

## OIA 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 dotted 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  $1 \text{ cm}^2$  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  $20^m$  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 ( $60^\circ$  North,  $30^\circ$  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  $2.2 \text{ g/cm}^3$ . 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 ( $60^\circ$  North,  $30^\circ$  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  $m = 0''.658/\text{year}$ , 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 Ten-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?

On the practical part problems were the following:

### Grades 8-12

Paper with a drawn circle and table of maximal elongations of Mercury and Venus had been done for participants.

1. The figure show a circle, that is the orbit of Earth. By using data from the table, draw orbits of Mercury and Venus.

2. Estimate radii of the orbits (in a.u.).

**Table: Greatest Elongations of Mercury and Venus.**

Mercury: 1989-1990			Venus: 1983-1990		
Date	East	West	Date	East	West
8 Jan 89	19°		15 Jun 83	45°	
18 Feb 89		26°	4 Nov 83		47°
30 Apr 89	21°		21 Jan 85	47°	
18 Jun 89		23°	12 Jun 85		46°
28 Aug 89	27°		26 Aug 86	46°	
10 Oct 89		18°	15 Jan 87		47°
22 Dec 89	20°		2 Apr 88	46°	
1 Feb 90		25°	22 Aug 88		46°
13 Apr 90	20°		8 Nov 89	47°	
31 May 90		25°	30 Mar 90		46°
11 Aug 90	27°				
24 Sep 90		18°			
5 Dec 90	21°				

As for observational part, its problem was non-competitive:

**Grades 8-12**

1. At what time did you see Venus on Saturday, November 2, 1996...

2. ... and at what angular distance from the Sun?