



Integration of body systems: practice questions

8 questions • 32 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 32

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 1A STYLE [1 mark]

HL only

Why is the relationship between ethylene production and fruit ripening described as positive feedback?

- A. ☐ Ethylene inhibits ripening once the fruit is ripe
- B. ☐ Ripening stimulates further production of ethylene
- C. ☐ Ethylene production stops when the fruit falls from the plant
- D. ☐ Auxin from the shoot tip reduces ethylene production

3 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.

4 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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5 PAPER 2A STYLE

[3 marks]

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

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PAPER 2B STYLE

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

PAPER 1B STYLE

HL only

Two groups of five oat seedlings were lit from one side for 24 hours. One group was treated with a chemical that blocks auxin efflux carriers. The angle of curvature of each seedling was then measured with a protractor. The data are for practice. (a) Calculate the mean angle of curvature of the untreated seedlings. [1] (b) Distinguish between the qualitative and quantitative observations that could be made in this experiment. [1] (c) Explain the difference between the two groups. [2] (d) Suggest one way to increase the precision of the measurements. [1]

Answer =

3 / 6

HL only

Explain how auxin causes positive phototropism in plant shoots.

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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. [1] **HL only**

B B [1]

3. [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]

4. [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]

5. [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]

6. [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]

7. [5] HL only

- (a) $200 \div 5 = 40^\circ$ [1]
- (b) qualitative: drawing / description of direction of bending; quantitative: measured angle in degrees [1]
- (c) untreated: efflux carriers transport auxin to the shaded side, so cells there elongate more and the shoot bends [1]
- (c) treated: auxin cannot be actively transported / concentrated on the shaded side, so little difference in growth rate / little curvature [1]
- (c) Accept auxin promotes H⁺ secretion / cell wall loosening on shaded side in untreated only [1]
- (d) photograph seedlings and measure angles with image-analysis software / use a protractor with finer scale / measure against a grid OWTTE [1]
- [max 5]

8. [7] HL only

- positive phototropism is directional growth towards lateral / one-sided light [1]
- auxin is produced in the shoot tip [1]
- auxin diffuses into cells but cannot diffuse out [1]
- auxin efflux carriers actively transport auxin out of cells [1]
- efflux carriers positioned on one side of cells / coordinated in all cells, creating a concentration gradient [1]
- lateral light causes auxin to be moved to / concentrated on the shaded side [1]
- auxin promotes secretion of H⁺ ions into the cell wall / apoplast [1]
- acidified cell wall / cross links between cellulose molecules loosened [1]
- cells elongate (due to turgor pressure) [1]
- cells on the shaded side elongate faster than on the lit side [1]
- so the shoot bends towards the light [1]
- [max 7]