AP® Physics B
2005 Scoring Commentary
Form B

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Question 1

Sample: 1A
Score: 10

This concisely written response received the maximum score of 10 points. Although the symbol F_n is not specifically identified with the reading on the scale, it is implied by the work shown, which is correct. Showing work is always helpful for possibly awarding partial credit if some of the work is incorrect.

Sample: 1B
Score: 6

In part (b) only the units for the quantities involved are written down; no solution is attempted so all 3 points for this part were lost. The point for part (c)(ii) was also lost because the net force exerted on the student in the elevator is calculated instead of the force exerted by the platform scale. The other parts are answered correctly and received full credit.

Sample: 1C
Score: 4

The response earned 2 points for the free-body diagram in part (a) and 1 point in part (b) for recognizing that the solution begins with Newton's second law. One point was awarded in part (c)(i) for the correct lower limit of the time interval. The point for part (c)(ii) was lost because the weight of the student in the elevator is calculated instead of the force exerted by the platform scale. No points were awarded for part (d) because only discrete times are given, not time intervals as required.

Question 2

Sample: 2A
Score: 10

The maximum of 10 points was awarded for this extremely well-written response. The steps in the solutions to parts (b), (c), and (d) are very clearly explained with much detail.

Sample: 2B
Score: 7

Full credit was awarded for the answers to parts (a), (b), and (d). But the 3 points for part (c) were lost for treating the swinging pendulum in its lowest position as an equilibrium situation instead of recognizing that the bob is making a circular arc, thus needing nonzero net force on it to provide a centripetal acceleration.

Sample: 2C
Score: 5

One point was lost in (a)(i) for the extraneous force shown on the free-body diagram. Although a point was given in part (b) for the use of conservation of energy, the point for carrying through the calculation to obtain the final answer was lost. The 3 points for part (c) were lost for treating the swinging pendulum as being in equilibrium instead of moving in a circular arc. But part (d) is answered clearly and correctly and received full credit.

Question 3

Sample: 3A
Score: 14

This well-written response lost only 1 point in part (a). An error was made in the expression for the cosine of the angle resulting in an incorrect answer, so the point for the correct expression for the magnitude of the force was lost. Although the graph in part (d) incorrectly contains points of inflection near the origin, the essential features of the graph for which points were awarded are correct, so full credit was awarded.

Sample: 3B
Score: 10

Although the approach used in solution to part (a) in this paper is correct, the cosine of the angle disappears in the last step of the solution so the final answer point was lost. The direction of the force is shown both by the arrow in the diagram in the solution and by stating that the force was at 0°. One point only was awarded in part (c) for the correct electric potential due to the $-Q$ charge, but parts (b) and (d) received full credit.

Sample: 3C
Score: 5

Part (a) received only 1 point for recognizing that the net force on the $-Q$ charge is obtained by the addition of the forces due to each of the other two charges. But the direction of the net force and the value for the distance between the charges are incorrect, and instead of vector addition the magnitudes of the forces are added. One point was lost in part (b) for failure to obtain the expression for the magnitude of the net electric field. Two points were given in part (c) for recognizing that the potential is the sum of three terms and having one of them correct, but no credit was awarded for part (d).

Question 4

Sample: 4A
Score: 15

This paper received the maximum score of 15 points. Although the outline form is not used in part (c), this was not required, and the steps in the procedure are very clearly described. The answers to the other parts are also very clear and complete.

Sample: 4B
Score: 11

One point was given in part (b) for the diagram of the setup, but the other details, such as the labeling and the identification of all the measurements needed to be made, are incomplete and no further points were awarded for this part. Another point was lost in part (c) for indicating that the sound level at the point equidistant from the two speakers would be zero, when it should be a maximum. The remaining parts to the question are done well and received full credit.

Sample: 4C
Score: 6

Two points were awarded for part (a) and also in part (b) for the labeled diagram of a correct setup of equipment. However, none of the distances to be measured are shown, so 2 points were lost. One point only was given for part (c) since the description of the setup and the measurements to take are incomplete, and there is no indication of the need to find the positions of maximum or minimum sound intensity. Part (d) contains a number of equations, some of which are irrelevant to this problem, which appear to have just been copied from the equation list. Although two of the equations needed to answer this part are present, they are not combined in any coherent fashion, so only 1 point was given for this part. Part (e) received no credit.

Question 5

Sample: 5A
Score: 10

The maximum score of 10 points was awarded for this well-written response. Although the steps used to eliminate terms in Bernoulli's equation in part (b) are not explicitly stated, it is clear from the subsequent work that the steps are taken correctly.

Sample: 5B
Score: 6

Part (a) was awarded 2 points for the relationship between force and pressure and for the expression for the gauge pressure of the water at the plug. But 1 point was lost for failing to include atmospheric pressure in the expression for the force exerted by the water. Another point was lost for using the height of the plug from the bottom of the tank instead of the height of the water above the plug in the expression for gauge pressure. Part (b) received full credit, but part (c) received no credit since the equations written are not appropriate to the calculation of the volume flow rate.

Sample: 5C
Score: 3

Part (a) lost 1 point for failing to include atmospheric pressure in the expression for the force exerted by the water. But the correct value for the height of the water above the plug is used in the expression for gauge pressure, and the ensuing calculation is correct and consistent with the error, so no further points were lost. Although an expression for Bernoulli's equation is given in part (b), there is no indication of it being applied to the top of the tank and the height of the drain, so no credit was given. Also, no credit was given for part (c), which shows no relevant work.

Question 6

Sample: 6A
Score: 10

This response received the maximum score of 10 points. It illustrates good graphing techniques and an understanding of how to compute the value of a quantity from experimental data.

Sample: 6B
Score: 6

This response received the point for part (a) but fails to include atmospheric pressure in the expression for the total pressure on the gas in part (b). Since the rest of the calculations are correct, 1 point was awarded for part (b). In part (c) the axes are labeled correctly and the data points plotted are generally consistent with the incorrect values in part (b), but the first and the middle points are not plotted correctly so 1 point was lost. In part (d) 1 point was awarded for the best-fit line and another for recognizing the need to determine the slope. But the calculation of the slope is based on the first and last data points in the table, which is inconsistent with the line drawn in the graph because the *P* axis is not scaled with zero at the origin, so no further points were awarded.

Sample: 6C
Score: 4

This response received 1 point for the ideal gas law in part (a) but then uses this relationship to try to compute the pressures in part (b), expressing them in terms of *n*, the number of moles. Since determining the number of moles is the purpose of the experiment, no credit was awarded for part (b). The data points are correctly plotted in part (c) consistent with the incorrect values in part (b), so this part received full credit. Although a line is drawn for part (d), there is no indication of the need to use the line or the data from the graph to determine the answer, so this part received no credit.

Question 7

Sample: 7A
Score: 10

This response received the maximum score of 10 points. In each part intermediate values are first calculated, which are then used in subsequent steps. This approach is sometimes more time consuming than deriving a final expression for the quantity to be determined and then substituting the numerical values, and can lead to rounding errors in the answer, but the approach is acceptable.

Sample: 7B
Score: 7

One point was lost in part (a) for leaving off the exponent in the value for the wavelength and thus failing to obtain the correct final answer. In part (b) 1 point was awarded for setting up the relation correctly, but the substitution for power is incorrect (the unit of megawatts was used instead of milliwatts) leading to an incorrect answer, so 2 points were lost. However, parts (c) and (d) are answered correctly and received full credit.

Sample: 7C
Score: 4

Part (a) is answered correctly and received full credit, but part (b) received no credit because it does not show an understanding of how to setup the needed relationship correctly. By attempting to use the photoelectric equation, the answer to part (c) displays a lack of knowledge of what is meant by the stopping potential, so this part also received no credit. But part (d) did receive full credit because the answer is consistent with the incorrect answer to part (c).