
3. Exercise intensity is an important parameter in exercise physiology and probably the most important parameter of the FIT triad.

- a) There are several parameters that are used to indicate exercise intensity. Describe 3 commonly used parameters related to performance output and 3 commonly used parameters related to energy expenditure (2 points)
- b) As shown in one of the lectures, Valent et al. (2007) studied relationships between heart rate and oxygen uptake in individuals with tetraplegia. Describe 2 of the differences from normal (abled-bodied individuals) that they (often) found and discuss how these may complicate estimating exercise intensity in this population (3 points).
- c) A trainer of a cyclist team comes to you and asks how he could monitor training load in his group of cyclists. Based on your acquired knowledge during the Course Biophysical Concepts, discuss the possibilities for this coach. What can you recommend? (5 points)

4. According to Jones et al. (2010), the Critical Power (CP) concept constitutes a practical framework in which to explore mechanisms of fatigue and help resolve crucial questions regarding the plasticity of exercise performance and muscular systems physiology.

- a. Draw a schematic illustration of the power–time (P–t) relationship for high-intensity exercise illustrating the location of the Lactate Threshold relative to the CP for healthy, physically active young men (2 points).
- b. The CP model is described in Morton (2006) as a hydraulic model. Describe this model and discuss the applications to variable power output exercise (as discussed by Morton) (4 points)
- c. The CP model as described in Morton (2006) is based on several assumptions. One of the assumptions is “Aerobic power is available at its limiting rate CP the moment exercise begins and remains so right up until the end of exercise”. Indicate why this assumption is not fully correct and describe how Wilkie (1980; in Morton 2006) tried to correct the model for this error? (4 points)

Biophysical Concepts in HMS**Monday 22/10/2012 8.45-11.45****4 questions; all questions are equally weighted; for weighting of sub-questions, see indications between brackets****Please, answer questions 3 and 4 on a separate sheet. Don't forget to write your name and student number on both sheets.**

1. During gait, the human trunk can be considered to be in static equilibrium in the frontal plane.

- a. Explain why cocontraction of trunk muscles may be necessary to maintain this equilibrium. (2 points)

The ground reaction force occurring at heel strike can be seen as a perturbation of this equilibrium of the trunk.

- a. Describe the direction of the movement(s) of the trunk that the ground reaction force at heel strike of the left leg would cause. (1 point)
- b. Describe the effect of increasing levels of cocontraction on the frontal plane trunk movement after left heel strike. (2 points)
- c. Why might an individual with an injury to one of the intervertebral joints in the lumbar spine increase the level of cocontraction above normal levels? (2 points)
- d. Describe two disadvantages that this strategy of increased cocontraction may have. (2 points)

2. An athlete performs a series of repetitive lifts of a barbell during a strength training session. Measurement of her trunk movements during quiet standing right after this training session show that the trunk orientation is more variable over time.

- a. Discuss whether this increased variability can be interpreted as an indicator of impaired control, or, informally phrased, a reduced stability. Mention the assumptions made in this interpretation and evaluate their feasibility in this particular case. (4 points)

Trunk movements during the lifting cycles were also measured and the short-term Lyapunov exponent of the sagittal plane movements is shown to increase over the training session.

- b. Describe in words, using the definition of the Lyapunov exponent, what this implies about these trunk movements. (2 points)
- c. Which physiological effects of trunk muscle fatigue could cause a loss of control over trunk kinematics, or, informally phrased, a reduced stability of trunk movement? Mention two effects and explain why these effects impair control. (4 points)

Imagine that the athlete participates in a game of soccer after the strength training session.

- d. Could the effects of trunk muscle fatigue discussed above increase the risk of lower extremity injury, when the athlete is pushed during the game? Motivate your answer. (4 points)