

PLEASE ANSWER THIS HOMEWORK ON A SCANTRON. MAKE SURE TO FILL IN YOUR NAME AND EID.

Due Tuesday, May 4, 2004

Exam-style multiple-choice questions. NOTE: Answering some of these questions will require you to read the text ahead of where I am in the lectures. Circle the correct answer. (5 points each)

1. According to our best theory of the formation of the Solar System, the Sun and the planets condensed out of a flattened, spinning disk. Which of the following observations about the Solar System is **not** evidence for this theory?
 - (A) The orbits of the planets are all roughly in a single plane.
 - (B) The Sun's rotation and the planets' revolution are in the same direction.
 - (C) The rotation axis of Uranus points towards Sun.
 - (D) The Sun's rotational equator is almost the same as the plane of the ecliptic.
2. Compared to the terrestrial planets, the Jovian planets have much more of their mass in hydrogen and helium and a much less in rocky cores. Why?
 - (A) Near the Sun, meteors move faster; they blasted away the ice from terrestrial planets.
 - (B) The hydrogen needed to form ice was never plentiful in the inner Solar System.
 - (C) The rocky cores of the Jovian planets were cut down by collisions with other planetesimals.
 - (D) It is cold in the outer Solar System, so light materials like hydrogen were not blown away by the Sun but instead were gravitationally collected by the planets.
3. In the deep interiors of Jupiter and Saturn, hydrogen
 - (A) exists as a low-temperature gas.
 - (B) is solid.
 - (C) is liquid and behaves like a metal.
 - (D) exists as a high-temperature gas.
4. No planet can be much larger than Jupiter because
 - (A) if you added a lot more mass, the gravity would get so strong that the planet would just compress more.
 - (B) the process that made the Solar System cannot make more massive planets.
 - (C) if it were more massive, it would be a star.
 - (D) Planets can be much larger than Jupiter. Our Solar System just doesn't contain one.
5. Which of the following never shone as bright as any kind of star?
 - (A) Earth
 - (B) Jupiter
 - (C) A brown dwarf – that is, a failed star
 - (D) A 5 solar mass black hole
6. What, in the Solar System, is found out beyond Pluto?
 - (A) Comets
 - (B) the Kuiper belt of icy planetesimals and smaller bodies
 - (C) primitive remnants of the Sun's protoplanetary disk
 - (D) all of the above

7. What are Plutinos?
- (A) satellites of the planet Pluto
 - (B) rocky asteroids that happen to live far from the Sun, like Pluto
 - (C) icy bodies in 3:2 orbital resonance with Neptune
 - (D) nuclei of short-period comets
8. What is the most important reason why the surfaces of comet nuclei are so dark?
- (A) The comet's coma shadows the nucleus from sunlight.
 - (B) Evaporation caused by sunlight gets rid of the ices near the surface. This leaves behind a rubble mantle of rocks.
 - (C) Cosmic rays cause reactions in icy surfaces, producing complex carbon compounds – like those in Jupiter's atmosphere – that are dark.
 - (D) They are not dark, they are just small. That's why it was necessary to send a spacecraft to the nucleus of Comet Halley to get a good look at it.
9. Which statement correctly describes the danger of asteroid or comet impacts on Earth?
- (A) Major impacts happened early in Earth's history, causing (for example) the extinction of the dinosaurs. But as the protosolar nebula got used up, they stopped and are no longer a danger.
 - (B) They still happen. They are rare, but a major impact would cause so much damage that it is important to survey the sky for possibly dangerous objects.
 - (C) Only small impacts happen and they are rare enough that we can ignore them.
 - (D) None of the above
10. How do we know the age of the Solar System?
- (A) radioactive dating of meteorites
 - (B) radioactive dating of Hawaiian rocks
 - (C) from iridium anomalies near mid-ocean ridges
 - (D) We don't know the age of the Solar System.
11. Jupiter emits more radiation than it gets as sunlight. What is the source of the excess radiation?
- (A) nuclear fusion reactions like those at the center of the Sun: they burn at much slower rates than in the Sun because Jupiter is less massive than the Sun
 - (B) heat from slow gravitational contraction of the planet: this compresses its core and raises its central temperature
 - (C) tidal energy from gravitational interactions between Jupiter and its four biggest moons
 - (D) the greenhouse effect
12. Saturn's satellite Titan is different from every other known satellite because it has
- (A) a dense atmosphere.
 - (B) a very slow orbit around its planet.
 - (C) geyser-like plumes of nitrogen.
 - (D) sulfur volcanoes.
13. Jupiter's satellite Io is different from every other known satellite because it has
- (A) a dense atmosphere.
 - (B) a very slow orbit around its planet.
 - (C) geyser-like plumes of nitrogen.
 - (D) sulfur volcanoes.

14. Which of Jupiter's Galilean satellites is most likely to have life?
 - (A) Io, since it has the warmest surface
 - (B) Europa, since it shows evidence of liquid water below its ice crust
 - (C) Ganymede, since it is the largest
 - (D) Callisto, since it is the farthest from Jupiter's radiation belts
15. The inner rings of Saturn orbit the planet
 - (A) faster than the outer rings.
 - (B) slower than the outer rings.
 - (C) at the same speed as the outer rings.
 - (D) with the same orbital period as the outer rings.
16. Continental drift happens on the Earth but not on Mars. Why?
 - (A) Mars is smaller, so it generates less internal heat.
 - (B) Only the Earth has internal convection currents that are strong enough to move continents.
 - (C) Both (A) and (B).
 - (D) The question is wrong: continental drift has happened on Mars (Tharsis bulge).
17. Why are there more impact craters seen on the Moon than on the Earth?
 - (A) Gravity is weaker on the Moon than on the Earth.
 - (B) The Moon is older than the Earth.
 - (C) The Earth's atmosphere prevents asteroids from hitting the Earth's surface.
 - (D) There is less erosion on the Moon than on the Earth.
18. Which of the following best describes our thinking about possible life on Mars?
 - (A) Viking spacecraft landed on Mars and made experiments that found evidence of organic molecules. This is the strongest argument that life exists on Mars.
 - (B) Viking did no experiments to look for life on Mars, but it did find evidence that Mars may have had free-flowing water and a denser atmosphere as recently as a few million years ago. It is possible that life evolved then. Future Mars missions will look for it.
 - (C) Viking experiments gave us only negative or ambiguous results. Also, the period when surface water and a denser atmosphere may have been present was more than 3 billion years ago. But some fossil remains of early life on Earth are as old as 3.5 billion years. So we think that life may have had time to evolve on Mars.
 - (D) No life is likely on Mars. There is no protective ozone layer, so ultraviolet radiation from the Sun would have broken down organic molecules and sterilized the planet.
19. Which of the following is true?
 - (A) Saturn's moon Titan is the only satellite in the Solar System with a dense atmosphere. Smog makes it opaque.
 - (B) All satellites in the Solar System (except Titan: see above) have craters left over from the time 4 – 5 billion years ago when they were repeatedly hit by asteroids.
 - (C) Mars's moon Phobos is so puny that a person could jump off of it to infinity.
 - (D) The Earth's Moon is the largest satellite in the Solar System in relation to its parent body.
20. Which of these lists bodies in order of how ancient their surfaces are, from oldest to youngest?
 - (A) Earth's Moon, Mars, Earth, Io
 - (B) Jupiter, Earth, Venus, Mars
 - (C) Europa, Earth, Mars, Mercury
 - (D) Mercury, Venus, Earth, Mars