



### Multiple-Choice Question Round

Saturday

1 June 2013

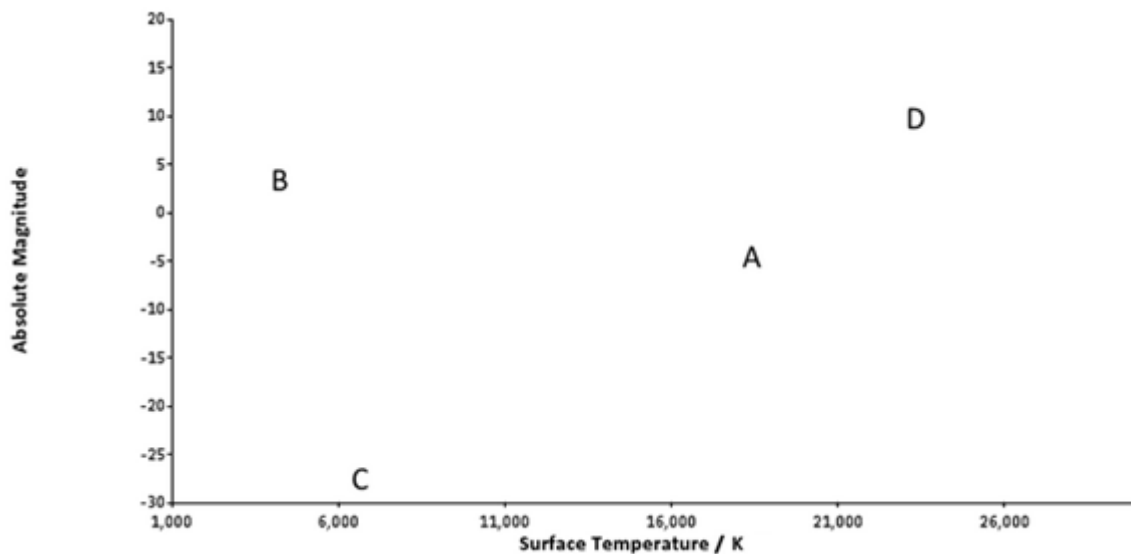
30 minutes

#### Information for participants

- This round will consist of 40% of the Preliminary Rounds.
- There are 30 questions.
- Each correct answer gives you 1 mark.
- Marks are not deducted for incorrect answers.
- Write your answer neatly in the answer sheet.
- You are allowed to use a scientific calculator.

**This question paper consists of 7 printed pages**

1. Where is the star Helios supposed to be on this HRD?



2. How many dwarf planets are there in the solar system?

- a) 1
- b) 3
- c) 5
- d) None of the above

3. How many moons does Uranus have?

- a) 2
- b) 5
- c) 27
- d) None of the above

4. Which black holes have an ergo sphere which is different from the event horizon?

I. Schwarzschild  
II. Reissner-Nordstrom

III. Kerr  
IV. Kerr-Newman

- a) I and II only
- b) II and IV only
- c) III and IV only
- d) All of the above

5. What is the “Tip of the Red Giant Branch” in the HRD used for in astronomy for?

- a) It serves as primary distance gauge for galaxies
- b) It helps astronomers predict the age the galaxies and the stars in the vicinity
- c) It indicates the possibility of many exoplanets in the vicinity
- d) It holds no significance for astronomers.

**6. What defines the edge of the solar system?**

- a) A set distance of 100 AU from the Sun
- b) The point where the Sun's Gravity is not strong enough to keep things in orbit
- c) The point where the temperature of space in the vicinity is that of the average temperature of space (2.725 K)
- d) The point where the solar wind slows down significantly

**7. The resolving power of a telescope increases with \_\_\_\_\_ wavelength and \_\_\_\_\_ lens aperture.**

- a) increasing, increasing
- b) increasing, decreasing
- c) decreasing, increasing
- d) decreasing, decreasing

**8. Jan Oort was a Dutch astronomer (1900 – 1992), currently most famously known for the Oort Cloud which was named in his honor. Which of the following is not something he discovered?**

- a) The mass of the Milky Way Galaxy
- b) The light from the Crab Nebula is polarized
- c) The first evidence of dark matter
- d) The length of the sidereal day (by using radio waves and seeing how often the waves repeated themselves from the center of the milky way)

**9. Umbriel is a moon of:**

- a) Jupiter
- b) Saturn
- c) Uranus
- d) Neptune

**10. Why were the images from the NASA Hubble telescope so bad, when it was first launched?**

- a) The lens curvature was fundamentally wrong, even if that lens were to be used on Earth.
- b) The CCD was not functioning properly due to the cold temperatures in space, which made the electronics not function and compute properly.
- c) A small object (most probably space junk) entered the lens and made a crack in it.
- d) Because the effect of gravity is less in orbit, which was not incorporated into the calculations to describe the curvature of the lens.

**11. The use of a CCD with a telescope can enhance the**

- a) Focal length
- b) Magnification
- c) Spectral output
- d) Image contrast

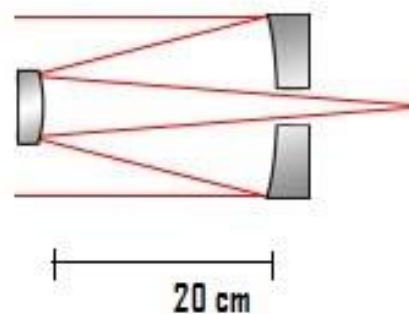
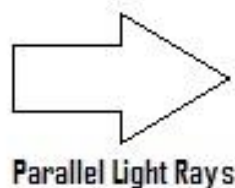
**12. The albedo of the moon is:**

- a) 0.02
- b) 0.12
- c) 0.56
- d) 0.83

**13. What is the Hayashi Track?**

- a) A hike up to a mountain in Japan that provides a stupendous view of the night sky.
- b) A dark region of the night sky that is very bright when viewed in radio frequencies.
- c) A part of the HRD which goes nearly vertically upwards.
- d) None of the above.

**14. Consider the following image. The diagram is to scale. Given that the eyepieces focal length is 20 mm, calculate the magnification power of this telescope.**



- a) 52.5 x
- b) 10 x
- c) 20 x
- d) Not enough information is provided

**15. How long is the Saros Cycle?**

- a) 28 days
- b) 18 years 11 and 1/3 days
- c) 11 years
- d) Depends on the celestial bodies in questions.

**16. How do you detect a black hole?**

- a) All black holes emit a certain radiation (Hawking Radiation), and this radiation is what astronomers look for
- b) The astronomers look for the super jets which are emitted from a black holes poles, which can clearly indicate the presence of a black hole
- c) They look for the effects due to the gravitational distortions in space time, which would indicate the presence of a black hole.
- d) Direct Observation thorough a combination of wavelengths spanning the entire electromagnetic spectrum

**17. Which of the following is a nebula?**

- a) M42
- b) NGC 3982
- c) NGC 1001
- d) M34

**18. In “The Rocket Equation”, what is the value of c?**

- a) Speed of light
- b) Effective Exhaust Velocity
- c) Propellant Mass Fraction
- d) Burn Time

**19. Which celestial body in the solar system has the lowest eccentricity in its orbit?**

- a) Triton
- b) Earth
- c) Mercury
- d) None of the above

**20. Which is the first spacecraft to cross Neptune’s Orbit?**

- a) Voyager 1
- b) Pioneer 10
- c) Viking 2
- d) Vostok 1

**21. Why is the Kepler Space Observatory's image sensor curved?**

- a) To accommodate for Distortion
- b) To reduce the effect of spherical aberration
- c) To remove the possible Astigmatism when objects are near the edge of the field of view
- d) To reduce the aberration caused by the Petzval Field Curvature.

**22. If the sun were to suddenly turn into a black hole, what would not happen? (Ignore any relativistic or quantum effects)**

- a) Life on Earth will be terminated
- b) The Earth would reach temperatures approaching 0 K
- c) The year becomes shorter, as the black hole would suck the Earth closer to itself.
- d) A large region of the sky will be opaque to all wavelengths of light.

**23. Which of the following is not a space mission by the Japanese?**

- a) Akari
- b) Suisei
- c) Astro G
- d) Jinja

**24. The value of L in the Drake Equation depends on**

- a) the length of time for which such civilizations release detectable signals into space.
- b) number of planets per star.
- c) the rate of star formation in the galaxy.
- d) the proportion of stars that have planets with conditions suitable for life.

**25. Find the velocity of a satellite around the earth at perigee, in a circular orbit, with a semi major axis of 24,000 km. (Note: Mass of Earth:  $5.97 \times 10^{24}$  kg,  $G = 6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$ , Mass of Satellite: 540 kg)**

- a)  $4070 \text{ ms}^{-1}$
- b)  $16.6 \times 10^6 \text{ ms}^{-1}$
- c)  $129 \times 10^3 \text{ ms}^{-1}$
- d)  $5760 \text{ ms}^{-1}$

**26. Fill in the blank.**

**The names of meteor showers are derived from the apparent positions of the \_\_\_\_\_ in the sky, which tend to be the same, year after year, for any given meteor shower.**

- a) escarpments
- b) originating asteroids
- c) radiant
- d) focal points

**27. What is the uncertainty in the age of the universe in millions of years?  
Accepted value of age of universe: 13.772 billion years.**

- a) 0.08
- b) 3.7
- c) 59
- d) 94

**28. If you want to weigh the most, where on Earth should you measure your weight?**

- a) The equator
- b) The poles
- c) At none of these places (but some other)
- d) You will weigh the same at any point on Earth

**29. The “dirty snowball” model for the structures of comets is sometimes credited to:**

- a) Fred L. Whipple
- b) Giuseppe Piazzi
- c) Johann E Bode
- d) Johann D Titus

**30. You are on a mission to a planet orbiting Alpha Centauri. If you want to reach there in less than 5 years, what is the velocity you must travel at to reach in time? The distance to Alpha Centauri is 5 ly.**

- a) 0.9 c
- b) 0.71 c
- c) 0.50 c
- d) 1 c

**- End of paper -**