

# HUMAN AND SOCIAL BIOLOGY

Paper 5096/01  
Multiple Choice

## General comments

A total of 347 candidates sat this paper and a standard deviation of 9.38 (23.45%) was obtained, with a mean score of 24.42 (61.1%). The standard deviation has considerably improved over that for last year, while the mean score remains very similar. The discriminations (point biserials) were particularly good, with 21 questions obtaining above 0.50. However, these statistics should be interpreted with caution because of the much smaller entry this year. Only **Questions 20** and **22** did not perform as expected. **Questions 1, 28** and **32** proved too easy as each obtained a proportion correct above 800. However, the discrimination was satisfactory in each case and indicates a good standard of answers by the candidates.

Only seven questions obtained a proportion correct below 500 and for the two lowest questions the score was 310. This shows a pleasing improvement in the overall standards, which may be due to the smaller entry being more selectively chosen.

## Comments on specific questions

### **Question 1**

Although the discrimination of 830 is a little high, Examiners prefer an easy starter question to the paper to boost confidence in the candidates.

### **Question 20**

No doubt some of the more able candidates knew that there is cartilage at the sternum, position 2, but they should have realised there are not joints present for cushioning. This would explain the low point biserial of 0.18, although the proportion correct (780) shows most candidates could work out that cartilage is present at the joints between vertebrae and at the knee. It is possible that some candidates did not realise that adjacent vertebrae form joints (fixed), so they avoided choosing those options concerned with the vertebrae, including the correct one (key D).

### **Question 22**

This is not an easy question because the detailed function of each part of the kidney tubule needs to be thoroughly known. With much sweating, the blood becomes concentrated and needs to retain water. Less water will pass into the Bowman's capsule (distractor A). For the correct answer, candidates needed to know that most water is reabsorbed into the blood from the collecting ducts (key D). This is where the main difference will occur with excessive sweating. In this situation the water reabsorption is not significant at the convoluted tubules (distractors Q and R).

### **Questions 28 and 32**

Both these questions were very well done and had high proportions correct. In both cases they tested fairly detailed specific knowledge. Such results together with many other questions with good proportions correct, show good standards by the candidates taking this paper.

# HUMAN AND SOCIAL BIOLOGY

Paper 5096/02

Theory

## General comments

The paper produced a wide range of marks from the candidates. Very few failed to observe the rubric concerning **Question 10**, and where only two B section questions were submitted, it seemed not to be due to a shortage of time. Once again, weaker candidates often failed to read the question carefully before answering or took no notice of the mark allocation, so failing to score as well as they might.

## Comments on specific questions

### Question 1

- (a) Nitrogen is the additional element found in all proteins.
- (b) Foods A and B contain protein; B has protein and lipid, while C has only carbohydrate.
- (c) A simple apparatus was shown with which to measure the energy content of a food sample burned below 50g of water in a boiling tube. The temperature of the water is taken before and after burning the food sample. The water is stirred so that the temperature is even throughout the tube. Nearly all candidates got this point.
- (d) If it takes 4.2J to raise the temperature of 1g of water by 1° C, then a rise in temperature of 30°C represents  $30 \times 50 \times 4.7 = 6300\text{J}$ . Many candidates forgot to allow for the mass of the water in their answer.
- (e) Theoretical results for food samples are invariably much higher than given by this apparatus. This is mainly because glass is a poor conductor and so much heat escapes without heating up the water. Answers suggesting that larger masses of the food were tested were also allowed here.
- (f) Showed a table of the different energy requirements of people of different ages measured as kilojoules per kilogram of body mass.
- 1 The male of 25-50 is more active than the male at 60-80 and so has a greater energy requirement.
  - 2 The child at 0-1 is growing faster than the child at 4-9.
  - 3 The male of 25-50 has more muscle tissue than the equivalent female (who has more fat). Muscle tissue uses more energy. Relatively few got these last two points.
- (g) Large fat globules in the small intestine are converted into tiny fat droplets by bile, while lipase digests these to fatty acids and glycerol. Bile is made in the liver; lipase in the pancreas. A high proportion of candidates got these marks.
- (h) The arteries labelled H are the coronary arteries. If these are blocked by fatty deposits a heart attack may occur, since they supply the muscle of the heart with oxygen and food. Weaker candidates seemed to think they took blood into the chambers of the heart.

**Question 2 (a)** was concerned with two of the processes in the nitrogen cycle. These were nitrification and nitrogen fixation.

**Part (b)** was a graph of crop yield at different amounts of fertiliser. Two points remained to be plotted. Most candidates completed this correctly.

In **(b) (ii)** candidates were asked to describe what the graph showed. There were several possible points: as fertiliser is added the yield rises steadily; from 2.6 tonnes per hectare to 4.7 tonnes; the fertiliser addition of 150 kg per hectare. If further fertiliser is added, the curve flattens; rising only from 4.8 tonnes per hectare. Good candidates scored their 3 marks with ease but weaker ones failed to note the figures or to see the point of inflection in the graph. This remains an area that needs practice.

**Question 3** showed a synapse between two neurons at high magnification and described the sequence of events when an impulse crosses this synapse. All the information needed to answer **(a)** and **(b)** was provided in the question.

Chemical transmission is one-way; from neurone 1 to neurone 2, since only 1 has the vesicles of transmitter and only 2 has the receptors for that transmitter. Both points were needed for the two marks indicated.

The time delay is caused by the diffusion of the chemical - a slow process in comparison with electrical transmission down the fibres of the neurone.

The evidence that the cell uses energy to make the transmitter is given by the high density of mitochondria in the bulb. This last mark proved the easiest to score.

**Question 4** began by stating that the matrix of a bone consisted of collagen fibres and calcium salts and went on to show the results of two different treatments of a long bone. In G the bone was soaked in acid for several days, after which it became flexible. This is because the calcium salts have been dissolved leaving only the collagen, which is tough but flexible. In H the bone was heated strongly for several hours after which it became brittle. This is because heat destroys the tough collagen, leaving only the calcium salts, which are brittle. It was surprising to see so many candidates believing that the heat removed the calcium salts and the acid the collagen.

Two advantages of bone being alive are that it can both grow and heal, if broken. Most candidates scored these two marks, even if they failed to score the first four.

**Question 5** showed the life cycle of *Schistosoma*.

- (a)** Three ways apparent from the diagram to reduce the spread of the disease were: prevent faeces and urine from reaching water supplies; destroy the snails; do not bathe or drink in infected water and treat the infected humans with drugs.
- (b)** A common age to become infected is 5 or 6, since this is when children are likely to play in water that may be infected.
- (c)** There are three larval stages in the life cycle, since each is adapted to a particular function in that cycle: the miracidium to find and infect the snail; the redia to reproduce within the snail and the cercaria to swim and infect the human being.

Although the last part was not well explained, many candidates scored well on this question.

**Question 6** dealt with aspects of the circulation. In **(a)** the blood vessels, by letter, were W, X, S, S and T respectively.

**(b) (i)** The blood supply to the liver differs from that to the kidney in that there are two supplies to the liver - the hepatic artery and the portal vein.

**(ii)** The reason for the difference is that the liver must process the foods absorbed from the gut, before they enter the general circulation.

There was a lot of guesswork in **(a)** and **(b)** proved a problem for many candidates.

**Question 7** showed a flow chart of the sequence of events that take place when the skin is cut. Once again, all the necessary information to answer the questions was contained in the diagram.

- (a)** Two end-results are that a clot is formed and the arterioles constrict.

- (b) A low platelet count will increase clotting time, since fewer activators and/or elastic fibres are released.
- (c)1 Removal of calcium ions from stored blood prevents clotting, since calcium is needed to convert prothrombin to thrombin.
- 2 Chilling will slow enzyme action and several enzymes are shown to be involved in clotting.

While good candidates could find the information in the diagram, weaker ones were not able to do so and scored poorly here.

## Section B

**Question 8 (a)** Large quantities of sewage are treated in a sewage works as follows: the material is passed through grids to remove sticks, paper, etc. It is then passed to a sedimentation tank to collect the solids. The liquor is treated by aerobic bacteria in either a trickling filter or an aerated tank. In each case the organic matter is converted to inorganic salts and gases such as carbon dioxide. In the trickling filter a series of food chains convert the bacterial protoplasm to protozoal, nematode and insect bodies. Algae use the inorganic materials and release more oxygen. The sludge is passed to a digester tank where anaerobic bacteria break it down and release methane which can be collected and burned to generate energy to run the pumps. The final sludge product can be dried and used as fertiliser. Several candidates conveyed the bulk of this information in a large flow chart which saved some time for them. Some Centres mis-interpreted this as cess-pit treatment, which does not count as large quantity treatment.

(b) Two latrines were pictured and candidates were asked to point out 4 differences, explaining why each was an improvement. Suitable observations included:

Deeper pit, so less chance of overflow and a longer period of use;  
 screen over door to exclude flies;  
 concrete lining to pit, to exclude rats;  
 lid on pit to reduce smell and exclude insects;  
 wider base, to increase stability and further prevent rats from entering.

Most candidates could see several of these points and many scored all 4 here.

**Question 9** tested knowledge of hormones, using named examples.

(a)(i) This question sought to illustrate the statement that a hormone is made in one place in the body but has its effect in another.

Marks were given for a suitable hormone example; where it was made; what its target tissue or organ is and a reference to its travel in the blood.

In (ii) a suitable 'quick-acting' hormone should be named e.g. insulin, glucagon, adrenaline etc.; what it does, and contrast this to a 'slower' hormone such as estrogen, progesterone etc. and what it does.

(iii) Hormones that act all our lives might be represented by ADH, what it does and why; whereas estrogen acts only from adolescence to menopause.

10 marks were given for this section.

There was often some confusion about 'slow' and 'quick' hormones and between periodic and 'all-time' hormones.

(a) Here a flow chart illustrated the feedback loop controlling thyroxine amounts in the body. Candidates were asked to use this to explain what would happen if thyroxine levels threatened to rise too high.

Answers expected were:

The pituitary gland activity would be depressed;  
so less TSH secreted;  
less growth of thyroid gland;  
less secretion;  
of thyroxine;  
so levels fall.

Although 5 marks were shown as the allocation for this part, many candidates limited themselves to one or two observations and so scored poorly.

#### Question 10 Either

- (a) This section asked what happens to protein, glucose, urea and water in the kidney and was worth 10 marks.

Protein stays in the blood, since its molecules are too large to filter at the glomerulus into the Bowman's capsule.

Glucose is filtered but all is reabsorbed at the proximal convoluted tubule by active transport.

Urea is also filtered out of the blood but most of it passes through the tubule to the ureter to be excreted.

Water is filtered but about 99% is reabsorbed in the tubule; most of that in the proximal convoluted tubule but also some in the loop of Henle and the collecting duct.

This is a familiar section of the syllabus for many candidates and many good answers were noted.

- (b) Here candidates were asked how the kidney helps to save water, if a person is sweating heavily.

The increase in concentration of the blood is detected at the hypothalamus. The pituitary gland is triggered to secrete more ADH. This travels to the kidney in the blood, where it causes the distal convoluted tubule and the collecting duct of each nephron to become more permeable. Thus, more water is reabsorbed into the blood, so that the urine is more concentrated and of a lower volume.

This was often well described, although weaker candidates were sometimes confused between the concentration of the blood and the urine.

#### Question 10 Or

- (b) Three similarities between the egg and the sperm might include:

Both are single cells/ gametes; they are formed by meiosis and so have the haploid number of chromosomes (23). They are short lived. Up to 3 marks were awarded here.

- (b) Fertilisation is the fusion of the nuclei of the egg and the sperm. It occurs in the oviduct and forms the zygote.

Implantation occurs after fertilisation and takes place in the uterus, when the now ball of cells sinks into the lining of the uterus.

There was quite a lot of confusion in this section.

- (c) It is necessary to prevent maternal and fetal bloods from mixing, since they may be of different blood groups; the maternal blood may contain harmful bacteria and is certainly of too high a pressure for the fetal capillaries.

Many candidates knew at least two of these points.

- (c) Mothers who smoke when they are pregnant are likely to have smaller babies for the following reasons:

Carbon monoxide poisons haemoglobin, so that blood carries less oxygen. Hence the fetus has a lower respiration rate and so has less energy for growth. Nicotine can cross the placenta and will constrict the fetal arterioles, so that less food and oxygen pass to the fetus. Hence, less growth of the fetus giving a smaller baby.

4 marks were available here. Most candidates knew about carbon monoxide but were less sure of the effects of nicotine.