Astronomy 104: Third Exam
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- Each question is worth 2 points.
- Write your name on this exam and on the scantron.

**Short Answer**

A What is the name of our galaxy?

Milky Way

B What type of galaxy is it?

Spiral (or Barred Spiral)

**Multiple Choice**

1. When we see stars through interstellar dust, what happens to them?
   
   (a) They look dimmer and bluer.
   
   **(b) They look dimmer and redder.**
   
   (c) They look brighter and bluer.
   
   (d) They look brighter and redder.
   
   (e) They look the same.
2. What does the Milky Way look like

(a) It has a large disk with spiral arms, and is relatively flat and thin.
(b) It has clouds of gas and dust in the spiral arms.
(c) Older yellow stars are found mostly in the central bulge.
(d) Old stars and globular clusters are located in a spherical halo above and below the disk.

(e) **all of the above**

3. With the naked eye we see a roughly the same number of stars in every direction because?

(a) We are at the center of the galaxy.
(b) We are just outside the galaxy.
(c) **Nearby stars are distributed this way**
(d) We are in a Dark Dust Cloud.

4. Why is it difficult to get a good picture of what the Milky Way Galaxy looks like?

(a) Dust blocks our view of the center and outer parts of disk.
(b) It is very large and the edges are far away and faint.
(c) We cannot view it from outside.

(d) **All of the above.**
(e) B and C only.

5. How do we get a good picture of the Milky Way?

(a) Use infrared and microwave to penetrate the dust.
(b) use radio telescopes to see where hydrogen is.
(c) satellites sent to take pictures from top and side.

(d) All of these.

(e) **A and B only.**
6. The mass estimate for stars in our galaxy is about
   (a) 100 times the total mass.
   (b) 10 times the total mass.
   (c) the same as the total mass
   (d) \textbf{1/10th the total mass.}
   (e) 1/100th the total mass.

7. The gas is added to the interstellar medium from Supernova is
   (a) Hydrogen
   (b) Helium
   (c) hydrogen helium and a little lithium only.
   (d) \textbf{gas rich in heavy elements}

8. How do heavy elements formed in stars get into other stars?
   (a) Supernova
   (b) Red Giant winds
   (c) travel through a black hole
   (d) all of these
   (e) A and B

9. Infrared telescopes penetrate dust and show that stars at the center of
    our galaxy are orbiting very fast. Why?
   (a) \textbf{Massive Black Hole}
   (b) gravity is too weak at the center
   (c) they are new stars just forming
   (d) supernova
   (e) none of the above
10. Which of these galaxies has a disk, bulge and halo

(a) elliptical

(b) **Spiral**

(c) irregular

(d) all of the above

(e) none of the above

11. Which of these galaxies may have very small stars

(a) elliptical

(b) Spiral

(c) irregular

(d) **all of the above**

(e) none of the above

12. Which of these galaxies is often found in clusters

(a) elliptical

(b) Spiral

(c) irregular

(d) all of the above

(e) none of the above

13. Which of these galaxies is likely not to have had recent star formation

(a) elliptical

(b) Spiral

(c) irregular

(d) all of the above

(e) none of the above
14. How did Edwin Hubble prove that the spiral nebulae were distant galaxies?
   (a) parallax of galaxies
   (b) Doppler shift of galaxies
   (c) supernova in galaxies
   (d) massive black holes at the center of galaxies
   (e) Cepheid variable stars in galaxies

15. What is Hubble’s Law?
   (a) The faster a galaxy is moving the closer it is
   (b) The further a galaxy is the faster it is moving
   (c) galaxies are getting closer over time
   (d) galaxies are expanding and their stars getting further apart.
   (e) none of the above

16. How do we estimate the age of the universe?
   (a) distance / velocity for stars
   (b) distance / velocity for black holes
   (c) distance /time for galaxies
   (d) none of the above

17. How can we measure speed of a distant galaxy?
   (a) observations of supernova
   (b) observations of parallax
   (c) mathematical models of stellar interiors
   (d) Doppler shift of lines
   (e) none of the above
18. What does it mean when we say the universe is expanding?

(a) Galaxies are moving apart through space.
(b) **Space itself is expanding**
(c) Everything is expanding, galaxies, stars, planets.

19. When we look at a galaxy billions of years away we see

(a) it billions of years younger.
(b) it billions of years older
(c) **it when both it and the whole universe were billions of years younger**
(d) it when both it and the whole universe were billions of years older

20. Why cannot we see beyond the cosmological horizon?

(a) The universe hasn’t formed yet.
(b) galaxies haven’t formed yet.
(c) stars haven’t formed yet.
(d) telescopes haven’t formed yet.
(e) people haven’t formed yet.

21. Galaxy A is moving twice as fast as Galaxy B, so it must be

(a) four times as far as galaxy B
(b) **twice as far as galaxy B**
(c) half as far as galaxy B
(d) one quarter as far as galaxy B
22. The oldest galaxies in the Hubble Deep Field are
   (a) about 12 to 13 billion years old.
   (b) are 4.5 billion years old.
   (c) about 1 or 2 billion years old.
   (d) are 12 to 13 million years old.
   (e) are 4.5 million years old.

23. Which of these may lead to formation of different type of galaxies
   (a) pre-galactic clouds have different densities.
   (b) pre-galactic clouds have different rotation rates.
   (c) galaxies colliding to create different types.
   (d) all of these
   (e) none of these

24. What is found at the center of many galaxies?
   (a) Open cluster
   (b) Closed cluster
   (c) Supermassive black hole.
   (d) Supermassive central planet.
   (e) none of these

25. Starburst galaxies are continuously forming new stars
   (a) Yes. This is the origin of new stars
   (b) Yes. But only since the universe began
   (c) No. If they carried on very long they would use up the gas before long
   (d) No. Starburst are candies not galaxies.
   (e) Starburst galaxies never actually form stars.
26. Matter falling into a supermassive black hole is thought to be the source of
(a) quasars
(b) active galactic nuclei
(c) jets shooting into space
(d) all of the above
(e) none of the above

27. A black hole is
(a) a giant star emitting x-rays and gamma rays
(b) an object which emits like a blackbody.
(c) an object with a gravitational potential such that light can’t escape
(d) any object we don’t understand.

28. Since quasars are mostly found at great distances
(a) There must have been more when the universe was young
(b) we can use there light to study the intergalactic medium.
(c) quasars must remain unchanged over the life of the universe.
(d) all of these.
(e) A and B

29. At the beginning of the universe
(a) it was very hot.
(b) it was very dense.
(c) matter and energy could turn into each other.
(d) all of these
(e) none of these
30. Which of the two main predictions of the big bang theory turned out to be true?

   (a) Radiation has been found coming from all of space, just as predicted.
   (b) The oldest stars are made of hydrogen, helium, and lithium, in the proportions predicted.
   (c) both A and B
   (d) neither A nor B

31. The cosmic background radiation from the big bang has been mapped in detail. What does it look like?

   (a) It is all over the sky.
   (b) It is seen even where there is no matter.
   (c) It is very uniform in overall distribution.
   (d) If you look very closely, there are slight fluctuations from place to place.
   (e) all of the above

32. When we look at galaxies we are looking further back in time than when we look at the Cosmic Background Radiation.

   (a) true
   (b) false
   (c) neither true or false

33. What is inflation.

   (a) counting more stars than there actually are
   (b) counting more galaxies than there actually are
   (c) Inflation is a period of rapid contraction just before the big bang
   (d) inflation is a period of rapid expansion shortly after the big bang
34. We can detect black holes by

(a) observing matter emitting as it falls in.
(b) inferring a mass from motion of objects near it.
(c) observing emission from matter after it falls in
(d) observing light that falls in
(e) a and b

35. During inflation matter moves faster than light.

(a) true and this is a point against the inflation model.
(b) true but it occurs only in a black hole.
(c) false inflation is slow and gentle expansion.
(d) false the matter doesn’t move in space, space itself is expanding.

36. Models of the universe say it is about how old,

(a) a few trillion years
(b) about 13 or 14 billion years.
(c) a hundred thousand years.
(d) a few thousand years.
(e) a few years.

37. About how long would it take light to travel across the galaxy

(a) a few trillion years
(b) about 13 or 14 billion years.
(c) a hundred thousand years.
(d) a few thousand years.
(e) a few years.
38. About how long for light to travel to nearest star.

(a) a few trillion years
(b) about 13 or 14 billion years.
(c) a hundred thousand years.
(d) a few thousand years.
(e) a few years.

39. The oldest stars are about how old,

(a) a few trillion years
(b) about 13 or 14 billion years.
(c) a hundred thousand years.
(d) a few thousand years.
(e) a few years.

40. Best estimate for composition of universe

(a) 4% ordinary matter, 23% dark matter, and 73% dark energy
(b) 14% ordinary matter, 23% dark matter, and 63% dark energy
(c) 24% ordinary matter, 23% dark matter, and 53% dark energy
(d) 4% ordinary matter, 3% dark matter, and 2% dark energy

41. Evidence for Dark Energy first came from

(a) Cepheid variables
(b) parallax measurements
(c) Supernova standard candles
(d) Post-planetary nebula
(e) Black holes.
42. Olber’s paradox is?
   (a) Galaxies are moving away, but appear to be closer.
   (b) Although Galaxies are close we see them far.
   (c) Stars are all moving in circles
   (d) why isn’t the night sky dark even though stars very near.
   (e) why isn’t the night sky bright, because every sight-line hits a star
43. We can estimate the mass of our galaxy by counting stars and multiplying by the mass of each star.
   (a) true
   (b) false
44. Stars in the halo of our galaxy are young and low mass.
   (a) true
   (b) false
45. Open cluster stars have more heavy elements then Globular cluster Stars.
   (a) true
   (b) false
46. High mass stars form quicker and live shorter on the main sequence.
   (a) true
   (b) false
47. All galaxies were closer together in the distant past.
   (a) true
   (b) false
48. The universe contains equal parts matter and antimatter.
   (a) true
   (b) false