2023 Bi H2 Q7

Section: Metabolism and Survival

Topic: Metabolism in Conformers and Regulators

Question Summary

The question investigates how environmental temperature affects the metabolic rate of a Komodo dragon, and explores differences between conformers and regulators.

Worked Solution

(a) As the environmental temperature increases from 20 C to 40 C, the oxygen consumption of the Komodo dragon rises from 0.4 to 1.7 cm^3/kg/hr. This shows that its metabolic rate depends on external temperature, meaning it is a conformer.

■ Answer: Its metabolic rate increases as environmental temperature rises, showing dependence on external conditions.

(b) To make the results more reliable:

• Repeat the experiment several times and calculate the average results.
• Use more Komodo dragons or replicate trials.
• Control other factors such as body mass, activity, and food intake.

■ Answer: Repeat readings and control other variables to improve reliability.

(c) Average increase in oxygen consumption between 20 C and 40 C:

(1.7 - 0.4) / (40 - 20) = 1.3 / 20 = 0.065

■ Answer: 0.065 cm^3/kg/hr per C

(d) Explanation for increased oxygen consumption at higher temperature:

Higher environmental temperature increases enzyme activity and reaction rates within cells. This causes faster metabolism and greater oxygen uptake for respiration.

■ Answer: Higher temperature increases enzyme activity, raising metabolic rate.

(e) The type of response that helps conformers tolerate environmental change:

■ Answer: Physiological acclimatisation

(f) Conformers vs regulators and ecological niches:

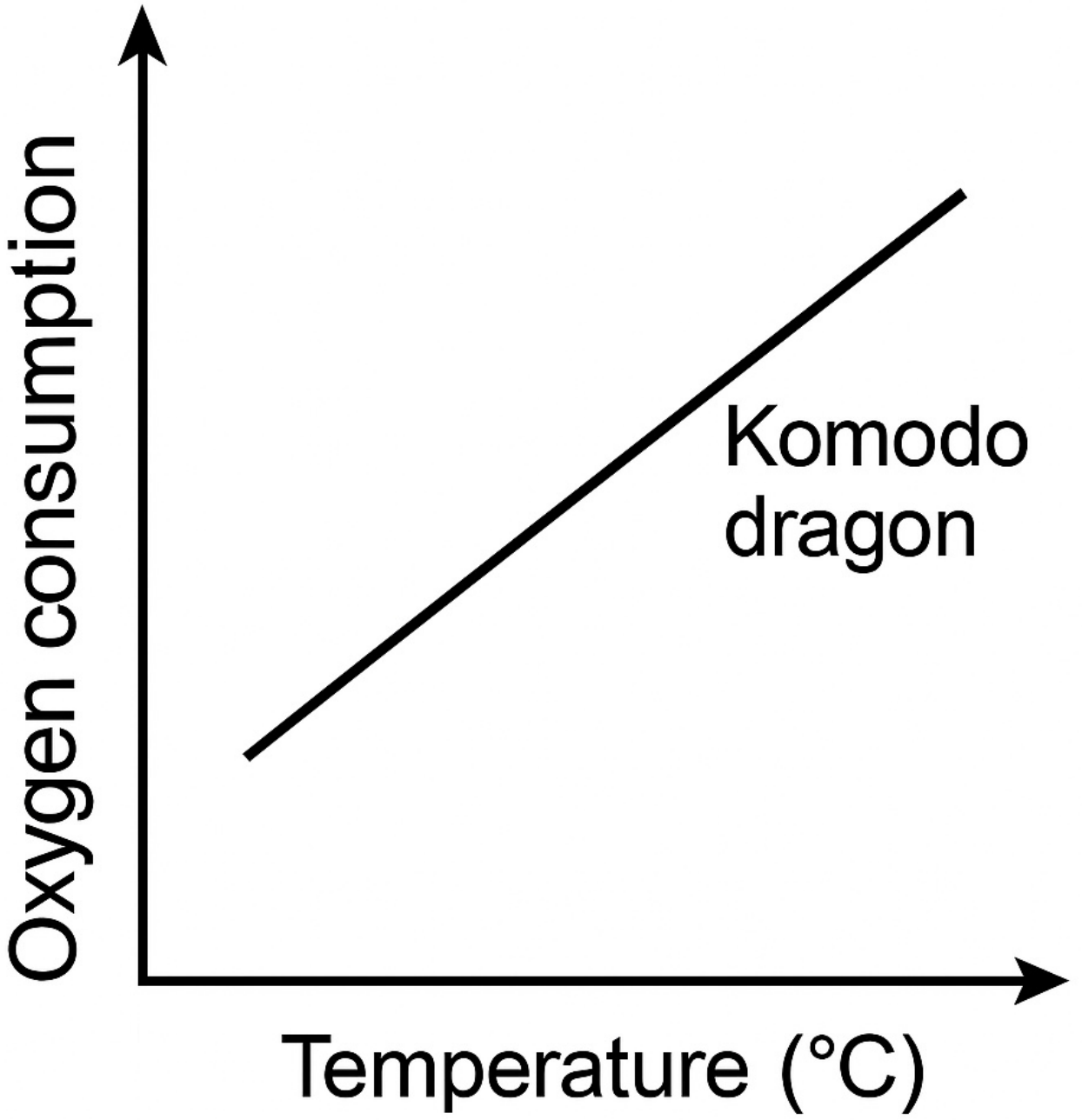
• Conformers can survive only within a narrow range of environmental conditions, so they occupy fewer ecological niches.
• Regulators maintain a constant internal environment, so they can

live in wider ranges of conditions and habitats.

■ Answer: Conformers occupy fewer niches; regulators occupy many due to internal regulation.

Revision Tips

• Conformers: Internal environment varies with external conditions (e.g. reptiles, amphibians).
• Regulators: Use metabolism and behaviour to maintain homeostasis (e.g. mammals, birds).
• Acclimatisation: Gradual physiological change to cope with a new environment.
• Temperature affects enzyme-controlled reactions, influencing metabolic rate.


Oxygen consumption
Komodo dragon
Temperature (°C)