

MA460 - Ordinary exam 2024

Information: There are one or more questions from 7 seminars. All parts count equally (10 points per seminar). Manage your time.

The answer must be written in English, Norwegian, Swedish, or Danish.

Seminar 3: Oxygen transport and utilization during whole body maximal exercise (10 points)

Questions:

Describe how the following organ systems contribute to or limit maximal oxygen uptake (VO_{2max}). Also, compare their structure and function between untrained and well-trained individuals, and explain how these differences impact VO_{2max} :

- The lungs
- Blood volume and its oxygen-carrying capacity
- The heart
- The muscles

Seminar 2: Running economy, a physiological and biomechanical perspective (10 points)

Questions (the three questions are equally weighted with 3.33 points each):

1. Define running economy and explain how it can be measured!
2. Describe how the relative contributions of body weight support, forward propulsion and leg swing to total running economy can be assessed in a laboratory?
3. Biomechanical “stiffness” has been associated with running economy. How can stiffness be quantified during running, and what mechanisms may explain this association?

Seminar 1: Muscle mechanics (10 points)

Questions

1. According to a series of cross-sectional studies published in the early 2000s (covered in the lecture), what are the architectural features of the vastus lateralis in sprinters compared to endurance runners and untrained? What advantage could their fascicle length give to sprinters? (2 points)
2. Endurance runners seem to have different architectural features compared to sprinters. How different is fascicle length between sprinters and endurance runners according to these studies? What possible advantage can the fascicle length of endurance runners represent in their sport? What about their pennation angle? (3 points)

3. You are planning a research project to estimate the effect of fatigue induced by a training session on fascicle force production in the soleus muscle during running at 12 m/s. You have access to all the methodologies discussed during the lecture and found at NIH. (3 points)
 1. In a first step, you plan to use the ankle joint moment recorded during the run, the Achilles tendon moment arm and the relative physiological cross-sectional area (PCSA) of the soleus muscle. Explain how you would use these variables to obtain the soleus force contribution during the run.
 2. You then plan to multiply the obtained force contribution of the soleus during the run by the cosine of the pennation angle of its fascicles. Why? What is returned from this operation?
4. Define the architecture gear ratio (AGR) and explain what functional advantage a high AGR gives to the muscle. (2 points)
- 5.

Seminar 4: Biomechanics of overuse injuries (10 points)

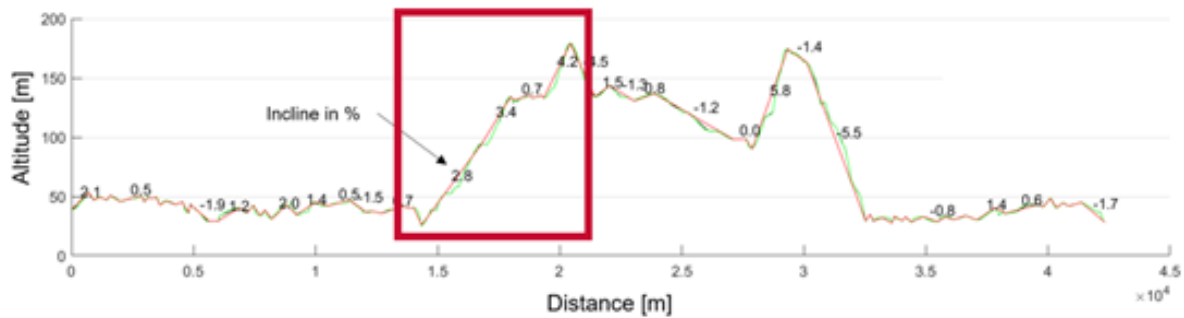
Question (the two questions are equally weighted with 5 points each):

1. Explain what pronation is and the problems that have arisen when trying to understand whether pronation is associated with overuse running-related injury risk.
2. Given the conflicting findings in the field of running-related injury risk, what are the primary scientific challenges and limitations in determining risk factors? Additionally, what are some potential strategies for addressing and overcoming these challenges?

Seminar 6: Integrated performance analysis (10 points)

Questions:

1. During cross-country skiing, where there are uphill and downhill, the oxygen demand will vary. On the uphill, oxygen demands may be higher than the oxygen uptake, causing skiers to experience an oxygen deficit. Define oxygen demand, oxygen uptake, and oxygen deficit. In addition, define maximal accumulated oxygen deficit. (3 points)
2. Compare the relationship between oxygen demand, oxygen uptake, and accumulated oxygen deficit in short uphill (approximately 20 seconds) and a long uphill (approximately 1 minute)? (3 points)
3. How would you expect the relationship between oxygen demand, oxygen uptake, and maximal accumulated oxygen deficit (MAOD) play out in a 5km long uphill of approximately 3% incline after 15km at the Olympic marathon in Paris 2024? Below you find an altitude profile and the question relates to the uphill framed in red. (4 points)



Seminar 7: Performance analysis in Team sport (10 points)

Questions:

1. How can match analysis contribute to the training planning process?
2. Several contextual factors can influence the outcome of a match analysis. List three (3) possible factors.
3. A sprint in a typical match analysis is defined by a (so called) speed threshold (e.g. 25 km/h). What is the challenge with this definition when it comes analyzing the training load players are subjected to?

Seminar 9: Force-velocity profile and performance (10 points)

Question:

Discuss factors that may interfere with the outcome of a force-velocity profile test based on jumping. You can decide on how force and velocity are measured, including this as a source of error.