UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	PHYSICS OF THE HUMAN BODY
COURSE CODE	:	BWC 33203
PROGRAMME CODE	:	BWC
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA
		☐ Open book
		☒ Closed book
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

TERBUKA

Q1 (a) Assuming a male has a body mass of 70 kg, 1.72 m high, has an average density of 1.1 g/cm^3 and is modelled as a right circular cylinder. Find the radius and diameter of this cylinder.

(4 marks)

  (b) Sketch and determine the type of lever based on the following situation:

  (i) A person extends her arm horizontally while holding a weight and balances the weight around her shoulder joint with her deltoid muscles.

(4 marks)

  (ii) One of the person's arms, with the pivot point being the hand on the ground while doing the push-up.

(4 marks)

  (c) A hammer thrower throws a 7.25 kg hammer up to 3.5 meters above the ground. The hammer travels 102 m if released at the required angle to cover the maximum distance.

  (i) Find the initial kinetic energy and the maximum increase in the potential energy of the hammer.

(4 marks)

  (ii) Calculate the energy used to throw the hammer in J and kcal if the throw is 20% potential energy efficient.

(4 marks)

Q2 (a) A person experiences a resisting force when trying to open or close a screen door faster. Conclude why a dashpot must be included in the mechanical model of the door closer unit.

(4 marks)

  (b) Assume that the release of ions occurs just outside the cell due to a nerve pulse arriving there and diffusion occurs in one transverse dimension of the cell.

  (i) Estimate the time for Ca^{2+} ions to diffuse throughout a typical skeletal muscle cell if the cell has a diameter of 200 μm and the diffusion coefficient of the ions is 10^{-5} cm^2/s.

(4 marks)

  (ii) The maximum distance the ions need to travel to diffuse across the whole sarcomere is 2 μm. Deduce the time taken and conclude whether this time seems more reasonable.

(5 marks)

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(c)   A racing cyclist produces excessive heat at a rate of 1,300 kcal/h. If all this excess heat is lost by perspiration and evaporative cooling, discuss how much water the cyclist must drink every hour to maintain body fluids.

(3 marks)

(d)   Describe what happens when the ambient temperature exceeds the body temperature based on the breathing cooling mechanism.

(4 marks)

Q3   (a)   It is known that the dynamic viscosity of whole blood decreases by 30% when temperature increases from 25°C to 37°C. Calculate the increase in systolic blood pressure from its normal value of 120 mmHg that is needed to pump blood throughout the body at the same rate if the core body temperature decreases to 25°C, with everything else being the same.

(5 marks)

(b)   Explain why downhill skiers adopt the "egg" position with a hunched-down body and skis pointed backwards when not manoeuvring.

(5 marks)

(c)   An intravenous infusion is made under gravity. The fluid to be delivered has a density of 1.0 g/cm^3. The gauge pressure in the vein is 18 mmHg. Assume the needle entering the vein has a large internal diameter.

(i)   Calculate the appropriate height of the fluid in the bottle to be positioned so the fluid just barely enters the vein.

(4 marks)

(ii)   Identify the reasons for the bottle being positioned either higher, lower or at the same height if the internal diameter of the needle is small.

(3 marks)

(iii)   Determine why such infusions are performed intravenously and not intra-arterially.

(3 marks)

Q4   (a)   A spirometer measures lung function. Explain how much water in the spirometer should rise and fall during asthma patients' breathing cycles.

(5 marks)

(b)   The breathing airway model is a series of sequential passages including the nasal, the pharynx, the larynx and the trachea. Compare the resistance properties of airflow in each of the passage parts.

(5 marks)

(c)   Ultrasound probes are essential components of ultrasound machines. Explain the probe's failure based on the factors below.

(i)   Transducer artefacts.

(5 marks)

(ii)   Image distortion.

(5 marks)

Q5   (a)   A contact lens made of material with a refractive index of 1.47 has a posterior radius of curvature set to match the anterior of the cornea, which is 0.0078 m. Estimate the needed anterior radius of curvature to correct the vision for

(i)   the myopic person needs −2.00D correction.

(5 marks)

(ii)   the hyperopic person needs +2.00D correction.

(5 marks)

(b)   A person wears glasses that provide −3.00D of correction for myopia and wants to have eye surgery. The person has cornea with an anterior radius of curvature is 0.0081 m. Find the radius of curvature after surgery. Given that −3.00D refers to the standard eye in the air.

(4 marks)

(c)   Temperatures outside the range of normality lead to conscious acts and automatic activity by the body to correct the temperatures. Explain how the homeostasis measuring these responses based on

(i)   Negative feedback.

(3 marks)

(ii)   Positive feedback.

(3 marks)

- **END OF QUESTIONS** -

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