

Quiz #3: Matter and Energy Cycles

17/22
Name _____

Part 1: Multiple Choice

1. The relationship between "Photosynthesis" and a "Chloroplast" is the same as the relationship between...

- a) "Cellular respiration" and a "Mitochondria"
- b) "Oxygen" and "Anaerobic cellular respiration"
- c) "Sunlight" is to "Plants"
- d) "Glucose" and "ATP"

2. Which of these statements correctly describes how photosynthesis and cellular respiration are related?

- a) The reactants of photosynthesis are also the reactants of respiration
- b) The product of photosynthesis are the reactants of cellular respiration
- c) The reactants of photosynthesis are needed for cellular respiration
- d) The products of photosynthesis are also the products of respiration

3. Which of the following statements gives a reason that humans DON'T need to go through photosynthesis themselves?

- a) We get the glucose we need for cellular respiration from the food we eat
- b) We produce our own oxygen during cellular respiration
- c) We can make glucose without sunlight during cellular respiration
- d) None of the above...human cells DO go through photosynthesis.

4. Why don't most eukaryotic organisms (humans, for example), rely entirely on anaerobic cellular respiration to make ATP?

- a) Anaerobic cell respiration causes our cells to swell up
- b) Anaerobic cell respiration requires more oxygen than we can easily get
- c) Anaerobic cell respiration requires extra energy
- d) Anaerobic cell respiration is not as efficient (and therefore doesn't produce as much ATP)

5. What is a direct result of the digestion of complex carbohydrates?

- a) Carbon dioxide
- b) Nucleic acids
- c) Simple sugars
- d) Water

6. Macromolecules are _____ made up of smaller _____.

- a) Building blocks; nucleic acids
- b) Large molecules; macromolecules
- c) Monomers; polymers
- d) Polymers; monomers

7. Lipids, carbohydrates, proteins and nucleic acids all contain...

- a) Carbon, Helium, and Oxygen
- b) Calcium, Hydrogen, and Oxygen
- c) Carbon, Hydrogen, and Oxygen
- d) Calcium, Hydrogen, Oxygen, and Phosphorus

Name _____

Part 2: Short Answer Section

16. (2pts) Describe the structure and function of TWO parts (organs) of your digestive system, and for each, indicate HOW it helps you get energy from your food to your cells.

~~Liver~~
helps by breaking down
carbs, fat, and proteins
into simpler molecules

~~holds partially broken
down foods and their
digestive juices~~

Esophagus →
pushes down food
into the stomach

Stomach ✓
uses enzymes to break
down enzymes; releases
digestion juices

17. (3 pts) You overhear a student make the following claim: "Matter is created by the sun, and is used up as it cycles between the geosphere, the hydrosphere, the atmosphere, and the biosphere"

i. (1pt) What about this statement do you agree with?

ii. (1pt) What about this statement do you disagree with?

iii. (1pt) How would you rewrite this statement to make it more accurate?

1. I agree with "cycles between the geosphere, hydrosphere, the atmosphere and the biosphere." ✓

2. don't agree with "Matter is created by the sun"

3. Matter is ~~created~~ by the earth's ecosystems and is used up as cycles between the geosphere, hydrosphere, atmosphere, and the biosphere

Quiz #4: DNA structure and Function

Name _____

1. What is the main function of DNA in living things?

- a) Its special double helix structure allows a cell to grow, heal, and divide
- b) It forms spindle fibers during mitosis to help separate chromosomes
- c) It is a molecule that stores and releases energy for a cell to use
- d) It contains genetic information (specifically, directions for how to build proteins)
- e) Its special double helix structure provides a pathway to help transport large proteins through a cell's membrane

2. Which of the following describes a nucleotide?

- a) The building blocks (monomers) of a DNA molecule
- b) An enzyme that helps during DNA replication
- c) A tightly coiled strand of DNA
- d) A double helix structure made of Adenine, Guanine, Cytosine and Thymine
- e) The part of a cell's nucleus that contains DNA

3. A DNA molecule is made of...

- a) Oxygen, ribose sugars, and nucleic acids
- b) Helicase, Polymerase, and ligase enzymes
- c) Phosphates, Deoxyribose sugars, and Nitrogenous bases
- d) Tightly coiled chromatin
- e) 2 Strands of replicated DNA

4. Imagine a hamster named Harold. How does the DNA in one of Harold's skin cells compare to the DNA in one of Harold's muscle cells?

- a) Both cells contain an identical set of DNA
- b) Harold's muscle cell contains more DNA than his skin cell
- c) Harold's skin cell contains DNA, but his muscle cell does not
- d) Both cells contain the same *amount* of DNA, but the sequence of nitrogenous bases will be different for skin and muscle cells

5. The diagram to the right shows...

- a) two duplicated chromosomes
- b) two unduplicated chromosomes
- c) one unduplicated chromosome
- d) one duplicated chromosome
- e) A bunny rabbit



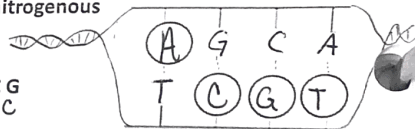
6. Transcription describes the process by which a cell...

- a) makes a disposable mRNA copy of a gene
- b) uses mRNA to build a protein
- c) links amino acids together to form a polypeptide chain
- d) sends a ribosome to make an identical copy of a strand of DNA
- e) makes new genes using proteins from the nucleus

7. Transcription takes place in the nucleus, translation takes place in the cytoplasm with the help of a ribosome

- a) Cytoplasm, ribosome, nucleus
- b) Ribosome, nucleus, chromosome
- c) Chromosome, nucleus, ribosome
- d) Nucleus, mitochondria, ATP molecule
- e) Nucleus, cytoplasm, ribosome

8. The image to the right represents a piece of DNA. Fill in the missing nitrogenous bases in the circled spaces



9. Transcribe the following DNA sequence into mRNA: ATC CGA CCG
UAG GCU GGC

- a) TAG GCT GGC
- b) CGA AAC CGA
- c) UAG GCU GGC
- d) AUC CGA CCG

10. Translate the following mRNA sequence into amino acids: CAC GGA CAA

- a) Histidine, Arginine, Asparagine
- b) Histidine, Glycine, Glutamine
- c) Alanine, valine, Glutamine
- d) Methionine, Proline, Leucine

11. A normal gene produces the following amino acids: Lysine, Serine, Tyrosine. A mutation occurs that causes this sequence to change to Lysine, Serine, Stop. This is an example of a

- a) Missense mutation
- b) Nonsense mutation
- c) Silent mutation
- d) Deletion frameshift mutation
- e) Chromosomal aberration

12. (3 points) IN YOUR OWN WORDS...

- a. Describe how a molecule of DNA gets copied
- b. Explain why this process is important
- c. Explain how this process is 'semi-conservative'

a. a DNA molecule separates into two strands, it then base pairs and continues producing a total of four strands of DNA

b. This process is important because without cell copying we would not have ongoing growth in our bodies

c. It is semi conservative because each new DNA strand contains/has part of a new strand each new strand "saves" half of the original strand

Selection and Speciation

How can changes in a population result in the formation of a new species?

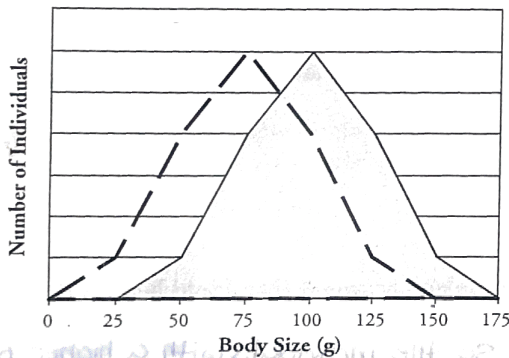
Why?

Have you ever wondered how the great diversity of life on Earth has come about or how a single new species forms? Environmental pressures may cause populations to change over time or evolve. This is because an organism's ability to live to adulthood in its current environment will determine its reproductive success and ability to pass on its genes. But changes within a population can occur without creating a new species. At what point do scientists start thinking of a new name for a species?

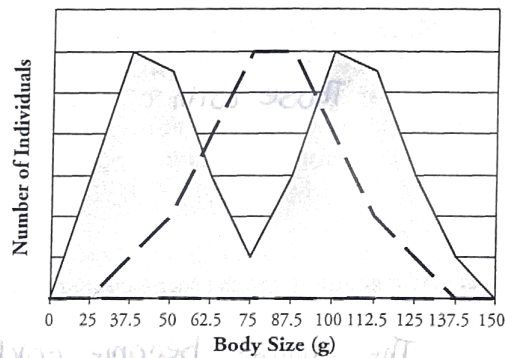
Model 1 – Three Types of Selection

Ed puzzle

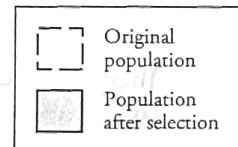
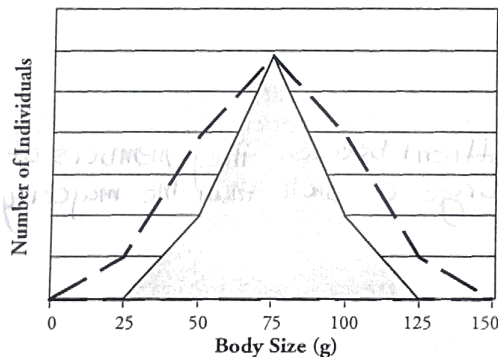
A Directional Selection



B Disruptive Selection



C Stabilizing Selection



1. What variables do the graphs in Model 1 compare?

Body size and the number of people

2. What are the three types of selection illustrated in the graphs in Model 1?

Directional, disruptive, stabilizing

3. According to the graphs in Model 1, there is variation in the body mass in the original population. Using your knowledge of genetics, describe how this variation is possible.

Different alleles are possible within the population because random mutations can occur

4. Refer to graph A of Model 1.

a. How is the population that has experienced selection different from the original population?

The ~~older~~ individuals in the new population have a larger body size than those in the older population.

b. Fitness is defined as the relative ability of an individual (or population) to survive, reproduce, and pass on genes. Which individuals in the original population appear to display better fitness? Those with a larger body mass

c. As a group, propose some characteristics of the environment that could lead to the population changes illustrated in graph A.

The climate became colder so the individuals with a higher body mass

5. Refer to graph B of Model 1.

a. How is the population that has experienced selection different from the original population?

They are different because they members of the new population are either large or small than the majority in the original population.

b. Which individuals in the original population appear to display better fitness?

Those with either very small or very large body mass

c. As a group, propose some characteristics of the environment that could lead to the population changes illustrated in graph B.

A issue that could lead to change is protection from predators

ing in size
b. Which individuals in the original population appear to display better fitness?

Those with medium body mass

c. As a group, propose some characteristics of the environment that could lead to the population changes illustrated in graph C.

The environmental changes could be crossing/going to a shelter too fit into



7. As a group, define the following terms in grammatically correct sentences. Each definition should contain the following words: population, selection, fitness, and environment.

a. Directional selection

Individuals with a phenotype demonstrate more fitness. Over time the selection occurs the structure of the population changes and have the more adapted phenotype

b. Disruptive selection

Individuals with extreme phenotypes would demonstrate more fitness. Over time the selection occurs the structure of the population changes with more individuals showing extreme phenotypes and less having a medium phenotype

c. Stabilizing selection

Individuals with a medium phenotype demonstrate more fitness. Over time selection occurs and the structure of the population ~~changes~~ changes more individuals having the medium phenotype



8. In each of the following examples, describe the likely outcome due to the environmental pressure and state the type of selection. Justify your choice.

a. Finches with a small beak cannot crack open seeds.

A population with a larger beak will be selected eventually because they can easily open seeds.

b. Human babies with very high or very low birth weights have a higher mortality rate.

The conditions will favor medium weight babies which will result them being in the stabilizing selection

c. A population of seed cracker finches feeds on seeds available in two sizes, small or large.

If two populations emerged with different beak types are best for the different sized seeds which ~~is~~ is disruptive selection

d. Overfishing occurs in two rivers in British Columbia, Canada, where larger salmon are preferentially caught.

Small sized salmon would become an advantage because ~~they~~ they are not harvested ~~because~~ so the population size would shift from large to small which is Directional selection

9. Refer to Model 2. Identify the pairs of organisms that are able to produce offspring.

Organism A/B, C/D, and E/F

10. Which pair of organisms in Model 2 are members of the same species?

The pair that is the same species organisms
A and B

11. Consider all of the pairs of organisms in Model 2 that are not of the same species. What criterion are missing in all cases that could be used to define a species?

The pairs of organisms that are not the same can't reproduce and have fertile offspring.

Read This!

The primary criteria for animals to be classified as different species is that there must be **reproductive isolation**, meaning for some reason organisms from the two populations cannot pass on their genetic code through reproduction for several generations. Other criteria such as differing morphology (appearance and body structure) and how much DNA the organisms share are also used to make a final determination when comparing two similar organisms.

12. A common farming practice is to breed a female horse with a male donkey. The result is a very robust animal – the mule. Most mules however are sterile, and therefore cannot reproduce. Are horses and donkeys members of the same species? Justify your answer with a specific example from Model 2.

No donkeys and horses are different species because they mate when their offspring is infertile. This is an example from organism C/D in model 2.

13. Many species of birds have elaborate mating rituals that include bird calls, nest construction, and courtship displays. A researcher is comparing two populations of birds with similar morphology that live in similar niches. Male birds in one population build a nest before attempting to court a female, while males in the other population build the nest in cooperation with the female. Is it likely the researcher will classify these birds as the same species? Justify your reasoning.

No these two birds are not the same species because they have different mating rituals.

14. Could directional selection lead to the creation of a new species? Justify your reasoning using what you've learned from Models 1 and 2.

Yes that selection could lead to a new species if the population changed to the point that members of the new population and the old population could no longer mate with each other.

15. Could disruptive selection lead to the creation of a new species? Justify your reasoning using what you've learned from Model 2.

I learned that disruptive selection can lead to a new species if the two resulting populations were able to produce fertile offspring.

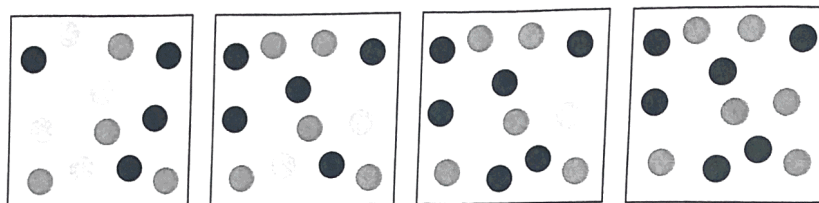
16. Could stabilizing selection lead to the creation of a new species? Justify your reasoning using what you've learned from Model 2.

No, the individuals in the species just become more alike. It's unlikely to change the ability to mate within the population to produce fertile offspring.



Extension Questions

Model 3 – Genetic Drift



1st Generation

2nd Generation

3rd Generation

4th Generation

17. Refer to Model 3. Fill in the table below with the number of alleles of each type in each generation.

| | 1st Generation | 2nd Generation | 3rd Generation | 4th Generation |
|--------|----------------|----------------|----------------|----------------|
| Light | 4 | 2 | 1 | 0 |
| Medium | 4 | 5 | 5 | 6 |
| Dark | 4 | 5 | 6 | 6 |

18. Compare the frequency of the three alleles in the 1st generation of the small population illustrated in Model 3.

Each of the three alleles observed equally represented in the population

19. In the scenario illustrated in Model 3 two of the light alleles were lost (through the death of the individual who had these two alleles) before reproduction occurred in the 1st generation. How did this affect the distribution of the three alleles in this small population?

There were fewer light alleles in the next generation because that allele was not passed on as often.

20. The phenomenon illustrated in Model 3 is called genetic drift. It mainly occurs in small, isolated populations. Propose an explanation for why the light allele disappears from the population by the fourth generation.

Because fewer organisms have the light gene the chances that the future generation will have that allele is reduced. Therefore eventually the population would no longer have organisms with that gene.

21. Will the light allele ever reappear in this population? If yes, describe the circumstances that would need to occur for the light allele to reappear.

No the light allele would never reappear. The only way it would appear is if another population ~~with~~ with the light allele would join this population and ~~make~~ a light allele.

22. If the population in Model 3 had been very large (hundreds of organisms), would the loss of two alleles from that population have led to the disappearance of that allele? Justify your reasoning.

If the population would have been ~~small~~ large its unlikely that a small death presentage would have an effect a disappearance of their alleles.