2004 NSO "Reach for the Stars" Exam **Answer Key**

Life Cycles of Stars

Question values: **Each number entry is worth 1 point. Total possible: 56 points.**

*Tie-Breakers (in order): **1st**: Score on ID Exam; **2nd**: 20; **3rd**: 21; **4th**: 38; **5th**: 40; 6th: 44: **7th**: 45

Card Series 1: Select the following numbered cards from the deck: 1, 2, 5, 6, 10, 13, and 16. Set the remaining cards aside. Arrange these cards to sequence the life of a low-mass star beginning with Card 6. Record the numbers, in order, according to evolutionary sequence from birth to death.

1. __6__ __**10**__ __**1**__ __**5**__ __**16**_ ___**2**__ or __13__

Directions: Using these same cards identify the stage – by card number – to match the descriptive phrases provided.

2. __**1**__ Mid-sized star
3. __**2**__ White dwarf
4. __**5**__ Red giant
5. __**6**__ Stellar nursery
6. __**10**__ Formation of a planetary system
7. __**16**_ Planetary nebula
8. __**13**_ Binary system

Directions: On the line preceding the questions, enter the card number of the stage described.

9. __**13**_ Includes a star that will explode if its mass becomes greater than 1.4 solar masses
10. ___**1**_ Star that fuses hydrogen to helium at its core
11. ___**2**_ The densest stage in the life of a medium-sized star
12. ___**5**_ Star that fuses helium at its core
13. ___**2**_ Star composed mostly of carbon created by the fusion of helium
14. ___**5**_ Fusion of hydrogen occurs outside this star's core.
15. __**16**_ Shell of gas which was once the outer layers of a medium-sized star
16. ___**2**_ This stage will cool very, very slowly to eventually become a black dwarf
17. ___**2**_ A stage in which a star has exhausted all, or nearly all, its nuclear fuel
18. ___**2**_ Its physical size is nearly equal to that of Earth.
19. ___**6**_ & __**10**__Select card number 18 from the remaining cards. Between which two cards in Series 1 could Card 18 be properly placed?

20* __**1**__ & ___**5**__ Select card number 19. Between which two cards in Series 1 could Card 19 be properly placed?

21* __**13**_ Select Card 20. Which card in Series 1 depicts the stage immediately preceding the event recorded on Card 20?

(Continued on the opposite side)

Card Series 2: Select the following numbered cards from the deck: 3, 4, 5, 6, 7, 10, 11, and 17. Arrange these cards, in order, to sequence the life of a very high mass star beginning with Card 6. Record the numbers, in order, following the evolutionary sequence from birth to death. Note that a high mass stars may have two different outcomes, i.e. illustrated on cards 3 and 11.

22. **__6__ _10__ __7__ __5__ _17__ __4__** __3__ or __11_

Directions: Using these same cards identify the stage – by card number – to match the descriptive phrases provided.

23. **__5__** Red giant
24. **__4__** Supernova remnant
25. **__7__** Main sequence star
26. **_11__** Neutron star or pulsar
27. **_17__** Supernova
28. **_10__** Formation of a planetary system
29. **__3__** Black hole
30. **__6__** Stellar nursery

Directions: On the line preceding the questions, enter the number of the stage described.

31. **__11_** A pulsating core remnant
32. **___6_** A protostar remains here until fusion of hydrogen begins
33. **__17_** Formation of many of the heavier elements
34. **___7_** Star's most stable stage
35. **___3_** Its escape speed is greater than the speed of light
36. **___5_** This stage has a core of helium surrounded by an envelope of hydrogen
37. **___5_** The lifetime of this stage is about 10% that of its main sequence lifetime
38* **___5_** This stage experiences a helium flash
39. **___3_** This stage may be described as a singularity
40* **___3_** This object's outer limit boundary is located at a point where escape speed equals the speed of light
41. **__11_** Under special circumstances this stage may be a pulsar
42. **__17_** This event may outshine all other stars in the galaxy in which it occurred
43. **___3_** This object's outer boundary is referred to as its event horizon
44* **__17_** Choose card number 21. Which event, in Series 2, is depicted by this graph?
45* **___5_** Choose card number 22. Which stage, in Series 2, is depicted in this graph?

Top five National Scores: 52 (1); 51 (3); 50 (1)
Average National Score: 37 out of 54 (or 68.5%)

The Stellar Cycle cards for this activity may be found at:
http://chandra.harvard.edu/edu/formal/stellar_cycle/
Click on "Stellar Cycle" beneath the heading "Performance Tasks"

STELLAR EVOLUTION: The Game is an exciting and effective tool for participants in both B and C Divisions to expand upon their understanding of stellar evolution. For further information about this game, visit http://www.stellarjourney.net.