

ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2012 SESSION

Open-book examination
Calculators: only authorized models
Duration: 3 hours

04-AGRIC-A6 Physical properties of biological materials and food product description

-I- (24 points)

The manager of a ship wants to cool haddock fish captured at 4°C down to -20°C. His average production is 1000 kg/h. Calculate the thermal mass to be extracted per hour by the freezing system to meet this production rate?

-II- (20 points)

A truck with a load volume of 20 m³ was designed to carry dry shelled corn at 12% moisture content (**dry basis**). The owner asks you to determine the maximum volume of shelled corn harvested at 35% moisture (**wet basis**) the same truck can carry.

-III- (20 points)

Calculate the error in percentage when neglecting the heat of respiration in the calculation of the thermal load to be extracted from a mass of strawberry at 30°C to cool it down to 0°C at a constant rate within 48 hours.

-IV- (20 points)

Determine in percentage, the difference in the value of the dielectric constant of shelled corn at 22% moisture content (wet basis) when increasing the treatment frequency from 20 MHz to 300 MHz for grain at 45°C.

-V- (16 points)

There are four rapid cooling methods for removing the heat from horticultural produce immediately after harvest: forced air cooling, water cooling, ice-liquid cooling and forced evaporative cooling by vacuum. Considering the physical properties of horticultural produce, describe one advantage and one disadvantage for each one of these methods.