APPENDIX A: STUDENT PERFORMANCE ON FINAL CUE QUESTIONS

Q#	Points	Short name	Student Performance Average Score (correctness + explanation) *Correctness only*				
			A	B	C	SD (%)	Gain*
Q1	5	V of theta	55 *57*	49 *52*	61 *63*	47	
Q2	5	Cube	44 *52*	25 *32*	56 *64*	40	28
Q3	5	Cube far away	43 *45*	29 *37*	38 *42*	33	
Q4	5	Images	64 *77*	65 *87*	38 *52*	35	
Q5	5	Super-position	55 *66*	21 *23*	32 *38*	39	38
Q6	5	Current Loop	41 *46*	29 *35*	24 *28*	32	
Q7	5	Gauss	61 *74*	46 *60*	46 *59*	36	19
Q8	5	Delta function	66	52	65	41	
Q9	10	Reference for V	49 *68*	24 *45*	36 *64*	35	31
Q10	10	Sketch E cylinder	54	65	68	27	22
Q11	6	BC's on E and V	31	36	23	28	
Q12	22	Graph E and V of disk A B C D	57 43 78 57 57	66 35 61 68 66	62 25 56 58 62	24	17
Q13	5	Cartesian BC's	45 *79*	36 *68*	30 *74*	32	
Q14	8	Dielectric	60	49	36	29	
Q15	5	Circle BC's	82	68	69	38	
Q16	5	Multipole	52 *79*	45 *77*	20 *62*	39	
Q17	7	Ampere	43 *71*	29 *45*	34 *66*	29	35

All problems on the CUE, including point allocations and student performance. This data is intended to enable comparison of rubric-reliability on individual items, and to allow instructors administering the CUE to compare student performance on individual items with our published results. Those items with a "gain" score also appear on the pre-test and are indicated with an asterix (*). Student performance is taken from the N=103 students in the three mostly-traditionally taught classes which used the final form of the exam: Classes A, B and C described in "Methods: CUE Administration." Student averages are given as the overall student average (%) in courses A, B and C, sequentially. The next line reports the average student percent correct (in italics) when "correctness" was able to be coded separately from other considerations such as explanation. This is followed with the average standard deviation for that question across courses (standard deviation was similar for all courses, varying by no more than 6%). The Gain is calculated by subtracting the student's score (%) for that question on the pre-test from their score for that question (%) on the post-test, and then averaging for the N=25 students who took the final form of the pre-test (in Course A), as well as the post-test. Total exam is worth 118 points.