Name___________________________________ NETID (eg, Morrisson 22)___________________________

Multiple Choice. Choose the one best answer. 40 questions at 2.5 points each. Print your first and last names and NET ID on this booklet and the scantron. Bubble in your answers carefully on the scantron. Hand in both exam booklet and scantron, and show your ID.

No calculators or other electronics allowed. Turn brimaround on hats. Thank you.

1) Approximately how many kilograms (kg) of carnivore (secondary consumer) biomass can be supported by a field plot containing 10,000 kg of plant material?
   A) 10,000  B) 10  C) 1000  D) 100  E) 1

2) For most terrestrial ecosystems, pyramids composed of species abundances, biomass, and energy are similar in that they have a broad base and a narrow top. The primary reason for this pattern is that ________.
   A) biomagnification of toxic materials limits the secondary consumers and top carnivores
   B) at each step, energy is lost from the system
   C) top carnivores and secondary consumers have a more general diet than primary producers
   D) as matter passes through ecosystems, some of it is lost to the environment
   E) secondary consumers and top carnivores require less energy than producers

3) Which habitat type in the figure makes available the most new tissue (biomass) in total to consumers?
   A) tropical wet forest  B) algal beds and reefs  C) open ocean  D) wetlands

4) The accompanying figure represents net primary productivity organized by ________.
   A) continent  B) biome  C) geography  D) region
5) Which of the following most often controls the rate of nutrient cycling in ecosystems?
   A) primary productivity  
   B) both primary and secondary productivity  
   C) secondary productivity  
   D) rate of decomposition of detritus

6) Which of the following locations are significant reservoirs for carbon for the carbon cycle?
   I. atmosphere  
   II. organisms and chemical processes in the ocean  
   III. fossil fuel in the form of fossilized plant and animal remains (coal, oil, and natural gas)  
   IV. terrestrial organisms (plant and animal biomass)
   A) only I and III  
   B) only II, III, and IV  
   C) only I, II, and IV  
   D) only II and IV  
   E) I, II, III, and IV

7) Which of the following are TRUE about the greenhouse effect?
   I. High-energy solar radiation enters the atmosphere.  
   II. Some of the energy is reflected, and some is absorbed by the Earth's surface.  
   III. Heat is emitted as infrared radiation, and some of it is retained in the atmosphere, increasing the temperature on Earth.
   A) III  
   B) I  
   C) I and II  
   D) I, II, and III

8) Which of the following statements regarding altitude and climate are TRUE?
   I. Species composition on different sides of a mountain range are often different from each other.  
   II. Rain shadows may appear on one side of a mountain range.  
   III. The higher the altitude, the warmer the climate.  
   IV. Both sides of a mountain range generally receive equal amounts of precipitation.
   A) only III and IV  
   B) only I, II, and IV  
   C) only I, II, and III  
   D) only I and II  
   E) only II, III, and IV

9) The main reason polar regions are cooler than the equator is that ________.
   A) the poles are permanently tilted away from the Sun  
   B) the polar atmosphere is thinner and contains fewer greenhouse gases  
   C) the poles are farther from the Sun  
   D) sunlight strikes the poles at a lower angle  
   E) there is more ice at the poles
10) NPP = GPP - _____.
   A) D (Death)
   B) R (Reproduction)
   C) D (Decomposition)
   D) R (Respiration)
   E) O (Oxygen)

11) In the figure, which of the following survivorship curves most applies to humans living in developed countries?
   A) curve A
   B) curve B
   C) curve C
   D) curve A or curve B

12) You observe two female fish of the same species breeding. One female lays 100 eggs and the other female lays 1000 eggs. Which one of the following is LEAST likely given the limits of fitness trade-offs?
   A) The female laying 100 eggs breeds more often than the female laying 1000 eggs.
   B) The female laying 100 eggs lives longer than the female laying 1000 eggs.
   C) The eggs from the female laying 1000 eggs have larger yolks than the yolks of the eggs from the female laying 100 eggs.
   D) The female laying 1000 eggs is larger than the female laying 100 eggs.
13) In the accompanying figure, which of the lines represents the highest per capita rate increase ($r$)?
   A) line A  
   B) line B  
   C) line C  
   D) line D

14) In the accompanying figure, which of the lines represents exponential growth?
   A) line A  
   B) line B  
   C) line C  
   D) line D  
   E) All of the lines represent exponential growth.

15) Assuming that these populations are density dependent, what would be the likely outcome if the system depicted in the previous figure were allowed to continue?
   A) Populations would go extinct.  
   B) Population growth would continue to be discontinuous.  
   C) Individual growth would continue to be indeterminate.  
   D) Population growth would likely decrease.
16) In the accompanying figure, which of the arrows represents the carrying capacity?

A) arrow A
B) arrow B
C) arrow C
D) Carrying capacity cannot be found in the figure because species under density-dependent control never reach carrying capacity.

17) Looking at the data in the accompanying figure from the hare/lynx experiment, what conclusion can you draw?

I. Food is a factor in controlling hare population size.
II. Excluding lynx is a factor in controlling hare population size.
III. The effect of excluding predators and adding food in the same experiment is greater than the sum of excluding lynx alone plus adding food alone.

A) only I
B) I, II, and III
C) only II
D) only III
E) only II and III
18) A scientist studying dispersion patterns in creosote plants at a research site near Tucson finds that these plants are generally found 8-15 feet from each other. Creosote at this site would be best characterized as having which type of dispersion pattern?
   A) clumped  B) uniform  C) desert  D) random  E) localized

19) The figure shown here represents the dynamics of ________.
   A) both metapopulations and extinction  B) metapopulations
   C) emigration  D) extinction

20) Epiphytic orchids grow harmlessly on their host trees, and derive their resources from the air and from rain, rather than from their host plant. The orchids benefit by having the host tree to grow on, while the host tree is unaffected. Which of the following is the best description of this species interaction?
   A) competition  B) commensalism
   C) amensalism  D) herbivory  E) parasitism
21) The competitive exclusion principle states that ________.
   A) it is not possible for two species with the same niche to coexist in the same region
   B) two species with the same niche will constantly be competing for resources
   C) two species with different niches will not compete for the same resources
   D) it is not possible for two species to compete for the same resources

22) People with at least one copy of the HLA-B53 gene are better able to beat back malarial infections before the infection progresses. If this is a coevolutionary arms race between Plasmodium and humans, what would the next step in this race be?
   A) to see Plasmodium populations that counter the HLA-B53 gene
   B) to see Plasmodium populations that have the HLA-B53 gene
   C) to see humans without the HLA-B53 gene
   D) to see humans with more than one copy of the HLA-B53 gene
   E) to see a mutation in the HLA-B53 gene that makes it more effective against malarial infections

23) A young coyote and a bobcat are fighting over a dead deer. This is an example of:
   A) omnivory
   B) interspecific interference competition
   C) intraspecific exploitation competition
   D) intraspecific interference competition
   E) interspecific exploitation competition

24) What interactions exist between a plant and the nitrogen-fixing bacteria that live mutualistically in the roots of the plant?
   A) -/+ B) +/+ C) +/- D) +/- E) +0

25) What interactions exist between a tick (ectoparasite) on a dog and the dog?
   A) +/- B) 0/0 C) +/+ D) -/+ E) +0

The symbols +, -, and 0 are to be used to show the results of interactions between individuals and groups of individuals in the examples that follow. The symbol + denotes a positive interaction, - denotes a negative interaction, and 0 denotes where individuals are not affected by interacting. The first symbol refers to the first organism mentioned.
26) Elephants are not the most dominant species in African grasslands, yet they influence community structure. The grasslands contain scattered woody plants, but they are kept in check by the uprooting activities of the elephants. Take away the elephants, and the grasslands convert to forests or to shrublands. The newly growing forests support fewer species than the previous grasslands. Which of the following describes why elephants are the keystone species in this scenario?
   A) Grazing animals depend upon the elephants to convert forests to grassland.
   B) Elephants prevent drought in African grasslands.
   C) Elephants help other populations survive by keeping out many of the large African predators.
   D) Elephants are the biggest herbivore in this community.
   E) Elephants exhibit a disproportionate influence on the structure of the community relative to their abundance.

27) Species richness increases ________.
    A) as community size decreases
    B) as area occupied decreases (ie, on smaller areas)
    C) as we travel southward from the North Pole
    D) on islands as distance from the mainland increases
    E) as net primary productivity decreases

Use the accompanying diagram of five islands formed at around the same time near a particular mainland, as well as MacArthur and Wilson's island biogeography principles, to answer the question(s) below.

28) Which island would likely have the greatest species diversity?
    A) A  B) B  C) C  D) D  E) E

29) Approximately how far back in time does the fossil record extend (ie what is approximate age of first life/the oldest fossil)?
    A) 3.5 billion years  B) 5.0 billion years
    C) 5.0 million years  D) 3.5 million years
30) Adaptive radiations can be a direct consequence of four of the following five factors. Select the exception (the one that DOES NOT apply):
   A) evolutionary innovation
   B) an adaptive radiation in a group of organisms (such as plants) that another group uses as food
   C) genetic drift
   D) vacant ecological niches
   E) colonization of an isolated region that contains suitable habitat and few competitor species

31) The largest mass extinction, measured as a percentage of species that disappeared, occurred at the end of which geological period?
   A) End of Paleogene (23 mya)
   B) End of Permian (251 mya)
   C) End of Cretaceous (66 mya)
   D) End of Devonian (359 mya)
   E) End of Silurian (419 mya)

32) From the video "Life's Rocky Start": Following the results of the famous experiment by Miller and Urey on the origin of life, Bob Hazen and his lab decided to do their own origin of life experiment that simulated the conditions of deep-sea volcanic vents. They initially failed to produce any interesting compounds. What “spark” did they add to their chemical soup that resulted in more interesting results?
   A) a powder of ground up minerals/clay
   B) sunlight
   C) stirring
   D) pond water

33) From the video "Life's Rocky Start": A fundamental change in earth's atmosphere that led to the "Red Earth" phase, and the extensive iron deposits on earth (called Banded Iron Formations) was due to the increase in what gas? (Hint: cyanobacteria were probably the first organisms to produce this gas)
   A) natural gas
   B) oxygen
   C) hydrogen sulfide
   D) methane
   E) nitrogen

34) Evidence that the mass extinction that occurred 66 mya that led to the extinction of the non-avian dinosaurs was due to a meteor impact includes:
   A) a massive crater found off the coast of Mexico
   B) none of these - there is no real evidence that a meteor impact caused this mass extinction
   C) a massive crater found off the coast of Mexico, and a layer of iridium found in rock strata dated from that time period
   D) a layer of iridium found in rock strata dated from that time period
   E) a one-mile thick layer of lava from the Siberian traps
35) As farmers abandon agricultural fields in Latin America, new species appear in a logical progression in the fields due to _________________.
   A) primary disturbance        B) primary succession
   C) secondary disturbance      D) secondary succession

36) If the Earth were to reorient such that the North Pole always received direct sunlight (always faced the Sun), how would that change Earth’s climate?
   A) The equators would get warmer.
   B) The North Pole would get more wind.
   C) The South Pole would get colder.
   D) The equators would not change in climate.

37) A 3-hectare lake in the American Midwest suddenly has succumbed to an algal bloom. What is the likely cause of this in freshwater ecosystems?
   A) introduction of nonnative tertiary consumer fish
   B) iron dust blowing into the lake
   C) nutrient runoff, particularly nitrogen
   D) accidental introduction of a prolific culture of algae
   E) increased solar radiation

38) Which of the following would NOT keep a lizard species out of some portion of its fundamental niche?
   A) local disease
   B) humans
   C) greater food abundance
   D) predatory birds
   E) another species of lizard
Consider the age structure diagram above. If the current birthrate persists, the population size in 30 years will be ______________ compared to the current population size. Assume no migration in or out of the population.

A) larger  
B) smaller  
C) cannot be determined  
D) the same

40) The resources used, roles played, and conditions tolerated describe the _________ of an organism.

A) habitat  
B) population  
C) niche  
D) biome  
E) community