

PRACTICE Exam #2**Instructor: Michael Brotherton****Covers Solar System and Exoplanet Topics****Instructions**

This exam is **closed book and closed notes**, although you may use a calculator (much of the few math questions on the exam may be easy enough to work without a calculator, but if you need to borrow one *please* ask!). Formulas and constants you might want are given on the last pages. The exam consists of 50 multiple choice questions. Please mark with a number 2 pencil your answers on a blue 5-answer scan sheet (only one answer per question). Fill in the bubbles for your name!!! Completely erase any stray marks. In the special code section please fill in "EXAM 2". Please don't cheat and make your best effort. Good luck!

Multiple Choice (50 questions)

1. What is the correct order of planets from the sun, nearest to farthest?
 - a. Mercury, Venus, Mars, Earth, Jupiter, Saturn, Neptune, Uranus
 - b. Venus, Mercury, Mars, Earth, Jupiter, Saturn, Uranus, Neptune
 - c. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Neptune, Uranus
 - d. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
 - e. Mars, Venus, Earth, Mercury, Jupiter, Saturn, Uranus, Neptune

2. Which planet has the highest average surface temperature, and why?
 - a) Jupiter, because it is so big
 - b) Venus, because of its dense carbon dioxide atmosphere
 - c) Mars, because of its red color
 - d) Mercury, because of its dense carbon dioxide atmosphere
 - e) Mercury, because it is closest to the Sun

3. According to our theory of solar system formation, why do all the planets orbit the Sun in the same direction and in nearly the same plane?
 - a) The laws of conservation of energy and conservation of angular momentum ensure that any rotating, collapsing cloud will end up as a spinning disk.
 - b) The Sun formed first, and as it grew in size it spread into a disk, rather like the way a ball of dough can be flattened into a pizza by spinning it.
 - c) Luck explains it, as we would expect that most other solar systems would not have all their planets orbiting in such a pattern.
 - d) Any planets that once orbited in the opposite direction or a different plane were ejected from the solar system.
 - e) The original solar nebula happened to be disk-shaped by chance.

4. Rank the five terrestrial worlds in order of size from smallest to largest:
- Mercury, Moon, Venus, Earth, Mars.
 - Moon, Mercury, Venus, Earth, Mars.
 - Mercury, Venus, Earth, Moon, Mars.
 - Moon, Mercury, Mars, Venus, Earth.
 - Mercury, Moon, Mars, Earth, Venus.
5. Heat escapes from a planet's surface into space by thermal radiation. Planets radiate primarily in the wavelength range of the
- ultraviolet.
 - infrared.
 - visible.
 - radio.
 - none of the above
6. Tidal forces are the result of
- erosion by ocean waves
 - greenhouse gas warming by water vapor.
 - volcanic explosions.
 - solar heating.
 - the fact that gravity depends on distance.
7. Which of the following planets has the least substantial atmosphere?
- Venus
 - Earth
 - Uranus
 - Mars
 - Neptune
8. The sky is blue because
- the Sun mainly emits blue light.
 - molecules scatter red light more effectively than blue light.
 - the atmosphere absorbs mostly blue light.
 - the atmosphere transmits mostly blue light.
 - molecules scatter blue light more effectively than red light.
9. Sunsets are red because
- sunlight must pass through more atmosphere then, and the atmosphere scatters more light at red wavelengths than bluer wavelengths.
 - the cooler atmosphere in the evening absorbs more blue light.
 - sunlight must pass through more atmosphere then, and the atmosphere scatters even more light at bluer wavelengths, transmitting mostly red light.
 - the Sun emits more red light when it's setting.
 - none of the above

10. Which is the densest planet in the solar system?
- Jupiter
 - Saturn
 - Earth
 - Mercury
 - Mars
11. Which world, other than Earth, has visible water ice on it?
- the Moon
 - Mars
 - Jupiter
 - Mercury
 - Venus
12. Which of the following is not a characteristic of the inner planets?
- Their orbits are relatively closely spaced.
 - They all have substantial atmospheres.
 - They have very few, if any, satellites.
 - They all have solid, rocky surfaces.
 - They are relatively smaller than the outer planets.
13. Which of the following observations indicates that conditions on Mars may have been suitable for life in the past?
- There are dried-up riverbeds on Mars.
 - There are very large extinct volcanoes on Mars.
 - There is a very deep and long canyon that extends across Mars.
 - Mars has two small moons.
 - Mars has polar caps made of "dry ice."
14. Why are the inner planets made of denser materials than the outer planets?
- In the inner part of the nebula only metals and rocks were able to condense because of the high temperatures, whereas hydrogen compounds, although more abundant, were only able to condense in the cooler outer regions.
 - In the beginning, when the protoplanetary disk was spinning faster, centrifugal forces flung the lighter materials toward the outer parts of the solar nebula.
 - Denser materials were heavier and sank to the center of the nebula.
 - The Sun's gravity pulled denser materials toward the inner part of the solar nebula, while lighter gases escaped more easily.
 - When the solar nebula formed a disk, materials naturally segregated into bands, and in our particular solar system the denser materials settled nearer the Sun while lighter materials are found in the outer part.
15. Which of the following is the likely origin of almost all the large moons around the jovian planets?
- They are captured planets.
 - They were formed by giant impacts.
 - They were formed by condensation & accretion in a disk of gas around the planet.
 - They are captured asteroids.
 - They are captured comets.

16. Why did the solar nebula flatten into a disk?
- a) The interstellar cloud from which the solar nebula formed was originally somewhat flat.
 - b) It flattened as a natural consequence of collisions between particles in the nebula, changing random motions into more orderly ones.
 - c) The force of gravity pulled the material downward into a flat disk.
 - d) As the nebula cooled, the gas and dust settled onto a disk.
 - e) Magnetic fields have disk shapes.
17. Based on our current theory of Earth's formation, the water we drink comes from
- a) comets that impacted Earth.
 - b) chemical reactions that occurred in Earth's crust after Earth formed.
 - c) ice that condensed in the solar nebula in the region where Earth formed.
 - d) chemical reactions that occurred in Earth's core after Earth formed.
 - e) material left behind during the giant impact that formed the Moon.
18. Vulcanism is more likely on a planet that
- a) has high internal temperatures.
 - b) is closer to the Sun.
 - c) doesn't have an atmosphere or oceans.
 - d) is struck often by meteors and solar system debris.
 - e) is very small.
19. Why does Mars have more extreme seasons than Earth?
- a) because it has a more eccentric orbit in addition to its tilt
 - b) because it is farther from the Sun
 - c) because it has more carbon dioxide in its atmosphere
 - d) because it has a larger axis tilt
 - e) all of the above
20. How does the greenhouse effect work?
- a) The higher pressure of the thick atmosphere at lower altitudes traps heat in more effectively.
 - b) Ozone transmits visible light, allowing it to heat the surface, but then absorbs most of the infrared heat, trapping the heat near the surface.
 - c) Greenhouse gases absorb infrared light from the Sun, which then heats the atmosphere and the surface.
 - d) Greenhouse gases transmit visible light, allowing it to heat the surface, but then absorb infrared light from Earth, trapping the heat near the surface.
 - e) Greenhouse gases absorb X rays and ultraviolet light from the Sun, which then heat the atmosphere and the surface.
21. Of the four gases CO₂, H₂O, N₂, and O₂, which are greenhouse gases?
- a) CO₂ and N₂
 - b) CO₂ and H₂O
 - c) only CO₂
 - d) all except O₂
 - e) all four

22. Venus is highly reflective and so bright in the sky because it is covered by
- light-colored rocks.
 - clouds.
 - dust storms.
 - the gleaming white bones of an alien race.
 - volcanic ash.
23. What is Jupiter's Great Red Spot?
- a large mountain peak poking up above the clouds
 - the place where reddish particles from Io impact Jupiter's surface
 - a long-lived, high-pressure storm
 - a hurricane that comes and goes on Jupiter
 - the place where Jupiter's aurora is most visible
24. Which moon has erupting geysers of water?
- Titan
 - Ganymede
 - Io
 - Enceladus
 - Mimas
25. Why is Saturn almost as big as Jupiter, despite its much smaller mass?
- Jupiter's greater mass compresses it more, thus increasing its density.
 - Jupiter's strong magnetic field constrains its size.
 - Saturn is further from the Sun, thus cooler, and therefore less compact.
 - Saturn's rings make the planet look bigger.
 - Saturn has a larger proportion of hydrogen and helium than Jupiter, and is therefore less dense.
26. Planetary rings are
- known to exist for all of the jovian planets.
 - nearer to their planet than any of the planet's large moons.
 - composed of a large number of individual particles that orbit their planet in accord with Kepler's third law.
 - orbiting in the equatorial plane of their planet.
 - all of the above
27. Which of below planets has beautiful blue clouds made of methane?
- Venus.
 - Mars.
 - Jupiter.
 - Saturn.
 - Uranus.

28. Why aren't small moons spherical in shape?
- a) The strength of gravity on small moons is less than the strength of the rock.
 - b) Small moons have odd shapes because they were all chipped off larger objects.
 - c) Large moons were once molten and therefore became spherical, but small moons were never molten.
 - d) Large moons became spherical because many small collisions chipped off pieces until only a sphere was left; this did not occur with small moons.
 - e) Aliens.

29. How do we think the "hot Jupiters" around other stars were formed?
- a) Many planets were formed around the star but coalesced into a single planet close in.
 - b) They formed as gas giants close to the star in the same orbits that they are seen today.
 - c) They formed as gas giants beyond the frost line and then migrated inwards.
 - d) They formed as dense, rocky planets close to the star in the same orbits that they are seen today.
 - e) Aliens.

30. The transit method of planet detection works best for
- a) Earth-like planets in any orbit.
 - b) big planets in face-on orbits around small stars.
 - c) small planets in face-on orbits around big stars.
 - d) big planets in edge-on orbits around small stars.
 - e) small planets in edge-on orbits around big stars.

For the next 5 questions, please use the following answer key:

- a) Io
- b) Europa
- c) Ganymede
- d) Titan
- e) Triton

31. Which of the above moons is the most volcanically active?
32. Which of the above moons has the densest atmosphere?
33. Which of the above moons is the farthest from the sun?
34. Which of the above moons likely has an ocean under its surface ice?
35. Which of the above moons is the largest?

For the next three questions, please use the following answer key:

- a) Mercury
- b) Venus
- c) Earth
- d) Mars
- e) Moon

36. Which of the above worlds has planet-wide dust storms?
37. Which of the above worlds is totally covered by clouds all the time?
38. Which of the above worlds has never had a human vehicle land upon it?

For the last two questions, please use the following answer key:

- a) Jupiter
- b) Saturn
- c) Uranus
- d) Neptune
- e) Pluto

39. Which of the above worlds is not known to have rings?
40. Which of the above worlds has the biggest magnetic field?

Potentially Useful Relationships/Formulas

$$\frac{\text{Angular diameter}}{206265 \text{ arcsec}} = \frac{\text{linear diameter}}{\text{distance}}$$

Kepler's third law: P^2 is proportional to a^3

Newton's Constant of Gravitation: $G = 6.67 \times 10^{-11} \text{ m}^3/\text{s}^2\text{kg}$

Newton's Law of Gravitation: $F = -Gmm/r^2$

Newton's version of Kepler's 3rd Law: $M_A + M_B = (4\pi^2/G) \times a^3/P^2$

$c = \text{speed of light} = 3 \times 10^8 \text{ m/s}$

Mass of the sun: $2 \times 10^{30} \text{ kg}$