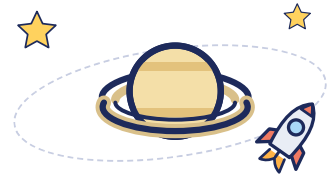


Space Quiz



Mission Specialists

Grades 9–12 (high school) · ages 14–18

SCORE

____ / 25

Name _____ Class _____ Date _____

25 questions · 25 points · about 35 minutes



Multiple choice

Fill in the circle next to the best answer. One point each.

12 POINTS

- ① In a main-sequence star's core, the outward pressure from fusion balances which force?

(A) Gravity
(B) Magnetism
(C) Friction
(D) The strong force
- ② Where does the Sun lie on a Hertzsprung-Russell (H-R) diagram?

(A) Among the red giants
(B) Among the white dwarfs

(C) On the main sequence
(D) Among the supergiants
- ③ What does the core of a Sun-like star become after the star sheds its outer layers?

(A) A black hole
(B) A white dwarf

(C) A neutron star
(D) A supernova remnant
- ④ The cosmic microwave background (CMB) is best described as which of these?

(A) Radio noise from quasars
(B) Heat from Milky Way stars

(C) Light from the first galaxies
(D) The oldest light we can observe
- ⑤ Light from distant galaxies is redshifted. What does this show?

(A) The galaxies are unusually hot
(B) Space is expanding

(C) The galaxies are mostly hydrogen
(D) Red dust is absorbing blue light
- ⑥ A planet orbits at an average distance of 4 AU. By Kepler's third law, its year lasts about

(A) 8 Earth years
(B) 4 Earth years
(C) 16 Earth years
(D) 2 Earth years
- ⑦ If the distance between two masses doubles, the gravitational force between them becomes

(A) Half as strong
(B) Twice as strong

(C) Four times as strong
(D) One quarter as strong
- ⑧ One parsec is equal to about

(A) 3.26 astronomical units
(B) 3.26 million kilometers

(C) 3.26 light-years
(D) 326 light-years

- 9 Absorption lines in a star's spectrum are used to identify its
- (A) Distance from Earth
 - (B) Rotation period
 - (C) Chemical elements
 - (D) Number of planets
- 10 The transit method finds exoplanets by detecting
- (A) A Doppler shift in the star's light
 - (B) Radio signals from the planet
 - (C) Direct photos of the planet
 - (D) A periodic dip in the star's brightness
- 11 A neutron star forms when
- (A) The core of a massive star collapses
 - (B) A white dwarf slowly cools
 - (C) Two planets collide
 - (D) A Sun-like star runs out of fuel
- 12 Why are X-ray telescopes placed in space?
- (A) X-rays are too faint to detect on Earth
 - (B) Earth's atmosphere blocks X-rays
 - (C) X-ray telescopes need zero gravity
 - (D) The Moon reflects X-ray light



True or false

Circle TRUE or FALSE. One point each.

4 POINTS

- 13 Stars much more massive than the Sun live longer than the Sun. True False
- 14 The radial velocity method detects planets by measuring Doppler shifts in a star's light as the star wobbles. True False
- 15 Radio waves have shorter wavelengths than visible light. True False
- 16 Nothing, not even light, can escape from inside a black hole's event horizon. True False



Matching key terms

Draw a line from each term to its meaning. One point each.

5 POINTS

- | | | |
|----------------------------------|---|--|
| 17 Astronomical unit (AU) | • | • (A) Stage when a star fuses hydrogen in its core |
| 18 Light-year | • | • (B) About the average Earth–Sun distance |
| 19 Absorption line | • | • (C) Boundary of no return around a black hole |
| 20 Main sequence | • | • (D) Dark line showing an element in a star |
| 21 Event horizon | • | • (E) Distance light travels in one year |



Short answer

Answer in complete sentences. One point each.

4 POINTS

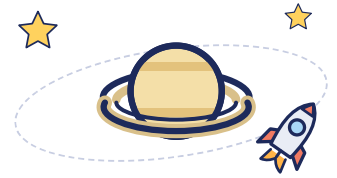
- 22) Name the nuclear reaction that powers the Sun and say what it produces.

- 23) Give two pieces of evidence that support the Big Bang theory.

- 24) Explain how the transit method and the radial velocity method each detect an exoplanet.

- 25) How does a planet's speed change as it moves closer to the Sun, and what law describes this?

Answer Key



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QUICK CHECK

1 A	2 C	3 B	4 D	5 B	6 A
7 D	8 C	9 C	10 D	11 A	12 B
13 F	14 T	15 F	16 T	17 B	18 E
19 D	20 A	21 C	22 see below	23 see below	24 see below
25 see below					

Part A · Multiple choice

12 POINTS

- In a main-sequence star's core, the outward pressure from fusion balances which force?
A · Gravity
Fusion's outward pressure supports the star's mass against gravity, which keeps the star from collapsing.
- Where does the Sun lie on a Hertzsprung-Russell (H-R) diagram?
C · On the main sequence
The Sun is a main sequence star, fusing hydrogen into helium in its core, as most stars do for most of their lives.
- What does the core of a Sun-like star become after the star sheds its outer layers?
B · A white dwarf
A Sun-like star ejects its outer layers as a planetary nebula, leaving its hot core behind as a white dwarf.
- The cosmic microwave background (CMB) is best described as which of these?
D · The oldest light we can observe
The CMB is the oldest light we can observe, a glow left over from the early universe as the first atoms formed.
- Light from distant galaxies is redshifted. What does this show?
B · Space is expanding
As space expands, it stretches light traveling through it to longer, redder wavelengths. More distant galaxies show larger redshifts.
- A planet orbits at an average distance of 4 AU. By Kepler's third law, its year lasts about
A · 8 Earth years
Period squared equals distance cubed (years and AU): 4 cubed is 64, and the square root of 64 is 8.
- If the distance between two masses doubles, the gravitational force between them becomes
D · One quarter as strong
Gravity is inversely proportional to the square of the distance, so doubling the distance gives 1/4 the force.
- One parsec is equal to about
C · 3.26 light-years
A parsec is the distance at which a star shows a parallax of one arcsecond: about 3.26 light-years.
- Absorption lines in a star's spectrum are used to identify its
C · Chemical elements
Each element absorbs light at specific wavelengths, so the pattern of dark lines reveals which elements are present.
- The transit method finds exoplanets by detecting
D · A periodic dip in the star's brightness
When a planet crosses in front of its star, it blocks a small fraction of the light, repeating each orbit.

- 11 A neutron star forms when

A · The core of a massive star collapses

When a massive star's core collapses, protons and electrons are crushed into neutrons, and neutrons can halt the collapse.

- 12 Why are X-ray telescopes placed in space?

B · Earth's atmosphere blocks X-rays

Earth's atmosphere absorbs X-rays, so X-ray detectors must be positioned above it.

Part B · True or false

4 POINTS

- 13 Stars much more massive than the Sun live longer than the Sun.

False

Massive stars use their fuel faster. The Sun gets about 10 billion years on the main sequence; massive stars only millions.

- 14 The radial velocity method detects planets by measuring Doppler shifts in a star's light as the star wobbles.

True

A planet's gravity tugs its star back and forth, shifting the starlight slightly bluer and redder.

- 15 Radio waves have shorter wavelengths than visible light.

False

Radio waves have the longest wavelengths in the electromagnetic spectrum, far longer than visible light.

- 16 Nothing, not even light, can escape from inside a black hole's event horizon.

True

Gravity just beneath the event horizon is strong enough that nothing, not even light, can escape.

Part C · Matching key terms

5 POINTS

- 17 **Astronomical unit (AU)**

B · About the average Earth–Sun distance

One AU is the distance from the Sun to Earth's orbit, about 150 million km (93 million miles).

- 18 **Light-year**

E · Distance light travels in one year

A light-year is the distance a photon travels in a year, about 9.5 trillion km (5.9 trillion miles).

- 19 **Absorption line**

D · Dark line showing an element in a star

Elements absorb light at characteristic wavelengths, leaving dark lines in a spectrum that identify them.

- 20 **Main sequence**

A · Stage when a star fuses hydrogen in its core

Stars on the main sequence of the H-R diagram burn hydrogen into helium.

- 21 **Event horizon**

C · Boundary of no return around a black hole

Inside the event horizon, gravity is strong enough that nothing, not even light, can escape.

Part D · Short answer

4 POINTS

- 22 Name the nuclear reaction that powers the Sun and say what it produces.

Nuclear fusion: hydrogen nuclei join to form helium, releasing energy as light and heat.

The Sun's core fuses hydrogen into helium, and the released energy is what the Sun radiates.

23 Give two pieces of evidence that support the Big Bang theory.

Any two: galaxies' light is redshifted, showing space is expanding; the cosmic microwave background is leftover light from the early universe.

Redshift shows the universe is expanding, and the CMB is the oldest light we can observe.

24 Explain how the transit method and the radial velocity method each detect an exoplanet.

Transit: the star dims slightly each time a planet crosses in front. Radial velocity: the planet's pull makes the star wobble, shifting its light by the Doppler effect.

Transits show a repeating dip in brightness; radial velocity shows a repeating Doppler shift from the star's wobble.

25 How does a planet's speed change as it moves closer to the Sun, and what law describes this?

It speeds up. Kepler's second law: a line from the Sun to the planet sweeps equal areas in equal times.

Kepler's second law means a planet moves fastest at perihelion, its closest point, and slowest at aphelion.