

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.**

- Which layers of the Earth are made primarily of metal?
 - Inner core (only)
 - Outer core (only)
 - Mantle (only)
 - Inner and outer core, but not the mantle
 - Inner core, outer core, and mantle
- Molecular clouds tend to be relatively _____ density and _____ temperature, which makes it easy for them to contract and form stars and planets
 - high, high
 - low, low
 - high, low
 - low, high
 - shiny, obsequious
- Titan is a moon that orbits
 - Jupiter
 - Mars
 - Saturn
 - Neptune
 - Uranus
- The primary source of heat that makes the Earth's interior hot is
 - Heat of formation, left over from when the Earth first formed
 - Friction from the motion of convecting layers within the Earth's mantle
 - The Sun
 - Chemical reactions in the interior of the Earth
 - Radioactive decay of materials inside the Earth
- Jupiter is known for having gigantic storms. How come the other gas giant planets don't have large storms?
 - They are too far from the Sun to get enough weather to cause large storms
 - They aren't large enough to still be holding heat inside, which drives the storms
 - They rotate too slowly to have significant storms
 - They have too little atmosphere to have significant storms
 - Actually, they do. In particular, Neptune has a very large storm
- Why do spacecraft that land on Venus tend to fail almost immediately?
 - Venus has extremely high surface temperatures
 - Sulfuric acid in the atmosphere destroys the spacecraft before they even touch down
 - There is so much water that everything rusts and corrodes
 - The winds are so strong they quickly destroy anything that lands on the surface
 - Volcanoes tend to cover any spacecraft immediately with lava
- Jupiter is the largest planet. What is the second largest planet?

A) Earth B) Saturn C) Uranus D) Neptune E) Mars

8. Which two factors cause the Moon to have wide swings in temperature, so it gets both much hotter and much colder than the Earth?
- A) Lack of atmosphere, and its eccentric orbit
 - B) Lack of atmosphere, and slow rotation
 - C) Lack of atmosphere, and no magnetic field
 - D) Eccentric orbit, and slow rotation
 - E) Eccentric orbit, and no magnetic field
9. Which of the following is true about how much we have explored Mercury?
- A) We have never sent any spacecraft to the neighborhood of Mercury
 - B) We have sent spacecraft there in the past, but nothing current or nearly current
 - C) We have recent or current spacecraft there, but not on the surface
 - D) We have sent spacecraft that have landed on the surface, but not humans
 - E) We have sent spacecraft with humans that landed on the surface
10. Why do planets normally have metal at the center, then rock, then ices, and finally gases on the outside, rather than some other order?
- A) This represents the order in which the different substances were pulled into the solar system, with the heavy metals first and the light gases last
 - B) Chemical reactions tend to segregate these various components, which cannot mix with each other
 - C) Metals are solids at the highest temperatures, and gases at the lowest, so in the cooling solar system the metal layer formed first
 - D) Gravity pulled the heavier metals, then rock, then ice, towards the bottom
 - E) Magnetic fields pull the metal to the bottom, since only metals are affected by magnets
11. Which represents the largest component of the protoplanetary disk, from which the planets formed?
- A) Hydrogen and Helium
 - B) Ices, such as water ice and ammonia
 - C) Rock
 - D) Metal
 - E) None of the above
12. I am standing on the tallest mountain in the Solar System. Where am I?
- A) Earth B) Jupiter C) Venus D) Mars E) Mercury
13. Why is Jupiter's moon Ganymede not considered a planet?
- A) It isn't quite round

- B) It has no atmosphere
 - C) It is much smaller and less massive than any other planet
 - D) It orbits Jupiter, instead of the Sun
 - E) It is composed primarily of ice, rather than rock and metal
14. Why does much of the gas and dust that formed the Solar System end up in a protoplanetary disk, rather than all going into the protostar in the center?
- A) The cloud typically has some rotation, which becomes more important as it shrinks
 - B) The star is emitting strong stellar winds, which clear away everything except what is in the disk
 - C) The magnetic fields of the protostar channel all gas and dust into the disk
 - D) Gravity causes all the gas to contract to a disk shape
 - E) Actually, it all goes into the star, but some of it is later flung out the equator by the protostar's rotation
15. What interesting property is believed to happen to the hydrogen atoms in Jupiter's and Saturn's interior, due to the enormous pressure?
- A) They undergo nuclear fusion, becoming helium
 - B) They undergo chemical reactions, making complex hydrogen rings
 - C) They compress so tightly that Jupiter and Saturn each have very high average density
 - D) They form a liquid metallic layer where the magnetic fields are probably generated
 - E) They create enormous heat, which is the source of these planet's internal heat
16. Why is there relatively little water and other ices on the four terrestrial planets, as compared to the gas giants?
- A) The metal and rock core of these planets were too small to attract ices
 - B) These planets formed inside the frost line, where it was too warm for ices to condense
 - C) Ices are relatively low density, and floated out to the outer planets
 - D) Initially, they had lots of ices, but it was all driven off by global warming
 - E) Actually, these planets are made primarily of ices; for example, Earth is about three-fourths covered in water
17. What causes meteor showers, a continuous rain of tiny meteors at certain times of the year?
- A) Debris left over from the evaporation of the ice of a comet
 - B) The fragments of an asteroid that has been pulverized
 - C) The dust that has been removed from an asteroid or moon by a collision
 - D) Material shot out from the Sun during a solar flare
 - E) A group of small asteroids held together by gravity until they neared the Earth
18. It is well known that Earth's continents are slowly moving, drifting from place to place. What is causing them to move?
- A) The slow convection of the mantle underneath them

- B) Tidal forces from the Sun and Moon
 - C) Pressure of water waves from the oceans
 - D) Magnetic forces generated inside the Earth
 - E) Plumes of magma coming up from the Earth's core
19. Unlike Earth, Mars has an atmospheric pressure that changes drastically from season to season. How is this possible?
- A) Life on Mars produces huge amounts of gas that are created and released by photosynthesis
 - B) The carbon dioxide in the atmosphere can freeze onto the polar caps and later get released, depending on the season
 - C) Chemical reactions bind the atmosphere into the rocks on Mars, changing the pressure
 - D) The amount of gas doesn't change, but because the temperature does, the pressure does as well
 - E) Mars' rotation is so much faster than Earth's, which causes it to have much more dramatic storms
20. The outer planets have atmospheres with lots of hydrogen and helium. How come Earth doesn't have such an atmosphere?
- A) There was no hydrogen or helium in the inner solar system
 - B) Though they used to have some such atmosphere, it was probably all stripped away by strong stellar winds from the young Sun
 - C) Earth's gravity was too weak to attract even a small hydrogen/helium atmosphere
 - D) All of Earth's hydrogen and helium have been incorporated into compounds like water and helium hexafluoride
 - E) The Earth is close enough to the Sun that the Sun's gravity pulled in all the hydrogen and helium
21. Which of the terrestrial planets has the thickest atmosphere?
- A) Earth B) Mars C) Mercury D) Uranus E) Venus
22. What clue has led us to believe that the maria on the Moon are much younger than the highlands?
- A) They are darker
 - B) They are lighter
 - C) They have fewer craters
 - D) They have more craters
 - E) They use a fake ID when they try to order drinks
23. Io is the most volcanically active object in the Solar System, even though it is comparable in size to the dead Moon. How is this possible?
- A) Io experiences tidal heating caused by its eccentric orbit around the planet Jupiter
 - B) Io has high levels of radioactive materials in it, which keeps it hot inside

- C) Io contains large amounts of sulfur, which undergo chemical reactions to keep it hot
 - D) Io passes through the powerful magnetic field of Jupiter, which heats it by induction
 - E) Io is so close to Jupiter that it actually rubs against the atmosphere, causing friction
24. Which planet is the most distant from the Sun?
- A) Mars
 - B) Venus
 - C) Neptune
 - D) Uranus
 - E) Saturn
25. Why is the banding pattern on Jupiter more evident than on Saturn, and far more evident than on Uranus or Neptune?
- A) Jupiter has a larger fraction of the relatively rare compounds that form those clouds
 - B) Icy layers on Neptune and Uranus (and to some extent on Saturn) block our view of these clouds
 - C) Jupiter spins much faster than any of these planets, causing it to naturally have a more band-like structure
 - D) Jupiter is simply better illuminated, since it is closer to the Sun
 - E) Jupiter is warmer, and hence the clouds that cause these bands are closer to the outside, since they form at temperatures close to the surface temperature
26. Are there signs of volcanism on Venus?
- A) There are no signs that there was every any volcanoes on Venus
 - B) There are signs that there were volcanoes, but probably not recently
 - C) There are signs that there have been recent volcanoes, but we haven't seen any erupting
 - D) We have seen volcanoes that are actually erupting, but they are rare
 - E) There are always numerous volcanoes erupting on Venus
27. Besides Saturn, what 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
28. Pluto and Eris are
- A) Asteroids
 - B) Members of the Oort cloud
 - C) Members of the Kuiper Belt
 - D) Moons

E) None of the above

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

29. What are these pictures of?

A) Titan B) Mars C) Europa D) Venus E) Earth

30. What is this a picture of?

A) Triton B) Europa C) Io D) Saturn E) Moon

31. What is this a picture of?

A) Mercury B) Ganymede C) Neptune D) Uranus E) Moon

32. What are these pictures of?

A) Venus B) Uranus C) Mercury D) Titan E) Jupiter

33. What is this a picture of?

A) Mars B) Ganymede C) Io D) Triton E) Jupiter