2025 Bi H2 Q8

Section: Metabolism and Survival
Topic: Metabolic Rate

Question Summary:
An athlete runs at different speeds. The graph shows blood lactate concentration and heart rate. Students interpret values, calculate percentage increase in heart rate, average increase in power, identify lactate concentration at a given power output, name the process that produces lactate, and explain lactate reduction after exercise.

Worked Solution

(a)(i) From 2.0 to 2.4 m/s lactate stays constant at **1.4 mmol/L**. From 2.4 to 4.8 m/s it increases steadily up to **6.3 mmol/L**.

(a)(ii) When heart rate is 135 bpm, blood lactate concentration is **1.7 mmol/L**.

(a)(iii) Heart rate increases from 120 bpm to 177.5 bpm. Percentage increase = (57.5 / 120) x 100 = **47.5 percent**.

(b)(i) Increase in power = 184 minus 120 = 64 watts. Heart rate increase = 164 minus 84 = 80 bpm. Average increase = 64 divided by 80 = **0.8 watts per bpm**.

(b)(ii) At 184 watts the heart rate is 164 bpm. From the graph blood lactate concentration is **4.4 mmol/L**.

(c) Lactate is produced by **fermentation**.

(d) Lactate is converted back into pyruvate and metabolised once

oxygen becomes available. This lowers lactate concentration over time.

Final Answer:
Lactate constant then increasing, 1.7 mmol/L, 47.5 percent, 0.8 watts per bpm, 4.4 mmol/L, fermentation, lactate converted to pyruvate.

Revision Tips
- Lactate rises sharply when anaerobic respiration begins.
- Percentage change = change divided by original value.
- Power output often correlates with heart rate.
- Fermentation produces lactate when oxygen is limited.
- Lactate is cleared once aerobic conditions return.