

Unit A
Biological Diversity

Key Concepts

- | | |
|--|---|
| <input type="checkbox"/> biological diversity | <input type="checkbox"/> chromosomes, genes and DNA (introductory treatment) |
| <input type="checkbox"/> species | <input type="checkbox"/> cell division—includes binary fission and formation of sex cells |
| <input type="checkbox"/> diversity within species | <input type="checkbox"/> natural and artificial selection of genetic characteristics |
| <input type="checkbox"/> habitat diversity | |
| <input type="checkbox"/> niches | |
| <input type="checkbox"/> populations | |
| <input type="checkbox"/> asexual and sexual reproduction | |
| <input type="checkbox"/> inheritance | |
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- Investigate and interpret diversity among species and within species
 - identify examples of **niches**, and describe the role of **variation** in enabling closely related living things to survive in the same ecosystem.
 - identify the role of **variation** in species survival under changing environmental conditions (*e.g., resistance to disease, ability to survive in severe environments*)
 - distinguish between **sexual** and **asexual reproduction**, and identify and interpret examples of asexual and sexual reproduction in different species, by:
 - describing representative types of asexual reproduction (*e.g., fission in the amoeba, budding in hydra, production of zoospores in some fungi*)
 - describing representative types of sexual reproduction (*e.g., cross-fertilization in seed plants, sexual reproduction in mammals*)
 - describing the formation of **zygote** and **embryo** in plant and animal reproduction
 - describe examples of variation of characteristics within a species, and identify examples of both **discrete** and **continuous variation** (*e.g., hand clasping preference is an example of a discrete variation, the length of human hands varies on a continuum*)
 - investigate the transmission of characteristics from parents to offspring, and identify examples of characteristics in offspring that are:
 - the same as the characteristics of both parents
 - the same as the characteristics of one parent
 - intermediate between parent characteristics
 - different from both parents
 - distinguish those characteristics that are **heritable** from those that are **not heritable**, and identify characteristics for which heredity and environment may both play a role (*e.g., recognize that eye colour is heritable but that scars are not; recognize that a person's height and weight may be largely determined by heredity but that diet may also play a role*)
 - identify examples of **dominant** and **recessive characteristics** (*e.g., dominance of brown eyes over blue eyes*), and recognize that dominance and recessiveness provide only a partial explanation for the variation of characteristics in offspring
 - describe, in general terms, the relationship of **chromosomes, genes and DNA**; and interpret their role as repositories of genetic information
 - distinguish between cell division that leads to identical daughter cells, as in binary fission and **mitosis**, and cell division that leads to formation of sex cells, as in **meiosis**; and describe, in general terms, the synthesis of genetic materials that takes place during fertilization
 - compare sexual and asexual reproduction, in terms of the **advantages** and **disadvantages**
 - distinguish between, and identify examples of, natural and artificial selection (*e.g., evolution of beak shapes in birds, development of high milk production in dairy cows*)
 - Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making



- describe ongoing changes in biological diversity through **extinction** and **extirpation** of native species, and investigate the role of environmental factors in causing these changes (*e.g., investigate the effect of changing river characteristics on the variety of species living in the river; investigate the effect of changing land use on the survival of wolf or grizzly bear populations*)
- evaluate the success and limitations of various local and global strategies for **minimizing loss of species diversity** (*e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts*)
- investigate and describe the use of **biotechnology** in environmental, agricultural or forest management; and identify potential impacts and issues (*e.g., investigate issues related to the development of patented crop varieties and varieties that require extensive chemical treatments; identify issues related to selective breeding in game farming and in the rearing of fish stocks*)

1. What is the difference between a **population** and a **community**?

2. What are the **five kingdoms**? How did Linnaeus' system differ from that of other scientists? List the eight levels in the now used classification system (Put them in order from most to least specific).

3. List and explain the difference between **commensalism**, **mutualism** or **parasitism**.

4. Look at the bottom table and answer the questions that follow:

English Name	Scientific Name	Family
house mouse	<i>Mus Musculus</i>	Muridae
grey squirrel	<i>Sciurus carolinensis</i>	Sciuridae
red squirrel	<i>Tamiasciurus hodsonicus</i>	Sciuridae
eastern chipmunk	<i>Tamias striatus</i>	Sciuridae
black rat	<i>Rattus rattus</i>	Muridae
fox squirrel	<i>Sciurus niger</i>	Sciuridae

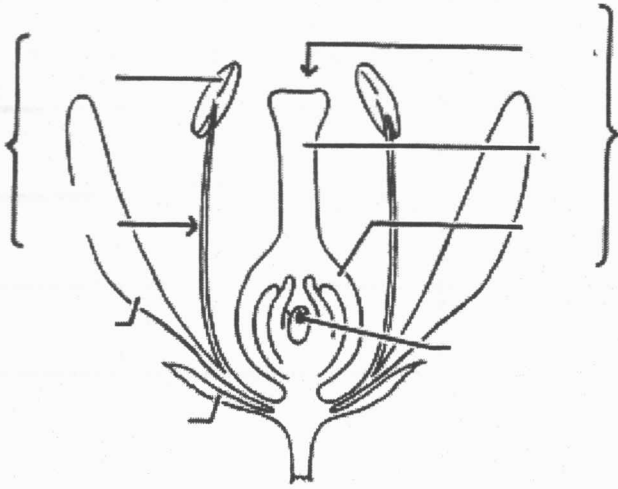
A. For the grey squirrel, list the species and the genus. _____

B. List the two most similar organisms. How do you know they are most similar?

C. Which two organisms are the least similar. Explain your answer.



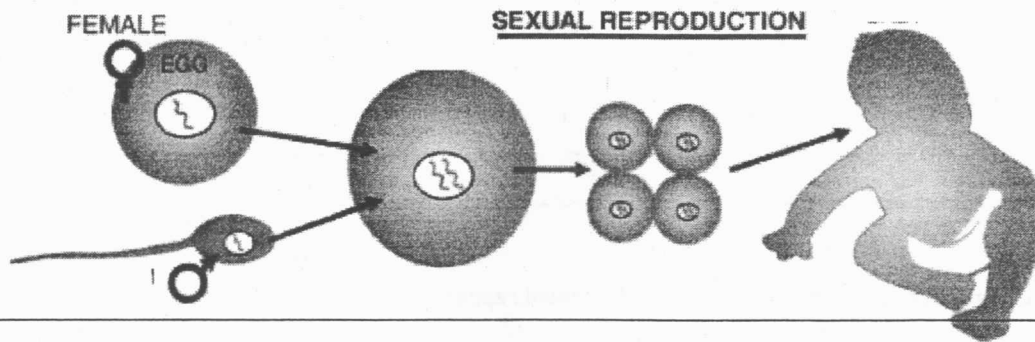
5. Label the diagram below and include the function for each.



6. Fill in the chart below:

	Advantages	Disadvantages
Sexual reproduction	✓ ✓	✓ ✓
Asexual reproduction	✓ ✓	✓ ✓

7. Explain what is happening in the diagram below.





8. Use your textbook to fill in the chart below:

Organism	# of chromosomes in a zygote	# of chromosomes. At end of mitosis	# of chromosomes in a gamete	# of chromosomes in a body cell	# of pairs of chromosomes
Human					
peanut					
Black bear					

9. List three major **natural causes** of extinction.

- A. _____
- B. _____
- C. _____

10. List three **human causes** of extinctions and extirpations. (3 marks)

- D. _____
- E. _____
- F. _____

11. What is the difference between **artificial** and **natural selection**.

12. Define **biotechnology** and provide three examples. (3 marks)

- a. _____
- b. _____
- c. _____

13. List and **explain** the **two methods** of **artificial reproduction**.

14. List and explain the **five strategies** that **Canadians** use to conserve biological diversity

15. List and define the different types of **asexual reproduction**.



16. What is the difference between a population and a community?

17. What is the difference between heritable and non-heritable characteristics?

18. Explain the difference between discrete and continuous variations

19. Read the mini explanation on mitosis below. Refer to the box to the right for further explanations.

MITOSIS

(Examples from an organism with a diploid number of 6 [$2n = 6$].)



• First, remember where the chromosomes come from. Sperm and egg, each containing 3 chromosomes ($n=3$), fuse to form a diploid ($2n$) cell. For the sake of convenience, we may refer to each chromosome by number: 1, 2, and 3 (#1 is the largest, and #3 is the smallest).



• The diploid ($2n$) cell produced by this fusion contains 6 chromosomes. These 6 include 3 pairs of homologous chromosomes.

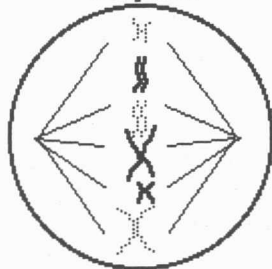
After a time, this cell will prepare for mitosis (cell division). Before entering mitosis, however, it will duplicate each of its 6 chromosomes.



← After this duplication is complete, we can think of the chromosomes as looking something like this.

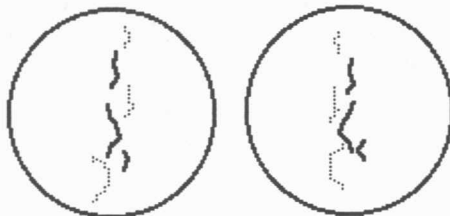
Each chromosome now consists of two duplicate strands called *chromatids*, held together at a structure called the *centromere*.

Metaphase:



• At metaphase of mitosis, the chromosomes are aligned across the center of the cell, and the mitotic spindle prepares to separate each of the chromosomes so that each daughter cell will receive one of the chromatids.

Note that there is no association between homologous chromosomes in mitosis. (Meaning, for example, that paternal chromosome #2 is not associated with maternal chromosome #2).



• The 2 daughter cells produced by mitosis are genetically identical to the cell that entered mitosis. They contain the same 6 chromosomes as the original cell did.

These cells, of course, will undergo a new round of chromosome duplication before they are able to enter mitosis themselves to produce a new generation of cells.

The **gametes** (sperm and the egg) each have half of the total DNA information.

Why do gametes only have half the number of total chromosomes?

Each chromatid of the sperm and the egg will come together when the **zygote** is formed.

In the zygote there will be 3 chromosomes. (each with half of the egg and half of the sperm.

Then the chromosomes will double so you get 6 pairs.

What is that?

At the end of mitosis, you have 2 identical cells with full # of chromosomes.

What happens to those cells in meiosis?

What is the end result in meiosis?

In what kind of cells does meiosis occur?

Why is meiosis necessary?



20. What is the difference between a **purebred** and a **hybrid**? Provide one example for each.

21. How do we know when something is **dominant** and not a **recessive** trait?

22. What is the difference between **extinction** and **extirpation**?

23. Is **mimicry** a form of adaptation? Explain your answer using an example.

Use the following information to answer questions 24 and 25

You are the editor of the local school newspaper and the following short article has been submitted to you.

The Importance of Biological Diversity

Biological diversity consists of a variety of ecosystems and species on Earth and the ecological processes they are part of. There are three main components to biological diversity. All three are important for Alberta's ecosystems.

The first component refers to the diversity in all living and non-living things found on Earth. The second component refers to the populations of species that live in certain communities. The third component refers to the diversity found at the cellular level.

24. As the editor, you notice a few problems with this short article. What is the correct order for the biological diversity components referred to in the article?

25. Check off the correct statement(s):

- A community refers to the same species living in an area
- A community consists of non-living things in the same area
- A population refers to all living things in an area
- A population consists of members of the same species

Use the following information to answer questions 26 and 27

The following graph shows the population of hares and lynx over an 8-year period.

26. What is the peak population of hares and lynx?



27. What type of **interdependence** between species is represented in this graph? Explain your answer.

Use the following information to answer questions 28 - 30.

On a field trip to a provincial park located beside the Pacific Ocean, the park naturalist shows you several interesting things:

- ✓ When a starfish loses an arm, it can grow it back and the lost arm has the ability to grow into a new starfish.
- ✓ Salmon return every four years to spawn in the stream where they hatched.
- ✓ Sea anemones live in colonies along the shore. Some colonies consist of over 100 identical sea anemones. This means they are all clones.
- ✓ Sponges and sea slugs can reproduce asexually and sexually

28. Which animals described by the park naturalist are some examples of asexual reproduction. Explain the type of asexual reproduction that they are involved in.

29. Explain one advantage and one disadvantage of asexual reproduction in one of the examples from question #28.

30. Explain the advantage of being able to reproduce sexually and asexually.

Use the following information to answer questions 30 - 33.

A summer job at a plant research station requires you to identify pure and hybrid strains of flowers. Pure strains can either be red or white. Seeds from the first generation of parents were planted. The following observations were made.

A. Parent 1 and Parent 2	Offspring - all red
B. Parent 3 and Parent 4	Offspring - 3 red : 1 white
C. Parent 5 and Parent 6	Offspring - 1 red : 2 pink : 1 whiter
D. Parent 7 and Parent 8	Offspring - no flowers produced

31. Which set(s) of parents were **purebred**? How do you know?

32. Which set(s) of parents were **hybrid**? How do you know?

33. Which set(s) of parents demonstrated **incomplete dominance**? How do you know?

34. Your science teacher decides she wants to use artificial selection techniques to create identical copies of one particular type of red flower. Which would be the best method to use? Justify your answer.



Use the following information to answer question 35

Kathy made the following observations on her trip to the forest:

1. An owl, a woodpecker, and a song sparrow were nesting in different parts of a tree.
2. A hawk and wolf were preying on rabbits.
3. The birds were eating the caterpillars off the leaves of trees.
4. A squirrel was hiding nuts in a tree.

35. Match each observation, as numbered above, with the science term given below. Use each number only once.

mutualism

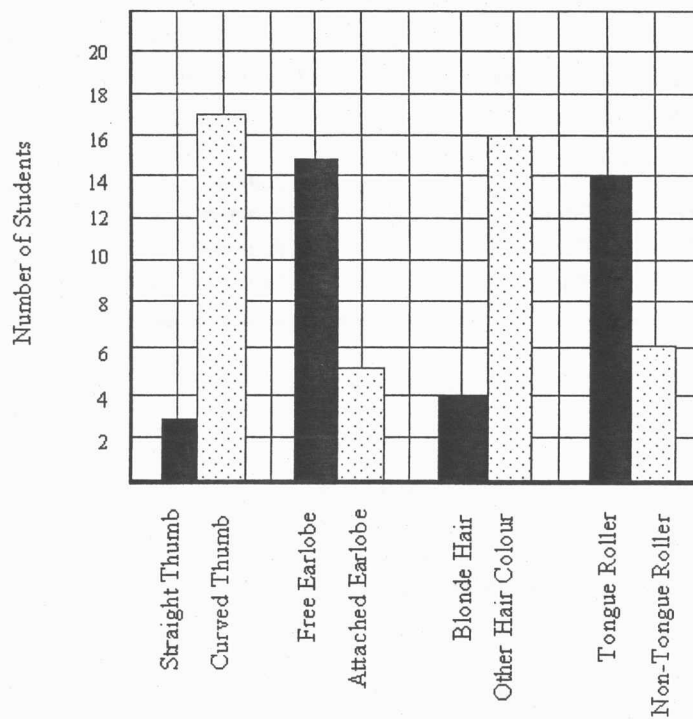
resource
partitioning

interspecies
competition

commensalism

Use the following information to answer question 36

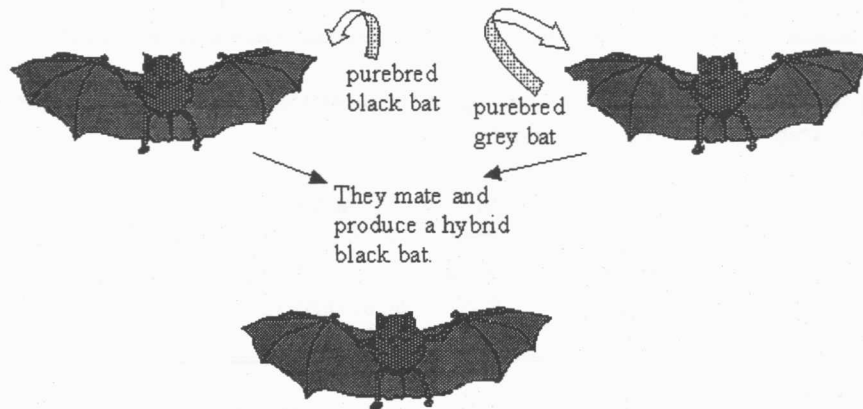
Mrs. Jovanovich's Grade 9 Science Class



36. Which of the above characteristics are recessive and which are dominant?



37. If 2000 **hybrid black bats** mate with other **black hybrids**, about how many of the offspring will be black? _____



Read the following statements in order to answer question 38.

- A. The best-adapted organisms survive in an environment.
- B. Differences among individuals exist in a population.
- C. Animals that could run the fastest survived the introduction of a swift predator into their habitat.
- D. Tigers have coats that range from white with brown stripes to orange with black stripes.

38. If the statement is referring to **variability**, put the number 1 in the correct spot below
 If the statement is referring to **natural selection**, put the number 2 in the correct spot below.

_____ A _____ B _____ C _____ D

Use the following information to answer question 39.

A grade 9 class decided to go for a hiking trip which was led by their science teacher. The science teacher made four statements about what they observed that day and told her kids they would be tested on this information. The students didn't believe her so they didn't study. Well, you can guess it. The question was on the test.
 The four statements were:

Statement 1	The Viceroy butterfly has undergone an adaptation to match the colours of the Monarch butterfly.
Statement 2	A beetle species was found living on only one type of tree.
Statement 3	Midge larvae and other fresh water larvae have structures such as hooks for living in fast-moving water.
Statement 4	Lichen exist because of a relationship between a fungus and an algae, and if they are separated from each other, they may die.



38. Match the number of the statement to the appropriate term. Use each number only once.

mimicry

mutualism

environmental
adaptation

single food-source
adaptation

During the hike, the class came upon an uprooted plant that looked very much like a cactus. The teacher listed the following plant functions.

- | | |
|------------|--------------------------|
| Function 1 | Diffusion of minerals |
| Function 2 | Prevention of water loss |
| Function 3 | Absorption of water |
| Function 4 | Production of gametes |

39. Match the number of the plant function to the plant structure or feature that performs the function. Use each number only once.

flower

roots

vascular tissue

waxy covering

Next, you saw a herd of mountain goats. Through natural selection, many species of animals have developed advantages that suit their particular habitat. Some natural selection advantages of mountain goats are:

1. broad feet
2. thick fur
3. quick reflexes
4. concentrated urine

40. Match the number of the natural selection advantage of mountain goats to the corresponding habitat feature. Use each number only once.

cold
temperature

high
snowfall

low
rainfall

fast
predators

