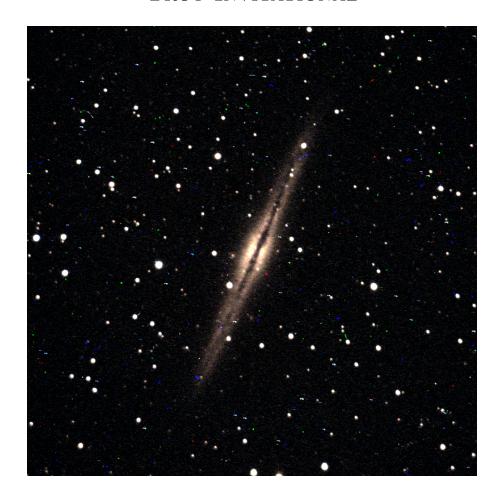
December 8th, 2018 TROY INVITATIONAL



KEY: Astronomy C

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Questions? Contact me at asher13a@gmail.com!

Directions:

Unless otherwise stated, each subquestion is worth two points.

1 Answer Key: Part A

- 1. (a) Milky Way Galaxy (+2)
 - (b) Instrumental Noise (+2)
 - (c) -20 -21 (+2)
 - (d) 27 28 Mly (+2)
 - (e) Higher (+1)

NGC 891 is viewed edge-on (+1)

(f) Mentions dust (+1)

Dust scatters light OR re-emits light in the IR (+1)

- 2. (a) M82 (+1), Ultraviolet (+1)
 - (b) Winds of massive stars (+1) Ejecta of core collapse supernova (+1)
 - (c) $15 20M \odot \text{yr}^{-1} \text{ kpc}^{-2} (+2)$
 - (d) 2 orders of magnitude (+2)
- 3. (a) B (+2)
 - (b) No change/ does not affect (+2)
 - (c) Low to zero metallicities (+1)

In these conditions, stars of higher masses form, so the slope is shallower/less negative /decreases in magnitude (+1)

- (d) Inverse (+2)
- 4. (a) IC 10 (+1), IC 10 X-1 (+1)
 - (b) Any mention of X-ray binary (+1) If specifically HMXB or "Wolf Rayet" X-ray Binary, then (+2)
 - (c) Perinigricon (+2)
 - (d) $A = \frac{2r_a r_p}{r_a + r_p}$ (+6)

Answer Key Astronomy C

2 Answer Key: Part B

- 5. (a) O, Ne, Mg, Si, S, and Ca (+1)
 - The triple-alpha process (+1)
 - (b) Cr, Mn, Ni, Fe, and Co (+1)
 - Supernova nucleosynthesis (+1)
 - (c) Later (+1)
 - The timescale of evolution of Type Ia supernova is much longer (+1)
 - (d) Higher (+1)
 - Initially, there are relatively more Type II compared to Type Ia because higher mass stars evolve more quickly (+1)
 - (e) A (+1)
 - It built up more oxygen before the iron peak elements kicked in (+1)
 - (f) Bulge: A (+1)
 - Dwarf Galaxy: C(+1)
- 6. (a) Thompson scattering of free electrons (+2)
 - (b) Constant (+2)
 - (c) $1.5 1.6 \times 10^4 \text{ L} \odot (+2)$
 - (d) $4-5 \times 10^2 \text{ R} \odot (+2)$
- 7. (a) GW170817 (+1), Hydra (+1)
 - (b) Short gamma-ray burst (+2)
 - (c) Black hole (+2)
 - (d) Decreases(+1), Gravitational Redshift (+1 points)
 - (e) Slower (+1), Time Dilation (+1) points
- 8. (a) No (+1), solar motion (+1)
 - (b) $10.1 10.9 \text{ kms}^{-1} (+2)$
 - (c) $5.4 5.9 \text{ kms}^{-1} (+2)$
 - (d) 0.2 0.40" (+2)
 - (e) 3.1 3.3 pc (+2)
 - (f) -2.8 -3.4 (+2)
 - (g) Sagittarius A^* (+2)

Grader's Note: Problem 8 is harder than expected. Precise answers should account for oscillatory motion, similar to how Barnard's star is treated in here. Because of the challenge, the above answer ranges have extended to allow for a simpler method that assumes linearity in the star's motion.