

National Science Olympiad *Reach for the Stars* – C
ANSWER KEY

1.

- (1) Cas A
- (2) Cassiopeia
- (3) supernova remnant
- (4) Chandra
- (5) X-ray
- (6) optical
- (7) infrared
- (8) radio
- (9) the layers of elements must be overturned during the explosion
- (10) 5421 km/s

2.

- (11) the Crab pulsar
- (12) 23 milliseconds
- (13) slowing down
- (14) 137655 km/s
- (15) 46%

3.

- (16A) elliptical
- (16B) lenticular
- (16C) spiral
- (16D) barred spiral
- (17) irregular
- (18a) Andromeda – spiral
- (18b) M82- irregular
- (18c) Large Magellanic Cloud-irr

(18d) M100-spiral

(18e) Cen A- elliptical

(19) 14⁰

(20) 28% larger

(21) 3.4 x 10⁶ yr

(22) 56 x 10⁶ ly

(23) C

(24) instability strip

(25) stable, bit short, abruptly longer

(26) 49,700 ly

(27) Milky Way Galaxy

(28) B

4.

(29) Hercules

(30) RA 16^h42^m dec 36^o 28'

(31) globular cluster

(32) -8.5

(33) 2.3 M_o & 3.86 M_o

(34) very old

(35) B

(36) E

(37) C

(38) D

(39) F

(40) A

(41) C

(42) **there are stars on the main sequence younger than the turnoff point of the cluster** _____

5.

(43) **52 km/s/Mpc** _____

(44) **19×10^9 yrs** _____

6.

(45) **Canis Major** _____

(46) **Sirius** _____

(47) **L** _____

(48) **O** _____

(49) **Crab pulsar** _____

(50) **C** _____

(51) **X-ray** _____

(52) **H** _____

(53) **F** _____

(54) **E** _____

(55) **Cen A** _____

(56) **M82** _____

(57) **RA 10^h dec $+69^0$** _____

(58) **B** _____

(59) **Q** _____

(60) **T** _____

(61) **I** _____

(62) **Andromeda Galaxy** _____

(63) **G** _____

(64) **S** _____

(65) **Pleiades** _____

(66) **open cluster** _____

(67) **A** _____

(68) **U** _____

(69) **P** _____

(70) **Puppis** _____

(71) **Spica** _____

(72) **Virgo** _____

(73) **77 pc** _____

(74) **black holes this size have not been found outside galactic centers before** _____