

# The Problems of the Teoretical Part of the 1<sup>st</sup> International Astronomy Olympiad in 1996

## Grades 8-10

1. Why is it sometimes better to use a small telescope in orbit around the Earth than it is to use a large telescope on a mountain top?
2. A thick black fly has dotten onto the object lens of a 5 cm telescope. What will an observer looking to the Moon through the telescope see?
3. Explain why we see more meteors from midnight to dawn than from evening to midnight.
4. The 12 Zodiacal signs are equally extended on the ecliptic. In which of them does the Sun lie in for the shortest period?
5. On 1 cm<sup>2</sup> of Pluto's surface fall approximately 10,000 photons per second from a star of the fifth magnitude. How many photons would fall on a detector from a star of 20<sup>m</sup> during half an hour, if BTA at the Earth is used (the diameter of the main mirror is 6 m)?
6. The sun has a parallax of  $\pi_s = 8''.8$ , and a star with the same absolute brightness –  $\pi_* = 0''.022$ . Is it possible to observe the star at night sky visually?
7. The moon set in St.Petersburg (60° North, 30° East) yesterday just at midnight. In what region of the Earth will there be an opportunity to observe a total solar eclipse sometime next week?
8. A spaceship landed on an asteroid 2.2 km in diameter with an average density of 2.2 g/cm<sup>3</sup>. The asteroid is slowly rotating. The cosmonauts decided to travel along the equator of the asteroid in a rover in 2.2 hours. Will it be possible for them to do such a thing? If the answer is negative, why? If the answer is positive, what do they take into account?

## Grades 11-12

1. Why might some stars appear double in blue light through they could not be resolved in red light?
  2. Why can radio astronomers observe during the day, whereas optical astronomers are (for the most part) limited to nighttime observing?
  3. Why is it better for some purposes to use a medium size telescope on a mountain instead of a telescope on a spaceship at low orbit near the Earth?
  4. What are the reasons why the Hubble Space Telescope is able to observe fainter objects than we can study from the ground?
  5. The moon set in St.Petersburg (60° North, 30° East) yesterday just at midnight. In what region of the Earth will there be an opportunity to observe a total solar eclipse sometime next week?
  6. Altair ( $\alpha$  Aquila) has a parallax of  $\pi = 0''.198$ , proper motion  $\mu = 0''.658/\text{year}$ , radial velocity  $V_r = -26 \text{ km/s}$  and visible brightness  $m = 0^m.89$ . When and what would be the minimum distance of Altair to the Sun? Also find the brightness of Altair at that point.
  7. Recently the 10 meter Keck telescope began to operate on Mauna Kea (Hawaii), where the diameter of stellar images may be as small as 0''.3. Can you evaluate the limiting stellar magnitude for visual observation with this telescope?
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