These are a few sample questions. A typical exam will have about 40 multiple choice questions and you are expected to select the BEST answer from among those given. Of the questions asked, I try to make ~13% challenging (A-student questions); ~15% more difficult than average (B-student questions), and ~72% average questions (C-student questions). The correct answers are indicated by the bold type.

Good luck.

Dr. Peterjohn

Examples of average questions.

1. An ecologist studies how the concentration of nutrients in groundwater changes as the groundwater flows from an agricultural ecosystem, through a stream-side forest, and then through a salt-marsh ecosystem before arriving in an estuary. This ecologist is best described as
_____.

A) a physiological ecologist
B) an ecosystem ecologist
C) a landscape ecologist
D) a community ecologist
E) a population ecologist

2. Which of the following correctly lists the types of electromagnetic radiation in order of increasing wavelengths, starting with the type having the shortest wavelength?

A) radio waves; visible light; ultraviolet radiation; X-rays
B) ultraviolet radiation; X-rays; visible light; radio waves
C) X-rays; ultraviolet radiation; visible light; radio waves
D) visible light; ultraviolet radiation; X-rays; radio waves
E) X-rays; ultraviolet radiation; radio waves; visible light

3. The wavelength of maximum emission for solar radiation is _____ the wavelength of maximum emission for terrestrial radiation.

A) greater than
B) less than
C) equal to

4. Prevailing easterly surface winds are found _____.

A) between the Equator and 30° latitude (both N & S)
B) between 30° and 60° latitude (both N & S)
C) between 60° and 90° latitude (both N & S)
D) between 60° and 90° N latitude, and between 30° and 60° S latitude
E) both A and C

5. The density of surface water in the ocean is affected by _____.

A) the formation of sea ice
B) temperature
C) salinity
D) both B & C
E) both A, B, & C

6. A watershed is an example of a _____ system.

A) closed
B) open
C) partially closed

7. A spectral irradiance curve is a graph plotting ____ on the x-axis, and ____ on the y-axis.

A) energy content per photon; flux of radiation
B) the wavelength of maximum emission; temperature
C) wavelength; flux of radiation
D) wavelength; energy content per photon

8. Other than electromagnetic radiation, energy is transported from the surface of the Earth to the atmosphere by _____.

A) convection (i.e. thermals)
B) the release of latent heat as water vapor condenses
C) the greenhouse effect
D) the coriolis effect
E) planetary albedo
F) both A & B
G) both C & E

Examples of above-average questions.

9. At the vernal equinox, the location of the subsolar point is at _____.

A) the Tropic of Cancer (23.5° N)
B) the Equator
C) the Tropic of Capricorn (23.5° S)
D) at a latitude where many large deserts are located
E) both B & D

10. From the material presented in class, and in the additional readings that were assigned, which of the following conclusions is supported by investigations into the problem of amphibian decline?

A) The worldwide decline in amphibian populations is due solely to an increase in the levels of UV-B radiation.
B) Among those studied, amphibians with high levels of photolyase were relatively unaffected by ambient levels of UV-B radiation.
C) Frogs are more sensitive to ambient levels UV-B than other species of amphibians.
D) The sensitivity of amphibians to ambient levels of UV-B radiation is species specific.
E) Both B & D

11. As a balloon rises to higher altitudes, the _____ of the electromagnetic radiation it emits _____.

A) total energy content; decreases rapidly
B) wavelength of maximum transmission; shifts to shorter wavelengths
C) speed; slows down
D) wavelength of maximum transmission; shifts to longer wavelengths
E) both A & D

12. If moist air rising near the equator has a temperature of 30° C, then we expect that by the time it reaches an altitude of 10,000 m (10 km) its temperature should be _____.

A) 0.6° C
B) 14° C
C) -30° C
D) -60° C
E) 24° C

13. In mountainous areas, the orographic effect can create local climates that are suitable for _____.

A) rain forests on the windward side of the mountains
B) deserts on the windward side of the mountains
C) rain forests in the rain shadow of the mountains
D) rain forests on the leeward side of the mountains
E) both C & D

14. Assume the fraction of accessible fresh water used by humans increased at a steady rate over the last 100 years from 10% to its current level. If this rate continues, then after 50 more years humans will be using about _____?

A) 70%
B) 55%
C) 100%
D) 40%

Examples of challenging questions

15. Spaceman Spiff crashed into the planet Zork. Using sophisticated sensors, Spiff determines that Zork is identical to Earth in every way except one: On Zork the Sun rises in the west and sets in the east. Spiff also determines that the place he crashed has prevailing easterly winds. With these observations our hero correctly concludes that he crashed in which of the following locations:

A) Somewhere between 30 & 60° N latitude.
B) Somewhere between 0 & 30° N or S latitude.
C) Somewhere between 30 & 60° N or S latitude.
D) Somewhere between 60 & 90° N or S latitude.
E) Somewhere between 60 & 90° S latitude.

16. You find yourself in a forest where there two distinct periods of enhanced precipitation and during these times the sun is directly overhead at noon. You are most likely to be at which of the following latitudes?

A) The Equator.
B) 60º N latitude.
C) 23.5º S latitude
D) 45º N latitude
E) 23.5º N latitude

17. Considering a balanced energy budget for Earth that has all the components of the one given in class, which of the following statements are false?

A) **The amount of *solar* radiation striking the top of the Earth's atmosphere is equal to the amount of *terrestrial* radiation emitted by the Earth's atmosphere back to space.**
B) The amount of *solar* radiation striking the top of the Earth's atmosphere (S) is equal to planetary albedo x S, plus the total amount of *terrestrial* radiation emitted by the Earth back to space from both the surface & atmosphere.
C) The amount of *solar* radiation that is absorbed by the surface of the Earth and the Earth's atmosphere combined is equal to the amount of *terrestrial* radiation emitted by the Earth's atmosphere back to space.
D) The greenhouse effect reduces the amount of *terrestrial* radiation emitted by the surface of the Earth that goes directly back to space

18. In cleaning out your attic you discover an old postcard from your great grandmother. It has a picture of Bogota, Columbia which is located at about 5^{o} N latitude. On the postcard she mentions that it has been raining steadily and that the locals have told her that she is visiting during a time of the year when they usually have some of their heaviest rains. The date on the postcard has faded but from the information provided above you can conclude that it was written within a month, or so, of _____.

A) March 22
B) September 22
C) June 22
D) December 22
E) **either A or B**

19. Use the following values to determine the amount of terrestrial radiation emitted by the surface of the Earth that is absorbed by materials in the atmosphere. **Assume that an energy balance exists for the surface, the atmosphere, and the entire Earth/atmosphere system**. I suggest drawing a planetary energy budget.

> 19% of the solar constant = Absorption of solar radiation by the atmosphere. This amount is then emitted to space as terrestrial radiation.
>
> 30% of the solar constant = Heat transfer from the surface to the atmosphere by evaporation + convection. This amount is then emitted to space as terrestrial radiation.
>
> 6% of the solar constant = Amount of terrestrial radiation emitted by the surface that is lost directly to space.
>
> 30% of the solar constant = Planetary albedo.
>
> Of the terrestrial radiation emitted by the surface that is absorbed by materials in the atmosphere, 90% is redirected back to the surface of the Earth where it is absorbed. The rest is emitted to space as terrestrial radiation.

A) 15% of the solar constant
B) 75% of the solar constant
C) 150% of the solar constant
D) 60% of the solar constant
E) 100% of the solar constant

20. If in a column of air over a given surface area of the Earth parcels of air rise straight up from the surface to an altitude of 10 km, then **before the parcels move away** (i.e. move out of the column), how will the atmospheric pressure change in that column of air at the surface of the Earth, and at an altitude of 9 km?

A) Decrease at the surface, and increase at 9 km.
B) Decrease at the surface, and decrease at 9 km.
C) Increase at the surface, and increase at 9 km.
D) No change at the surface, or at 9 km.
E) No change at the surface, and increase at 9 km.

21. The tilt of the Earth's axis of rotation changes over long periods of time from its current value. These changes can contribute to the triggering of an ice age which happens when summers in the northern hemisphere are cold enough to prevent all the winter snow from melting. Compared to current conditions, which of the following values of tilt would make a new ice age more likely?

A) 25^{o}
B) 24^{o}
C) 30^{o}
D) 22^{o}
E) Both A, B, & C

22. The equation $A*(1- B) = \sigma * C^4$ would represent a planet in radiation balance if …

A) A = albedo; B = solar constant; C = temperature of planet
B) A = solar constant; B = albedo; C = temperature of planet
C) A = temperature of planet; B = albedo; C = greenhouse effect
D) A = albedo; B = temperature of the planet; C = solar constant

23) For Earth, if A represents the solar constant and B represents the albedo, then the value from the Stephan-Boltzman equation is …

A) < (A-A*B) in the Arctic (>66.5^{o}N latitude)
B) = (A-A*B) everywhere
C) < (A-A*B) at the Equator
D) > (A-A*B) at the Equator
E) > (A-A*B) everywhere