PTYS/ASTR 206 – Section 3 – Mid-Term Exam 1 – Assigned 2/19/09

A few guidelines:

- You shouldn't need a calculator to do any of the math here.
- It will help for some questions to sketch out cartoons on scratch paper before picking answers.
- Fill out the scantron form clearly, these are being electronically graded.
- The exam ends at 1.30pm, if you finish early please leave as quietly as possible
- This is roughly divided up by lecture, but the number of questions on each topic varies.
- All questions are worth equal points, but some are harder than others.

Lecture 1: Solar system scales

1. What is an astronomical unit?
   a) The age of the solar system
   b) The diameter of the Sun
   c) The unit that astronomers use to measure mass
   d) The distance between the Earth and the Sun
   e) The distance between the Earth and the Moon

2. Astronomers measure temperature in Kelvin. Room temperature is close to:
   a) 3 K
   b) 30 K
   c) 300 K
   d) 3000 K
   e) 30,000 K

3. How old is the solar system?
   a) 16,500 years
   b) 6.5 million years
   c) 250 billion years
   d) 150 million years
   e) 4.5 billion years

4. Arrange the following is decreasing order of size: Earth, Moon and the Sun.
   a) Sun, Earth, Moon
   b) Sun is largest; Earth and Moon are smaller and the same size
   c) They're all the same size
   d) Earth is largest; sun and Moon are smaller and the same size
   e) Moon, Sun, Earth

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Lecture 2: Days, Seasons and Lunar Phases

5. Earth's seasons are caused by:
   a) Earth is closer to the sun in summer than in the winter
   b) Earth's tilt makes summer locations get more direct sunshine
   c) Earth's rotation speeds up and slows down so that the length of day changes
   d) Warm air blows from the equator during the summer and cold air from the pole during the winter
   e) Vegetation changes cause the temperature to go up and down

6. If we look down on the Earth from above the north pole, does the planet spin?
   a) Earth doesn't spin, it's an optical illusion
   b) It spins clockwise
   c) It spins anti-clockwise
   d) It depends on the season
   e) It depends on the time of day

7. When Venus looks nearly fully-illuminated from the Earth it is…
   a) Closer than when it looks nearly fully-shadowed
   b) Further away than when it looks nearly fully-shadowed
   c) The same distance away as when it looks nearly fully-shadowed
   d) Can be nearer or further depending on where the other planets are
   e) Venus always looks fully illuminated

8. The Moon always points the same face towards the Earth because
   a) When the other face points towards the Earth then it's in darkness
   b) When the other face points towards the Earth then the Moon is too far away to see
   c) The Moon spins once a day so that it looks the same every night
   d) It doesn't spin
   e) It spins once per orbit

9. For a solar eclipse to occur
   a) The Moon must be full
   b) The Moon must be at its closest point to the Earth
   c) It must be spring equinox
   d) It must be a new Moon
   e) More than one of the above

10. When there is a lunar eclipse then the Moon appears red because...
   a) The Earth emits so much red light that it reflects off the Moon
   b) The Moon naturally glows red, but we usually can't see it
   c) Red sunlight passes through Earth's atmosphere most effectively
   d) It's an optical illusion. The Moon is really no redder than usual.
   e) It reflects starlight from nearby low-mass red stars.

11. If the full Moon is at its highest point in the sky, what time is it?
    a) Midnight
    b) 6am
    c) Noon
    d) 6pm
    e) This could happen at any time of day

12. If you're at the equator and the sun is directly overhead then what season is it?
    a) December
    b) June
    c) March
    d) Could be either March or September
    e) Could be either June or December

13. If you're at the north pole and it's spring equinox (March), the Sun is…
    a) Directly overhead
    b) On the horizon
    c) 23½° above the horizon
    d) It's permanently dark at the north pole
    e) It depends on the time of day

Lecture 3: Orbits and Gravity

14. Europa and Io are two moons of Jupiter, Europa is smaller and farther from Jupiter than Io. Which of the following is true?
    a) Europa takes less time to orbit Jupiter than Io because it's smaller
    b) Europa takes more time to orbit Jupiter than Io because it's smaller.
    c) Europa takes less time to orbit Jupiter than Io because it's further away.
    d) Europa takes more time to orbit Jupiter than Io because it's further away.
    e) They take the same amount of time to orbit Jupiter.

15. The Sun has about 1000 times more mass than Jupiter. Which of the following is true?
    a) The gravitational force on Jupiter from the Sun is 1000 times that on the Sun from Jupiter
    b) The gravitational force on the Sun from Jupiter is 1000 times that on Jupiter from the Sun
    c) Jupiter and the Sun are too far apart to exert a gravitational force on each other
    d) The force on the sun is zero, only Jupiter feels a gravitational force
    e) The force on each object is the same

16. An astronaut has a mass of 120 kg on the Earth (complete with suit & backpack etc…). Gravity on the Moon is six times lower than on the Earth. What is the astronaut's mass on the Moon?

a) It's still 120 Kg
b) It's six times less i.e. 20kg
c) It's six times more i.e. 720 Kg
d) The astronaut has no mass when on the Moon
e) It depends on how close the Moon is to the Earth

17. The Moon and Sun raise tides on the Earth, but the Moon is more important. Each point on the Earth has high tide, caused by the Moon, …

a) Once per day due to the Earth's rotation
b) Twice per day due to the Earth's rotation
c) Once per month due to the Moon's orbit
d) Twice per month due to the Moon's orbit
e) Once per year due to the Earth's orbit around the Sun

18. If it's high tide at 6pm, what is the phase of the Moon?

a) Full Moon
b) Half full and waxing
c) Half full and waning
d) Half full and either waxing or waning
e) New Moon

19. All planets are flattened somewhat, i.e. their radius at their equator is different than their radius at their north or south pole. Neptune and Uranus are flattened by about 2% (i.e. their polar radii are about 2% less than their equatorial radius) while Jupiter and Saturn are more flattened, by about 7-10%. This is because…

a) Jupiter and Saturn are composed of weaker materials
b) Jupiter and Saturn are closer to the Sun
c) Jupiter and Saturn are bigger
d) Jupiter and Saturn have more numerous and larger moons
e) Jupiter and Saturn spin faster

Lecture 4: Light and Heat from Planets and Stars

20. The sky looks blue because…

a) Sunlight is naturally blue
b) The red light is absorbed at the top of the atmosphere
c) The Earth only reflects blue light, which lights up the sky
d) Air molecules scatter more blue light towards the surface
e) Small droplets of water in the atmosphere are colored blue

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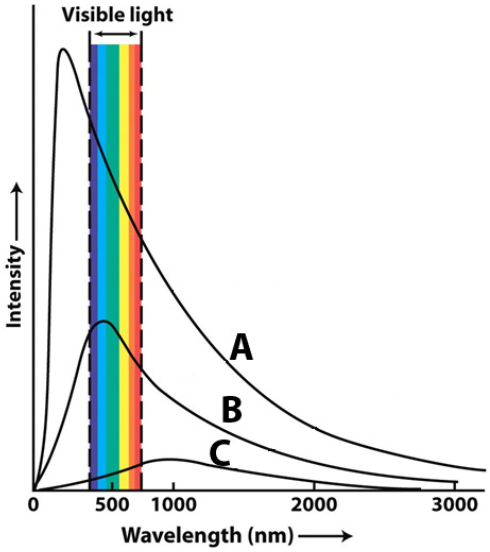
21. Arrange the following in order of decreasing wavelength x-rays, radio waves, visible light and infrared radiation.

a) Infrared, radio, visible and x-rays
b) Visible, x-rays, infrared and radio
c) Radio, x-rays, infrared, visible
d) Infrared, visible, radio, x-rays
e) Radio, infrared, visible, x-rays

22. Jupiter is about 5 times further from the Sun than the Earth. The solar power per square meter arriving at Jupiter is…

a) Five times less
b) Five times more
c) 25 times less
d) 100 times less
e) The same as that on Earth



23. The spectrum of three stars appears on the plot to the left. Which has the higher temperature?

a) Star A
b) Star B
c) Star C
d) They're all the same
e) You can't tell from this information

24. Which of the stars on the plot above most closely corresponds to our Sun?

a) Star A
b) Star B
c) Star C
d) Any of these could be the Sun
e) You can't tell from this information

25. Why are sunspots dark?

a) They're hotter and emitting all their light at ultraviolet wavelengths
b) They're holes in the solar atmosphere and show deeper levels that don't make light
c) They're high clouds over the Sun that block our view of the surface
d) They're cooler areas on the Sun's surface that don't emit as much light
e) They're floating solid islands of rock on the Sun's surface

26. The total amount of power coming from one square meter of the sun is $\sigma * T^4$ (where σ is a constant number and T is the Sun's temperature). If we double the temperature the sun emits

a) The same amount of energy at a shorter wavelength
b) Twice as much energy
c) Four times as much energy
d) 8 times as much energy
e) 16 times as much energy

Lecture 5: Exploring the Solar System from the Earth

27. Why do we put telescopes on top of mountains?

a) To get closer to the planets
b) So that the planets appear bigger
c) Colder temperatures make the electronics work better
d) To get above most of the atmosphere
e) Because gravity is lower and the large mirrors are easier to move around

28. Adaptive optics is a way to

a) Upgrade telescopes as cheaply as possible
b) Be able to use the same instruments on many telescopes
c) Cancel out the blurriness caused by the moving atmosphere
d) Cancel out light pollution from nearby cities
e) Cancel out the effects of Earth's gravity on starlight

Lecture 6: The Sun

29. How does the Sun produce its energy?

a) The Sun is cooling off and not producing any new energy
b) Burning of oil and gas
c) Radioactive decay of Uranium and Potassium
d) Tidal heating from Jupiter
e) Fusion of hydrogen atoms into helium

30. In the near-surface part of the Sun, most of the heat escapes by…

a) Convection, upwelling of hot gas
b) Conduction of heat through stagnant gas
c) Energy is transported by magnetic fields
d) Energy doesn't escape because no new energy is being created
e) All the energy escapes through sunspots

31. Over the past few Centuries, the number of sunspots that we can see on the Sun…
    a) Is constant
    b) Steadily decreases
    c) Steadily increases
    d) Increases and decreases in regular cycles
    e) Increases and decreases randomly

Lecture 7: Craters

32. Complex craters with central peaks are…
    a) Larger than simple bowl-shaped craters
    b) Smaller than simple bowl-shaped craters
    c) Can be larger or smaller than bowl-shaped craters depending on what planet you're on
    d) What simple craters turn into over time
    e) Produced by volcanoes rather than impacts (which produce bowl-shaped craters)

33. Impact craters differ from volcanic collapse craters in that…
    a) You'll never find rock that has melted in an impact crater
    b) Impact craters have raised rims
    c) Impact craters don't have raised rims
    d) Impact craters have flat floors
    e) Impact craters don't have flat floors

34. The energy of an impact is the kinetic energy of the impactor and equal to $\frac{1}{2}*m*v^2$ (where m is the mass of the impactor and v is its velocity). If the mass and velocity of the impactor are doubled the energy of the impactor is…
    a) 2 times higher
    b) 4 times higher
    c) 8 times higher
    d) 4 times lower
    e) 2 times lower

Lecture 8: Terrestrial planet interiors and surfaces

35. The core of the Earth is mostly…
    a) Iron
    b) Rock
    c) Ice
    d) Hydrogen and Helium
    e) Carbon

36. Energy is produced within the Earth mostly by…
    a) Burning of oil and gas
    b) Radioactive decay
    c) Nuclear fusion of Hydrogen into helium
    d) Tidal heating
    e) Solar heating

37. Why does Earth have a magnetic field and Mars does not?
    a) Mars has no magnetic rocks, whereas Earth does
    b) Earth has higher gravity
    c) Earth has a liquid core, whereas Mars does not
    d) Earth has volcanoes, whereas Mars does not
    e) Earth is nearer the Sun and so warmer than Mars

38. Why do stratovolcanoes explode and shield volcanoes erupt lava quietly?
    a) Stratovolcanoes are much bigger and so more explosive
    b) The explosions in a shield volcano's eruption occur underground
    c) It always rains over shield volcanoes which damps the explosions
    d) You need an earthquake during the eruption to make the explosion
    e) Stratovolcanoes get clogged up by sticky lava causing the pressure to build up

Lecture 9: The Moon

39. What's the leading theory for the origin of the Moon?
    a) A giant impact between the Earth and another planet created debris that formed the Moon.
    b) The Early Earth was spinning so fast that it split into two pieces
    c) The Moon formed elsewhere and was captured by the Earth
    d) The Moon and the Earth formed together
    e) The Moon used to be a small asteroid, but gained mass because many objects hit it

40. Most of the large impact basins we see on the Moon today were created …
    a) during the formation of the Moon
    b) right after its formation when impact rates were highest
    c) over a period covering the past 3 billion years
    d) within the last 1 billion years
    e) during a short-lived spike in the impact rate long after the Moon formed

41. The dark patches on the lunar surface (Maria) are
    a) Blast zones from giant impacts
    b) Sheets of dark volcanic rock
    c) Holes in the crust where we can see the underlying rocks in the mantle
    d) Areas where liquid water has eroded the surface
    e) Darker because they contain fewer impact craters

42. We can recognize recently formed craters on the Moon and Mercury because
a) They tend to be bigger
b) They usually contain volcanoes
c) They have bright rays extending away from their edges
d) All recent craters occur in one area of the planet
e) We have samples of every crater that we can date in the lab

Lecture 10: Mercury

43. Mercury rotates three times every two orbits. If the zero longitude meridian faces the sun when Mercury is closest to the Sun (i.e. perihelion) then when Mercury is at perihelion in the future…
a) zero longitude will always face the sun
b) Either longitudes 0 or 180 will face the sun
c) All longitudes will get their turn at facing the sun
d) Only longitudes 0, 90, 180 and 270 can face the sun
e) Only longitudes 90 and 270 can face the sun

44. The lobate scarps that are found all across Mercury's surface indicate that…
a) The entire planet shrank in the past
b) The entire planet expanded in the past
c) Parts of the crust expanded and parts shrank
d) The planet expands and contracts periodically
e) Volcanoes don't exist on Mercury

45. Mercury is much denser than expected because…
a) Its gravity is so strong that it compressed all the surface materials
b) It has fewer craters than the Moon
c) It has an abnormally large iron core for its size
d) It's so close to the Sun
e) It's made up of a very dense kind of rock