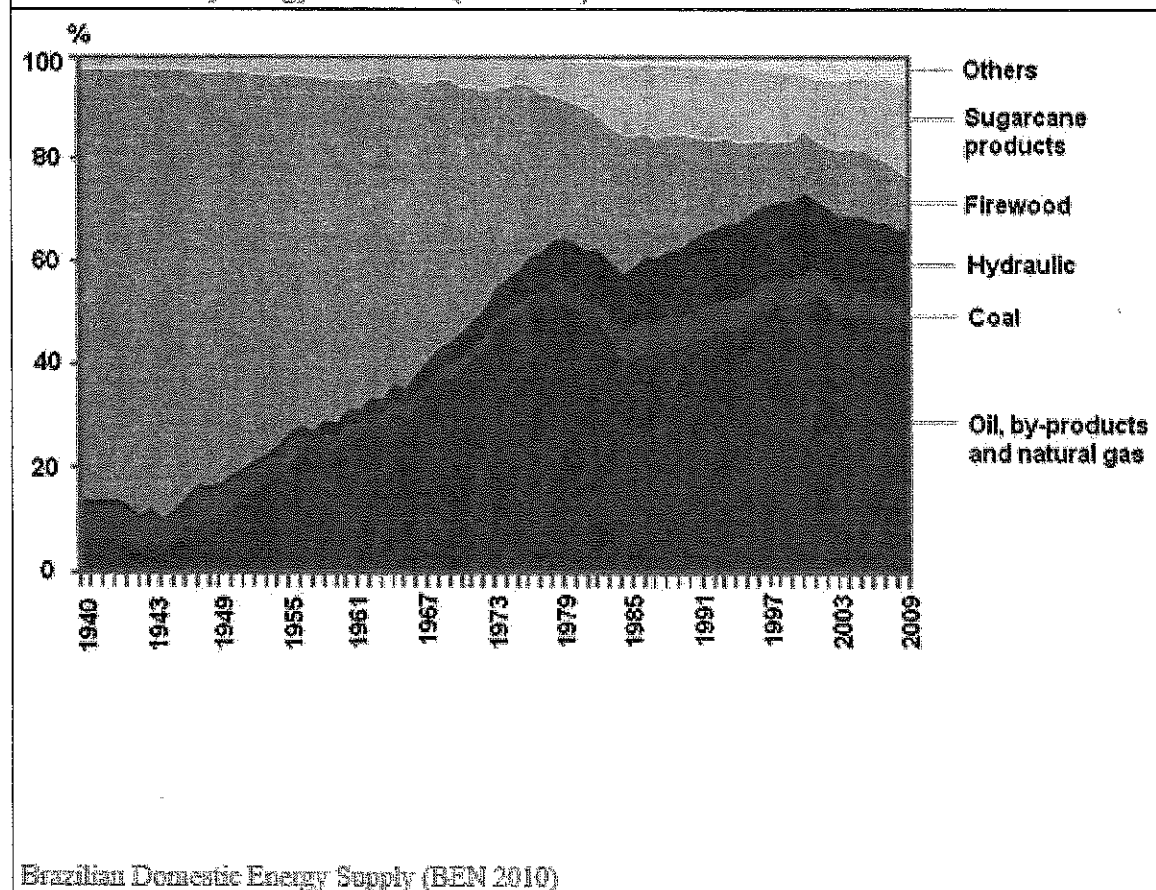
[15 marks]

Assets	Liabilities

Assets (continuation)	Liabilities (continuation)

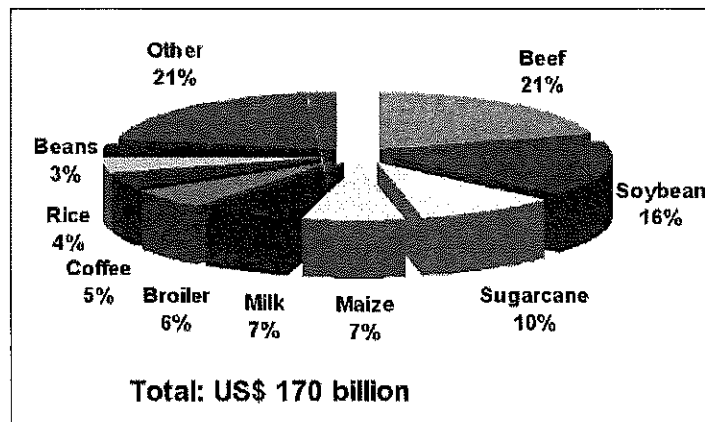


Brazilian Primary Energy Production (BEN 2010)



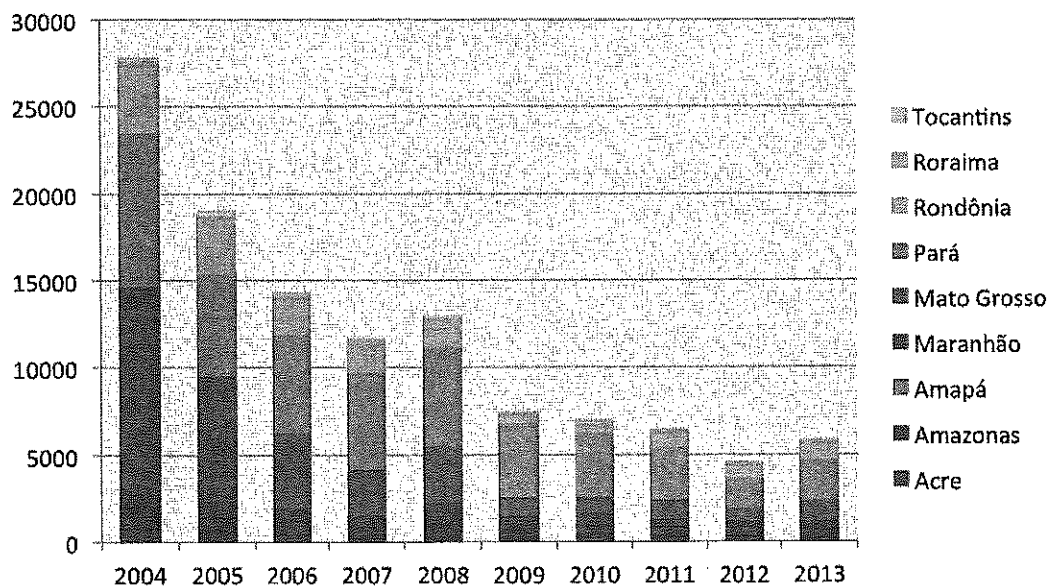
Brazilian Domestic Energy Supply (BEN 2010)

MAJOR AGRICULTURAL PRODUCTS IN BRAZIL GROSS VALUE OF PRODUCTION (June 2009)



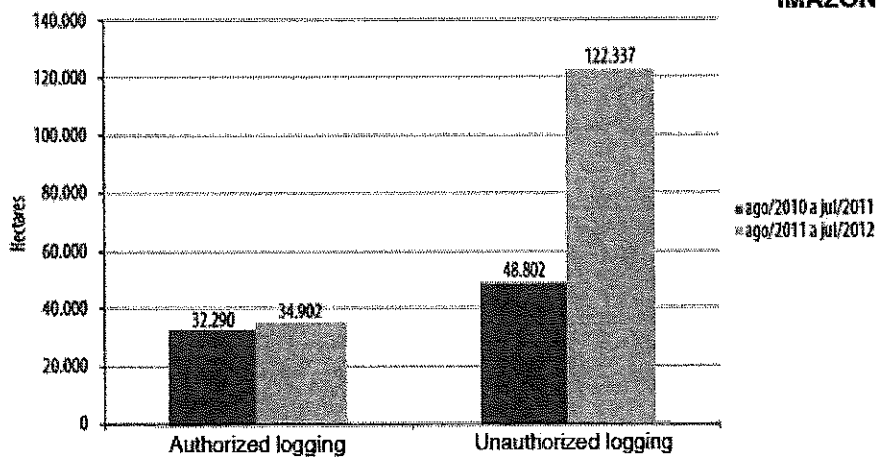
Source: CNA

Deforestation in the Brazilian Amazon, by state, 2004-2013



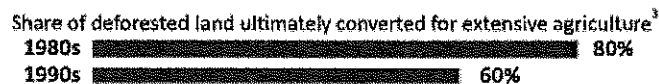
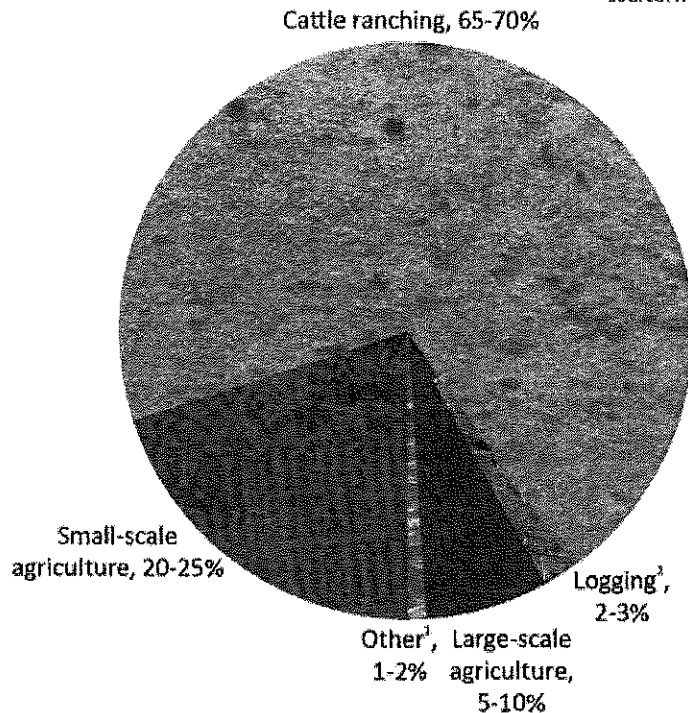
Legal and illegal logging in Pará (ha), Aug 2010-Jul 2011 vs Aug 2011-Jul 2012

IMAZON



Causes of Deforestation in the Brazilian Amazon, 2000-2005

source: mongabay.com



1) Other includes fires, mining, urbanization, road construction, dams; 2) Logging generally results in degradation rather than deforestation, but is often followed by clearing for agriculture; 3) Data from Holly Gibbs 2009

Agriculture



10,21 of farmers, 9,78 % of the Brazilian labor force



9,4 % of agricultural lands (61,15% of forests and 29,5% of other type of lands)



24 % of women in agriculture

GDP

5,2 %, what represents agriculture in the GDP



The fifth first agriculture products in terms of quantity :sugar cane, corn, soybeans, milk, cassava



83 % of farms are sized from 2 and 100 ha but represent only 21 % of the agricultural land (44% for the farms between 1000 and 100000 ha)

Food



200,3 million of Brazilians, therefore of consumers



16%, the obesity rate (IMC >30 for women) and 43% of obese women or suffering from overweight (IMC >25)



6%, the part of meat consumption of Brazil in the world



26,3 million of tons food wasted every year



7 % of Brazilian are suffering from under-nutrition