

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

ANSWERS TO EXERCISES

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|-------------------------------|----------------------|-------|
| 1. species | 7. false, time | 21. a |
| reproductive | 8. true | 22. d |
| 2. speciation | 9. false, premating | 23. c |
| adaptive radiation | 10. true | 24. a |
| geographic | 11. false, isolation | 25. d |
| allopatric | 12. true | 26. h |
| ecological | 13. true | 27. b |
| premating | 14. true | 28. e |
| 3. temporal | 15. true | 29. c |
| behavioral | 16. true | 30. f |
| 4. mechanical incompatibility | 17. c | 31. a |
| 5. hybrid infertility | 18. b | 32. d |
| postmating | 19. b | 33. c |
| 6. polyploidy | 20. c | 34. d |

35. Two hypothetical mechanisms of speciation are allopatric speciation, in which the populations are geographically separated from each other and thus isolated from gene flow, and sympatric speciation, in which the populations share the same area but are isolated from gene flow due to different behaviors.
36. Speciation is the process by which new species form. Speciation in animals generally depends on two factors: isolation, since gene flow between diverging populations must be small or non-existent; and the genetic divergence of two populations, since they must evolve large genetic differences so that they cannot interbreed or produce normal offspring.
37. Postmating isolating mechanisms prevent production of vigorous, fertile offspring, and include gametic incompatibility, hybrid inviability, and hybrid inferiority. Gametic incompatibility occurs when sperm from one species are unable to fertilize eggs of another. Hybrid inviability occurs if hybrid offspring survive poorly. Hybrids may die during development, or display behaviors that are mixtures of the two parental types and be unable to attract mates. Hybrid infertility occurs if hybrid offspring are unable to produce normal sperm or eggs due to problems in chromosome pairing during meiosis.
38. Speciation has occurred twice in part (a) to produce three contemporary species at the top of the figure. The branched arrows indicate the speciation events which resulted in reproductive isolation between the new species formed. In part (b), a large amount of phenotypic change has occurred over an extended period of time, but no reproductive isolation has occurred so that the entire lineage has remained as a single species.
39. Since dogs and coyotes successfully interbreed in captivity, they must be closely related, having diverged from common ancestors in the not too distant past. Biologists consider them different species because they hardly ever interbreed under natural conditions in the wild. Also, recent molecular genetics studies have shown that dogs are much more closely related to wolves than they are to coyotes.
40. Let's say that the plant species has 20 pairs of chromosomes in its diploid cells and 20 chromosomes in its haploid cells. If colchicine is used on cells undergoing meiosis, instead of the resulting spores having 20 chromosomes (haploid), they will have 40 chromosomes (diploid). If these diploid spores develop into diploid gametes (20 pairs of chromosomes), they could mate with normal haploid gametes (20 chromosomes) and produce triploid organisms with each of the 20 chromosomes being present three times in each cell of the offspring. If the triploid organism thus produced can be propagated asexually (by budding or by planting cuttings that could take root and grow into complete plants), a new polyploid species of plant will have been produced.
41. Cultivated bananas are triploid organisms lacking seeds. Their wild diploid relatives have hard seeds within the fruits. The triploid bananas are seedless because meiosis cannot occur normally in triploid organisms, meaning that no normal gametes can be produced. During normal meiosis, pairs of homologous chromosomes pair up and segregate during the first meiotic division, so that each gamete receives an exact haploid number of chromosomes. In triploid organisms, there are three copies of each chromosome type so that during meiosis two of them pair up and the other remains unpaired. When segregation occurs, the extra chromosomes move randomly, some to one of the poles and some to the other pole. This leads to genetically unbalanced gametes, each with a random combination of

of their mating behaviors towards each other, whether they can together produce normal, healthy, fertile offspring, and whether their chromosome numbers are identical or not, are valid ways to determine whether they represent one or two species.

43. According to P. Massicot of animalinfo.org, the saola is a forest-dwelling ox weighing about 100 kg (220 lb). All known locations for the species are mountainous with steep river valleys, covered by evergreen or semi-deciduous forests between 300–1800 meters (1000–6000 feet), with low human disturbance. Current knowledge indicates that the saola prefers the edge areas of wet lowland evergreen forest habitats and evergreen montane forests. Villagers say that the ox eats the leaves of fig trees and other bushes along riverbanks. The saola is said to travel in small groups of 2–3 animals, rarely up to 6–7 animals. The most serious threats to the saola are hunting and loss of forest habitat due to logging and conversion to farmland. In May 1992, the discovery of three pairs of horns in the only remaining area of pristine forest in northern Vietnam led to the first documentation by Western scientists of a new species of ox. Saola are shot for their meat. Because of their scarcity, local people place a higher value on saola than on more common species. Hunters were also aware of the intense interest from the world's scientific community, increasing their motivation to capture live specimens. Among local communities, there was some awareness that forest resources were declining, but the general perception was that resources were still plentiful. Moreover, the hunters showed little or no understanding of the principles of resource management of the species that they hunted. Everything that was encountered during hunting trips was shot or captured, if possible. Although the saola was valued by hunters, there seemed to be little concern about its decline or local extinction. There are an estimated several hundred saola left.
44. According to an Agence France-Presse article reprinted by forests.org, this mammal is a small stag belonging to the muntjac (or barking deer) family. It has black fur and weighs about 15 kilos (33 pounds), only half the weight of the other muntjac species in Vietnam. The scientists were not able to observe the animal directly and made the discovery from skulls found in villages in the area. They established it was a new species after analyzing the animal's tissue while further information was provided by Vietnamese hunters. This muntjac species lives in forests between 400 and 1,000 meters (1320 and 3,300 feet) in altitude. Its small size allows the animal to move easily through the dense vegetation.
45. Researchers at the University of East Anglia have identified a new and highly distinctive species of rabbit—striped and with a red rump—found in the Annamite Mountains in Laos and Vietnam. Three of the striped rabbits were found, freshly hunted, in a meat market in Laos by a British biologist. Samples from these animals were sent for identification to one of the world experts on rabbits. Researchers extracted DNA from the Laos rabbits and also from 100-year-old museum specimens of the only other known species of striped rabbit, the critically endangered Sumatran rabbit, endemic to mountain forests in Sumatra. The Annamite rabbit, which has since been seen in a nature reserve in neighboring Vietnam, closely resembles the Sumatran rabbit, both possessing black/dark brown stripes on the face and back, a red rump and short tails and ears. However, despite the striking external similarity, genetic analysis reveals significant differences between the two. The genetic data suggests that these two species may