AP® Biology
2003 Scoring Commentary

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Question 1

Sample 1B (10 points)
This is an example from a student who is very well prepared to answer the question. The student is able to identify parental genotypes, describe sex-linkage, and use the Punnett square to demonstrate the F1 expectations. This paper also illustrates the fact that the readers could allot a fourth point in Part (a) for the F2 reasoning although the student has written this after saying he or she is starting Part (b). The student gains all 4 points for Part (b) quickly and cleanly: hypothesis, setup of table, calculation, and degrees of freedom. The student could have gotten a point as well for the correct explanation of the importance of p, but the student had already achieved the maximum score in this section. In Part (c) the student describes mutation and base pair substitution, then elaborates with an example, thus already going beyond the 10 points possible. Then the student correctly describes an inversion and gives a further example, thus earning the maximum points again, even after having received the full points for the question. In other words, every possible item with a point value in the rubrics has been included by this student.

Sample 1E (6 points)
This is an example of a mid-range response. In Part (a) the student explains how the data show sex-linkage. The example shows a correct if unconventional use of symbols to describe the F1 expected progeny and the parental genotypes. No fourth point is given because the student merely says which phenotype is dominant but gives no explanation of why this is known. In Part (b) the student earns points for describing the hypothesis (expected values) , setting up the problem according to the formula, and calculating Chi-square = 2. The student uses the wrong critical value and gets no fourth point here either. Part (c) earns no points, since the genotype can change without mutation having occurred.

Sample 1F (8 points)
This student has done quite well. The student receives all 4 points for Part (a): parental genotypes, Punnett square and explanation of F1 progeny, description of dominance, and, later, a Punnett square and explanation of the F2 expectations. In Part (b) however, the student gets only 2 points: for the hypothetical expected values and the use of the formula to set up the data. The calculation is incorrect, as are the degrees of freedom. In Part (c) the student earns the last 2 points for a definition of mutation and for a nice explanation of the consequences of mutation in terms of protein function.

Sample 1G (8 points)
This is also an example of a student who has done quite well. In Part (a) the student uses the correct parental genotypes, describes dominance and, with a Punnett square, describes the F1, therefore getting 3 points. In Part (b) the student shows the correct hypothetical expected values and sets up the problem correctly using the formula, but the calculation is incorrect and there is no interpretation of the result. In Part (c) the student correctly defines mutation, describes a deletion mutation, and goes on to provide an example, therefore getting the final 3 points. No points can be given for inversion, because it is described in terms of inverting amino acids and not DNA.

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Question 2

Sample 2E (10 points)

In first paragraph, the recognition of photoperiod as the stimulus for flowering earned a point. The description of recognition incorporating phytochrome and the pattern and ratio of red (night) and far-red (day) forms was awarded two points. These points were awarded as elaboration only after the point-earning explanation in the third paragraph that the length of the dark period at night was the important factor. The maximum total of four point for part (i) were then awarded, so no points were awarded for the correct description of the concept of florigen in the fourth paragraph.

The identification of ADH as a water balance mechanism, the explanation of increase urine concentration and elaborating description of changing water permeability in the collecting duct earned three points. Identification of adlosterone as a mechanism earned the final point available in this section, so the explanation of aldosterone's action and the description of nitrogenous wastes were not awarded points.

Identification of vasodilation as a mechanism for cooling at the surface, and its effects on heat loss at the periphery were awarded an explanation point. Having already reached 10 points, the identification and explanation of sweating and panting do not garner additional points.

Sample 2F (8 points)

In the first paragraph, shivering is awarded a point as a mechanism, but it did not receive explanation points. The mechanism of increased insulation earns a second point and the "help trap heat in" explanation is awarded the third point. A third mechanism, sweating was also explained by evaporation, and worthy of a point, but the internal maximum had been reached, and no more points were available.

In the second paragraph, ADH mechanism is identified but not explained, earning one point, so the aldosterone explanation point must precede the awarding of its mechanism point.

In the third paragraph, stomates gain a mechanism point, but they are not explained-- the guard cell relationship to stomate opening is opposite to this description.

Sample 2G (7 points)

In the first paragraph, the comment that photoperiod change for floral induction was evident for one point. The night-length-measurement explanation earned a second point. In the second paragraph, Phytochrome involvement in photoperiod measurement earned a point.

In the third paragraph, identifying stomates gained a mechanism point, and the explanation of their role in water movement is clear and elaborated for two additional points. The activity pattern of CAM plants was awarded a second mechanism point in this section, reaching the internal maximum and disqualifying the explanation point.

The fourth paragraph describes only general aspects of kidney functions.

Sample 2H (5 points)

In the first paragraph, pollination is confused with regulation of flowering. The identification of the epidermis as a water-regulation mechanism and explaining that it prevents desiccation earns two points in the second paragraph.

The description of the long loop of Henle and the explanation in terms of salt concentration in the urine earns two additional points.

The mention of panting as a heat regulation mechanism without an explanation earns one point.

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Question 3

Sample 3A (10 points)

Part (a) In this section all three points for a description of the curve were awarded. Note that the carrying capacity or global point was given above and beyond the three point maximum for this part of the question. The value of having a global point is that it can be given above the internal maximum for the question.

Part (b) The first factor described is awarded two points as the student takes us through a complete cycle. This first example concerning food resources also shows both a solid cause and effect and a linking to the graph. The completion point showing a complete cycle of a fluctuation can only be given once. The student earned the maximum of four points in this section.

Part (c) One point was awarded for an explanation of exponential strategies and one point for an explanation of logistic strategies. The student did not attempt to answer the second part of the question concerning the discussion over time. However, the student has earned the maximum score of 10.

Sample 3B (7 points)

Part (a) One point was awarded for the exponential nature of the graph and one point for the deceleration of the growth as it approaches carrying capacity.

Part (b) Two points were awarded for the discussion of predation. Notice how the rise of predators is tied to the fall of the prey followed by the drop in predators and subsequent rise in prey. This is what the graders referred to as cause and effect. It would not have been adequate to just write that the cycle could be caused by predators. The student addressed predator/ prey carefully but gained no points on a casual mention of several other factors.

Part (c) The student explained *r*- and *K*-strategies for two points. The explanation of exponential growth came close, but ended not with a sharp drop but with a note that if conditions are not perfect the population is not affected. However, they did get the logistic growth over time point.

Sample 3C (9 points)

Part (a) The most commonly given point, the exponential point, is earned. The student gives a plausible reason for the shape of the curve, but the question only asked for the student to describe what is happening in the population, not to explain why.

Part (b) Student earns two points for the description of a complete cycle of the graph. It was possible to earn points even with broad categories, resource competition in this case, as long as the example shows cause and effect and is tied to the graph. The other two examples both earn a point allowing the student to earn the maximum of four points.

Part (c) All four points are earned in this section. Graphs alone do not collect any points, but in this case the graph coupled with the explanation helped to show changes in population size over time.

Sample 3F (5 point)

Part (a) The first two parts of the graph are explained and points are awarded. We did not see students declaring this an exponential curve with a constant growth rate until the inflection point. Students seemed to interpret the introductory portion of the graph as a lag or establishment period.

Part (b) Disease was a commonly mentioned factor and could work as long as the student stressed the cyclical nature of the disease or diseases and not a cataclysmic, one time disaster. The discussion of food was awarded one point. Had the completion point not been given already it could have been given at this point.

Part (c) This portion of the question was not attempted.

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Question 4

Sample 4D (5 points)

In part (a), 2 points were awarded for how cell death affects function when skin cells die and when DNA damaged cells stay in an organism. In part (b), 2 points were awarded for degradation of glucose to products and its discussion. In part (c), 2 points were awarded for selection based on variation and differential reproduction.

Sample 4E (7 points)

In part (a), 4 points were awarded. Cell death in infected cells and in the formation of xylem were used as examples. When discussing infected cells, 1 point was awarded for how cell death affects functioning, and one point for an elaboration on how cell death occurs. Using xylem as the example, 1 point was awarded for how cell death affects development and 1 point for how CD affects function. In part (b), 2 points were awarded for degradation and discussion. In part (c), 1 point was awarded for differential reproduction.

Sample 4G (9 points)

In part (a), 4 points were awarded. Examples of cell death used were with embryo development and removal of cells with damaged DNA. 1 point was awarded for the development of fingers, 1 point for discussion of the p53 gene, 1 point for the development of aging since it is being used as a consequence in overexpression of p53, and 1 point for how aging affects the functioning of the organism. In part (b), 3 points were awarded for how a substance is degraded, how a product is being used, and a discussion on reuse in a cell. In part (c), 2 points were awarded for selection and differential reproduction.