

ASTRONOMY 111 Session 003
Date: Oct. 29, 2007
Instructor: Dr. Jie Zhang

Fall 2007

In-class Exam #2

I understand that this examination lasts from **7:20 PM to 8:20 PM**. I have not received, nor given any aid, nor assistance, nor answers, nor questions to anyone else during this examination period. I understand that any violation of the GMU honor code will result in my being reported directly to the honor committee, **without warning**. I understand that any honor code violation can cause me to fail the course, be suspended, and/or be expelled from the university; and, it will automatically be entered into my official records.

Test Form: **X**
Name (Print): _____
Signature: _____
Student ID: _____

In your **scantron**, please record the **ID number** (from far-left to right, the 8-digit G number without letter G), **name, subject and date**.

The class will resume at 8:30 PM. Please come back at this time.

Chap. 0: 1
Chap. 5: 12
Chap. 6: 8
Chap. 7: 10
Chap. 8: 8
Chap. 9: 11

Note: Answer Keys --- asterisk symbol indicate the correct answer

(Chap. 0)

1. Your answer to question 1 must be "A"

(Chap. 5)

2. The speed of light in the vacuum is
- A 3.0×10^4 km/s
 - B $*3.0 \times 10^5$ km/s
 - C 3.0×10^6 km/s
 - D 3.0×10^7 km/s
3. Which one of the following statements is true?
- A **Visible light takes up only a very small part of the total range of wavelengths in the electromagnetic spectrum.*
 - B Visible light takes up most (but not all) of the total range of wavelengths in the electromagnetic spectrum.
 - C Visible light takes up all of the electromagnetic spectrum.
 - D Visible light is not part of the electromagnetic spectrum.
4. Which of the following groups have electromagnetic wavelengths, **all** of which are **longer** than visible light:
- A ultraviolet, microwave, radio
 - B ultraviolet, x-ray, gamma ray
 - C **infrared, microwave, radio*
 - D none of the above has wavelengths with all greater than visible light
5. The Kelvin scale measures
- A temperature referenced to zero at the freezing point of water.
 - B mass per unit volume, or density, with water having a value of 1.0.
 - C temperature in Fahrenheit-sized degrees above absolute zero.
 - D **temperature in Celsius-sized degrees above absolute zero.*
6. A perfect blackbody is so named because it
- A reflects only the radiation falling on it and emits none of its own.
 - B **absorbs all radiation falling on it and reflects none.*
 - C never emits radiation.
 - D always emits the same amount and color of radiation regardless of its temperature.
7. According to the Wien's Law of blackbody
- A the wavelength of light is shifted to a shorter wavelength if the source of light is moving toward you.
 - B the wavelength of light is shifted to a longer wavelength if the source of the light is moving toward you.
 - C the wavelength of peak emission of light from a blackbody is shifted to a longer wavelength when the temperature of the blackbody increases
 - D **the wavelength of peak emission of light from a blackbody is shifted to a shorter wavelength when the temperature of the blackbody increases*

8. Blackbody "A" is at 6000 degrees K while blackbody "B" is at 3000 degrees K. Therefore blackbody "A" gives off _____times more total energy than blackbody "B" (Using Stefan-Boltzmann Law: $F = \sigma T^4$)
- A *16
 - B 8
 - C 4
 - D 2
9. The spectrum of a pure blackbody is
- A *a continuous spectrum
 - B an absorption spectrum
 - C an emission spectrum
 - D any of the above
10. The physical structure of an atom is
- A neutrons orbiting an electrically neutral nucleus of protons and electrons.
 - B *negatively charged electrons moving around a very small but massive, positively charged nucleus.
 - C positively and negatively charged particles orbiting a small but powerful black hole.
 - D negatively charged electrons and positively charged protons mixed uniformly in the volume of the atom.
11. What happens when an electron in a hydrogen atom in the $n=3$ energy level jumps to the $n=2$ energy level
- A It absorbs a photon
 - B *It emits a photon
 - C It is ionized to become a free electron
 - D It collides with the proton.
12. Electrons in atoms
- A *occupy discrete orbits whose energies are fixed.
 - B can have any energy.
 - C cannot interact with light.
 - D can only absorb light.
13. According to the Doppler effect,
- A *the wavelength of light is shifted to a shorter wavelength if the source of light is moving toward you.
 - B the wavelength of light is shifted to a longer wavelength if the source of the light is moving toward you.
 - C the wavelength of peak emission of light from a source changes as the temperature of the source changes.
 - D spectral lines are split into two or more wavelengths when the source of the light is in a strong magnetic field.

(chap 6)

14. What is the refraction of light?
- A the change in direction of a light ray as it reflects from a more dense material than the one in which it is traveling
 - B the absorption of light as it traverses a dense, transparent material
 - C the breaking of white light into its composite colors
 - D *the change in direction of a light ray as it crosses from a less dense, transparent material to a more dense one
15. Which type of telescope uses a lens as the main optical element?
- A radio telescope
 - B all telescopes
 - C reflecting telescope
 - D *refracting telescope
16. Which of the following aspects of a telescope is most important?
- A High magnification
 - B *Large light-gathering power
 - C Long focal length
 - D Secondary mirror configuration
17. The limit to how sharply we can resolve stars from a ground-based telescope, but not a space-based telescope, is
- A the diameter of the primary mirror or objective lens.
 - B the light-gathering power.
 - C *the stability of the atmosphere.
 - D the pixel sizes of CCD camera
18. The limit to how sharply we can resolve stars from a space-based telescope, but not a ground-based telescope, is
- A *the diameter of the primary mirror or objective lens.
 - B the light-gathering power.
 - C the stability of the atmosphere.
 - D the quality of the camera optics.
19. A spectrograph is usually used in astronomy to measure the
- A variation of the mass of an object as it moves through space.
 - B *distribution of light intensity among the various wavelengths
 - C vibration of Earth following an earthquake.
 - D the distance of a remote star
20. The two ranges of electromagnetic radiation for which Earth's atmosphere is reasonably transparent are
- A UV and radio waves.
 - B X rays and visible radiation.

- C visible and far infrared radiation.
- D *visible and radio radiation.

21. The reason we have space-based X-ray observatories is

- A X-rays pose too great a hazard on Earth.
- B there are no authorized X-ray bands for Earth-based observing.
- C X-rays focus more clearly outside the turbulence of the atmosphere.
- D *X-rays cannot penetrate the Earth's atmosphere.

(chap. 7)

22. The correct sequence of planets in our solar system from the Sun outward is
- A Mercury, Venus, Earth, Mars, Saturn, Uranus, Jupiter, Neptune.
 - B Mercury, Earth, Venus, Mars, Jupiter, Saturn, Uranus, Neptune.
 - C Mercury, Venus, Mars, Earth, Jupiter, Saturn, Uranus, Neptune.
 - D *Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.
23. The following characteristic that is NOT true of the terrestrial planets is
- A a relatively small size compared to the Jovian planets.
 - B an orbit that is closer to the Sun than Jupiter.
 - C *a relatively low density compared to the Jovian planets
 - D a rocky surface with mountains and valleys.
24. In our solar system, which of the following planets is not a member of the Jovian group?
- A *Mars
 - B Saturn
 - C Neptune
 - D Jupiter
25. The seven largest satellites in the solar system, in their size and physical characteristics, most resemble
- A *the terrestrial planets.
 - B the Jovian planets.
 - C the Comets
 - D the asteroids.
26. To an astronomer, the word “ice” can mean any one or more of
- A *water (H₂O), carbon dioxide (CO₂), methane (CH₄), or ammonia (NH₃).
 - B hydrogen (H₂), and helium (He₂).
 - C only water (H₂O).
 - D water (H₂O) or rocky material.
27. The asteroid belt exists between the orbits of which planets?
- A Jupiter and Saturn
 - B Venus and Earth
 - C *Mars and Jupiter
 - D Earth and Mars
28. Comets are typically
- A *chunks of ice that begin to vaporize if they pass close to the Sun.
 - B chunks of rock a few tens to hundreds of kilometers in diameter.
 - C liquid balls that turn into gaseous bodies as they pass close to the Sun.
 - D gaseous bodies from which some of the gas is pushed out by the Sun to form a long tail.

29. Pluto is classified

- A as a Jovian planet because it orbits farther from the Sun than Mars.
- B as a terrestrial planet because it has a hard surface and is small in size.
- C as an asteroid because of its small size.
- D *as neither Jovian nor terrestrial but is in a class of objects from Kuiper belt.

30. As a general rule

- A younger surfaces are more heavily cratered than old surfaces.
- B planets closer to the sun have more craters than more distant ones.
- C *older surfaces are more heavily cratered than younger surfaces.
- D hotter planets or moons have more craters than colder ones.

31. All of the following conditions **except one** appear to be necessary in order for a planet or satellite to produce a planet-wide magnetic field by the dynamo effect. Which is the exception?

- A an interior that is at least partially liquid
- B an interior containing material that can conduct an electric current
- C rotation around its axis
- D *a rotation axis that tilts with respect to the ecliptic

(Chap. 8)

32. The most abundant material in the universe is
- A *hydrogen.
 - B carbon dioxide.
 - C water.
 - D helium.
33. Most of the elements beyond H and He in the periodic table in our Sun and solar system probably originated
- A in the original Big Bang.
 - B from the center of our own Sun, through nuclear fusion and later ejection as solar wind.
 - C from chemical reactions in planetary atmospheres.
 - D *from nuclear fusion reactions in the centers of earlier stars.
34. Radioactive dating shows that
- A * meteorites are all the same age and it is likely the solar system formed from material created 4.56 billion years ago.
 - B meteorites have a spread in age so it is likely the solar system formed from material being created as late as 2 billion years ago.
 - C Earth rocks are all the same age so the Earth was created 4.56 billion years ago.
 - D Earth rocks have a spread in age so the Earth was gradually created over 4.56 billion years of time.
35. The origin of our solar system is believed to be
- A collision of two neutron stars
 - B a vast cloud of pure hydrogen.
 - C the convergence of the solar winds of several nearby stars.
 - D *a vast cloud of gas and dust.
36. As the solar nebula contracted it
- A spun faster and cooled down.
 - B spun slower and cooled down.
 - C *spun faster and heated up.
 - D spun slower and heated up.
37. The rocky terrestrial planets formed closer to the Sun than the gaseous Jovian planets because
- A angular momentum threw the lighter gases farther out from the Sun.
 - B lighter gases did not feel gravity as strongly and remained in the outer regions.
 - C there was less room available for large amounts of ice material in the inner orbits.
 - D *the condensation temperature of rock-forming materials is higher so this material condensed nearer to the Sun than the lighter gases
38. The most probable time sequence for the solar system's formation was that the

- A Sun formed initially, and the planets and major moons were captured much later as they drifted by the Sun.
 - B planets formed first out of the cold gas and dust nebula, followed by the Sun, which formed when the gas had become much hotter.
 - C Sun formed first, the planets were spun off from the Sun, and the moons in turn were spun off from the planets.
 - D *Sun contracted first as a gas ball, and the planets and moons formed shortly afterward by accretion and condensation.
39. What type of search technique has discovered the largest number of planets around the stars other than the Sun?
- A *Looking for tiny variations of the radial velocity in the star's "wobble" motion, caused by the gravitational pull of one or more planets orbiting the star.
 - B Looking for radio signals sent by aliens of the planets.
 - C Using space-based telescopes to search for tiny pinpoints of light that follow circular or elliptical paths around the star.
 - D No extrasolar planet has been found yet.

(Chap. 9)

40. Which of the following is the major power source that drives the dynamics of Earth's atmosphere?
- A outflow of the original heat from Earth's interior
 - B tidal effects from the Moon and Sun
 - C the burning of fossil fuels such as coal, oil, and natural gas on Earth's surface
 - D *solar radiation
41. The greenhouse effect is the
- A *trapping of infrared radiation from the Earth's surface by greenhouse gases in the atmosphere.
 - B the light-scattering effect in the atmosphere that makes the sky appear blue.
 - C capturing of visible and ultraviolet radiation from the Sun by the atmosphere.
 - D shielding of life-forms from solar ultraviolet radiation by the ozone layer.
42. "Chemical differentiation" in planetary sciences refers to
- A the formation of rocky planets in the hotter, inner solar system and gas giants in the colder, outer regions.
 - B the circulation of iron in the core of a planet, resulting in the generation of a magnetic field.
 - C the large-scale convection of rock in the mantle of a planet, that on Earth causes continental drift.
 - D *the sinking of heavier elements toward the center of a planet and the floating of lighter elements toward the surface.
43. Which of the following techniques is used by geologists and geophysicists to probe the interior structure of Earth?
- A direct sampling of interior rock by deep drilling through the ocean floor
 - B extrapolation of surface features (e.g., mountain chains) into the deep interior
 - C *study the seismic waves produced by earthquakes
 - D X-ray analysis from satellites
44. The internal structure of Earth is a
- A core of solid rock extensively enriched in iron, surrounded by a solid mantle of pure rock.
 - B *large core of iron, partly solid and partly molten, surrounded by a thick, flexible mantle of rock.
 - C large, solid iron core surrounded by a thick, flexible mantle of rock.
 - D core of rock and iron, surrounded by a mantle of liquid hydrogen.
45. The name "Pangaea" refers to the
- A *supercontinent that split into the present North and South America, Europe, and Africa.
 - B tectonic plate on which most of North America is riding.
 - C ocean that covered most of North America millions of years ago.

- D outer life-bearing layer of Earth, including the soil, oceans, and atmosphere.
46. The moving plates on the Earth's surface
- A *have boundaries clearly mapped out by the locations of Earthquakes and volcanos.
 - B have boundaries that are only easily traced by the study of thunderstorms.
 - C have boundaries that are mainly found on land and not in the oceans.
 - D are powered by the tidal pull of the Moon. If the Earth did not have a moon, it would not have plate tectonics.
47. What element did the early Earth atmosphere contain more than the present atmosphere?.
- A Oxygen
 - B Nitrogen
 - C Ozone
 - D *carbon dioxide
48. Earth's atmosphere contains about 20% oxygen. What is believed to be the source of this molecular oxygen?
- A It was outgassed from the interior through volcanoes.
 - B It was part of the original solar nebula from which the solar system condensed.
 - C It was the byproduct of radioactive decay.
 - D *It was created by plants through photosynthesis process.
49. In which layer of Earth's atmosphere does all weather occur?
- A thermosphere
 - B stratosphere
 - C mesosphere
 - D *troposphere
50. In the past century, the surface temperature of the Earth is likely warming because human activity is
- A *adding carbon dioxide to the atmosphere faster than natural processes remove it
 - B removing oxygen from the atmosphere, and oxygen is a natural cooling agent.
 - C creating heat by burning trees when clearing land, which warms the atmosphere.
 - D decreasing the ozone layer, which lets more energy in from the Sun.