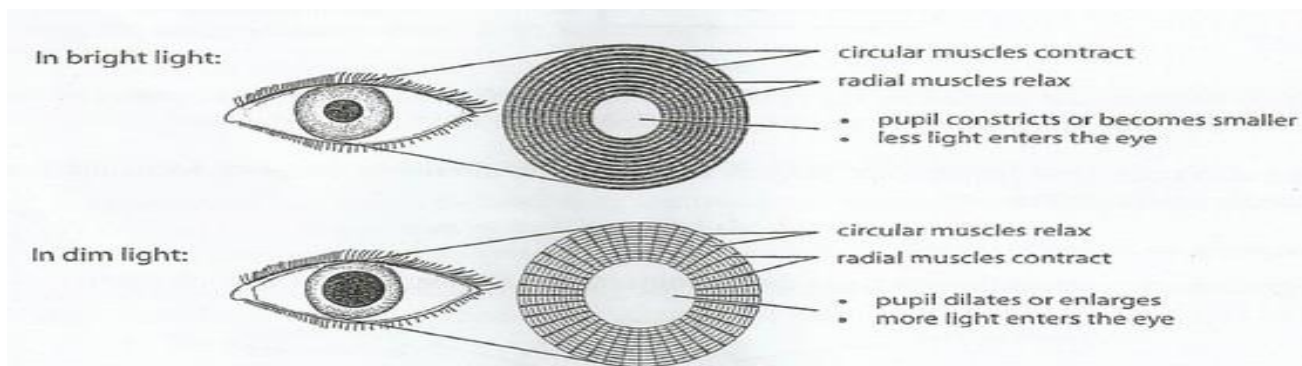
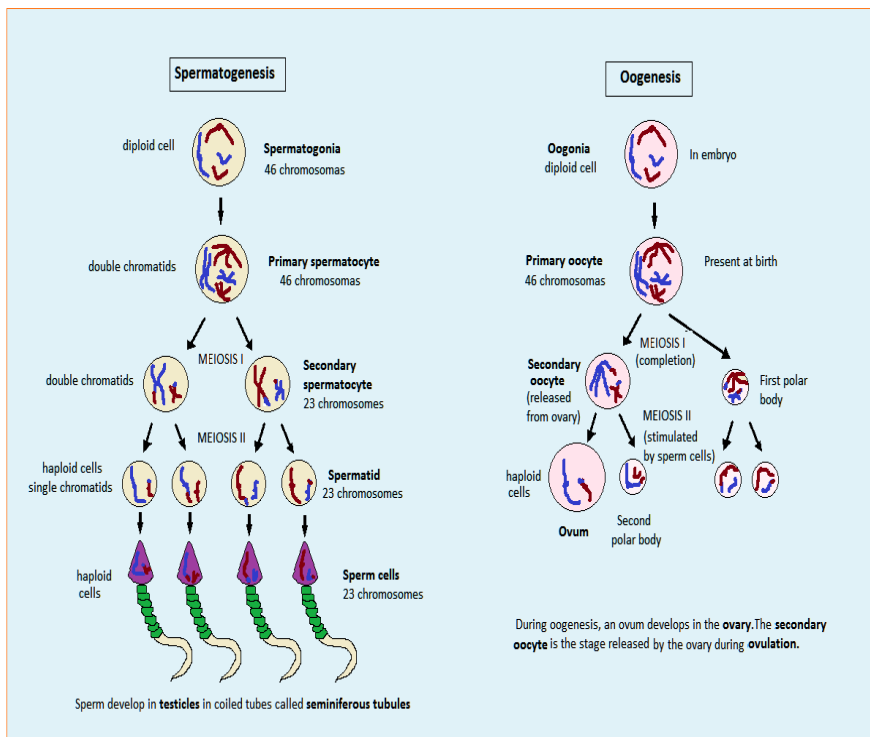


GRADE 10



***Set by: Alemayehu Dejene.
Dessie
2014 E.C***

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Unit 1

Biotechnology

1.1 What is biotechnology?

- ☞ **Biotechnology** is use of micro-organisms to make things that people want.
- ☞ The broad area of biology
- ☞ The term first used by Karl Ereky in 1919
- ☞ Involving the use of living systems and organisms to make or develop products

Traditional application of Biotechnology

- Making and preserving foods
- Making alcoholic drinks. Such as beers, wines,
- Making bread, and injera
- Making cheese and yoghurt.

Modern applications of biotechnology include

- Using **genetic engineering** to change crops and animals;
- Producing new medicines
- To provide new energy sources.
- ❖ Biotechnology is based on **microbiology**.
- ❖ **Microbiology** deal about **micro-organisms** and their effect on humans
- ❖ Micro-organisms are tiny living organisms including bacteria, viruses, fungi and protoctists,
- ❖ The main groups micro-organism used in biotechnology are **bacteria** and **fungi**, although viruses are being used in genetic engineering.

☞ Bacteria

- ❖ Are single-celled organisms
- ❖ Much smaller than the smallest plant and animal cells.,
- ❖ They can reproduce very quickly.

☞ Viruses

- ❖ Smaller than bacteria.
- ❖ They do not carry out any of the normal functions of living things.

☞ Molds and yeasts (fungi)

- ❖ Living organisms which obtain their food from other dead or living organisms.
- ❖ **Yeasts** are single- celled organisms,
- ❖ **Molds** are made up of thin, thread-like structures called hyphae

Traditional application of biotechnology

1. Traditional technology using yeast

- ❖ Yeast cell has a nucleus, cytoplasm and cell wall (surrounded membrane)
- ❖ Yeasts reproduce by asexual by **budding** – splitting into two, to form new yeast cells.

❖ **In a plenty of oxygen, yeast respire aerobically,**

- Breaking down sugar to provide energy for the cells
- Producing **water** and **carbon dioxide** as waste products.
- **Carbon dioxide** produce is important in **making bread and injera**

❖ **In the absence of oxygen yeasts respire anaerobically.**

- Yeast cells in the absence of oxygen, produce **ethanol** and **carbon dioxide**.
- Allowing yeast cells to grow and reproduce.
- The anaerobic respiration of yeast is referred as **alcoholic fermentation**.
- Aerobic respiration provides more energy than anaerobic respiration.

☞ **Injera needs yeast**

❖ At first the yeast respire **aerobically**, produces carbon dioxide,

❖ **Carbon dioxide produced used for**

- Giving injera a **tangy flavour**.
- Its bubbles of gas expand in the high temperature,
- Giving **injera its typical texture**, this is so good for soaking up the food.

☞ **Making alcoholic drinks**

❖ In the absence of oxygen yeasts respire anaerobically

- Produce **ethanol** and **carbon dioxide**
- **Ethanol** produce used for making of alcoholic drinks such as tej, tella, beer, wine

❖ **Tej making**

- Tej need **honey**, water and gesho leaf or gesho stick.
- Gesho gives a bitter edge to the brew
- The yeasts use **honey** as a source of food and respire anaerobically,
- Produces ethanol and carbon dioxide.

❖ **Wine making**

- Wine uses natural sugar, found in **fruit** such as **grapes**, as the energy source for the yeast.

2. Food production using bacteria

☞ **Making yoghurt (irgo)**

- ❖ Traditionally, **yoghurt is formed** by the action of **bacteria** on the lactose (milk sugar).
- ❖ The bacteria converted lactose into lactic acid. This is known as **lactic fermentation**.
- ❖ Lactic acid gives the yoghurt it's;
 - **Sharp, tangy** taste.
 - The milk to clot and **solidify** into yoghurt.
 - Make yoghurt a smooth, thick texture.
- ❖ Yoghurt- forming bacteria prevent the growth of other bacteria which makes milk bad.
- ❖ In Ethiopia, traditionally sticks such as olive tree burned intro yoghurt. Which is used;
 - giving the yoghurt a **pleasant flavor**
 - **Disinfects the vessel** so that only good bacteria grow in the milk

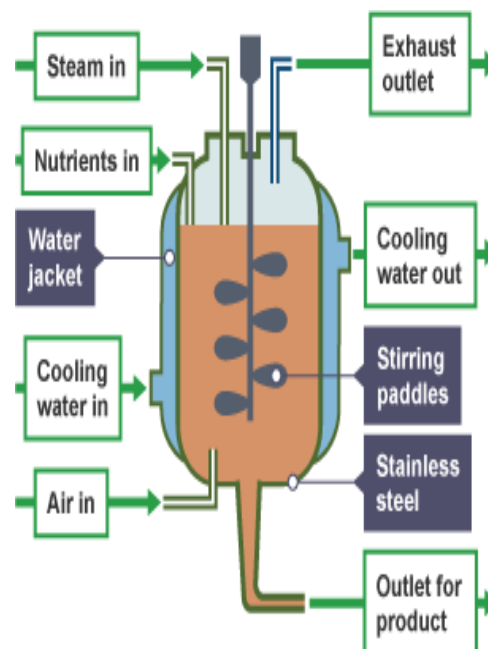
☞ Cheese making (ayib)

- ❖ Cheese formed by action of bacteria
- ❖ Bacteria **changing the texture and taste** of the milk.
- ❖ Cheese making is very successful in preserving milk.
- ❖ The bacteria in cheese convert lactose to lactic acid. .
- ❖ As a result, the solid part (curds) and **whey(aguat)** produced
 - The **whey** is often used in other dishes.
 - The **curds** the solid part contain protein and fat.
- ❖ Here in Ethiopia cheese is traditionally made by;
 - First making yoghurt from fresh milk,
 - Extracting the butter by continuous agitation,
 - Finally boiling the remaining part to make the cheese

☞ To sum up some traditional application of biotechnologies are;–

- ❖ Brewing,
- ❖ Win making,
- ❖ Bread making and
- ❖ The production of yoghurt and cheese

Figure 1; industrial fermenter



1.2 New applications of biotechnology

- ❖ The new application of biotechnology involves the following major area.
 - Agriculture
 - Food industry
 - Medicine
 - Energy
- ❖ One of the most important areas of biotechnology is genetic engineering.

What is genetic engineering?

- ❖ **Genetic engineering/ genetic modification** /is a technique of changing the organism character by inserting a new gene (genetic information) into another organism
- ❖ It is a practice of transferring genes from one organism to another organism.
- ❖ In genetic engineering, **bacterial plasmids (small pieces of circular DNA)** or **viruses** are used to transfer genetic information between different organisms
- ❖ Genetic material carries the instructions for a new organism, found in the nucleus of every cell.
- ❖ For example insulin production;

The technology

- ❖ Growing large numbers of micro-organisms on an industrial scale in large vessels, known as **fermenters**. **Industrial fermenters usually have:**

FEATURE	FUNCTION
➤ An oxygen supply	to provide oxygen for respiration by the micro-organism
➤ Stirrer	Keep the micro-organisms distributed evenly through the culture.
➤ A water-cooled jacket	keeps the temperature inside constant
➤ Nutrient inlet	Allow sterile nutrient enter the fermenter
➤ Steam inlet	Sterile inside of the fermenter
➤ Measuring instruments	for continuous monitoring of factors such as pH

Applications of biotechnology in agriculture

- ❖ Using genetic engineering, we can introduce new variety of plants and animals.
- ☞ **Engineered genes** (engineered genes a new gene added into an organism) can be used;
 - To improve the growth rates of plants and animals.
 - Used to improve the food value of crops.
 - Used to make crop plants that are resistant to drought and to disease,
 - To produce plants that makes their own pesticide chemicals.
- ❖ However, there are **some possible problems** with the new biotechnologies,
 - Produce pesticide-resistant crops
 - Genetically modified plants and animals might spread into new genes into wildlife.
 - Genetically modified crops are often not fertile, which means farmers have to buy new seed each year.

Applications of biotechnology in food

- ❖ Enzymes are produced by genetically engineered bacteria, and the enzymes are then used in;
 - The production of processed foods and drinks.
 - Clarify beer.
 - To break down starch and convert the sugars into glucose syrup.
 - used to make meat more tender,
 - To break down the food used to make commercial baby food.
- ❖ Production of fungal protein **mycoprotein**. Which is low in fat content and preferred by vegetarians

\

Applications of biotechnology in medicine

- ❖ Biotechnology is extremely important in modern medicine.
 - It is used to develop vaccines and antibiotic.
 - The first antibiotic in microbiology was penicillin.
 - Introduced by Alexander Fleming from fungi *penicillium notatum*
 - Engineered bacteria used to make drugs and hormones E.g. insulin for people with diabetes.
 - Genetically modified sheep make special **blood-clotting proteins** in their milk, for people with **hemophilia**.

Applications of biotechnology in energy production

i. Biogas

What is biogas?

- ❖ Biogas is a flammable mixture of gases, formed when bacteria break down plant material, or waste products of animals, in anaerobic conditions.
- ❖ Methane the main component of biogas
- ❖ Table 1.1 The components of biogas

Components	Percentage in the mixture by volume
Methane	50—80
Carbon dioxide	15—45
Water	5
Hydrogen sulphide	0-3

ii. Biofuels (ethanol)

- ❖ Ethanol-based fuels are sugar-rich products from **sugar cane** and **maize** is fermented anaerobically with yeast to give ethanol and water.
- ❖ **Ethanol** used in cars and other vehicles as a fuel. Many cars can run on a mixture of petrol and ethanol without any problems at all.

☞ Advantages of ethanol as fuels

- ❖ It does **not produce toxic gases** when you burn it.
- ❖ It is much **less polluting** than conventional fuels,
- ❖ Can be mixed conventional petrol **used for car engine**
- ❖ Using ethanol as a fuel is a **carbon-neutral activity**.
 - **Carbon-neutral** process whereby the amount of carbon emitted is matched by the amount absorbed

☞ Disadvantage of ethanol as fuels

- ❖ it takes a lot of plant material to produce the ethanol
- ❖ it requires enough space, and a suitable climate, to grow a lot of plant material

Review exercise

Choose the best answer

1. *Production of biogas is an application of biotechnology in the area of*
A. Energy B. Water C. Food D. Medicine
2. *Which of the following is not correctly matched the alcoholic drinks and the substance on which yeast cell act on?*
A. Tella-maize B. Wine-Grape C. Tej-Gesho D. Beer-barley
3. *Which of the following products of yeast cell is important in making injera?*
A. Energy B. Carbon dioxide C. Water D. Ethanol
4. *Which the following produced by bacterial action.*
A. Beer B. Wine C. Yoghurt D. Ethanol
5. *Tell and tej are a biochemical product of;*
A. Bacteria B. Yeast C. Fungus D. Viruses
6. *Milk go sour by the action of bacteria due to the production of compound called;*
A. Ethanol B. Carbon dioxide C. Lactic acid D. Water
7. *Which of the following statement is true about ethanol*
A. it increase accumulation of carbon dioxide
B. it is more polluting then conventional fuels
C. it does not produce toxic gases
D. it is not produce from sugar cane
8. *Biotechnology is important*
A. Produce only alcoholic drinks C. Reduce new form of fuel production
B. Reduce genetic engineering products D. Produce new medicines
9. *The Application of biotechnology that involves changing the hereditary material in an organism is*
A. Civil engineering C. Genetic engineering
B. Mechanical engineering D. Chemical engineering
10. *Which of the following is an example that shows the significance of biotechnology?*
A. Digging large hole to conserve water
B. Building traces to minimize soil erosion
C. Using genetic engineering to improve plant growth
D. Using dung to fertilize soil
11. *In which of the following areas of the present day application of biotechnology could human and animal waste be used?*
A. Biogas production B. Plastic production C. Medicine production D. Steel production
12. *When mother wants to make injera, first she prepares dough from teff powder and water. She leaves the dough for two or three day for*
A. Yeast to produce CO₂ B. Yeast to produce ethanol C. Bacteria to produce lactic acid

Answer. 1.A, 2.C, 3.B, 4.C, 5.B, 6.C, 7.B, 8.D, 9.C, 10.C, 11.A, 12.A

Unit 2

Heredity

2.1 Mitosis and meiosis

- ☞ **Heredity** is the transmission of trait or characteristics from parent to offspring.
 - ❖ The science that study heredity or inheritance are called **genetics**
 - ❖ The nucleus of every cell contains thread-like structures called **chromosomes**, where the genetic information passed from parent to child.
 - ❖ Chromosome is a structure in the nucleus of a cell consisting of genes.
 - ❖ **Chromosomes** are made up of **DNA (deoxyribonucleic acid)** and **protein histone**
 - ❖ DNA is chemical carries the instructions needed to make all the proteins in cells.
 - DNA is the genetic material contained in the nucleus.
 - ❖ Different type of organism has a different number of chromosomes in the cells .E.g.
 - Humans have **46 (23 pair)** chromosomes an
 - Tomatoes have **24 (12 pair)** chromosomes
 - Elephants have **56 (28 pair)** chromosomes
 - ❖ Child inherits half chromosomes from mother and half from father.
 - ❖ Human inherit 23 chromosome from each of their parent
 - ❖ Chromosomes come in pairs from both parents known as **homologous pairs**
 - People have 23 pairs,
 - Tomatoes have 12 pairs and
 - Elephants have 28 pairs of chromosomes.
 - ❖ A photograph of chromosomes in dividing human cells known as a **karyotype**.
 - ❖ Human karyotypes show **23 pairs of chromosomes**.
 - **22 pairs**, are known as the **autosomes**
 - Autosomes are the same size and shape,
 - Do not determine a boy or a girl.
 - ❖ The remaining **one pair** of chromosomes are known as the **sex chromosomes**
 - Determine maleness or femaleness, different for boys and girls.
 - A **girl** has a pair of two similar X chromosomes,(**XX**)
 - A **boy** has one X chromosome and another, much smaller, Y chromosome.(**XY**)
- ☞ **Sex determination in human**
 - Everyone inherits an X chromosome from their mother.
 - If it is fertilized by a sperm carrying X chromosome, you will be a girl.
 - If it is fertilized by a sperm carrying a Y chromosome, you will be a boy.
 - X chromosomes carry information about being female,
 - ✓ but also carry information about many other things – like
 - ✓ the way of **blood clots**,
 - ✓ The formation of **teeth, body hair and sweat glands**.
 - Y chromosomes mainly carry information about maleness.

Chromosomes, Genes and DNA

☞ Chromosomes

- ❖ Chromosomes are strand of DNA carrying genetic information
- ❖ Composed of DNA and protein histone
- ❖ homologous chromosomes are a pair of chromosomes having the same gene sequences, each derived from one parent

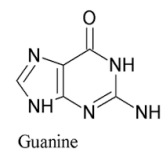
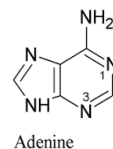
☞ Gene

- ❖ **Gene** is a **unit of hereditary material** located on the chromosomes
- ❖ Genes are repeating patterns of bases in the DNA
- ❖ The order of the bases in the DNA acts as a code to instruct the cell about the sequence of amino acids to make a particular protein
- ❖ DNA is a long molecule, made up of two strands twisted together to make a spiral known as a double helix.

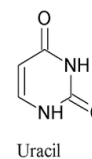
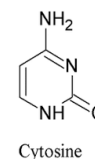
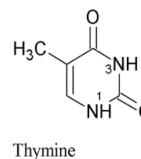
☞ Deoxyribonucleic acid (DNA)

- ❖ DNA nucleic acid containing the genetic instructions used in the development and functioning of all known living organisms and some viruses
- ❖ **DNA molecule** is made up of lots of smaller molecules (**nucleotides**) joined together.
- ❖ DNA is a polynucleotide chain.
- ❖ A nucleotide consists of a **phosphate group**, a **sugar** and a **base** .
- ❖ Bases that make up DNA are called **adenine, thymine, guanine and cytosine**
- ❖ Cytosine and thymine **pyrimidine** are whereas guanine and adenine are **purine**.
- ❖ DNA molecule has twisted double helix structure
- ❖ The two DNA strands are linked by bases,
 - Adenine pairs with thymine (A---T)
 - Cytosine pairs with guanine.(G---C)
 - In DNA the sum of **A+G=T+C** , **A+C=G+T**
 - The number or percentage of **A=T** , **G=C**
- ❖ The strands are made of **deoxyribose sugar** and **phosphate**.

Purine



Pyrimidin



☞ EXERCISE

1. In a DNA molecule has 40% thymine , the percentage of cytosine would be:
2. In a DNA molecule cytosine makes 30%, what is the % of thyme

The cell cycle

- ❖ Cell cycle is the a sequence events which occurs between one cell division and the next
- ❖ Which involves three different stages;

1. **Interphase** (G₁, S and G₂)

- ❖ A long period of non-division –
- ❖ Preparing the cell for division
- ❖ A period of growth(G₁ and G₂) and synthesis (S)
- ❖ Replication of DNA ready for the next division.

2. **Mitosis**

- ❖ A period of active cell division.
- ❖ Division of the nucleus (karyokinesis)

3. **Cytokinesis**—division of the cytoplasm

☞ *There are two main type of cell division*

Mitosis 2) Meiosis

1. **MITOSIS**—replication division

- ❖ Mitosis is division of the somatic cells to make two identical daughter cells. It helps in:
 - growth , replacement and repair of worn out cells
 - a method of asexual reproduction in unicellular organism
- ❖ It is divided into four phases
 - Prophase**
 - The chromatin network condense into thick visible chromosome
 - Nucleoli and nuclear membrane disappear
 - Spindle fiber formed
 - Metaphase**
 - Sister chromatids line up along the equatorial plane of the cell
 - Anaphase**
 - The centromere and sister chromatid divide and move to the opposite pole
 - The spindle fibers shorten and pull the chromatids to opposite poles
 - Telophase**
 - Two new nuclei form at the poles of the cell.
 - Each has a copy of identical chromosome from the parent cell.
 - After nuclear division the cytoplasm is divided into two equal parts

☞ **Significance of mitosis**

- ❖ The daughter cell contain the same number of chromosome as the parent cell
 - The daughter cells carry the same hereditary information as in the parent cell
 - There is no variation genetic information
 - It gives genetic stability with in a population
- ❖ Growth and cell replacement
- ❖ Regeneration and asexual reproduction

19.2 The Cell Cycle

The cell cycle

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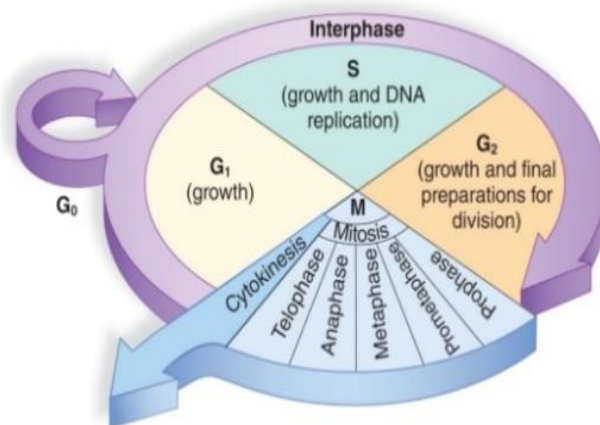


Figure 19.2 Stages of the cell cycle

2. MEIOSIS-reduction division

It is a division

- ❖ Meiosis is the division of the sex cells resulting in 4 daughter cells with half the original number of chromosomes.
- ❖ Occur in reproductive organ namely ovary and testes
- ❖ Result in genetically different **4 daughter cells** per division
- ❖ Each having half the chromosome number of the original cell
- ❖ Important in production of gametes (sperm and egg cell)
- ❖ Responsible for the transmission of hereditary information from generation to generation
- ❖ the type of cell division that creates egg and sperm cells
- ❖ It involve two successive division

Meiosis I

- ❖ Pairing of homologous chromosomes
- ❖ Exchange of genetic material in the process called **crossing over**
- ❖ Separation of homologous chromosomes

Phases of meiosis

☞ Meiosis I

Prophase I –

- The chromatin network condense into thick visible chromosome
- Pairing of homologous chromosomes called synapsis
- homologous chromosomes exchange genetic material in the process called **crossing over**

Metaphase I

- homologous pairs line up on the equatorial plane

Anaphase I –

- Homologous chromosome separate and move toward the opposite pole.
- One chromosome (pair of chromatids) from each homologous pair moves to each end of the cell.
- As a result the chromosome number in each cell has half that of the original

Telophase I

- The nuclear membrane reforms and the cells begin to divide.

☞ Meiosis II

- ❖ No doubling of chromosome
- ❖ Separation of sister chromatid
- ❖ Production of four haploid cell

Prophase II

- ❖ The chromosome lie in two polar nuclei
- ❖ Nuclear membrane and nucleus disappear

Metaphase II

- ❖ new spindles are formed and the chromosomes, still made up of pairs of sister chromatids, line up on the metaphase plate

Anaphase II –

- ❖ The centromeres now divide and the sister chromatids move to the opposite ends of the cell

Telophase II

- ❖ Giving four daughter cells each with half the chromosome number of the original diploid cell
- ❖ Nuclear envelopes reform, the chromosomes return to their interphase state,

☞ Cytokinesis in plant and animal cell

- ❖ Division of the cytoplasm /cytokinesis/ in animal cell usually formed by forming **cleavage furrow**
- ❖ Division of the cytoplasm /cytokinesis/ in plant cell usually formed by forming a **cell plate**

☞ Crossing over during meiosis increase genetic diversity

- ❖ **Crossing over:** exchange of chromosome segments between homologous chromosome during prophase of meiosis
- ❖ Result in new combination of gene



Gametogenesis—production of male and female gametes

☞ Oogenesis—occur in ovaries of females

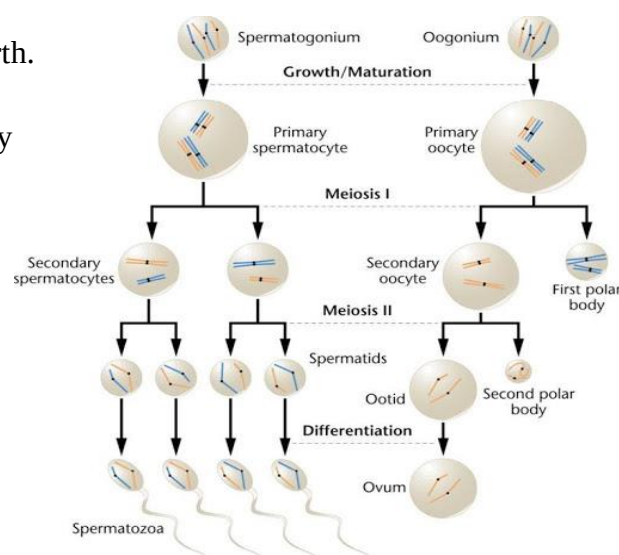
- ❖ The first stage of meiosis is completed before birth.
- ❖ Baby girl contain all the ova she will ever have
- ❖ The second meiotic division occur during puberty
- ❖ Only one large ova(egg) produce per cycle
- ❖ **Oogenesis:** Stops at menopause

☞ Spermatogenesis—occur in taste of males

- ❖ The production of sperm
- ❖ In males, meiosis doesn't start until puberty,
- ❖ Carries throughout a man's life.
- ❖ 4 spermatid (sperm) produce per cycle
- ❖ Each gametes genetically deferent

Spermatogenesis

Oogenesis



1. How many mitotic divisions are needed for a single cell to make 64 cells?

A. 8

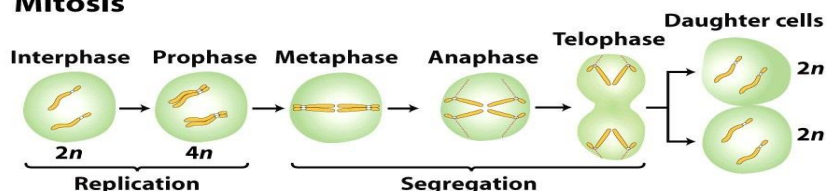
C.9

C. 6

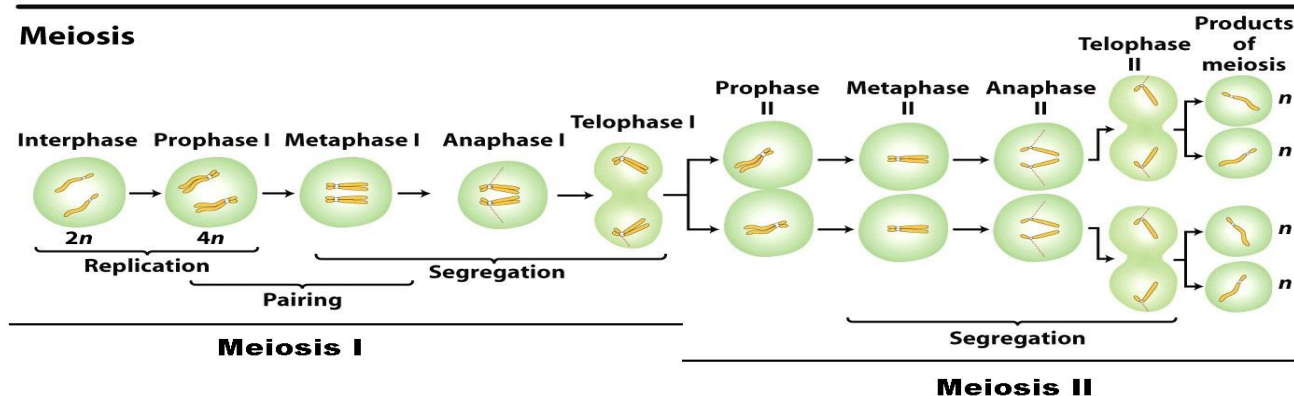
D. 7

Solution 2^n cell produce n =number of division $=2^8=256$, $2^9=512$, $2^6=64$, $2^7=128$

Mitosis



Meiosis



☞ Comparison of mitosis and meiosis

MITOSIS	MEIOSIS
❖ Take place in somatic cell	❖ Take place in germ (sex) cell
❖ Occur in both sexually and asexually reproduction organism	❖ Occur only in sexually reproduction organism
❖ One division	❖ Two division
❖ Important in cellular reproduction, growth and repair of body cell	❖ Important in genetic diversity through sexual reproduction
❖ Makes every cell other than sex cell	❖ Makes sex cell, sperm and egg
❖ 2 daughter cell produced	❖ 4 daughter cell produced
❖ Daughter cell genetically identical	❖ Daughter cell genetically different because of crossing over
❖ Chromosome number the same as the parent	❖ Chromosome number reduce by half of original
❖ No pairing of homologous chromosome	❖ Pairing of homologous chromosome

Review exercise

Choose the best answer

2. In somatic cell cycle, DNA replication takes place in;
A. Interphase B. Prophase C. Metaphase D. Telophase
3. How many mitotic divisions are needed for a single cell to make 128 cells?
A. 8 B. 9 C. 6 D. 7
4. The 'rungs' of DNA ladder made of;
A. Phosphates and bases B. Bases C. Sugar D. Sugar and phosphate
5. If a cell with 12 chromosomes undergo mitotic division and produced two daughter cells, how many chromosomes will each cell have?
A. 6 B. 12 C. 4 D. 24
6. What stage of meiosis where sister chromatids moves to the opposite pole?
A. Anaphase I C. prophase I
B. Anaphase II D. Metaphase II
7. What is mitosis? it is
A. Formation of sex cell C. Formation of zygote
B. Copying of chromosomes D. Division of somatic cell
8. What is meiosis? It is division of
A. Haploid cell B. Sex cell C. Blood cell D. Brain cell
9. Which of the following is true about gene?
A. A small section of chromosomes C. Located on the cell membrane
B. Made up of histone protein D. Made up of fat
10. In the process of mitotic cell division, what will happen during anaphase stages?
A. Spindle fiber pull chromatid to opposite pole
B. Two new nuclei form at the poles of the cell
C. Chromatid line up in the equatorial of a cell
D. Chromosomes are copied as DNA replicates
11. During meiosis I which phase does each chromosome appear condensed form with two chromatid?
A. Telophase I C. Metaphase I
B. Prophase I D. Anaphase I
12. Which of the following is a correct pairing of nitrogenous base in DNA?
A. Cytosine- Guanine C. Adenine- Guanine
B. Thymine-Guanine D. Thymine-cytosine
13. What do genetics call the genotype in which the two alleles of a pair are identical? see page 16
A. Dominant B. Recessive C. Homozygous D. Heterozygote
14. Which of the following chromosomal composition result in human male?
A. XX B. XO C. XXX D. XY

15. Which stage of mitosis do sister chromatid line up along equatorial plane
A. Telophase B. Prophase C. Metaphase D. Anaphase
16. If a cell have $2n=40$ chromosomes divides mitotically and produce four daughter cells, how many chromosomes will each daughter cell?
A. 40 B. 20 C. 10 D.80
17. During which stages of meiosis do member of homologous chromosomes separate?
A. Prophase I B. Anaphase I C. Metaphase I D. Telophase I
18. An organism has 24 chromosomes in their normal body cell is mated with another organism having 24 chromosomes. The number of chromosomes of the resulting offspring will be?
A.48 B.12 C.24 D.46
19. What do genetic call the genotype in which the two allele of a pair are different? see page 16
A. Dominant B. Recessive C. Homozygous D. Heterozygous
20. A genetic cross having a hybrid yellow seed in F₁ generation, what % of a green seed produced in F₂ generation?
A.100 B.0 C.75 D.25
21. How many chromosomes do human inherits from each of their parents?
A. 46 B.23pair C.46 pair D 23
22. How is one DNA differing from another DNA? This is because
A. DNA molecule is capable of replication
B. the number, type and sequence of bases
C. they contain a number of gene
D. DNA molecule separates during meiosis
23. Which of the following statements true about DNA and RNA
A. Both composed of sugar, phosphate and bases
B. Both are equally important in determining traits
C. Both exist as a single chain nucleotide
D. Both are capable of replication
24. if one imagines the DNA molecule a tiny ' ladder' the backbone of the ladder are made up of
A. sugar and phosphate C. phosphate and bases
B. sugar D. bases
25. The $2n$ chromosome number of a horse is 64 the number of horse chromosomes in each sex cell of a horse is
A. 64 D.128 C. 32 D. 8
26. When a cell having 12 chromosomes divided by mitosis and produce 2 daughters cell , each of the daughter cell would receives
A. 6 B.12 C. 24 D.4

ANSWER.2A, 3D, 4B,5B, 6B, 7D, 8B, 9A, 10A, 11B, 12A, 13C, 14D, 15C, 16B, 17B, 18C, 19D, 20D, 21D, 22B, 23A, 24A, 25C, 26B

2.2 Mendelian inheritance

☞ Before Mendel--Blending inheritance

- ❖ Inheritance of traits from two parents produces offspring with the characteristics that are intermediates between those parents
- ❖ The characteristics of the parents blended (mixed) together so that the distinct characteristics of each parent were lost
- ❖ E.g. a cross between a black dog and a white dog would give grey puppies

☞ Gregor Mendel discoveries

- ❖ The father of genetics
- ❖ The first person who tried to explain the **pattern of inheritance of trait** experimentally on garden pea
- ❖ Mendel chose garden pea for his experiment, for the following reason
 - Pea have self-pollinating flower that can be easily controlled
 - Easy to cultivate
 - Pea have many contrasting traits
 - Cross pollination and fertilization can easily be achieved
- ❖ Mendel use 7 pair of contrasting traits listed below

Specific traits	Contrasting traits	
	dominant	Recessive
Stem length	Tall	Short
Pod color	Green	Yellow
Pod shape	Inflated (Smooth)	Constricted (pinched)
Seed shape	Round	Wrinkled
Seed color	Yellow	Green
Flower position	Axial	Terminal
Flower color	Red	White

☞ Important terms

- ❖ **Alleles** different forms of the same gene
- ❖ **Homozygous**; has **the same or identical allele of gene** on each of the chromosomes in the homologous pair .E.g. TT. tt
- ❖ **Heterozygous**; has **different alleles of gene** on each of the chromosomes in the homologous pair. E.g. Tt, Yy
- ❖ **Genotype**; describes the pair of alleles for a particular gene possessed by a organism. E.g. TT, Tt, Yy
- ❖ **Phenotype**; describes traits determined by a particular **genotype** E.g. tall, short, yellow seed. wrinkled seed,
- ❖ **Dominant allele** is the allele expressed in a heterozygous organism

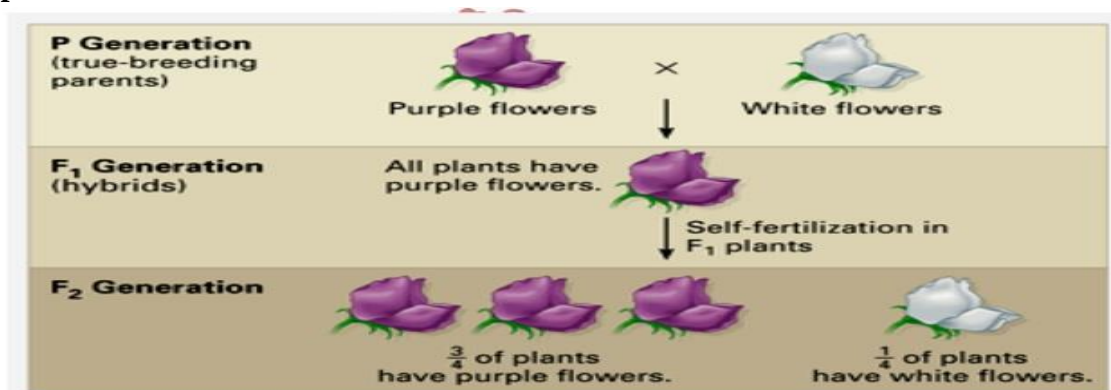
- An allele expressed in the phenotype even if only one copy of the allele is present. Always represented by capital letter. Tall (T), yellow seed (Y)
- ❖ **Recessive alleles** is an allele only expressed in a homozygous organism
 - An allele expressed in the phenotype only if two copies of the allele are present.
 - represented by small later short plant(t),green seed (y)

☞ Mendel experiment on monohybrid inheritance

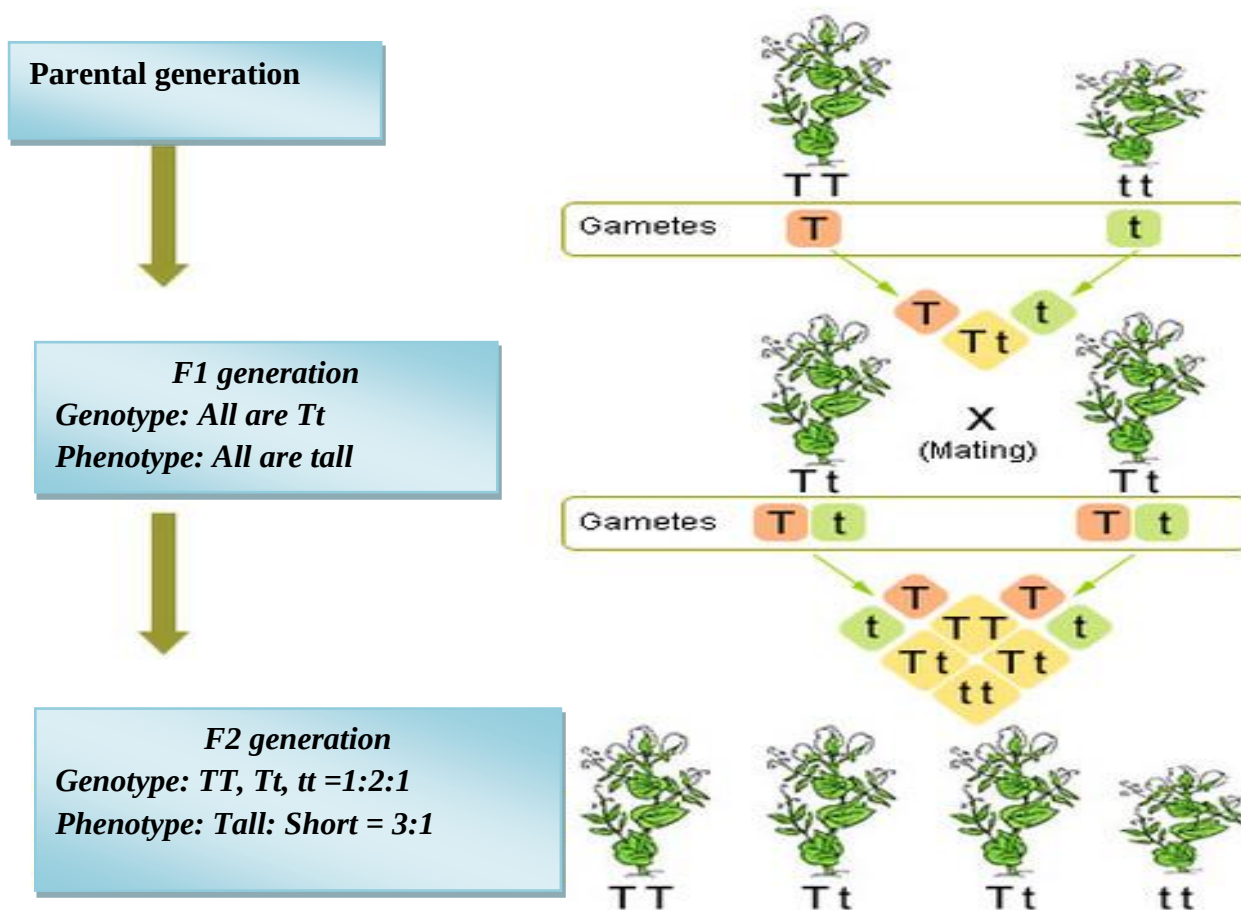
☞ **Monohybrid inheritance** is inheritance of a single pair of contrasting traits

- ❖ **First** Mendel produce pure breeding or **true breeding plant**
 - **Pure breeding or true breeding** plant is the one that produce offspring through self-pollination and always resembles their parents for the given traits
 - For example, a pure plant that is true breeding for tallness would always produce a tall pea plants upon self-pollination and self-fertilization
- ❖ **Second** removing male part or emasculation and artificially cross pollination for each pair of contrasting traits.
For example;
 - Pure breeding tall plants (TT) cross with a pure breeding short plant (tt). He called **Parental generation**
 - The offspring or the resulting from P₁ generation is called **first filial generation (F₁)**, all become tall plant (Tt) or dominant traits.
- ❖ Mendel allowed F₁ plant to self-pollinate in the next season and produce **second filial generation or F₂** (F₁ × F₁ → F₂)
 - The offspring produced three quarter dominant ($\frac{3}{4}$) and one quarter recessive ($\frac{1}{4}$), the ratio 3;1
 - The trait expressed itself in F₁ generation, is dominant. Whereas the trait masked or hidden in F₁ generation is recessive

Example 1



Because of the purple flower trait completely masks the white flower trait when true breeding plants crossed, the purple flower is called dominant and the white flower is called recessive



Mendel conclusion from his discover

- ❖ Heredity determined by **factors** which today called **gene**
- ❖ Each trait determine by a pair of factors
- ❖ One factor comes from each parents
- ❖ The alleles are not paired in gametes
- ❖ During fertilization the allele paired again

Mendel develop two important law

☞ The law of segregation;

- Factor separate during gamete formation
- A pair of factors are not included in the same gamete
- Gamete contain only one factor

☞ The law of independent assortment;

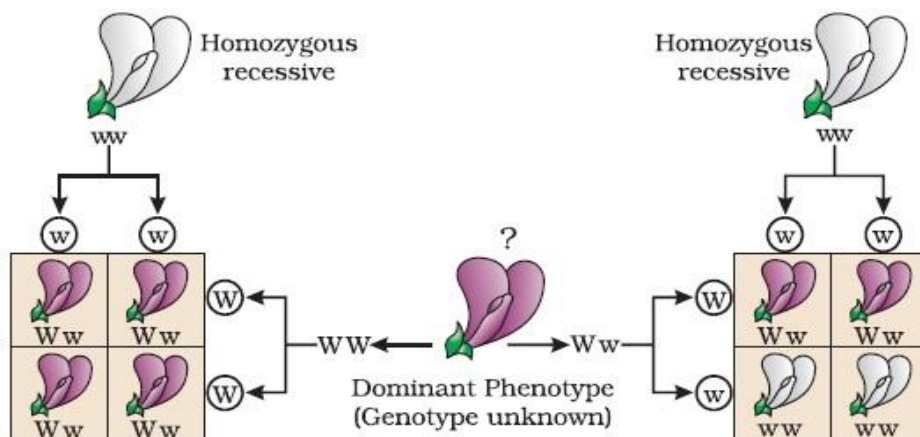
- Factors belonging to different traits segregate independently during gamete formation.
- The traits transmitted to offspring independently of one another
- Example the inheritance of tall plant seed is independent of yellow color seed

Test cross

- ❖ A breeding experiment important to determine the genotype of an organism with a dominant phenotype
- ❖ The organism is crossed with a homozygous recessive organism
- ❖ If all of the offspring shows a dominant phenotype the organism is homozygous dominant
- ❖ If it produces a 1:1 ratio of dominant and recessive phenotype the organism is heterozygous

Example

Note
W=Purple
w=White



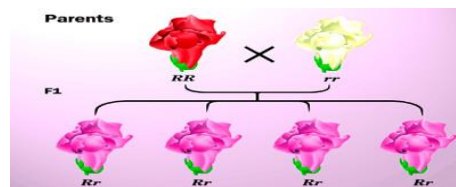
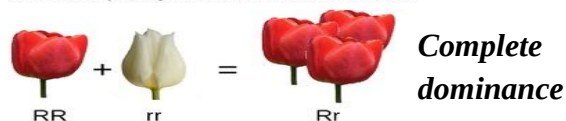
Result Interpretation

All flowers are purple
Genotypically unknown
Flower is homozygous dominant WW

Half flowers are purple and half flowers are white 1:1 ratio
Genotypically unknown flower is heterozygous dominant Ww

Type of dominance

1. **Complete dominance**; one pair of allele in a heterozygote completely masks expressions of other. E.g. tallness dominant over shortness
2. **Incomplete dominance**; there is a dominance but not expressed in full extent, the heterozygote shows somewhat intermediates between the two parents E.g. Red x white produce pink
3. **Codominant**; No dominant and recessive relationship,
 - In heterozygous organism each allele of a gene expresses their gene product equally on the offspring
 - Example. Cattle fur color, ABO blood group



Incomplete Dominance

Codominant

A. Cattle fur color

Phenotype of parents Red bull x White cow
 Genotype of parents RR x rr
 Gametes R R r r

	R	R
r	Rr	Rr
r	Rr	Rr

- ✓ F1 genotype: Rr
- ✓ F1 phenotype: roan

Exercise

1. **Roan X white**
2. **Roan X red**

B. ABO blood group of human

- ❖ Human blood type is controlled by A, B and O alleles
- ❖ Allele A and B codominant
- ❖ Allele O is recessive

PHENOTYPE	GENOTYPE
❖ Type A	❖ AA, AO
❖ Type B	❖ BB, BO
❖ Type AB	❖ AB
❖ Type O	❖ OO

☞ Example

1. Suppose a **man with blood type O** marries a **woman with blood type B**. What would be the blood group of the child?

Answer. **Man; Phenotype type O, Genotype OO**

Women; Phenotype Type B, Genotype BB, BO

Man			Man		
Women		O	O		
	B	BO	BO	B	BO
	B	BO	BO	O	OO

- ❖ **Genotype of children** would be **BO** and **OO**
- ❖ **Phenotype** of children would be; **type O. type B**

2. A woman with blood type AB Maries a man with blood type O. What blood type might the children have

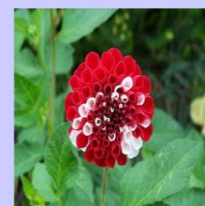
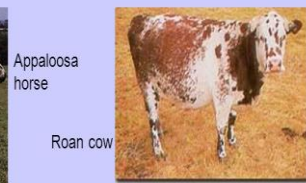
Man

- **Phenotype women type AB, genotype AB**
- **Phenotype of man type O, genotype OO**
- **So the Children have blood type**

Woman

	A	B
O	AO	BO
O	AO	BO

Examples of Codominance in Animals



Mendelian genetics in people

- ❖ Mendel mechanism of inheritance work for all organism including all organism
- ❖ There are ten thousands of traits that can be determining the gene of human. Some of these trait are

TRAITS	DOMINANT	RECESSIVE
❖ Dampens	❖ Dimple	❖ No dimple
❖ Ear lobe	❖ Dangly	❖ Attached
❖ Thumb	❖ Straight	❖ Curved
❖ Tongue rolling	❖ Roller	❖ Non roller
❖ Handedness	❖ Right hand	❖ Left hand
❖ Albinism	❖ Normal	❖ Albino

Example

1. **Dimpleness** dimple, D

No dimple, d

☞ **Father no dimple mother hybrid dimple. What about children?**

Answer. Father; Phenotype no dimple, Genotype dd

Mother; phenotype dimple, Genotype Dd

Mother

		D	d
Father	d	Dd	dd
	d	Dd	dd

- ❖ Genotype of children 2 hybrid dimple Dd and 2 non dimple dd
- ❖ Phenotype of children 2 hybrid dimple, 2 no dimple (1:1 ratio)

☞ **Both couple hybrid dimple**

❖ **Answer**

➤ **Phenotype dimple**

➤ **Genotype**

Father

		D	d
Mother	D	DD	Dd
	d	Dd	dd

- ❖ Genotype of children pure dimple, 2 hybrid dimple Dd and 1 non dimple dd **1:2:1**
- ❖ Phenotype of children 3 dimple, 1 no dimple (3:1 ratio)

2. Ear lobe; *dangly*, *D*

Attached, *d*

- ☞ If both of the couple have hybrid dangly ear lobe, How many % of children have dandily Answer.

- Father; Phenotype no dimple, Genotype Dd
- Mother; phenotype dimple, Genotype Dd

Father

Mother		D	d
	D	DD	Dd
	d	Dd	dd

- ❖ Genotype of children **1dangly DD**, .hybrid dangly **2Dd** and **1 attached dd** (genotype ratio 1;2;1)
- ❖ Phenotype of children **3dangly ear lobe**, **1 attached ear lobe** (3;1ratio)
- ❖ Therefore **75% dangly** ear lobe **and 25% attached**

3. Albinism

- ❖ Albinism is a humans genetic disorder characterized by absence of melanin pigment in skin, hair and nail
- ❖ Results from a recessive gene
- ❖ A person with a complete loss of melanin pigment is called **albino**
- ❖ Albinism is an inherited disorder. Children have a risk of albinism if;
 - They have parents with albinism
 - Parents who carry the gene for albinism

Example Normal, A
 Albino, a

Genotype	Phenotype
AA	Normal
Aa	Normal carry an albino gene (carrier)
aa	Albino

- ☞ How two carriers can produce an albino child?

Answer.

- ❖ Phenotype of the parent's normal carrier,
- ❖ Genotype of the parents Aa
- ❖ Genotype of children **1pure normal AA**, **2 hybrid normal Aa** and **1albino aa** (genotype 1;2;1ratio)
- ❖ phenotype of children **3 normal**, **1albino** (3;1ratio)
- ❖ Therefore **75% of the normal** but **25% of albino** child

Father

Mother		A	a
	A	AA	Aa
	a	Aa	aa

Exercise

1. Father heterozygous normal and mother an albino

❖ **Answer**

- **Phenotype father heterozygous normal and mother albino**
- **Genotype** Father Aa and mother aa
- Gametes A and a a and a

	A	a
a	Aa	aa
a	Aa	aa

Phenotype ratio 50% normal and 50% albino
Genotype ratio 50 % hybrid Aa and 50% aa

2. Mother pure normal and mother an albino

❖ **Answer**

- **Phenotype father normal and mother albino**
- **Genotype** Father AA and mother aa
- Gametes A and A a and a

	A	A
a	Aa	Aa
a	Aa	Aa

Phenotype ratio 100% normal
Genotype ratio 100% hybrid

3. *An allele for dangly earlobes (D) is dominant over attached ear lobes; a woman with dangly ear lobes is married to a man with attached ear lobes. Which of the following shows the possible genotype of their offspring?*

A. DD C. DD and Dd C. DD and dd D. Dd and dd

Solution

- ❖ Phenotype of a parent woman dangly man attached
- ❖ Genotype women DD or Dd man dd

		Woman	
Man		D	D
	d	Dd	Dd
	d	Dd	Dd

		Woman	
Man		D	d
	d	Dd	dd
	d	Dd	dd

- ❖ **So the possible genotype of the parent is Dd and dd**

Review exercise

Choose the best answer

1. Which of the following character can be considered as having been controlled by dominant allelic gene in pea plant?
A. Smooth seed and yellow seed coat C. Smooth seed and wrinkled seed
B. Pinch and terminal flower D. Short and green cotyledon
1. If one crosses phenotypically tall pea plants and all the off springs are tall, the parents
A. Both could be homozygous tall C. Both could be heterozygous tall
B. Both could homozygous short D. Both could only be heterozygous tall
2. If in a DNA molecule adenine makes 20% what is the percentage of cytosine?
A.20 B.80 C.60 D.30
3. The complete set of chromosomes that we inherit from one of our parent is referred to as;
A. Diploid B. Haploid C. Homozygous D. Polyploidy
4. A single cell of testis divide to produce
A. A single sperm B. 2 sperm C. 6 sperm D. 4 sperm
5. In which of the following crosses would one expect more than one phenotype assuming that "B" is dominant to "b"
A. BB and bb B. BB and Bb C. bb and bb D. Bb and Bb
6. Assuming 'A' is dominant over 'a' which one of the following phenotypic ratio is expected from Aa and Aa cross
A. 2:2 B.3:1 C.2:1 D.4: 0
7. What is the number of chromosomes in a human fertilized egg?
A.23 B. 23 pair C.46 D. 46 pair
8. In a human, albinism is determined by a recessive gene. if two parents have produced a legitimate child who is an albino. The child has most likely inherited the defect from
A. Both parents C. The mother only
B. Either mother or father only D. The father only
9. Kebed is left handed his parent are both right handed. If right handedness (R) is dominant over left handedness(r) what are the genotype of the parents?
A.RR and rr B. RR and RR C. Rr and Rr D.RR and R
10. A married couple had three boys in a row, what is the chance of the next child would be a girl?
A.25 B.50 C.75 D.100
11. Suppose 800 pea plant produced from Tt and Tt cross. How many of them to be to be short?
A.600 B.400 C. 200 D.800
12. When Mendel crossed pure round pea flower with pure wrinkled pea the offspring at F₂ generation will be?
A. All Wrinkled C. 2 Wrinkled 2 Round
B. All round D. 1 Wrinkled 3 Round

13. Given From the individual of which of the generation did Mendel develop the concept of dominance?

- A. P_1 plants C. F_1 plants
B. F_2 plants D. P_1 and F_2

P_1 cross	F_1 parent	F_2 parent
Round seed	All plants	5,474 round
Wrinkled seed	were round seed	1,850 wrinkled

14. The main objective of Gregor Mendel's work was to proof how

- A. Cell division works C. Blood circulation work
B. Inheritance work D. Breathing system work

15. Which of the following outcomes was correct in a crossing of a yellow seed (Yy) and green seed (yy) pea plant?

- A. Three yellow and one green seed, phenotypically
B. All of the outcomes were yellow, genotypically
C. All outcomes were green, genotypically
D. Two yellow and two green seed, Genotypically

16. A tall plant with Tt genotype is test crossed (T = tall t =short), what would be the expected result?

- A. All of the offspring will be tall C. 50% tall and 50% short
B. 75% tall and 25% short D. 25% tall and 75% short

17. Suppose a lost and found baby is claimed by four families whose blood genotype is shown below. If the baby blood type is "O" which family is the possible parents?

- A. AO and BB B. AA and OO C. AO and BO D. AB and OO

18. As shown in Gregor Mendel garden pea, what % of the F_2 generation of monohybrid cross has a dominant phenotype?

- A. 100 B. 75 C. 25 D. 0

19. Among the following one is not produced in Mendel monohybrid cross in F_1 generation?

- A. Tall plant B. White flower C. Round seed D. Axial flower

20. The process of combining good traits from different breed is; Reed next page

- A. Cross breeding C. association breeding C. test cross D. selective breeding

21. Which of the following is considered as the importance of breeding to society? it is used to

- A. Reduce use of natural resource C. Reduce genetic diversity
B. Produce sufficient food D. Avoid new gene production

22. A type of breeding done to produce a particular traits; Reed next page

- A. Multiple breeding B. Cross breeding C. True breeding D. Selective breeding

23. If both of the parents have carrier of albino gene, how many % of the child is an albino?

- A. 75 B. 25 C. 50 D. 100

25. which of the following couple would a probability of producing children with all blood type/

- A. AB and AO C. AO and OO
B. AO and BO D. AB and BO

Answer. 1A, 2A, 3D, 4B, 5A, 6D, 7B, 8A, 9A, 10C, 11B, 12C, 13D, 14C, 15B, 16D, 17C, 18C, 19B, 20B, 21C, 22B, 23D 24B, 25B

2.3 Heredity and breeding

- ❖ **Breeding** is the process of genetic modification of plant and animals
- ❖ It is largely important in for agriculture for breeding of farm animals and crops

☞ **Selective breeding**

- ❖ It is a technique of breeding crop plant and animal with desirable trait.
- ❖ For Selective breeding is used to breed for particular traits.
- ❖ It should be select true-breeding plants or animals, for doing this
 - It is important to know the history of the organism.
 - If the recessive characteristic select, it is easy to be sure that the parents are true breeding because they will be homozygous.
 - If the trait you want is dominant, it needs to carry out a test cross using a known homozygous recessive on the parents to make sure they are homozygous.
- ❖ In selective breeding plant and animals the best characteristics allowed to mate, but animals which do not have the characteristic should be castrated or prevented from mating
- ❖ In selective breeding also need to avoid the animals becoming **too inbred** –
- ❖ **In breeding** it is breeding of two close relatives can eventually lead to genetic weakness.
- ❖ For example a **Belgian Blue** (bred purely for meat) and a **Holstein Friesian**, bred purely for milk.

☞ **Cross-breeding -combination of traits**

- ❖ It is a technique of breeding crop plant and animal is to combine good traits from two different breeds.
- ❖ Take an example.

Family one herd goat

- ❖ **Give good milk but not resistant heat**

Family two herd goat

- ❖ **Give less milk resistant to heat**

- If both families selected their best male and female goats, and cross-bred,
- The offspring would be **good milk production** and **heat resistance gene**.
- ❖ Farmers often simply continue to cross-breed to get the benefits of each F1 generation.

☞ **Importance of breeding for society**

Selective breeding used to maintain

- To create the best possible performance in our local breeds
- People will gain the biggest possible benefit from them.
- They will get the best possible yield from their crops,
- The most milk from their cows, sheep, goats or camels,

Importance of cross-breeding: combining useful traits;

- A good temperament with a fast growth rate, or
- A better milk yield with an ability to thrive on poor forage,
- Can create new breeds even better suited to the different areas of our country.
- The more food we can produce, the stronger and healthier both we and our children.
- As a source of new genetic material to help overcome changes in the world climate

Unit 3 Human biology and Health

3.1 The nervous system

There are two different systems that have a role in co- ordination and control of the body.

Nervous system	Endocrine /hormonal/ System
➤ It use a nervous coordination system	➤ It is chemical coordination
➤ Messages travel fast through nerve cell	➤ Hormone transported through blood
➤ Messages usually have rapid effect	➤ Often take longer to have an effect. •
➤ Usually a short-lived response	➤ Provide a quick response
➤ Origin of message are receptors	➤ Origin of message are endocrine gland
➤ Destination of message are effector	➤ Destination of message are target cell

☞ **The nervous system has two main systems.**

❖ **The central nervous system (CNS)** is made up of **brain** and **spinal cord**.

❖ **The peripheral (body) nervous system (PNS)** is made up of the **neurons (nerve cells)** and the **sensory receptors**.

- PNS have two nerves that connect CNS to all part of the body. These are;
 - **Cranial nerves** the nerves that come out of the brain. They go mainly head and neck, like your eyes, tongue and jaws
 - **Spinal nerves** the nerves come out of the spinal cord. They go to the arms, the legs and the trunk

☞ **For nervous coordination three things are necessary**

- ❖ **Sensory receptors:** nerve endings that can sense stimuli. e.g. pressure, pain, temperature
- ❖ **Coordinator**(Brain and Spinal cord) process information coming from sensory receptors
- ❖ **Effectors** (Muscle and Gland), the part of the body which give response to stimuli

Neurons (nerve cell)

☞ the basic unit of nervous system, it contains 3 parts;

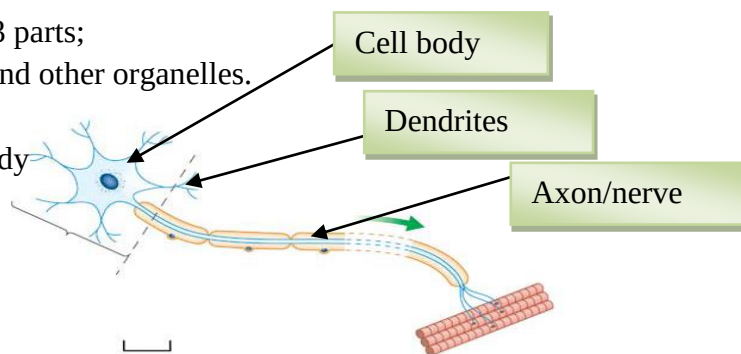
1) **Cell body:** contains nucleus, mitochondria, and other organelles.

2) **Dendrites** slender finger-like projection

- Receive impulse and conduct to cell body
- Join one neuron with other

3) **axon (nerve fiber)**

- long and thin carry nerve fiber
- Carry impulses away from cell body.
- The axon membrane changes its permeability to sodium ions to create an electrical impulse



- ❖ **Myelin sheath** provides a layer of insulating material so the nerve impulse travels as fast as possible.
- ❖ **Synapse** is the junction (gap) two type; synapse in spinal reflex found in **grey matter**
 - **Neuron-neuron junction** is the junction between two neurons (axon-to-dendrite)
 - **Neuromuscular junctions** is the junction between an axon terminal of a motor neuron and a muscle fiber

☞ **Type of neuron**

I. **Affector, Afferent, Sensory neuron**

- Carry impulses from receptor to CNS /spinal cord and brain/
- **Cell body** is located in **dorsal root spinal ganglia**

II. **Effector , Efferent, Motor neuron**

- Carry impulses from the CNS /brain and spinal cord/ to the effectors organs (muscles and gland
- Cell body is found **grey matter of spinal cord.**

III. **Relay (inter neuron)**

- Found in central nerve system
- Connect sensory and motor neuron
- Transfer incoming impulse from sensory to motor neuron

☞ **The pathway of an impulse during nerve coordination**

- Sense organ → afferent neuron → central nervous system → efferent neurons → effector / muscles or a gland /.

Nerve impulse transmission

- ❖ **Nerves** are bundles of neuron fiber. **3 different type of nerve**
 - **Effectors nerves**, carry only effectors neurons
 - **Affector nerves**, carry only affector neurons
 - **Mixed nerves**. carry a mixture of effectors and affector neurons

☞ **Nerve impulse**

- ❖ An electrical message that move from one part of the neuron to others
- ❖ Is an electrical events that is the result of charge difference across the membrane of axon
- ❖ If the neuron is resting or **polarized**. outside positive inside negative
- ❖ When impulse transmit, the positive charge comes inside and the negative charge comes out side. This condition is known as the **action potential**.
- ❖ A neuron during action potential is called **depolarization**
- ❖ **Action potential** is a wave of depolarization across a neuron.

☞ **Neurotransmitter**

- ❖ The electrical impulses cannot jump **synapse** or the gap.
- ❖ An impulse transmits across the synapse by means of chemical transmission called neurotransmitters.
- ❖ The neurotransmitter can be **inhibitory** or **excitatory** chemical.

- ❖ For example acetylcholine has excitatory effect on skeletal muscle but inhibitory effect on cardiac muscle.
- ❖ A number of well-known poisons work by affecting synapses with acetylcholine
 - **Botulinus toxin** affects the first membrane and stops the release of acetylcholine. No transmission of impulses across synapses prevents the nervous system from working and causes death.
 - **Strychnine and organo phosphorus** compounds deactivate the enzymes on the second membrane and so prevent the breakdown of acetylcholine. The nerves fire continuously and the muscles contract all the time causing rigid paralysis.
 - **Curare** stops the second membrane from responding to the chemical transmitter. This causes paralysis as the muscles can no longer be stimulated by the nerves

Central nervous systems; the brain and the spinal cord

1. The Brain

- ❖ Brain is enclosed in membranes and protected by the bones of **skull** and **meninges**, a membrane that surround the brain
- ❖ Each side of your body is controlled by the opposite side of your brain –
 - The left-hand side of brain is good at processing information and largely controls speech,
 - While the right- hand side is better at special awareness and recognizing faces.
 - If the right-hand side of your brain is damaged you may be unable to recognize even your closest family.

☞ Cross section of the brain.

- **Grey matter** the bulk of the brain– the cell bodies of neurons and the synapses that connect them.
- **white matter** is Inside the brain -the axons that lead into and out of the brain

☞ Parts of the brain

a) The fore brain consists

❖ The Cerebral Hemispheres

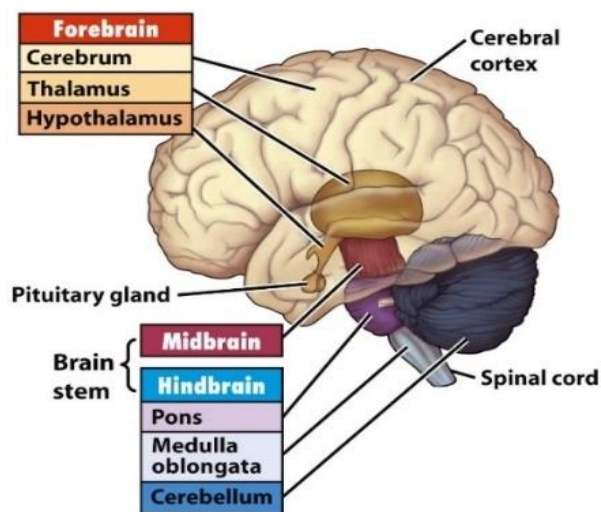
- Involved in speech, intelligence, thought
- Dealing with coordination of sensory and motor function

❖ Hypothalamus regulation of temperature, hunger, thirst, sleep, emotion and reproductive behavior

b) The mid brain that deal with vision (the optic lobes)

c) Hind brain consists;

- ❖ **Cerebellum** deal with balance and orientation
- ❖ **Medulla** regulate respiration, breathing, Circulation and salivation



2. The spinal cord

- ❖ Runs out from brain down body.
- ❖ It is encased and protected by the vertebrae

☞ The cross section of spinal cord

- ❖ The **grey matter** are in the middle
 - Contain short relay neurons and cell bodies motor neuron
- ❖ The **white matter** is on the outside.

☞ Root of spinal cord

- ❖ **Dorsal root** at the back of the spinal cord
 - Sensory impulse enter the spinal cord through dorsal root
 - Contain sensory (afferent) neuron
- ❖ **Ventral root** at the front of the spinal cord
 - Motor impulse leave the cord to the effectors organ through Ventral root
 - Contain motor (effector) neuron

☞ Function of spinal cord

- ❖ It serves as a **center of reflex action**
- ❖ It serve as the pathway of motor impulse from the brain to various part of the body and also sensory impulse from various part of the body to brain

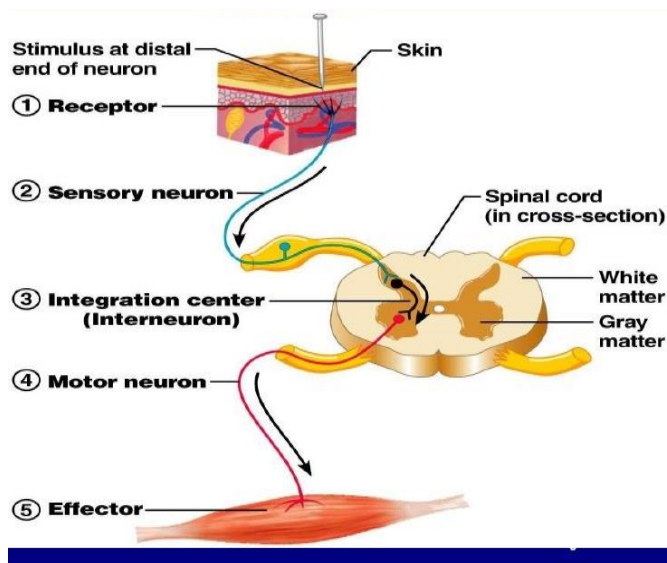
Reflexes (Reflex action)

- ❖ Is sudden ,automatic, and uncontrolled response part of the body or the whole body to external stimuli
- ❖ Important for the body by providing a means of protection and homeostatic reaction automatically

Reflex arc is the neural pathway during reflex. It involves;

- ❖ Stimulus → **Receptor** → **Afferent neuron** → **Coordinator** → **Efferent neuron** → **Effectors (muscle and gland)** → response
- ❖ There are two type of reflex action
 - I. Simple reflex action
 - II. Conditioned reflex action

❖ 5 essential component of reflex arc



1) Simple reflex action

- ❖ A very rapid, involuntary, Automatic response to stimuli
- ❖ Example of simple reflex action
 - Knee-jerk reflex
 - Withdrawal from heat
 - Blinking of the eye sneezing , coughing

2) Conditioned reflex

- ❖ It is not inborn
- ❖ It is dependent on past experience and training
- ❖ Example Pavlov's experiment

A. Before conditioning

- ❖ Food(unconditioned stimulus) $\xrightarrow{\text{RESPONSE}}$ salivation =unconditioned response
- ❖ Hand bell (neutral stimulus) $\xrightarrow{\text{RESPONSE}}$ no salivation (no response)

B. During conditioning

- ❖ Hand bell +food $\xrightarrow{\text{RESPONSE}}$ salivation- unconditioned response

C. After conditioning

- ❖ Hand bell (conditioned stimulus) $\xrightarrow{\text{RESPONSE}}$ salivation (conditioned response)

The difference between reflex and voluntary action

Reflex action	Voluntary action
➤ Is an involuntary action in response to impulse imitated by stimulus	➤ Are responses to stimuli that are consciously controlled by the brain
➤ It is not under the control of the will	➤ It is under the control of the will
➤ E.g. blinking, salivation, coughing, peristalsis, secretion, heart beat	➤ E.g. Writing, Dancing, Eating, Driving, singing, Walking

Drug abuse

- ❖ **A drug** is a substance which alters the way in which mind, or body, or both, works. .
- ❖ In Ethiopia caffeine, nicotine, khat and alcohol are the legal recreational drugs.
- ❖ **Drug abuse** is use a substance to the point of excess and/or dependence.
- ❖ **Drug dependence** is use a drug again and again and become addicted.
 - **Psychological dependence** – the need to keep using it becomes a craving or compulsion.
 - **Physical dependence**; where your body no longer works properly without added chemical extras.
- ❖ **Withdrawal symptoms.** an addict tries to stop using their drug
 - Feel very unwell,
 - often experiencing combinations of aches and pains,
 - Shaking, sweating, headaches,
 - Cravings for the drug
 - Even fevers as the body reacts –
- ❖ Alcohol, khat and tobacco are legal drugs in Ethiopia but cannabis is illegal.

1. **Smoking** the addictive drug in cigarette smoke is **nicotine**, physically addictive.

- ❖ Smoking increases the risk of developing the following diseases:

☞ **Coronary Heart Disease**

- ❖ The chemicals in the tobacco smoke affect the walls of arteries.
- ❖ They make the blood vessels supplying oxygen to the heart narrow.
- ❖ This reduces the blood supply to the heart and other areas of the body.
- ❖ Tend to damage the smooth lining of the arteries, **atherosclerosis** will occur.

☞ **Strokes**

- ❖ Damage or blocked of the blood vessels taking blood to the brain
- ❖ This may lead to paralysis, memory loss and even death.

☞ **Lung Disease**

- ❖ **Tar and other chemicals** in tobacco smoke damage the tissues of the lungs a
- ❖ This lead the risk of developing chronic obstructive pulmonary disease (**COPD**) and **lung cancer**.

☞ **Cancers (lip, mouth, throat, pancreas, bladder and kidney)**

- ❖ Many of the chemicals in cigarette smoke are **carcinogenic (cancer causing)**

2. **Alcohol**

- ❖ Alcoholics people who are addicted to alcohol may develop **cirrhosis of the liver** disease destroys liver tissue. They can also get liver cancer
- ❖ Drinking alcohol have social and economic impact on people

3. **Khat**; the drug **cathinone** from the khat leaves is absorbed into the bloodstream and affect the body

4. **Cannabis (marijuana)**

- ❖ It is a dangerous hallucinogen drug that contain a chemical called cannabinoids,.
- ❖ **Delta-9 tetrahydrocannabinoid (THC)**. THC is known to affect the brain cells responsible for memory, emotion and motivation.
- ❖ Hallucinogens are drugs that produce vivid waking dreams,

5. **LSD (lysergic acid diethylamide)**: this is a very **strong hallucinogenic drug made in the laboratory**.

6. **Cocaine**

- ❖ It is a highly powerful stimulant drug that is finalized by depression.

7. **Heroin**

- ❖ Heroin is medically as very **good painkillers and as recreational drugs**,
- ❖ Increase the risk of liver diseases such as hepatitis, heart and brain damage.

Review exercise

Choose the best answer

1. Which of the following is not the part of central nerve system
A. Medulla B. Nerve C. cerebellum D. Spinal cord
2. The function of relay neuron is
A. Carrying nerve impulse from receptor to brain
B. Carrying nerve impulse from receptor to spinal cord
C. Carrying nerve impulse from brain to effectors
D. Linking sensory and motor neurons together
3. The gap across which an impulse passes from one neuron to another is an(a)
A. Axon B. Synapses C. Cell body D. Dendrites
4. Reflex response occurs more quickly than voluntary response because the nerve impulse in reflex action
A. are activated without a stimulus
B. are a series of electrochemical waves transmitted from neuron to neuron
C. travel a shorter distance than the impulse of voluntary response
D. travel along the cranial nerve
5. Alcoholics people **under the influence of alcohol losses his ability to think clearly, his ability to walk straight and ability to breathe normally. Based on this evidence, which is the correct order in which alcohol affects the central nervous system.**
A. Cerebrum → cerebellum → medulla
B. Medulla → cerebellum → cerebrum
C. Cerebellum → medulla → cerebrum
D. Cerebellum → cerebrum → medulla
6. Which of the following is called breathing center
A. Cerebellum B. Medulla C. Hypothalamus D. Pons
7. The dendrite of a neuron can carry an impulse only
A. toward the brain C. toward the cell body
B. away from the cell body D. away from the spinal cord
8. Speech and intelligence are associated with the
A. Hypothalamus B. Medulla C. Cerebral hemisphere D. Cerebellum
9. Which of the following system are responsible for the regulation and coordination of body activities?
A. Nervous and muscular systems C. Nervous and endocrine systems
B. cranial nerve and spinal nerve D. Brain and spinal cord
10. **If you breathe deeply after running a kilometer distance, the part of the brain mostly activate is;**
A. Pons B. Spinal cord C. Medulla D. Thalamus

11. The human central nerve system consists of
 - A. Cranial nerve and Spinal cord
 - B. Brain and Spinal cord
 - C. Cranial nerve and Brain
 - D. Cranial nerve and Spinal nerve
12. An example of a conditioned reflex
 - A. Type writing
 - B. knee jerk
 - C. Swallowing
 - D. Sneezing
13. A drunken person may sway about because alcohol affects the normal function of the
 - A. Spinal cord
 - B. Medulla
 - C. Cerebrum
 - D. Cerebellum
14. Which one of the following is not the part of peripheral nerve system?
 - A. Optic nerve
 - B. Auditory nerve
 - C. Spinal cord
 - D. Spinal nerve
15. As you are working on this work sheet, now you think and try to memorize the answer to some questions. Which part of brain is helping you on this?
 - A. Cerebrum
 - B. pons
 - C. cerebellum
 - D. Medulla
16. Which one is the functional unit of nerve system?
 - A. Neuron
 - B. Nerve fiber
 - C. Reflex arc
 - D. Reflex action
17. What do we call a change of electric potential on the surface of neuron when it is stimulated?
 - A. Resting potential
 - B. Neurotransmission
 - C. Action potential
 - D. Polarization
18. Effector organ include
 - A. Muscles and gland
 - B. Brain and Spinal cord
 - C. Sensory receptor and neuron
 - D. Efferent and afferent neuron
19. Which of the following is true about neurotransmitter? It is
 - A. an electric events across the membrane of axon
 - B. an electric potential on the surface of a cell
 - C. a gap whenever one neuron ends and another begins
 - D. a chemical released when a neuron reaches at a synapse
20. Which of the following statements describes the harmful effect of drugs? It
 - A. Exposes the user to sexually transmitted disease
 - B. Improve the living system the entire community
 - C. Increase the concentration for proper management
 - D. Help to make good decision throughout life
21. Which of the following action considered as reflex?
 - A. Walking
 - B. Drinking
 - C. Swimming
 - D. Sneezing
22. After information is processed in the central nerve system, instruction are sent to the body by specific neuron which are known as
 - A. Afferent neuron
 - B. Efferent neuron
 - C. Relay neuron
 - D. Sensory neuron
23. Which one of the following statements is correct about reflex arc? It is
 - A. flow of impulse from sensory neuron to the brain and spinal cord
 - B. flow of impulse from the spinal cord to the brain and back to sense organ
 - C. flow of information from receptors to the spinal cord and to the effectors
 - D. unidirectional flow of information from receptors to spinal cord

24. Which structure of the brain is situated in the posterior region?
A. Cerebrum B. Thalamus C. Medulla oblongata D. Hypothalamus
25. When you learn biology in your class room, which portion of your brain helps you to remember the concept?
A. Hypothalamus B. Medulla oblongata C. Cerebrum D. Cerebellum
26. The axon of motor neuron is connected in;
A. Relay neuron B. Motor neuron C. Muscle fiber D. Dorsal root
27. Which of the following is true of a resting neuron?
A. It is polarized C. Out sides member become negative
B. It is depolarized D. It has an action potential
28. The peripheral nervous system is composed of;
A. Cranial and spinal nerve C. sensory nerve only
B. motor nerve only D. spinal nerve only
29. Neuron in spinal reflex make synapse in the;
A. White mater B. Grey mater C. Dorsal root D. Ventral root
30. A long cytoplasmic fiber that send message to the surrounding neuron is known as;
A. Axon B. Nucleus C. Cell body D. Auricles
31. Which of the following is situations is the most likely to produce a reflex action?
A. Seeing a meal B. Reading text book C. Climbing tree D. Receiving a present
32. Suppose a person holds a very hot object and does not feel a burning pain in his hand. Which of the following neuron is probably damage in his hand?
A. Sensory B. Motor C. Relay D. Effectors
33. The nerve impulse that carry impulse to muscle and glands are called?
A. Relay neuron B. motor neuron C. sensory neuron D. afferent neuron
34. The most anterior part of your brain is called;
A. Cerebral hemisphere B. cerebellum C. spinal cord D. medulla
35. In the reflex action, in which of the following does impulse reaches last? To;
A. Effectors B. efferent neuron C. receptor D. coordinated

ANSWER.1B, 2D, 3B, 4C, 5A, 6B, 7C, 8C, 9C, 10C, 11B, 12A, 13D, 14C, 15A, 16A, 17C, 18A, 19D, 20A, 21D, 22B, 23C, 24C, 25C, 26C, 27A, 28A, 29B,30.A , 31.A, 32.A, 33.C, 34.A, 35.A

3.2 Sense organs

- ❖ Sense organ contain sensory receptor that detect a particular stimulus,
- ❖ A sensory organ is an organ that contains a large number of sensory receptor cells and the human eye is a good example
- ❖ Sensory receptors can change energy of the stimulus into electrical energy in nerve impulse

Receptor	Energy
❖ Eye (retina,provides vision)	❖ Light
❖ Ear (cochlea , organ of hearing)	❖ Sound
❖ Ear (semi-circular canals, organ of balance)	❖ Movement (kinetic)
❖ Tongue (taste buds , enable us to taste)	❖ Chemical
❖ Nose (olfactory organ or organ of smell)	❖ Chemical
❖ Skin (touch, pressure and pain)	❖ Movement (kinetic)
❖ Skin (temperature receptors)	❖ Heat
❖ Muscles (stretch receptors)	❖ Movement (kinetic)
❖ Arteries and brain (chemo receptors responding to pH and carbon dioxide levels)	❖ Chemical

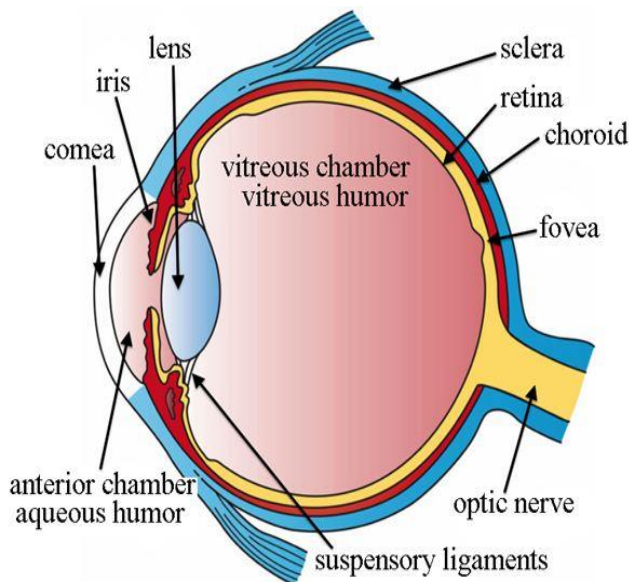
THE HUMAN EYE

☞ Eye protection

- ❖ **Sockets** the cavity in the skull in which eye is situated.
- ❖ **Eyelids**, **eye brow**, **eye lash** protect the eye from the entry of material like dust, sand
- ❖ The conjunctiva; transparent mucus membrane covering the front of eye ball
- ❖ Tear; a salty solution contain an enzyme called lysosome that kill some bacteria. Tear is secreted by tear gland or lachrymal gland.

☞ Parts of the eye

- A. **The sclera:** the tough, opaque external covering of the eye.
Important to protect and maintain the shape of eye ball , white part of eye
- B. **Cornea** transparent front part of sclera , important to bend light ray toward retina
3. **Choroid** the middle pigmented layer of the eye. rich in blood vessel that supply nutrient and oxygen to the cell of retina
4. **Pupil;** is a hole in the center of the iris, through which light enter the eye
5. **Iris** is the colored part of the eye
-It contain two set of muscle called **circular** and **radial**
-Responsible for controlling the amount of light entering the eye the retina



In dim light

- ❖ The radial muscles contract
- ❖ The circular muscles relax
- ❖ The pupil is pulled open wide (it dilates).

In bright light,

- ❖ The circular muscles of the iris contract
- ❖ The radial muscles relax,
- ❖ Pupil very small (it constricts)

6. **The lens**, a flexible disc that helps focus light on the retina

- ❖ The lens is held in place by suspensory ligaments and the Ciliary muscles.

7. **Suspensory ligaments** elastic-like structures that suspend the lens and pull lens into shape for focusing distant objects onto the retina

8. **Ciliary muscles** eye muscles that automatically contract and change the shape of the lens by changing the tension of suspensory ligaments

9. **Retina**; the inner layer of the eye

- ❖ It contains special light-sensitive **photoreceptors** called rods and cones

Rods	Cones
❖ Respond to relatively low light levels, ❖ Do not give a very clear image ❖ They do not respond to different colors, everything looks black and grey ❖ Distributed evenly on retina except fovea ❖ Fewer in number on retina ❖ The pigment in the rods that responds to light is based on vitamin A. ❖ A lack of vitamin A in the diet causes Night blindness	❖ Responsible for bright light color ❖ They give a very clear, defined image ❖ Responsible for color vision ❖ More concentrated in and around fovea ❖ Occur greater on retina ❖ Color blindness is the genetic disorder inability of the eye to distinguish colors like red, blue and green

I. Fovea (yellow spot)

- ❖ The most sensitive part of retina
- ❖ It contain cones, Most light ray are focused on it

II. Blind spot

- ❖ The point where light optic nerve leave the eye
- ❖ There is no cones and rods on blind spot
- ❖ The light ray falls on blind pot do not form image

10. **Aqueous humor**; is a watery fluid that fill the front chamber of the eye,

- ❖ maintain the shape of eye ball

11. **Vitreous humor**; is jelly like (semi solid) substance that fill the area behind retina. it also maintain the shape of eye ball

12. **Optic nerve**; the bindle of nerve fibers that transport nerve impulse from retina to brain

☞ **Accommodation; the ability of the eye focusing near and distance object**

Focusing on a distant object	Focusing on a nearby object
❖ Ciliary muscles relax ❖ Suspensory ligaments pulled tight ❖ lens 'flat' and less convex (flatter)	❖ Ciliary muscles contract ❖ Suspensory ligaments slacked off ❖ Lens more rounded and more convex (rounded)

Common eye defects

☞ Short sight(myopia)

- ❖ The condition where the eye can only see near object
- ❖ Cannot see object from long distance
- ❖ Image of far object formed in front of retina

Caused by

- ❖ **Longer eye ball** than normal
- ❖ Lens is '**too strong**' and **curved**
- While Ciliary muscle relaxed

Corrected by

Wearing **diverging (concave)** lens

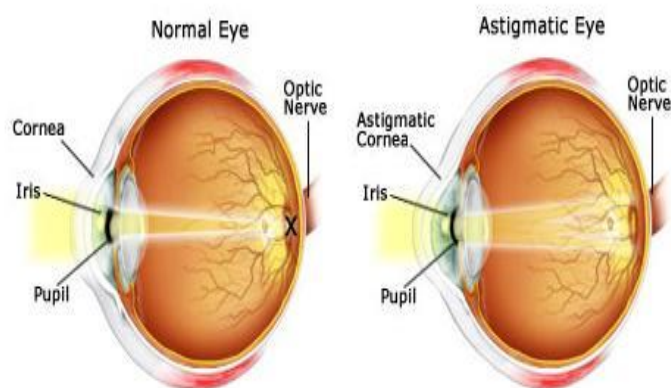
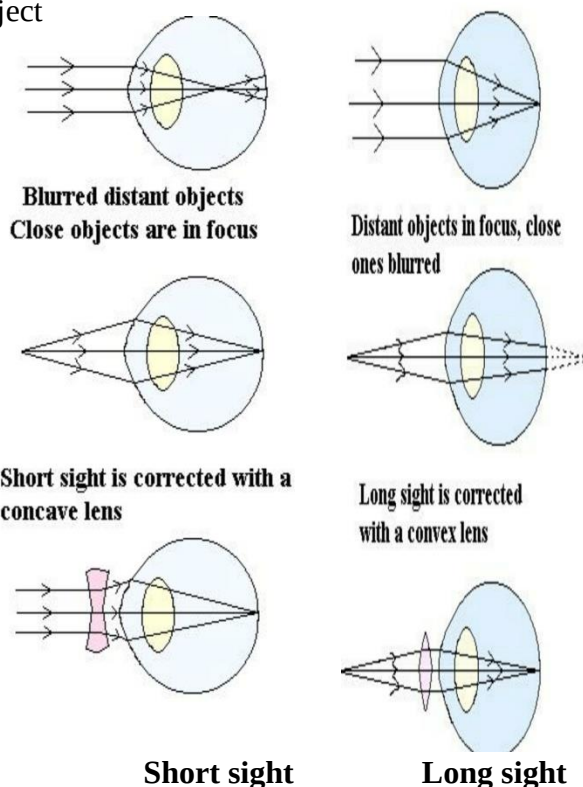
☞ Long sight (hypermetropia)

- ❖ A condition where the eye can only see far object
- ❖ Nearby object cannot see clearly
- ❖ Image of near object focused behind retina

Caused by

- ❖ **Short eye ball** than normal
- ❖ A lens is '**too weak**' and **flat** while Ciliary muscle Contracted

Corrected by; wearing converging (convex) lens



☞ **Astigmatism:** is a type of refractive error in which the eye does not focus evenly on retina

- ❖ **Caused by;** The egg shaped eye instead of round
- ❖ The cornea is curved asymmetrically and this affects the way light is focused on retina.
- ❖ **Corrected by;** irregular lens

Review exercise

Choose the best answer

1. Which one of the following eye defects is correctly matched with its corrective measure?
A. Long sight- diverging lens C. Short sight –irregular lens
B. Long sight-Convex lens D. Astigmatism –any eye glass
2. What is accommodation? it is the ability of the eye to
A. Change the shape of lens to focus object
B. Change the shape of retina to focus object
C. Focus far object then close object
D. Focus object during the night time
3. How image is formed in human eye? When light from an object is focused on
A. Retina B. Iris C. Cornea D. Lens
4. Astigmatism is one of the common eye defects which is caused by
A. Regular shape of the eye which become more round
B. Lens that is too strong and curved while Ciliary muscle is relaxed
C. Lens is too weak and flat while Ciliary muscles contracted
D. The egg shape of eye instead round
5. The flexible disk that help to focus light on retina of the eye is
A. Choroid B. Iris C. Pupil D. Lens
6. Older people have accommodation problems and they cannot focus easily on close objects? What is the cause of this problem
A. Hardening of the lens C. Smoothness of the eye ball
B. Roughness of the eye ball D. Weakening of the lens
7. Which of the following part of the eye is responsible for controlling the amount of light reaching the retina?
A. Cornea B. Pupil C. Iris D. Choroid
8. When Melat look at near object forms blurred image. As the object far and far to him, the image become clear. Melat's eye defects is called
A. Long sight B. Short sight C. Astigmatism D. Color blindness
9. Eye color such as black or blue eye, actually refer the color of?
A. Pupil B. Iris C. Sclera D. Retina
10. The cell responsible for color vision in vertebrates are called
A. Rod cell B. Cone cell C. Bipolar cell D. Scapula cell
11. The fluids that fill the chamber of the eye in front of the lens is known as:
A. Tear B. Salty water C. Aqueous hummer D. Vitreous hummer
12. The iris is the continuation of the;
A. Cornea B. choroid C. Sclera D. retina
13. Which of the following abnormality of the eye cannot be corrected by wearing of leans?
A. Astigmatism B. Night blindness C. Short sightedness D. Long sightedness

14. Which structure of human eye does not refract light?
A. Cornea B. Lens C. Pupil D. Vitreous humor
15. Which of the following eye problems is caused by poor diet;
A. Trachoma B. Astigmatism C. Night blindness D. Short sightedness
16. Suppose you were sitting in your class room and studying your notes. Suddenly you heard a sound outside in the field and glanced through the window. What happen to the lens of your eye?
A. It became rigid B. It became thicker C. It became thinner D. No change at all
17. Nerve impulse are carried from the eye to the brain by:
A. Optic nerve B. Auditory nerve C. Olfactory nerve D. Spinal nerve
18. What do we call the regions of the retina where light sensitive cell are not found?
A. Yellow spot B. Optic lobe C. Conjunctiva D. Blind spot
19. As one get older he / she become long sighted. What kind of eye glasses would you advise him/ her to were, eye glass with
A. Concave lens B. Converging lens C. Combination of the two D. Diverging lens
20. Which of the following is not the cause of short sight?
A. Long eye ball C. Short eye ball
B. Weak Ciliary muscle D. Rigid lens
21. In the eye of long sighted person image of near object formed;
A. In front of the retina C. No image is formed
B. Behind the retina D. On the retina
22. Which of the following is takes place during image formation?
A. Divergence of light by aqueous humor C. Refraction of light by lens
B. Refraction of light by sclera D. Divergence of light by cornea
23. If a problem of focusing the image behind the retina, which type of lens can be prescribed to correct the problem?
A. Flat B, Concave C. Convex D. Scattering
24. Which part of the eye regulates the size of pupil?
A. Lens B. Cornea C. Retina D. Iris
25. Part of human eye that is filled with blood vessels?
A. Pupil B. Sclera C. Iris D. Choroid
26. A flexible disk that helps to focus light on the retina of the eye is
A. Cornea B. Pupil C. Iris D. Choroid
27. How image is formed in human eye? When light from an object is focused on
A. Cornea B. Retina C. Iris D. Lens
28. Which of the following part of the eye responsible for controlling the amount of light entering the eye? A. Cornea B. pupil C. Iris D. Choroid
- Answer: 1B, 2A, 3A, 4D, 5A, 6D,7B, 8A,9B,10B,11C,12C,13B,14C,15C,16C, 17A, 18B, 19B, 20C, 21B, 22C,23C, 24D, 25D,26A, 27B, 28C

THE EAR

☞ The human ear are responsible for

- Hearing
- Balance and position

☞ The ear divided into three regions

A. Outer(external ear)

Pinna; direct sound wave into ear canal

- Helps to know the direction of sound

Ear canal

- Used to direct sound wave to eardrum
- Have gland to produce wax inside ear canal
- Wax use;
 - ✓ Trap dust and germs
 - ✓ Lubricate the ear drum

Ear drum (tympanum)

- A tiny and delicate membrane

B. The middle ear (air filled cavity)

- It contain three tiny bones (**ossicles**)
 - ✓ **Hammer /malleus/**attach to ear drum
 - ✓ **Anvil /incus/**
 - ✓ **Stirrup /Stapes/** attach to oval window
- **Eustachian tube;** helps to equalize air pressure between outer and middle ear

C. The inner ear / fluid filled cavity/ consists;

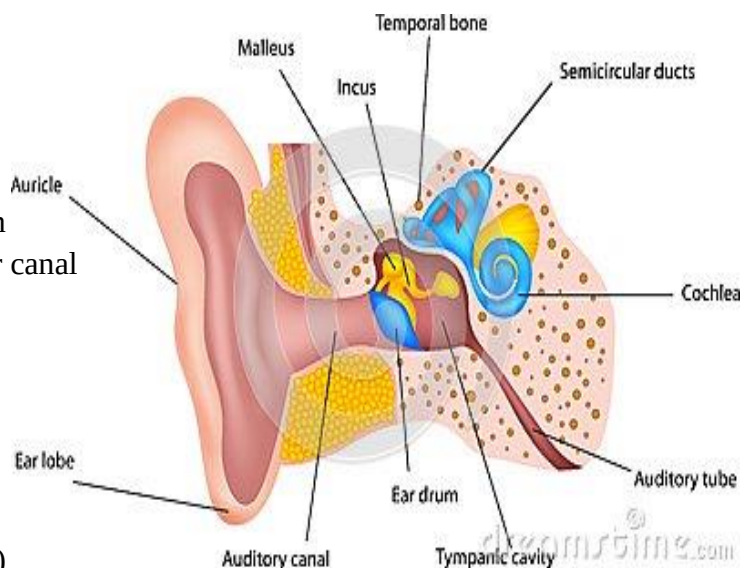
- **Cochlea** a coiled tube
 - ✓ Contain nerve ending of auditory nerve
 - ✓ It is sensitive to sound vibration
- **Semicircular canal;** consists of cell that are sensitive to the motion of body
- **Utricullus and sacculus;** are concerned with the balance and posture

☞ **The path way of vibration in the ear**

Pinna → ear canal → **eardrum** → Hammer /malleus → Anvil /incus/ →
Stirrup/stapes → oval window → cochlea → auditory nerve brain → sense of hearing

☞ **Common disorder of the ear**

- ❖ Partial hearing loss is called **hearing impairment**
- ❖ The total loss of hearing is called **deafness**
- ❖ Some of the common hearing impairment and deafness are;
 - Obstruction of auditory passage
 - Inflammation
 - Loud noise Infection



TASTE AND SMELL

☞ Tongue

- ❖ Taste are caused by chemical stimuli
- ❖ **Taste bud** are sensory receptor of taste
 - Located on the upper surface of the tongue
 - Sensitive to dissolved substance on the tongue
- ❖ There are five different types of taste buds spread evenly across the tongue. these are:
- ❖ **Sweet, Sour, Bitter and Salt** recently discovered a fifth taste called **Umami**.
 - **Umami** is a very savory flavor found in foods such as meat, cheese, broth and mushroom.

☞ The nose

- ❖ Smell is caused by chemical stimuli
- ❖ Smell receptor are called **olfactory cells**
 - Olfactory cells located in the roof of nasal cavity
 - Similar to sense of taste however, nose **detects dissolved chemical at distance**

THE SKIN AS A SENSE ORGAN

- ☞ Human skin is sensitive to five types of stimuli **touch, temperature, pain and pressure**. Due to the following receptors

I. Meissners corpuscles; Touch

II. Pacinin corpuscles; pressure

III. Thermo receptors; Temperature /Coldness and hotness/

IV. Nocireceptors; pain

☞ Importance of the skin

- ❖ It forms a waterproof layer around body tissues,
- ❖ It protects from the entry of bacteria and other pathogens.
- ❖ It protects from damage by UV light from the sun.
- ❖ It is an excretory organ (nitrogenous wastes are lost in your sweat).
- ❖ It is vital in controlling body temperature.

☞ Skin has three main layers.

- ❖ **Hypodermis/Subcutaneous layer/;** the lower layer,
 - Contains fatty tissue which helps to insulate the body against heat loss.
- ❖ **Dermis;** the middle layer
 - Contains **blood vessels, sweat glands, sensory receptors** and **hair follicles**.
 - Closely involved in **temperature control in homeostasis** and **sense of touch**.
- ❖ **Epidermis;** the upper layer /made up of dead cells/.
 - Stop water loss and also protect against the entry of pathogens.
 - particularly involved in the homeostatic mechanisms of the skin

Review exercise

Choose the best answer

- 1) *The incoming sound wave pass from middle ear to inner ear :*
A. Eardrum B. Oval window C. Eustachian tube D. Ossicles
- 2) *Which of the following ear bones directly transmit sound waves to cochlea?*
A. Stapes B. Malleus C. Incus D. Ampulae
- 3) *Which of the following human ear collects sound waves?*
A. Ear canal B. Pinna C. Eustachian tube D. Cochlea
- 4) *Which of the following bones of the middle ear fits between the other two*
B. Stapes B. Malleus C. Stirrup D. Incus
- 5) *How is the pressure in the middle ear equalizing to that in the throat when you are flying in an aero plane?*
A. By shacking your head continuously C. By plugging Cotton into your ear canal
B. By opens the Eustachian tube D. By closing the pinna over the ear canal
- 6) *Which of the following bones of the middle ear attach to eardrum?*
A. Stapes B. Malleus C. Stirrup D. incus
- 7) *Which of the following structure is different from others?*
A. Malleus B. Incus C. Stapes D. Sclera
- 8) *Receptor that detect body passion are found in*
A. Nose B. Skin C. Ear D. Eye
- 9) *Which ear ossicles vibrate last to transmit sound wave to the inner ear?*
B. Anvil B. Hammer C. Stirrup D. Malleus
- 10) *Which of the following sense are detected the same sense organ?*
A. Sight and smell B. smell and taste C. Hearing and balance D. Hearing and sight
- 11) *The sense of receptor in the skin that enable as to distinguish between rough and smooth surface is known as;*
A. Meissines's corpuscles C. Nociceptorse
B. Pacinian corpuscles D. Thermo receptors
- 12) *Which of the following stimuli respond by tongue?*
A. Sound B. Movement C. Light D. Chemical
- 13) *How are the sensory cells of semicircular canals in the inner ear stimulated to initiate a nerve impulse? To correct the problem (reed text book page 86)*
A. Vibration of ear drum C. Vibration of the ossicles
B. Titling of otoliths D. Titling of cupula

Answer: 1B, 2A, 3B, 4D, 5B, 6B, 7D, 8C, 9C, 10C, 11A ,12D, 13D,

3.3 THE ENDOCRINE GLAND

☞ Glands are structures that produce hormone and other useful substance.

There are two types of glands

☞ **EXOCRINE GLAND (duct gland)**

- ❖ Release its secretion in to its ducts
- ❖ Some example of exocrine gland
 - Salivary gland
 - Sweat gland
 - Mammary gland
 - Pancreatic gland
 - Intestinal gland

☞ **ENDOCRINE GLAND (ductless gland)**

- ❖ Gland without duct
- ❖ Transport there secretion through **blood vessels**
- ❖ Produce a chemical called **hormones**
- ❖ **Hormones** are chemical messengers which carry information from one part of the body to other.
- ❖ Hormones exert their influence on certain body parts called **target organs**
- ❖ The cells contain receptor cells specific to the hormone to find target cells
- ❖ Hormones have a long term effect on the body such as growth, development, metabolism, reproduction
- ❖ Some examples of endocrine glands;

1. PITUITARY GLAND

- ❖ **Found in the brain**
 - ❖ Control the activity of other endocrine glands. Thus, it is called **master gland** or an **endocrine orchestra**
 - ❖ Pituitary gland secretes the following hormones
- A. Growth hormone** regulates the development of bone and muscle
- ❖ Low secretion **dwarfism(very short)**
 - ❖ High secretion **gigantism (Very tall)**
- B. Thyroid stimulating hormone (TSH)** stimulates thyroid gland to produce thyroxine hormone
- C. Gonadotrophic hormone(GTH)**
- ❖ **Follicular stimulating hormone(FSH)** stimulates the development of egg in ovary
 - ❖ **Luteinizing hormone(LH)** stimulates the production of progesterone in female and testosterone in male
- D. Antidiuretic hormone** stimulates reabsorption of water by kidney tubules
- E. Oxytocin hormone** secretes at the end of pregnancy to initiate uterus contraction to cause birth

2. THYROID GLAND

- ❖ Found in neck region in front of wide pipe
- ❖ Secret iodine contain hormone called **thyroxin**
- ❖ It involve in regulation of
 - Rate of metabolism
 - Stimulate the conception of oxygen by most cell
 - Development of brain in children

Too much thyroxin	Low level of thyroxin
❖ Metabolic rate will rise ❖ Heartbeat, blood pressure rises ❖ People with this condition may have ➤ Loss of weight(Thin body) ➤ Irritable or restlessness ➤ Heavy sweat	❖ Metabolic rate decrease ❖ People with low thyroxin; ➤ People feel tired and lack of energy ➤ Weight gain ➤ Miscarriage in pregnant women ➤ Reduce mental and physical development in children known as cretinism The deficiency of thyroxin in adult human results thyroid gland enlarges. This condition is known as goiter Goiter prevented by including more iodine in our diet

3. PARTHYROID GLAND

- ❖ Four tiny structure found at the back of thyroid gland
- ❖ Produce a hormone called **parathyroid hormone (Parathormon)**
- ❖ Parathyroid hormone control the amount of calcium ion in body fluids
- ❖ Calcium ion necessary for bone formation.
- ❖ Parathyroid hormone promotes the release of calcium ion from;
 - Bone
 - absorption from calcium ion from food in small intestine
 - re-absorption of calcium ion from kidney tubules

4. PANCREASE

- ❖ Pancreases is both endocrine and exocrine gland
- ❖ Contain endocrine gland called '**islets of langerhans**'
- ❖ Secretes two hormone known as **insulin** and **glucagon**
- ❖ Control blood glucose level in the body
- ❖ Insulin and glucagon are **antagonistic hormones** because they have opposite effect on glucose level.

INSULINE	GLUCAGON
❖ Secretes when blood glucose level higher than normal ❖ Decrease blood glucose level by; ➢ Glucose is removed by cellular respiration ➢ Increase the take up of glucose by cells ➢ glucose is converted into glycogen in liver and muscle cell ➢ glucose → glycogen	❖ Secretes when blood glucose level hlower than normal ❖ Increase blood glucose level by; ➢ Stimulate the conversion of glycogen into glucose glycogen → glucose ➢ Stimulate the formation of glucose from amino acid and fat ❖ The deficiency of insulin and glucagon cause the disease called diabetes

- ❖ **Type 1 diabetes :** appeared in children, It is inherited ,cannot be avoid
- ❖ **Type 2 diabetes:** appeared in person life, can be linked , being obese

5. ADRENAL GLAND

- ❖ Found on the top of kidney
- ❖ Adrenal gland have two separate and independent parts
 - Adrenal cortex (outer layer)
 - Adrenal medulla (Inner layer)

Adrenal medulla (fight and flight hormone)	Adrenal cortex
❖ Produce a hormone called adrenalin ❖ Secret under stress, emergency, excited, freighted situation ❖ Important for preparing the body for action ❖ The main change produce by adrenalin ➢ Increase heart rate ➢ Increase breathing rate ➢ Pupil dilates ➢ Body hair stand	❖ Secret complex steroid hormone called corticoids ❖ Control certain phase carbohydrate, fat and protein metabolism ❖ Another hormone release by adrenal cortex is aldosterone ❖ This hormone promotes the re-absorption of sodium and chloride ion in the kidney tubules, Therefore affect water and salt balance in the blood

❖ GONADES (sex gland)

A. Testes

- ❖ Produce male sex hormone **testosterone**
- ❖ Control male secondary sexual characteristics such as:
 - The whole body growth spurt, Tests began to produce sperm
 - Pubic, body and facial hair began to produce sperm
 - Voice deepens , Body become ,more muscular

B. Ovaries

- ❖ Produce female sex hormone called **progesterone** and **estrogen**

Estrogen

Cause the development of female secondary sexual characteristics such as;

- The whole body under goes growth spurt
- Brest develop
- Widening of hip
- Ovaries began to produce egg
- Menstruation begins
- Voice become thinner

Progesterone

- ❖ Preparing uterine lining for pregnancy
- ❖ Stops the development of additional while the women is pregnant
- ❖ Prevent menstruation during pregnancy

Menstrual cycle

☞ **Menstruation**; monthly discharge of blood and cell shed from endometrium

- ❖ **Menstrual cycle** is a sequence of events which takes place approximately every four weeks
- ❖ Menstrual cycle occur between two coordinated events

Ovary

- ❖ Graffian follicle ripens and burst releasing the mature egg into the fallopian tube. This condition is called **ovulation**

Uterus

- ❖ Prepare uterine wall to receive zygote (fertilized egg)
- ❖ After ovulation the follicle undergoes change become **corpus luteum**
- ❖ the corpus luteum produce a hormone called progesterone
- ❖ **If the egg is fertilized** progesterone stimulate:
 - The wall of uterus thicken
 - The uterus develop new blood vessels
 - Stop further ovulation
- ❖ The egg moves down the oviduct by muscular contraction of the oviduct wall
- ❖ **If the egg is not fertilize**, the ovum dies and the wall of uterus breakdown and menstruation occur

☞ **Hormones involve in menstrual cycle**

I. Produce by pituitary gland

Follicular stimulating hormone FSH)

- ❖ *Stimulate the development of egg in ovary*
- ❖ *Stimulate the ovary to produce estrogen*

Luteinizing hormone (LH)

- ❖ *Stimulate the release of egg from ovary*
- ❖ *Stimulate the ovary to produce progesterone*

II. Produce by ovary

Estrogen

- ❖ *Responsible for the development of feminine traits*

Progesterone

- ❖ *Prepare the uterus for implantation of fertilized egg*

Review exercise

Choose the best answer

1. **What is the function of thyroxin in human body?**
 - A. Controls metabolic rate of the body
 - B. Control blood glucose concentrations
 - C. Cause the development of embryo in the uterus
 - D. Cause the development of secondary sexual characteristics
2. **What is the cause of diabetes mellitus?**
 - A. Less or no production of insulin by pancreases
 - B. More production of adrenalin by adrenal gland
 - C. Less or no production of bile by liver
 - D. More production of progesterone by ovary
3. **Which of the following g is true about the function of the gonad?**
 - A. Produce hormones of fight and flight
 - B. Control the development of secondary sexual characteristics
 - C. Control the use of oxygen by the body tissue
 - D. Control the metabolic activity of the body
4. **Which of the following structures produces hormone?**
 - A. Neuron
 - B. Vessels
 - C. Gland
 - D. Organ
5. **Which of the following gland produce luteinizing hormone?**
 - A. Thyroid
 - B. Pancreases
 - C. Pituitary
 - D. Adrenal
6. **Which of the following statements is true about exocrine gland? It**
 - A. Include pituitary and thyroid gland
 - B. Has special tube to carry its secretion
 - C. Secret hormone directly into the blood
 - D. Is ductless and control reproduction
7. **In human body, which hormones are used to control blood glucose level?**
 - A. Insulin and glucagon
 - B. Thyroxin and glucagon
 - C. Adrenalin and glucagon
 - D. Testosterone and progesterone
8. **Which of the following is a secondary sexual characteristic of male only?**
 - A. Production of ova by ovary
 - B. Brooding of shoulder and chest
 - C. Beginning of menstruation
 - D. Development of breast
9. **Which of the following method is to treat diabetes?**
 - A. Eating red meat
 - B. Taking more glucose
 - C. Insulin injection
 - D. Taking antibiotics
10. **When there is no pregnancy after ovulation,**
 - A. Follicle is formed in the ovary
 - B. Oestrogen level increase
 - C. The egg is released from ovary
 - D. Progesterone level decrease
11. **The two hormones act as antagonistic to one another in regulating blood glucose level?**
 - A. Thyroxin and insulin
 - B. Adrenalin and progesterone
 - C. Glucagon and estrogen
 - D. Insulin and Glucagon

12. What is the difference between endocrine and exocrine gland? Endocrine glands
- A. are more in number in our body than exocrine gland
 - B. have duct whereas exocrine glands do not have duct
 - C. do not have ducts whereas exocrine glands do have
 - D. release their secretion through ducts to site of destination
13. Which of the following hormone is not correctly paired with its function
- A. Thyroxin-regulates metabolism
 - B. Adrenalin-prepare the body for stressful situation
 - C. Parathyroid hormone-regulates the development of sex hormone
 - D. Insulin- regulate the glucose level
14. The hormone involved in the regulation of the blood glucose level are secreted by
- A. Pancreases
 - B. Thyroid gland
 - C. Gonads
 - D. Liver
15. What happens during ovulation in a woman?
- A. The new egg matures in the ovary
 - B. Follicle forms corpus luteum
 - C. The level of pituitary hormones begins to increase
 - D. The mature egg is released from the ovary
16. The hormone involved in the regulation of the blood glucose level are secreted by
- A. pancreases
 - B. thyroid gland
 - C. gonads
 - D. liver
17. Suppose a girl looked like a boy in her external feature. This situation could be due to the lack of hormone called.
- A. Adrenalin
 - B. Testosterone
 - C. Insulin
 - D. Estrogens
18. The gland which produces a hormone that regulates the level of calcium ion in the blood is;
- A. Adrenal
 - B. Thyroid
 - C. Parathyroid
 - D. Pancreases
19. The endocrine gland which produces at the base of brain is
- A. Parathyroid
 - B. Pituitary
 - C. Adrenal
 - D. Thyroid
20. Which of the following glands would be affected if your kidney is surgically removed?
- A. Parathyroid gland
 - B. Thyroid gland
 - C. Gonads
 - D. Adrenal gland
21. Which of the following deficiency disease is caused by the lack of thyroxine hormone in adult human?
- A. Cretinism
 - B. Diabetes
 - C. Goiter
 - D. Anemia
22. Which of the following method is secreted by pituitary gland?
- A. Luteinizing hormone
 - B. Parathyroid gland
 - C. Progesterone
 - D. Thyroxine
23. The hormone whose deficiency results in slow growth and mental development in children;
- A. Luteinizing hormone
 - B. Parathyroid gland
 - C. Progesterone
 - D. Thyroxine
24. What is the cause of diabetes mellitus?
- A. More production of adrenalin by adrenal gland
 - B. More production of progesterone by ovary
 - C. Less or no production of insulin by pancreases
 - D. Less or no production of insulin by ovary

25. How hormone able to find target cell?

- A. The gland and the cell are located each other
- B. The cell contain receptor cells specific to the hormone
- C. The hormone are taken to the cell by carrier molecules
- D. The hormones and the cells are made up of identical molecules

26. An increase in the level of insulin in the blood would directly result in;

- A. an increase in the level of carbohydrate in the cell
- B. an increase in the level of carbohydrate in the cell
- C. a decrease in the amount of glucose in the blood
- D. a decrease in the amount of glucose in the blood

27. Which of the following hormone cause ovulation?

- A. Oxytocin
- B. Estrogen
- C. FSH
- D. Progesterone

ANSWER: 1A, 2A,3B,4C,5C, 6B, 7A, 8B, 9C, 10,D 11D, 12B, 13C, 14A, 15D, 16A, 17D, 18C, 19B, 20D, 21C, 22A, 23D, 24C, 25B, 26C, 27B,

3.4. REPRODUCTIVE HEALTH

- ❖ **Sexual intercourse** the erect penis of male entering the vagina of the female
- ❖ **Ejaculation** the release of semen from the penis
- ❖ **Fertilization** a single sperm combine with ovum
- ❖ **Zygote** a fertilized ovum
- ❖ The path of sperm in male reproductive structure describe as
Testis → epididymis → vas deference → urethra
 - ❖ The pathway of sperm in female reproductive organ
Vagina → cervix → uterus → oviduct
 - ❖ The process of releasing egg from ovary to fallopian tube is called **ovulation**
 - ❖ Fertilization takes place in the oviduct (fallopian tube)
 - ❖ Fertilized egg (ovum) is called **zygote**
- ☞ **Contraception--** Is a method of avoiding pregnancy or controlling fertility
 - ❖ Different contraceptive method are based on different techniques these are
 - Preventing conception
 - Preventing ovulation
 - Preventing implantation

MAJOR CONTRACEPTIVE METHODS USED BY PEOPLE ARE;

1) NATURAL METHOD

- ❖ Natural birth control method without using hormonal or physical material

☞ Rhythm or calendar method

- ❖ Contraception based on understanding menstrual cycle and predict ovulation time

Advantage there is no side effect

Disadvantage

- ❖ It is not easy to pinpoint ovulation so pregnancy can result
- ❖ Depend on full cooperation on both partner

Effectiveness 10 pregnancy per 100 percent

☞ Breast feeding

- ❖ Delay ovulation and the start of menstruation, because the level of progesterone is high to regulate the feeding breast

2) PHYSICAL OR BARRIER METHOD

☞ Condoms

Advantage

- ❖ No side effect
- ❖ Do not need medical advice
- ❖ Protect against sexually transmitted disease

Disadvantage

- ❖ Sheath may tear or damage during sexual intercourse

Effectiveness; 2.5 pregnancies per 100 woman years

☞ The diaphragm or cap

- ❖ Is a rubber inserted into the vagina before intercourse
- ❖ Prevent the entry of sperm on the cervix
- ❖ 2.5 pregnancy per 100 woman of years

3) HORMONAL METHOD

Use natural hormone progesterone and estrogen to prevent pregnancy

☞ Mixed pill

- ❖ Consists estrogen and progesterone;;
- ❖ **Rises estrogen in the blood results in**
 - Pituitary gland slow down the production of follicle stimulating hormone
 - FSH responsible for maturation of egg
 - If the egg is not mature there is no pregnancy.
- ❖ Rises of progesterone results in;
 - Increase the mucus in the cervix and vagina to prevent the entrance of sperm cell
- ❖ The **most reliable** contraceptive method

☞ Mini pill (progesterone only pill)

- ❖ Does not contain estrogen
- ❖ Does not inhibit ovulation
- ❖ Need to be taken precise time interval

☞ **Hormonal implant**

- ❖ Involves implanting small silicon capsule contains female hormone implanted under the arm of woman
- ❖ If a woman wants to become pregnant the implant can be removed
- ❖ **Advantage** prevent pregnancy up to five years
- ❖ **Disadvantage (side effect)**
 - Changes period
 - Headaches
 - Depression

☞ **Hormonal injection**

- ❖ Prevent pregnancy up to three months
- ❖ Contain female hormone estrogen and progesterone
- ❖ Stops ovulation
- ❖ Changes cervical mucus to prevent sperm getting through

4) STERILIZATION OR SURGICAL CONTRACEPTION permanent contraception

III. Vasectomy (male sterilization)

- ❖ Involves cutting and tying of vas deference
- ❖ Prevent sperm getting into uterus

IV. Tubectomy or female sterilization

- ❖ Involves cutting and tying of fallopian tube
- ❖ Prevent the release of egg from ovary to fallopian tube

5) INTRAUTERINE DEVICE (IUD)

- ❖ A device which is inserted by doctor in the uterus
- ❖ Does not prevent fertilization
- ❖ Prevent implantation
- ❖ Prevent pregnancy up to twelve year

Review exercise

1. *The monthly discharge of blood in human female which starts at puberty:*
A. Menstruation B. Ovulation C. Menopause D. Fertilization
2. *Which of the following is not true about female genital mutilation (FGM)?*
A. it increases the rate of HIV/AIDS
B. it leaves scarring so sexual intercourse is painful
C. it keeps girls pure and necessary for marriage
D. it has big problem giving birth due to searing
3. *In which part of female reproductive structure fertilization usually occurs?*
A. Uterus B. Cervix C. Fallopian tube D. Vagina
4. *Which of the following is the correct order of events?*
A. Fertilization → implantation → ovulation
B. Implantation → Fertilization → ovulation
C. Ovulation → Implantation → Fertilization
D. Ovulation → Fertilization → Implantation
5. *Which one of the following does not produce progesterone?*
A. Corpus luteum B. Oviduct C. Adrenal gland. D. Pituitary gland
6. *Which of the following structures are cut and tied in making male sterilization?*
A. penis B. Epididymis C. Semiferous tubules D. Vas deference
7. *Contraceptive method involves buying of a small silicon capsule containing female hormones under the skin.* A. Hormonal implant B. Mixed pill C. IUD D. hormonal injection
8. *Which of the following forms of birth control does not prevent fertilization?*
A. IUD B. Condom C. Diaphragm D. Vasectomy
9. *Which of the following contraceptive methods is grouped with hormonal contraceptive methods?*
A. Intrauterine B. Condom C. Norplant D. Vasectomy
10. *Which of the following contraceptive methods can be used by a human male?*
A. Diaphragm B. Hormonal injection C. Vasectomy D. Tubectomy
11. *Which of the following is a physical method of contraception?*
A. Injection B. Implant C. Pill D. Condom
12. *Which of the following is a harmful traditional practice?*
A. Using IUD for birth control C. Female genital mutilation
B. Using female condom D. Discrimination of AIDS patient
13. *What is the role of estrogen in hormonal contraceptive methods?*
A. Slowdown the production of follicle stimulating hormone
B. Prevent the maturation of egg in the ovary
C. Increase the mucus and cervixes in vagina
D. Prevent the fertilization of egg in oviduct E. A&B F. A&C

Answer: 1A, 2C, 3A, 4D, 5C, 6D, 7A, 8A, 9C, 10C, 11D

3.5 HOMEOSTASIS

☞ **Homeostasis:** is the ability of the body maintains a Constant internal environment.

- ❖ Come from two Greek words.

Homoios; like

Stasis; states

- ❖ Keeping internal environment the same state.
- ❖ The body ability to maintain a constant internal environment
- ❖ The ability of an organism maintaining a constant internal environment both in tissue fluids and cells.
- ❖ Homeostasis makes living organism in **steady state**.
- ❖ A **steady state** is the rate of input substance equals the rate of output substance.

3.5.1 Controlling temperature

☞ **Temperature** is a way of measuring hotness and coldness of something.

☞ **Living organism continually gained heat by;**

- ❖ **Conduction** the transfer of heat through direct contact
- ❖ **Conviction** the transfer of heat through the current of air and water
- ❖ **Radiation** the diffusion of heat from warmer to colder through the air
- ❖ **Cellular respiration**

☞ **Living organism continually losing heat by;**

- ❖ Conduction
- ❖ Conviction
- ❖ Radiation
- ❖ Evaporation

With regard to temperature regulation organism can be divided into two major groups.

1. Poikiltherms
2. Homoiotherms

1. Poikilotherms

- ❖ Body temperature governed by external temperature.
- ❖ Body temperature vary over a wide range
- ❖ E.g.; Invertebrates , Fish, amphibians and reptiles

Poikilotherms Organism	Environmental temperature	Body Temp.
Fish	25 ⁰ C	25 ⁰ C
	30 ⁰ C	30 ⁰ C
	40 ⁰ C	40 ⁰ C

2. Homoiotherms

- ❖ Constant internal body temperature
- ❖ Independent of environmental temperature
- ❖ E.g.; Birds and mammals

Homoiotherms organism	Environmental temperature	Body Temp.
Human	25 ⁰ C	37 ⁰ C
	30 ⁰ C	37 ⁰ C
	40 ⁰ C	37 ⁰ C

☞ Temperature controls in Poikilotherms

When hot

- ❖ Move into shade
- ❖ Move into water

when cold

- ❖ press their body to warm temperature
- ❖ Bask in the sun
- ❖ Erect special sails to absorb more heat from the sun

Temperature controls in Homoiotherms

1. Physiological method

i. Heat losing mechanism in response to **hot condition** in order to **cool** the body

A. Sweating carries

- ❖ As sweat evaporates from the skin surface it has a cooling effect because the evaporating liquid carries away body heat.

B. Vasodilations

- ❖ Is the widening(dilates) of blood vessels
- ❖ More blood flows through the capillaries
- ❖ More heat is lost through radiation from the surface

C. Panting and licking

- ❖ Man mammals have thick and furry coat so sweat cannot evaporate from the skin surface
- ❖ Some animals, such as dog and cats may lick themselves with saliva to cool the body
- ❖ They also pant, which allows more heat to evaporate from the moist surface.

ii. Heat gain mechanism operates in response to **cold condition** in order to **warm** the body

A. Vasoconstriction

- ❖ Narrowing (constricts) of blood vessels
- ❖ Reduce the flow of blood through capillaries
- ❖ Reduce heat lost through the surface of skin

B. Piloerection→pulling the hair upright

❖ When body temperature fails (drops)

- Hair erector muscle contract and pulling the hair upright, trapping an insulating layer of air to conserve heat.

❖ When body temperature rises

- Hair lie flat, hair erector muscle relaxes and reduce an insulating layer which makes easier to loss heat by convection.

C. Shivering and metabolic response

❖ When body temperature fails (drops ,cools)

- Metabolic rate speeds up
- The muscle starts shiver and contract rapidly
- The rate of respiration increase to generate more heat

- ❖ **When body temperature rises(warms up)**
 - Shivering stops
 - Metabolic rate drops and less heat produce.

D. Fat layer under skin →subcutaneous fat

- ❖ Serve as an insulator and reduce heat loss from the body in cold climates.
- ❖ Animal that lives in cold climate like polar bear and seal have thick layer of fat which aid in heat conservation.

2. Behavioral method of temperature regulation

- ❖ Clothing
- ❖ Bathing
- ❖ Seeking shade and shelter
- ❖ Taking high calorie food
- ❖ **Hibernation**; animal response to cold environment undergo period of dormancy (deep sleep)
- ❖ **Aestivation** ; Animals response to hot environments undergo a period of dormancy (deep sleep)

3. Morphological method of temperature regulation

- ❖ Surface to volume ratio is the amount of surface area to per unit volume
- ❖ As organism get larger both its surface area and volume increase but the volume increase faster than surface area.
- ❖ Smaller organism tending to have a greater surface area to volume ratio than larger animals
- ❖ Smaller organism tend to loss heat faster than larger organism

To sum up

☞ **Smaller organism**

- ❖ Larger surface area to volume ratio
- ❖ Loss heat faster
- ❖ Adapted to live hot condition

☞ **Larger organism**

- ❖ Smaller surface area to volume ratio
- ❖ Do not loss heat faster
- ❖ Adapted to live cold condition\

HYPOTHERMIA

- ❖ Occurs when your body losses heat faster than it can produce heat
- ❖ Causing a dangerous low body temperature
- ❖ Normal human body temperature is **37⁰c or 98.6⁰F**
- ❖ **Hypothermia occurs** as your body temperature **passes below35⁰c or 95⁰F**

Controlling core body temperature

- ❖ Human being have internal control mechanism (homeostasis)
- ❖ Loss excess heat if core body temperature rises
- ❖ Conserve heat when core temperature starts to fall.
- ❖ **Thermoregulatory center** of the brain (hypothalamus) control the core body temperature
- ❖ The control of core body temperature is an example of **negative feedback loop**.

☞ As body temperature rises; heat lost from the body using:

- ❖ Dilation of blood vessels ,blood flow through the capillaries increase and more heat is lost
- ❖ Lot of sweat produced and hair lie flat

☞ As the core body temperature fails; heat gain to the body

- ❖ Contraction of blood vessels , decrease blood flow to the capillaries, less heat is lost
- ❖ No sweat is produce
- ❖ Hairs pulled erect to trap insulating the air

3.5.2 Homeostasis in the kidney

☞ Kidney, lung and skin are the main excretory organ of the body

☞ Human kidney has **important** in two aspect of homeostasis:

- Excretion
- Osmoregulation

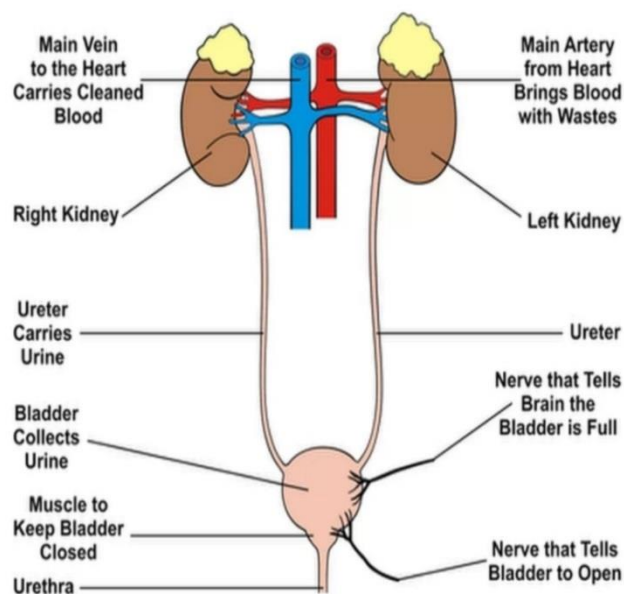
1. Excretion.

- ❖ The removal of metabolic waste from the body
- ❖ Kidney removes nitrogenous waste such as urea.
- ❖ Urea is produced in the liver.
- ❖ Excess amino acid
 - Amino group; convert to ammonia
 - Carboxylic acid: converts to carbohydrate
 - Urea→ammonia + carbon dioxide
 - Urea filtered out of blood by kidney and removed as urine

2. Osmoregulation. Control of water and ion balance in the body

The kidney

- ❖ Blood **filtration and purification organ**
- ❖ Each kidney connected to a tube called **ureter** , carries urine to the bladder
- ❖ **Bladder**; urine is stored until it is ready to be passed away from the body
- ❖ **Sphincter**-a ring of muscle that control the opening of bladder
- ❖ **Urethra**-A duct through which urine is discharged
- ❖ **Renal arteries**; carries oxygenated blood to the kidney
- ❖ **Renal vein**; carries deoxygenated blood away from the kidney



☞ Nephrones

- ❖ Microscopic structure of the kidney
- ❖ Functional unit of the kidney where blood is filtered and urine is produced
- ❖ Consists of a cluster capillaries known as **glomerulus**

☞ Section of nephrones

1. Bowman's capsules site of ultra-filtration

- ❖ **Ultra filtration** the removal of excess water and other substance from the blood into bowman's capsules.
- ❖ **Glomerulus**—the knot of blood vessels in bowman capsules
 - **Afferent arterioles**; arterioles that takes blood into the glomerulus
 - **Efferent arterioles**; arterioles that leading blood away from the kidney
- ❖ **Glomerular filtrate**—the liquid resulting from filtration in the bowman capsules

2. First coiled (convoluted) tubules –Reabsorption of useful substance

3. Loop of Henley- urine is concentrated and more water is conserved.

4. Second convoluted tubules—the main water balance is done.

The role of ADH in second convoluted tube

☞ If the water contents of the blood is too low-

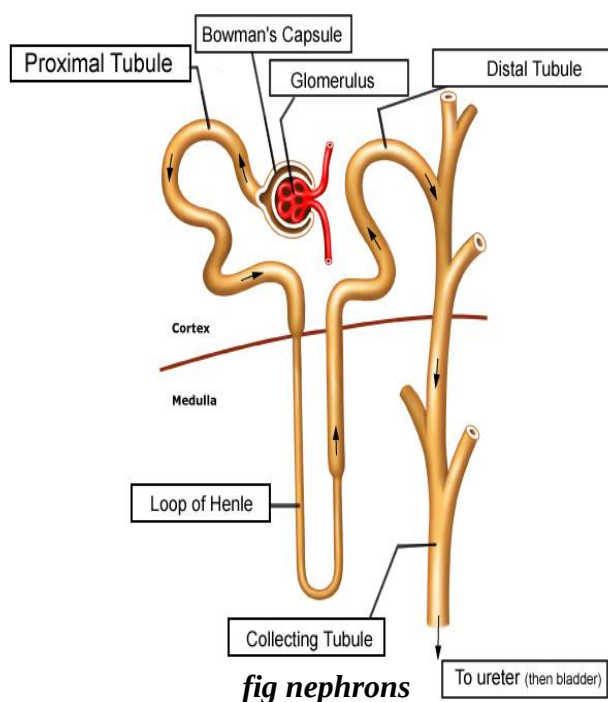
- ❖ More ADH is released into the blood
- ❖ Kidney tubules reabsorb more water
- ❖ Little dark colored concentrated urine is produced

☞ If the water content in the blood is too high

- ❖ Less ADH is released into the blood
- ❖ Kidney tubules reabsorbs less water
- ❖ Much pale colored urine is produced

3.5.3 Liver and homeostasis

- ❖ The liver is the **body's chemical factory**
- ❖ It performs many different chemical Processes.
- ❖ The largest organ in the body and it can regenerates itself if it gets damaged
- ❖ Liver has a special blood supply
 - **Hepatic artery**—carries oxygenated blood to liver
 - **Hepatic vein**-remove deoxygenated blood from liver
 - **Hepatic portal vein**-comes from liver directly from gut
 - Brings the product of digestion to the liver



☞ Liver plays the following role:

- ❖ Regulation of blood glucose level- because glucose is used;
 - ✓ Source of energy
 - ✓ Affect blood osmotic potential
- ❖ Protein metabolism; the process of removing amino group from amino acid is called **deamination**
- ❖ Control toxins -change harmful substance to harmless **Detoxification**
- ❖ Temperature control
- ❖ Control fat and cholesterol in the blood
- ❖ Production of plasma protein

Choose the best answer

1. Which of the following occurs during cold for thermoregulation?
A. Sweat produce B. Hair lay flat C. Narrow blood vessels D. None
2. Among the following, one is mechanism that facilitates the loss of excess heat from the body?
A. Sweating B. Vasoconstriction C. Piloerection D. Shivering
3. Which of the following process living organism gain heat?
A. Cellular respiration B. Conduction C. Conviction D. Evaporation
4. Which of the following is a principal organ for maintaining body water balance?
A. Skin B. Liver C. Kidney D. Anus
5. Which of the following mechanism used by the body to gain heat?
A. Vasoconstriction B. Sweating C. Vasodilatation D. Panting
6. Which part of the nephrons reabsorption of water takes place use ADH?
A. Bowman's capsule B. first coiled tubules C. Second coiled tubules D. loop of henele
7. All of the following are the function of the liver except one;
A. Control sugar level in the blood C. Maintain water balance in the blood
B. Protein metabolism D. Control core body temperature
8. Which process decrease when the human body temperature decreases?
A. Blood flow to the internal organ C. Secretion of sweat
B. Shivering D. Secretion of insulin
9. Feedback mechanism is best described as, the process that
A. Keep body conditions near a normal steady state C. Destroy hormones in the blood
B. Directly control muscle contraction in the leg D. Reduce hormone level below normal
10. Which of the following animal has a greater surface area in proportion to its weight?
A. Whale B. Cat C. Elephants D. mouse
11. Organism undergoes constant chemical changes as they maintain internal balance known as?
A. Recombination B. Homeostasis C. Synthesis D. Interdependence

12. Which of the following will help you to cool the body in hot weather?
A. Sweating B. Fat layer C. Wearing woolen and dark clothes D. Vasoconstriction
13. Some reptiles living in temperate go into very deep sleep for a longer time during cold season. This kind of adaptation is called?
A. Vasoconstriction B. Hibernation C. Aestivation D. Vasoconstriction
14. Which of the following structure of urinary system connects the kidney with the bladder?
A. Loop of henele B. Renal vein C. Urethra D. Ureter
15. Which of the following response to temperature is a physiological response?
A. Bathing B. Sweating C. Aestivation D. Hibernation
16. Which of the following physiological method has a cooling effect on the body?
A. Hibernation B. Vasoconstriction C. Sweating D. Fat layer
17. High level of ADH hormone in the blood indicates that
A. Blood water level greater than salt level C. Water should remove from blood via urine
B. Blood salt level greater than blood water level D. Water and salt level is balanced
18. Which of the following is true about homoeothermic animal?
A. Have variable body temperature C. Unable to control body temperature
B. Include reptiles and fishes D. Have high metabolic activity
19. Which of the following serves as an excretory organ in your body?
A. Pancreas B. Heart C. Liver D. Lung
20. Which of the following is a physiological method of temperature regulation in Homoiotherms?
A. Aestivation B. Panting C. Hibernation D. Bathing
21. Which part of the nephrons are involved in osmoregulation of salt and water
A. Glomerulus and Bowman's Capsule C. First coiled tube and loop of Henle
B. Second coiled tube and loop of Henle D. Collecting duct and second coiled tube
22. It is estimated that the concentration of urea in urine is 60 times more than in the blood. This increase in concentration results because
A. Some urea could be produced in the kidney nephrons
B. The volume of water is decreased in urine.
C. Much of the urea is reabsorbed into the blood.
D. Much of the mineral ions in the blood are removed.
23. Which of the following is correct about anti-diuretic hormone (ADH)?
A. It is produced when the water content of the blood is too low.
B. Its production is initiated by low salt concentration in the blood.
C. It facilitates reabsorption in the first convoluted tubule.
D. It works in the direction of producing dilute urine.
24. Which of the following is an adaptive mechanism for animals in cold climates?
A. Have large surface area to volume ratio. C. They are small in size
B. They have thin layer of fat. D. They have thin skin

25. Which of the following processes takes place in the kidney?
A. Deamination B. Detoxification C. Osmoregulation D. Production of bile
26. Which of the following statement describes deamination?
A. Converting excess amino acids into glycogen and urea
B. Converting excess glucose in blood into glycogen
C. Making alcohol and other poisonous substances to harmless
D. Producing plasma proteins involved in the process of blood clotting
27. Which psychological method of temperature regulation occur in homoeothermic animal in cold environmental condition
A. Sweating B. Panting and licking C. Pillow erection D. Vasodilation
28. Which of following occur during low level of water concentration in the blood?
A. Production of less ADH hormone
B. Production of dilute and small volume of urine
C. Decrease in the absorption of water back to the blood
D. Increase in the permeability of second coiled tube
29. Which of the following contents of blood in the kidneys is not found in Glomerular filtrate?
A. Glucose and Amino acids B. Proteins and RBCs
C. Sodium ions and urea D. Glucose and urea
30. What do you call animals which have body temperature that varies with the external temperature?
A. Aestivation B. Hibernation C. Homoiotherms D. Poikilotherms
31. Which of the following parts of the body is different from the rest in relation to homeostasis?
A. Skin B. Liver C. Kidney D. Heart
32. Which of the following is an adaptation of desert animal to loss excess heat?
A. Thick layer of fat C. Large body size
B. Thick fur coat D. Large and thin ear
33. Which part of the nephrones is the site of ultrafiltration?
A. Bowman's capsules C. First coiled tube
B. Loop of henele D. Second coiled tube
34. The metabolic waste product urea produce in
A. Kidney B. Skin C. Liver D. Lung
35. Which of the following homeostatic mechanism apply when core body temperature drops?
A. Dilation of blood vessels C. Hair pull erect
B. Increase blood flow to the capillaries D. A lot of sweat produce
- ANSWER: 1C, 2A, 3A , 4C, 5A, 6C, 7C, 8B, 9A, 10D, 11B, 12A, 13B, 14D, 15B, 16C, 17B, 18D, 19D, 20B, 21B, 22B, 23A, 24D, 25C, 26A, 27C, 28D, 29B,30D, 31D, 32A, 33A, 34C, 35C

UNIT 4

Food making and growth in plant

☞ There is four main organ of flowering plant

- ❖ **Flower**-reproductive organ
- ❖ **Leaves**-Make food by photosynthesis
- ❖ **Stem**-transport and support system
- ❖ **Roots**-anchoring and absorption

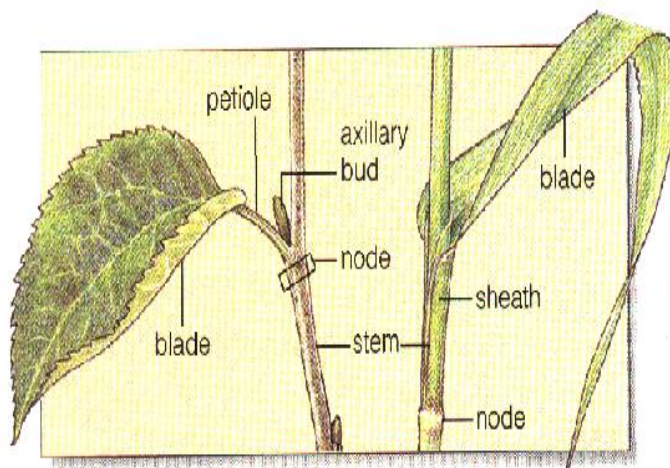
4.1 The leaf; a photosynthetic machine

☞ **Adaptation of leaf for photosynthesis**

- ❖ Leaf is flat and wide
- ❖ large surface to collect light
- ❖ short distance for gas exchange

☞ **External structure of the leaf**

- ❖ **Petiole (leaf stalk)** the leaf is attached to the stem
- ❖ **Lamina (leaf blade)**
 - The photosynthetic portion of the leaf
- ❖ **Mid rib and veins;**
 - Contain xylem and phloem
- ❖ **Margin;** is the border line of the leaf



☞ **Internal structure of the leaf**

I. Waxy cuticle

- ❖ Water proof layer
- ❖ Found on the surface of many leaves
- ❖ Help to prevent water loss

II. Mesophyll

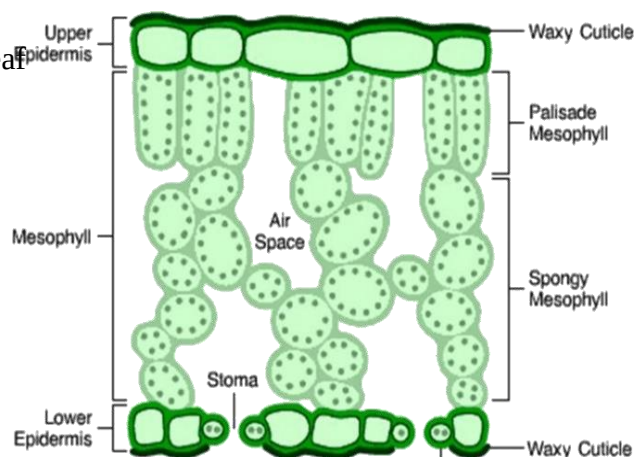


fig. internal structure of leaf

Palisade mesophyll	Spongy mesophyll
➢ found below upper epidermis	➢ Found below palisade layer
➢ Composed of closely packed cell	➢ Composed of loosely arranged cell
➢ Have many chloroplast	➢ Has few chloroplast
➢ has less air space	➢ It allow a lot of air space
➢ Vertically arranged	➢ Irregular arranged.
➢ Elongated shape	➢ Irregular shape.
➢ The main site of photosynthesis	➢ It allow exchange of gases

III. Lower epidermis

- ❖ Has opening known as **stomata**, Stomata used to exchange of gases.
- ❖ **Guard cell** control the opening and closing of stomata

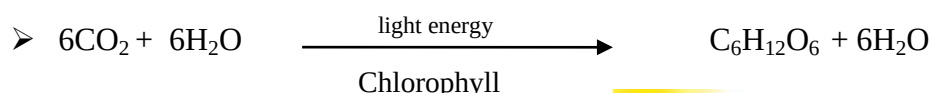
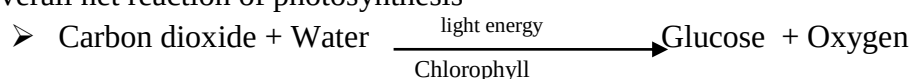
IV. Vascular bundle

- ❖ Contain xylem and phloem
- ❖ **Xylem –dead tissue**
 - Transport water and dissolved mineral from soil to leaves
- ❖ **Phloem—Living tissue**
 - Transport product of photosynthesis away from leaves.

4.2 Photosynthesis

☞ **Photo** –light ☞ **Synthesis**—making } So photosynthesis process of making food by green plants

- ❖ Photosynthesis is the process of making food by green plants in the presence light energy and chlorophyll
- ❖ The overall net reaction of photosynthesis



☞ **In photosynthesis**

- ❖ **Two raw material**-CO₂ and H₂O
- ❖ **Two products** -Glucose and oxygen
- ❖ **Two condition**-Chlorophyll and Light energy

☞ **Green plant use the food produced**

- ❖ Source of energy
- ❖ Growth
- ❖ Repair of tissue
- ❖ Excess of food is converted to starch for storage

Requirements of photosynthesis

1. Carbon dioxide (CO₂)

- ❖ The source of carbon to prepare sugar
- ❖ Plant get CO₂ from the air
- ❖ To show up CO₂ is used in photosynthesis KOH (soda lime) is used

2. Water (H₂O)

- ❖ The source of hydrogen ion to reduce CO₂ to sugar
- ❖ Oxygen gas produced from photosynthesis comes from the split of H₂O
- ❖ Radioactive tracers(O¹⁸) is used to show the need of water for photosynthesis

3. Sun light

- ❖ Used to break down water into hydrogen ion and oxygen

4. Chlorophyll—is the green pigment chloroplast

- ❖ Used to trap light energy
- ❖ **Variegated leaves** are used to show the importance of chlorophylls for photosynthesis

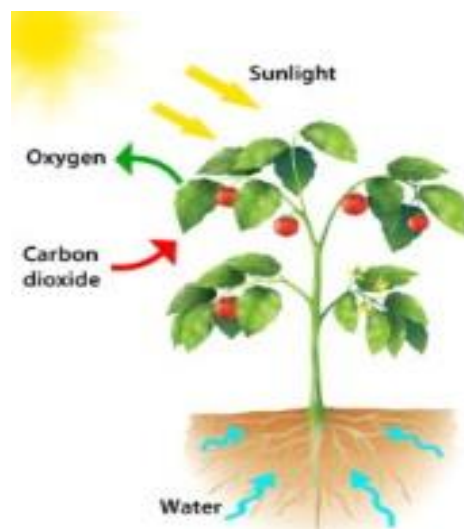


Fig. photosynthesis

☞ **Two phases of photosynthesis**

1. Light dependent reaction 2. Light independent reaction

Light dependent reaction	Light independent reaction
❖ First phase of photosynthesis ❖ Depend on light ❖ Split water molecule into hydrogen and oxygen ❖ Produce metabolic energy (ATP) ❖ $12\text{H}_2\text{O} \xrightarrow[\text{Light energy}]{\text{Chlorophyll}} 24\text{H}^+ + 6\text{O}_2$	❖ Do not require light ❖ Depend on hydrogen ion and oxygen ❖ Reduction of CO_2 to glucose ❖ Use energy(ATP) produce in light reaction ❖ $24\text{H}^+ + 6\text{CO}_2 \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$

Glucose

- ❖ The first product of photosynthesis
- ❖ Other compound are also produce after photosynthesis
- ❖ Glucose molecule converted to fats, proteins, starch

☞ **Testing leaf for starch** using iodine solution

- ❖ **The leaf is put in boiling water because**
 - To stop the biochemical process by killing the leaf
 - Making the leaf soft for iodine penetration
- ❖ **The leaf put in ethanol because**
 - remove chlorophyll (green pigment) from leaf

4.3 Transports

☞ **The main transport system of plans is**

- ❖ Osmosis
- ❖ Diffusion
- ❖ Active transport

☞ **Osmosis is important for plants**

- ❖ Make the plants rigid and firm by the movement of water into the cell
- ❖ Plants take up water through **root hair**
 - **Root hair** increase surface area for osmosis to take place

☞ By using **active transport** plants absorb mineral ion against concentration gradient

Transport material around the plants

- ❖ A double transport system (vascular system)
- ❖ Plants have two separate transport system /**phloem and xylem**/

Phloem and xylem

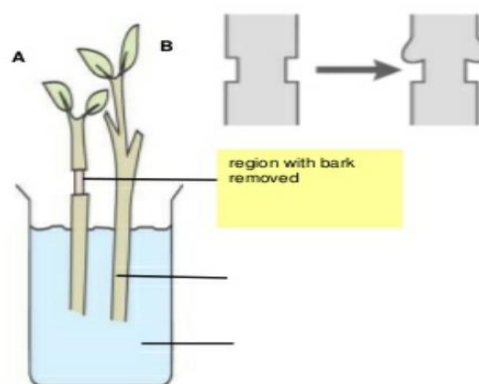
Phloem	Xylem
❖ Made up of living tissue ❖ Transport organic material made by photosynthesis ❖ Active transport since it uses energy to move substance ❖ Food substance moves both up and down of the plant ❖ Phloem cells are thin-walled and contain liquid rich food ❖ Phloem is found in woody plants in the ring next to bark	❖ Made up of dead cells ❖ Transport water and dissolved mineral ions ❖ Transport from root around the plant ❖ No active transport takes place ❖ Passive transport; no need of energy from the plant ❖ Water and mineral transport upward of the plant ❖ Movement of water in xylem is due to transpiration

☞ **The ringing experiment**

- ❖ To find out whether, xylem or phloem tissue is involved in transport of food material
- ❖ If xylem is involved in the transportation, the roots found below the ring are not affected
- ❖ But in this experiment, the roots suffer temporarily because they don't get adequate supply of food material
- ❖ This experiment suggests that phloem tissue is involved in transport of food.

Ringing experiment

1. Removing a ring from a woody branch will result in the removal of the **Phloem tissue** in that region. Swelling in the region will be observed.
2. The swelling above the ring where the phloem is removed will be caused by an accumulation of sugars in the region above the ring.



The need of transport

To transport

1. Sugar made in leaves around the plant

- ❖ Plant store glucose in the form of starch which is osmotically inert
- ❖ Plant deposited starch in root tubers, stem and leaves
- ❖ Starch is also deposited in fruit and leaves

2. The movement of mineral and water from leaves

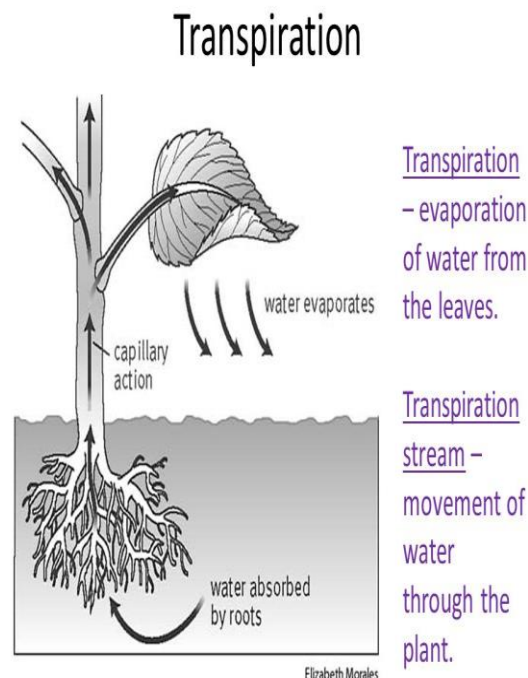
- ❖ Mineral is needed to make protein and other molecules
- ❖ Plant needs water for two reasons
 - I. Maintain turgor pressure
 - II. Raw material for photosynthesis

Moving water through xylem tissue

- ☞ **Transpiration stream**; a constant moving of water through xylem from root to leaves
- ☞ **Transpiration** – the loss of water through the stomata
 - Water enters the root hair of the plant by osmosis to xylem tissue

Opening and closing of stomata

- ☞ **During the day**
 - ❖ Photosynthesis is high
 - ❖ Concentrations of sugar in the guard cell are high
 - ❖ Water moves into the guard cell and swells up
 - ❖ The stomata open
- ☞ **During night**
 - ❖ Photosynthesis is low
 - ❖ Concentrations of sugar in the guard cell are low
 - ❖ Water moves out of guard cell
 - ❖ The guard cell shrinks
 - ❖ Stomata close



fig, water movement in plant

Moving water through xylem tissue

☞ The factors which move water upwards

- 1) **Root pressure** the pressure pushing water upwards
- 2) **Adhesive force** the force of attraction between water molecules and xylem tube
- 3) **Cohesive force** the strong attraction force between water molecules through xylem tube
- 4) Constant evaporation of water from leaves

Leaves the main pull which moves water up from root

- 5) **Capillarity of water**: refers to the rise of water in a tube

☞ Factor affect in the rate of transpiration

The main factors which affect the rate of transpiration are

- 1) **Humidity** rate of transpiration **decrease in humid air**
- 2) **Light intensity** rate of transpiration very high during day time
- 3) **Temperature** transpiration faster on warm sunny day then cold and dully day
- 4) **Wind (air movement)** transpiration faster in windy day then still day

To sum up transpiration is more rapid in **hot, dry** and **windy** than **humid** day

4.4 Response in plants

Plants active achieve the coordination and responsiveness through a system of hormone

4.4.1 The germination seed

What the basic structure of seed?

1. **Endosperm** food storage tissue
2. **An embryo**
 - i. **Plumule** embryonic shoot
 - ii. **Radicle** embryonic root
 - iii. **Cotyledon** embryonic leaves
 - a. **Monocot** have one cotyledon
 - b. **Decoct** have two cotyledon
3. **Testa (seed coat)** protects the seed. **Micropyle** A thin hole on the seed

Factor need for germination

- ❖ **Water** activate enzymes and aids hydrolysis of stored food into soluble materials
- ❖ **Temperature** (warmth) for optimum activity
- ❖ **Oxygen(Air)** for aerobic respiration that produces energy for germination

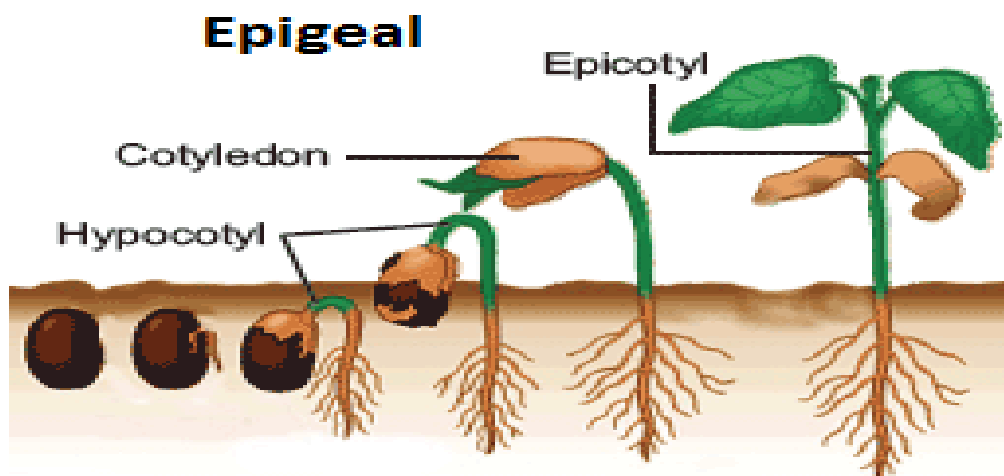
Enzymes in seed

- ❖ **Diastase** converts starch to simple sugar
- ❖ **Lipase** hydrolysis fat into fatty acid and glycerol
- ❖ **Proteolytic** hydrolysis protein into amino acid
 - ✓ **Stage of development** **Zygote→Embryo→Seed lings**
 - ✓ **Embryo develops from zygote , Embryo develops into seedlings**

Type of germination

1. Epigeal germination

- ❖ Cotyledons are carried above the ground because;
- ❖ The elongation of hypocotyls bring the cotyledon above the ground
- ❖ E.g. **Most dicot plant** been ,ground nuts, Cotton \
- ❖ **few monocots** onion , lilies



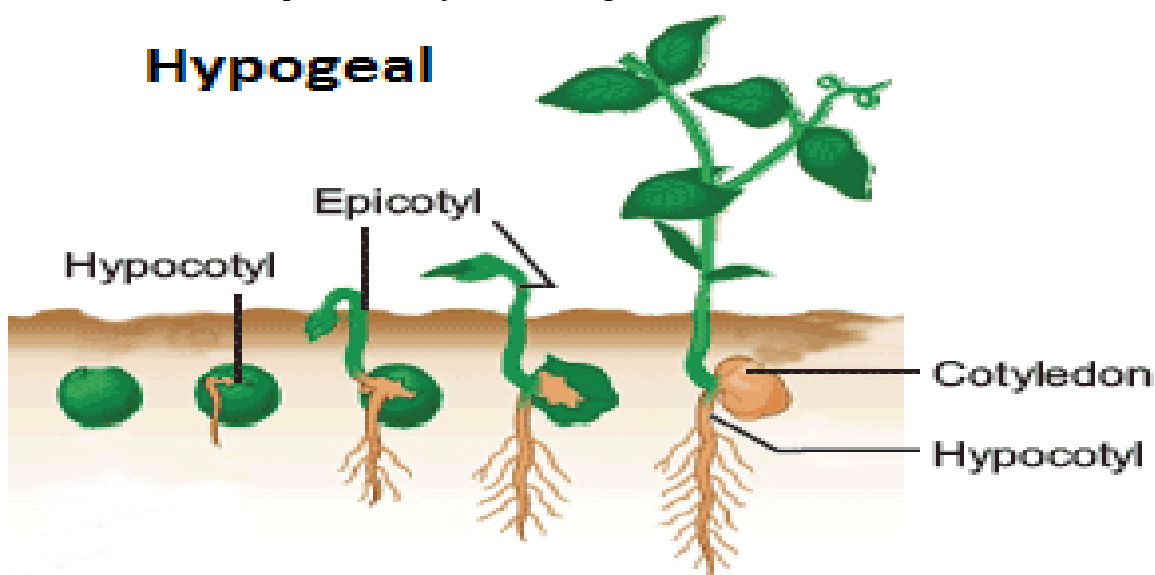
2. Hypogeal germinations

- ❖ Cotyledon below the ground because;
- ❖ The elongation of epicotyls leaving the cotyledon below the ground
- ❖ E.g. **most monocots** maize, wheat, sorghum, millet
- ❖ **few dicot** kidney bean, broad bean

☞ **Epicotyls** the region above the cotyledons which gives rise to young leaves

☞ **Hypocotyls** the stem like area below cotyledon which gives rise to embryonic root

- ❖ Radical the first part of embryo that emerges from seed



4.4.2 Plant hormone and growth

☞ The main hormone involve in plant growth

- | | | |
|-------------------|--------------|---------------------|
| 1) Auxin | 2) Ethylene | 3) Gibberellin acid |
| 4) Absciscic acid | 5) Cytokines | |

☞ Auxin (IAA)

- ❖ Involve in **general plant growth**
- ❖ Promote **lateral bud dormancy**
- ❖ Stimulates the elongation of new plant cell (**apical dominance**)
- ❖ Stimulates **the growth of root on cuttings**
- ❖ Prevent the falling of fruits before ripening
- ❖ Plays a significant role in tropism

☞ Gibberellins

- ❖ Involve the growth of plants stem
- ❖ Helps seed to break their dormant period start germinations
- ❖ Stimulates the production of enzymes used to breakdown food stored in seed
- ❖ Makes **dwarf plants grow in normal size**

☞ Ethylene

- ❖ Gas at room temperature
- ❖ Promotions of **root ripening**
- ❖ Causes fruits and leaves to fall from plants

☞ Cytokinins

- ❖ Stimulate cell division in plants
- ❖ The balance between Auxin and cytokine very important in plant growth
- ❖ Promote lateral bud development
- ❖ Inhibit leaf falling

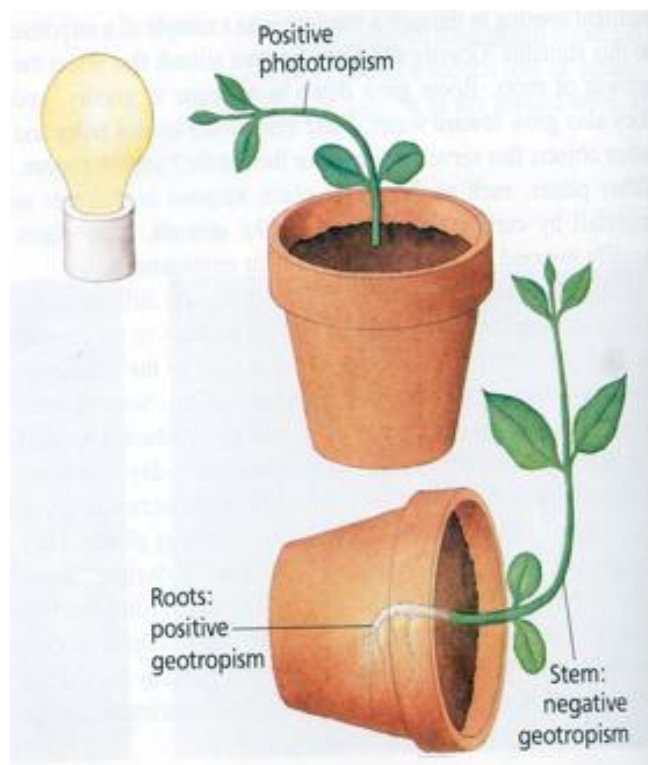
Abscisic acid (ABA)

- ❖ Inhibit growth
- ❖ Involve in **seed dormancy**
- ❖ Involved in geotropism
- ❖ Play a major role in leaf fall

4.4.3 Tropic response (tropism)

- ❖ The directional growth movements to stimuli
- ❖ **Positive tropism** growth toward stimuli
- ❖ **Negative tropism** growth away from the stimuli

Example of phototropism and geotropism



Phototropism	Hydrotropism	Geotropism
❖ Growth movements to light	❖ Growth response to water	❖ Growth response to gravity
❖ Shoot positive phototropism	❖ Root positive hydrotropism	❖ Shoot negative geotropism
❖ Root negative geotropism	❖ Shoot negative hydrotropism	❖ Root positive geotropism

- ☞ The response of seedling to gravity can be **investigated** using **klinostat**. Seedling horizontally fixed to klinostat both shoot and root continue to grow straight

☞ **Nastic response**

- ❖ Non directional response to stimuli
- ❖ Nastic response differ from tropic response

Nastic response	Tropic response
❖ Non directional response	❖ Directional response
❖ Independent of stimulus position	❖ Depend on the direction of stimulus
❖ E.g. opening and closing of stomata	❖ E.g. phototropism

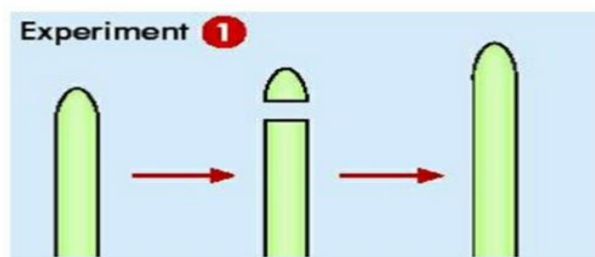
How tropic response brought about

- ❖ Plant responds to unilateral stimuli
- ❖ Maize grain germinate to produce a straight shoot called **coleoptiles**
- ❖ **Coleoptiles** widely used in experiment to investigate the role of hormone in shoot growth

☞ **When the tip of coleoptiles are removed (decapitated)**

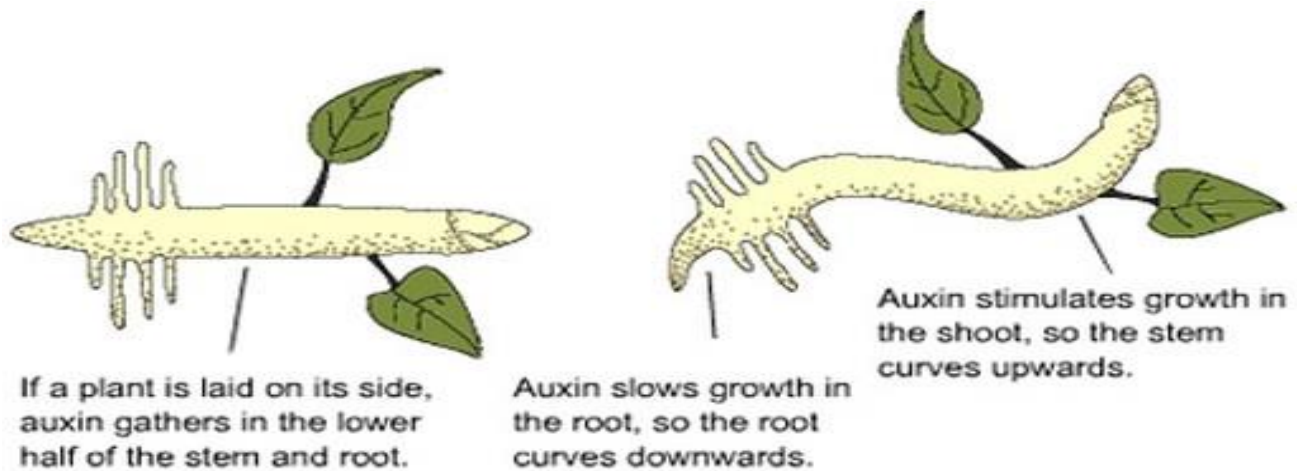
- ❖ They don't grow since the source of IAA is removed
- ❖ Failure of decapitated seed to grow suggest that Auxin probably produce in the tip
- ❖ Auxin produce in the tip is iodol acetic acid (IAA)
- ❖ IAA involves the response of shoot to light and gravity

- ❖ *When coleoptile tip was removed*
- ❖ *There was no growth until it was removed*



☞ **When the plant placed horizontally**

- ❖ Due to force of gravity auxin accumulate to the lower side
- ❖ Auxin promote shoot growth and the shoot growth upward
- ❖ Auxin inhibit root growth and the root growth downward (*see the next picture*)

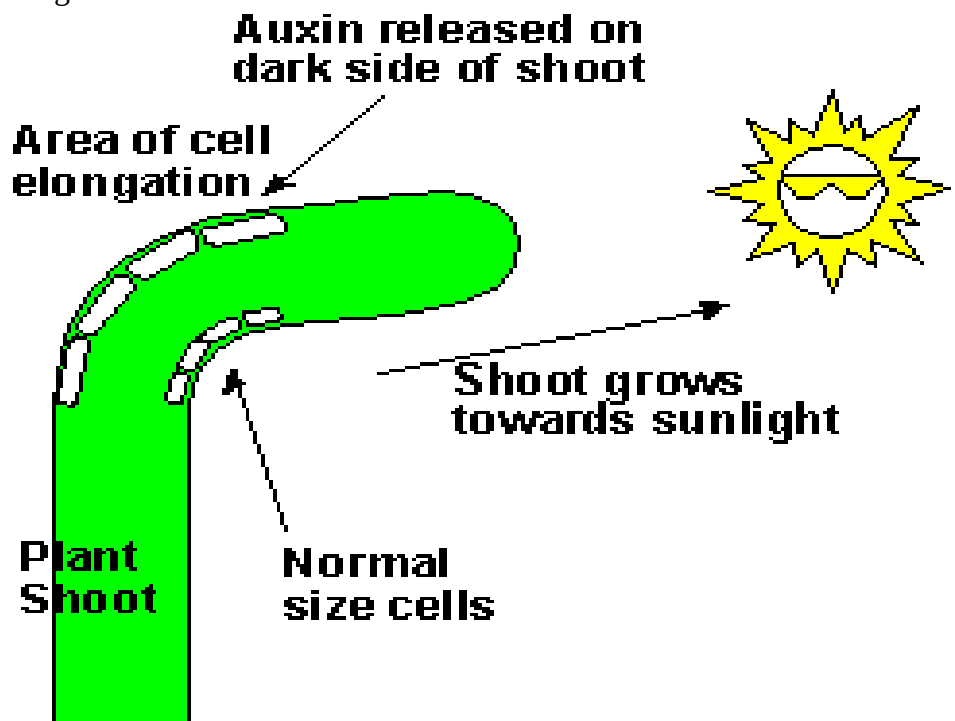


☛ **When the shoot is lit from one side only**

- ❖ Light involved the distribution of IAA in shoot
- ❖ IAA diffuse toward the dark side of the shoot
- ❖ The dark side grow faster than illuminated
- ❖ Growth is directly proportional to IAA
- ❖ The a shot bend toward light

Phototropism

- ❖ Growth movements in response to light
- ❖ **Shoot** positive phototropism
- ❖ **Root** negative geotropism



Review exercise

1. In which part of plant leaf does main gas exchange takes place
A. Spongy mesophyll B. Upper epidermis C. Palisade mesophyll D. Guard cell
2. Radioactive oxygen (O^{18}) in water molecule used to show all of the following except
A. Plant use oxygen for reduction of carbon dioxide
B. Water is a source of hydrogen for CO_2 reduction
C. Breakdown of water molecules occurred in light dependent reaction
D. Oxygen produced from water molecule
3. Which of the following ingredients is required to undergo photosynthesis by a leaf?
A. Carbon dioxide, oxygen and chlorophyll C. Oxygen, water and chlorophyll
B. Carbon dioxide, glucose and chlorophyll D. Carbon dioxide, water and chlorophyll
4. Why do plants convert their primary product of photosynthesis, glucose to starch?
A. Because starch is important for making cell wall of plants.
B. Because large amount of glucose becomes toxic for plants.
C. Because starch does not affect the water balance
D. Because glucose cannot be used for respiration directly
5. The chemical substance used to absorb carbon dioxide in the activity to show its importance in photosynthesis is
A. Iodine solution C. Potassium hydroxide solution
B. Benedict's solution D. Copper sulphate solution.
6. The presence of starch in leaves is shown by the
A. Iodine test B. Million's test C. Benedict's test D. Emulsion test
7. One of the following is not true about the internal structure of leaf?
A. Palisade mesophyll is a main site of photosynthesis
B. Spongy mesophyll is a main site of gas exchange
C. Palisade mesophyll is located on the upper side of leaf
D. Spongy mesophyll have elongated shape and vertical arrangement
8. In order to demonstrate the need of CO_2 for photosynthesis plants have been expose for intense light, the result of the experiment helps to show all of the following except
A Rate off photosynthesis decrease C. Level of glucose increase in the plant leaf
B. CO_2 is a source of carbon for glucose D. Level of CO_2 decrease in the atmosphere
9. Which of the following is true of germination of most monocot
A. Cotyledon appear above the ground C. Radicle pushes cotyledon above the ground
B. Cotyledon remain below the ground D. Leaves emerge from cotyledon
10. In one of experiments conducted to prove the necessary condition for photosynthesis variegated leaves used. The use of variegated leaves to show the presence of
A. Chlorophyll B. Light C. carbon dioxide D. water
11. During photosynthesis, the hydrogen ion used to reduce carbon dioxide derived from?
A. Water B. Glucose C. Minerals D. Air

12. Which of the following is true of plants growing in dark?
A. Short and fully expanded green leaves C. Short and well developed stem
B. Long and weak stem D. Long and well developed green leaves
13. Plant grows toward the source of water in the soil.
A. Chemotropism B. Hydrotropism C. Phototropism D. Geotropism
14. Which of the following play an opposite role in recycling of carbon between the environment and living things?
A. Respiration and combustion C. Evaporation and condensation
B. Photosynthesis and combustion D. Photosynthesis and Respiration
15. During germination of monocot seeds, the embryo obtain food from;
A. Epicotyl B. Endosperm C. Plumule D. seed coat
16. What do phloem vessels carry;
A. Mineral ion and sugars C. Water and mineral ion
B. Water and chlorophyll D. Dissolved sugar
17. Which of the following is an example of hydrotropism?
A. Pollen tube grow toward ovary C. Shoots grow toward light
B. Root grow toward the source of water D. Tendrils grow around stem
18. Which of the following is TRUE of light dependent phase of photosynthesis? It
A. Splits water molecule into hydrogen and oxygen C. Occurs outside chloroplast
B. Supply oxygen for the synthesis of carbohydrate D. Gives off hydrogen as waste
19. What happen when the ring of bark is removed from a woody shoot?
A. Rate of photosynthesis will slow down C. Uptake of mineral salt will slow down
B. Movement of food will be blocked. D. Absorption of water will stop
20. Which of the following is an adaptation of plant to desert area?
A. Soft and herbaceous stem B. Large and evergreen trees
C. Small leaves reduce to spines D. broad and large leaves
21. Which of the following plant cell do not photosynthesis?
A. Guard cell B. Palisade cell C. Spongy cell D. Phloem cell
22. In testing for starch, a leaf is put in ethanol, this is to:
A. Remove green pigment from leaves C. Kill the cell in the leaf
B. Break down starch into glucose D. Make the cell soft for photosynthesis
23. In germination the embryo of a seed develop into;
A. Zygote B. Seedlings C. Plumule D. Radicle
24. In the experiment conducted to show carbon dioxide is used up in the process of photosynthesis the compound used to absorb carbon dioxide?
A. Ethanol B. Potassium hydroxide C. Sodium bicarbonate D. Iodine solution
25. Which of plant hormone stimulate root formation in cutting;
A. Ethylene B. Cytokinins C. Gibberellin D. Auxin

26. In the leaf of green plant, energy from the sun is first used to make?
A. Lipids B. proteins C. carbohydrates D. genetic material
27. Unlike tropisms, nastic movements are in response to;
A. Darkness B. Wind C. Directional stimuli D. Non directional stimuli
28. Which of the following plant hormone incorrectly paired with its function?
A. Auxin ; responsible for apical dominance
B. Absciscic; promote root formation in cuttings
C. Ethylene; promotes fruit ripening
D. Gibberellins; promotes shoot elongation
29. How light influence the distribution of auxin in plant?
A. Causing auxin to migrate to the shaded portion C. Decreasing the cell sensitivity to plant
B. Auxin concentration increasing to the light side D. Destroying the auxin
30. Which of the following is correct about a germinating seed?
A. Plumule develops into a root C. Cotyledon become a shoot
B. Cotyledon begin photosynthesis D. Embryo develops into seedlings
31. The mesophyll of the leaf has two distinct layers known as:
A. Spongy and Epidermis C. Palisade and Epidermis
B. Upper and lower epidermis D. Palisade and Spongy
32. If a ring bark is removed from a woody shoot, after some days the tree will day. This is because;
A. Food cannot reach the roots C. water accumulates in the root
B. The tree cannot absorb water D. the tree cannot undergo photosynthesis
33. Plant hormone promotes stem elongation and enzyme production in developing seed;
A. Auxin B. Gibberellins C. Absciscic acid D. Ethylene
34. The hormone promotes lateral bud dormancy.
A. Auxin B. Gibberellins C. Absciscic acid D. Ethylene
35. Apical dominance is stimulated by the hormone;
A. IAA B. ABA C. ethylene D. gibberellins
36. A dwarf plant can be induced to reach a normal height by the application of;
A. Auxins B. Cytokinins C. Gibberellins D. Ethylene
37. A tropism in which plant “ bend” towards the sun throughout the day;
A. Hydrotropism B. Geotropism C. Phototropism D. Thigmotropism
38. Among the following which hormone can promote seed dormancy;
A. ABA B. Gibberellins C. Ethylene D. IAA
39. After root has grown down wards, a shoot grow upwards towards light, this shoot is known as?
A. Radicle B. Plumule C. Cotyledon D. Stem
- ANSWER: 1A, 2A,3D, 4C, 5C, 6A, 7D, 8D, 9B, 10A, 11A, 12B, 13B, 14D, 15B, 16D, 17B, 18A, 19B, 20C, 21D, 22A, 23B, 24B, 25D, 26C, 27D, 28B, 29A,30D, 31D, 32A, 33B, 34B,35A,36C, 37.C, 38.B, 39.B

UNIT 5

CONSRVATION AND NATURAL RESOURCE

5.1 Definition of resource

- ☞ **Natural recourses** are resource that exist in nature and are useful for human beings resource supplied by nature
- ☞ Can be classified into two
 1. Renewable
 2. Non renewable
- ☞ **Renewable natural resource**
 - ❖ Are resource capable of producing indefinitely
 - ❖ They are found in unlimited quantity
 - ❖ They can be reused and replaced easily
 - ❖ Include mostly living things and their products
 - ❖ Examples: vegetation, animal, water , air, solar energy, micro organism
- ☞ **Nonrenewable natural resource**
 - ❖ Are resource that cannot be easily made or produced if they are used once
 - ❖ They are found in limited quantity
 - ❖ Cannot be reused or replaced
 - ❖ Include mostly nonliving things
 - ❖ Example ;petroleum, coal, diamond, minerals

5.2 Conservation and biodiversity

- ☞ **Conservation**
 - ❖ The wise and sustainable use of natural resource
 - ❖ involves protection and preservation of natural environment
 - ❖ only if the natural resources are properly used and managed can lost forever
 - ❖ if natural resource are not wisely used their number declines become extinct
 - ❖ **extinct** is the loss of a species everywhere in the world or particular habitat
- ☞ **Biodiversity**
 - ❖ Is the measure of wealth of species in a given place or habitat
 - ❖ Is the different variety species in a given area (species richness)
 - ❖ Include all type of organisms ranging from small micro-organism to big tree and large animal
- ☞ **Importance of biodiversity**
 - ❖ Maintain the balance in an ecosystem
 - ❖ Produce genetic variety
 - ❖ Make place look good with a mixture of different species rather than monoculture
 - ❖ Help to reduce the spread of diseases
- ☞ **Monoculture** is the cultivation of a single croup

☞ **Monocultures are:**

- ❖ not attractive to look at
- ❖ does not support wide range of plants and animals
- ❖ increase the risk of diseases to spread to quickly

☞ **Biodiversity of an area lost by;**

- ❖ to grow crop for agricultural purpose
- ❖ deforestation
- ❖ environmental pollution like acid rain
- ❖ for growing industrial raw material E.g. sugar

☞ **Conserving the biodiversity**

- ❖ Avoid over exploitation of natural resource
- ❖ Improved the habit of planed use of forest resource
- ❖ Reduce pollution
- ❖ Establish national parks, sanctuaries and zoos

5.3 Vegetation

☞ **Importance of plant**

- ❖ Source of food
- ❖ To make drink such as tella, tej and coffee
- ❖ Export product for the country
- ❖ For building material
- ❖ For timber production
- ❖ of medicine
- ❖ Source of oxygen to the atmosphere
- ❖ Absorb atmospheric CO₂

☞ **Human effect on vegetation**

- ❖ **Deforestation** for various purposes such as agriculture, fuel consumption, timber production
- ❖ **Overgrazing** expose the land for serious wind and soil erosion
- ❖ **Burning**

☞ **Endemic species**

- ❖ Some of endemic species in Ethiopia are
- ❖ Teff (*Eragrostis teff*)
- ❖ Noug (*Guizotia abisinica*)
- ❖ Enset (*Ensete ventricosum*)
- ❖ Juniper (tid)
- ❖ Kerero etc

☞ **Conservation**

Some method of conserving vegetation

1. Afforestation planting young tree
2. Controlled grazing
3. Fire protection
4. Awareness creation

5.4 Wildlife

Importance of wildlife resource

- ❖ Economic or commercial value from tourism
- ❖ Educational, scientific and recreational value
- ❖ Maintenance of natural balance in an ecosystem

☞ **Endemic wildlife species in Ethiopia**

Mammals

Gelada babbon
Walia ibex
Menlik's bushbuck

Birds

thick-billed raven (kura)
white colored pigeon

☞ **Human effect on wildlife**

- ❖ Distraction of forest habitat
- ❖ Uncontrolled hunting
- ❖ Human settlement

☞ **Wildlife conservation**

- ❖ Establishing park, zoos, sanctuaries
- ❖ Preventing the spread of disease
- ❖ Controlling human settlement
- ❖ Awareness creation

☞ **National park** is conservation area designed to give maximum protection to wild animal

☞ **Sanctuaries** are conservation area establish to focus on a particular species, some example of wildlife sanctuary

2. **Harer wild life sanctuaries;** set up to conserve and protect native elephant species,
Laxodonta African oleansieSe
3. **Kuni-mukhtar mountain neyala sanctuaries;** set up to protect mountain neyala
4. **Senkelle Sewayne' heart beest sanctuaries;** close to rift valley lake national park which is dedicted for protection of heart beest

5.5 Air

- ❖ **Pollution;** the contamination of the natural environment by harmful substances as a result of human activity.
- ❖ **Pollutant;** a harmful substance

National park	Organism found
Abijatia-shall	Flamingoes, pelicans, Gazelle,
Awash	Zebra, wild pig, cheetahs
Bale mountain	Gelada babbon, neyala, Wolves, M. bushbucks
Gambella	Lion, Elephants, buffalo, Zebra
Rift valley lake	Gazella, flamingoes, pelicans
Mago	Giraffe. Elephants, lions, buffalo
Omo	Giraffe. Elephants, lions, buffalo
Nechisar (b/n Abaya & chamo	200 species of birds
Simian mountain	World heritage site Walia, wolves, G. babbon
Yangudi--rassa	Variety of vegetation Zebra, cheetah

❖ **Air pollution** can occurs in different forms, these include

1. **Global dimming;** is the worldwide blockage or reduction of sunlight from reaching the earth's surface as a result of hydrocarbon released in the atmosphere in the form of smoke. **Black carbon pollution.**
2. **Global warming;** is the rising of temperature on earth's surface as a result of accumulation of greenhouse gas like **carbon dioxide** and **methane**.

☞ **Carbon dioxide CO₂**

Increase as a result of human activity such as

- ❖ Combustion Burning of fissile fuel
- ❖ Deforestation
- ❖ Respiration

☞ **Methane**

- ❖ It is increased in the atmosphere as a result of
- ❖ Growth of rice in swampy condition
- ❖ Digestive activity of cattle produce methane

3. **Acid rain**

- ❖ Caused by sulfur and nitrogen oxide
- ❖ Formed when rain water react with these oxide

☞ **Acid rain damages our environment by;**

- a) Killing leaves
- b) Depletion of soil which destroys roots of tree
- c) Pollution of lake, river and stream water
- d) Damage on building materials by reacting with carbon dioxide

Natural cause of acid rain

- ❖ Volcanic eruption and lightning
- ❖ Water vapors from clouds

Human cause of acid rain

- ❖ Burning of fossil fuels from industries and vehicles

Effect of air pollution on human

- ❖ Chronic respiratory problems
- ❖ Lung cancer
- ❖ Heart disease
- ❖ Brain damage
- ❖ Nerve, kidney. Liver damage

☞ **Chlorofluorocarbon (CFC'S)** cause ozone depletion

Review exercise

Choose the best answer

1. What is biodiversity? it is the
 - A. Nonrenewable natural resource we have
 - B. Measure the wealth of species we have
 - C. Abolishing of a stable ecosystem by human activities
 - D. Interaction of biotic and abiotic component of the ecosystem
2. Which of the following activities is used to conserve our vegetation?
 - A. Reducing indigenous plants
 - C. Encouraging deforestation
 - B. Protecting natural resource
 - D. Planting exotic plant
3. Which of the following is the major reason to allow hunting in national park?
 - A. To rise huge amount money need for the park
 - B. To full fill the meat demand of the country
 - C. To get rid of wild animals those are dangerous to tourists
 - D. To reduce damage in ecosystem
4. Covering huge area with a single crop is known as;
 - A. Irrigation
 - B. Monoculture
 - C. Mixed farming
 - D. Deforestation
5. Which of the following activities is considered as a method of wild life conservation?
Increasing
 - A. The breeding of wild life with domestic animal
 - C. The spread of disease
 - B. The size of national parks to protect life
 - D. Deforestation in ecosystem
6. Which of the following statements is correct about the importance of conservation? It
 - A. Enhance monoculture of crop verity
 - C. Develops less resistant crop verities
 - B. Preserve genetic diversity
 - D. Preserve less quality of seed only
7. Which of the following statements is correct about renewable natural resource?
 - A. Never lost no matter how we use them
 - C. Mainly living things and their products
 - B. Cannot be reused or replaced
 - D. Mainly fossil fuels and minerals
8. Which of the following methods helps to conserve biodiversity?
 - A. Setting up protected area
 - C. Elimination of unnecessary organism
 - B. Deforestation of exotic species
 - D. Interbreeding of plant species
9. Which of the following method of conservation of vegetation?
 - A. Covering more area of land with exotic plant
 - B. Planting tree that take long time to produce seed
 - C. Replanting of land with indigenous plant
 - D. Burning plant which have no immediate effect
10. How global warming is caused? It is caused
 - A. Replanting forest with native tree
 - C. Decreasing the amount of carbon dioxide
 - B. Deforestation and burning of tree
 - D. Increased rate of photosynthesis\\

11. Which of the following plant is not endemic to Ethiopia?
A. Maize B. Zigba C. Enset D. Teff
 12. What is the use of wild life? it is used
A. Maximize soil erosion C. Generate income from truisms
B. Reduce genetic resource D. Crop from farm land degrade
 13. Which of the following statements is correct about the importance of conservation in a given ecosystem? Conservation;
A. Shifting their habitat and niche
B. Reduce biodiversity from the ecosystem
C. Maintain pure air and water in the ecosystem
D. Gives favor of a single species in the ecosystem
 14. Which of the following is used to conserve wild life?
A. Mixing wild life with domestic species C. Seating national park and sanctuaries
B. Allowing poaching for economical use D. Shifting their habit and their niche
 15. Which of the following activities cause global warming?
A. Afforestation of the habitat C. Reducing the amount of rice farms
B. Reducing the number of livestock D. Burning of fossil fuels
 16. Ethiopia has various type of vegetation it is mainly due to its;
A. Nearness to the equator C. Tropical climate
B. Varied altitude and rainfall D. location and lakes
 17. The most serious ecological problem in Ethiopia is;
A. Industrial pollution B. Soil erosion C. Over grazing D. Over hunting of wild life
 18. Which of the following activities increase biodiversity of our country?
A. Burning of fossil fuels C. Cultivation of a single crop
B. Cutting tree D. Replanting of tree
 19. Air palliations caused by chlorofluorocarbons (CFCs) has caused:
A. Global cooling B. Ozone depletion C. Global diming D. Global warming
 20. Cactus has spiny leaves and fleshy stem, this is important to
A. Increase the rate of gas exchange C. increase the rate of photosynthesis
B. Conserve water D. Conserve energy
 21. Which of the following action would contribute toward conservation of soil and water?
A. Deforestation B. Desertification C. Over-grazing D. Reforestations
 22. Which of the following is renewable natural resource:
A. Petroleum B. Coal C. Diamond D. Water
 23. One of the following national parks regarded as the world heritage site?
A. Awash B. Simian mountain C. Bale mountain D. Awash
- ANSWER: 1B, 2B,3D, 4B, 5B, 6B, 7C, 8A, 9C, 10B, 11A, 12C, 13C, 14C, 15D, 16B, 17B, 18D, 19B, 20B, 21D, 22D, 23B

