

7th Indian National Astronomy Olympiad

May 1 to 20, 2005

Theory Test 1

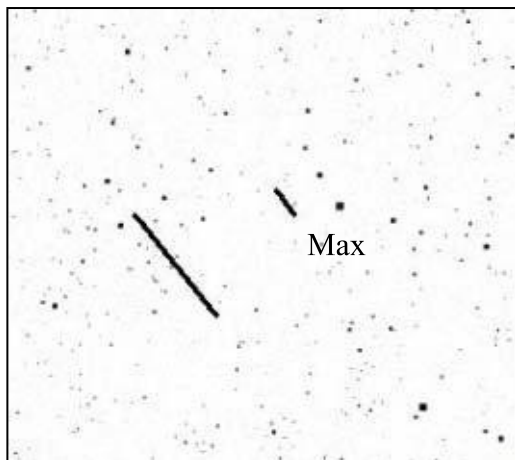
May 10, 2005: 10:00 IST

Duration 2^h

All questions carry equal marks

Seniors

1. You know that the sun crosses the celestial equator on 23rd September. Find the time required for the Sun's disk to cross it.
2. The distance between Sun and Jupiter is 5.2 AU. The biggest moon of Jupiter, Ganymede is 5262 km in diameter. Calculate the distance at which it must revolve around Jupiter to give a perfect total solar eclipse for the 'Jovians'? How the answer will change if the 'Ganys' want to see the solar eclipse? Now that you are at it, find the magnitude of Ganymede from Jupiter at opposition in the first case. Albedo of Ganymede is 0.1. (Radius of Jupiter = 142,800 km)
3. Some arbit sailor happens to see a solar eclipse. He notices that the moon is covering the sun from the bottom. Where could he be? More specifically, at what latitude do you expect this sailor to be. What time of the day is it? Where does he see the sun?
4. Two small bodies Pingu and Tingu orbit a white dwarf Xaerox ($1M_{\odot}$) along the same closed orbit. The distance between them is small enough for the part of the orbit between them to be considered a straight line. Now, Pingu & Tingu (both long separated brothers) want to shake hands. Their maximum separation in the orbit is $d = 10$ m, and each of them can reach out 1 m. Assuming the time period of the orbit be 30 years, find the limit on the eccentricity of the orbit if Pingu is able to shake hands with Tingu.



5. The Earth gets energy from the sun at the rate of 1400 W/m^2 at the top of the atmosphere. Some of it (37%) gets reflected from the cloud tops, polar snow caps etc. Assuming that the solid part of the Earth is a perfect blackbody and that the temperature of interplanetary space is about 100 K, what is the equilibrium temperature of Earth. Compare it with the real mean temperature of Earth (14°C). What effects invalidate the assumption?

6. In the figure you see a photograph of a star field taken by 2.3 m Vainu Bappu Telescope at

Kavalur last December. The stars were tracked; hence two asteroids Mux and Max left a trail. Assuming almost circular and coplanar orbits, which one of them is closer to:
i) the Earth, ii) the Sun.