



Integration of body systems: practice questions

5 questions · 19 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 19

1 PAPER 1A STYLE

[1 mark]

Which process in the human digestive system is under involuntary control by the enteric nervous system?

- A. ☐ Initiation of swallowing
- B. ☐ Chewing of food
- C. ☐ Peristalsis in the small intestine
- D. ☐ Egestion of faeces

2 PAPER 2A STYLE

[4 marks]

A person touches a sharp pin and pulls their hand away before feeling pain. Describe the pathway of the pain reflex arc that produces this response.

3 PAPER 1B STYLE

[5 marks]

A student's heart rate, ventilation rate and blood pH were measured at rest, after 5 minutes of vigorous exercise and after 5 minutes of recovery. The data are for practice. (a) Calculate the percentage increase in heart rate from rest to exercise. [1] (b) Explain the change in blood pH during exercise. [2] (c) Explain how the change in blood pH causes the change in ventilation rate. [2]

Heart rate, ventilation rate and blood pH (practice data)			
Condition	Heart rate / beats min ⁻¹	Ventilation rate / breaths min ⁻¹	Blood pH
At rest	70	14	7.40
After 5 min exercise	140	30	7.33
After 5 min recovery	85	16	7.38

Answer =

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4 PAPER 2A STYLE

[3 marks]

Outline how the effects of epinephrine (adrenaline) facilitate intense muscle contraction.

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Explain how heart rate is controlled by feedback following sensory input from baroreceptors and chemoreceptors.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C [1]

2. [4]

- free nerve ending (of a sensory neuron) in the hand acts as the pain receptor [1]
- sensory neuron carries impulse to the spinal cord / CNS [1]
- synapse with (a single) interneuron in the grey matter (of the spinal cord) [1]
- interneuron synapses with / passes impulse to motor neuron [1]
- motor neuron carries impulse to skeletal muscle / effector [1]
- muscle contracts, pulling the hand away [1]
- [max 4]

3. [5]

- (a) $(140 - 70) \div 70 \times 100 = 100\%$ [1]
- (b) increased (aerobic) respiration in muscles produces more CO_2 [1]
- (b) CO_2 dissolves / forms carbonic acid, which releases H^+ ions, lowering pH [1]
- (b) Accept lactic acid from anaerobic respiration lowers pH [1]
- (c) chemoreceptors in the brainstem / medulla / carotid / aortic bodies detect the fall in pH [1]
- (c) medulla sends (more) nerve impulses to the diaphragm and intercostal muscles [1]
- (c) muscles contract more frequently, increasing ventilation rate, removing CO_2 (negative feedback) [1]
- [max 5]

4. [3]

- epinephrine is secreted by the adrenal glands [1]
- heart rate / stroke volume increases, so more blood reaches muscles [1]
- arterioles to skeletal muscles dilate / blood diverted from gut and skin [1]
- airways widen / ventilation rate increases, so more oxygen is supplied [1]
- glycogen in liver broken down to glucose, raising blood glucose for respiration [1]
- more oxygen and glucose for (aerobic) respiration / ATP for contraction [1]
- [max 3]

5. [6]

- baroreceptors monitor blood pressure [1]
- baroreceptors located in the walls of the aorta / aortic arch and carotid arteries [1]
- chemoreceptors monitor blood pH / concentration of CO₂ / O₂ [1]
- chemoreceptors located in aortic bodies / carotid bodies / brainstem [1]
- receptors send nerve impulses (along sensory neurons) to the medulla [1]
- medulla coordinates the response [1]
- impulses along sympathetic nerve increase heart rate [1]
- and increase stroke volume / force of contraction [1]
- impulses along vagus / parasympathetic nerve decrease heart rate [1]
- nerves act on the sinoatrial node / pacemaker [1]
- eg fall in pH / rise in CO₂ in exercise causes heart rate to increase [1]
- rise in blood pressure causes heart rate to decrease [1]
- negative feedback returns the variable to its normal level / set point [1]
- [max 6]