HL Paper 3

Outline a mechanism used to transport products of digestion from the lumen of the ileum into the blood.

Markscheme

facilitated diffusion;

substance moves from high to low concentration/ down concentration gradient;

protein channels needed;

does not require ATP/energy / passive;

valid example; *(eg amino acids* / *glucose* / *fructose* / *water soluble vitamins)*

or

active transport;

substance moves from low to high concentration / against concentration gradient;

membrane pumps needed / Na/K pump, Ca^{++};

ATP/energy required;

valid example; *(eg amino acids* / *glucose* / *mineral irons* / *iron)*

or

endocytosis/pinocytosis;

droplets of intestinal fluid surrounded by membrane;

forms vesicle;

vesicles are released inside villus cell;

valid example; *(eg fat soluble vitamins)*

Accept appropriate diagram.

Examiners report

There were good answers, but many answered "microvilli" and/or couldn't label the longitudinal muscles. Most gained all marks about the transport mechanisms, but many seemed to not have understood the question and discussed movement through the digestive tract. Outlining the role of membrane-bound enzymes was difficult, and the marks were gained mainly for examples only.

Antibiotics are sometimes given orally to poultry to prevent disease that may lead to reduced growth. Antibiotic resistance of bacteria from turkeys and chickens bred for meat and from egg laying hens was measured.

Excrement was collected and *Escherichia coli* bacteria were isolated. These bacteria were tested for resistance to a range of antibiotics and the results are shown below.

Number of antibiotics to which *E. coli* are resistant	Turkeys $n = 43$	Chickens $n = 45$	Egg laying hens $n = 20$
0	7	9	13
1	8	5	3
2	7	7	0
3	2	7	3
4	5	7	1
≥5	14	10	0

[Antibiotic resistance of faecal _Escherichia coli_ in poultry, poultry farmers and poultry slaughterers. A. E. van den Bogaard, N. London, C. Driessen, E. E. Stobberingh. _Journal of Antimicrobial Chemotherapy_, 47, June 1, 763--771. 2001, Oxford University Press.]

a. Calculate the percentage risk of bacteria becoming resistant to more than five kinds of antibiotics in turkeys and egg laying hens. [1]

Turkeys:

Egg laying hens:

b. Compare the incidence of drug resistance in bacteria from chickens and egg laying hens. [2]

c. Discuss the hypothesis that giving antibiotics increases antibiotic resistance in poultry bacteria. [2]

d. Suggest how antibiotic-resistant bacteria are passed from animals to humans. [1]

e. Outline the mechanism of the action of antibiotics. [2]

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Markscheme

a. *turkeys:* 33/32.6/32.56 %

egg laying hens: 0 %

Both needed to award the mark.

b. a. none of the egg laying hens have bacteria resistant to 5 or more antibiotics while (10) chickens have bacteria resistant to 5 or more antibiotics;

b. 13/65 % of the egg laying hens have no resistant bacteria while 9/20 % of the chickens have no resistant bacteria;

c. both have approximately same percentage/number of *E. coli* resistant to 1 or 3 antibiotics;

d. egg laying hens have less incidence of antibiotic-resistant bacteria than chickens;

c. a. hypothesis supported for poultry raised for meat but not for egg-laying;

b. turkeys and chickens always have bacteria resistant to more antibiotics than egg laying hens;

c. antibiotic-resistant bacteria are still found in egg laying hens even though antibiotics are rarely given;

d. antibiotic-resistant strains (of bacteria) may have arisen by other means/other than by poultry being given oral antibiotics;

d. from fecal matter to man handling the chickens / by accidental hand to mouth contact / contaminated dust / eating raw meat;

e. a. inhibition of synthesis of walls;

b. inhibition of protein synthesis;

c. inhibition of nucleic acid synthesis;

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b. inhibition of protein synthesis;

c. inhibition of nucleic acid synthesis;

Examiners report

a. Many could calculate the percentages correctly, but demonstrated a total lack of understanding of the data. There was quite a bit of confusion about the poultry being resistant to bacteria rather than the bacteria found in the poultry being drug resistant.

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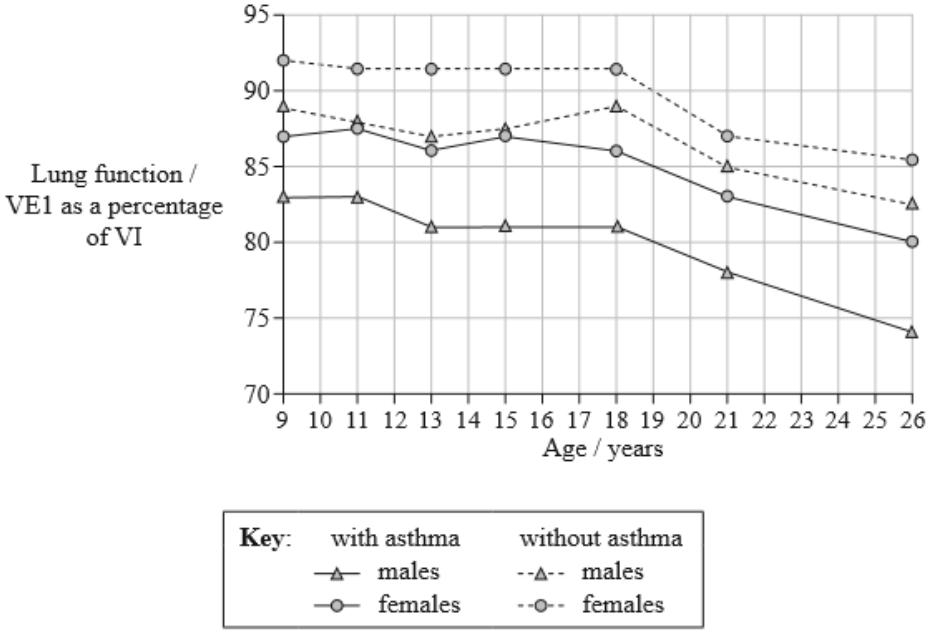
In a long-term study carried out in New Zealand, 9-year-old children were tested for asthma by checking if they had difficulty in breathing (wheezing). The children were then re-tested periodically until they were 26 years old. In addition, a measure was made of how well the lungs functioned by calculating the maximum volume of air exhaled in one second (VE1) as a percentage of the maximum volume of air inhaled (VI). The graph shows the lung function for males and females with or without asthma.



[Source: From *The New England Journal of Medicine*, Malcolm R. Sears, Justina M. Greene, Andrew R. Willan, et al., *A Longitudinal, Population-Based, Cohort Study of Childhood Asthma Followed to Adulthood*, 349, pages 1414–1422. Copyright © (2003) Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.]

a. State the relationship between asthma and lung function. [1]

b. Calculate the change in lung function of females with asthma between the ages of 11 and 26. [1]

c. Compare the data for 26-year-old males and females. [2]

d. Explain how the units used to measure lung function are useful in showing if a person suffers from asthma. [2]

Markscheme

a. (children) with asthma have lower lung function / (children) without asthma have higher lung function

b. 7 % (*units needed*) (*accept answers in the range of 6 % to 8 %*)

c. a. female lung function higher than male;

b. males and females both better (lung function) without asthma;

c. males with asthma have a greater reduction in lung function / greater difference between males and females with asthma than without asthma;

d. a. asthma causes constriction/congestion/inflammation of the airways/breathing tubes/bronchi/bronchioles;

b. units measure ability to exhale quickly/efficiently which could indicate asthma;

Examiners report

a. Answers to questions (a) to (c) were relatively good.

b. Answers to questions (a) to (c) were relatively good.

c. Answers to questions (a) to (c) were relatively good.

d. Candidates were not very clear about the symptoms of asthma and the use of the units in (d), but nevertheless many gained some marks. They were not able to relate the description of the units in the background information to the physiological effects of asthma. Some have the misconception that the bronchioles contract as muscles, or that asthma is due to a problem with gas exchange. Many thought that people breathe out less than they breathe in, and so asthma sufferers had a less efficient gas exchange.

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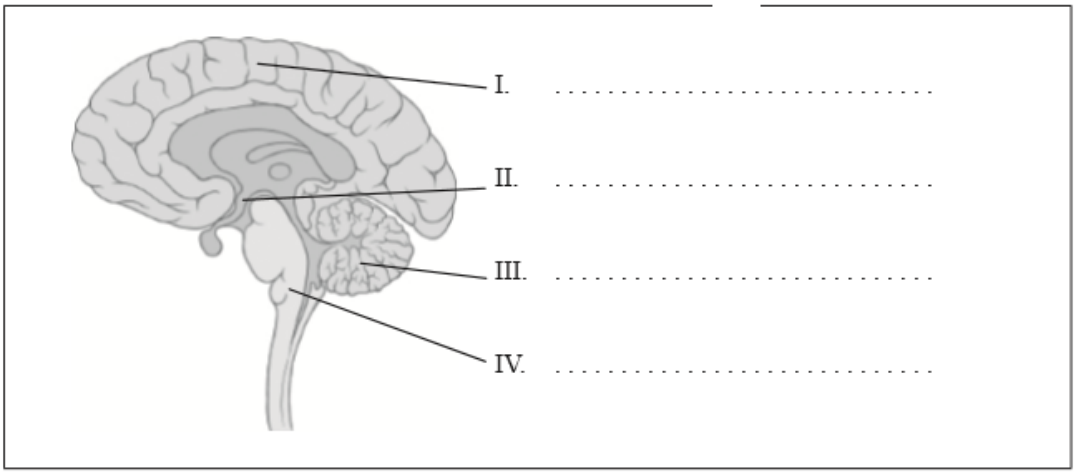
a. Identify the parts of the brain indicated on the diagram below. [2]



Patrick J. Lynch, medical illustrator; C. Carl Jaffe, MD, cardiologist

b. Outline the unconscious control of the heart rate. [3]

c. Describe different aspects of the processing of visual stimuli. [3]

Markscheme

a. I. cerebral hemisphere / cerebrum;

II. hypothalamus;

III. cerebellum;

IV. medulla oblongata;

Award [1] for any two of the above.

b. heart can contract without nervous stimulation/myogenic contractions;

SA node is pacemaker/generates heart beat/initiates each cardiac cycle;

epinephrine/adrenalin speeds up the heart rate;

autonomic/sympathetic and parasympathetic nervous system control;

sympathetic speeds up heart rate;

parasympathetic/vagus nerve slows heart rate (back to normal/resting rate);

c. edge enhancement is greater perception at edges of light/dark areas;

caused by processing in two types of ganglion cell in retina;

contralateral is processing left field of view in right side of brain / *vice versa*;
cross over between left and right sides in the optic chiasma;

convergence is combining impulses from groups of (rod/cone) cells;
done by bipolar cells in retina;

Examiners report

a. Part (a) was straightforward for well prepared candidates.

b. In part (b) candidates were expected to base their answer on assessment statement E5.4 and outline the roles of the sympathetic and parasympathetic nervous systems. Some candidates failed to distinguish between the control of the heart rate by these parts of the autonomic nervous system and the stimulation of the heart beat by the sino-atrial node.

c. Part (c) was answered in great detail by the best prepared candidates, who described edge enhancement, contralateral processing and convergence. There was some misunderstanding of contralateral processing, with candidates suggesting that all stimuli perceived by an eye are processed by the opposite side of the brain, rather than each side of the brain processing stimuli from the same half of the visual field in both eyes.