

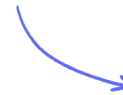
Structured Questions

Integration of Body Systems

Integration in Living Organisms / The Nervous System / Reflex Arc & Movement Control / Epinephrine & Melatonin / Control Mechanisms

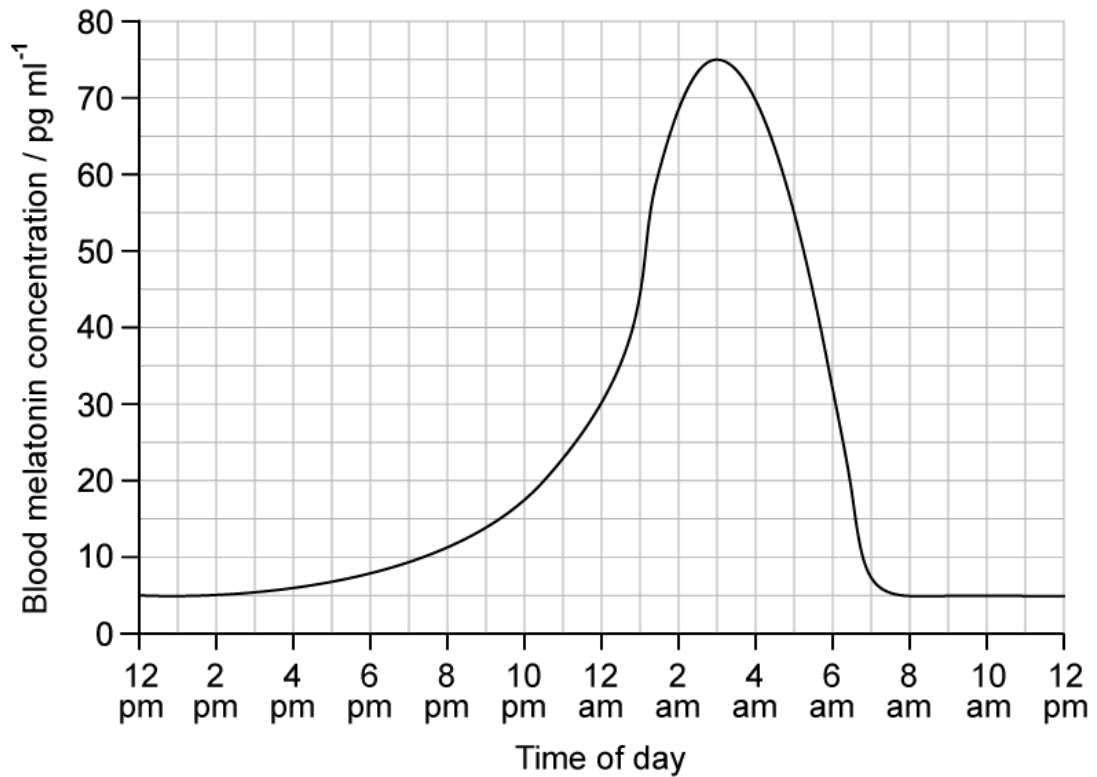
Easy (1 question)	/6
Medium (1 question)	/5
Hard (2 questions)	/20
Total Marks	/31

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Easy Questions

- 1 (a) The graph below shows changes in levels of the hormone melatonin over a 24-hour period. Blood melatonin concentration is measured in picograms per ml.



Calculate the percentage increase in melatonin concentration between 2 pm and 12 am.

.....

.....

(2 marks)

- (b) Identify **one** physiological changes that would occur between 2 pm and 3 am in the body of an individual with the melatonin levels shown in part a).

.....

(1 mark)

(c) Another hormone is thyroxin.

Identify the gland that secretes thyroxin.

(1 mark)

(d) Outline the part played by thyroxin in regulating body temperature.

(2 marks)

Medium Questions

1 (a) Outline how peristalsis ensures one way movement of food through the alimentary canal.

(2 marks)

(b) An increase in blood CO₂ concentration was detected in the chemoreceptors of a person's medulla.

(i) State how this change in CO₂ concentration is detected.

(ii) This change caused the person's breathing rate to increase by 38.5% up to 18 breaths per minute.

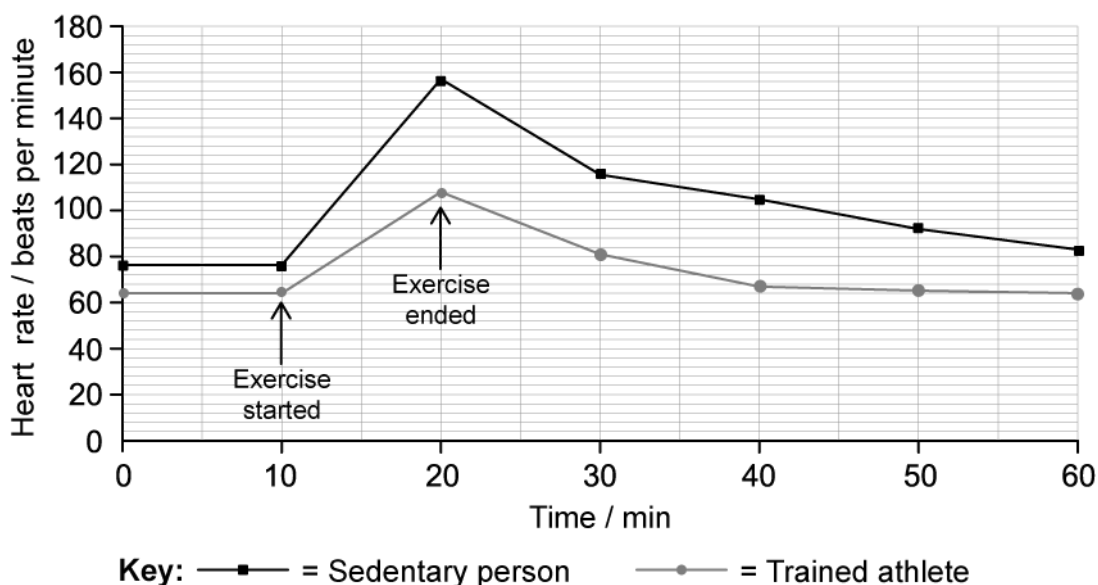
Calculate the person's breathing rate before the increase in blood CO₂ concentration. State your answer to the nearest whole number.

(3 marks)

Hard Questions

1 (a) A group of students investigated the effect of a person's fitness level on the heart rate before, during and after exercising. They measured the resting heart rate of an unfit person leading a sedentary lifestyle and that of a trained athlete. After monitoring their resting heart rate for 10 minutes, both participants were asked to run for a period of 10 minutes. Their heart rates were monitored during this time by a heart rate monitor that was attached to their wrists. After exercising, their heart rates were monitored for a period of 40 minutes.

The results of this investigation is shown in the following graph.



Contrast the results of the two participants.

(3 marks)

(b) Explain the mechanisms that caused the change in heart rate that was observed after the exercise ended.

(3 marks)

- (c) The group of students concluded that an increased fitness level enables the heart to recover more quickly after exercise.

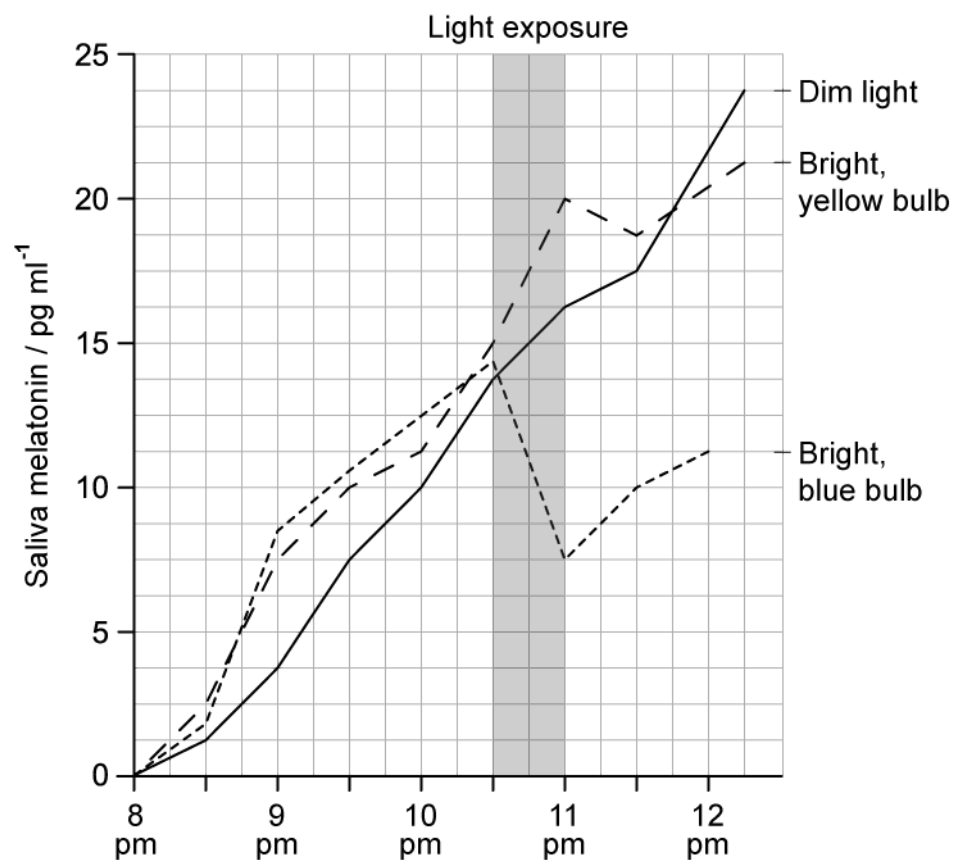
Evaluate the conclusion of the students.

(3 marks)

2 (a) A group of scientists studied the effect of exposure to bright bathroom lights late in the evening on melatonin levels. Subjects attended a sleep clinic where they were allocated to three different light exposure groups; dim light, bright yellow light, and bright blue light.

Over the course of a week, all of the subjects spent most of each evening carrying out normal activities under dim light, before each group was exposed to a 30 minute period of either continuing dim light, bright yellow light, or bright blue light between 10:30 and 11 pm to simulate exposure to bathroom light.

The saliva melatonin levels of all groups were measured at 30 minute intervals throughout the evening and an average is taken for each light condition. The results are shown below.



Describe the effect of the 30-minute period of light exposure on melatonin levels.

(3 marks)

- (b)** A student was changing the light bulb in their bathroom and concluded, after reading the data in part a), that the best bulb type for improving their sleep would be a bright, yellow bulb.

Evaluate the student's conclusion using information from part a).

(3 marks)

- (c)** One of the roles of melatonin is to bind to cell membrane receptors on pancreas cells and slow down the secretion of insulin.

(i) Describe the effect that the binding of melatonin to receptors on pancreas cells will have on the body. [2]

(ii) Suggest a benefit of the effect described in part i) during the period at which melatonin levels are high. [1]

(3 marks)

- (d)** A mutation known as the G allele has been identified in some individuals. The G allele is thought to increase the sensitivity of cells to melatonin. Individuals who regularly undertake shift work at night and who also have the G allele are thought to be at particularly high risk of diabetes.

Use the information provided in parts c) and d) to suggest why individuals with the G allele who regularly work night shifts are thought to be at greater risk of type 2 diabetes.

(2 marks)