

Multiple Choice (1pt each, total 10pts):

1. D How is the environment defined in ecology?
  - a. rivers
  - b. garbage dumps
  - c. the constructed habitat needed for an animal to live in a zoo
  - d. everything that influences an organism and everything influenced by that organism
  - e. none of the above
2. B What is one of the underlying assumptions of the scientific method?
  - a. Absolute proof exists for everything.
  - b. An organized reality exists.
  - c. Once supported, a hypothesis is assumed to always be true.
  - d. Accurate hypothesis can always be formulated.
  - e. The world is too complicated for humans to understand.
3. B Which of the following is not a mechanism of evolution?
  - a. Natural selection
  - b. Adaptation
  - c. Meiotic drive
  - d. Genetic drift
  - e. Gene flow
4. D Which kind of model gives the highest level of precision?
  - a. verbal
  - b. written
  - c. graphical
  - d. mathematical
  - e. pictorial
5. A A scientist asks the question "What pigment makes these flowers red?" What kind of question is this?
  - a. a proximate question
  - b. a stylistic question
  - c. a prescriptive question
  - d. an ultimate question
  - e. an evolutionary question
6. D,B What do you call selection that selects FOR all the rare phenotypes and selects AGAINST abundant phenotypes?
  - a. Stabilizing
  - b. Directional
  - c. Super
  - d. Disruptive
  - e. Devious
7. B Anthropocentrism refers to which type of worldview?
  - a. Humans have destroyed the earth and have doomed all its life to extinction.
  - b. Humans are the center of the universe.
  - c. All of life on earth is equally important.
  - d. Humans are the least important life form on earth.
  - e. Humans have evolved from ape-like ancestors

8. A Pick the correctly ordered hierarchy.
- Molecular biology, cell biology, physiology, population ecology
  - Cell biology, molecular biology, population ecology, ecosystem ecology
  - Population ecology, physiology, cell biology, behavior
  - Ecosystem ecology, population ecology, community ecology, physiology
  - Population ecology, ecosystem ecology, community ecology, molecular ecology
9. D Which of the following results in adaptation?
- Gene flow
  - Selfish genes
  - Genetic drift
  - Natural selection
  - None of the above
10. E Which is most important in determining the phenotype of an organism?
- Nature
  - Genes
  - Nurture
  - Environment
  - Both genes and environment

**Define the following: (2pts each, total 16pts)**

11. Evolution

Any change in the gene pool.

12. Meiotic Drive

Disproportionate representation of alleles in offspring. Allele is present in more than half the gametes.

13. Natural Selection

Heritable traits that make it more likely for an organism to survive and successfully reproduce become more common in a population over successive generations.

14. Altricial

Offspring that require supervision and care from their parents after birth.

15. Deme

Local population of organisms of one species that actively interbreed with one another and share a distinct gene pool. Population that follows Mendelian inheritance rules.

16. Reproductive Effort

Amount of energy put into offspring/reproduction.

17. Darwinian fitness

Capability of an individual of certain genotype to reproduce and pass their genes on to the next generation.

18. Anisogamy

Sexual reproduction involving gametes of different sizes.

Short Answer (5pts each, total 35 pts)

19. Explain Medawar's theory of senescence.

See pages 168-171

20. What is the best evidence that most real populations, except humans of course, are regulated?

See pages 187-190

21. Draw two graphs showing trade-offs in reproduction, one for an iteroparous organism and another for a semelparous one. Clearly label all axes, curves, and points.

See pages 157-160

22. Explain Fisher's theory of the sex ratio.

See pages 207-211

23. What is the pivotal age assumption in demography?

See page 138-139

24. Draw the three different survivorship curves and describe what is happening in each.

See pages 139-141

25. Discuss two of your favorite hypotheses about population cycles.

See pages 193-198

26. Leslie Matrix (19pts total)

0.16	0.3	1.0	0.1	0.00
0.8	0.00	0.00	0.00	0.00
0.00	0.6	0.00	0.00	0.00
0.00	0.00	0.5	0.00	0.00
0.00	0.00	0.00	0.2	0.00

a. Using the Leslie matrix above, give  $P$  and  $m$  for each age class.

Age Class	$P$	$m$
0	0.8	0.2
1	0.6	0.5
2	0.5	2
3	0.2	0.5
4	0	0

b. Calculate the number of individuals in each age class for time  $(t+2)$  given the age vector (18, 14, 13, 10).

12.8, 18.02, 14.95, 1.41, 0

c. How would you determine if this population is increasing or decreasing?

Calculate the eigenvector of the matrix.

27. Complete the table below. (20 pts)

Age	Survivorship	Fecundity	Realized Fecundity	Expectation of Life	Reproductive Value
0	1.0	0.0	0	3.2	1.225
1	0.8	0.3	0.24	2.75	1.25
2	0.6	0.5	0.3	2.33	1.266
3	0.5	0.8	0.4	2.6	0.92
4	0.3	0.2	0.06	1	0.2
5	0.0	0.0	0	0	0

a. Explain the difference between what is being calculated in fecundity and realized fecundity.

Realized Fecundity takes into account survivorship to that age, so fecundity is the expected probability of reproduction at that age, and realized fecundity is the expected probability of a newborn reproducing at that age.

b. In general terms, what is the difference between GRR,  $R_0$ , and  $r$ ?

Each of these measures some aspect of reproduction, but not the same thing. GRR stands for Gross Reproductive Rate which is the total number of offspring produced by an average organism in the absence of mortality.  $R_0$  is the Net Reproductive Rate, also known as the replacement rate, which is defined as the average number of age class 0 offspring produced by an average newborn organism during its entire lifetime. This measure takes into account mortality over time.  $r$  is the intrinsic rate of natural increase, or the instantaneous rate at which a population is changing per individual; the birth rate minus the death rate.

c. What pattern can you observe in the reproductive value column in the table above, and what does it mean for the organism?

The organism has high reproductive value up to age class 2, after which it drops quickly, indicating that the organism has passed the optimal age of reproduction.