

AST 103 Midterm 1 Review
Exam is 3/3/08 in class

Exam is closed book/closed notes. Formulas will be provided.

Bring a No. 2 pencil for the exam and a photo ID.

Calculators are OK, but will not be needed.

There will be 50 multiple-choice questions.

There will be a review session Thursday Oct 18 in class.

The best way to prepare for the exam is to study (in order of priority):

- 1) The lecture notes
- 2) The homework
- 3) The Figures in the book
- 4) The rest of the book

Topics include (but are not limited to):

Part one: Astronomical Framework

a) Cosmic Landscape:

- Scale, units, scientific method
- Angular measure; altitude, azimuth, and meridian;
- Celestial sphere, daily apparent motion of sky;
- The ecliptic, seasons, equinoxes and solstices.
- Phases of the moon, lunar and solar eclipses.
- Motions of the planets: direct and retrograde motion, inferior and superior planets;
- Geometric models: relative size of earth, moon, sun and earths orbit;
- geocentric and heliocentric models of solar system; epicycles;
- Kepler's Laws: ellipses, focus.
- Physical models: classical mechanics (velocity, acceleration, force, mass);
- Newton's Laws of motion; Gravity, angular momentum.
- Orbits and "weightlessness".
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b) Probing matter, Light and Their Interactions:

- Light, matter and energy
- Thermal radiation, black-body radiators
- Wien's Law, Stephan-Boltzmann law
- Spectroscopy: atomic absorption and emission lines;
- Telescopes: light-gathering; Reflecting vs. refracting telescopes.
- Advantages of CCD's

Clicker questions:

- 1) Why is it impossible to prove a theory?

- a) A theory is not a fact. Only facts can be proven.
- b) A theory is only supported by observations, a single contrary observation can disprove it.
- c) Theories can be proven! Once it is proven it is called a fact.
- d) It is not possible for humans to observe everything about the universe, if they could they could prove a theory.

2) Why is the moon so cratered, while the Earth is not?

- a) The Moon is older and hence hasn't been impacted as much.
- b) The Moon protects the Earth from meteors since it's orbit surrounds the Earth.
- c) The Earth has an atmosphere which protects it against smaller meteors.
- d) The Earth has erosion which hides the evidence of impacts.
- e) The Earth does have as many craters, we just don't see them due to oceans and plants.

3) If the Earth was to be magically stopped in its rotation and spin in the opposite direction what would you observe?

- a) The stars would rise in the east and set in the west while the sun would rise in the west and set in the east.
- b) The sun would rise in the east and set in the west while the stars would rise in the west and set in the east.
- c) Both would rise in the west and set in the east
- d) None of the above

4) Kepler's 3d law (that the period squared is proportional to the semi-major axis cubed) does NOT apply to the motion of:

- a) a satellite around the Earth
- b) a satellite around the Moon
- c) one star about another in a binary star system
- d) one galaxy about another
- e) all of the above apply

5) A spacecraft in one stable orbit moves to another stable orbit that has twice the semi-major axis as the first. The period of the second orbit is ____ times that of the first orbit.

- a) 0.5
- b) 2
- c) cube root of 64
- d) square root of 8

6) A bowling ball and a paper bag are pushed out of the airlock of a tourist spaceship. The spaceship is coasting with its engines off, halfway along on a weeklong cruise to the Moon. After ten minutes,

- a) both objects are still moving together alongside the spaceship.
- b) the bowling ball is still moving alongside the spaceship, but the paper bag has been left far behind.

- c) both objects are far behind the spaceship.
- d) the bowling ball is falling back towards Earth, while the paper bag is still coasting alongside the spaceship.

7) Which situation(s) does NOT describe an acceleration:

- a) a car traveling with constant speed on a straight road
- b) a car traveling with constant speed around a bend
- c) a planet traveling in its orbit around the Sun
- d) a car decreasing speed on a straight road
- e) an electron traveling around a nucleus.

8) Two identical spacecraft are to be accelerated by rockets. The first rocket fires with a force four times as great as the second. The acceleration of the first rocket is _____ as large as the acceleration of the second.

- a) 1/4
- b) 4 times
- c) 1/2
- d) 2 times
- e) None of the above

9) Since angular momentum is conserved, the rotational speed of a collapsing gas cloud

- a) depends on its mass
- b) increases
- c) decreases
- d) is independent of its initial rotation

10) An artificial satellite passes near Jupiter and gains some orbital energy in a 'slingshot effect'. What is the effect on Jupiter?

- a) cooling
- b) none
- c) Jupiter slows down in its orbit, but the effects are minimal
- d) faster rotation
- e) Jupiter will revolve about the Sun faster

11) If the size of the Earth were to double (with the mass unchanged), the gravitational attraction of the Sun

- a) would double
- b) would decrease by two times
- c) would increase by four times
- d) would decrease by four times
- e) not change

12) When you are on the top floor of a building, your weight is _____ when you are on the ground floor.

- a) much greater than

- b) very slightly greater than
- c) equal to
- d) very slightly less than
- e) much less than

13) The observed speed of light is affected by

- a) the velocity of the source of the light.
- b) the velocity of the observer.
- c) the reference frame of the observer.
- d) none of the other answers are correct.

14) If you could see in the infra-red, what would be the brightest thing in the room?

- a) The projector screen
- b) The ceiling
- c) The people
- d) The heat register
- e) Impossible to say

15) You have a lump of coal, a lump of uranium, a frozen lump of nitrogen. Which emits more energy per unit area? Assume they are all at the same temperature and are all perfect Blackbodies.

The lump of coal

The lump of uranium

The lump of frozen nitrogen

Cannot be determined from the info provided

They all emit equally

16) Atoms of different elements have unique spectral lines because each element

- a) has atoms of a unique color
- b) has a unique set of neutrons
- c) has a unique set of electron orbits
- d) has unique photons
- e) none of the above; spectral lines are not unique to each type of atom.

17) Bright lines visible in a (non-continuous) spectrum

- a) are related to the energy level in particular elements.
- b) are produced as electrons in atoms drop energy levels.
- c) are characteristic of particular elements.
- d) All of the above
- e) None of the above

18) An electronic lock can only be activated if light with a certain minimum frequency strikes its surface. Suppose a blue laser fails to activate the lock. Which of the following will be true?

- a) A red laser will fail to activate the lock.

- b) A yellow laser will activate the lock.
- c) An infrared source will activate the lock.
- d) A lower energy light source will activate the lock.

19) Given 5 stars with the colors below, which has the lowest surface temperature?

- a) Blue
- b) White
- c) Red
- d) Orange
- e) yellow

20) The energy of a photon emitted by thermonuclear processes in the core of the Sun takes thousands or even millions of years to emerge from the surface because

- a) it is circling in the gravitational field of the Sun.
- b) it loses energy due to convection, conduction, and radiation
- c) of the Sun's enormous radius.
- d) it is absorbed and re-emitted countless times along the way

21) According to the Ideal Gas Law, if the temperature in the core of a star is made 4-times higher, which of the following can happen?

- a) The pressure increases by 4 times and the density remains the same
- b) The density increases by 4 times and the pressure remains the same
- c) Its pressure and density both double.
- d) The pressure increases by 4 times while density decreases by 4 times
- e) Its pressure and density both decrease by 2.

Part 2, sample exam questions:

22) The Celestial Pole is

- A. another name for Copernicus
- B. the place where the Earth's axis extended intersects the celestial sphere
- C. the place where the Earth's equatorial plane extended intersects the celestial sphere
- D. the apparent path of the Sun against the stars
- E. will always be near the star Polaris, in the North

23) In which direction does the Earth rotate on its axis, and in which direction does it revolve about the Sun, as seen from above the North Pole?

- A. rotates clockwise, revolves counter-clockwise
- B. rotates clockwise, revolves clockwise
- C. rotates counter-clockwise, revolves counter-clockwise
- D. rotates counter-clockwise, revolves clockwise
- E. depends upon the season

- 24) If the Earth's axis were perpendicular to the plane of its orbit there would be no
A. tides B. day and night C. seasons D. temperate zones
- 25) With respect to the background of stars, the Sun appears to move
A. eastward along the celestial equator C. eastward along the ecliptic
B. westward along the celestial equator D. westward along the ecliptic
- 26) The changing phases of the moon are primarily caused by
A. the rotation of the Earth
B. the moon's period of revolution equaling its period of rotation
C. the revolution of the Earth about the Sun
D. the revolution of the moon about the Earth
- 27) As the Sun sets in the west, you might see
A. the new moon rising in the east C. the quarter moon rising in the east
B. the full moon high in the south D. the quarter moon high in the south
E. none of the above
- 28) According to the heliocentric model of the solar system, retrograde motion of the planets
A. is observed when the planets are on the opposite side of the sun in their orbits
B. is an apparent motion caused by a combination of the orbital motion of the Earth and the planets
C. should be observable, but was not found until the telescope was invented
D. is due to the uneven motion of the planets in their orbits
- 29) Kepler's law of areas (the second law) implies that a planet
A. moves most slowly when nearest the Sun
B. moves most slowly when farthest from the Sun
C. moves at a uniform rate everywhere in its orbit.
D. none of the above
- 30) An asteroid in a circular orbit 4 astronomical units from the Sun would have an orbital period of
A. 4 years B. 16 years C. 8 years D. 64 years
- 31) A 24-inch telescope gathers _____ times more light than a 12-inch telescope.
A. 2 B. 3 C. 4 D. none of these
- 32) For a telescope with a given focal length,

- A. increasing the diameter of the mirror gives brighter images of extended sources
 - B. decreasing the diameter of the mirror gives brighter images of extended sources
 - C. decreasing the mirror diameter always causes sharper images
 - D. increasing the mirror diameter causes an increase in the distance between the images of two given stars
- 33) All photons in a vacuum have the same
- A. wavelength
 - B. color
 - C. frequency
 - D. speed
 - E. energy
- 34) As the temperature of a blackbody is increased, the wavelength of the peak amount of energy will
- A. stays the same
 - B. decreases
 - C. increases
 - D. is proportional to T^4
- 35) The single quantity that determines the wavelength at which a blackbody emits most of its radiation is its
- A. density
 - B. size
 - C. temperature
 - D. composition