PTYS/ASTR 206 – Section 3 – Mid-Term Exam 2 – Assigned 4/2/09

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 11: Terrestrial planet atmospheres

1. Arrange the atmospheres of Earth, Mars, Titan and Venus in order of increasing pressure (Hint: Titan has a slightly larger pressure than the Earth).

a) Venus, Earth, Titan, Mars

b) Mars, Venus, Earth, Titan

c) Mars, Earth, Titan, Venus

d) Earth, Mars, Venus, Titan

e) Venus, Mars, Earth, Titan

2. The atmospheres of Titan and the Earth have similar compositions (both mostly nitrogen) and similar surface pressures. How can this be possible considering that Titan's atmosphere is three times more dense than the Earth's?

a) Titan's colder temperature compensates

b) Titan's lower gravity compensates

c) Tidal effects from our large Moon cancel this difference

d) Earth's higher wind speed compensates

e) More than one of the above

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3. The atmospheric scale height…

   a) Measures what altitude clouds form at

   b) Measures how fast pressure decreases with altitude

   c) Measures how fast temperature decreases with altitude

   d) Is the point where the atmosphere stops and empty-space begins

   e) Is how much the thickness of the atmosphere varies between day and night

4. What size of particles is most easily moved by the wind?

   a) Sand

   b) Dust

   c) Gravel

   d) Cobbles

   e) They're all equally easy to move, it depends on the wind-speed

5. Why do we think that there is water ice in the polar craters of the Moon and Mercury?

   a) Because there's water everywhere else on these bodies

   b) Because they have polar ice caps nearby

   c) Because comets impact the polar regions more often and deliver water there

   d) Because these craters are permanently shadowed

   e) A combination of 'C' and 'D'.

6. Why do winds at the Earth's equator blow from east to west?

   a) Because the planet spins west to east so it appears like the atmosphere moves east to west

   b) Because the rotation of the Earth deflects rising air to flow to the west

   c) Because the rotation of the Earth deflects air flowing towards the equator towards the west

   d) Because of the ocean currents, which drag surface air along with them

   e) Because east to west is the downhill direction at the equator

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Lecture 12: Venus

7. Venus appears much brighter than other planets in the night sky because….

a) It's relatively close to the Earth

b) It's relatively close to the Sun

c) It's covered in very bright clouds

d) All of the above

e) A combination of 'A' and 'B'

8. Venus has no magnetic field because

a) Venus has no iron core

b) Venus is too hot to generate a magnetic field

c) The iron core of Venus is completely solid

d) The magnetic field is there we just can't measure it

e) Venus spins too slowly to produce a magnetic field

9. What kind of geologic process dominates the surface of Venus?

a) Volcanism

b) Impact cratering

c) Erosion by wind from its dense atmosphere

d) Formation of river channels

e) Plate tectonics

10. The impact crater record on Venus is unusual because…

a) Venus is the only planet with no craters at all

b) The age of the surface seems larger than the age of the solar system

c) All the impact craters were erased half a billion years ago

d) Only craters smaller than a few kilometers in size can be found

e) No new craters have formed for 3.5 billion years

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11. It takes over 200 days for Venus to rotate once! Why does Venus rotate so slowly?

a) It formed that way

b) Because it has no moons like Earth and Mars

c) Close approaches with the Earth caused it to lose angular momentum

d) Venus used all it's rotational energy to heat up its surface

e) It was slowed down by the Sun's tidal effects

12. There's almost no water vapor in the atmosphere of Venus. Why is Venus so dry?

a) The pressure is too high for water vapor to exist

b) All the water is trapped underground

c) All the water was lost to space long ago

d) The temperature is too high for water vapor to exist

e) Venus never had as much water as the other planets

Lecture 13: Mars - Early History

13. Mars was once much warmer and wetter, why did the planet cool down?

a) The Sun has gotten fainter since that period

b) Mars is further away from the Sun than it used to be

c) Greenhouse gases were trapped in rocks

d) Heat from the interior decreased so the surface got cooler

e) Bright ice formed and reflected most of the solar energy back to space

14. How do we know that Mars once had a magnetic field?

a) Because all planets used to have magnetic fields

b) Because it spins fast, like the Earth

c) Because liquid water couldn't have existed otherwise

d) This result comes from computer models of early Mars

e) Because ancient rocks there are still magnetized

15. What is the crustal dichotomy on Mars?

a) The northern hemisphere is lower in elevation than the southern
b) The southern hemisphere is brighter than the northern
c) The eastern half of the planet is warmer than the western half
d) The bottom of the crust has a different composition than the top
e) Mars has both oceanic and continental crust

16. Mars has the largest volcanoes in the solar system. Olympus Mons is over 20km high; nothing on the Earth (volcanic or otherwise) even comes close to this. The main reason Mars can have such high mountains is…

a) Due to its weaker gravity which lowers the weight of the mountain
b) Due to its colder temperature which strengthens its surface rocks
c) Due to its thinner atmosphere, so the pressure on the mountains is less
d) Due to its different rock composition which happens to be stronger than Earth's
e) All of the above

Lecture 14: Mars - Recent History

17. Large flood channels on the martian surface were formed due to…

a) Rainfall on Mars
b) Ground-water burst out of the sub-surface
c) Erosion by lava flows
d) Melting of ice due to climate change on Mars
e) Erosion by glaciers

18. Today's Martian climate can be divided into…

a) A hot, dusty southern summer and a cooler wet northern summer
b) Cold dusty conditions near both equinoxes and cloudy conditions otherwise
c) Cloudy conditions around mountains and dusty conditions in valleys
d) Dusty conditions around the polar caps and clouds in the equator
e) Dust storms all year and clouds only in southern summer

19. Seasonal ice caps on Mars today…

a) Are composed of nitrogen ice
b) Are composed of CO_2 ice
c) Are composed of water frost
d) Are composed of clear slabs of water ice
e) Have different compositions in different hemispheres

20. Methane has been discovered recently in the martian atmosphere which prompted some people to wonder if currently-living things on Mars produced it. What are the alternative explanations?

a) Methane can be delivered to Mars by impacts of comets
b) This methane may have formed billions of years ago so it doesn't mean life exists today
c) The active volcanoes on Mars pump out methane
d) Methane is trapped in the polar ice which melts and releases it to the atmosphere
e) Alteration of rocks deep underground by warm water can release methane

21. The polar regions of Mars have thick ice-sheets like the Greenland ice-sheet on the Earth. Studying these ice-sheets is useful because…

a) Layers within this ice tell us about the climate on Mars
b) They are composed of an exotic kind of water ice that is denser than liquid water
c) They have a record of impact craters that goes back more than 3 billion years
d) When this ice melts in the summer it provides liquid water for possible life on Mars
e) It's easier to study these ice-sheets from space than it is to study Greenland

22. Variation in Mars' obliquity is much more extreme than it is for the Earth. Why is this?

a) Earth's larger moon stabilizes the planet against such changes
b) Earth's oceans make it harder to change the obliquity
c) Earth's denser atmosphere makes it harder to change the obliquity
d) Plate tectonics keeps Earth's obliquity at the same value
e) The asteroid impact rate is higher on Mars and these impacts can reorient the planet

Lecture 15: Processes unique to Earth

23. How do oceanic plates differ from continental plates?

a) The oceanic plates are denser
b) The oceanic plates are younger
c) The oceanic plates have a different composition
d) All of the above
e) None of the above

24. What happens when two continental plates start to split apart?

a) New continental crust is formed between them

b) New oceanic crust forms between them

c) The continental crust is stretched and becomes thinner

d) A mountain range forms and covers the area where the plates meet

e) This is a trick question – continents never split apart

25. Continents currently cover less than one third of the surface of the Earth. The area of this continental crust is…

a) Shrinking with time

b) Expanding with time

c) Holding steady for the past few billion years

d) Can go up or down depending on the situation

e) It depends on sea-level

26. What happens when two oceanic plates collide?

a) They crumple up and form underwater mountains

b) The older plate slides underneath the younger one

c) The slower plate slides underneath the faster one

d) Oceanic plates only spread apart and never collide

e) Underwater volcanoes like the Hawaiian islands form

27. Earth didn't suffer a runaway greenhouse like Venus because…

a) The greenhouse effect didn't operate early in Earth's history

b) The Earth receives much less solar radiation than Venus

c) Earth reflects much more radiation back to space than Venus does

d) Rainfall removed the main greenhouse gas from the atmosphere

e) Venus had more volcanoes than the Earth

28. What makes Earth's atmosphere different than any other planet?

a) It's mostly nitrogen
b) It contains trace amounts of methane
c) It contains water vapor
d) It contains oxygen
e) It's the only planet that forms pure water clouds

Lecture 16: Asteroids and Meteorites

29. The asteroid belt is…

a) The remains of a planet that was destroyed
b) A previous moon of Jupiter that was destroyed
c) Material from further out in the solar system captured by Jupiter's gravity
d) Debris thrown into space from impacts onto planets
e) Material that never formed a planet

30. The total amount of material in the asteroid belt is…

a) Amount the same as that in the planet Mars
b) About the same as that in the Earth
c) Less than what's in our Moon
d) More than what is in Mars, but less than what is in the Earth
e) Amount the same as what is in all the terrestrial planets combined

31. Near-Earth asteroids…

a) Were thrown out of the main asteroid belt by Jupiter's gravitational effects
b) Formed near the Earth billions of years ago
c) Formed nearer the Sun and drifted outwards to Earth's neighborhood
d) Were pulled out of the main asteroid belt by Earth's gravitational effects
e) Were knocked out of the main asteroid belt by collisions with other asteroids

32. Iron meteorites formed…

a) In an iron-rich part of the asteroid belt

b) As a mixture of iron and rock, but the rock burned off when it passed through Earth's atmosphere

c) From breaking up a large asteroid that had an iron core

d) By iron getting concentrated in Jupiter's large magnetic field

e) By being blasted off the surface of Mercury (the most iron-rich planet) in large impacts

33. Asteroids in the outer asteroid belt differ from those in the inner half because

a) They tend to be larger

b) They tend to be smaller

c) They tend to have more craters

d) They tend to have more ice

e) They tend to spin more slowly (makes them more circular in shape)

Lecture 17: Global Warming on the Earth

34. We're producing greenhouse gases at a quickly increasing rate. What causes most of our CO_2 emissions?

a) Cars and trucks driving around

b) Animals and people exhaling

c) Nuclear power

d) Burning coal

e) Agriculture

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35. Which of these is climate change <u>not</u> expected to cause over the next century?

a) An increase in the strength of hurricanes

b) Sea level rise and displacement of ~100 Million people due to flooding

c) Longer droughts in currently dry areas

d) A larger hole in the ozone layer

e) Actually, climate change will cause all of these things

36. Our emissions of greenhouse gases have caused a temperature increase of only about 1° C. This is worse than it sounds because…

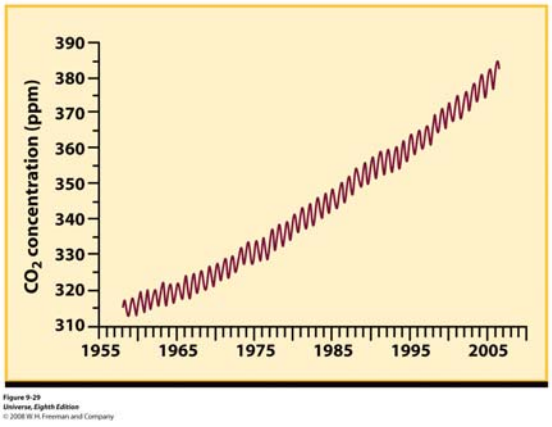
a) Even one degree is enough to kill many species on the planet

b) It sets off feedback effects that cause a runaway increase in temperature

c) It increases the size of the ozone hole

d) It makes people use air conditioners more and so use more power

e) It makes volcanoes more active which adds more CO_2 to the atmosphere



37. The plot on the left shows CO_2 concentrations over a 50 year period in the late 20th century. CO_2 is clearly going up with time, but what are the smaller wiggles in the plot due to?

a) Year-to-year variation in industrial activity

b) Seasonal changes in ocean temperature that cause less/more of the atmospheric CO_2 to be absorbed

c) Seasonal temperature changes in the atmosphere

d) People switching on their air-conditioners every summer and using more power

e) Seasonal changes in how much CO_2 is used by vegetation

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Lecture 18: Gas giants: Jupiter and Saturn

38. Metallic hydrogen makes up a big part of Jupiter and Saturn. This exotic sounding substance is made by…

a) Mixing iron and hydrogen under great pressure

b) Forcing iron to disintegrate into hydrogen atoms

c) Putting pure hydrogen under great pressure

d) Chemically combining iron and hydrogen

e) Putting pure hydrogen in a strong magnetic field

39. Helium in Saturn's atmosphere is…

a) Uniformly mixed at all depths

b) Concentrated near the surface

c) Produced from fusion of hydrogen nuclei

d) Raining out to lower levels

e) Forms a liquid layer about half way through the planet

40. Outer solar system planets are much larger than the inner planets because…

a) There are fewer of them so each planet contains more material

b) Hydrogen and helium was more abundant in the outer part of the disk from which the planets formed

c) The gravitational effects of the Sun stopped large planets forming close by

d) Water ice is stable further from the Sun and bulked up these planets early in their history

e) The colder temperatures further from the Sun allowed the atmospheres of these planet to expand to huge sizes

41. What is the main energy source for the Great Red Spot in the Jovian atmosphere?

a) Incoming solar radiation
b) Heat that still exists inside Jupiter left over from its formation
c) Nuclear fusion occurring in Jupiter's core
d) Radioactive decay of Uranium and other elements in Jupiter's core
e) Jupiter's intense magnetic field

42. The pretty colors in Jupiter's atmosphere are caused by…

a) Gasses at different temperatures
b) Different ratios of hydrogen and helium
c) Metallic hydrogen rising to the surface in places
d) Trace components of methane, water etc…
e) Dust delivered by asteroid and comet impacts into Jupiter

Lecture 19: Jupiter's Moons: Volcanoes and Oceans

43. Jupiter has a set of tenuous rings composed of…

a) Ice crystals ejected from Europa by impacts
b) Dust from asteroid collisions onto Jupiter's moons
c) Sulfur ejected by Io's volcanoes
d) Ice from breakup of comets like Shoemaker-Levy 9
e) Gas particles that escaped from Jupiter's atmosphere

44. Io's fantastic volcanic activity is driven by…

a) Heat left over from Io's formation
b) Heat produced by radioactive decay of elements in Io's core
c) Heat trapped by Io's large greenhouse effect
d) Heat Produced by tides raised by Jupiter
e) Heat created by the large number of asteroids that hit Io's surface

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45. Io's orbit around Jupiter is still an ellipse rather than a circle. This is a surprise, what keeps the orbit from becoming a circle

a) Jupiter's tides
b) Gravitational interactions with passing asteroids
c) Energy loss through Io's volcanoes
d) Interaction with Io's plasma torus
e) Gravitational interaction with other Moons of Jupiter

46. How do we know Europa has a liquid water ocean under its icy crust?

a) We can detect it a spectrometer
b) We know it's there from the gravitational effect on passing spacecraft
c) We've drilled through the ice and detected this water
d) We can measure its effect on Jupiter's magnetic field
e) We know this from theoretical models

47. What's weird about the interior of Jupiter's Moon Callisto?

a) It's a uniform mix to rock and ice that didn't differentiate
b) It differentiated, but there is no iron core
c) All the iron is located near the surface rather than in the core
d) There's a liquid water ocean that's more than 1000km deep
e) Gravitational measurements indicate that it appears to be partly hollow

48. Which of these geologic processes affects the surface of Callisto?

a) Volcanism
b) Tectonics
c) Impact cratering
d) All of the above
e) None of the Above

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49. Ganymede is the largest Moon in the solar system. It's larger than some planets and all the asteroids. What interesting feature does that allow for?

a) Ganymede can have large impact basins

b) Ganymede can have a core that's still molten and so have a magnetic field

c) Ganymede retains its own atmosphere

d) Ganymede has plate tectonics

e) More than one of the above

50. From the closest to the farthest away from Jupiter, what is the correct order of the Galilean satellites?

a) Io, Ganymede, Europa, Callisto

b) Europa, Io, Callisto, Ganymede

c) Io, Europa, Ganymede, Callisto

d) Io, Europa, Callisto, Ganymede

e) Ganymede, Callisto, Io, Europa