International Astronomy and Astrophysics Competition
Qualification Round 2019

Problem A : Planets and Stars (5 Points)

(1) ≈ 8	(2) solar eclipse	(3) Jupiter	(4) Mercury
(5) ≈ 88	(6) Sirius	(7) 200 ± 150	(8) Andromeda

Problem B : The Size of Jupiter (5 Points)

(a). 1326 Earths
(b). 319 times

Problem C : Space Race to the Moon (5 Points)

Bob wins. (Time Alice: 768 hours, Time Bob: 741 hours)

Problem D : Forces between Earth and Moon (5 Points)

(a). $F(r_1) = 0 \implies r_1 = d\frac{\sqrt{M_E}}{\sqrt{M_E}+\sqrt{M_M}} = d\left(1 + \sqrt{\frac{M_M}{M_E}}\right)^{-1}$

(b). Missing aspect: angular velocity of objects (causes additional L-points).

Problem E : Polar Lights (5 Points)

sun activity (e.g. storms) $\rightarrow$ charged particles (electrons, protons) $\rightarrow$ interacting with earth's magnetic field $\rightarrow$ follow trajectory of magnetic field to poles $\rightarrow$ ionization and excitement of atoms in atmosphere (higher state) $\rightarrow$ atmosphere atoms emit light (return to ground state) $\rightarrow$ colors depending on gas (oxygen: yellow, green; nitrogen: reg, violet, blue)