



Organisms (Interaction and interdependence) practice questions

13 questions · 46 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 / 46

Integration of body systems **Spec C3.1**

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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5

[6 marks]

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

[illegible]

Defence against disease Spec C3.2

6

[1 mark]

What is the role of thrombin in blood clotting?

- A. ☐ It is released from platelets to start the clotting cascade
- B. ☐ It converts fibrinogen into fibrin
- C. ☐ It binds erythrocytes together directly
- D. ☐ It converts fibrin into fibrinogen

7

[1 mark]

Which of the following is a zoonosis transmitted to humans by the bite of a mosquito?

- A. ☐ Rabies
- B. ☐ Tuberculosis
- C. ☐ Japanese encephalitis
- D. ☐ AIDS

8

[1 mark]

Why are antibiotics not effective against viral infections?

- A. ☐ Viruses are too small to absorb antibiotics
- B. ☐ Viruses have no metabolism of their own for antibiotics to block
- C. ☐ Viruses have cell walls made of a different material from bacteria
- D. ☐ Antibiotics are broken down by the host's immune system

Outline how antibodies against a specific antigen are produced.

The table shows weekly COVID-19 cases per 100 000 adults in one region, in vaccinated and unvaccinated adults. The data are for practice. (a) Calculate the percentage change in cases among unvaccinated adults from week 1 to week 8. [2] (b) Calculate the percentage difference between the case rates of unvaccinated and vaccinated adults in week 8. [2] (c) Suggest one reason, other than vaccination, why cases fell in both groups between week 4 and week 8. [1] (d) Evaluate the claim that these data prove that vaccination reduces infection. [2]

Weekly COVID-19 cases per 100 000 adults (practice data)

Week	Unvaccinated adults	Vaccinated adults
1	420	150
4	610	190
8	280	70

Answer =

11 PAPER 2A STYLE

[3 marks]

Explain why a person infected with HIV for several years is likely to develop opportunistic infections.

[illegible]

12 PAPER 2B STYLE

[6 marks]

Explain how strains of pathogenic bacteria resistant to several antibiotics evolve, and why careful use of antibiotics is needed.

[illegible]

13 PAPER 2A STYLE

[4 marks]

Outline how vaccination of a large proportion of a population can prevent an epidemic.

[illegible]

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]

6. [1]

B B [1]

7. [1]

C C [1]

8. [1]

B B [1]

9. [4]

- antigen (glycoprotein / protein) on surface of pathogen [1]
- specific B-cell binds / interacts directly with the antigen [1]
- helper T-cell activated by the same antigen [1]
- contact with activated helper T-cell activates the B-cell [1]
- activated B-cell divides by mitosis [1]
- forms a clone of plasma cells [1]
- plasma cells secrete the (same) specific antibody [1]
- [max 4]

10. [7]

- (a) $(280 - 420) \div 420 \times 100$ [1]
- (a) = -33.3% / a decrease of 33% [1]
- (b) mean of the two rates = $(280 + 70) \div 2 = 175$ [1]
- (b) $|280 - 70| \div 175 \times 100 = 120\%$ [1]
- (b) Accept $(280 - 70) \div 280 \times 100 = 75\%$ (lower in vaccinated adults) for [1] max only if unvaccinated adults are clearly stated as the reference value
- (c) social distancing / lockdown / mask wearing / more people immune after infection / seasonal change / less testing OWTTE [1]
- (d) supports: vaccinated adults had fewer cases than unvaccinated in every week [1]
- (d) but correlation does not prove causation / data are from one region only [1]
- (d) groups may differ in age / behaviour / testing rate / only three weeks shown / no statistical test [1]
- [max 7]

11. [3]

- HIV infects and kills (certain types of) lymphocytes / helper T-cells [1]
- number of helper T-cells falls over time [1]
- fewer B-cells activated, so fewer antibodies produced [1]
- immune system cannot fight pathogens normally controlled / this is AIDS [1]
- [max 3]

12. [6]

- variation in the bacterial population [1]
- resistance arises by random mutation / gene for resistance [1]
- resistance genes can be transferred between bacteria on plasmids [1]
- antibiotic kills susceptible bacteria [1]
- resistant bacteria survive: natural selection [1]
- resistant bacteria reproduce rapidly / binary fission, passing on resistance gene [1]
- proportion of resistant bacteria in the population increases [1]
- exposure to several antibiotics selects multiresistant strains [1]
- careful use slows the emergence of multiresistant bacteria [1]
- eg prescribe only for bacterial infections / not for viral infections [1]
- eg complete the course / avoid routine use in livestock / hospital hygiene [1]
- [max 6]

13. [4]

- vaccine contains antigens / DNA or RNA coding for antigens [1]
- stimulates a primary immune response without causing the disease [1]
- memory cells produced / retained, giving immunity [1]
- on infection, memory cells give a rapid secondary response, eliminating the pathogen [1]
- if a sufficient percentage is immune, transmission is greatly impeded: herd immunity [1]
- protects people who cannot be vaccinated / are not immune [1]
- [max 4]