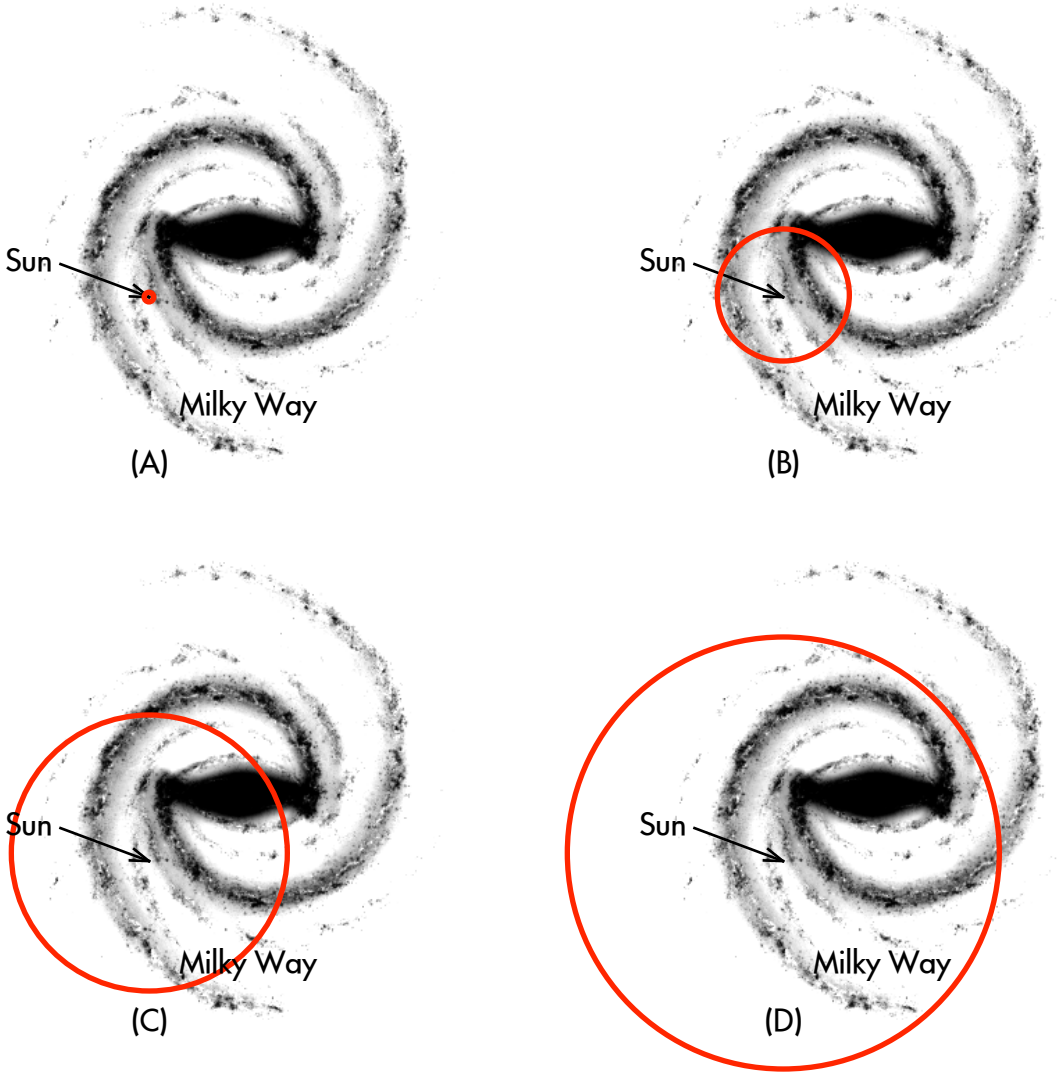
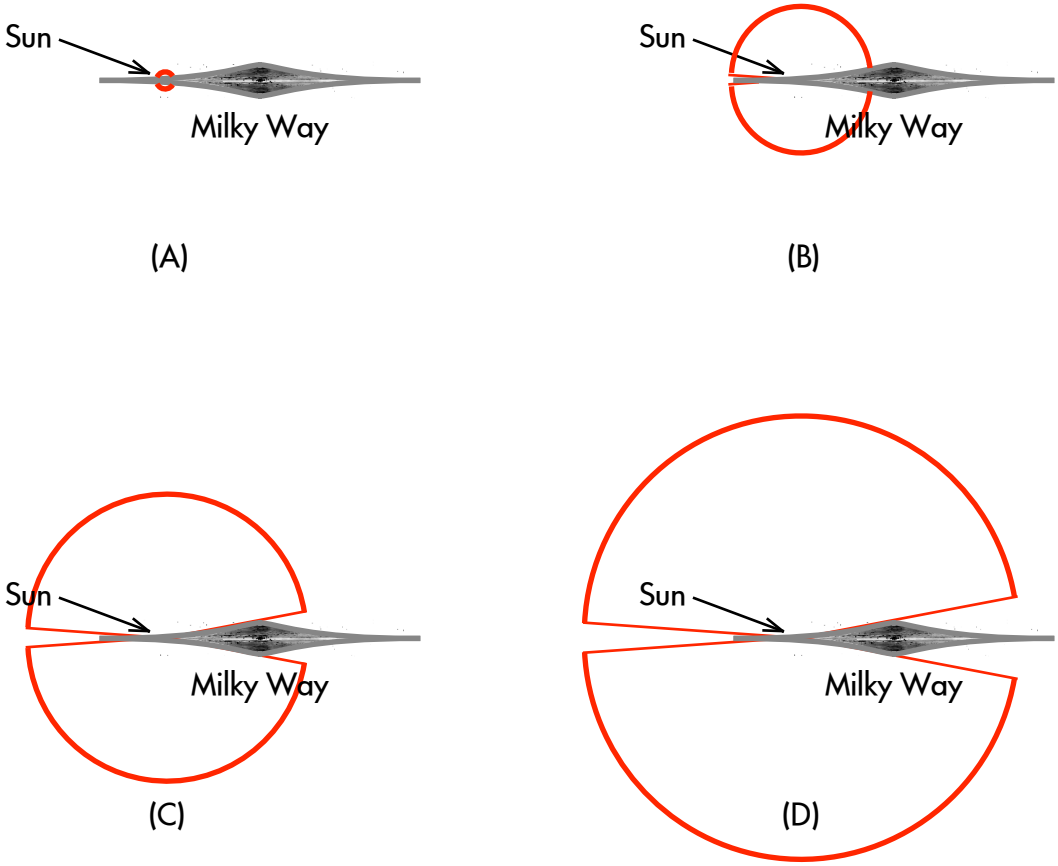
1. In this top view, which circle shows how many of the stars in the disk of the Milky Way are visible from Earth?



(E) Much further than can be shown on this page.
(F) (Unsure/guessing/lost/help!)

2. In this side view, which circle shows how much outside of the Milky Way is visible from Earth?



(E) Much further than can be shown on this page.
(F) (Unsure/guessing/lost/help!)

3. Most of the stars in the Milky Way cannot be seen from Earth because of:
(A) the finite speed of light.
(B) dark matter.
(C) interstellar gas and dust.
(D) expanding space.
(E) (Unsure/guessing/lost/help!)

4. Evidence that the Milky Way is shaped like a flat disk is:
(A) other disk-shaped galaxies.
(B) observations from dark sky locations.
(C) distant stars dimmer than nearby stars.
(D) Earth's precession.
(E) (Unsure/guessing/lost/help!)

5. The locations of globular clusters is evidence for the _____ of the Milky Way.
(A) location of the center.
(B) dark matter in the halo.
(C) self-sustaining star formation.
(D) spiral arm structure.
(E) (Unsure/guessing/lost/help!)

6. The _____ of Cepheid variable stars in globular clusters allows their distances to be determined.
(A) black hole companions.
(B) decreasing metal composition.
(C) erratic explosions.
(D) changing brightnesses.
(E) (Unsure/guessing/lost/help!)

7. The Milky Way's total mass can be determined by observing:
(A) the central supermassive black hole.
(B) globular cluster positions in the halo.
(C) radio emissions from dark matter.
(D) orbital motions of stars.
(E) (Unsure/guessing/lost/help!)

8. Evidence of dark matter in the Milky Way halo comes from:
(A) temperature measurements.
(B) stars with varying brightnesses.
(C) orbital motions of stars.
(D) the cosmic background radiation.
(E) (Unsure/guessing/lost/help!)

9. "Dark matter" is so named because it:
(A) exerts gravitational forces, but is less luminous than stars, gas, or dust.
(B) annihilates all luminous matter that it comes in contact with.
(C) blocks light from globular clusters in the halo.
(D) is emitted from black holes.
(E) (Unsure/guessing/lost/help!)

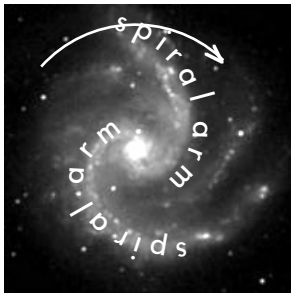
10. Dark matter in the Milky Way is located:
(A) between the spiral arms.
(B) above and below the disk, in the halo.
(C) in supergiant cores.
(D) inside the central supermassive black hole.
(E) (Unsure/guessing/lost/help!)

11. Evidence that spiral arms extend across the Milky Way comes from:
(A) lookback time.
(B) radio telescope observations.
(C) redshifted absorption lines.
(D) globular cluster positions.
(E) (Unsure/guessing/lost/help!)

12. Massive main-sequence stars are used to map some of the Milky Way's spiral arm structure because these stars:
(A) are metal-rich.
(B) are luminous.
(C) explode as type II supernovae.
(D) become neutron stars or black holes.
(E) (Unsure/guessing/lost/help!)

13. The Milky Way's spiral arm structure is mapped by radio waves that:
(A) travel at the same speed as density waves.
(B) travel between spiral arms.
(C) are unaffected by interstellar dust.
(D) are absorbed by dark matter.
(E) (Unsure/guessing/lost/help!)

14. According to the density wave theory, a gas cloud forms new stars as it passes through a spiral arm because:
(A) it collides with dark matter.
(B) its metals break down into non-metals.
(C) it slows down and compresses.
(D) it gathers more interstellar material.
(E) (Unsure/guessing/lost/help!)



15. [The self - sustaining star formation theory / Gravitational interactions within the disk, or with passing galaxies] may explain how _____ in the Milky Way.

(A) density waves start.
(B) branches and spurs form.
(C) metal-poor stars become metal-rich.
(D) dark matter formed.
(E) (Unsure/guessing/lost/help!)

16. The outermost layers of _____ are more abundant in metals (elements heavier than hydrogen and helium).
(A) extremely old stars that formed a long time ago.
(B) young stars that formed very recently.
(C) (There is a tie.)
(D) (Neither of the above choices, as stars cannot have metals.)
(E) (Unsure/guessing/lost/help!)

17. The _____ of the Milky Way [are older / have more metals / have more absorption lines / have flat, nearly circular orbits / have randomly oriented, elongated orbits] ?

(A) disk stars (population I stars).
(B) halo stars (population II stars).
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

18. Older stars are metal-poor, while newer stars are metal-rich because:
(A) older stars break down their metals.
(B) older stars have longer lifetimes.
(C) newer stars contain less dark matter.
(D) newer stars contain metals produced by older stars.
(E) (Unsure/guessing/lost/help!)

19. Evidence that the Milky Way became thinner and flatter as it evolved is that halo stars _____ than disk stars.
(A) have less metals.
(B) are cooler.
(C) are less luminous.
(D) have more dark matter.
(E) (Unsure/guessing/lost/help!)

20. According to the monolithic collapse model, the oldest stars in the Milky Way are located:
(A) in the halo.
(B) within the spiral arms.
(C) in the nuclear bulge.
(D) inside the central supermassive black hole.
(E) (Unsure/guessing/lost/help!)

21. _____ is evidence that small galaxies were captured by the growing Milky Way.
(A) The sun's absorption lines.
(B) Halo dark matter.
(C) Different ages of globular clusters.
(D) Stars orbiting the central supermassive black hole.
(E) (Unsure/guessing/lost/help!)

22. The [hydrogen in the sun's core / helium in the sun's core / carbon in your body / calcium in your bones / iron in your blood / gold and silver from mines] was produced by:

(A) the very early universe.
(B) the sun.
(C) another star, in the past.
(D) heat inside Earth's core.
(E) (More than one of the above choices.)
(F) (None of the above choices.)
(G) (Unsure/guessing/lost/help!)

Two different mass stars that began their main-sequence life at the same time 1 million years ago are located in the same spiral arm 1,000 light years from Earth.

Star (spectral type)	Mass[1]	Main-sequence lifetime[2]
O5	$40M_{Sun}$	1 million years
B5	$6.5M_{Sun}$	100 million years

23. Light from the _____ star takes the [shortest / longest] time to travel to us.

(A) O5.
(B) B5.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

24. The _____ star is visible as a [main - sequence / supergiant] in the San Luis Obispo, CA night sky tonight.

(A) O5.
(B) B5.
(C) (Both stars.)
(D) (Neither star.)
(E) (Unsure/guessing/lost/help!)

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[1] wki.pe/Main_sequence#Sample_parameters.
[2] wki.pe/Main_sequence#Lifetime.

25. Observing the very early universe, just after the start of the big bang, is possible because of:
(A) the Doppler effect.
(B) dark matter.
(C) space-time curvature.
(D) the finite speed of light.
(E) (Unsure/guessing/lost/help!)

26. Distant galaxies _____ is evidence that they are moving away from the Milky Way.
(A) getting dimmer.
(B) decreasing in size.
(C) with redshifted absorption lines.
(D) appearing as they did in the past.
(E) (Unsure/guessing/lost/help!)

27. Evidence that the universe $\begin{bmatrix}\text{has no center of expansion}\\ \text{is not expanding like an explosion}\\ \text{is not infinitely old}\end{bmatrix}$ is that:

(A) the speed of light is finite.
(B) galaxy redshifts are proportional to galaxy distances.
(C) matter and antimatter can annihilate into energy.
(D) the night sky is dark, and not blindingly bright.
(E) (Unsure/guessing/lost/help!)

28. Distant galaxies seem to recede in every direction from the Milky Way because of:
(A) gravitational forces.
(B) expanding space.
(C) the finite speed of light.
(D) look-back time.
(E) (Unsure/guessing/lost/help!)

29. Tracing the present-day recession of galaxies backwards in time is evidence for:
(A) the origin of dark matter.
(B) a high-density, high-temperature early universe.
(C) the location of the center of the universe.
(D) a closed universe that will expand and collapse again.
(E) (Unsure/guessing/lost/help!)