

1. The Punnett square is an effective tool which can be used to predict the probability of different phenotypes arising from the breeding between two parental organisms.

Consider the following example. Let there be a gene which has alleles dominant for blue eyes (B) and recessive for brown eyes (b). If a person with Bb genotype mates with another person with Bb phenotype, based on the Punnett square:

	B	b
B	BB	Bb
b	Bb	bb

There will be a 75% chance the offspring has blue eyes (25% BB, 50% Bb) and 25% chance the offspring has brown eyes (bb).

People with albinism have pink eyes and this masks the original color the person should have inherited from the parents. Let the alleles for albinism be A and a and note that albinism is a recessive disorder (only people with the aa genotype will be albino).

Shown below is a Punnett square for the possible genotypes of offspring of parents with the BbAa (blue eyed without albinism) and Bbaa genotypes (albino):

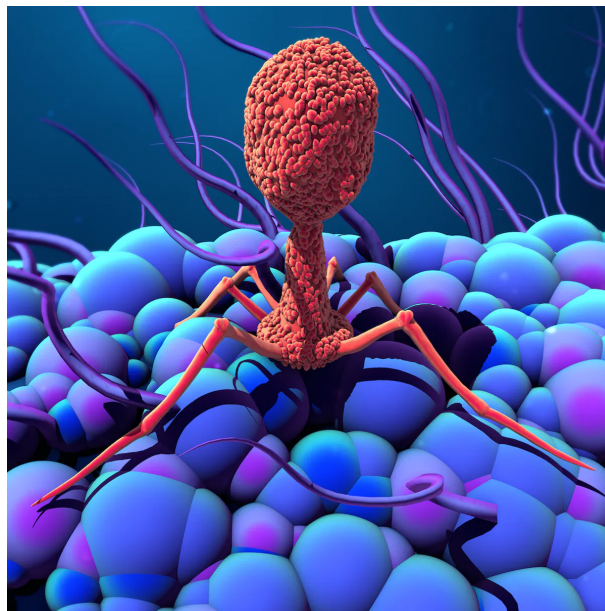
	BA	Ba	bA	ba
Ba	BB Aa	BB aa	Bb Aa	Bb aa
Ba	BB Aa	BB aa	Bb Aa	Bb aa
ba	Bb Aa	Bb aa	bb Aa	bb aa
ba	Bb Aa	Bb aa	bb Aa	bb aa

In the scenario above, what are the chances that an offspring will have brown eyes?

- A. 0.0%
- B. 12.5%
- C. 25.0%
- D. 50.0%

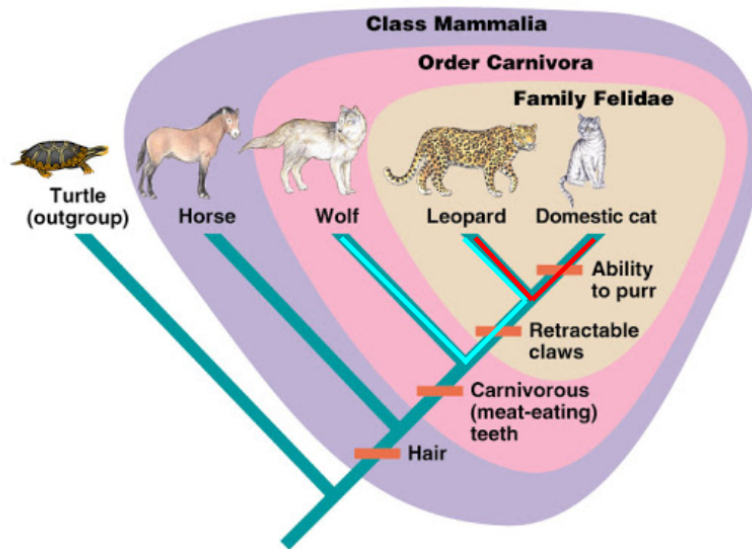
2. Antibiotics are medicines used to fight bacteria. Traditional antibiotics prevent the formation of peptidoglycan which is required to create bacterial cell walls. As a result, bacteria burst because of the weakened cell wall and eventually die.

Sometimes, people use antibiotics without a receipt of the doctor to fight a viral disease. However, antibiotics do not have any effect on viral disease development.

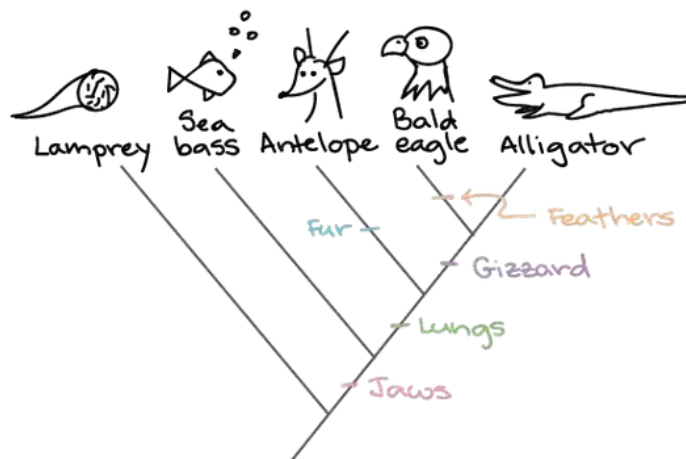


Why are antibiotics not effective in fighting against the virus?

- A. Viruses do not use peptidoglycan as a part of their structure
 - B. Viruses do not have an envelope
 - C. Viruses are not prokaryotes or eukaryotes
 - D. Viruses have a much more complex shape
3. Phylogeny is the diagram representing differences and similarities between different animal species. The less the length of the path between animals, the closer are the animal species. For example: Leopard and Domestic cat are closer to each other than Leopard and Wolf in terms of genetic similarities.



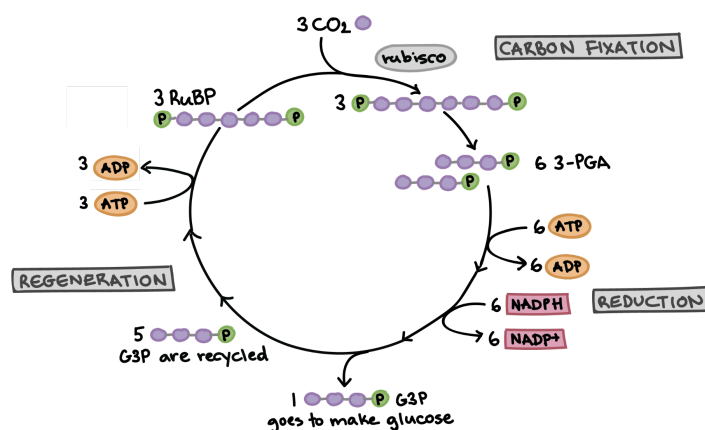
For the phylogeny below, which pair of animal species is the farthest in terms of genetic similarities?



- A. Sea bass and Bald eagle
- B. Sea bass and Alligator
- C. Sea bass and Lamprey
- D. Sea bass and Antelope

4. Most plants produce glucose from carbon dioxide using the Calvin cycle.

Three molecules of carbon dioxide are added to three molecules of RuBP, forming six molecules of 3-PGA. These six molecules of 3-PGA are converted to six molecules of G3P. Five molecules of G3P are used to regenerate the three molecules of RuBP, and one molecule of G3P is produced as an excess, and is eventually converted to glucose. One molecule of glucose requires two molecules of G3P to produce.

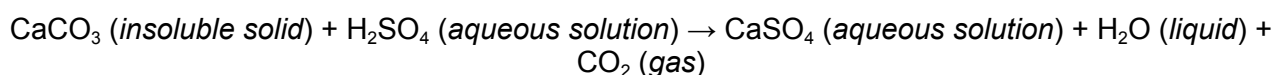


Some plants have an adaptation which allows them to store carbon dioxide as another molecule, oxalate. One molecule of oxalate can be converted back to two molecules of carbon dioxide.

How many molecules of oxalate are needed to form one molecule of glucose?

- A. 1
- B. 2
- C. 3
- D. 4

5. Many decoration statues and sculptures are made of marble, a rock consisting of calcium carbonate, CaCO₃. In recent years, many statues placed outdoors experienced heavy damage. Calcium carbonate enters into reaction with sulfuric acid and gets dissolved:



H_2SO_4 is formed by water, H_2O , and sulfur trioxide, SO_3 ($\text{H}_2\text{O} + \text{SO}_3 \rightarrow \text{H}_2\text{SO}_4$). However, sulfur trioxide is not a usual component of the atmosphere. What can explain its unexpected occurrence in nature?

- A. Temperature rise
- B. Industrial pollution
- C. Sulfur mining
- D. Soil erosion

Answers

1. B
2. A
3. D
4. C
5. B