Lesson 3 – Origin of species

1. Most of biological diversity has probably arisen by
   a. anagenesis.
   b. cladogenesis.
   c. phyletic evolution.
   d. hybridization.
   e. sympatric speciation.

2. The largest unit in which gene flow is possible is a
   a. population.
   b. species.
   c. genus.
   d. subspecies.
   e. phylum.

3. Bird guides once listed the myrtle warbler and Audubon's warbler as distinct species, but applying the biological species concept, recent books show them as eastern and western forms of a single species, the yellow-rumped warbler. Experts must have found that the two kinds of warblers
   a. live in the same areas.
   b. successfully interbreed in nature.
   c. look enough alike to be considered one species.
   d. are reproductively isolated from each other.
   e. are allopatric.

4. Among allopatric species of *Anopheles* mosquito, some live in brackish water, some in running fresh water, and others in stagnant water. What type of reproductive barrier is most obviously separating these different species?
   a. habitat isolation.
   b. temporal isolation.
   c. behavioral isolation.
   d. gametic isolation.
   e. postzygotic barriers.

5. A genetic change that caused a certain *Hox* gene to be expressed along the tip of vertebrate limb bud instead of further back made possible the evolution of the tetrapod limb. This type of change is illustrative of
   a. heterochrony, a change in the timing of developmental events.
   b. allopolyploidy, an increase in chromosome number.
   c. paedomorphosis, or retention of ancestral juvenile structures in an adult organism.
   d. a change in a homeotic developmental gene that altered the spatial organization of body parts.
   e. allopatric speciation.

6. According to advocates of the punctuated equilibrium model,
   a. natural selection is unimportant as a mechanism of evolution.
   b. given enough time, most existing species will branch gradually into new species.
   c. a new species accumulates most of its unique features as it comes into existence, then changes little for the rest of its duration as a species.
   d. most evolution is anagenic.
   e. speciation is usually due to a single mutation.

7. Which of the following factors would not contribute to allopatric speciation?
   a. A population becomes geographically isolated from the parent population.
   b. The separated population is small, and genetic drift occurs.
c. The isolated population is exposed to different selection pressures than the ancestral population.
d. Gene flow between the two populations is minimal or does not occur.
e. The different environments of the two populations create different mutations.

8. Plant species A has a diploid number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from hybridization fo A and B. The diploid number of C would probably be
a. 12.
b. 14.
c. 16.
d. 28.
e. 56.

9. The speciation episode described in question 9 is most likely a case of
a. allopatric speciation.
b. sympatric speciation.
c. speciation based on sexual selection.
d. adaptive radiation.
e. anagenic speciation.

10. What is: "all the populations of organisms that can potentially interbreed with one another under natural circumstances and are reproductively isolated from other populations"?
   a. Genus
   b. Species
   c. Genotype
   d. Community
   e. Tribe

11. Fruit fly species all look more or less alike. If you have a male and female fruit fly how can you prove that they are the same species?
   a. Base sequence the DNA of their chromosomes.
   b. Examine them closely with a low power microscope comparing their physical characteristics to published species key lists of characteristics.
   c. If they mate when they are put together then they are the same species.
   d. If they mate successfully and their offspring can also mate successfully all are the same species.
   e. If they can both asexually reproduce and their offspring can also successfully asexually reproduce then they are all the same species.

12. If a species that is forms a new species by doubling its chromosome number, what will be the diploid number of the new species?
   a. 62
   b. 93
   c. 122
   d. 124
   e. 153

13. If there is no gene flow into a population, it is said to be...
   a. allopatric
   b. sympatric
   c. a founder population
   d. isolated
   e. in a bottleneck

14. Two species of squirrels live on either side of the Grand Canyon. They are an example of:
   a. Temporal isolation
b. Behavioral isolation
c. Mechanical isolation
d. Hybrid inviability
e. Allopatric speciation

15. A European species of marsh grass called *Spartina maritima* has 2N=60. A similar species native to North America, *S. alterniflora* has 2N=62. In 1835 the North American species was found growing near the European species near Southampton England, having been accidentally imported. Occasional sterile hybrids were noted. In 1895 a new species, *S. anglica*, was first identified at Southampton and subsequently became very common. The new species has been identified as a fertile hybrid of the original two species. What is the "2N" chromosome number of the sterile hybrids that form between the original two species *S. maritima* and *S. alterniflora*?
   a. 31
   b. 60
   c. 61
   d. 122
   e. 153

16. What is the 2N chromosome number of the new species *S. anglica*?
   a. 60
   b. 61
   c. 62
   d. 122
   e. 153

17. A horse has 2N=64 and a donkey has 2N=62. The hybrid of these two species, mules have 63 chromosomes and are sterile. Why are mules sterile?
   a. They cannot physically mate with each other.
   b. They cannot physically mate with horses and donkeys.
   c. They lack homologous chromosomes and cannot undergo meiosis.
   d. Their zygotes cannot complete the first mitotic division to form the two cell stage.
   e. Only autoploid interspecies hybrids are able to form new species.

18. Since the Pleistocene ice age, deserts have been gradually forming in the southwestern United States. As the original lakes and rivers of this area shrank into isolated streams and springs the fishes living in them developed a strong potential for:
   a. speciation
   b. hybridization
   c. polyploidy
   d. temporal isolation
   e. introgression

19. There are currently many similar but different species on either side of the isthmus of Panama. They probably resulted from:
   a. sympatric speciation
   b. allopatric speciation
   c. temporal isolation
   d. large rapid changes in their gene frequencies
   e. hybridization

20. Which of the following "species" cannot be tested via the biological species concept to see if all the individual organisms are in fact a single species?
   a. yeast purchased at the grocery store
   b. a dinosaur species
   c. different populations of the same bird species
d. the so called "races" of humans
e. different genetic strains of the same presumed fungus species

21. An example of adaptive radiation is:
   a. bat wings
   b. peppered moths in Britain
   c. Galapagos finches
   d. long giraffe necks
   e. starfish arms

22. When a species invades a new habitat and evolves rapidly into several new species to better exploit new resources what has occurred?
   a. phyletic speciation
   b. divergent speciation
   c. stabilizing selection
   d. polyploidy
   e. adaptive radiation

23. Where would a researcher most likely find examples of allopatric speciation?
   a. In the bottom waters of Lake Michigan
   b. In a forest on the east side of Lake Michigan
   c. In a forest on the west side of Lake Michigan
   d. Comparing forests on the east and west sides of Lake Michigan
   e. In the surface waters of Lake Michigan

24. When the London underground (subway) system was built in the 19th century mosquitoes moved into the tunnels and became adapted at biting the customers and small animals that inhabit the subway system. Like people, mosquitoes can freely enter and leave through the tunnel entrances. Recently DNA analysis and cross breeding attempts between above ground and underground mosquitoes indicate that there are now two different species. The underground insects are visibly larger. What has likely happened?
   a. temporal isolation
   b. population bottleneck
   c. geographic isolation
   d. behavioral incompatibility
   e. adaptive radiation

25. Two populations of mountain dwelling salamanders are separated by an impassable valley. The populations are __________.
   a. allopatric
   b. sympatric
   c. divergent
   d. founders
   e. subspecies

26. The organisms most likely to undergo sympatric speciation by polyploidy are ...
   a. mammals
   b. insects
   c. plants
   d. protists
   e. birds

27. What type of speciation results from errors in cell division and producing chromosomal aberrations?
   a. Allopatric
   b. Sympatric
   c. Phyletic
28. What has happened when two populations become geographically isolated from one another and then genetic divergence occurs?
   a. Allopatric speciation
   b. Sympatric speciation
   c. Phyletic speciation
   d. Continental drift
   e. Founder effect

29. The flies that show a preference for either Hawthorn or Apples, and are no longer interbreeding populations because of this, illustrate what type of speciation?
   a. Allopatric
   b. Specialization
   c. Polyploidy
   d. Founder effect
   e. Sympatric

30. Two different species of pine release their pollen at different times. This is an example of:
   a. Geographical isolation
   b. Ecological isolation
   c. Behavioral incompatibility
   d. Temporal isolation
   e. Mechanical isolation

31. The Kiabab squirrel lives on the north side of the Grand Canyon and the Abert squirrel lives on the south side. Even though these two populations are only miles apart, their gene pools are kept isolated by:
   a. Mechanical incompatibility
   b. Hybrid infertility
   c. Geographic isolation
   d. Ecological isolation
   e. Temporal isolation

32. Which of these definitions of species most closely fit the biological species concept?
   a. Members of the same species are all morphologically similar.
   b. Members of the same species are all genetically identical.
   c. Members of the same species look almost exactly alike.
   d. For asexually reproducing organisms, members of the same species are whatever an expert says they are.
   e. Members of the same species can mate and produce fertile offspring. Members of different species can't.

33. The biological species concept cannot be used for:
   a. fossil organisms
   b. sympatric speciation
   c. allopatric speciation
   d. polyploidy
   e. adaptive radiation

34. Two species of garter snakes live in the same geographic area. One mainly lives in water and the other mainly on land so that they rarely encounter each other and do not interbreed. This is an example of what type of genetic isolation?
   a. ecological
   b. temporal
c. mechanical
d. behavioral
e. directional

35. Horses and donkeys mate successfully to produce mules which are always sterile. Which genetic isolating mechanism is involved here to prevent horses and donkeys from becoming a single species?
   a. hybrid inviability
   b. gametic isolation
   c. mechanical isolation
   d. behavioral isolation
   e. temporal isolation

36. Blue-footed boobies of the Galapagos will only mate after a very specific courtship display on the part of the male. He high steps to advertise his bright blue feet. What isolating mechanism discourages mating outside the species?
   a. Ecological isolation
   b. Temporal isolation
   c. Behavioral isolation
   d. Mechanical isolation
   e. Gametic incompatibility

37. Two species of pines, *Pinus radiata* and *Pinus muricota* live together in California and are capable of forming hybrids under laboratory conditions. However they do not interbreed because one releases pollen in February and the other in April. What is the genetic isolating mechanism involved?
   a. ecological
   b. temporal
   c. gametic
   d. geographic
   e. hybrid inviability

38. In many species of fireflies males flash to attract females. Each species has a different flashing pattern. This is an example of:
   a. allopatric speciation
   b. geographical isolation
   c. temporal isolation
   d. natural selection
   e. behavioral isolation

39. Eastern and Western meadowlarks look almost identical and sometimes inhabit the same areas of prairies. They recognize members of their own species by distinctive songs and thus do not breed with each other. This is an example of:
   a. ecological isolation
   b. behavioral isolation
   c. mechanical isolation
   d. geographic isolation
   e. no isolation mechanism

40. Which of these is not gametic incompatibility?
   a. Male and female sex organs do not fit together.
   b. Pollen grain does not germinate on stigma (female structure).
   c. Lilly sperm can not fertilize tulip eggs.
   d. Trout sperm does not penetrate perch eggs.
   e. Female stigma destroys germinating pollen grain.

41. The many different species of tree frog that inhabit forests in the eastern U.S. maintain their genetic isolation from other species by breeding at slightly different times, sometimes in different places in
the forest, and by "singing" slightly different songs. How are these populations isolated?

a. behavioral isolation
b. temporal isolation
c. ecological isolation
d. only a and b are correct
e. a, b, and c are correct

42. If a hybrid is unable to produce sperm because meiosis does not proceed correctly, gene flow between the populations is restricted by:

a. hybrid viability
b. hybrid infertility
c. gametic isolation
d. ecological isolation
e. temporal isolation

43. Moss "A" produces gametes in May, and moss "B" produces gametes in June. This is an example of a ___________ isolating mechanism.

a. geographic
b. temporal
c. mechanical
d. behavioral
e. post-mating

44. The elaborate courtship rituals of many bird species help to preserve genetic isolation due to:

a. Behavior isolation
b. Temporal isolation
c. Mechanical incompatibility
d. Hybrid inviability
e. Allopatric separation

45. When offspring are infertile after breeding occurs between individuals of different species, the genetic identities of the two populations are protected by:

a. Mechanical incompatibility
b. Temporal isolation
c. Behavioral isolation
d. Hybrid infertility
e. Genetic isolation

46. One method of protecting the genetic identity of a population is the inability of sperm to fertilize eggs of a different species. This is called:

a. Ecological isolation
b. Temporal isolation
c. Behavioral isolation
d. Hybrid inviability
e. Gametic incompatibility

47. Donkeys and horses can interbreed and produce offspring called mules that live normal lifespans but are sterile. Horses and donkeys remain isolated genetically because of:

a. Hybrid infertility
b. Hybrid inviability
c. Mechanical incompatibility
d. Behavioral isolation
e. Heterozygote disadvantage

48. The great dane and the chihuahua are both domestic dogs (the same species), but mating between them is limited by:
49. The many different species of tree frog that inhabit forests of the eastern U.S. maintain their genetic isolation from other species by breeding at slightly different times, sometimes in different places in the forest, and by "singing" slightly different songs. How are these populations isolated?
   a. Behavioral isolation
   b. Temporal isolation
   c. Ecological isolation
   d. Only choices a and b are correct
   e. Choices a, b, and c are correct

50. Interbreeding two different species of lovebirds produces offspring unable to build a nest after they mature (they lack the innate knowledge needed to carry the materials) so they do not reproduce. This limits genetic mixing between the species due to:
   a. Hybrid inviability
   b. Behavioral isolation
   c. Ecological isolation
   d. Mechanical incompatibility
   e. Geographical isolation

51. If a hybrid is unable to produce sperm because meiosis does not proceed correctly, gene flow between the populations is restricted by:
   a. Hybrid inviability
   b. Hybrid infertility
   c. Heterosis
   d. Ecological isolation
   e. Geographic isolation

52. Which of these is the most important cause of extinction?
   a. specialization
   b. environmental change
   c. disease
   d. predation
   e. competition

53. Researchers believe that at least ______ of the species that have lived on earth have become extinct.
   a. 29.9%
   b. 59.0%
   c. 75.3%
   d. 90.0%
   e. 99.9%

54. Which of these is not considered a major mechanism of extinction?
   a. climate change
   b. introductions
   c. overspecialization
   d. small population size
   e. interspecific competition

55. When a species invades a new habitat and evolves rapidly into several new species to better exploit new resources (e.g., Darwin's Finches), what has occurred?
   a. Phyletic speciation
b. Divergent speciation
c. Stabilizing selection
d. Polyploidy
e. Adaptive radiation

56. The various species of cichlid fish in lake Victoria can best be explained by:
   a. polyploidy
   b. adaptive radiation
   c. premating isolating mechanisms
   d. random events
   e. the fossil record