# Reach for the Stars

Answer Key

2012-2013

Questions? Comments? Concerns?

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Section 1: General Knowledge

1. J2000
2. Gan De
   a. **Bonus:** 4th century BC
3. A supermassive black hole (accept black hole)
4. $d = \frac{1}{p}$
5. Population I stars have a higher metallicity than Population II stars. Population I stars are also younger than Population II stars.
   a. Disk population
6. They are laws that govern the movement (or orbits) of the planets around the sun and give properties of these orbits. Accept equivalent answers (this goes for the three subquestions as well).
   a. The orbits of the planets are ellipses, with the Sun at one focus of the ellipse.
   b. The line joining the planet to the Sun sweeps out equal areas in equal times as the planet travels around the ellipse.
   c. The ratio of the squares of the revolutionary periods for two planets is equal to the ratio of the cubes of their semimajor axes.
7. A unit of angular measurement equal of 1/3600th of a degree
8. Most of the galaxies are moving away very fast from each other, causing most things to have a redshift as seen from Earth. This implies that the universe is still expanding, as a leftover mechanism of the Big Bang.
9. Rydberg Formula
   a. **Bonus:** $\frac{1}{\lambda} = R\left(\frac{1}{m^2} - \frac{1}{n^2}\right)$, where R=Rydberg shell constant (1.0974×10^7 m^{-1}), m=shell going to, and n=shell coming from (accept even if lacking exact Rydberg constant)
10. Electrons absorb photons and move up an energy level. (accept absorb photons)
11. It is a graph that shows the brightness of a stellar object over a period of time.
12.
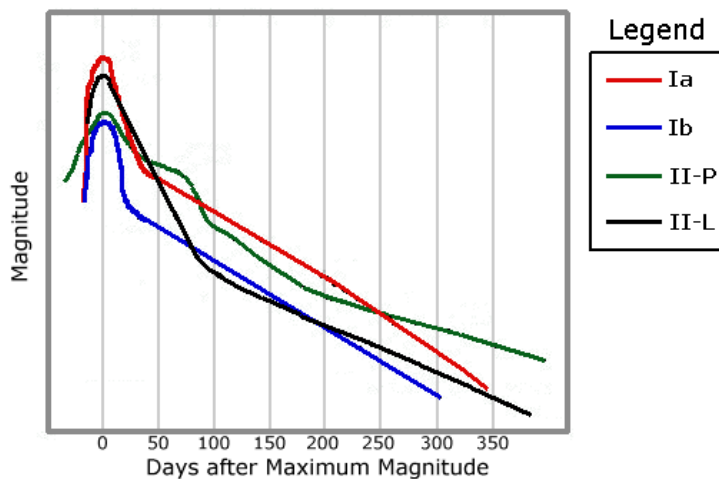
13. Accept any three of the following: Cepheids, RR Lyrae, RV Tauri, long period variables. Also accept any off of pages 9-16 of the following link: http://www.aavso.org/vsx/help/VariableStarTypeDesignationsInVSX.pdf
14. Accept any three of the following: pulsating, eruptive, eclipsing binary, rotating stars
15. Type I
16. Eclipsing binary
17. Accept anywhere between 140-160
18. A black hole without an event horizon (accept anything of the equivalent)
19. Schwarzschild radius
20. Hydrostatic equilibrium
21. Tolman-Oppenheimer-Volkoff Limit (accept TOV Limit or Oppenheimer-Volkoff Limit)
22. The information loss paradox
23. Sgr (Sagittarius) A* (must have the *)
24. Brown dwarf
25. Molecular clouds that condense in very localized regions inside a nebula, becoming approximate spheres of very dense and largely varied gases. Also accept: cold, dense, dark clouds of dust & gas that sometimes are sites of star formation or anything of the equivalent.
26. Quasi-stellar radio source
27. A very bright and active galactic center, often a supermassive black hole with relativistic jets
28. The brightest star of the constellation should be called Alpha, the next brightest Beta, and so on.
29. Approximately100 parsecs (accept within 5 parsecs of this distance)
30. 5-24 hours
31. Nicolaus Copernicus (accept Copernicus)
32. Search for Extraterrestrial Intelligence
33. January 1st, 4713 BC
34. Paschen series
35. Accept the following:

Proxima Centauri ● Alpha Centauri A ● Toli ● Barnard's Star ● Wolf 359 ● Laland 21185 ● Sirius A ● Sirius B ● BL Ceti ● UV Ceti ● Ross 154 ● Ross 248 ● Epsilon Eridani ● Lac 9352 ● Ross 128 ● EZ Aquarii A ● EZ Aquarii B ● EZ Aquarii C

Section 2: DSO/Star Questions

1. It changed its appearance from a normal Type II supernova to a Type Ib supernova.
2. 1) being the largest and most active star forming region in the Local Group, and 2) containing the largest star known to man (1 bonus point if they mention star is **250 M$_\odot$**)
3. Gamma rays
4. X-rays
5. 30 times per second (accept anything within .5 of this value)
   a. SN 1054
6. Vela Supernova Remnant (accept VSR)
   a. x-ray
   b. 717-913 light years or 220-280 pc (accept anything in between)
7. CoRoT-2a
   a. The star is bombarding the planet with tons of x-rays, **pulling off about 5 million tons of matter per second from the planet.** (The BOLD is worth 1 bonus point if they put that.)
   b. CoRoT-2b
8. SS433
   a. Relativistic jets
   b. Eclipsing binary
9. Tycho's SNR (accept Tycho's Star)
   a. 1572
   b. Accept any of the following: Cassiopeia (Cas) B, SN 1572, SNR 021.0+63.0, SNR 120.1+01.4, SNR 120.2+01.4, NOVA Cas 1572, X Cep X-1, B Cas, GRS 120.10 +01.40, and BD+63 39a
10. Pleiades
    a. Accept any four of the following: Alcyone, Asterope, Celaeno, Electra, Maia, Merope, Taygeta, Atlas, Pleione
    b. Accept anywhere from 100-150 million
11. M13 Globular Cluster
    a. Hercules
    b. Accept anywhere from 10 to 15 billion (10^{10} to 1.5×10^{10})

Numbers 9-14 deal with image 7.

12. Northern hemisphere
13. Sirius (or α Canis Majoris)
    a. Canis Major
    b. Being the brightest star in the sky
14. Pollux
    a. Castor
    b. The Twins
15. Aldebaran
    a. Alpha Tauri
    b. The Bull's Eye

16. Rigel
    a. Blue supergiant
    b. −6.7 (accept anywhere from −6 to −7)
17. Accept any of the following: Orion, Canis Major, Puppis, Taurus, Gemini, Auriga, Eridanus
18. Accept any two of the following: Helix Nebula, 30 Doradus, NGC 7000 North America Nebula, M57 Ring Nebula, Orion Nebula, M17 Omega Nebula, M1 Crab Nebula
19. Accept any five of the following: Aquarius, Cancer, Sagittarius, Gemini, Libra, Leo, Scorpius, Taurus, Virgo
20. Quadruple star system
    a. Spectroscopic binary
21. Type Ia
22. Vega
23. It contains a planet that is deemed the most likely to support life after Earth.
    a. Gliese 581g
24. Accept any 6 of the following: Altair, Sirius, Deneb, Castor, Vega, Mizar, Alcor

Section 3: Stellar Evolution and the HR Diagram

1. A process that fuses helium into carbon
2. Black dwarf
3. T Tauri star
4. 100 million K
5. Asymptotic Giant Branch
6. Chandrasekhar Limit
    a. 1.44 $M_\odot$ (accept 1.4 to 1.5)
7. Iron
8. A spinning neutron star
9. 25 $M_\odot$
10. An explosive release of energy from a burning shell, causing the star to expand and brighten
11. A molecular cloud in the process of forming new stars
12. Must at least be somewhat in the right order: protostar, main sequence, red giant, planetary nebula, white dwarf, black dwarf. Partial credit can be given.
13. Must at least be somewhat in the right order: protostar, main sequence, red giant, Type II supernova, neutron star OR black hole. Partial credit can be given.

Star	Ab Mag	Spect Type	Temp (K)	Right Asc	Dec δ
Capella	~0.48	G8	4,940±50	05h16m41.359s	+45d59'52.77"
Sirius	1.42	A1	9,940(A)	06h45m08.917s	16d42'58.017"
Proxima Centauri	15.49	M5 (or M6)	3,042±117	14h29m42.9487	62d40'46.141"
Regulus	~0.52	B7	10,300-15,400	10h08m22.3s	+11d58'02"
Castor	1.33	A1	10,300	07h34m36s	+31d53'18"
Vega	0.58	A0	9,602±180	18h36m56.336s	+38d47'01.29"
Betelgeuse	~6.05	M2	3,500	05h55m10.305s	+07d24'25.43"
Rigel	~6.7	B8	11,000	05h14m32.272s	~08d12'05.91"
Aldebaran	~0.63	K5	4,010	04h35m55.239s	+16d30'33.49"
Polaris	~3.63	F7	7,200	02h31m49.09s	+89d15'50.8"

14.

Absolute Magnitude

+16 +14 +12 +10 +8 +6 +4 +2 0 -2 -4 -6

Spectral Type

O   B   A   F   G   K   M

Rigel
Regulus
Vega
Sirius
Castor
Polaris
Capella
Aldebaran
Betelgeuse
Proxima Centauri