ORDRE DES INGÉNIEURS DU QUÉBEC

NOVEMBER 2022 SESSION

Any documentation allowed
Calculators: authorized models only
Duration of the exam: 3 hours

14-EC-3 SUSTAINABILITY, ENGINEERING AND THE ENVIRONMENT

This exam consists of 3 sections (A, B, C)

PART A)
THEORETICAL KNOWLEDGE (50%)

I) Biomimicry in Engineering and Biomimicry Design (25%)

Biomimetic design is a relatively new approach in engineering innovation process. The biomimetic design methodology is marked out by the ISO 18458 standard which frames the steps of this approach initially proposed by the *biomimicry institute*.

Q A-I-1) Describe biomimicry in a few lines: What it is, its origins, its use in engineering, the main principles found in sustainable ecosystems. (12%).

Q A-I-2) Describe the main steps or the sequence to follow for a biomimetic design process. (13%).

II) Environmental law in Quebec (25%)

Companies, industry, and all professionals working in Quebec must offer solutions that comply with environmental laws and regulations. These legal frameworks outline, among other things, the government's approach to combating climate change. Indeed, under the Environment Quality Act (EQA), the Government of Quebec has adopted a mechanism to control greenhouse gas (GHG) emissions.

Q A-II-1) According to the EQA, what system is in place in Quebec to achieve GHG emission reduction targets? (12%).

Q A-II-2) Describe the outline of this GHG emission reduction system (13%).

PART B)
PUTTING TOOLS INTO PRACTICE (40%)

Life cycle analysis (LCA) and Environmental Product Declaration (EPD)

In order to disseminate objective, credible and verifiable environmental information about the environmental performance of the products and services they design, engineers can use life cycle analysis (LCA), and the environmental product declaration (EPD). As part of your work, you are receiving an extract of the very partial results taken from a life cycle analysis. (See graph below)

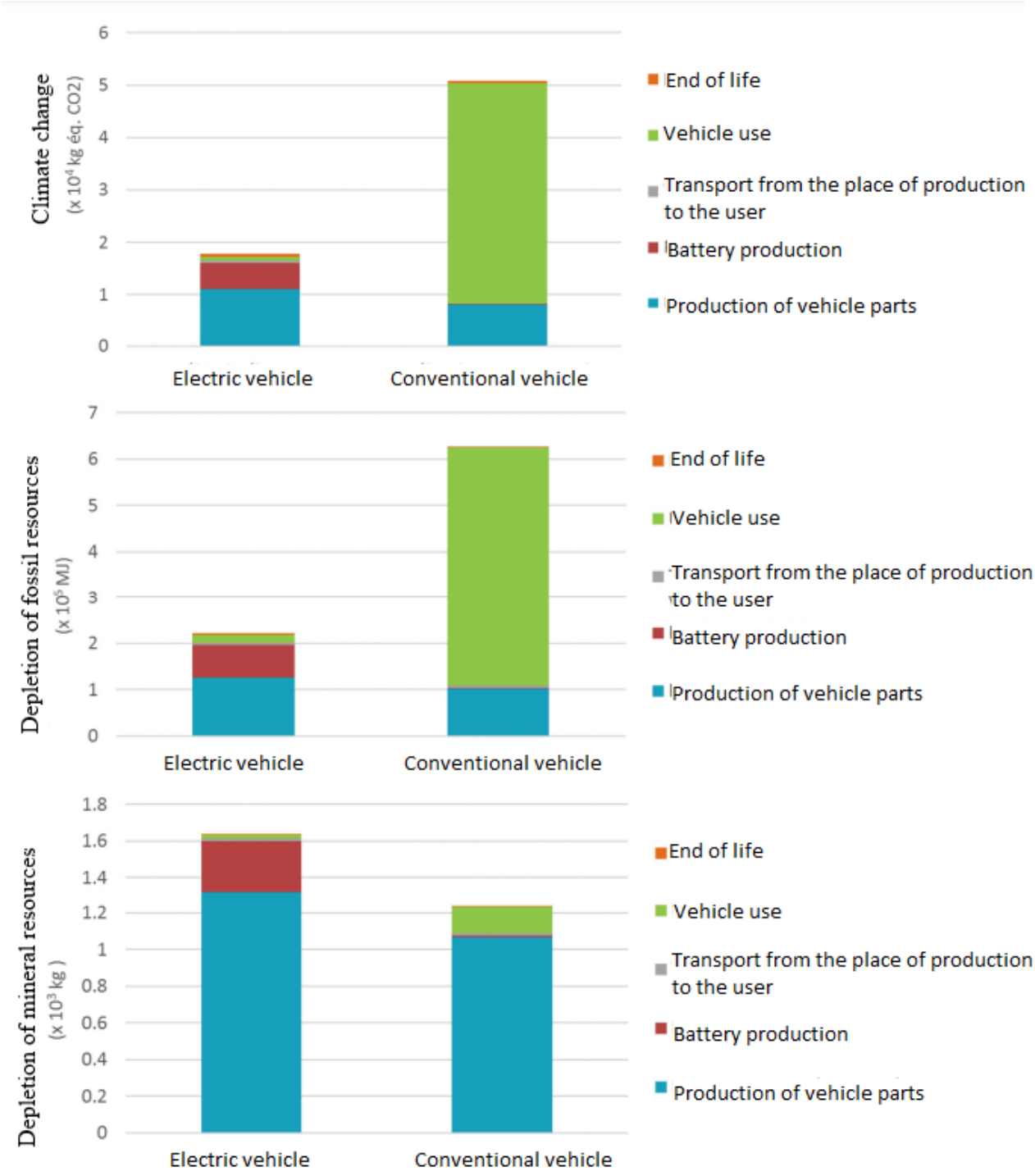
Q B-1) The results presented in the graph below come from a life cycle analysis (LCA). Briefly present what an LCA is (10%).

Q B-2) Why is LCA an important tool for the engineer? (8%)

Q B-3) Based on an interpretation of the very partial results presented in this LCA extract, is the electrification of vehicles in Quebec an interesting choice from an environmental point of view? (10%)

Q B-4) Present the main steps in producing an Environmental Product Declaration (EPD), which could be carried out following the LCA (12%).

We submit to you an extract of the very partial results taken from a life cycle analysis
(Source : Ciraig. RAPPORT TECHNIQUE ACV COMPARATIVE EN CONTEXTE QUÉBECOIS. 2016)



Note: The parts of the vehicle are: the engine, the transmission, the body….

PART C)

YOUR IDEAS ABOUT IMPLEMENTING SUSTAINABLE ENGINEERING. (10%)

As an engineer and educated citizen, aware of the issues of your time, suppose that you are part of a committee of experts who must advise the Government of Quebec on a set of subjects related to sustainable development or the principles sustainable engineering.

Given the current environmental situation, the issues of responsibility and social acceptability, the need for energy and social transitions, Quebec's GHG report, the various solutions proposed to eventually achieve emission reduction objectives, your knowledge of economics, technology, environmental law, your experience, your values, your vision….

Q C-1) WHAT WOULD YOU PROPOSE as reflections and/or solutions for Quebec in order to meet the great challenge that forces us to live within the "limits of the planet"

Formulate your thoughts and proposal in 1 page maximum

End