

UNIT LEARNING PACKS  
**FOCUS IN ACTION**

**Grade 9 Science In Action**  
Unit A - Biological Diversity

## ‘Focus in Action’ UNIT LEARNING PACKS

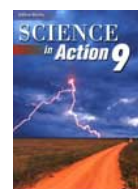
These booklets are designed to provide Grade 9 students with all the resources needed to review or reinforce concepts, covered in the Alberta Science Curriculum, and included in the Grade 9 Science Final Exam in June. There are circumstances in which **an entire unit** may be missed and covering the concepts from that unit (for the final exam) can be difficult. This can happen for a number of reasons:

- Students – new to the school – register throughout the year (from other provinces, school jurisdictions or countries)
- Students may be ill or have surgery and often can miss one or more units
- Students have extended holidays throughout the year
- Transfers from another school, who have completed the units in a different order

For additional support, students are directed to the **Edquest Middle School Science Website** or, Scienceman Resource ( [www.scienceman.com/scienceinaction/pgs/hot\\_9u1.html](http://www.scienceman.com/scienceinaction/pgs/hot_9u1.html) )

### ***Unit 1 – Biological Diversity***

- **Section 1 Notes & Quiz**
- **Section 2 Notes & Quiz**
- **Section 3 Notes & Quiz**
- **Section 4 Notes & Quiz**
- **Unit Summary**
- **Review Booklet**  
(Covered in class, prior to the Final Achievement Exam)
- **Unit Test**
- **Answer Key for Section Quizzes and Unit Test**



Additional support will be provided, in the form of practice Achievement Test Questions, during the course review in June. Multiple Choice Questions and Numerical Response Questions will be reviewed, as these are the types that will make up the Science 9 Final Exam

Handouts and other activities, to reinforce the concepts covered in this Unit, will be made available based on need. If you require further information or resources, email Edquest directly: [edquest@gmail.com](mailto:edquest@gmail.com).

**Finding Solutions to Problems, instead of Making Excuses**

## Student Instructions for use of this Learning Pack

The purpose of this Learning Unit Pack is to provide you with the resources that will help you cover the material from the curriculum that will be tested on the Final Exam in June. Follow these steps to successfully complete this Unit Learning Pack:

**Step 1** – Read the **Topic Notes**

**Step 2** – Use a **highlighter** to identify the key words or phrases in the Topic Notes and reread the material again paying close attention to those words that you highlighted. If necessary, modify your highlights to make sure you understand the material in the notes.

**Step 3** – Complete the **Topic Quiz**

**Step 4** – Correct the Topic Quiz by **checking the answers** in the back of this Learning Pack.

**Step 5** – Using your **textbook** and the **completed quiz**, find the page where the question and correct answer can be found and write it next to the question number in your Learning Pack.

**Step 6** – **Repeat Steps 1-5** for each of the other Topics in this Unit.

**Step 7** – Look over the **Unit Outline** to review the **Key Concepts** once you have completed all of the Topics.

**Step 8** – Complete the **Unit Review**, using your **Learning Pack** and **Textbook**.

**Step 9** – **Highlight** those sections of the Review that you had difficulty with and review those sections with your teacher prior to taking the Unit Test.

**Step 10** – Take the **Unit Test** and correct it using the answer key provided in the back of the Learning Pack.

**Step 11** – You should now be ready to answer any questions on the **Final Exam** related to this Unit.

Anything you still do not understand should be discussed with your teacher. Congratulations on your **Independent Study**, and Good Luck on the Final Exam. I hope you have made good use of this resource. Please provide feedback to your teacher, so that this resource can be improved.

Additional support is available in the form of practice Achievement Test Questions. **Multiple Choice Questions** and **Numerical Response Questions** will be made available on request, as these are the types that will make up the **Alberta Science 9 Achievement Exam**.

Handouts and other activities, to reinforce the concepts covered in this Unit may be acquired by visiting the Edquest Middle School Science Resource Website

<http://www.edquest.ca>

## Unit 1 - Biological Diversity

### 1.0 Biological diversity is reflected in the variety of life on the Earth.

#### 1.1 Ecosystems, Species and Genetic Diversity

A **species** is a particular group of organisms that have the same structure and can reproduce with each other. Of the 30 – 100 million possible different species of living things, there are over 1.5 million species of animals and 350,000 species of plants that have been identified by biologists. The most successful life form seems to be the insect.

**(Grade 7 Review)** All living things are made up of cells, need energy, grow and develop, reproduce and have adaptations, which suit them to the specific habitat in which they live.

*The entire collection of living organisms, each with their own unique characteristics, makes up the Earth's **biodiversity**. "Biological diversity refers to the variety of species and ecosystems on the Earth and the ecological processes of they are a part of." The **main components of biodiversity** are:*

- **Ecosystem diversity** – the different types of living communities and the environments, such as marshes, lakes, streams and forests, in which they are found
- **Community** (populations of different species living in the same area) **diversity** – occurs within **populations** (members of a species that live in a specific area and share the same resources) of organisms living within a particular ecosystem
- **Species diversity** – occurs within individual organisms of the same species
- **Genetic diversity** – occurs within organisms at a cellular level, as it describes the variety of genetic material in all living things.
- **Species Distribution** – Plant and animal species are not distributed evenly throughout the various eco-regions of the world. Most of the different species of plants and animals can be found in tropical regions and, more specifically, in the rainforests. As you move closer to the poles of the Earth, there is less biological diversity.

#### Biological Diversity Classification

The two-name Latin naming system for all living things was developed by Carolus Linnaeus in the 18<sup>th</sup> century, enabling scientists, around the world, to refer to the same species, by the same name. This classification system was much more reliable than previous systems, because he used structure, rather than habitat. Two words identify each organism. The 1<sup>st</sup> represents the organisms **genus** and the 2<sup>nd</sup> represents the organisms particular **species**.

Scientists earlier had developed a system, which classifies all organisms, based on their structural differences, into [5 kingdoms](#).

- **Animalia** (animals)
- **Plantae** (plants)
- **Fungi** (yeasts, moulds and mushrooms)
- **Protista** ( mostly single-celled organisms)
- **Monera** (bacteria)

The 5 kingdom classification system can be further subdivided, with each sub-division having its own name. **Kingdom – phylum – class – order – family – genus - species**

**Specialists** refer to other sub-divisions as well, such as;  
**subfamilies, super-orders, and sub-species or varieties.**

#### Biodiversity under the Sea

Coral reefs reflect a great diversity of species. Like tropical forests, coral reefs support many different communities of organisms surviving on a small amount of nutrients, which are very efficiently recycled.

## 1.2 Interdependence

Each and every species depends on many other species within an environment in order to survive and prosper. Food chains and Food webs represent different types of ongoing relationships between and among all the organisms, within a particular environment.

### Symbiosis

A different type of interdependence is an association, within a certain population, between members of different species.

There are different types of symbiotic relationships:

- **Commensalism** – in which one of the participating members benefits, but the other does not, and there is no harm done to that organism.  
(a bird using a tree to build its nest in) (barnacles on a whale)
- **Mutualism** – both organisms benefit from the relationship.  
(lichen (algae and fungi) growing in the Arctic Tundra benefit each other)  
(flower Clusia provides medicine to bees)
- **Parasitism** – one organism benefits while the other organism (the victim) is harmed. (the parasite usually doesn't kill the host, because the host represents the parasite's food supply. (tapeworm in a human host) (Mexican bean beetle is a plant parasite)
- **Interspecies competition** happens when two or more species need the same resource.  
This type of relationship helps to limit the size of populations, of the competing species.

There are many examples of these types of symbiotic relationships, which show the importance of adaptations, helping particular species survive.

### Niches

A **niche** is the role of an organism within a particular ecosystem. An organism's niche includes:

- What it eats
- What eats it
- Its habitat
- Nesting site, range and habits
- What effect it has on the other populations
- What effect it has on the environment

A niche, for a particular organism, can change, depending on the environment in which it is located and the organisms with which it inter-relates.

**Resource partitioning** is the action, which enables competing species to share the resources by accessing these resources in different ways, involving less direct competition.

## 1.3 Variation within Species

**Variation** within a population, of a single species, is called **variability**.

Variability is important if the environment, in which the species lives, changes (suddenly or drastically). When a species has a great deal of variation, then, some of the individuals within that species will likely survive when there is change.

Examples of variability include:

- Red fox (color of coat)
- Antibiotic resistance (bacteria)
- Banded snail (color of shell)

**Natural selection** happens when factors in the environment determines, or 'selects' which individuals, within a species, will be able to survive. If they are able to live long enough to reproduce, then those individuals with their 'survival adaptations (characteristics) will have offspring with similar survival characteristics.

## 1.0 Biological Diversity is reflected in the variety of life on Earth

### 1.1 Examining Diversity

1. A group of organisms that have the same structure and can reproduce with one another are considered to be ...
  - A. order
  - B. family
  - C. genus
  - D. species
2. **Biotic** and **abiotic** things interact within the same environment. An example of an abiotic part of an environment is ...
  - A. grass
  - B. flowers
  - C. water
  - D. insects
3. The entire collection of the many different types of organisms on the Earth is called ...
  - A. The Living Kingdoms
  - B. Biological Diversity
  - C. A World of Animals
  - D. The Living Ecosystem
4. How many different types of species have live on the Earth, since life began - roughly 5 billion years ago? Scientist estimate that the **species alive today** represents this percentage of all the species that have ever lived on the Earth ...
  - A. 19%
  - B. 15%
  - C. 11%
  - D. 1%
5. When **populations** of different species live together within the same area, these populations form what is known as a ...
  - A. collection
  - B. congregation
  - C. community
  - D. ecosystem
6. Although the same species may have the same basic structure, variations exist within the same species. **Variations** among members of a population are referred to as ...
  - A. genetic diversity
  - B. biotic diversity
  - C. species diversity
  - D. living diversity
7. The distribution of species on the Earth is not even. The area around the equator is where the most diverse plant species exists. This makes for the greatest biological diversity in tropical ...
  - A. rainforests
  - B. tundra
  - C. deserts
  - D. grasslands

8. Closely related species have the same **genus** name, but different **species** names. This makes for identification based on ...
- A. habitat
  - B. structure
  - C. coloring
  - D. names
9. The **five-kingdom classification system** used by scientists includes: ...
- A. Animalia, Plantae, Fungi, Protista, Bacteria
  - B. Animalia, Plantae, Fungi, Virus, Bacteria
  - C. Animalia, Plantae, Fungi, Monera, Carnivore
  - D. Animalia, Plantae, Fungi, Protista, Monera
10. The system that is used to classify individual organisms is ordered from general classification to very specific identification. The correct order of this classification system is ...
- A. phyla, class, order, kingdom, genus, species, family
  - B. family, order, phyla, genus, class, kingdom, species
  - C. kingdom, phyla, class, order, family, genus, species
  - D. species, class, family, order, kingdom, genus, phyla
11. These areas, like the rainforests of the equator, have diverse collections of species. They are known as the “**amazons of the oceans**” because of the richness of their diversity. These area are called ...
- A. coral reefs
  - B. aspen parklands
  - C. serengeti plains
  - D. botanical gardens

## 1.2 Interdependence

12. Interdependence of species occurs because no species can survive by itself. Each species is dependent on many other species in its environment. One of the most obvious examples of this interdependence is the relationship known as ...
- A. scavengers
  - B. predator-prey
  - C. herbivores
  - D. forage-food
13. Another type of interdependence is called **symbiosis**. There are several types of symbiosis. The differences between each type are determined by how beneficial or harmful the relationship is. When both species in the relationship benefit, it is called ...
- A. mutualism
  - B. colonialism
  - C. parasitism
  - D. commensalism
14. A symbiotic relationship where one species benefits and the other species is harmed is called ...
- A. commensalism
  - B. mutualism
  - C. parasitism
  - D. colonialism

15. There is one type of interdependent relationship in which the interaction between the species indicates that ***neither species benefits***. This type of interaction is called ...

- A. cooperative dependence
- B. interspecies cooperation
- C. interspecies competition
- D. dependent cooperation

16. Each organism in an ecosystem has a role. It includes what it eats, what food it provides for other organisms, its habitat, and its effect on the other organisms it shares space in the environment with. This role is called a ...

- A. mycorrhizae
- B. partition
- C. niche
- D. forager

17. Another type of interdependent relationship involves the sharing of resources within the same environment among different organisms. This sharing is called resource ...

- A. partitioning
- B. allocation
- C. development
- D. competition

18. ***Barnacles*** are organisms that attach themselves to whales to move throughout the different parts of the ocean. They benefit from their relationship with the whales, but the whales are not harmed, nor do they benefit. This type of symbiotic relationship is called ...

- A. mutualism
- B. mycorrhizae
- C. parasitism
- D. commensalism

### 1.3 Variation Within Species

19. Not every member of every species is exactly the same. There are differences, called ***variations***, which make the individuals within a species unique. This variation within a species is called ...

- A. commonality
- B. variability
- C. selectivity
- D. genetics

20. Variation within a species may not be something that is immediately noticeable. Often variability is a characteristic that may help or hinder a species' adaptation to a change in the environment. A species is more likely to survive when there is ...

- A. little variation
- B. common variation
- C. great variation
- D. no variation at all



21. Over time, some deadly organisms become resistant to antibiotics, that are designed to kill them. Scientists think this resistance is due to ...

- A. species specialization**
- B. over prescription of antibiotics**
- C. resource partitioning**
- D. frequency specialization**

22. The *banded snail* lives in a wide range of habitats. Its shell color has many variations, sizes and numbers of bands. Scientists explain the reason for this variation by referring to the ...

- A. type of predator it has**
- B. locomotion ability it has**
- C. natural instincts it has**
- D. the changing of the seasons**

23. When individuals within a species survive a change in the environment and other individuals do not survive, the process is known as ...

- A. selective breeding**
- B. natural selection**
- C. artificial selection**
- D. interspecies breeding**

24. Charles Darwin observed a large orchid on the island of Madagascar and predicted the existence of an organism that could feed on the nectar of this plant (located at the base, 20-30 cm from the top). The moth, which feeds on the nectar of this orchid, was discovered 40 years later. It had adapted to the unusual location of nectar by ...

- A. poking the bottom with it's proboscis**
- B. having a long proboscis**
- C. tipping the orchid upside-down**
- D. relying on a caterpillar to puncture the nectar tube**

## 2.0 As species reproduce, characteristics are passed on from parents to offspring.

### 2.1 A Closer Look at Variation

Variation is one of the most critical aspects of species survival. This variation may not always be as easy to find as color usually is, because it may be a behavioral tendency or a genetic (cellular code) modification that enables some individuals within a species to survive, while others, of the same species, will perish.

#### **Genetic Trait Variations**

(Observing Variation in Human Characteristics p. 27)

<http://edquest.ca/Projects/GHTS/ghts.html>

#### **Inherited and Non-inherited Characteristics**

**Inherited** (heritable) characteristics are those traits which are passed on to offspring directly from their parents. These traits are passed on by way of the genetic material that is combined from the parents during the process of sexual reproduction. Heritable traits include, structural and distinguishing characteristics, such as eye color, hair type, skin color and earlobes.

**Non-inherited** characteristics are acquired and not necessarily passed on from generation to generation. Athleticism, artistic ability, leadership qualities are all learned during the early years of life.

#### **Discrete and Continuous Variations**

**Discrete** variations are differences in characteristics that have a definite form. This includes those individuals, within a species, that have either one characteristic, or the single, other variation, of the characteristic.

**Continuous** variations are differences in characteristics that have a multitude of variations, such as height, shoe size, etc.

#### **Variation and the Environment**

Some variations may be influenced by interactions with the environment. These variations are not inherited. Examples include:

Change in the pigmentation of skin color throughout the seasons due to the sun.

Height and weight can be influenced by diet.

## 2.2 Asexual and Sexual Reproduction

### Asexual Reproduction

Asexual reproduction involves only one parent. All of the offspring are identical to the parent.

There are different types of asexual reproduction:

- **Binary Fission** - only single-celled organisms reproduce in this way. The cell splits into two cells and each one is identical. (*bacteria, amoeba, algae*)
- **Budding** - the parent organism produces a bud (a smaller version of itself), which eventually detaches itself from the parent and becomes a self-sufficient individual - identical to the parent. Coral also reproduces in this way, but do not detach themselves (*hydra, yeast, coral*)
- **Spore Production** - spores are similar to seeds, but are produced by the division of cells on the parent, not by the union of two cells. One parent may produce many spores, each of which will grow into a new individual, identical to its parent. (*fungi, green algae, moulds, ferns*)
- **Vegetative Reproduction** - is the reproduction of a plant not involving a seed, including; cuttings, runners, suckers, tubers. (*coleus plant, spider plants, strawberries, aspen, potatoes*)

### **Sexual Reproduction**

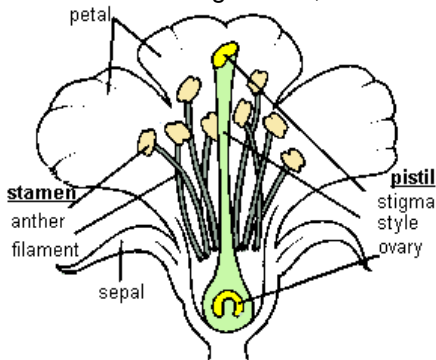
Sexual reproduction usually involves two individual organisms. The offspring that are produced from this union have a mix of characteristics, half from one parent and the other half from the other parent. Sexual reproduction does not always involve male and female parents, but can have specialized **gametes** (reproductive cells that have only one role - to join with another gamete during reproduction).

### **Sexual Reproduction in Animals**

Sexual reproduction in animals involves gametes. The male gametes are called **sperm cells**, and the female gametes are called **egg cells** (ova). During mating, the sperm cell and the egg cell unite to form a fertilized combination of cells called a **zygote**. This zygote is the first of many cells of a new individual. This zygote will begin to divide into two cells and this continues to be repeated over and over resulting in the development of an **embryo**. This embryo develops into a multi-cellular organism inside the female (in most mammals) or, outside (in an egg shell) in other animals.

### **Sexual Reproduction in Plants**

Sexual reproduction in plants involves gametes as well, male gametes and female gametes joining, during **fertilization**, to produce a zygote and then an embryo. Most plants produce both male and female gametes, while some produce one or the other only.



**Pollen** contains the male gametes and is found on the **stamen**. **Ovules** contain the female gametes and are found in the **pistil**. **Pollination** occurs when pollen is transferred from the **anther** of the **stamen** to the **stigma** of the **pistil**. **Cross-pollination** occurs when **pollen** from one plant is carried to the **stigma** of another plant by wind, water or animals (bees or butterflies). **Cross-fertilization** occurs when a grain of the pollen forms a long tube, which grows down the **style** into the **ovary**. The gametes unite to produce a **zygote**, which then develops into an **embryo**. This usually happens inside a **seed**, which protects the embryo and provides food (**cotyledon**) for the embryo when growing conditions are right. Plants which are produced, as a result of **cross-fertilization**, are not identical to either plant.

### **Advantages and disadvantages of Asexual and Sexual Reproduction**

Variation usually helps a species survive when the environment changes.

**Asexual reproduction** does not require any specialized cells to produce a new plant. It can therefore produce many plants very quickly. This is an advantage in places where the environment doesn't change very much (**bacteria**). By building a large population of organisms very quickly the species is able to thrive. The great disadvantage is that when the environment changes, all of the organisms will die, if they do not have the ability to adapt to the change.

**Sexual reproduction** has the advantage of providing lots of variation within a species, helping it to survive when the environment changes. The main disadvantage is that this process takes a lot of energy. This means that they can only produce small populations.

### **Organisms that Reproduce both Sexually and Asexually**

**Sponges** are organisms that can produce both sexually and asexually. Most plants that produce seeds can also reproduce asexually (cuttings, runners). Depending on the environmental conditions the amount of energy varies, enabling the plant organism to control its population.

## 2.1 A Closer Look At Variation

1. To better understand variation; scientists explore the characteristics, which are passed on from generation to generation within a species. Those characteristics that are passed on from generation to generation are ...
  - A. **genetic**
  - B. **inherited**
  - C. **non-inherited**
  - D. **non-genetic**
2. This type of characteristic, eye color, is considered to be ...
  - A. **genetic**
  - B. **inherited**
  - C. **non-inherited**
  - D. **non-genetic**
3. An albino kangaroo is a kangaroo that is pure white. This characteristic is classified as a ...
  - A. **non-inherited variation**
  - B. **continuous variation**
  - C. **discrete variation**
  - D. **singular variation**
4. Those characteristics or variations that have a wide range of forms are ...
  - A. **obnoxious**
  - B. **discrete**
  - C. **overbearing**
  - D. **continuous**
5. Your height is considered to be a heritable characteristic, but is affected by ...
  - A. **age**
  - B. **diet**
  - C. **bone mass**
  - D. **skin type**
6. Variations caused by interactions with the environment are not heritable. Plants that are grown in dim lighting conditions would turn out to be ...
  - A. **identical to their parents in all aspects**
  - B. **much like their parents**
  - C. **very different from their parents**
  - D. **similar to parent plants that were grown in dim light**
7. In a class activity students recorded the results of Left Thumb on top vs Right Thumb on top. The data they collected indicated that 'hand-clasping preference' was ...
  - A. **unrelated**
  - B. **discrete**
  - C. **isolated**
  - D. **continuous**

## 2.2 Asexual and Sexual Reproduction

8. There are different forms of reproduction in organisms. Asexual reproduction involves only one parent. A hydra reproduces asexually when it produces a smaller version of itself by ...

- A. budding**
- B. binary fission**
- C. spore production**
- D. vegetative reproduction**

9. Parthenogenesis, meaning 'virgin birth' in Greek, is the term used to describe the process that transforms unfertilized eggs into mature organisms. Bees are a good example, where unfertilized eggs become ...

- A. queen bees**
- B. male workers**
- C. female workers**
- D. male drones**

10. Fungi, algae, moulds and non-flowering plants reproduce by producing ...

- A. seeds**
- B. spores**
- C. buds**
- D. tubers**

11. When a plant cutting produces a new individual, it does so without the formation of a seed. This type of asexual reproduction is called ...

- A. budding**
- B. binary fission**
- C. spore production**
- D. vegetative reproduction**

12. Suckers (which are miniature identical forms of the parent plant) can be formed in the roots of poplar trees. Each of these suckers can produce trees identical to the parent tree. This form of asexual reproduction is called ...

- A. budding**
- B. binary fission**
- C. spore production**
- D. vegetative reproduction**

13. The most likely alien form of reproduction would be these because they can be dormant for long periods of time and can survive in space ...

- A. seeds**
- B. spores**
- C. buds**
- D. tubers**

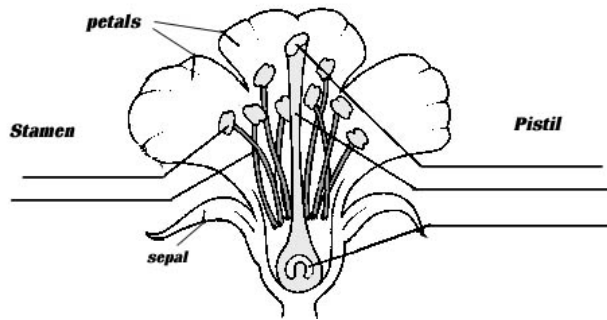
14. Sexual reproduction in plants and animals relies on the union of 2 specialized cells called ...

- A. zygotes**
- B. embryos**
- C. gametes**
- D. stamens**

15. When a female cell (egg) is penetrated by a male cell (sperm) this occurs ...

- A. fertilization**
- B. cleavage**
- C. pollination**
- D. specialization**

16. This diagram illustrates the parts of a flower.



The stamen is the ...

- A. female part**
  - B. male part**
  - C. seed producing part**
  - D. zygote producing part**
17. The pistil is made up of the following parts ...
- A. ovary, filament, stigma**
  - B. stamen, stigma, ovary**
  - C. anther, ovary, stigma**
  - D. stigma, style, ovary**
18. Cross-fertilization occurs when a pollen grain ...
- A. from one plant fertilizes a different plant**
  - B. from one plant fertilizes the plant it belongs to**
  - C. is not able to pollinate another plant**
  - D. is carried by the wind, water or animal to another plant**
19. Some plants and animals can reproduce asexually and sexually. Alternating between these types of reproduction enables the organism to be ...
- A. identical to their parents in all aspects**
  - B. much like their parents**
  - C. very different from their parents**
  - D. identical to parent plants every other generation**
20. Plants or animals that can reproduce asexually and sexually include the following ...
- A. prairie cord grass**
  - B. garden worms and slugs**
  - C. aphids and sponges**
  - D. identical to parent plants every other generation**
21. Sexual reproduction is very advantageous because it provides lots of ...
- A. identical organisms**
  - B. variation among the species**
  - C. energy for the species to survive**
  - D. similar copies of the parent**
22. Asexual reproduction is very advantageous because it provides lots of ...
- A. identical organisms**
  - B. variation among the species**
  - C. energy for the species to survive**
  - D. similar copies of the parent**

### 3.0 DNA is the inherited material responsible for variation.

Captive breeding programs enable scientists to control populations of species at risk of extinction. Using modern technology, geneticists and staff from zoos around the world can analyze the genetic code of the species they are trying to save and use it to introduce variation that will help the species survive when the environment changes.

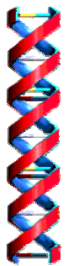
#### 3.1 DNA - Transmitter of Genetic Code

*Characteristics are passed on from one generation to another within a species through the genetic code of the parents. This genetic code is called DNA.*

##### DNA

*The blueprint that is passed on from the parents to the offspring is found in a molecule of the cell nuclei. This molecule, **deoxyribonucleic acid**, (**DNA**) is the inherited material responsible for variation. All living organisms contain DNA in their cells.*

##### DNA and the Genetic Code



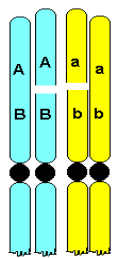
*DNA was discovered prior to 1944. All DNA molecules contain exactly the same chemicals, but the way the chemicals combine determines the characteristics of the organism. **James Watson and Francis Crick** unraveled the structure of DNA, revealing the key to the multitude combinations of variation that are possible.*

*The DNA molecule is like a ladder twisted into a spiral (see image). The sides of the ladder are the same in all DNA molecules, but the rungs are what make the variations. Each rung pairs up two of the following chemicals: guanine (G), cytosine (C), adenine (A) and thiamine (T). The arrangement of these four chemicals creates the code that the cells are able to interpret. This is the **genetic code** of the organism.*

##### Chromosomes

***DNA** contains all the instructions, which create the organism's characteristics. The multitude of characteristics for each organism means that there is a lot of DNA in any one cell. This DNA is arranged in the cell in compact packages, called **chromosomes**. Every human cell contains **46 chromosomes**. In order to have a complete human organism, all 46 of the chromosomes must be present. Not all organisms have the same number of chromosomes (Dogs have 78, cats have 38). Every cell of a human contains **23 pairs** of chromosomes (dogs 39, cats 19). Not all of the chromosomes from species to species are the same, which accounts for the different characteristics between the species.*

##### Genes



A single gene is an uninterrupted segment of DNA, which contains the coded instructions for the organism. Researchers found out that (by working on the fruit fly):

Genes are located in the chromosomes

Each chromosome has numerous gene locations

Genes come in pairs

Both genes in a pair carry DNA instructions for the same thing

Specific characteristic genes occupy matching locations on the two chromosomes

DNA code may not be exactly the same in both locations

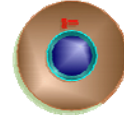
Offspring inherit genes from both parents. The genes exist in an array of possible forms that differ as to their exact DNA sequence. These variations in forms are called alleles. The ultimate combination of the chromosome pair is what makes the variation possible - combining the different variations of different characteristics to create a unique variation.

## 3.2 Cell Division

### **Cell Division and Asexual Reproduction**

Asexual reproduction involves only one parent. All of the offspring are genetically identical to the parent. In single celled organisms, **binary fission** enables the parent cell to split its contents equally between the two new cells. Prior to this division, the parent cell duplicates its DNA and when the split takes place each new cell receives a complete exact copy of the DNA, of the parent.

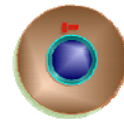
In multi-cellular organisms the process that produces two new cells with the same number of chromosomes is called [Mitosis](#).



[Mitosis](#).

### **Cell Division and Sexual Reproduction in Plants and Animals**

Sexual reproduction usually involves two individual organisms. The offspring that are produced from this union have genetically different characteristics, half from one parent and the other half from the other parent - making a unique offspring. During sexual reproduction, the specialized sex cells (gametes) unite to form a zygote, which develops into the new organism. When a male gamete and a female gamete unite, meiosis takes place. [Meiosis](#) is a type of cell division that produces cells with only half the DNA of a normal cell. This process involves two cell divisions, not one.



## 3.3 [Patterns of Inheritance \(Gregor Mendel\)](#)

Long before the science of [genetics](#) started, people tried to reproduce organisms with only the most preferred traits, by allowing only those organisms with the desirable traits to reproduce. This method was not always successful, but through time (trial and error), this practice of controlled breeding provided scientists with the information to determine which alleles were responsible for specific traits.

### **Purebred VS Hybrid**

To produce purebred organisms, a breeder would choose pure bred parents, those parents whose ancestors have produced only the desired characteristic they want (**true-breeding**). If a breeder chooses two different 'true-breeds' then a **hybrid** would be produced.

### **Dominant Traits**

Crossbreeding two different true-breeds will result in all of the offspring having the same characteristic, that is, the **dominant trait**. Only the DNA instructions for the dominant trait will be carried out.

### **Recessive Traits**

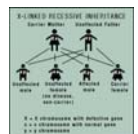
When crossbreeding hybrids, the average results will produce 75% of the offspring with the dominant trait and 25% of the offspring with the recessive trait, because there are only 4 possible combinations. One trait is recessive and therefore the allele is recessive. A recessive trait only appears in the offspring if two recessive alleles are inherited. [Punnett Squares](#)

### **Other Patterns of Inheritance**

**Incomplete dominance** occurs because the dominant-recessive pattern does not always prevail. When the alleles are neither dominant, nor recessive, an intermediate trait will occur (combining the two traits).

**Offspring unlike Either Parent. More than one gene location and more than one allele** may be responsible for specific traits. As a result, the complex mixing of the possible combinations for that particular trait may account for the variation of traits an offspring has.

**Environmental Factors** can also have a bearing on how DNA is interpreted and developed. Fetal alcohol syndrome can be a direct result of alcohol consumption during the developing stages of the offspring. The 'normal' DNA is affected by the alcohol and will not develop normally. Taking drugs can also affect the DNA during normal development and defects in the organism can occur. (Thalidomide)





### 3.1 DNA – Transmitter of Genetic Code

1. Scientists researched and studied the genetic code that is passed on from parent to offspring from generation to generation. By knowing what makes up this genetic code, scientists are able to be more selective in what is passed on from parent to offspring during the breeding process. The **genetic code** is the ...
  - A. blueprint
  - B. species-plan
  - C. illustration
  - D. specification
2. The inherited material that is responsible for variation in all organisms is **DNA**, which stands for ...
  - A. donornucleic acid
  - B. delicate nucleus assist
  - C. denitro acetaminaphen
  - D. desoxyribonucleic acid
3. All living cells contain DNA. In the cells of plants and mammals, **DNA** is located in the ...
  - A. cytoplasm
  - B. nucleus
  - C. vacuoles
  - D. mitochondria
4. **DNA** was first identified in 1969. In 1944 Canadian scientist Oswald Avery confirmed that the **DNA** was the material of ...
  - A. inheritance
  - B. variation
  - C. restructure
  - D. character
5. To solve the structural questions that **DNA** posed, two scientists revealed that the same chemical building blocks could carry a wide range of instructions needed for diversity. The scientists were ...
  - A. Emery and Avery
  - B. Avery and Crick
  - C. Watson and Holmes
  - D. Crick and Watson
6. Paired chemicals make up the '**rungs**' of the '**spiral ladder**' that represents the model of **DNA**. The four chemicals that are paired in different combinations, making up the 'rungs', are ...
  - A. cytosine, adenine, thymine, guanine
  - B. cryptosine, adenine, thalamine, guanine
  - C. cytosine, adonine, thalamine, qanine
  - D. cryptosine, adonine, thymine, qanine
7. The varied arrangement of the four chemicals forms the code that the cell can read. Each pairing along the ladder provides specific instructions for making each unique individual. The **DNA** in each cell is arranged in packages known as ...
  - A. globules
  - B. chromosomes
  - C. nuclei
  - D. helical

8. In organisms such as plants and animals, the **chromosomes** are located in the nucleus. Each human nucleus has this many chromosomes ...

- A. 18
- B. 24
- C. 46
- D. 72

9. The chromosome numbers vary from organism to organism. Dogs have 78 chromosomes and cats have 38. The different pairings of chromosomes outlines the blueprints, which are the source of ...

- A. heredity
- B. diversity
- C. pigmentation
- D. sexuality

10. A single **gene** is an uninterrupted segment of DNA, which contains coded instructions for the cell. Genes are located in the ...

- A. helical strands
- B. cytoplasm
- C. globules
- D. chromosomes

11. Offspring inherit genes from both parents. Most genes in most species exist in an array of possible forms known as ...

- A. alleles
- B. genomes
- C. traits
- D. chromosomes

12. To understand how genes, chromosomes and alleles are linked to inherited characteristics inferences are made. For each characteristic there must be ...

- A. a single gene pair involved
- B. more than one gene pair involved
- C. 2 alleles are present for each gene
- D. several alleles for each chromosome

### 3.2 Cell Division

13. A single fetus that grew into a full size human from one sperm cell was a hypothesis held by scientists until the ...

- A. telescope was invented
- B. microscope was improved
- C. first MRI was built
- D. DNA model was developed

14. The process that produces two new cells with the same number of chromosomes is called ...

- A. meiosis
- B. mitosis
- C. pollination
- D. fertilization

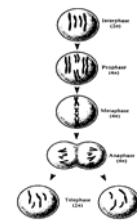
15. The **Science of Genetics** is the study of how these types of characteristics are passed on from generation to generation ...

- A. symmetrical
- B. meiotic
- C. observable
- D. heritable

16. Use the illustration to help you answer this question  
Mitosis produces two offspring cells with the same number of chromosomes as the parent cell. Meiosis is associated with ...

- A. pollination
- B. photosynthesis
- C. sexual reproduction
- D. asexual reproduction

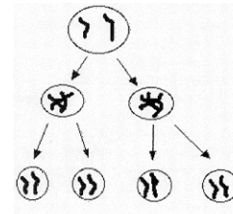
Mitosis



17. Use the illustration to help you answer this question  
Meiosis produces four sex cells that have half the number of chromosomes of the parent cell. Meiosis is different from mitosis because it involves ...

- A. only one cell dividing into two
- B. two cell divisions, instead of one
- C. unique chromosomes
- D. duplication – making an exact copy

Meiosis



### 3.3 Patterns of Inheritance

18. A breeder who wishes to produce a certain breed of animal that displays the characteristics that are desired should choose only ...

- A. hybrid offspring
- B. hybrid parents
- C. purebred parents
- D. purebred offspring

19. A trait that will always be visible in the offspring of purebred parents despite the apparent difference in the parents is called a ...

- A. hybrid trait
- B. recessive trait
- C. observable trait
- D. dominant trait

20. Other patterns of inheritance include examples like when a purebred plant bearing one color of flower is crossed with another purebred with a different color flower, all the offspring have an intermediate color which is known as ...

- A. offspring unlike either parent
- B. incomplete dominance
- C. environmental factors
- D. hybrid recessive traits

## 4.0 Human Activity affects Biological Diversity.

### 4.1 A Closer Look at Variation

#### Reduction of Biological Diversity

The stresses of urbanization and habitat intrusion by farming and industry have resulted in a decline in genetic, species and ecosystem diversity. Extinction, population decreases and degradation of ecosystems reduces biological diversity on the Earth.

#### Extinction and Extirpation

**Extinction** is the disappearance of every individual of a species from the entire planet. It is a natural part of the Earth's history. Scientists estimate that 99% of species that have ever existed on the Earth are now extinct (many by mass extinction - sudden environmental change, like the Ice Age). Most extinctions take place over long periods of time, but the rate of extinctions is rising, and this is reducing the biological diversity of our planet.

**Extirpation** is a local extinction, or the disappearance of a species from a particular area.

[The General Status of Alberta Wild Species 2000](#) (pdf format)

#### **Natural Causes of Extinction and Extirpation**

**Natural selection** is a slow process. Even if there is a lot of variation within a species, sometimes the changes in the environment are so drastic that and so quick, that none of the individuals within a species can survive. Most extinctions, in the past, were due to:

- catastrophic events (volcanic eruptions, earthquakes, floods, fire)
- lack of food (due to overpopulation)
- disease

Not all extinctions happened millions of years ago. Diseases and natural events occur all the time and when they do, a species, within a particular area, can be extirpated very quickly.

#### **Overspecialization**

Sometimes organisms have adaptations that suit them only to a very narrow set of environmental conditions. This usually occurs in a relatively stable area, where the environment does not change for a very long period of time. This is called **overspecialization** and it is another cause of extinction. The giant panda is a species that is overspecialized, because it relies on bamboo, making it vulnerable to extinction, when the bamboo is scarce.

#### **Human Causes of Extinctions and Extirpations**

Most extinctions and extirpations today are caused by human activity.

**Habitat destruction** happens as a result of – Urbanization, Construction, Agricultural Development, Logging, Damming of rivers, Pollution. Pesticides, Herbicides and Fertilizers

#### **Introduction of Non-Native Species**

When introduced species use the same resources, as the native species, the competition will cause a decline in the numbers of native species, simply because there is less to go around. The introduced species will have no natural predators to limit its population and will, in time, take over from the native species.

#### **Over-Hunting**

This was the major cause of the decline and eventual extirpation of the plains **Bison**, as well as the extinction of the **passenger pigeon**. Sometimes species are hunted to deliberately extirpate them. The **black-tailed prairie dogs** were considered a pest in the 1930's and were hunted to reduce their numbers.

#### **Effects of Extinctions and Extirpations**

Extinctions and extirpations reduce biological diversity. When an organism disappears locally or globally, many other species are affected. The cycle of life is adversely affected.

## 4.2 Selecting Desirable Traits

**Artificial Selection** is the process of selecting and breeding individuals with desirable traits to produce offspring with the desired traits. The selection process is simple. Only those individuals, with the desired trait, will be allowed to reproduce. This selection process also applies to plants, which can be bred to possess desirable traits. The main difference between '**natural**' selection and '**artificial**' selection is that, humans control the artificial selection process.

### **Biotechnology**

The process of intervention to produce more desirable organisms has been going on for some time. This process takes a long time to see results - usually many generations. Farmers, dog and horse breeders, along with scientists can now speed up the artificial selection process by using 'low-tech' or 'high-tech' technologies, such as;

**cloning** (made from cells)

**artificial insemination** (artificially joining the male and female gametes)

**in vitro fertilization** (male and female gametes are selected and then allowed to fertilize in a controlled setting)

**genetic engineering** (directly altering the DNA of an organism)

### **Biotechnology and Society**

**Beneficial** or **detrimental** to society? That is one of the pressing questions that many humans are struggling with, when it comes to biotechnology. There are many good things that can be produced, but what about the problems, including,

- **risks in animals** (reducing genetic variation within a specific population, less resistance to disease, birth defects and other abnormalities)
- **risks in plants** (resistance to herbicides)

## 4.3 Reducing Our Impact on Biological Diversity

Preserving global biological diversity is a challenge that is receiving much attention. The 1995 **Canadian Biodiversity Strategy** was created to preserve biodiversity in Canada. It will be done through the cooperation of many levels of government, along with many groups, agencies and individuals, who are dedicated to preserving our bio-diverse future.

**Protected Areas** (National Parks, Provincial Parks, game preserves, natural areas)

### **Restoration Programs for Ecosystems and Species**

Governments and *Nature Conservancy of Canada* programs to purchase land for species habitat renewal, individual landowners giving habitat back - in the form of a naturally protected area, Ducks Unlimited CARE program, **Swift Fox** - restoration of a species - extirpated from Canada and now recovering)

**Resource Use Policies** (Laws - *National Accord for the Protection of Species at Risk - Species at Risk Act - Wildlife Act, 1998*)

**Controlling the Introduction and Spread of Exotic Species** (Information and teaching about the invasiveness of an exotic species is communicated to the public on a regular basis. Penalties and fines, as well as loss of desirable areas for recreational purposes, has improved the perception of the negative effect an exotic species can have on a local ecosystem.)

**Conservation of Genetic Resources** (**Ex-situ** conservation refers to conservation of components of biodiversity outside of a natural habitat. The collection and storage of genetic resources, such as:

- Seeds (**IPGRI**)
- Zoos (captive breeding programs)
- Sperm and Egg Banks
- Human Genome Project

#### 4.1 Reduction of Biological Diversity

1. The decline in biological diversity around the world is being stressed by all of the following human activities EXCEPT ...
  - A. urbanization
  - B. agriculture
  - C. forestry
  - D. politics
2. The reduction of biological diversity is due to degradation of ecosystems, the extinction of some species and the decrease in other species populations. Strategies to preserve important habitats and the species that depend on them include ...
  - A. nature preserves and national parks
  - B. amusement parks and zoos
  - C. wild animal farms and animal shelters
  - D. nature trails and off-road recreation areas
3. **Extinction** is the complete disappearance of a species from the entire planet. This happened to the dodo bird, a flightless bird that lived on the island of Mautitius, in the Indian Ocean. The dodo became extinct when Portuguese explorers brought their domestic pets with them when they first landed on the island. The explorers used the dodo bird as food, but the reason the dodo became extinct is because the domestic animals ...
  - A. chased the dodo until it had a heart attack
  - B. ate all of the dodo bird's eggs
  - C. attacked the defenseless dodo bird for fun
  - D. lured the dodo bird to the water, where it drowned
4. Scientists think the extinction of the dinosaurs occurred because of a catastrophic event. Other species also became extinct because of catastrophic events. One such event, the **Pleistocene epoch** is the last major event to occur, nearly 1.8 billion years ago. It is commonly referred to as ...
  - A. Doomsday
  - B. The Ice Age
  - C. Armageddon
  - D. A Meteor Impact
5. Extirpation is a local extinction, or the disappearance of a species from a particular area. Of the species that are listed below, only one was extirpated completely from Canada. It was the ...
  - A. Swift Fox
  - B. Snowy Owl
  - C. Grizzly Bear
  - D. Woodland Caribou
6. The species that is currently at risk to be extirpated from the boreal forests of Northern Alberta, because of habitat degradation resulting from logging, forest fires, and increased interspecies competition is the ...
  - A. Swift Fox
  - B. Snowy Owl
  - C. Grizzly Bear
  - D. Woodland Caribou

7. The **Alberta Department of Environmental Protection** is working with wildlife conservation groups around the world to save species at-risk. Alberta Environmental Protection is working with this group to reintroduce the swift fox to Canada ...

- A. World Wildlife Fund
- B. Swift Fox Conservation Group
- C. Environmental Protection Agency
- D. World Wildlife Conservation Association

8. If a species is at risk to be endangered, and it is particularly vulnerable to natural events or human activities its status is regarded as ...

- A. Illegal
- B. Threatened
- C. Of Special Concern
- D. Extirpated

9. Natural selection is usually a slow process. When the environment changes drastically – making it difficult for a species to adapt, the species may not survive. All of the following are naturally occurring events that have caused extinctions or extirpations, EXCEPT for ...

- A. disease
- B. volcanic eruptions and forest fires
- C. lack of food due to overpopulation
- D. pollution of the atmosphere

10. One of the most numerous trees in the forests of the eastern United States was the **American Chestnut Tree**. The nuts produced by the tree were a source of food for wildlife, livestock and humans. A disease, called the **chestnut blight**, carried over from Europe, basically destroyed all the trees. The disease, was caused by a ...

- A. parasite
- B. bacteria
- C. fungus
- D. mould

11. Sometimes organisms have adaptations that suit them only to a very specific set of environmental conditions. Biologists call this natural cause of extinction ...

- A. inter-specialization
- B. overspecialization
- C. super-specialization
- D. adaptive specialization

12. Humans can also affect the populations of species. When human activities change the environment, extinctions and extirpations can occur. The burning of the rainforests in South America is a good example of ...

- A. habitat destruction
- B. non-native species
- C. over-hunting
- D. regional diversity

13. Sometimes species are extirpated on purpose, because they are considered a menace. The very last passenger pigeon died in captivity on September 1, 1914. The reason that the passenger pigeon became extinct was as a result of ...

- A. need for food
- B. habitat destroyed
- C. sport hunting
- D. poisoning

## 4.2 Selecting Desirable Traits

14. The process that selects and breeds individuals of a species to survive in a particular environment without human intervention is called ...
- A. artificial selection**
  - B. natural selection**
  - C. survival of the strongest**
  - D. inter-species genetics**
15. When humans intervene in the reproduction of specific individuals of a species by selecting and breeding specific desirable characteristics the process is called ...
- A. artificial selection**
  - B. natural selection**
  - C. survival of the strongest**
  - D. inter-species genetics**
16. The original wild species bred by Native peoples to produce corn came from a species of grass known as ...
- A. canola**
  - B. maize**
  - C. teosinte**
  - D. creole**
17. Biotechnology is the process of selecting specific traits and enabling those traits to develop in future generations. There are many different biotechnologies that have worked successfully thus far. The technology, which uses a single cell of an organism to reproduce an identical organism in the laboratory, is called ...
- A. cloning**
  - B. insemination**
  - C. in vitro fertilization**
  - D. genetic engineering**
18. Another biotechnology involves inserting a gene from one organism into the cell of another organism. An example of this is the production of life-saving medicines, such as insulin, by using bacteria to produce it. This technology is called ...
- A. cloning**
  - B. insemination**
  - C. in vitro fertilization**
  - D. genetic engineering**
19. A specific side effect (drawback) in using these types of reproductive technologies is the decrease in genetic variation that is occurring. There are other risks associated with cloning and genetic engineering. Some researchers have speculated that the reason there are so many abnormalities in the resulting offspring is because the ...
- A. technique is too delicate and mistakes have been made**
  - B. removal of the nucleus from the donor egg is to blame**
  - C. reproductive technologies are not proven yet**
  - D. abnormal characteristics are hidden within donor eggs**
20. Rice normally does not contain a particular vitamin. Researchers have genetically engineered a strain of rice that contains this vitamin – which is ...
- A. Vitamin A**
  - B. Vitamin B<sub>12</sub>**
  - C. Vitamin C**
  - D. Vitamin E**



### 4.3 Reducing Our Impact on Biological Diversity

21. International recognition of biological diversity was achieved at the Earth Summit in Rio de Janeiro in 1992. **The United Nations Convention on Biological Diversity** outlined the importance of preserving diversity on a global scale. This document is a ...
- A. law
  - B. treaty
  - C. arrangement
  - D. proclamation
22. Conservation of biological diversity around the world requires the elimination or reduction of adverse impacts to biological diversity resulting from human activity. **The Canadian Biodiversity Strategy** focus on ...
- A. ex-situ and out-situ management
  - B. in-situ and out-situ conservation
  - C. in-situ and ex-situ conservation
  - D. ex-situ and insitu management
23. Canada's first protected **National Park** area was established in 1885. It is ...
- A. Glacier National Park
  - B. Yoho National Park
  - C. Banff National Park
  - D. Jasper National Park
24. The maintenance of populations of wild organisms in their own functioning ecosystems, allowing for the ecological processes of an area to continue undisturbed is called ...
- A. in-situ conservation
  - B. ex-situ conservation
  - C. sustainability
  - D. resource partitioning
25. **The Nature Conservancy of Canada** acquires land or raises money to ensure the continued protection of natural area, by working with local conservation groups, private citizens and corporations. [The Nature Conservancy of Canada](#) - dedicated to preserving ecologically significant areas is a ...
- A. provincial association
  - B. government agency
  - C. municipal committee
  - D. not-for-profit charity
26. Wetland areas, where habitat - nesting areas - is vital to the continued diversity of organisms living in these areas is supported by this group who promote through their **CARE** program, the restoration or improvement of available cover in wetland areas ...
- A. Ducks Unlimited
  - B. Trout Unlimited Canada
  - C. The Green Team
  - D. Alberta Fish & Game Association
27. "**Purge the Spurge**" refers to a volunteer activity that occurs every year in July at [Fish Creek Park](#). Volunteers gather to pull a non-native noxious weed that threatens to take over the park and destroy wildlife habitat. The weed is called ...
- A. thistle purge
  - B. leafy spurge
  - C. weedy purge
  - D. thorny spurge

28. The goal of this document was to ... “prevent species in Canada from becoming extinct as a consequence of human activity”. The document is ...

- A. The Biodiversity Protection Accord**
- B. The National Accord for the Protection of Species At Risk**
- C. The Alberta Wildlife Protection Accord**
- D. The Canadian Endangered Species Protection Accord**

29. The identification of **species-at-risk** in Canada is made by ...

- A. WWE**
- B. WWF**
- C. ESCC**
- D. COSEWIC**

30. Controlling the spread of an **invasive species** that takes over a wetland area, by reproducing very quickly and becoming the most prominent species in this ecosystem, (because it has no natural enemies) is done by using volunteers to pull it by hand, or using another exotic species, the weevil, that feeds on it to be introduced. The invasive species is the ...

- A. purple loosestrife**
- B. Canada thistle**
- C. ragweed**
- D. creeping bellflower**

31. Conservation practices also include collections of specific species to maintain the genetic material necessary for reproducing the species in the future, should it be necessary. This collection of genetic materials is known as ...

- A. in-situ conservation**
- B. ex-situ conservation**
- C. sustainability**
- D. resource partitioning**

32. The conservation of genetic material began with seed banks, between farmers. It has grown to world wide preservation banks of genetic material that is administered by a group of scientists known as the ...

- A. Biodiversity Conservation Genetic Bank**
- B. International Seed Bank Conservation Group**
- C. International Plant Genetics Resources Institute**
- D. World Seed and Genetic Material Institute of Conservation**



## Science In Action 9

### Unit 1

### Biological Diversity

#### Section 1.0

#### Biological Diversity reflects life on Earth

- Millions of species live on the Earth
- Biodiversity - three main components: **ecosystem diversity**, **community and species diversity** and **genetic diversity**
- Variation between and among species
- Species co-existing in a habitat are interdependent – **predator-prey**, **commensalism**, **parasitism** and **mutualism**
- Different species share resources by having different **niches**
- **Natural Selection** - selection of desirable traits by the environment

#### Section 2.0

#### Reproduction: Traits are passed on

- **Heritable Traits** vary, as variations can be **discrete** or **continuous**
- The environment can also affect some heritable traits (height)
- **Asexual Reproduction** (only 1 parent) - the offspring identical to the parent – allowing a species to reproduce quickly
- **Sexual reproduction** (2 parents) - the offspring is different from the parents and results in variation among individuals within a species
- Sexual – a male **gamete** fuses with a female **gamete** to produce a **zygote**, which develops into an **embryo** and grows into an individual

#### Section 3.0

#### DNA – Inheritable Material

- **Chromosomes** (alleles arranged in pairs), **genes** (instructions for a particular trait) **DNA (genetic code)** for making a particular individual) are passed on from generation to generation within a species
- Asexual Reproduction (**mitosis**) – Sexual Reproduction (**meiosis**)
- **Dominant** traits are always seen in offspring, **recessive** traits occur when both parents have the **recessive alleles** of that trait

#### Section 4.0

#### Biodiversity is Affected by Humans

- **Extinction** is a loss of a species from the entire planet
- **Extirpation** is a loss of a species from a particular area
- Human actions or natural events can cause extinction and extirpation
- **Artificial Selection** - human selection & breeding for desirable traits
- Technologies affecting biodiversity – artificial selection, artificial reproductive technologies and genetic engineering



# Biological Diversity



## Unit Review

[Go over the **Unit Summary: on p. 80**, as you review this unit]

### 1.0 *Biological Diversity is reflected in the variety of life on Earth*

Describe the variety of biological **species** on the Earth.

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What is **Biological Diversity**?

---

What are the **three main components** of biological diversity?

---

---

What is **variation**?

---

What is **co-habitation**?

---

Describe the different types of **interdependencies** between and among species.

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What are **niches**?

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What is **natural selection**?

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**2.0** *As species reproduce, characteristics are passed from parents to offspring*

What are **heritable traits**?

---

---

What is the difference between **continuous** and **discrete variations**?

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How does the **environment** affect variation?

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What is **asexual reproduction**?

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What is **sexual reproduction**?

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Describe the **process of sexual reproduction**.

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How do the different types of reproduction affect **variation**?

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### 3.0 *DNA is the inherited material responsible for variation*

What carries the **genetic information** that is passed on from parent to offspring?

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What is **DNA** and **genetic code**?

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What are **genes**?

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How are **chromosomes** arranged?

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Describe the process of **mitosis** in asexual reproduction.

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Describe the process of **meiosis** in sexual reproduction.

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Describe the difference between **dominant** and **recessive traits**?

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What other factors affect **inheritance of traits**?

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**4.0 Human activity affects biological diversity**

What is **extinction**?

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What is **extirpation**?

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What are **extinction and extirpation** caused by?

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What is **artificial selection**?

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Describe the **technologies** that affect biological diversity.

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What **biological conservation strategies** are being used to preserve diversity?

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## Biological Diversity Practice Unit Test

### 1.1 Examining Diversity

1. *Biotic* and *abiotic* things interact within the same environment. An example of an abiotic part of an environment is ...
  - A. grass
  - B. flowers
  - C. water
  - D. insects
2. Although the same species may have the same basic structure, variations exist within the same species. The *variations* among the members of a population is referred to as ...
  - A. genetic diversity
  - B. biotic diversity
  - C. species diversity
  - D. living diversity
3. The five-kingdom classification system used by scientists includes: ...
  - A. Animalia, Plantae, Fungi, Protista, Bacteria
  - B. Animalia, Plantae, Fungi, Virus, Bacteria
  - C. Animalia, Plantae, Fungi, Monera, Carnivore
  - D. Animalia, Plantae, Fungi, Protista, Monera
4. The system that is used to classify individual organisms is ordered from general classification to very specific identification. The correct order of this classification system is ...
  - A. phyla, class, order, kingdom, genus, species, family
  - B. family, order, phyla, genus, class, kingdom, species
  - C. kingdom, phyla, class, order, family, genus, species
  - D. species, class, family, order, kingdom, genus, phyla

### 1.2 Interdependence

5. Interdependence of species occurs because no species can survive by itself. Each species is dependent on many other species in its environment. One of the most obvious examples of this interdependence is the relationship known as ...
  - A. scavengers
  - B. predator-prey
  - C. herbivores
  - D. forage-food
6. Another type of interdependence is called *symbiosis*. There are several types of symbiosis. The differences between each type are determined by how beneficial or harmful the relationship is. When both species in the relationship benefit, it is called ...
  - A. mutualism
  - B. colonialism
  - C. parasitism
  - D. commensalism



7. Each organism in an ecosystem has a role. It includes what it eats, what food it provides for other organisms, its habitat, and its effect on the other organisms it shares space in the environment with. This role is called a ...

- A. mycorrhizae
- B. partition
- C. niche
- D. forager

8. *Barnacles* are organisms that attach themselves to whales to move throughout the different parts of the ocean. They benefit from their relationship with the whales, but the whales are not harmed, nor do they benefit. This type of symbiotic relationship is called ...

- A. mutualism
- B. mycorrhizae
- C. parasitism
- D. commensalism

### 1.3 Variation Within Species

9. Not every member of every species is exactly the same. There are differences, called *variations*, which make the individuals within a species unique. This variation within a species is called ...

- A. commonality
- B. variability
- C. selectivity
- D. genetics

10. Charles Darwin observed a large orchid on the island of Madagascar and predicted the existence of an organism that could feed on the nectar of this plant (located at the base, 20-30 cm from the top). The moth, which feeds on the nectar of this orchid, was discovered 40 years later. It had adapted to the unusual location of nectar by ...

- A. poking the bottom with it's proboscis
- B. having a long proboscis
- C. tipping the orchid upside-down
- D. relying on a caterpillar to puncture the nectar tube

11. Over time, some deadly organisms become resistant to antibiotics, that are designed to kill them. Scientists think this resistance is due to ...

- A. species specialization
- B. over prescription of antibiotics
- C. resource partitioning
- D. frequency specialization

12. *Adaptation* is best defined as the ...

- A. stages of development throughout an organism's normal growth and life cycle
- B. differences and/or variations found among a group of organisms living within the same habitat
- C. arrangement of organisms in various groups or classes and identified by their structural differences
- D. features that increase an organism's chances of surviving and reproducing in a particular environment

## 2.1 A Closer Look At Variation

13. To better understand variation; scientists explore the characteristics, which are passed on from generation to generation within a species. Those characteristics that are passed on from generation to generation are ...

- A. genetic
- B. inherited
- C. non-inherited
- D. non-genetic

14. Those characteristics or variations that have a wide range of forms are ...

- A. obnoxious
- B. discrete
- C. overbearing
- D. continuous

15. Variations caused by interactions with the environment are not heritable. Plants that are grown in dim lighting conditions would turn out to be ...

- A. identical to their parents in all aspects
- B. much like their parents
- C. very different from their parents
- D. similar to parent plants that were grown in dim light

16. In a class activity students recorded the results of Left Thumb on top vs Right Thumb on top. The data they collected indicated that '*hand-clasping preference*' was ...

- A. unrelated
- B. discrete
- C. isolated
- D. continuous

## 2.2 Asexual and Sexual Reproduction

17. There are different forms of reproduction in organisms. *Asexual reproduction* involves only one parent. A hydra reproduces asexually when it produces a smaller version of itself by ...

- A. budding
- B. binary fission
- C. spore production
- D. vegetative reproduction

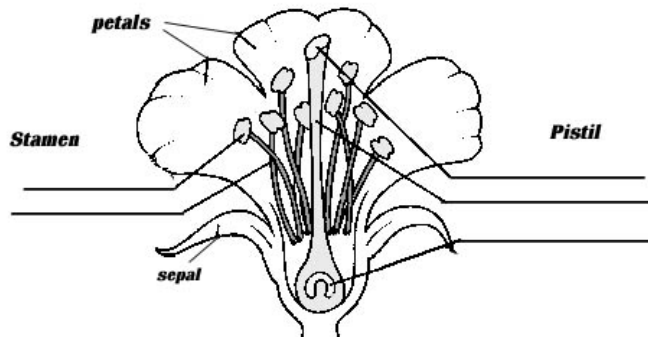
18. *Parthenogenesis*, meaning 'virgin birth' in Greek, is the term used to describe the process that transforms unfertilized eggs into mature organisms. Bees are a good example, where unfertilized eggs become ...

- A. queen bees
- B. male workers
- C. female workers
- D. male drones

19. The most likely alien form of reproduction would be these because they can be dormant for long periods of time and can survive in space ...

- A. seeds
- B. spores
- C. buds
- D. tubers

20. This diagram illustrates the *parts of a flower*.



The *pistil* is made up of the following parts ...

- A. ovary, filament, stigma**
  - B. stamen, stigma, ovary**
  - C. anther, ovary, stigma**
  - D. stigma, style, ovary**
- 3.1 DNA – Transmitter of Genetic Code**
21. Scientists exploring genetic research on many different kinds of organisms, take the eggs of females who have certain desirable traits and fertilize them with the sperm of males, from the same species. A major disadvantage that may sometimes occur is ...
- A. desirable characteristics will not always be present in the offspring**
  - B. undesirable traits can also be inherited**
  - C. mutations will not occur**
  - D. offspring will be sterile**
22. Scientists researched and studied the genetic code that is passed on from parent to offspring from generation to generation. By knowing what makes up this genetic code, scientists are able to be more selective in what is passed on from parent to offspring during the breeding process. The *genetic code* is the ...
- A. blueprint**
  - B. species-plan**
  - C. illustration**
  - D. specification**
23. DNA was first identified in 1969. In 1944 Canadian scientist Oswald Avery confirmed that the DNA was the material of ...
- A. inheritance**
  - B. variation**
  - C. restructure**
  - D. character**
24. To solve the structural questions that DNA posed, two scientists revealed that the same chemical building blocks could carry a wide range of instructions needed for diversity. The scientists were ...
- A. Emery and Avery**
  - B. Avery and Crick**
  - C. Watson and Holmes**
  - D. Crick and Watson**

25. Paired chemicals make up the 'rungs' of the 'spiral ladder' that represents the model of DNA. The four chemicals that are paired in different combinations, making up the 'rungs', are ...

- A. cytosine, adenine, thymine, guanine
- B. cryptosine, adenine, thalamine, guanine
- C. cytosine, adonine, thalamine, quanine
- D. cryptosine, adonine, thymine, quanine

26. Offspring inherit genes from both parents. Most genes in most species exist in an array of possible forms known as ...

- A. alleles
- B. genomes
- C. traits
- D. chromosomes

### 3.2 Cell Division

27. The process that produces two new cells with the same number of chromosomes is called ...

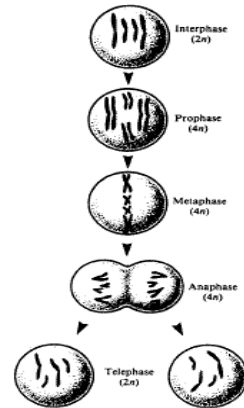
- A. meiosis
- B. mitosis
- C. pollination
- D. fertilization

28. Use the illustration to help you answer this question

Mitosis produces two offspring cells with the same number of chromosomes as the parent cell.  
Meiosis is associated with ...

- A. pollination
- B. photosynthesis
- C. sexual reproduction
- D. asexual reproduction

Mitosis

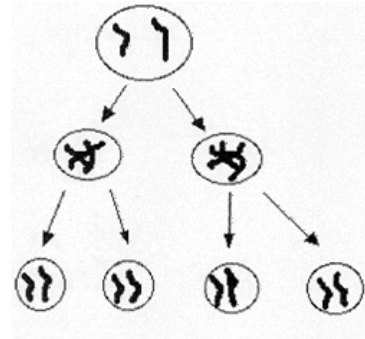


29. Use the illustration to help you answer this question

Meiosis produces four sex cells that have half the number of chromosomes of the parent cell.  
Meiosis is different from mitosis because it involves ...

- A. only one cell dividing into two
- B. two cell divisions, instead of one
- C. unique chromosomes
- D. duplication – making an exact copy

Meiosis



### 3.3 Patterns of Inheritance

30. A breeder who wishes to produce a certain breed of animal that displays the characteristics that are desired should choose only ...

- A. hybrid offspring**
- B. hybrid parents**
- C. purebred parents**
- D. purebred offspring**

31. A trait that will always be visible in the offspring of purebred parents despite the apparent difference in the parents is called a ...

- A. hybrid trait**
- B. recessive trait**
- C. observable trait**
- D. dominant trait**

32. Other patterns of inheritance include examples like when a purebred plant bearing one color of flower is crossed with another purebred with a different color flower, all the offspring have an intermediate color which is known as ...

- A. offspring unlike either parent**
- B. incomplete dominance**
- C. environmental factors**
- D. hybrid recessive traits**

### 4.1 Reduction of Biological Diversity

33. The reduction of biological diversity is due to degradation of ecosystems, the extinction of some species and the decrease in other species populations. Strategies to preserve important habitats and the species that depend on them include ...

- A. nature preserves and national parks**
- B. amusement parks and zoos**
- C. wild animal farms and animal shelters**
- D. nature trails and off-road recreation areas**

34. Scientists think the extinction of the dinosaurs occurred because of a catastrophic event. Other species also became extinct because of catastrophic events. One such event, the *Pleistocene epoch* is the last major event to occur, nearly 1.8 billion years ago. It is commonly referred to as ...

- A. Doomsday**
- B. The Ice Age**
- C. Armageddon**
- D. A Meteor Impact**

35. The *Alberta Department of Environmental Protection* is working with wildlife conservation groups around the world to save species at-risk. Alberta Environmental Protection is working with this group to reintroduce the swift fox to Canada ...

- A. World Wildlife Fund**
- B. Swift Fox Conservation Group**
- C. Environmental Protection Agency**
- D. World Wildlife Conservation Association**

36. Sometimes organisms have adaptations that suit them only to a very specific set of environmental conditions. Biologists call this natural cause of extinction ...

- A. inter-specialization**
- B. overspecialization**
- C. super-specialization**
- D. adaptive specialization**

#### 4.2 Selecting Desirable Traits

37. When humans intervene in the reproduction of specific individuals of a species by selecting and breeding specific desirable characteristics the process is called ...

- A. artificial selection**
- B. natural selection**
- C. survival of the strongest**
- D. inter-species genetics**

38. Biotechnology is the process of selecting specific traits and enabling those traits to develop in future generations. There are many different biotechnologies that have worked successfully thus far. The technology, which uses a single cell of an organism to reproduce an identical organism in the laboratory, is called ...

- A. cloning**
- B. insemination**
- C. in vitro fertilization**
- D. genetic engineering**

39. A specific side effect (drawback) in using these types of reproductive technologies is the decrease in genetic variation that is occurring. There are other risks associated with cloning and genetic engineering. Some researchers have speculated that the reason there are so many abnormalities in the resulting offspring is because the ...

- A. technique is too delicate and mistakes have been made**
- B. removal of the nucleus from the donor egg is to blame**
- C. reproductive technologies are not proven yet**
- D. abnormal characteristics are hidden within donor eggs**

40. Rice normally does not contain a particular vitamin. Researchers have genetically engineered a strain of rice that contains this vitamin – which is ...

- A. Vitamin A**
- B. Vitamin B<sub>12</sub>**
- C. Vitamin C**
- D. Vitamin E**

#### 4.3 Reducing Our Impact on Biological Diversity

41. International recognition of biological diversity was achieved at the Earth Summit in Rio de Janeiro in 1992. *The United Nations Convention on Biological Diversity* outlined the importance of preserving diversity on a global scale. This document is a ...

- A. law**
- B. treaty**
- C. arrangement**
- D. proclamation**

42. Conservation of biological diversity around the world requires the elimination or reduction of adverse impacts to biological diversity resulting from human activity.

*The Canadian Biodiversity Strategy* focus on ...

- A. ex-situ and out-situ management**
- B. in-situ and out-situ conservation**
- C. in-situ and ex-situ conservation**
- D. ex-situ and insitu management**

43. *The Nature Conservancy of Canada* acquires land or raises money to ensure the continued protection of natural area, by working with local conservation groups, private citizens and corporations. [The Nature Conservancy of Canada](#) - dedicated to preserving ecologically significant areas is a ...

- A. provincial association**
- B. government agency**
- C. municipal committee**
- D. not-for-profit charity**

44. "Purge the Spurge" refers to a volunteer activity that occurs every year in July at [Fish Creek Park](#). Volunteers gather to pull a non-native noxious weed that threatens to take over the park and destroy wildlife habitat. The weed is called ...

- A. thistle purge**
- B. leafy spurge**
- C. weedy purge**
- D. thorny spurge**

45. The identification of *species-at-risk* in Canada is made by ...

- A. WWE**
- B. WWF**
- C. ESCC**
- D. COSEWIC**

46. The conservation of genetic material began with seed banks, between farmers. It has grown to world wide preservation banks of genetic material that is administered by a group of scientists known as the ...

- A. Biodiversity Conservation Genetic Bank**
- B. International Seed Bank Conservation Group**
- C. International Plant Genetics Resources Institute**
- D. World Seed and Genetic Material Institute of Conservation**

Continue on to the next two pages and complete the Numerical response questions in this test booklet

**NUMERICAL RESPONSE Questions**

47. Sandy worked at the **Enterprise Animal Research Center**, where there are many scientific concepts that must be fully comprehended. She developed a system to learn these concepts by making observations for each of the concepts. These are his observations:

<b>Observation 1</b>	Butterflies match colors for protection.
<b>Observation 2</b>	Some organisms can only be found in one particular type of habitat
<b>Observation 3</b>	Some invertebrates have specialized structures, which help them exist in fast-flowing streams
<b>Observation 4</b>	Some organisms exist only because of their unique relationship with another organism

Sandy's observations match with the scientific concepts she was studying, as follows:

- \_\_\_\_\_ **symbiosis**
- \_\_\_\_\_ **food-source dependence**
- \_\_\_\_\_ **environmental adaptation**
- \_\_\_\_\_ **mimicry**

	.	.	
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>
<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>
<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>
<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>

48. As a result of **Natural Selection**, species develop adaptations that suit their habitat. Sandy observed organisms high on the mountainside near the Research Center and recorded some of the adaptations she observed:



padded paws  
1.



thick fur  
2



quick reflexes  
3.



.acute hearing  
4.

Match the number of the adaptation observed by Peter with the corresponding condition within the natural habit of these organisms.

- \_\_\_\_\_ **cold climate**
- \_\_\_\_\_ **rocky terrain**
- \_\_\_\_\_ **sparse vegetation**
- \_\_\_\_\_ **landscape enhances echoes**

	.	.	
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>
<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>
<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>
<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>



49. Interdependence of species within the environment is necessary for survival. **Symbiosis** is an association between members of different species.

- 1- one organism benefits the other doesn't
- 2- one organism benefits, the other is harmed
- 3- one organism appears to be like another organism
- 4- both organisms benefit

\_\_\_\_\_ *commensalism*      \_\_\_\_\_ *mutualism*      \_\_\_\_\_ *parasitism*      \_\_\_\_\_ *mimicry*

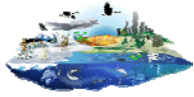
	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

50. The reduction of diversity has resulted in species being listed on **Protection Lists**. Match the threat to a species population with the term it describes

- 1. none in a local area
- 2. none in the world
- 3. few left in a local area
- 4. numbers are being reduced

\_\_\_\_\_ **Endangered**      \_\_\_\_\_ **Extirpated**      \_\_\_\_\_ **Threatened**      \_\_\_\_\_ **Declining**

	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9



## Unit A Biological Diversity

## ANSWER KEYS

### Section 1 Quiz

1	D	5	C	9	D	13	A	17	A	21	B
2	C	6	A	10	C	14	C	18	D	22	D
3	B	7	A	11	A	15	C	19	B	23	B
4	D	8	B	12	B	16	C	20	C	24	B

### Section 2 Quiz

1	B	5	B	9	B	13	B	17	D	21	B
2	B	6	D	10	D	14	C	18	A	22	A
3	C	7	B	11	B	15	A	19	D		
4	D	8	A	12	D	16	B	20	C		

### Section 3 Quiz

1	A	5	D	9	B	13	B	17	B		
2	D	6	A	10	D	14	B	18	C		
3	B	7	B	11	A	15	D	19	D		
4	A	8	C	12	B	16	D	20	B		

### Section 4 Quiz

1	D	7	A	13	C	19	B	25	D	31	B
2	A	8	C	14	B	20	A	26	A	32	C
3	B	9	D	15	A	21	B	27	B		
4	B	10	C	16	C	22	C	28	B		
5	A	11	B	17	A	23	C	29	D		
6	D	12	A	18	D	24	A	30	A		

### Unit Test

1	C	11	B	21	B	31	D	41	B		
2	A	12	D	22	A	32	B	42	C		
3	D	13	B	23	A	33	A	43	D		
4	C	14	D	24	D	34	B	44	B		
5	B	15	D	25	A	35	A	45	D		
6	A	16	B	26	A	36	B	46	C		
7	C	17	A	27	B	37	A				
8	D	18	D	28	D	38	A				
9	B	19	B	29	B	39	B				
10	B	20	D	30	C	40	A				
Numerical Response Questions	47	4231	48	2134	49	1423	50	3124			