

FEEDBACK FROM CONTESTANTS, PHYSICS CUP 2018.

Feedback was submitted by 23 contestants, out of whom four got more than 4 points, seven got score between 2 and 4 points, ten — between 0.5 and 2 points, and two remained at 0 points.

Importance of awards. 13 participants selected answer “what motivates me the most is the possibility to learn new physics ideas and compare my skills with peers”; 5 contestants felt that “Awards definitely motivate me”, and another 5 opted for “Awards are not that important (although nice), it is enough to have diplomas and published ranking list”.

Difficulty level of the problems. It seems that overall, it was OK. The question “Was the second problem too easy?” received 7 votes “Yes”, 12 votes “No, at least one such problem needs to be in the set”, and 4 votes “No, and it would be even better if there were more such problems”. The question “Was the fifth problem too difficult?” got 5 answers “Yes, but problems 3 and 4 were OK”, 8 answers “Yes, and problems 3 and 4 were too difficult, too”, and 10 answers “No, at least one such problem needs to be in the set”. It appears that it is impossible to meet all the expectations, and the difficulty level of the whole set provided a reasonable compromise.

Favourite, second favourite, and least favourite problems.

The number of votes is shown in the table below, followed by specific comments.

Problem	favourite	second	least
Loop's inductance	8	4	2
Resistor grid	6	3	3
Brownian motion in vacuum	3	5	3
Relativistic acceleration	2	8	3
V-shaped vessel	4	1	5

Loop inductance, why was good: “Amazing idea.” “Not able to do it, but it seemed very interesting.” “I particularly enjoyed this problem due to the divergent integral solution and the use of ferromagnetic boundary conditions.” “Difficulty in finding an exact solution, and learning new concepts (use of characteristic scales in physics).” “Even though I didn't have correct solution I learned many things trying to solve it (it would have been nice if hints were more useful, hints were too general, at least first ones).” “The solution is really tricky.” “I like electromagnetism most out of all physics areas.” “The answer was intuitively obvious, and the solution seemed really elegant. I was elated, when I obtained exactly the same answer I guessed in the beginning”.

Loop inductance, why was not so good: “That is too difficult”.

Resistor grid, why was good: “The solution of the problem is simple.” “Favourite not as this competition problem (finding the bounds), but because of how the exact resistance can be found. I haven't encountered Fourier series method when dealing with resistance circuits before.” “I had figured out a new technique to figure out arbitrary resistance values.” “I like electromagnetism most out of all physics areas.” “Cool ideas, and not much calculation required.” “The unusual idea of using inequalities was what made it really good.” “I like this topic, but I think the infinity is irreality and so interesting.”

Resistor grid, why was not so good: “I found it somewhat uninteresting. There were no great physical thought behind it, in my opinion.”

Brownian motion in vacuum, why was good: “I like thermal physics and I found that situation extremely interesting. I had never thought about such Brownian motion.” “Many different approaches connected various parts of physics together.” “Un-

fortunately I didn't have time to think about this problem, but it seemed very interesting.” “I like problems which require order of magnitude estimates, they can be done really fast (say, 20-30 minutes), while revealing a lot about the system's properties. It simply highlights the beauty and power of physics.”

Brownian motion in vacuum, why was not so good: “That's too hard to understand what is happening.” “I didn't know the idea behind this problem, because solving this problem requires the knowledge of statistical mechanics which is not taught in high school.” “To me, it was unreachable.”

Relativistic acceleration, why was good: “I like relativity problems. And also it was the first one I solved using rapidity.” “I enjoyed a lot the geometrical solution of this problem, using the $x - ic\tau$ diagram.” “That's so easy that I can solve it!” “I like relativity.” “An interesting problem.” “It was a nice boost of moral.”

Relativistic acceleration, why was not so good: “Problem was too easy, but it required too much writing (at least in the way I solved it).”

V-shaped vessel, why was good: “I was wrong two times.” “I realized best the procedures though I couldn't solve, because I couldn't find the right expression for the centre of mass.” “The phenomenon was simple in principle, but it was the model you chose that demanded accurate calculations.”

V-shaped vessel, why was not so good: “I didn't enjoy a lot this problem because even though you were required to find the velocity dependence on coordinates, it was very difficult to do all the sums by hand (the first and second derivative and also the integrals).” “This seemed to be too technical, although I understand the motivation behind that.” “It was just very calculative.” “Much math less physics.” “I don't like fluids, mostly since I'm not good with them.”

Comments and suggestions.

“It would have been nice if there were fewer hints (once every two week) and if there were more time for each problem also it would have been great if competition started earlier.”

Reply: it is a good suggestion — start earlier and give more time for each problem. But it would also take more time from me — so, at least in 2019, it will be still the same format...

“For certain countries (like ...) where idiotic, objective college entrance exams, amongst others, litter the last year of high school, especially the January-to-May time (these exams test only speed, accuracy and calculations...), it would be slightly more convenient if the problems were given on a weekly basis...”

“Difficult problems are okay, however I would have liked them less challenging on the mathematical side and more on the conceptual one.”

Reply: in general, I concur. There was, indeed, one fairly mathematical problem (the V-shaped vessel), the purpose of which was to make sure you would not be surprised when you start going deeply into theoretical physics that you also need to be skilful in math. Still, we'll try keeping mathematical side as simple as we can.

“I enjoyed a lot this competition and if necessary I would be willing to help create future editions of this competition.”

“I hope there will be more than 5 problems.”

Reply: maybe in the future, we'll be able to start the competition earlier (e.g. in October) so that there would be enough time for 6-7 problems...