

Problems of the XI International Olympiad, Moscow, 1979

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The XI International Olympiad in Physics for students took place in Moscow, USSR, in July 1979 on the basis of Moscow Institute of Physics and Technology (MIPT). Teams from 11 countries participated in the competition, namely Bulgaria, Finland, Germany, Hungary, Poland, Romania, Sweden, Czechoslovakia, the DDR, the SFR Yugoslavia, the USSR. The problems for the theoretical competition have been prepared by professors of MIPT (V.Belonuchkin, I.Slobodetsky, S.Kozel). The problem for the experimental competition has been worked out by O.Kabardin from the Academy of Pedagogical Sciences.

It is pity that marking schemes were not preserved.

Theoretical Problems

Problem 1.

A space rocket with mass $M=12t$ is moving around the Moon along the circular orbit at the height of $h = 100$ km. The engine is activated for a short time to pass at the lunar landing orbit. The velocity of the ejected gases $u = 10^4$ m/s. The Moon radius $R_M = 1,7 \cdot 10^3$ km, the acceleration of gravity near the Moon surface $g_M = 1.7$ m/s²

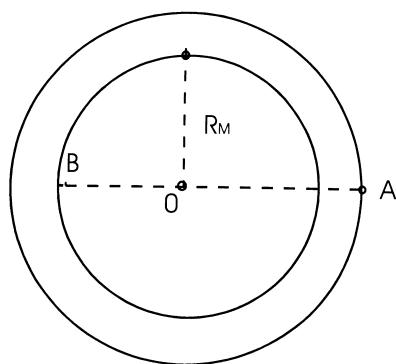


Fig.1

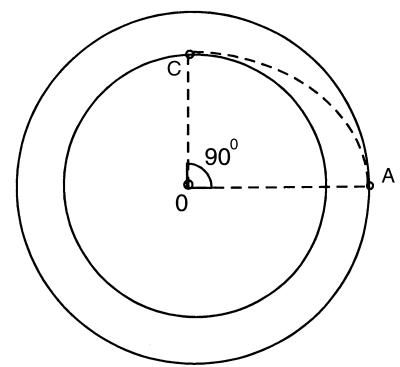


Fig.2

- 1). What amount of fuel should be spent so that when activating the braking engine at point A of the trajectory, the rocket would land on the Moon at point B (Fig.1)?
- 2). In the second scenario of landing, at point A the rocket is given an impulse directed towards the center of the Moon, to put the rocket to the orbit meeting the Moon surface at point C (Fig.2). What amount of fuel is needed in this case?