

HUMAN AND SOCIAL BIOLOGY

Paper 5096/01

Multiple Choice

Question Number	Key	Question Number	Key
1	D	21	D
2	D	22	B
3	D	23	B
4	A	24	D
5	C	25	C
6	D	26	C
7	B	27	D
8	B	28	C
9	A	29	A
10	B	30	B
11	B	31	C
12	B	32	D
13	D	33	C
14	D	34	C
15	C	35	D
16	C	36	D
17	B	37	D
18	C	38	B
19	C	39	C
20	D	40	D

General comments

The standard deviation of 6.87 is similar to that obtained last year. Most questions performed well and only **Questions 8** and **34** were too easy, with a facility beyond .80. These questions required interpretation of experimental, or graphical data, so these good answers were pleasing.

Fewer questions gained a low facility below .25 this year, as shown by **Questions 8, 9** and **34**, although some questions had facilities that should have been higher, for example **Questions 2, 18, 37** and **40**.

Comments on specific questions.

Questions 8

Testing the use of bar graphs to show the nutrients present in eggs proved too easy. The low discrimination is not easy to explain, because apparently some of the more able candidates selected options C and D, that wrongly show fat and sugar are present in eggs.

Question 9

Candidates needed the knowledge that digestion, respiration and protein synthesis are all biochemical reactions using enzymes. The positive distractor suggests they misread option D, which clearly states 'release energy to produce ATP'. ATP is *needed* for digestion, respiration and protein synthesis, but the processes do not *release* ATP. This is a case of not considering the wording of the question carefully.

Question 13

Again more care was needed to read the question carefully. The reason option D was a positive distractor, chosen by half of the candidates, was that they neglected the end of the question stating 'after 24 hours without food'. Without this part of the question this would be the correct answer and such a question is frequently asked. Without food in the intestines, most glucose will be in the hepatic vein, labelled option D leaving the liver.

Question 16

The positive distractor D shows candidates do not know how the vital capacity is represented on a graph and this should be rectified in teaching. Many candidates simply guessed and wrongly read the highest point on the graph.

Question 21

Less able candidates were not able to interpret, that on a hot day without drinking, more ADH is released and this decreases the reabsorption of water. The function of the kidneys in relation to ADH and the water content of the blood is a difficult concept, because the word 'reabsorption' is often not understood and so needs careful explaining.

Question 27

This re-used question from winter 1990 performed much better this time, showing candidates have a pleasing ability to interpret the result of meiosis.

Question 34

This question proved too easy, probably because candidates only needed to know the answers to the first two columns in the table. Generally such experimental questions give difficulty; hence in constructing the question columns 3 and 4 were added to be helpful.

Question 40

Many candidates must have guessed option A because the graph looks a nice regular shape. They needed to know that sewage reduces the quantity of oxygen in water and that when the water is unpolluted, the oxygen level rises as was clearly shown in graph D.

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Paper 2

General Comments

Very few candidates disobeyed the rubric by attempting both **Question 10's**.

The spelling of technical terms was better this year. Interpreting graphs and tables remains an area requiring more attention by many of the candidates. The vast majority of candidates appeared to have sufficient time for their answers. However, it is always good practice to see how many marks are awarded for each section. In a paper like this one, two marks indicates two facts or two statements are expected. Similarly, if four lines are given for an answer, some detail is expected rather than a one-word answer.

Detailed Comments

Question 1 tested various aspects of the blood system. In 1(a), candidates were given a diagram of the heart as seen from the front and asked to show the position of the aorta, aortic valve, bicuspid valve, right atrium and pulmonary vein, using label lines and the letters A to E. Weaker candidates confused left with right on the diagram and also the two valves. However, many examples of full marks were recorded.

In 1(b), a graph of pressure changes in the left atrium, ventricle and aorta against time was provided. In (i) candidates were asked to read off the highest pressures reached in the atrium and the ventricle from the y axis. The answers were 17 and 136 mmHg, although a lee-way of 2 mm was allowed either way, from 15 to 19 and 134 to 138.

In (ii) they were asked to read when the aortic valve opens from the x axis. The answer was 0.21 seconds, but again answers were accepted between 0.19 and 0.23. A lot of candidates put 0.3 or higher having misread the scale.

(iii) What happened at **X** on the graph was that the bicuspid valve opens; blood flows from atrium to ventricle, since the pressure in the atrium is now greater than that in the ventricle. Any of those points could score the two marks. Few candidates could translate what the graph was showing into their knowledge of the action of the heart.

Part **(c)** tested the relationship between structure and function of red blood cells. They are biconcave to increase their surface area to facilitate uptake or unloading of oxygen; their flexibility enables them to squeeze through narrow capillaries; they have no mitochondria so they do not use up any of the oxygen they carry and they contain much haemoglobin so that they can hold lots of oxygen. The last point was the most commonly scored mark here.

Part **(d)** showed a photograph of a blood smear with two white blood cells labelled **F** and **G**. **F** was smaller than **G**, had clear (agranular) cytoplasm, less cytoplasm, and a simple nucleus. **F** was a lymphocyte, **G** was a phagocyte or polymorph. As such, **F** made antibodies, while **G** ingested bacteria. While many candidates found this part of the question easier than the earlier parts, several confused the cell types or even identified **F** as a red blood cell.

Question 2 showed a graph comparing the amount of tooth decay in two groups of children, one having fluoride added to their drinking water, the other not.

Part **(a)** asked what the graph showed about the addition of fluoride. The full answer was that fluoride reduces tooth decay; at all the ages tested. Few saw the point about the ages tested and many said that it *prevented decay*, which was not true.

In (b), the two group curves were similar in that both showed a rise in the number of decayed teeth and both curves showed a marked upward change in the rate of decay after 11 years. The first group more often scored than the second.

Fluoride affects the enamel of the tooth, or the crown.

Question 3 compared the composition of cow's and breast milk in a table.

Parts (a) to (e) could be answered from the table, although some interpretation was required for the last sections.

Water, iron and calcium are present in the same quantity in the two milks.

Lactose, fats, vitamins A, C and D are present in greater quantity in breast milk.

Cow's milk leads to more urea in the baby's blood, since it has more protein.

Babies absorb calcium better from breast milk since breast milk has more vitamin D.

Breast milk has the higher energy value since the table shows it has more lactose and more fats than cow's milk - both were required for the mark.

Disappointingly few were able to link urea and protein, calcium and vitamin D and to see beyond one constituent of the milk as an energy substrate.

Question 4 showed a kidney machine. The part of the kidney that filters the blood, as the machine was shown to do, is the glomerulus or Bowman's capsule.

The dialysis fluid is changed continuously, firstly to remove the wastes that it has collected and secondly, to keep the gradient steep between the blood and the fluid, since the process relies on diffusion.

The fluid is kept at 40 °C to avoid cooling the blood in the machine and, incidentally, to speed up the diffusion process. Very few answers got this temperature point, many referring vaguely to body temperature.

Glucose is added to the dialysis fluid to avoid loss of glucose from the blood (by diffusion), not *to supply energy to the blood*, as many thought.

The haemoglobin sensor attached to the machine is to detect any blood in the dialysis fluid. Should any be found here it indicates a leakage in the membranes, since red blood cells are normally far too large to cross the membrane. Even the use of the word sensor in the question failed to trigger the correct response in many answers to this question.

Question 5 showed two frontal views of the eye under different lighting conditions.

In (a) candidates were asked to label the iris and the pupil. The majority got this right, although there was some confusion between the two and with the cornea and tear duct.

In (b) they were asked to describe how the change (from dim to bright light) was brought about. Most could state that in bright light the pupil got smaller and so scored 2 marks. The rest of the marks came from explaining that this happened because the circular muscles of the iris contracted. There was the usual confusion with ciliary muscles and accommodation. Credit was also given for answers which described the cranial reflex circuit involved here with references to retinal receptors, optic nerve and the brain. With a lot of possible marks here, many candidates managed to score 6.

Question 6 showed a section through an incomplete pit latrine and invited three improvements to be suggested together with explanations for each one.

Answers expected were: fit concrete liner to pit-to exclude rats or prevent contamination of top soil: fit seat and/or plug to make the latrine safer and more comfortable and to seal in the smell or prevent the entry of flies; to fit a mesh over the door to exclude flies. This is obviously a well-understood part of the syllabus, with many candidates scoring all six marks.

Question 7 gave a diagram of a placenta with the umbilical artery and vein labelled **P** and **N** respectively. Blood in the vein differs in composition from that in the artery since it has more oxygen, glucose, amino acids, vitamins etc. and less carbon dioxide, urea. It is necessary to use the terms more and less as shown, since there is some oxygen, some urea in either vessel. Many candidates failed to score here, some even confusing the two vessels or describing the direction of flow, not the composition.

The two bloods must not mix, since they are almost certainly of different groups; the mother's blood is at a higher pressure and will contain pathogens and there is the possibility of rhesus incompatibility. The best candidates often failed to score all three marks here. The placenta secretes progesterone and oestrogen.

Section B

Question 8 showed a map of a small town with three blocks of houses **R**, **S** and **T**, each of which was subject to a number of health hazards. Candidates were asked to explain the possible dangers to health of living in the three named blocks. Whilst this question was well-answered by very many of the candidates, a few gave no reference to which of the blocks they were discussing and so failed to score.

R close to a busy road so there will be noise pollution and the possibility of accidents.

The exhaust fumes contain carbon monoxide, leading to haemoglobin damage or even anaemia; lead pollution with its effects on children's learning and various particulates and dusts leading to breathing problems. The pond is a source of mosquitoes and hence the possibility of malaria or dengue, and of snails and hence a risk of schistosomiasis.

S has no mains water and so must use the wells. But these are close to the latrines and so could easily be contaminated, either in times of flooding or by vectors such as flies. Hence there is a risk of diseases such as cholera, typhoid, dysentery etc. or of intestinal worms. The proximity of the rubbish dump increases the chances of flies and of rats, the latter being vectors of leptospirosis.

T has no mains water, so inhabitants must either use the river or cross the road to reach the wells.

In either case, there is a danger of waterborne diseases or of pollution from upstream.

The swamp is a possible breeding ground of mosquitoes and/or snails, hence malaria and schistosomiasis. The river may flood in the wet season bringing risk of drowning.

Many candidates showed good knowledge here and scored well. However, a significant number referred to the pond or swamp as *breathing grounds* for mosquitoes!

Question 9 dealt with the neurone and the reflex arc. From the lack of detail shown in many answers it was apparent that this area is one that many find difficult to learn.

A neurone is a single nerve cell whilst a nerve is a bundle of many such neurones.

The stimulus of heat is detected by (heat) receptors in the skin of the fingers. Each receptor generates volleys of impulses which travel to the spinal cord in a sensory neurone, entering via the dorsal root. In the grey matter, the sensory neurone synapses with a relay neurone, which synapses in turn with a motor neurone. This leaves the cord via the ventral root and runs to an effector – here, this is a muscle in the arm, such as the biceps. Impulses arriving at the muscle cause it to contract and pull the hand away from the hot pan.

The circuit is called a reflex, since it is an automatic response to a stimulus, the brain is not involved.

As indicated above, this question was often poorly done with few details quoted. Where diagrams were used they usually gave no further information than had already been scored in the description.

Question 10 Either concerned the inheritance of albinism. Part **(a)** asked how it was possible for two phenotypically normal parents to have an albino child. Candidates were told that albinism is due to a recessive allele **a** and they were to use **A** and **a** in their explanatory diagram. The small percentage of candidates that answered this question usually scored well here. The commonest error was not to identify the albino as **aa**. The diagram expected was:

Parents	Aa	x	Aa	
Gametes	A	a	A	a
F1 genotypes	AA	Aa	Aa	aa
				aa is the albino.

Part (b) asked for descriptions of the parts played in such an inheritance by the gene, allele, and meiosis.

The gene is a piece of DNA, coding for a particular characteristic, which here is pigmentation. Each can exist in two or more forms called alleles. One allele (here A) is dominant and produces its effect (pigmentation) whenever it is present, either as AA or Aa. The other is recessive- no pigmentation- but is only expressed if no dominant allele is present. Each individual has two such alleles for each characteristic.

Paired alleles are carried on paired chromosomes in the nucleus of every cell. Each chromosome is a long thread-like structure consisting of protein and DNA.

During gamete formation, a special kind of cell division called meiosis occurs in which the chromosome pairs are split, so that only one chromosome (and so only one allele of each pair) passes into each gamete.

This explanation was usually very sketchy with considerable confusion between gene, allele and chromosome.

Question 10 Or was answered by the majority of candidates. In (a), the mechanisms of four methods of birth control were tested for 12 marks.

The contraceptive pill is made of oestrogen or progesterone or a mixture of the two. Taken daily it produces high levels of these hormones in the blood and so prevents ovulation. Thus there is no egg to be fertilised. The IUD or coil is a metal or plastic device inserted into the cervix. It prevents implantation of any fertilised eggs or embryos. The condom is a rubber sheath that covers the erect penis. It collects the semen discharged during intercourse and so prevents the sperm from entering the vagina. The cap is a cup-shaped diaphragm inserted into the vagina to fit over the cervix. Usually used in conjunction with spermicides, it prevents sperm entering the cervix from the vagina.

There were many good answers here with candidates displaying a thorough acquaintance with this part of the syllabus. However, there were a number of common errors among the weaker candidates. Some thought the pill *destroyed the egg* or even *the sperm*. The positioning of the coil was often quoted as the uterus or the vagina; and its effect to *stop the sperm from reaching the egg*. The condom was the best understood of the methods and its role in preventing STD's was often quoted. The cap was the least understood, especially in terms of its positioning.

In (b) candidates were asked to state three advantages of family planning.

The answers could include: to limit the number of children in the family; to space the children, so enabling the mother to recover fully between births; to ensure each child has adequate nutrition and to improve the quality of life in terms of more attention for each child, better education affordable etc.

Reducing the need for abortions or reducing the spread of STD's were not considered viable answers here.