

Sample Test

Equations: $T = 2.9 \times 10^6 / \lambda_{\max}$ $L_{\text{ap}} = 4\pi R^2 \sigma T^4 / (d^2)$ $L_{\text{MS}} = M^{3.5} = \sqrt{M \times M \times M \times M}$

$t_{\text{MS}} = 1 \times 10^{10} \text{ yrs} / (M^{2.5}) = 1 \times 10^{10} \text{ yrs} / (\sqrt{M \times M \times M})$ $R_{\text{sch}} = 3M$ (M in solar units, R in km)

Drake Equation: $N = R \cdot f_s \cdot f_p \cdot n_e \cdot f_i \cdot f_c \cdot L$ Seager Equation: $N = N_* \cdot F_Q \cdot F_{\text{HZ}} \cdot F_o \cdot F_L \cdot F_s$

$H_o = v/D$ $\Delta\lambda = \lambda v/c \rightarrow v = c \Delta\lambda / \lambda$

Use the following information from the Big Bang theory:

- A) Protons and Neutrons freeze out (stop forming).
- B) Nucleosynthesis begins
- C) Recombination
- D) Inflation
- E) Gravity separates from the other forces.
- F) Nucleosynthesis ends.
- G) Electrons freeze out (stop forming).

1) What is the age of the Universe?

- a) 3000 years
- b) 14 billion years
- c) 10 billion years
- d) 4.6 billion years
- e) There's no way to know.

2) What type of galaxy is 2 in the figure?

- a) Elliptical
- b) Spiral
- c) S0
- d) Irregular.
- e) All of the above.

3) Which step in the big bang theory is the first one?

- a) A
- b) B
- c) C
- d) D
- e) E

4) Which of the following variables in the Drake equation need to be solved by biologists?

- a) n_e (the number of Earth-like planets).
- b) f_i (the fraction of planets that develop life).
- c) R (the rate of star formation).
- d) f_c (the fraction of intelligent life that develops the ability to communicate across interstellar distances).
- e) f_s (the fraction of Sun-like stars).

5) What is located in the center of our Galaxy?

- a) a globular cluster.
- b) a spiral arm.
- c) a black hole.
- d) the solar system.
- e) the Sun.

6) According to astronomical clues, what is the most likely ending for our Universe?

- a) It will eventually collapse into the Big Crunch (or gnab gib).
- b) It will expand forever.
- c) It has a fixed size and always will.
- d) None of the above.

7) What are the characteristics of stars in an elliptical galaxy?

- a) Population II with random orbits.
- b) Population I with random orbits.
- c) Population II with organized orbits.
- d) Population I with organized orbits.
- e) Population III, regardless of orbit.

10) Which statement about the Milky Way Galaxy is correct?

- a) Our Galaxy contains all stars in the universe.
- b) All stars in our Galaxy take the same time to complete one orbit.
- c) Most stars in our Galaxy are in the central bulge.
- d) None of the stars in our Galaxy move.
- e) Our Galaxy is but one of many galaxies.

13) What type of galaxy is 5 in the Figure?

- a) Elliptical
- b) Spiral
- c) Black hole.
- d) Irregular

14) Why is it not possible for the Universe to be "forever and unchanging", as once thought?

- a) Because stars process H into heavier elements.
- b) Because the gas within galaxies forms stars and is used up.
- c) Because stars evolve into white dwarfs, neutron stars, or black holes.
- d) Because gravity is a force that tries to pull massive objects together.
- e) All of the above.

15) What makes up most of our Universe? (Not just in mass.)

- a) Stars.
- b) Black holes.
- c) Dark Matter.
- d) Dark Energy.
- e) Planets.

16) If you could travel at the speed of light, which of these journeys would be the longest?

- a) A trip to the Sun.
- b) A trip to the nearest neighbor star (not the Sun).
- c) A trip to the dwarf planet Pluto.
- d) A trip to the center of the galaxy.
- e) A trip to Jupiter.

23) What is the distance to a galaxy with a redshift velocity of $95,000 \text{ km/s}$? (Use $H_0 = 72 \text{ km/s/Mpc}$).

- a) 72 Mpc.
- b) 1320 Mpc.
- c) 3205 Mpc.
- d) 95,000 Mpc.
- e) 12 million Mpc.

24) Which of the following statements best describes the overall motion in the Universe?

- a) The universe is expanding faster and faster.
- b) The universe is expanding but more slowly all the time.
- c) The universe is expanding at a constant rate.
- d) The universe is collapsing at a constant rate.
- e) The universe is collapsing faster and faster.

26) In one short sentence each, describe a planet, a star, and a galaxy.

29) Draw a Hubble Tuning fork diagram and label the following types of galaxies: Spiral, S0, Elliptical, Barred spiral.

9) What is the smallest (in size) part of a spiral galaxy?

- a) Disk
- b) Halo
- c) Bulge
- d) They are all the same size.
- e) Depends on the type of spiral galaxy.

13) What is dark matter?

- a) Faint stars.
- b) Black holes.
- c) Exotic particles that don't interact with light.
- d) Regular stars that are blocked by gas.
- e) Darth Sidious, Vader, Maul, and Tyranus.

18) Which sequence of Big Bang events is in the correct chronological order?

- A) A, B, D, F, G
- B) E, D, A, G, B
- C) G, F, D, B, A
- D) B, F, G, D, A
- E) B, G, A, D, F

21) Which of the following is *not* evidence confirming the Big Bang Theory?

- a) The amount of H and He observed in the Universe.
- b) All galaxies are moving away from us (expansion).
- c) The cosmic microwave background.
- d) 90% of the Universe is Dark Matter.
- e) All of the above confirm the theory.

22) What is most of the matter in our Universe made of?

- A) H and He gas.
- B) Stars.
- C) Dark Matter.
- D) Heavy materials (like planets, comets, students, and chairs).
- E) An even distribution of the above materials.

23) What is the main difference between the N (left hand side) values for the Drake and Seager equation?

24) Which factor(s) in the Drake Equation needs to be solved by sociologists?