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## Question 1

1ai There were some well-drawn diagrams where the tubules and the loop of Henle were clearly distinguishable. Others however, and there were many, lacked too much clarity to award full marks. Many candidates tended to draw just one tube extending from the Bowman's capsule or attempted to add to the blood vessels protruding from the top of the capsule. Candidates working at lower levels were mostly unable to complete the diagram accurately but were generally awarded a mark for showing the proximal convoluted tubule.

1aai A few candidates failed to measure the distance in millimetres (mm) and divided a value measured in centimetres (cm) to arrive at a final answer, despite the question stating clearly that the measurement should be given in mm. Others measured in cm but then carried out an incorrect conversion to mm. Some candidates proceeded to multiply the distance by 650 rather than divide indicating uncertainty in working with magnification calculations. There were many responses that divided the measured value by 10 or 100 and some that carried out quite complex calculations that were difficult to make sense of.

1aiii Surprisingly many answers included glucose or urea as a blood component that would not pass into the Bowman's capsule and others tended to give the same marking point twice e.g. red blood cells and white blood cells. Some candidates gave just abbreviations for components without further detail e.g. wbc and rbc – these were not awarded.

1bi Several responses gave temperature or time intervals for taking measurements as variables to control throughout the investigation despite these already being considered as part of the investigation. Answers scoring one mark often included the volume of water above all other marking points although students working a higher levels also recognised that the amount of exercise also needed to be controlled for a second mark. Choice of wording cost some candidates marks. For example, the concentration of water rather than volume or the amount of food rather than the same type of food were often seen in responses.

1bii Candidates failed to gain marks for dividing by 6 to calculate a mean (and arriving at a final answer of 118 rather than 178) rather than dividing by 4. This was frequently seen in responses that overlooked information given in the introduction to the question referring to the mean rate of urine production on day 1 in  $\text{cm}^3$  per hour.

1biii Some responses failed to make it clear which day was being referred to which meant that answers remained unclear and could not be awarded marks. From the responses seen, there was a clear misconception amongst candidates where many stated that sweating did not occur at the lower temperature (rather than stating less sweating), others stated that more water was lost through urine at  $30^\circ\text{C}$  (day 2) which confused further details given. There were a fair number of students that lost sight of the context of the question and just described the role of ADH and/or sweating. Again,

these failed to gain any marks. Some candidates confused the role of ADH stating that more water was lost as urine due to more ADH being secreted (and vice versa). Several marks were lost here as other details included in the responses meant that the science given was incorrect.

There were many candidates that clearly failed to understand that sweating takes place all the time, not just in warmer temperatures and responses inevitable included incorrect information suggesting that no sweating took place at the lower temperature. Similarly, many students stated that no ADH would be secreted on the cooler day rather than less ADH

## Question 2

2ai Most candidates understood that it was better to breathe in through the nose rather than the mouth and the majority of responses referred to sticky mucus trapping bacteria. Many students mentioned blood capillaries but failed to state their role. There were a vast number of answers given by candidates that described the role of blood capillaries in gas exchange or allowing more oxygen into the body rather than warming inhaled air. In fact, it was rare to see answers that included information about air being warmed or moistened. Some responses stated that it would be better to breathe through the mouth for the simple reason that you could take in more oxygen or air this way.

2aia There were many one mark answers; candidates generally understood that the rings of cartilage allowed air to flow freely and a good number gained a second mark by extending their answer to include information on how the cartilage prevented the collapse of the trachea (although many preferred to state that the cartilage kept the trachea open).

2c There were some very complicated calculations shown in the space for working out inferring that candidates misunderstood the passage or misinterpreted the question. Quite often candidates gained at least one mark for showing working out, some of which was correct although some of the details given were confusing and presented poorly making it difficult to make any sense of. However, there were a good number of fully correct responses where calculations were able to use the information given in the passage to present their calculations and final answer clearly.

2d Overall a well answered question with the majority of candidate responses covering all marking points. Some students failed to gain a mark for stating that 'growth (of fetus) is affected/altered' or that it causes 'problems with growth' without clarification – these answers were too vague to award. Other answers included details about nicotine and tar and how it affects the mother rather than describe the effects of smoking on the growing fetus. Some candidates were clearly unaware of the harmful effects of smoking on a growing fetus. These candidates gave information such as the baby would have breathing difficulties or that it could get lung cancer.

### Question 3

3a The two most common correct answers given for this question covered marking points 1 and 2 where candidates gave the role of the skin in protection from pathogens and were also aware of the skin as a sensory receptor. Many candidates repeated their answer twice. For example, gave two pieces of information linked to protection and so could only be awarded one mark. There were very few responses that mentioned the role of the skin as an excretory organ but too many providing details linked to temperature regulation which were not credited due to the nature of the question being asked.

3b Candidates working at higher levels tended to gain 3 out of the 4 marks available for their responses. The last marking point – to lower body temperature – was often missed which tended to prevent answers getting full marks. There were many candidates that went into far too much detail on aerobic respiration and oxygen supply and left themselves little room to gain any marks for the expected answer. Marks were not gained for use of incorrect terms such as 'heat is evaporated' or for vague descriptions such as skin gets *darker* or simply that it *affects* the colour of the skin. There were explanations on how more blood flowed to muscles to pay the oxygen debt making the skin look more pale and there were several responses that confused the red colour of the skin with increased melanin production.

3ci Most candidates scored one mark for stating that as the temperature of the skin increased the rate of sweating increased. Many were confused on the gradients of the graph at rest with a large number of candidates suggesting that the steeper the gradient the faster the rate of sweating. Despite the question asking specifically about the person at rest, some candidates included irrelevant details about the person exercising. There were very few answers that mentioned the rapid increase in sweat production between 35.9 °C and 38 °C.

3cii Some responses were very vague. For example, collect or measure sweat without stating clearly how it was to be collected or measured were commonly seen. Similarly, there were many answers that mentioned measuring the mass of the person before and after exercise which is an unrealistic and unreliable measure of sweat production. Other incorrect answers included measurement of skin temperature or measure the volume of water drunk and compare this to the amount of urine produced. There were a good number of 2 mark answers that mostly covered marking points 1, 2 or 3. The use of cobalt chloride paper was not seen at all.

3d There were a fair few responses that implied candidates were overhung with information from the previous questions on sweating and proceeded to discuss thermoregulation and the importance of sweating. Some candidates just stated that enzymes would be affected and others went into further detail to include information on how enzymes were affected at higher and lower temperatures.

#### Question 4

4a ii Injection 1 was the preferred method that was highlighted in student responses although the reasons given for this were not always correct. There was a definite lack of understanding of passive immunity – the majority of candidates seemed not to understand that antibodies were injected but rather were produced more quickly in the body following the injection. Similarly, the term immunity seemed to be misunderstood and students failed to recognise that passive immunity only gives short term protection. There were a fair number of responses that included poor terminology such as *killing* or *fighting disease* or *fighting pathogen* rather than destroying.

4b There was the usual mix-up between antibodies and antigens. For example white cells produce antigens. There was also a lot of unnecessary detail given by candidates that went beyond the expectation of Level 2 and although not incorrect in some cases, this information was not awarded. The first four marking points were the most popular with students and although many made an attempt at including the fifth an implication that the production of antibodies on reinfection was *faster* was frequently omitted. There was also some confusion about memory cells were produced and despite the mention of these cells in several responses they could not be awarded as the science was incorrect.

#### Question 5

5b Responses tended to score a maximum of two marks for this question with most candidates recognising that stereoscopic vision involved two eyes. The second mark most often came from an awareness that two eyes enabled better depth of vision or better judgement of distance. Although marking point two was included in some responses, it was rare.

5c This was generally well answered with candidates recognising that the investigation had to be carried out with one eye closed and then both eyes open. In describing this, some students were too vague and stated that a person with stereoscopic vision and a person without stereoscopic vision were needed in the investigation. All marking points were covered equally across the responses seen and candidates were well aware of control measures to be taken during the activity, most mentioning the distance of the ball thrower to the ball catcher.

#### Question 6

6a The most common incorrect answer given in the table was hormones rather than chemicals to describe the type of signal carried by the hormonal system. Poor use of terminology was seen fairly often. For example, chemical impulses or electric/electricity rather than electrical.

6bii It was clear that candidates did not realise to use the diagram to help them answer this question. There were some very vague answers which often omitted to state where neurotransmitters were released from and many that confused the vesicles with neurotransmitters. Some responses were detailed in some areas including information such as vesicles fusing with the membrane and releasing neurotransmitters into the synapse but then failed to incorporate key terminology such as diffusion or other detail in their answer. Many responses just detailed a normal nerve pathway, from receptor to effector with no other information provided.

6biii The question was a challenge for a fair number of candidates. It was very rare to see a response gain full marks. There were several candidates that made a good attempt at explaining how an impulse can only travel in one direction across a synapse but weren't quite clear enough in their wording to gain more than one or two marks. The most common marking points awarded were marking points 3 and 4 where several candidates recognised that the neurotransmitter would move from high to low concentration and that their receptors were found only on the post-synaptic membrane.

### Question 7

7ai There were few candidates able to score both marks for their response to this question although a fair number recognised that both males and females were affected. A vast majority of responses mentioned that it would only affected males if it was sex-linked with some attempting to describe a sex-linked disorder rather than focus on the expectations of the question. Marking point 2 was rarely seen in answers although several students gave the actual numbers of males and females affected by the disorder.

7aii This was another challenging question for students who seemed unable to structure their answers with the clarity needed to award many marks. Some candidates failed to interpret the pedigree correctly and overlooked the fact that that parents produced offspring with and without Huntington's chorea. There were few responses that attempted to describe that the condition was present in a heterozygous genotype but many less students that that stated that only one allele was needed for the condition to be expressed in an individual.

7bi The most common maximum mark for responses was two out of the three marks available. The majority of candidates were able to correctly give the probability that the child would be male with slightly less giving the overall probability of 50%. It was pleasing to see that a good number of students were able to give the probability of the child not having the disease for marking point two and although some answers reversed this to give the probability that the child would have the disease these were awarded the mark.

7bii Despite being clear in the information given in a previous question that stated Huntington's chorea was not a sex-linked disorder, many candidates lost marks by drawing a genetic diagram that showed sex linkage. There was clearly some confusion here and these responses were not awarded. However, a good number of students were able to gain the majority of the marks available, not necessarily for specifically including individual marking points in their answers but because the detail given was very strongly implied. For example, candidates that understood person 3 to be homozygous recessive for marking point 1 were also awarded a mark for marking point 2 for recognising that this person did not carry the faulty allele. The least commonly awarded mark was marking point 3 – it was particularly rare to see any detail in responses that implied the father of person 2 was not affected by the disorder.



