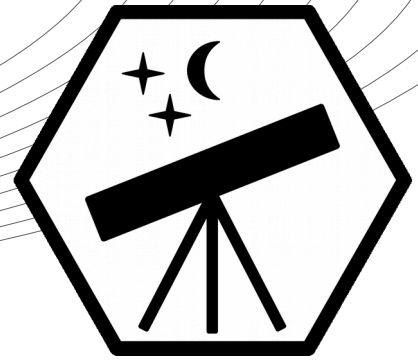


# International Astronomy and Astrophysics Competition Qualification Round 2019



## Problem A : Planets and Stars (5 Points)

- |                  |                   |                   |               |
|------------------|-------------------|-------------------|---------------|
| (1) $\approx 8$  | (2) solar eclipse | (3) Jupiter       | (4) Mercury   |
| (5) $\approx 88$ | (6) Sirius        | (7) $200 \pm 150$ | (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: red, violet, blue)