General Comments

Although this paper produced a relatively good spread of marks, it was evident that the majority of students performed very well on questions requiring factual recall. This is shown by the high percentage of students scoring high marks on Question 8 and on parts of questions relating to definitions. In the longer recall questions, there were some very impressive answers with students displaying an excellent understanding of the unit content covered on the examination paper. However, some of the relatively simple calculations proved more challenging than expected as did questions with synoptic links to the biological principles of units 1 and 2. Conversely, the questions involving interpretation of data presented graphically were generally well answered. Parts of Question 7 relating to How Science Works proved troublesome for some students but gave others the opportunity to show their understanding of a topic, or to demonstrate analytical skills. Poor powers of expression often prevented students gaining credit, although it was also evident that many of these answers were based on a poor understanding of biological concepts.

Question 1

(a)(i) Almost ninety percent of students correctly identified process P as being nitrification.

(a)(ii) Slightly fewer students correctly identified process Q as being denitrification.

(b) Very few students gained both marks in this question. The most common error was to suggest that nitrogen-fixing bacteria fix nitrogen to form nitrate rather than ammonia. Approximately half the students obtained one mark for indicating that the crop would be able to produce amino acids or proteins. Weaker answers simply stated that nitrogen was needed for better growth.

(c) Most students gained at least one mark by referring to a decrease in the water potential of the soil. Many students mentioned water loss from the plant but did not always refer to osmosis or diffusion to gain a second mark. Some students suggested that fertilisers would move into the plant by osmosis, or would alter the pH of the soil. Other students misinterpreted the context of the question and described the effects of eutrophication.

Question 2

(a) The vast majority of students gained the mark for explaining what is meant by the term population. Incorrect responses generally referred to all the species in a habitat.

(b) Over ninety percent of students were able to provide two factors which could lead to a decrease in the death rate. Students failing to gain the mark often gave at least one factor which would increase the death rate.

(c) It was disappointing that less than a third of students were able to calculate a percentage increase. Common incorrect responses included 64% and 391% indicating that students could read the graph correctly but did not know what to do with the figures obtained.

(d) Over ninety percent of students gained one mark for describing in various ways that more individuals would survive. Approximately a third of these students referred to an increase in average life expectancy to obtain the second mark point. A significant number of students used the survival curve for 2007 rather than for 1960 and were restricted to a maximum of one mark.
Question 3

(a) Two out of three students gained at least one of the two marks, often for linking the large number of eggs to a large sample size. Approximately twenty five percent of students obtained the second mark, usually by suggesting why the small size or distinct markings made the fruit fly a useful organism for studying genetic crosses. A third of students scored zero as they often provided two features of the fruit fly but no explanations of how these features were useful.

(b)(i) Almost seventy percent of students obtained full marks. Students scoring zero often completed an autosomal cross with no reference to the sex chromosomes, or showed an allele for eye colour on the Y chromosome. Students gaining two marks often showed the red-eyed males with a white-eyed genotype.

(b)(ii) The most common correct responses related to random fertilisation or a small sample size. Slightly more than half the students did not gain the mark, with many using the terms random, or chance but not in the correct context.

(c) Most students gained at least one mark for explaining that males have one allele that determines their phenotype. Better answers then provided a variety of suitable explanations as to why females were less likely to express a phenotype controlled by a recessive allele on the X chromosome. Weaker answers often referred to dominant or recessive genes/chromosomes, or used incorrect terminology, e.g. homologous rather than homozygous.

Question 4

(a) Very few students gained all three marks as most students failed to use all the relevant data to show that succession had occurred. The vast majority of students gained one mark for linking the change in species to a change in abiotic conditions, more soil or a less hostile environment. Approximately a third of students gained a second mark for explaining that the increase in depth of soil was caused by the death/decay of plants. Only the better answers then linked the decrease in bare ground/surface water to the presence of more plant species.

(b) Approximately forty percent of students scored zero on this question, as they simply described how succession provided a less hostile environment for all species of organisms. Most students obtaining a single mark explained that the increase in plant species would provide more niches/habitats. However, less than a third of students then explained that the increase in plant diversity would provide more food sources.

(c)(i) The vast majority of students gained at least one mark for this question and almost thirty percent gained both marks. Common correct responses referred to the method of marking organisms not affecting their survival, no immigration/emigration and the need to allow time for marked organisms to reintegrate into the population. Random sampling on its own was not credited, neither were references to the population not increasing or decreasing unless there was further qualification.

(c)(ii) The vast majority of students correctly calculated the number of sand lizards to gain both marks. A minority of students obtained an answer of 51, having interpreted the second sample size as being 30 rather than 20, and were awarded one mark.
Question 5

(a)(i) Slightly more than two-thirds of students correctly identified the stroma as the precise location of the enzyme Rubisco. Common incorrect responses included the ‘matrix’, ‘grana’ and ‘cytoplasm’.

(a)(ii) Most students correctly gave the answer of two as the number of carbon atoms in one molecule of phosphoglycololate. The most common incorrect responses were three and five.

(b) The majority of students clearly understood that, as the oxygen concentration increased, more Rubisco/RuBP reacts with the oxygen rather than with carbon dioxide. However, very few students realised that this was an example of competitive inhibition or mentioned that less RuBP would be regenerated. Consequently, most students obtained only one of the two marks available.

(c) This proved to be a good discriminator. Most students gained one mark for realising that less glycerate 3-phosphate would be produced. A significant percentage of these students then gained a second mark for describing the formation of a named photosynthetic product from triose phosphate. However, less than ten percent of students referred to less RuBP being regenerated. Weaker answers often included references to the Krebs cycle rather than the Calvin cycle and linked the uptake of oxygen to respiration.

Question 6

(a) Approximately half the students correctly calculated the rate of oxygen uptake as 0.8 arbitrary units.

(b)(i) Most students gained two marks for this question. They linked the uptake in oxygen to aerobic respiration and then provided one of a range of correct responses to explain the decrease in uptake including: oxygen/glucose becoming limiting, ethanol causing death of cells and, most commonly, anaerobic respiration occurring. Very few students gained a third mark by linking the increase in uptake of oxygen to the growth/reproduction of the yeast cells. Weaker answers linked ethanol production to oxygen uptake, or suggested that the yeast would carry out photosynthesis.

(b)(ii) The vast majority of students appreciated that the ethanol was produced during anaerobic respiration. However, only half these students linked the increase in ethanol production to the fall in oxygen uptake. Relatively few students referred to the decrease in ethanol production as the glucose was used up.

(c) Overall this question was well answered by students. The role of oxygen in the ETC was well known and there were some very clear answers that gained all three marks. The decreased uptake of oxygen and the earlier and greater production of ethanol were often described. Occasionally, the sodium azide was believed to have no effect on ethanol production. NADP was sometimes included rather than NAD in descriptions of the ETC and there were disappointing references to energy being produced. Some confused responses suggested that oxygen was needed for ethanol production and without oxygen being used, no ethanol would be produced. Weaker answers described yeast as a plant and referred to the Calvin cycle.

Question 7

(a) Very few students were able to suggest two advantages of using the LC50 to determine the effect of a pesticide. Correct responses usually referred to not killing
all the tadpoles, or for comparing different pesticides. Incorrect responses were often rather confusing and focused on statistical tests, finding the most cost-effective concentration or on reliability.

(b) This question proved to be relatively straightforward for most students, who often gained at least two marks. They appreciated that previous studies have been carried out mainly on one species of toad and for a relatively short time period. However, many students did not make the link between a biotic factor and a predator. In fact, there was a significant minority of students who described a biotic factor as being temperature or pH.

(c)(i) The majority of students gained at least one mark, usually for explaining that the scientists could see the effect without the newts being present. Less than half these students gained a second mark for mentioning that the scientists would see the effect of the pesticide on the tadpoles. Students failing to gain any marks often simply stated that experiment 1 was a control with no further qualification.

(c)(ii) Almost ninety five percent of students gained at least one mark, usually for the idea that the newts are visible to the tadpoles. More than half these students gained a second mark for stating that the barrier prevented the tadpoles being eaten by the newts.

(d) Most students had difficulty obtaining both marks on this question. Many students gained a mark for explaining that the tadpoles would be exposed to the pesticide for a longer time period, as they stay in the water. However, relatively few students linked the smaller size of tadpoles to a larger surface area to volume ratio and even fewer students mentioned a shorter diffusion pathway.

(e) This proved to be a very demanding question, with two-thirds of students scoring zero. Most students failed to understand why a range of concentrations of the pesticide was used. Many answers only described finding the most effective concentration to use, to see the effect on other organisms or to see if the tadpoles developed resistance; to get a reliable mean, to identify anomalies or to use a statistical test also featured. When marks were awarded, it was usually for the idea of the pesticide building up in the environment, being diluted or for the idea of finding the lowest effective concentration that causes least harm to the environment.

(f) Weaker answers were limited to responses such as ‘to obtain valid results’, ‘see effects in the real world’, or suggested that these investigations would be cheaper. However, better answers showed appreciation that these investigations would enable scientists to see the effects of abiotic factors on the pesticide and/or the effect of the pesticide on other organisms.

Question 8

(a) This question was well answered by students with over eighty percent of students obtaining three or more marks. The most commonly awarded marks were; electrons becoming ‘excited’, energy being released from the ETC, energy being used to form ATP from ADP and Pi and details of the photolysis of water. Marks were often not awarded because of references to chlorophyll absorbing light rather than light energy (or photons), or for referring to NAD being reduced rather than NADP. However, it was clearly evident that this topic is well understood by most students, with many answers including factual details well beyond the requirements of the specification.

(b) This question was also very well answered and produced a higher mean mark for students than part (a). Students had little difficulty in explaining the reasons for the
low efficiency of energy transfer through ecosystems. Although all the mark points were readily awarded, there were a few common misconceptions. A significant number of students referred to energy being used in respiration and this was not credited. A major issue was that many students referred to the excretion of faeces, or used excretion in other inappropriate contexts. A-level Biology students should also avoid using terminology such as ‘warm blooded’.

(b) This question proved to be a relatively good discriminator and provided a good spread of marks. There were some excellent answers where students provided a detailed account of speciation, clearly linking this process to the context of the question. At the other end of the range, there were references to plants becoming ‘immune to copper’ and considerable confusion between genes and alleles. Most students referred to a mutation, to an allele providing ‘resistance to copper’ and to differential reproductive success. Better answers mentioned the ‘allele for copper resistance’ and often appreciated that the frequency of the allele would increase in future generations. Far fewer students mentioned ‘variation’. A significant minority of students provided a description of succession, often in addition to explaining speciation.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.