

Name _____

Do not forget to write your name and fill in the bubbles with your student number, and fill in test form D on the answer sheet. Write your name above as well. You have 40 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.**

- Where can be found the largest storm in the Solar System?
A) Earth B) Titan C) Mars D) Venus E) Jupiter
- Why does metal tend to be nearer to the center of planets, while ices (for example) are higher up?
A) The metal part formed first
B) The planet's magnetic fields draw the metal to the center
C) The metal is denser, so it falls to the bottom (center)
D) The high temperatures at the center would melt and vaporize the ices, causing them to rise
E) Ices can only form in the presence of salts, which tend to be on the surface
- What difference between the Earth and our Moon can account for the fact that the Earth has an atmosphere and the Moon does not?
A) The Moon is closer to the Sun sometimes, so it has a higher average temperature
B) The Moon formed within the frost line, so it couldn't gather the volatile materials that the Earth can
C) The Earth has more mass, and the greater gravity helps it hold onto gasses
D) The Earth has plants, which produce the oxygen that is the main component of our atmosphere
E) The Moon is not a planet, and only planets can have atmospheres
- As you move away from the Sun, the next planet after Saturn is
A) Jupiter B) Titan C) Neptune D) Uranus E) Mars
- The planets generally decrease with temperature as we move away from the Sun. Which planet does not follow this pattern?
A) Venus B) Earth C) Jupiter D) Neptune E) Saturn
- What causes the interior of the Earth to circulate, slowly flowing?
A) Tidal forces from the Moon
B) The gravitational pull of the Sun
C) Convection of heat moving from the center outwards
D) Magnetic pulls from the Sun, Moon, and other planets
E) None of the above; the Earth's interior is not flowing
- For planets like Earth, most of the heat of the interior comes from

- A) Heat of formation, from the time the Earth formed
 - B) Gravitational contraction of the Earth
 - C) Ongoing differentiation
 - D) Radioactive decay
 - E) Light from the Sun
8. Which of the following is the most volcanically active in the Solar System?
- A) Earth
 - B) Venus
 - C) Mars
 - D) Ganymede
 - E) Io
9. Earth's first or primary atmosphere was probably made primarily of
- A) Hydrogen and helium
 - B) Nitrogen
 - C) Carbon dioxide
 - D) Oxygen
 - E) None of the above
10. Which of the techniques below has been most successful in discovering the most exoplanets, or planets around other stars?
- A) The transit method: Observing the dimming of the star as the planet passes in front of it
 - B) Direct observation: Seeing the planet in images next to its star
 - C) Astrometry: Seeing the change in position of the star as the planet orbits it
 - D) Gravitational waves: Seeing the gravitational waves generated by an orbiting planet
 - E) None of these: None of these methods has discovered more than a handful of planets
11. Which of the following was the largest component of the protoplanetary disk?
- A) Rock
 - B) Metal
 - C) Hydrogen
 - D) Water
 - E) Ammonia
12. The bluish color of Neptune is believed to be caused by which substance?
- A) Hydrogen
 - B) Methane
 - C) Water
 - D) Helium
 - E) Nitrogen
13. Which of the following objects has a composition very different from Earth?
- A) Neptune
 - B) Mars
 - C) Mercury
 - D) Venus
 - E) Earth's Moon
14. What clue tells us that Mars's southern hemisphere is older than its northern hemisphere?
- A) The southern hemisphere has more craters
 - B) The northern hemisphere has more craters
 - C) There are more volcanoes near the southern hemisphere
 - D) There are more volcanoes near the northern hemisphere
 - E) Radioactive dating of rocks from different regions allow us to measure their age
15. Which of the following is smallest?
- A) Earth
 - B) Mars
 - C) Venus
 - D) Mercury
 - E) Ganymede
16. The biggest component of Venus's atmosphere is believed to be
- A) Nitrogen
 - B) Carbon dioxide
 - C) Hydrogen
 - D) Methane
 - E) Water vapor

17. The best information about the deep interior of the Earth comes from
A) Drilling B) Earthquakes C) Magnetism D) Volcanoes E) Gravity
18. Which moon, if any, has a significant atmosphere?
A) Earth's Moon B) Io C) Titan D) Europa E) None of these
19. According to the current definition of a planet, Pluto does not qualify as a planet because
A) It doesn't have enough mass to be in hydrostatic equilibrium (round)
B) It doesn't orbit the Sun
C) Its moon is nearly as big as it is
D) It is made mostly of ice
E) It is not significantly larger than objects in similar orbits
20. When the protoplanetary disk from which the planets formed, why did its rotation increase?
A) The solar wind pushed on it, spinning it
B) It was contracting, which causes rate of rotation to increase
C) It was shedding gas much like a spinning water sprinkler
D) Magnetic fields from the Sun pushed it around
E) Convection in the disk caused rotation
21. The center of the Earth is believed to be made of
A) Solid rock B) Liquid rock C) Liquid metal D) Solid metal E) None of these
22. Why is it believed that Earth has active volcanoes, but Mars does not?
A) Since Mars is smaller, it cooled faster
B) Since Mars is farther from the Sun, it is not as hot
C) Mars has much less atmosphere, and atmosphere is necessary for volcanoes
D) Mars has less metal in its core, and this is where the heat is generated
E) Mars spins slower than Earth, and fast rotation generates volcanoes
23. Which of the following is not expected to be required for a planet or moon to have a magnetic field?
A) Rotation
B) Magnetic rocks, such as magnetite
C) A liquid layer inside
D) A layer that conducts electricity
E) Actually, all of these are required to make a magnetic field
24. A typical comet is typically made primarily of _____ with a little _____ .
A) Ice, dust B) Dust, ice C) Hydrogen, dust D) Dust, hydrogen E) Ice, hydrogen
25. Besides Earth, which object has ice caps?
A) Jupiter B) Mercury C) Earth's Moon D) Venus E) Mars

26. For which of the following planets do we think it was cold enough when they formed for hydrogen and helium to condense?
- A) All eight planets
 - B) All four gas giants, but none of the terrestrial planets
 - C) Jupiter and Saturn, but no other planets
 - D) Uranus and Neptune, but no other planets
 - E) None of the planets
27. Which planets have no moons?
- A) Mercury (only)
 - B) Venus (only)
 - C) Mars (only)
 - D) Mercury and Venus (but Mars has moons)
 - E) Mercury, Venus, and Mars
28. What substance is believed to be in Uranus and Neptune's water layer that allows them to conduct electricity?
- A) Metallic hydrogen
 - B) Iron and other metals
 - C) Superconducting diamonds
 - D) Salts
 - E) None, because water is already a good conductor

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

29. What are these pictures of?
- A) Venus
 - B) Titan
 - C) Io
 - D) Triton
 - E) Mercury
30. What is this a picture of?
- A) Ganymede
 - B) Mercury
 - C) Moon
 - D) Io
 - E) Europa
31. What is this a picture of?
- A) Venus
 - B) Neptune
 - C) Uranus
 - D) Earth
 - E) Mars
32. What is this a picture of?
- A) Triton
 - B) Io
 - C) Iapetus
 - D) Mars
 - E) Titan
33. What is this a picture of?
- A) Miranda
 - B) Iapetus
 - C) Venus
 - D) Moon
 - E) Europa