

Name _____

Do not forget to write your name and fill in the bubbles with your student number, and fill in test form A on the answer sheet. Write your name above as well. You have 50 minutes. For each question, mark the best answer. There are no formulas for this test. **The final five questions are based on images projected at the front of the room.**

1. The main component of the gas giant's atmospheres is/are:
 - A) Nitrogen
 - B) Carbon dioxide
 - C) Helium and Xenon
 - D) Hydrogen and helium
 - E) Oxygen

2. What is the ultimate source of heat that keeps the interior of the Earth hot?
 - A) Light from the Sun
 - B) The Solar wind
 - C) Radioactive decay of elements like uranium and thorium inside the Earth
 - D) Heat of formation left over from when the Earth formed
 - E) Tidal heating caused by the gravitational influence of the Sun

3. What probably happened to Earth's first (primary) atmosphere?
 - A) It underwent chemical reactions and is now mostly in our oceans
 - B) It was subducted inside the Earth by the movement of tectonic plates
 - C) It was converted by plants into oxygen
 - D) It was demolished by winds coming from the Sun
 - E) Nothing; we still have it

4. Which source gives us samples that we can use to determine the approximate age of the Solar system?
 - A) Stony meteorites
 - B) Iron meteorites
 - C) Carbon-rich primitive meteorites
 - D) Apollo moon rocks
 - E) Mars Sample Return Mission

5. Why are earthquakes so useful in helping us learn about what the Earth is like on the inside?

- A) Earthquakes bring us samples from the interior
 - B) Earthquakes are responding to motions in the core of the Earth, so indirectly they tell us about the core this way
 - C) Earthquakes temporarily shift dense parts of the Earth out of the way, so we can use radar to detect the interior
 - D) Earthquakes create cracks so we can send in robotic probes to study the interior
 - E) Earthquakes cause vibrations to pass through the entire Earth, and since different materials respond different ways, we can learn what the Earth is probably made of
6. In order from most to least common, what is the nebula from which stars and planets form made of?
- A) Hydrogen and helium, metal and rock, ices
 - B) Hydrogen and helium, ices, metal and rock
 - C) Ices, hydrogen and helium, metal and rock
 - D) Ices, metal and rock, hydrogen and helium
 - E) Metal and rock, ices, hydrogen and helium
7. The gas giants are much more massive than the terrestrial planets because
- A) They are made of a higher percentage of rock
 - B) They are made of a higher percentage of metal
 - C) In addition to rock and metal, they have thick layers of ices and thick atmospheres
 - D) They have large quantities of dense materials like uranium and osmium, which are rare on the terrestrial planets
 - E) They formed in the thicker part of the protoplanetary nebula, so they have more of everything
8. Why is it believed that the Moon has so little metal, in contrast to the Earth?
- A) It originally formed in a part of the nebula which had very little metal
 - B) The Earth's greater gravity pulled all the metal to itself
 - C) The Earth has a strong magnetic field, which pulled the metal in
 - D) The Moon probably formed from a giant impact, so it is made mostly from the rocky mantle of the Earth
 - E) The Moon cooled more quickly, being smaller, before it could accumulate any metal
9. What is the outer core of the Earth probably made of?
- A) Solid rock
 - B) Liquid rock
 - C) Solid metal
 - D) Liquid metal
 - E) None of these
10. Which two factors make a planet or moon more likely to keep its atmosphere?
- A) Being close to the Sun and having a high mass
 - B) Being far from the Sun and having a high mass
 - C) Being close to the Sun and having a low mass
 - D) Being far from the Sun and having a low mass
 - E) Paying your dues to the Atmosphere Protection Fairies Union
11. In addition to Saturn, what other planets have rings around them?
- A) Uranus (only)

- B) Neptune (only)
- C) Jupiter (only)
- D) Uranus and Neptune, but not Jupiter
- E) Uranus, Neptune, and Jupiter

12. To form planets, first you have tiny pieces come together due to _____ to form planetismals, and then the planetismals come together due to _____ .
- A) Random collisions, gravity
 - B) Gravity, random collisions
 - C) Magnetic forces, gravity
 - D) Gravity, magnetic forces
 - E) Magnetic forces, random collisions
13. The rings of Saturn are made of primarily _____ with a little bit of _____ mixed in
- A) Ice, dust
 - B) Dust, ice
 - C) Ice, gas
 - D) Gas, ice
 - E) Gas, dust
14. Short period comets probably originate in which location?
- A) Oort Cloud
 - B) Kuiper belt
 - C) Asteroid belt
 - D) Neptune's moons
 - E) The Sun
15. The largest known mountain in the Solar system is on _____ and the largest valley is on _____.
- A) Mars, Mars
 - B) Mars, Venus
 - C) Mars, Earth
 - D) Earth, Mars
 - E) Earth, Venus
16. Which of the following is true about volcanism on Mercury?
- A) There is no evidence that there were ever volcanoes on Mercury
 - B) There is strong evidence that there were volcanoes in the distant past, but probably not any more
 - C) There are probably still active volcanoes on Mercury, though we have never seen one
 - D) Active volcanoes have been identified, but they are no more common than they are on Earth
 - E) Active volcanoes have been seen and are much more common than on Earth
17. Which of the gas giant planet rotates on an axis that is tipped way over compared to its orbit?
- A) Saturn
 - B) Jupiter
 - C) Neptune
 - D) Uranus
 - E) None of them
18. Which of the following is largest in diameter?
- A) Titan
 - B) Mercury
 - C) Ganymede
 - D) Triton
 - E) Pluto
19. In what way, according to the currently accepted definition, does a dwarf planet differ from a planet?
- A) A dwarf planet does not have an atmosphere; a planet does

- B) A dwarf planet need not be round (in hydrostatic equilibrium), but a planet must be
 - C) A dwarf planet need not orbit a star; it can orbit another planet
 - D) A dwarf planet need not have a lot more mass than all other objects in similar orbits
 - E) A dwarf planet does not have a moon of its own; a planet does
20. The initial cloud of gas from which stars and planets form is called a
- A) Protoplanetary disk
 - B) Accretion disk
 - C) Molecular cloud
 - D) H-I region
 - E) Reflection nebula
21. Which planet has a large moon that orbits backwards compared to the direction of rotation of the planet?
- A) Saturn
 - B) Jupiter
 - C) Earth
 - D) Uranus
 - E) Neptune
22. Which of the terrestrial planets has the densest atmosphere?
- A) Earth
 - B) Mars
 - C) Venus
 - D) Mercury
 - E) None of these
23. Why do planets normally have a layered appearance, with metal, then rock, then ices (if any) and then their atmospheres?
- A) Gravity: the heaviest components sank to the bottom
 - B) Magnetism: Metals are the most magnetic and fall first
 - C) Temperature: Metals condense at the highest temperatures, so they formed first, etc.
 - D) Layered formation: The metals entered the solar system first and formed the cores, then came the rocks, etc.
 - E) Radioactivity: The materials with the highest radioactivity naturally go to the center
24. Which moon has active volcanoes that are spewing sulfur?
- A) Europa
 - B) Enceladus
 - C) Triton
 - D) Titan
 - E) Io
25. The disk from which the planets formed often is spinning fairly fast. How did it get such a fast spin?
- A) Magnetic fields from the rotating star accelerate the disk to high speeds
 - B) Passing stars tend to pull on it, always spinning it faster and faster
 - C) Early stellar winds spin it up to high speed
 - D) Gas expelled by this disk always pushes backwards, accelerating it
 - E) The disk shrank at first, and as it shrank, slow spin gets converted into fast spin
26. Which technique has actually succeeded in finding the largest number of exoplanets?
- A) Transit method, where you watch the star getting dimmer as the planet gets in front of it
 - B) Pulsar timing; where you study the timing of precise pulses from the star
 - C) Radial velocity method, where you study the Doppler shift of the star

- D) Direct imaging, where you search of the faint image of a planet next to a star
- E) Astrometry, where you watch the star wobble back and forth due to the planet's gravity

27. Which is the largest moon of all the terrestrial planets?

- A) Earth's Moon
- B) Ganymede
- C) Phobos
- D) Deimos
- E) Titan

28. For which planet, and why, do visible light pictures from space not tell us about the surface?

- A) Mars, because it is covered by polar caps that hide the surface
- B) Venus, because it is covered by clouds all the time
- C) Venus, because it is uniform in color and you can't see anything
- D) Mercury, because without an atmosphere, there is nothing to see
- E) Mercury, because it is so close to the Sun it is too bright to take pictures of

For each of the following, please look at the pictures on the screen to identify the object.

29. What are these pictures of?

- A) Uranus
- B) Neptune
- C) Venus
- D) Triton
- E) Titan

30. What is this a picture of?

- A) Ganymede
- B) Triton
- C) Neptune
- D) Jupiter
- E) Io

31. What is this a picture of?

- A) Iapetus
- B) Moon
- C) Mercury
- D) Europa
- E) Ganymede

32. What is this a picture of?

- A) Iapetus
- B) Moon
- C) Mercury
- D) Europa
- E) Ganymede

33. What is this a picture of?

- A) Io
- B) Miranda
- C) Mars
- D) Saturn
- E) Earth