Science Olympiad Delaware Invitational
January 26th, 2002

Reach for the Stars
C Division

You will be shown three sets of images for specific amounts of time.
Use Image Set A and the H-R diagram provided to answer Question Set A, 1 – 40. [15 minutes]
Use Image Set B to answer Question Set B, 1 – 15. [30 minutes]
Use Image Set C to answer Question C. [15 minutes or time remaining] This question will be used for any possible tie-breaking.

Place all answers on the Student Response Sheet and return ALL materials before leaving the event. Make sure your team number is on all response sheets.

A. Use the Image Set shown and the H-R Diagram provided (next page) to answer the following (use the numbers on the H-R Diagram to indicate location; groups of questions relate to the same image): [15 minutes]

1. **Where is image N located on the H-R Diagram?**
2. **What is the name of the object in image N?**
3. **What is the next evolutionary stage for image N?**

4. **Where is image E located on the H-R Diagram?**
5. **What is the name of the object(s) in image E?**
6. **What type of object(s) is image E?**

7. **Which image is located at #5 on the H-R Diagram?**
8. **Which image shows the end product for this object?**
9. **Where is the end product for this object on the H-R Diagram?**
10. **What type of object is this end product?**

11. **Which image shows Sagittarius A?**
12. **Sagittarius A is located at the center of what galaxy?**
13. **The bright x-ray flare in Sagittarius A indicates what type of object?**

14. **What are the names of the objects in image O?**
15. **In which band of the spectrum was image O taken?**
16. **Where is the brightest object in image O on the H-R Diagram?**

17. **Which of the images is a planetary nebula?**
18. **What is the name of this planetary nebula?**
19. **Where is it located on the H-R diagram?**
20. **What evolutionary stage precedes a planetary nebula?**

21. **What types of objects are in images F and I?**
22. **What is the name of the object in image I?**
23. **Where would these objects be located on the H-R Diagram?**

24. **What type of object produces the light curve in image G?**
25. **Which image is produces this type of light curve?**
26. **What is the name of this image?**

27. **What is the name of the object in image Q?**
28. **What type of object is it?**
29. **Which band of the spectrum does this image show?**
30. **Which image is the radio counterpart of this object?**

31. **What type of object is image C?**
32. **Which light curve preceding the formation of this object?**
33. **Which image will collapse to form this same type of object?**

34. **Which image(s) will result in image D?**
35. **What type of event produces image D?**
36. **What type of system produces image L?**
37. **What image shows this type of system?**

38. **Which image shows a Type II supernova?**
39. **Which image(s) can lead to a Type Ia supernova?**
40. **Which image shows an object that will produce a black hole?**

B. Use the Image Set shown to answer the following questions. Groups of questions relate to the same image. [30 minutes]

1. **Image F shows what area of the sky?**
2. **The large orange object in the upper left of the image is what object?**
3. **What is the evolutionary stage of this object?**
4. **What is the name of the small white object below the large orange object?**
5. **What type of object is it?**
6. **This object is also shown in which other image(s)?**
7. **One of the images shows several end products of stellar evolution. What are they?**

8. **Image O is the Hydra A cluster of galaxies; image P is an x-ray image of this same cluster. The x-ray spherical image has a diameter of 500,000 light years. Calculate the volume of this gas cloud in cubic light years.**
9. **Calculate how many Earth's could be made with the total mass from the gas cloud.**
10. **The mass of the Earth is about 0.0003% of the mass of the Sun. How many Suns could be made from the cloud of hot x-ray gas in the Hydra A cluster?**

11. **What is the name of the object in Image J?**
12. **If this object is 108 pc away and a supernova explosion occurred with an absolute magnitude of –19, at what apparent magnitude would we see the supernova?**

13. **What is the name of the object in image A?**
14. **What type of object is in image A?**
15. **Which image is an x-ray image of the center of this object?**
16. **Which H-R Diagram belongs to this object?**
17. **Is the object very young, young, middle-aged, old, or very old?**
18. **What part of the diagram portrays its relative age?**

19. **The Rosetta nebula is which image?**
20. **What is the catalog number for the object(s) in the center of this image?**
21. **What type of object(s) is it?**
22. **Which H-R diagram best represents this object(s)?**
23. **This object(s) contains a binary star system in which each star has the same mass as the Sun and the semi-major axis is 6 AU. What is the period of revolution?**

24. **What is the name of the large object in image B?**
25. **What are the smaller objects within the large one?**
26. **Which H-R diagram shows their motion?**

27. **Image M shows two supernovae light curves. Which type of supernova does the blue line represent?**
28. **Which type of supernova does the green line represent?**
29. **If a supernova has an absolute visual magnitude of –25, what is its visual luminosity in terms of the Sun?**

30. **What is the name of the object in image E?**
31. **What is the catalog number for this object?**
32. **What bandwidth was the image taken in?**

33. **Image L is a good representation of what type of object?**
34. **Is the object young, middle-aged, or old?**
35. **What is the most advanced evolutionary stage on the diagram?**

C. [15 minutes]

Place the image set shown in evolutionary sequence from gas cloud through Type Ia Supernova. Name the object in each image according to evolutionary stage.

STUDENT RESPONSE SHEET

A

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____
36. _____
37. _____
38. _____
39. _____
40. _____

B

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____

C. List in order of first to last with a 1-5 word description of the evolutionary stage

—

—

—

—

—

—

—

—

—

—

—

—