**SS1 Agric Lesson Note (Third Term) [year]**

**SCHEME OF WORK FOR AGRICULTURAL SCIENCE**

**THIRD TERM – SS ONE**

**SS ONE AGRICULTURE**

**WEEK ONE**

**TOPIC: SIMPLE FARM TOOLS**

**These are simple, handy tools used mainly by peasant farmers. They are designed to help the hands to apply force in farm operations. Some common simple farm tools and their functions are discussed below.**

**Cutlass**

**Description: This is the tool most commonly used by farmers. There are two main types- one has a lightly curved blade with a short wooden handle, while the other has a straight metal blade and short wooden handle. One edge of the metal blade is sharp and the other is blunt.**

**Functions/Uses**

**i.For cutting down and clearing bushes and trees.**

**ii.For transplanting seedlings.**

**iii.For planting seeds and harvesting crops.**

**iv.For weeding farmlands.**

**Maintenance practice**

**i.Cutlass should be sharpened regularly**

**ii.Keep it dry and cool place**

**iii.Metal parts should be oiled or greased before storage.**

**iv.It should not be left lying about.**

**Hoe:**

**Description: the hoe consists of a metal blade which may either be rounded or slightly rectangular in shape with a wooden handle which can be long or short.**

**Types of Hoe**

**There are two types of hoe. These are:**

**i.West African Hoe: it has a wooden handle and a round metal blade. Its metal blade is attached to the wooden handle with a prong.**

**ii.West Indian Hoe: it has a long wooden handle and a rectangular metal blade. The metal blade has a loop round its handle.**

**Similarities and differences between West African Hoe and West Indian Hoe**

**(a) Similarities**

1. **Both types of hoe have a metal blade.**
2. **Both types of hoe have a wooden handle.**

**(b) Differences**

**West African Hoe West Indian Hoe**

**i.Has a short handle**

**ii.Has a round metal blade**

**iii.Blade is attached to wooden handle with a prong. Has a long handle**

**Has a rectangular metal blade**

**Blade is attached to handle by a loop round the handle.**

**Functions/Uses**

**i.Hoe is used for land preparation.**

**ii.It is used for making ridges and heaps.**

**iii.For planting or transplanting some crops.**

**iv.For harvesting some crops.**

**v.It is used for weeding.**

**Maintenance practices**

**i.Sharpen blunt blades.**

**ii.Keep in dry and cool places.**

**iii.Oil or grease metal blade before storage.**

**iv.Clean or wash after use.**

**Spade**

**Description:**

**Spade has a long wooden handle and a broad metal blade. The edge of the metal blade is sharp so that it can easily be driven into the soil.**

**Functions/Uses**

**i.Spade is used for lifting the soil and completely turning it over.**

**ii.It is used for levelling the soil.**

**iii.For digging holes during transplanting.**

**iv.For mixing cement/concrete for**

**v.Farm structures.**

**Maintenance practices**

**i.Store in dry and cool place.**

**ii.Keep away from rain and termite attack on wooden handles.**

**iii.Sharpen the blade regularly.**

**Shovel**

**Description: Shovel is just like the spade. It has a long wooden handle but the blade of a shovel is hallow and broad with a rectangular or round edge.**

**Functions/Uses**

**i.It is used for lifting or transferring soil from one place to another.**

**ii.To load materials from ground level into wheel barrow.**

**iii.For making garden paths.**

**iv.For levelling the ground and removing stones or rubbish.**

**Maintenance practices**

**i.Store in a dry place.**

**ii.Oil, grease or paint metal parts.**

**iii.Keep the wooden part away from the attack of termites.**

**iv.Clean after use.**

**Garden Fork**

**Description: garden fork usually has four prongs or teeth which taper to a point. The prongs, made of hard metal are about 20cm long, mounted on a long wooden handle of about 70-80cm.**

**Function/Uses**

**i.It is used for turning manure during compost making.**

**ii.It is used for loosening the soil before transplanting.**

**iii.It is used for loading manure.**

**iv.It is used for loading hay.**

**Maintenance Practice**

**i.Apply grease to avoid rusting.**

**ii.Clean after use.**

**iii.Keep in dry and cool place.**

**iv.Paint metal parts before long storage.**

**Hand Fork**

**Description: the hand fork consists of a piece of metal with three or four short flat prongs. Some have short wooden handle while others are entirely made of metal. It is mainly used in squatting position because of its small size.**

**Functions/Uses**

**i.It is used for loosening surface soil or breaking soil clods.**

**ii.It is used for light weeding.**

**iii.For mixing small quantity of soil or manure.**

**iv.For working manure into the soil.**

**Maintenance Practice**

**i.Store in a dry cool place.**

**ii.Paint, oil or grease to prevent rusting.**

**iii.Clean or wash after use.**

**Hand Trowel**

**Description: hand trowel is a small hand tool consisting of a short handle and a scoop-shaped blade. Like the hand fork.**

**It is mainly used in squatting position because of its small size. The curved metal blade makes it possible for a small ball of earth to be carried with seedling during transplanting.**

**Functions/Uses**

**i.It is used for transplanting seedlings;**

**ii.It is used for nursery practices or light weeding.**

**iii.For fertilizer or manure application.**

**iv.It is used for digging holes for planting.**

**v.It is used for sampling soil/mixing soil and fertilizers.**

**Maintenance practice**

**i.Clean or wash and dry after use.**

**ii.Straighten bent blade.**

**iii.Sharpen blunt blade.**

**iv.Store in a termite-free area.**

**v.Store in a cool, dry place.**

**Rake**

**Description: Rake consists of a long, wooden handle and a strong metal head with several stout prongs.**

**Functions/Uses**

**i.It is used for levelling or spreading soil surface after hoeing;**

**ii.For removing stones and weeds from seed-beds;**

**iii.For covering vegetable seeds when they are broadcast;**

**iv.For breaking up soil lumps into finer particles.**

**Maintenance Practices**

**i.Clean or remove dirt after use.**

**ii.Store in a dry, cool place.**

**iii.Keep away from termite attack on the wooden handle.**

**iv.Oil metal part.**

**Axe**

**Description: Axe consists of a strong wooden or metal handle onto which a solid, flat and heavy metal blade with a sharpened edge is inserted. Larger axes are held in both hands when in use.**

**Functions/Uses**

**i.It is used for felling trees,**

**ii.For slicing wood/splitting wood,**

**iii.For cutting wood,**

**iv.For uprooting stumps,**

**v.For cutting firewood and logs.**

**Maintenance practice**

**i.It should be sharpened regularly.**

**ii.Store in a dry, cool place.**

**iii.Paint, grease or oil metal parts before being put away for a long time.**

**iv.Clean after use.**

**v.Keep wooden from termite attack.**

**Pick Axe or Digger**

**Description: Pick axe or digger consists of a long wooden handle and a metal head with double blades. One blade is sharped to form a short and rather narrow hoe while the other side of the head is sharped into a small narrow axe like blade.**

**Functions/Uses**

**i.It is used for removal of roots of trees (stumping);**

**ii.For tilling of every hard soils;**

**iii.For making ridges;**

**iv.For tilling soil for farm-building erection.**

**Maintenance Practices**

**i.Clean or wash after use.**

**ii.Sharpen blade regularly.**

**iii.Keep in cool, dry place.**

**iv.Keep away from rain to avoid rusting.**

**v.Store in termite free areas.**

**vi.Paint, grease or oil metal parts.**

**Headpan**

**Description: Head pan is a metal container with small circumference at the bottom but a larger one at the top. It has two handles which are opposite to each other.**

**Functions/Uses**

**i.It is used for the collection of harvested crops.**

**ii.It is used for transplanting seedlings;**

**iii.For carrying and mixing manure/fertilizers;**

**iv.For carrying farm inputs and outputs.**

**Maintenance practice**

**i.Wash or clean after use.**

**ii.Paint or oil before stored for a long time.**

**iii.Keep in a cool, dry place.**

**iv.Keep away from rain.**

**Watering Can**

**Description: This is a metal or plastic can fitted with a spout which has perforated metal sheet calle rose, over its mouth. The rose is removable after use and replaceable when needed. It's also has two handles used for lifting or carrying the can.**

**Functions/Uses**

**i.It is used for light irrigation, like, application of water to crops during the dry season.**

**ii.It is used for the application of liguid fertilizers.**

**iii.Application of water to seedlings in the nursery or vegetable beds.**

**iv.It is used for watering cement blocks used for constructing farm house.**

**Maintenance practice**

**i.Wash and keep dry or clean after use to prevent rusting.**

**ii.Store or hang upside down.**

**iii.Keep the nozzles free from blockages.**

**iv.Store/keep in a cool- dry place.**

**v.Rinse with water if used for liquid fertilizers.**

**Mattock**

**Description: mattock consists of a small wooden handle and a double-headed metal head. The mattock is essentially a small axe and hoe combined in one.**

**Functions/Uses**

**i.It is used for digging and uprooting small stumps.**

**ii.It is used for loosening of stones, roots and hard plants in the soil and digging of soil.**

**iii.It is used in clearing bush and weeding farms.**

**Maintenance Practice**

**i.Clean after use.**

**ii.Store in a cool, dry place.**

**iii.Sharpen metal blade.**

**iv.Paint, grease or oil metal parts before storage for a long time.**

**Pruning Saw**

**Description: The pruning saw is flat and made of flexible metal, its handle is wooden. Both edges of the saw have sharp pointed teeth.**

**Functions/Uses**

**i.It is used for cutting wood or log,**

**ii.For pruning operations,**

**iii.For falling of trees,**

**iv.It is also used for cutting of budded seedlings.**

**Maintenance Practices**

**i.Sharpen the teeth regularly.**

**ii.Grease or oil metal before storage.**

**iii.Store in a cool, dry place.**

**Sickle**

**Description: The sickle has a curved blade fitted to a short handle. The inner edge of the metal blade is sharp while the outer edge is blunt.**

**Function/Uses**

**i.It is used for harvesting fruits/cereal crops**

**ii.For cutting grass pasture for animals.**

**iii.It can be used for lighting weeding of vegetable plants.**

**Maintenance Practices**

**i.Sharpen the inner edge/blade regularly.**

**ii.Store in a dry, cool place.**

**iii.Paint or oil before storage for a long time.**

**Harvesting Knife**

**Description: Harvesting knife has a long wooden pole or handle with a small curved metal blade close at one end. It also has a short, strong blade close to the curved end.**

**Functions/Uses**

**i.It is used for harvesting some crops, e.g. cocoa, oil palm, mango, orange, kolanut, etc.**

**ii.It is also used for light pruning.**

**Maintenance Practices**

**i.Keep away from rain to avoid rusting.**

**ii.Keep in termite free area.**

**iii.Sharpen the blade regularly.**

**iv.Oil or grease the metal parts before storage.**

**Root-Loading Fork**

**Description: this tool is similar to the garden fork except that the prongs are usually bent at angle to the wooden handle.**

**Functions/Uses**

**It is used mainly to load roots, hays or silage into carts or wheel barrows.**

**Maintenance practices**

**i.Store in a dry, cool place.**

**ii.Clean after use.**

**iii.Keep away from rain or moist place to avoid rusting.**

**iv.Grease or oil metal parts before storage for a long time.**

**Hay Fork**

**Description: hay fork has two or three long, round and curved tines (or prongs) with a long wooden handle.**

**Functions/Uses**

**The tool is used for collecting and removing hay and livestock bedding. The fork is inserted vertically in the middle of the load and the load is carried with the prongs held upwards.**

**Maintenance Practices**

**i.Store in a dry, cool place.**

**ii.Clean or wash after use.**

**iii.Grease or oil metal parts before storage for a long time.**

**Manure Drag**

**Description: This tool has four or five tines, sharped like those of a garden fork but with the pointed ends at right-angles to the handle to facilitate digging.**

**Functions/Uses**

**i.It is used for digging farm-yard manure.**

**ii.It is also used for uploading farm-yard manure.**

**Maintenance Practices**

**i.Keep in a dry, cool place.**

**ii.Oil or grease metal parts before storage.**

**iii.Keep away from rain or moist places to avoid rusting.**

**Wheelbarrow**

**Description: The wheelbarrow is a large metal or wooden container with one wheel at the front, two handles at the rear and below these, are two legs which support the container. It is pushed by raising the rear end slightly so that the main weight is taken up by the front wheel. Tools which can perform the same function as the wheelbarrow include head pan, bucket, tractor- mounted container and container driven by work animals.**

**Functions /Uses**

**i.It is used for carrying farm inputs, e.g. fertilizers, seeds, etc.**

**ii.It is used for carrying farm outputs, e.g. harvested crops, slaughtered animals, etc.**

**iii.It is used for transplanting seedlings.**

**iv.It is also used for carrying load/materials to market.**

**Maintenance Practices.**

**i.Clean the tool after use.**

**ii.Replace worn-out parts.**

**iii.Paint the tool if necessary.**

**iv.Store in a dry, cool place.**

**v.Tighten bolts and nuts on wheels properly.**

**Crowbar**

**Description: this is an iron bar 90-120cm long and bent slightly at one end.**

**Functions/Uses**

**i.By inserting the pointed end underneath a load and pushing the long end down wards, the load can be gradually moved.**

**ii.It is also used for digging holes for planting seeds.**

**Maintenance Practices**

**i.Keep in dry, cool place.**

**ii.Grease or oil the metal part before storage for a long time.**

**iii.Keep away from rain to avoid rusting.**

**Bradawl**

**Description: This is a small tool with a wooden handle. It has a short, round blade with a small, narrow cutting edge.**

**Functions/Uses**

**It is used for boring holes in wood.**

**Maintenance practices**

**i.Store in a cool, dry place.**

**ii.Keep away from rain and sun.**

**iii.Sharpen the tool regularly.**

**Budding Knife**

**Description: Budding knife is a small knife with a short, wooden handle and a short, metal blade which is sharpened at one edge. Budding.**

**Functions/Uses**

**Budding knife is used mainly in budding by vegetative propagation in citrus, cocoa, rubber, etc.**

**How the tool is used**

**An inverted T- shaped cut is made with a budding knife in the bark of the stock plant, about 20cm above the ground level. The bark on either side of the cut is lifted slightly to admit the bud, which is pushed into position so that the layers of both the scion and the stock are in close contact.**

**Maintenance Practices**

**i.Sharpen the metal blade regularly.**

**ii.Store in a cool, dry place.**

**iii.Use for the purpose for which it is meant.**

**Emasculator**

**Description: This is an instrument used for castration of some farm animals. It consists of a pair of powerful pincers with plastic or metal handles. The pincers press the neck of the scrotum to crush the spermatic cord which supplies blood to the testes.**

**Functions/Uses**

**The emasculator is used to castrate some farm animals, especially the males, e.g; bull, ram, doe (goat).**

**Maintenance Practices**

**i.Keep clean always**

**ii.Use according to instructions**

**iii.Employ the service of an expert.**

**iv.Keep in cool, dry place.**

**Shears**

**Description: The shears are an enlarged pair of scissors or, are scissors-like in shape.**

**They possess two long metal blades and two handles which may be wooden, metal, rubber or plastic. The blades are sharpened at one edge and are connected to the pivot by bolt and nut.**

**Functions/Uses**

**i.Shears are used for pruning operations.**

**ii.They are also used for trimming flower hedges.**

**iii.They can be used for cutting flowers.**

**Maintenance Practices**

**i.Store in a cool, dry place.**

**ii.Sharpen the blades properly.**

**iii.Keep away from rain to prevent rusting.**

**iv.Clean or wash after use.**

**Secateurs**

**Description: It is scissors- like in sharpe but small in size.. It consists of two short, metal blades- one with a concave curve and the other with a convex curve joined at a pivot by bolt and nut. It possesses two short wooden or metal handles. It usually has a spring between the handles.**

**Functions/Uses**

**i.It is used for pruning shrubs, ornamental plants and for weeding.**

**ii.It is used for trimming hedges or shrubs.**

**iii.It is used for cutting bud, wood or scion and the root stock.**

**Maintenance Practices**

**i.Metal blades should be washed or cleaned after use.**

**ii.Blades should be sharpened when necessary.**

**iii.Keep in termite-free area to protect wooden handles.**

**iv.Tighten bolt and nut when loosened.**

**v.Store in a cool, dry place.**

**Hammer**

**Description: Hammer is a tool with heavy, metal head on a short wooden handle. The metal head has two ends-one is the flat-ball end and the other is prong-like.**

**Functions/Uses**

**i.Hammer is used for straightening damaged or bent components of farm implements.**

**ii.It is used for driving nails into the wooden parts of farm structures/equipment.**

**iii.The ball end is used for riveting.**

**iv.The pronged end is used for removing nails from wood.**

**Maintenance Practices**

**i.Keep in dry, cool place.**

**ii.Store in termite-free area to protect wooden handle.**

**iii.Grease or oil metal part before storage for a long time.**

**Mallet**

**Description: This is wooden hammer with a short handle and large wooden head. This shape is just like the normal hammer except that it is larger but lighter than the metal hammer.**

**Functions/Uses**

**i.It is used for driving a chisel while cutting or shaping wood.**

**ii.For hammering materials that would be damaged by a metal hammer.**

**Maintenance Practices**

**i.Keep in a cool, dry place.**

**ii.Use only for intended function(s).**

**iii.Keep away from rain and termite infested area.**

**iv.Store in tool box.**

**Pliers**

**Description: A pair of pliers is a small metal tool with jaws which normally have parallel-toothed surfaces, used for gripping.**

**Functions/Uses**

**i.It is used for gripping firmly and for twisting wires;**

**ii.For holding or handling boils and nuts;**

**iii.For handling small objects;**

**iv.For cutting, especially wires and other cables.**

**Spanner**

**Description: A spanner is a hand tool which consists of a small bar or steel having an open or close grip or jaw at once or both ends. This fits over or clamps the head of a bolt and can be used either to turn it or hold it in position. Some spanners are adjustable.**

**Functions/Uses**

**i.It is used for loosening nuts/ bolts on farm machineries.**

**ii.For tightening nuts on farm machineries.**

**Maintenance Practices**

**i.Keep in dry, cool place.**

**ii.Keep away from moist areas or rain to avoid rusting.**

**iii.Grease or oil before being put away for a long time.**

**Screw Driver**

**Description: This is a small tool with a wooden or plastic handle and a pointed or narrow rod. It has a blunt end which is either flat and straight or star-shaped.**

**Functions/Uses**

**i.It is used for turning or screwing nails or screws into or out of wooden or metal surfaces.**

**ii.Some are used to detect the presence of electric current.**

**Maintenance Practices**

**i.Keep away from rain to avoid rusting.**

**ii.Keep in a cool, dry place.**

**iii.Oil or grease metal parts, if it is to be stored for a long time.**

**Nut and Bolt**

**Description: A bolt is a piece of metal consisting of a rod with a head at one end and a threaded area at the other end. It is used often with a nut.**

**Functions/Uses**

**Both bolt and nut are used for holding two pieces of metals or wood in position in farm machineries or structures.**

**Maintenance Practices**

**i.Keep properly in tool box.**

**ii.Keep bolt and nut in a cool, dry place.**

**iii.Keep away from rain to avoid rusting.**

**iv.Use the appropriate bolt for a nut.**

**Screw**

**Description: A screw is a piece of metal consisting of a pin threaded 2/3 with a pointed end. The other bigger end has a narrow hole or cut on top in which a flat screw driver can fit in during use.**

**Functions/Uses**

**It is used to hold two or more pieces of metals or wood in position in farm machineries, equipment and structures.**

**Maintenance Practices**

**i.Keep tool in a cool, dry place.**

**ii.Rub with oil or grease to prevent rusting.**

**iii.Use appropriate plier to screw in or screw out to avoid it wearing out.**

**File or Chisel**

**Description: This has a straight steel blade with a sharp cutting edge. It is about 20-30cm long with a wooden handle.**

**Functions/Uses**

**i.It is used for sharpening blades of farm tools.**

**ii.It is used for smoothening rough surfaces of farm implements.**

**Maintenance Practices**

**i.Keep in a cool, dry place.**

**ii.Store in termite-free area to protect wooden handle.**

**iii.Grease or oil metal parts before storage for a very long time.**

**GENERAL MAINTENANCE OF SIMPLE FARM TOOLS AND IMPLEMENTS**

**The following maintenance practices or precautions are to be adopted to prolong the "life span" and effective use of farm tools.**

**i.Tools should be washed or cleaned after use.**

**ii.Oil, grease or lubricate movable joints to reduce friction.**

**iii.Turn or store upside-down for water to drain out where necessary, e.g. watering can.**

**iv.Sharpen (blunt) edges or blade where necessary.**

**v.Paint, oil or grease metallic parts against rusting where necessary.**

**vi.Store in a cool, dry place.**

**vii.Replace worn-out parts.**

**viii.Check and tighten loose nuts and bolts daily or periodically.**

**ix.Follow manufacturer's instructions before using implement.**

**x.Handle tools with care and use for intended purposes only.**

**Question**

**1.What is farm tool?**

**2.State five examples of farm tools**

**3.State two uses of each example stated**

**4.State two maintenance practice of each tool stated**

**5.State Five general maintenance of farm tools**

**WEEK TWO**

**TOPIC: SOURCES OF FARM POWER**

**Power is defined as the rate of doing work or the rate of expenditure of energy. Farm power can be obtained from the following sources:**

**1)Human power**

**2)Animal power**

**3)Mechanical power**

**4)Electrical power**

**5)Solar power**

**6)Wind power**

**7)Water power**

**8)Biogas.**

**HUMAN OR MANUAL POWER**

**Human power is derived from the power provided by human beings (fig.9.1). it is the most common source of power in farm operations. With the aid of his intelligence, man uses his hand to perform certain farm operations. Human labour is used with traditional tools. It involves more people than all other sources of power. Human labour can be hired; it may be skilled or unskilled.**

**Farm operations which require human power**

**Human power is required in all farm operations. In crop production, for example human power is required in:**

**i.Land clearing,**

**ii.Stumping**

**iii.Land preparation, e.g. ploughing, hallowing and ridging**

**iv.Weeding**

**v.Harvesting**

**vi.Storage**

**vii.Food processing**

**Advantages of human power**

**i.Man uses his intelligence to control the work he does.**

**ii.It is easily available in all farm operations**

**iii.It has control over all other sources of farm power.**

**iv.It is the most intelligent source of power used for precision jobs.**

**v.It is easy to control and readily available**

**vi.It is used with traditional tools.**

**vii.It can be used for a job that requires precision.**

**Disadvantages of human power:**

**i.Human power is not stable. A normal human power is about 75W and decreases to about 20W when it is used continuously; that is, output is low.**

**ii.It cannot perform tedious farm operations like land preparation, planting, weeding, etc. without being exhausted**

**iii.Poor state of health of the individual may affect his performance.**

**iv.It may be expensive.**

**v.Human labour can easily get fatigued.**

**vi.Human beings can easily die**

**vii.Efficiency decreases with age.**

**viii.It consumes time and is less efficient.**

**ANIMAL POWER**

**This is the type of power derived from some animals which are used to perform certain farm operations. Animals like the bull (fig. 9.2), are used for pulling ploughs, harrows, planters, ridgers while donkeys, camels and horses are used for transportation of farm produce. Animals can be hired.**

**Draught animals such as oxen, bullock, etc. are yoked. The yoke is attached to any farm implement. Animal drags the implement while man controls the direction of the implement for the tillage of soil.**

**Qualities of a good draught animal**

**i.It must have a good body size or deep barrel.**

**ii.It must have strong hind limbs and a sloping rump.**

**iii.It must have strong hooves, good stride and stance (gait).**

**iv.It should be preferably male or castrated.**

**v.Draught animal must be docile.**

**vi.It should be healthy.**

**vii.It must be energetic or strong or powerful.**

**Precautions to be observed when using draught animals**

**i.Treat animals fairly to prevent them from being hostile.**

**ii.Apply muzzle.**

**iii.Do not overwork draught animals.**

**iv.The best time to use them to work is early in the morning or evening.**

**v.Make sure that animals are healthy.**

**vi.Keep them in a healthy environment.**

**vii.Feed and provide them with adequate water.**

**Farm operations which require animal power**

**Animal power is required in the following farm operations:**

**i.For carrying people.**

**ii.For drawing ploughs.**

**iii.For drawing harrows.**

**iv.For drawing ridgers.**

**v.For transporting loads e.g. farm produce, fertilizers, chemicals, etc.**

**vi.For drawing planters.**

**Advantages of animal power**

**i.It can perform more tedious jobs than man, because the output is about 500W for a bull, for instance.**

**ii.It can handle many farm operations.**

**iii.Initial outlay is cheap relative to cost of machines, i.e. it is cheap to purchase.**

**iv.It can be controlled or easy to operate.**

**v.It has a relatively low maintenance cost compared to machines.**

**vi.Animal do not get fatigued easily, compared with man.**

**vii.It can operate in rugged terrains.**

**viii.It can be used in evacuation of produce from inaccessible areas.**

**ix.Animal power removes drudgery or it makes work easier.**

**Disadvantages of animal power**

**i.Huge amount of money is needed to feed and maintain the animal.**

**ii.It cannot perform at certain periods of the day such as in the afternoon.**

**iii.Diseases may affect the efficiency of the working animals.**

**iv.Poor handling of the animals by the operator may result in poor performance and even refusal to work.**

**v.The use of animal is restricted to certain climatic zones, e.g., tsetse fly-free zones.**

**vi.Unsuitable for processing agricultural produces as they may eat up the products.**

**vii.It is not suitable for large scale production.**

**viii.Animals can die and get fatigued easily.**

**ix.Power output is very low.**

**MECHANICAL POWER**

**Description: This requires the use of machines and engines like planters, harvesters, ploughs, harrows, ridgers to carry out various farm operations like ploughing, harrowing, weeding, planting, harvesting, processing and transportation. They facilitate the cultivation of large hectares of land. Machines are used in tractions, grinding, food processing and others. Examples are tractors , generators, water pump, bulldozers, etc.**

**Farm operations which requires mechanical power:**

**Mechanical power is required in many farm operations which include:**

**i.Ploughing**

**ii.Stumping**

**iii.Planting**

**iv.Harrowing**

**v.Ridging**

**vi.Harvesting**

**vii.Weeding**

**viii.Traction**

**ix.Grinding**

**x.Food processing**

**xi.Transportation of inputs and outputs.**

**xii.Feed milling.**

**Advantages of mechanical power**

**i.It can handle more land area per unit of time.**

**ii.It works faster and more efficiently**

**iii.It reduces labour cost and overall cost of production.**

**iv.It is not prone to diseases.**

**v.It can perform a wide range of farm operations.**

**vi.They reduce farm drudgery or they make farm work less tedious.**

**vii.They make farm operations timely.**

**Disadvantages of mechanical power**

**i.It requires high capital investment or it is costly to purchase.**

**ii.It requires lots of technical skills to operate.**

**iii.It can lead to displacement of labour (unemployment).**

**iv.It cannot be used by small scale farmer.**

**v.It can cause air pollution through gases from exhaust pipe.**

**vi.It is not easily available.**

**vii.It requires high cost of maintenance.**

**viii.It can destroy soil structure.**

**ELECTRICAL POWER**

**Electrical power is the type of power derived from electricity or generator. Electricity is used for many purposes. It is a neat or clean source of energy. It is efficient and reliable, but expensive.**

**Farm operations which requires electrical power**

**Electrical power is required in the following farm operations:**

**i.Refrigeration**

**ii.Incubation**

**iii.Milking machines**

**iv.Drying of products**

**v.Brooding of chicks**

**vi.Shelling of fruits/seeds**

**vii.Feed milling/grinding/mixing**

**viii.Most processing operations e.g. par boiling, threshing, winnowing, etc.**

**ix.Defeathering/plucking**

**x.Debeaking**

**xi.Candling**

**xii.Egg grading.**

**Advantages of electrical power**

**i.It cannot contaminate products, thus making them safe for human consumption.**

**ii.It is a cheap source of power**

**iii.It is very versatile, i.e. it can be used for various services and at different times.**

**iv.It is very neat.**

**v.It aids fast operation or increases production.**

**vi.It is very dependable.**

**vii.It is easy to operate**

**viii.It is efficient or it saves labour.**

**Disadvantages of electrical power**

**i.Its supply is not always regular, especially in developing countries, e.g, Nigeria.**

**ii.It is dangerous or fatal, if carelessly handled.**

**iii.It must be strictly controlled or regulated.**

**iv.Its maintenance cost may be high.**

**v.It is very expensive.**

**vi.It can cause fire hazards.**

**vii.It cannot be widely used in field operations.**

**SOLAR POWER**

**Solar energy is derived from the radiation light and heat reaching the earth's surface from the sun. The energy from the sun is the ultimate source of energy. solar energy is converted into electrical energy by solar panels installed in buildings.**

**In other words, solar energy is trapped by photo-voltaic cell or solar collectors or panels. It is then converted to electrical energy which can be stored in batteries. It can be used directly.**

**Farm operations which requires solar power**

**Solar power is required in the following farm operations:**

**i.Generation of electrical power.**

**ii.It is used in heating of farmstead.**

**iii.Processing of farm produce, e.g. drying of materials such as melon, cocoa, maize, meat, fish, etc.**

**iv.Electricity generated can be used for several farm operations.**

**v.Solar energy by crops for photosynthesis.**

**Advantages of solar power**

**i.It is a cheap source of energy.**

**ii.It is free.**

**iii.It is easily available.**

**iv.It is a neat source of energy**

**v.Disadvantages of solar power**

**vi.It is only available during the day.**

**vii.It cannot be adjusted and stored.**

**viii.Its supply cannot be controlled.**

**ix.It is expensive to harness and store.**

**x.Excess of it can cause transpiration and evaporation.**

**xi.It fluctuates in supply.**

**WIND POWER**

**Wind power is generated by wind movement. Its use in windmill helps to pump water out of a borehole to a generating set for the production of electricity. Wind power can be converted to mechanical power.**

**Farm operations which requires wind power**

**Wind power is required in the following farm operations:**

**i.Operation of wind mills in which the force of the wind is converted into electricity.**

**ii.It is used in winnowing, i.e. separation of chaff from grains.**

**iii.It is used for drying produce.**

**iv.It can be used to generate electrical power.**

**v.It can be used for propelling ships.**

**vi.It may be used in pumping water out of a borehole.**

**vii.Advantages of wind power**

**viii.It can serve as alternative to electrical power .**

**ix.It is cheap.**

**x.It is available everywhere.**

**Disadvantages of wind power**

**i.Its supply is sporadic and uncertain as power depends on the wind.**

**ii.Its operation is expensive compared with the energy it generates.**

**iii.It is limited to certain farm operations.**

**iv.It cannot be stored and it is difficult to control.**

**v.Efficiency is highly varied.**

**WATER POWER**

**Water power is the power derived from water flowing in rivers, streams and dams. Water is used in hydro-electric stations to drive the turbines.**

**Farm operations which required water power**

**Water power is required for the following farm operations:**

**i.In hydro-electric power stations water is used to drive turbines that generate electricity.**

**ii.The electricity so generated can be used for many farm operations.**

**iii.It is used in transportation, e.g. logs, farm goods, etc.**

**iv.It is used to operate steam engines.**

**v.It is used by crops for normal growth.**

**vi.It can be used for processing farm products.**

**Advantages of water power**

**i.It is very cheap.**

**ii.It is easy to be harnessed.**

**iii.It can easily be converted to other forms of energy.**

**Disadvantages of water power**

**i.Low level of water can hinder low electricity output.**

**ii.It is not available in all areas.**

**iii.Supply is affected by weather.**

**iv.It does not supply power directly.**

**v.It must be harnessed to generate power.**

**vi.It could be destructive if carelessly handled.**

**Biogas**

**Biogas is a new method of generating power by making use of farm wastes, especially animal dung. Animal dung is carefully collected and processed through scientific means to produce certain gas that provides power.**

**Animal droppings mixed with water are accumulated in air tight device called digester or dome. As it decays anaerobically by microbes, hydrocarbon (methane) which is a colourless and odourless gas is released. This hydrocarbon is stored and used for heating and lighting.**

**Advantages of Biogas**

**i.It constitutes a cheap source of power.**

**ii.It can convert chemical power in dung to heat power.**

**iii.Power derived from biogas can be used as source of heat for brooding chicks.**

**iv.The power can also be used for cooking and drying.**

**v.It can easily be controlled.**

**Disadvantages of biogas**

**i.It is not a common source of power.**

**ii.It requires expertise which may not be easily available.**

**iii.It may be expensive to set up and maintain.**

**iv.It is only limited to where animals are reared on commercial basis, where dung is easily available.**

**Questions**

**1.What is farm power?**

**2.State five sources of farm power**

**3.State two advantages of each source**

**4.State two disadvantages of each source**

**5.Explain biogas.**

**WEEK THREE**

**TOPIC: PROBLEMS AND PROSPECTS OF MECHANISATION**

**MEANING OF MECHANISATION**

**Farm mechanization is the application of principles and technology in agricultural production, storage and processing on the farm.**

**Farm mechanization is applicable to land preparation, planting, fertilization application, weeding and crop harvesting, rearing, care and feeding of animals as well as processing and storage of farm produce, using appropriate farm machinery.**

**Problems of farm mechanization**

**i.Land tenure system: The type of land tenure system (communal) does not allow for large farm holdings suitable for mechanization.**

**ii.Scattered farm holdings: Scattered farm holdings are also not conducive or economical for mechanization, especially in West Africa.**

**iii.Poverty of farmers: Most farmers, especially in West Africa are very poor and cannot afford the cost of tractors and farm implements.**

**iv.Inadequate facilities (machinery): The facilities or machinery for fabricating and repairing farm implements are grossly insufficient where they are available.**

**v.Bad topography: The topography of most West African landscape is too rough and unconducive for farm mechanization.**

**vi.Varied soil types: Soil types are extremely varied and the machines to use on them have not been developed locally. West African countries, Nigeria for instance, still depend on imported machinery which is too suitable for our soil.**

**vii.Inadequate spare parts: Availability of spare parts is a major problem as these parts are still being imported.**

**viii.Inadequate technical manpower: Available technical manpower to operate or service the implements and machines is not adequate.**

**ix.Problems of stumps and logs: During clearing, heavy stumps and logs are usually left behind, and they constitute additional problems in mechanization.**

**Advantages of farm mechanization**

**Farm mechanization has the following advantages:**

**i.Timeliness of operation: Farm mechanization ensures that all farm operations are done and completed within a short period of time.**

**ii.It saves labour: In farm mechanization, most human are substituted with machines. Hence, labour saved could be employed elsewhere.**

**iii.It reduces health hazards: These include those posed by knives, hoe, stumps, pest, etc.**

**iv.It reduces drudgery: Farm mechanization makes it easy to avoid unpleasant manual jobs.**

**v.Increase in farm revenue: As a result of mechanization, farmers become richer due to high yield.**

**vi.It encourages large scale farming: Farmers are capable of working on large farms and, hence, reap heavy harvest.**

**vii.Increase in output: Mechanization makes it possible for farmers to have increase in output (production, harvest or yield ).**

**viii.It promotes specialization of labour: Farm mechanization enables people to become specialized in certain operations within the farm.**

**ix.Co-operation among farmers: Mechanization enables many farmers to come together and pool their resources together, thereby promoting or encouraging co-operation among farmers.**

**x.It saves time: Mechanization translate quickly the products of man's brain into reality.**

**xi.Reduction in cost of operation: Mechanization leads to reduction in the cost of agricultural operations per unit output.**

**xii.Improvement in quality of produce: Farm mechanization usually improves the quality of some farm produce, e.g. rice processing.**

**xiii.Availability of labour for other sectors: mechanization also helps to release labour to other sectors of the economy.**

**xiv.Use of less human labour: Mechanization helps to accomplish lots of work with less human labour.**

**Disadvantages of farm mechanization**

**Farm mechanization has the following disadvantages:**

**i.High cost: farm mechanization, due to the numerous machines involved, is usually expensive to operate.**

**ii.Displacement of workers: in farm mechanization, very few workers are required; hence, many people will be out of job when mechanization is introduced.**

**iii.Compaction of soil: mechanization leads to compaction of soil due to the movement of heavy machines.**

**iv.It causes environmental pollution: mechanization causes environmental pollution due to smokes emanating from machines, chemicals and fertilizer usage.**

**v.Degradation of landscape: mechanization ensures the degrading of landscape as a result of continuous excarvation.**

**vi.Land tenure system: land tenure system may hinder efficient of tractors due to small holding of farmlands.**

**vii.Destruction of soil structure: the soil structure can easily be destroyed due to continuous movements and usage of machines.**

**viii.Redundancy of farm labour: with farm machines working on the farm, the work can easily be completed and this situation can create redundancy in farm labour.**

**ix.Few crops can be mechanized: very few crops like maize, rice, guinea corn, millet, etc. can easily be mechanized.**

**x.Inadequate technical knw-how: ther is always inadequate technical knw-how on the use and handling of the farm machines and equipment.**

**xi.Damage to crops: most crops are usually damaged during mechanized farm operations, especially if care is not taken.**

**xii.Inadequate spare parts: most spare parts or replaceable parts are not always available. Therefore they may be scarce or inadequate.**

**xiii.High cost of maintenance: there is usually high cost of maintenance involved, especially for heavy machines.**

**xiv.Spread of pests and diseases: mechanization helps to spread pests and diseases through contaminated machines.**

**xv.Human control: mechanization needs human labour to control it.**

**xvi.Unstable fuel supply: unstable supply of fuel affect the working of machines.**

**LIMITATIONS OF FARM MECHANIZATION**

**Factors limiting agricultural mechanization in Nigeria can be discussed under the following major headings:**

- **Economic limitation**

**i.Machines are not readily available in the country.**

**ii.Most farmers are poor and cannot afford them.**

**iii.Cost of hiring the machines is high/exorbitant.**

**iv.Cost of maintenance is high.**

**v.Operators of machines demand high pay/wages which most farmers cannot afford.**

- **Technical limitation**

**i.There is lack of technical know-how of the machines.**

**ii.Experts on these machines are not readily available.**

**iii.Mode of operations of most machines are not known**

**iv.Most of the machines are not adapted to our local environment/needs.**

**v.Very few schools exist for the training of machine operators.**

- **lack of maintenance**

**i.Most machines are imported.**

**ii.Replacement parts are not available.**

**iii.Inadequate trained personnel to repair farm machines.**

**iv.Facilities for repair and maintenance are lacking.**

**v.The very few trained personnel are not always available when machines breakdown.**

- **Small farm holdings**

**i.Land tenure system encourages fragmentation of land which cannot be mechanized.**

**ii.Fragmentation of land discourages mechanization.**

**iii.Agriculture is practice by peasant farmers.**

**iv.Peasant farmers have small area of farmland.**

**POSSIBLE WAYS OF IMPROVING AGRICULTURE THROUGH MECHANIZATION**

**i.Farmers should be educated to accept modern system of farming, especially in the areas of mechanization.**

**ii.Government should provide loans to enable farmers to purchase farm machines.**

**iii.The land tenure system should be reviewed to enable farmers to acquire large hectares of land.**

**iv.Simple and less expensive machines should be developed.**

**v.Farmers should form co-operative societies to enable them to pool their resources together to buy farm machines.**

**vi.Government should establish agricultural engineering schools or institutions to train personnel and fabricate simple machines.**

**WEEK FOUR AND FIVE**

**TOPIC: ANATOMY AND PHYSIOLOGY OF FARM ANIMALS**

**Anatomy refers to the form and structure of the body while physiology refers to the functions of the forms and parts of the body. It is very important for the farmer to understand the anatomy and physiology of farm animals because it will enable him to know more about the nutrition, reproduction and management of the animals.**

**MAJOR PARTS OR DIVISION OF FARM ANIMALS**

**The body of farm animals is divided into four major groups. These are:**

**i.Head**

**ii.Thoracic cavity**

**iii.Abdominal cavity**

**iv.The limbs**

**HEAD: The head is the upper part of the body. The major organs found in the head region include the brain, eyes, ear, tongue, nose, etc.**

**THORACIC CAVITY: The thoracic cavity refers to the chest region of the body. The major organs in the thoracic cavity include heart, lungs, treachea etc.**

**ABDOMINAL CAVITY: The abdominal cavity refers to the stomach region of the body. The major organs in the abdominal cavity include liver, uterus, stomach, oviduct or fallopian tube, kidney, ovary, spleen, intestine, gall bladder, pancreas etc.**

**LIMBS: The limbs include the fore limbs (hands) and hind limbs (legs) .They are used by farm animals for walking.**

**Some of the systems which maintain the body include:**

**i.Digestive system**

**ii.Circulatory system**

**iii.Respiratory system**

**iv.Nervous system**

**v.Reproductive system.**

**DIGESTIVE SYSTEM:**

**The digestive system of a farm animal includes all the organs and tissues associated with the breaking down or digestion of food in the body. It includes the teeth or beak, tongue, the alimentary canal or digestive tract and all the associated gland, secretory enzymes and other body fluids.**

**Farm animals are grouped into two main classes based on the mature of their alimentary canal or digestive tract. These are:**

**(1)Monogastric or non- ruminant Animals:these are animals which possess only one stomach and they do not ruminate ( i.e. they do not chew the cud). In other words, these animals have simple stomach and cannot digest cellulose and fibres properly. Examples include, the pig, rabbit and poultry birds like the domestic fowl.**

**(2)Polygastric or Ruminant Animals : these are animals which possess four stomach compartments ( complex stomach ) and hence, they can ruminate or chew the cud. The four stomach compartments are rumen ( the largest ), reticulum and abomasum ( true stomach ).**

**Cattle**

**(3)The rumen ( pounch ): it has several tongue-like projections called papillae. It also has a soft towel-like appearance. It is the largeart and the first compartment of the stomach.**

**(4)Reticulum ( Honeycomb ): this is lined with a mucosal layer which is formed into hexagonal chamber that looks like honeycomb. It is the second compartment.**

**(5)Omasum ( manypiles) : the omasum is the third and smallest compartment. It has several "leaves" or laminae/layers.**

**(6)Abomasum: this is the only glandular stomach. It is synonymous with simple stomach of monogastric animals. The abomasum is the fourth and last compartment of the stomach.**

**Functions of the first compartment (the rumen) of the stomach of a ruminant are:**

**i.Fermentation brought about by micro-organisms takes place in the rumen.**

**ii.It used for temporary storage of feed before regurgitation for proper rechewing**

**iii.Volatile fatty acids and other gases are produced in the rumen as a result of fermentation**

**iv.Absorption of volatile fatty acids takes place through the walls of the rumen**

**v.Some vitamins, e.g. vitamin B, are produced in the rumen**

**vi.Breakdown of cellulose takes place in the rumen**

**Examples include the cattle, sheep and goat. They are all herbivores.**

**DIGESTION IN RUMINANTS**

**Ruminants animals like cattle, sheep and goat feed mainly on grasses and they can ruminate or chew the cud because of the complex nature of their stomach. The digestion in ruminant can be explained properly with the aid of diagram below.**

**Digestive tract of ruminant e.g. cattle**

**When a ruminant animal like a cow wants to feed, it cuts the grass and swallows it with minimal chewing. The grass passes from the mouth through the oesophagus to the rumen where the grass is stored. In the rumen, the grass is acted upon by micro-organisms like bacterial and protozoa which digest the cellulose and synthesize some amino acids needed by the animal from non-protein nitrogenous substances. When the cow has finished filling the rumen, it finds a cool place and lies down quietly. By anti- peristaltic movement of the stomach, the undigested grass passes from the rumen to the reticulum from where it re-enters the oesophagus ( regurgitate ) back to the mouth. The food is not chewed properly by using the molar and premolar teeth ( chewing the cud ) into a semi-liquid cud which is re-swallowed. This liquid cud now moves into the omasum from where it passes to the abomasum ( the true stomach ) . the whole process is called rumination.**

**In the abomasum, enzymes are secreted which act on the food. Further digestion and absorption of the food take place progressively along the digestive tract. The digested food is then absorbed into the blood through the villi in the small intestine while the undigested food passes to the large intestine where they are removed through the anus as dung or faeces.**

**DIGESTION IN NON-RUMINANT ( PIG )**

**Pig has only one stomach. The do not chew the cud neither do they utilize roughages properly. The digestion in pig can be understood properly with the aid of diagram below.**

**Digestive tract of pig**

**The pig feeds mainly on basal feeds like maize, cassava and other mashed food. Digestion of food takes place in four areas of the tract.**

**1.Mouth: in the mouth the food is chewed and mixed with saliva which contains an enzyme called ptyalin. The ptyalin converts starch to maltose. The food is now swallowed and moves by peristaltic movement to the stomach.**

**2.Stomach: in the stomach two enzymes, renin and pepsin, are present. Renin acts on milk or it helps to curdle milk while pepsin convert proteins to peptones under the influence of an acid medium. The thick liquid called chime, now passes to the duodenum.**

**3.Duodenum : digestion also takes place here. Three enzymes are present and they act on different food stuffs.**

**(a) Amylase : this enzymes converts starch to maltose.**

**(b)Lipase: converts fat and oil to fatty acids and glycerol.**

**(c)Trypsinogen: converts protein and peptones to polypeptides. These enzymes are secreted by the pancreas. The digestion of fat and oil is aided by bile which is secreted by the liver and stored in the gall bladder. The bile helps in the emulsification of fats. At the end of digestion in the duodenum, the food ( now in liquid form ) called, chyle, passes to the ileum or small intestine.**

**4.Small intestine; the wall of the small intestine secretes many enzymes which complete the process of digestion. The enzymes are:**

**(a)lipase which converts fats and oil to fatty acids and glycerol**

**(b)Erepsin converts polypeptides to amino acids**

**(c)Maltose converts maltose to glucose**

**(d)Sucrose converts sucrose to glucose and fructose**

**(e)Lactose converts lactose to glucose and galactose.**

**The end product in the digestion include the conversion of :**

**i.Protein to amino**

**ii.Starch to glucose**

**iii.Fats and oil to amino acids.**

**These end products ( amino acids, glucose and fatty acid and glycerol ) are absorbed in the small intestine by a structure called the villi. The undigested food materials are passed to the large intestine from where they are ejected through the anus as faeces or dung.**

**The digestion of food in rabbit ( a non- ruminant ) is just like the pig except that rabbit can feed properly on grasses which are digested in the large caecum which contains micro-organisms like bacteria and protozoa.**

**DIGESTION IN DOMESTIC FOWL**

**The domestic fowl is a moniogastric animal and has a simple stomach. Digestion in fowl can be explained properly with the help of the diagram below.**

**Digestive tract of fowl**

**The fowl has no teeth but the food is picked up by the beak. This food then passes on to the crop through the oesophagus. This food is stored temporarily in the crop where it is moistened and fermented by some bacteria. The food now passes on to the proventriculus where digestive enzymes are secreted on the food.**

**The proventriculus is often regarded as the glandular stomach because it secretes digestive enzymes on the food like pepsin, amylase, etc. From the proventriculus, the food moves to**

**the gizzard where grinding takes place. With the aid of small stones or grits, the food is ground by the gizzard. From the gizzard, the food moves to the duodenum and small intestine where further digestion and absorption take place while the undigested food materials are removed from the tract as faeces.**

**DIFFERENCES BETWEEN MONOGASTRIC AND RUMINANT ANIMAL DIGESTIVE SYSTEM**

**Monogastric Animal Ruminants Animal**

**(1)Possesses only one stomach**

**(2)It can ruminate or chew the cud**

**(3)It cannot digest cellulose and fibres properly**

**(4)Digestion is not aided by bacteria**

**(5)Its diet is mainly basal and concentrate feeds**

**(6)It cannot synthesize its own proteins unless supplied in the feed**

**(7)It does not regurgitate**

**(8)It has no rumen**

**(9)Poultry, rabbits and pigs are examples. Possesses four stomach compartment**

**It can ruminate or chew the cud**

**It can digest cellulose and fibres very well**

**Digestion is aided by bacteria**

**Its diet is mainly grasses and other cellulose e.g. legumes**

**It can synthesize its own protein through micro bacteria activities in the rumen**

**It regurgitates**

**It has rumen**

**Cattle. Sheep and goats are examples.**

**IMPORTANCE OF DIGESTIVE SYSTEM**

**i.It aids the ingestion of feed**

**ii.It promotes the digestion of feed**

**iii.It ensures the absorption of digested feed**

**iv.It helps in ejection of undigested feed**

**v.It aids the secretion of productive hormones and digestive enzymes.**

## CIRCULATORY SYSTEM

**Circulatory system involves all the organs and tissues which are concerned with the movement of materials from one part of the body to another where they are either used or removed. The organs and tissues include the heart, the blood and the blood vessels.**

## COMPOSITION OF BLOOD

**Blood is a fluid tissue. It is made up of two parts. The fluid and the blood cells corpuscles.**

**(1) Plasma: plasma is the liquid portion of blood. It is made up of water, blood protein, globulin, fibrinogen, prothrombin, dissolved mineral salts and other organic substances in hormones. Enzymes, digested food, waste products etc. within the body.**

**(2) The blood cells ( corpuscles ): there are three blood cells or corpuscles. These are;**

**a.Red blood cell (Erythrocytes): these are biconcave and circular in shape, non-nucleated when matured. They are manufactured by the bone marrow and any excess is stored in the spleen. Erythrocytes contain an iron pigment called hemoglobin which helps to transport oxygen.**

**b.White blood cells ( Leucocytes ) : They are irregular in shape, larger but fewer than red blood cells. They have nucleus and are produced in the lymphatic tissues. The phagocytic leucocytes attack and destroy foreign organisms in the body. In other words, white blood cells defend the body against foreign germs.**

**c.The blood platelets ( Thrombocytes ) : They are irregular or star shape, tiny and non-nucleated. They are produced in the red bone marrow. The white blood cells are responsible for blood clothing.**

## FUNCTIONS OF THE BLOOD

**1.It maintains body temperature by distributing heat during circulation.**

**2.The red blood cell carries oxygen with the help of haemoglobin to different parts of the body.**

**3.It transports hormones from ductless glands to their areas of activities.**

**4.It transports waste products like carbon di-oxide, mineral salts, urea, water to where they are removed.**

5. **Leucocytes help to defined the body against germs.**

**6.It helps in blood clothing with the aid of platelets.**

**7.It also helps to transport digested food to the cells.**

**8.It also helps to maintain the water level of the body.**

**CIRCULATORY SYSTEM IN FARM ANIMALS**

**Farm animals possess a close circulatory system. This means that there is no mixing of oxygenated blood and deoxygenate blood in the heart. Farm animals also display pattern of double circulation. This implies that for one complete circulation, blood has to pass through the heart twice- each time going through a separate pathway.The two pathways re referred to as pulmonary circulation and the systemic circulation.**

**Circulatory system in Rabbits**

**The pulmonary is the movement of blood between the heart and the lungs while the systemic circulation is the movement of the blood between the heart and all parts of the body besides the lungs.**

**Importance of Circulatory System**

**I.It circulates nutrients to the body tissues.**

**II.It removes waste products from the body tissues**

**III.It assists in heat distribution in the body**

**IV.It assists in the distribution of oxygen and removal of carbon dioxide from the body tissues**

**V.It contains white blood cells which helps in combating diseases**

**VI.It helps in turgidity**

**VII.It ensures blood circulation in the body**

**VIII.It transports hormones and enzymes within the body.**

**RESPIRATORY SYSTEM**

**Respiratory system includes all the organs and tissues associated with the exchange of gasses between the animal and its environment, leading to the release of energy.**

**The purpose of respiration is to supply oxygen to the cells which oxidize or burn down the food release energy.**

**Structure of the lung**

**Respiration can be represented by this equation:**

**$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O +$ Energy**

**( Glucose ) ( Oxygen ) ( Carbon dioxide ) ( Water ) ( ATP )**

**Types of Respiration**

**1.Aerobic Respiration : this is the type of respiration which takes place in the presence of oxygen. This is the type possessed by all farm animals. Aerobic respiration can be represented by this equation.**

**$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O +$ Energy**

**( Glucose ) ( Oxygen ) ( Carbon dioxide ) ( Water ) ( ATP )**

**2.Anaerobic Respiration : this is the type of respiration which takes place in the absence of Oxygen. In anaerobic respiration, the end products are energy, carbon dioxide and alcohol. It can be epresented by this equation.**

**$C_6H_{12}O_6$ $2C_2H_5OH + 2CO_2$ + Energy**

**( Glucose ) ( Alcohol) ( Carbon dioxide )**

**The process is also referred to as fermentation.**

**The most important organ of respiration in all farm animals is the lung while aquatic animals like fish use the gills to respire. Other organs associated with respiration are the nostril and diaphragm.**

**The lung is located in the thoracic cavity of farm animals. The atmospheric oxygen passes through the nostrils, the pharynx, larynx or voice box bronchi and to the lungs. The movement of oxygen through these organs finally terminates in the alveoli where exchange of gases ( Oxygen and carbon dioxide ) take place.**

**Process of Breathing**

**Breathing involves two processes:**

**1.Inspiration ( inhalation ) : this involves breathing in of air into the lungs. During the process, the following takes place within and around the lungs.**

**a.The diaphragm contracts and flattens out.**

**b.Intercostal muscles contract, ribs are thus raised.**

**c.Sternum moves forward**

**d.Volume of thoracic cavity therefore increases and the pressure in the lungs is lowered**

**e.This therefore creates a high pressure in the lungs and oxygen is taken into the lungs.**

**2.Expiration ( exhalation ) : this involves the breathing out of air from the lungs. During the process, the following takes place within and around the lungs.**

**a.The diaphragm relaxes to its dome shape**

**b.Intercostal muscles relax and the ribs are lowered**

**c.The sternum moves backwards**

**d.Volume of thoracic cavity therefore decreases; pressure in the lungs is increased and carbon dioxide is expelled from the lungs.**

**Differences between Inhaled Air and Exhaled Air**

**GAS INHALED AIR EXHALED AIR**

**Oxygen**

**Carbon dioxide**

**Nitrogen**

**Water vapour 21%**

**0.03%**

**79%**

**Variable 16%**

**4%**

**79%**

**saturated**

**The oxygen which diffuses into the blood through the lungs is now transported by the haemoglobin of the blood cells to various cells in the body. The oxygen is used to oxide food substances in the mitochondria of the cells during tissue respiration to release energy used by farm animals for movement, growth, reproduction and other body metabolic activities.**

**Importance of the Respiratory System**

**1.It supplies oxygen to the body cells**

**2.It helps to reduce heat load in the body especially in poultry**

**3.It removes carbon dioxide from the body**

**4.It promotes gaseous exchange.**

**NERVOUS SYSTEM**

**The nervous system includes all the organs and tissues which enable animals to respond to changes in their environment. A change in the environment is called response.**

**The nervous system of mammals is composed of two parts: the central nervous system and the peripheral nervous system.**

**Central Nervous System**

**This is made up of the brain and the spinal cord. Both are made up of thousands of nervous cells or neurons.The functions of the central nervous system is correlation of impulses from various sense organs and storage of impulses as information or impressions in the brain for reaction to future similar stimuli.**

**a.The Brain: the brain is enclosed in a bony case called the cranium. It is divided into fore, mid and hind brain**

**The Brain**

**The fore brain consists of olfactory lobes which receive sensory impulses for smell and cerebrum which is the seat of consciousness, intelligence, memory and all voluntary actions. The mid brain consists mainly of optic lobes which controls sight. The hind brain consists of the cerebellum which is concerned with balance and body posture, receives impulses and coordinate action, respiration, heartbeat, digestive movements and blood supply.**

1. **The Spinal Cord: the spinal cord stems from the medulla oblongata and runs through the neural canal of the vertebral column or backbone. It communicates between the brain and other parts of the body. It controls all the reflex (involuntary) actions of the body.**

**The Peripheral Nervous System**

**The peripheral nervous system consists of the cranial and spinal nerves and the autonomic nervous system. The cranial and spinal nerves of the peripheral nervous system together with the central nervous system, mediate relations between the animals and its external environment. On the other hand, the autonomic nervous system, consisting of the sympathetic and parasympathetic nervous system regulates event within the animal.**

**A nervous (nerve cell ) is the structural and functional unit of the nervous system. It helps in receiving and relaying or transmission of impulses. A neurone has three main parts: the dendrite, cell body and the axon ( nerve fibre or axis cylinder ).**

**The cell body has dendrites, extending from it, and a central nucleus. The axon is surrounded by myelin sheath which is interrupted at intervals forming nodes of ranviker. The axon terminates in dentrites.**

**Types Of Neurones**

**i.Sensory or Afferent Neurone : these neurons carry impulses from receptors, such as the eyes, skin, ear, etc. to the central nervous system.**

**ii.Motor or Efferent neurone: these neurons carry impulses from the central nervous system to effectors, such as muscles and glands in the body.**

**iii.Intermediate or Relay neurones: These neurones receive, transmit and interpret messages in the spinal cord and brain.**

**The Tense Organs**

**The sense organ are the organs which receive stimuli and with the help of the brain ( voluntary action), the message is received and interpreted. Hence, such organs enable animals to respond to stimuli within the environment.**

**The sense organs include:**

**i.Nose - sense of smell**

**ii.Eyes - sense of vision ( sight )**

**iii.Ears - sense of sound (hearing )**

**iv.Tongue - sense of taste**

**v.Skin - sense of touch, heat, etc.**

**Functions Of The Neurones**

**i.It coordinate body functions**

**ii.It is responsible for bringing about locomotion or movement**

**iii.It enables the body to respond to external stimuli.**

**Reproductive System**

**The reproductive system includes all the organs and tissues concerned with reproduction in animals. Reproduction is the ability in animal to give birth to young ones. The purpose of reproduction is to ensure continuity of life.**

**Farm animals reproduce sexually and are mostly viviparous because they bear their young ones alive. Poultry birds on the other hand are oviparous because they produce their young ones by hatching eggs after an incubation period.**

**Male Reproductive System**

**The male reproductive system includes the testes which produce the spermatozoa and sex hormone called testosterone which aids the development of male sexual secondary characteristics. The spermatozoa are specifically produced in the seminiferous tubules of testes during meiotic cell division by a process called spermatogenesis. The testes are suspended or protected by scrotal sac ( scrotum ) outside the abdominal cavity to enable sperm cells to be produced at desired temperature.**

**The epididymis ensures the storage and maturation of sperm cells in the testes. The testes are connected to the uterus masculinus by vas deferens which transports sperms from testes to the uterus masculinus where matured spermatozoa are stored until they are released during coition or mating. Blood vessels called spermatic cord supply nutrients and oxygen to the testes. Located along the urethra are accessory glands which are the Cowper's gland, seminal vesicle and prostate glands. They produce slimy alkaline fluid which aids the movement of spermatozoa. This fluid together with the spermatozoa results in the formation of semen. The**

**urethra is a uro-genital organ which helps to inject sperms into the vaginal as will as the removal of urine. The urethra ends externally in penis.**

**Male Reproductive System**

**Female Reproductive System**

**The female reproductive system include the ovaries which produce the ovum or ova ( eggs ) enclosed by the graffian follicles and some hormones such as the oestrogen.**

**Female Reproductive System**

**A matured eggs or ovum is released from the follicle in the ovary into the oviduct. This process is called ovulation. As the ovum or egg is release from the ovary, the female animal comes into 'heat' and is willing to mate with the male animal.**

**Fertilization which is the fusion of the male sex cell (spermatozoa and the female sex cell ( egg or ovum ) takes place in the fallopian tube or the oviduct. When the egg is fertilized by the spermatozoa, the fertilized egg anchors itself to the wall of the uterus. This process is called implantation. The development of the foetus takes place in the uterus. Below the uterus is the vagina which receives the spermatozoa during corpulation. The female reproductive system terminates with an external opening called the vulva.**

**Development of the embryo (foetus)**

**The fertilized egg is implanted in the uterus where the development of the embryo takes place. Soon a number of embryonic membranes develop round the embryo. These are: the chorion, the allantois and the yolksac. The amnion forms a sac in which the embryo lies and is filled with amniotic fluid. Hence, the embryo is held in a liquid environment which acts as a buffer or " shock absorber ".This endures the protection of the embryo. The allantois forms a sac which is excretory, respiratory and nutritive in function. It contributes to the formation of placenta. The yolk sac provides the food during the early stages of embryonic development. The chorion form the outermost membrane, enveloping all these structures.**

**The placenta establishes an intimate connection between the embryo and the mother which aids nutritional, respiratory and excretory needs of the embryo**

**(foetus). The placenta and the embryo are connected by the umbilical cord which develops from the allantois. The parental blood supply is linked to the foetal blood supply through this umbilical cord.**

**Position of the development foetus in the uterus of the cow**

**At the end of the gestation period ( from fertilization to birth ) parturition ( giving birth ) takes place during which the young animal is pushed out through the vagina. The remaining part of the embryonic membrane known as after birth is sent out after the birth of the foetus.**

**Reproductive Systems In Birds**

**In the male bird, the two testes are located inside the body. A narrow tube connects them to the cloaca in which the tube ends as a small raised papilla.**

**In the female, only the left ovary is functioning. The single ovary produces ova (eggs ) in capsules attached to the ovary by short stalks. The ovary also produces the yolk.**

**The infundibulum receives the yolk released by the ovary. Albumen and chalaza (which hold the yolk and germ cell in position) are formed in the magnum. The two shell membranes and the shape of the eggs are formed in the isthmus. The eggs shell is finally formed in the uterus after the egg is laid through the cloaca. Fertilization of the egg can take place as soon as the egg enters the oviduct when**

**REPRODUCTIVE SYSTGEM IN BIRDS.**

**spermatozoa are presents. Fertilization occurs before the formation of the albumen.**

**Functions Of The Reproductive System**

**i.It ensures the continuity of species by gamete for motion and coitus or mating or servicing**

**ii.It ensures the formation of eggs and spermatozoa (sperm cells )**

**iii.It ensures the production of production of reproductive hormones.**

**ORGANS OF FARM ANIMALS**

**Organs of farm animals include the eyes, ears, kidney, liver, skin, nose tongue, lungs, heart, etc. most of these organs have already been discussed nin this chapter. However, the structure and functions of the skin, kidney and liver are discussed below in detail.**

**1.Skin**

**Structure of skin: the skin of farm animals has been described as the largest organ of the body. The skin is made up of two layers – epidermis and dermis.**

**a.Epidermis : the epidermis is the outermost layer and it is made up of three layers:**

**i.Cornified layer**

**ii.Granular layer and**

**iii.Malpighian layer.**

**The cornified layer: it is the outermost layer of the epidermis. It is made up of flat, hard and scaly cells. The cells of cornified layer are dead.**

**The granular layer : this contains the living cells where active division of cells takes place. These cells replace the cells of the granular layer which in turn are replacing the cells of the cornified layer which are constantly being worn out.**

**The Malpighian layer : this contains granules of pigment called, melanin. This pigment is responsible for skin colour. The melanin also prevents the penetration of a lot of violet rays of sunlight. The malpighian layer also contains another pigment called keratin which is responsible for the toughness and flexibility of the skin.**

**b.Dermis**

**The dermis is a thick layer of fibrous connective tissues. The dermis contains nerves which enable the skin to be sensitive to changes in its environment such as pain, heat, temperature, touch, cold, etc. The blood and lymph vessels supply materials to the skin; remove wastes from the cells and carries out temperature regulation. The sweat glands which consist of a coiled tubular gland opening into the epidermis excretes water and salts as sweat, sebaceous**

**or oil gland which produces an oily substance called sebum. This helps to lubricate the hair and make it waterproof, while the erector muscle controls the erection of the hairs on the skin surface by its contraction and relaxation. Underneath the skin is a layer of fat called subcutaneous fatty tissue. This fat layer varies in thickness, depending on the part of the body.**

**Functions of the Skin**

**functions of the skin include the following:**

**(a)Protection: the skin protects the inner skin or tissue from mechanical injuries, bacterial infection, ultra – violet rays of the sunlight and against decication.**

**(b)Excretion: the skin excretes excess water, mineral salts and some nitrogenous waste through the sweat glands as sweat.**

**(c)Sensitivity : the skin is sensitive to its environment through the specialized sensory nerve endings scattered in the dermis. The skin is sensitive to such stimuli as change in temperature , pressure, pain and cold.**

**(d)Production of vitamin D: the skin manufactures vitamin D by using infra – red rays from sunlight.**

**(e)Production of milk in females : the mammary gland which is a modification of the skin produces milk which is used for feeding the young ones.**

**(f)Storage of preserved foods : fats are stored under the dermis of mammals, especially those of pigs. Fats also form an insulating layer.**

**(g)Regulation of the body temperature : when an animal is hot, blood vessels under the epidermis of the skin dilate ( vasodilation ) and more blood is brought to the surface to be cooled through the process of convection and radiation. On the other hand, the blood vessels of the skin constrict (vasoconstriction )in cold weather thereby conserving heat.**

**2.Kidney**

**The kidneys are two reddish brown, bean – shaped structures that lie asymmetrically on the posterior dorsal body wall of the lumber – upper region of the abdomen below the adrenal gland. At the concave edge is a depression called the helium. Arising from the helium is a small tube called the ureter. The helium also serves as the point of entry of the renal artery and leaving of the renal vein. The ureter connects the kidney to the urinary bladder and from**

**the bladder to the urethra. The urethra opens through the penis in male and separately in female as the urinary tract.**

**The kidney is made up of two district regions : the outer cortex and inner medulla. This contains thousands of urinary tubules. Each Malpighian tubule consists of Malpighian body situated in the cortex and convoluted tube.**

**Each Malpighian body, consists of a cup-like chamber, the bowman's capsule, into which a knot of blood capillaries, the glomerus fit. Beyond the Malpighian body each tubule makes a U-shape loop into the medulla, re-enters into the cortex and bends again into the medulla where its course is completed.**

**The U-shape loop is the Henle's loop. The tubule transverse both regions and opens at the tips ( papillae ) of triangular- shape masses called pyramids, which open into the pelvis.**

**Functions of the Kidney**

**The functions of the kidney include :**

**a.Excretion : The kidney helps to remove unwanted nitrogenous wastes like urea ammonium compounds, water, salts, etc. from the body.**

**b.Detoxication : The kidney also helps to eliminate poisonous substances from the body e.g. toxins, drugs and alcohol.**

**c.Removal of excess glucose : The kidney also aids the removal of excess glucose from the body.**

**d.Maintenance of acid/ base balance : The kidney helps to maintain the body pH and osmotic pressure. Normal urine is slightly acidic.**

**e.Osmo-regulation of body : The kidney also functions in the osmo-regulation of the body i.e. keeps the concentration of the blood plasma and conditions of the body cells fairly constant.**

**f.Conservation:The kidney aids the conservation of some useful materials by the absorbing of some useful materials by re-absorbing them from the glomerula filtrate which is the first step in urine formation. Materials conserved include water, glucose, sodium ions,chlorine ions and vitamin C.**

**3.Liver**

**The structure of the liver: the liver is usually regarded as the most powerful organ in the body because it is constantly at work, controlling major activities going on in the body. It is located on the right side of the upper abdomen and partly overlaps the stomach. It is basically divided into lobes.**

**Functions of the Liver**

**The liver performs number of functions which include:**

**1.Digestion: the liver produces the bile which is secreted into the duodenum through the bile duct. The functions in digestion include:**

**a.It adds water to chime (less watery form of food undergoing digestion ) , because of its high percentage of water.**

**b.Its alkaline ( sodium ) salts neutralize hydrochloric acid of the chyme,thereby providing a right medium for the action of pancreatic juice enzymes.**

**c.It reduces the surface tension of fats and emulsifies them, i.e. splits them into minute droplets.**

**2.Deamination : proteins are not stored in the body and so excess amino acids must be eliminated. Amino acids which are not built up in proteins are used for growth and replacement of cells are broken down (deamination) by the liver into carbohydrate and urea by the removal of the amino group. The urea is secreted through the kidney while the carbohydrate can be converted into glycogen to be stored or oxidized to release energy.**

**3.Storage of iron: iron derived from the broken red blood cells ( erythrocytes ) is completed and stored in the river.**

**4.Regulation of the blood sugar : the liver has the role of carbohydrate metabolism and so is able to convert glucose, amino acid and other substances to an insoluble carbohydrate called glycogen. Some of the glucose may be taken from the hepatic portal vein carrying blood which is rich in digesting food from the small intestine to the liver. Their reserve of glycogen is converted to glucose so as to maintain the level of glucose circulating in the blood.**

**5.Regulation of body temperature : many chemical activities taking place in the liver release energy in form of heat which is distributed round the body by the circulatory system.**

**6.Fat metabolism : the liver contains about 6% stored lipid and when required for use in providing energy and in starvations., it travels in the blood stream from the fat deposits**

**leading to a fall in fat content of the liver. This happens after exhaustion of all other body fat. Some are used directly or changed to other substances that can be oxidized for energy.**

**7.Detoxication : poisonous compounds and other chemical substances transported in the blood to the liver are converted to harmless substances and latter excreted in the urine.**

**8.Manufacture of plasma protein : the liver produces most of the protein found in the blood plasma including, fibrinogen which forms an important part in the clothing action of blood.**

**9.Storage of vitamins : vitamin A and D are stored in the liver. ( liver of fish are richer in vitamins especially vitamin D than livers of mammals ) . the liver also stores vitamin B 12, an antianaemic factor which is necessary for the production of red blood cells in the bone marrow.**

**Questions**

**1.State five farm animal organs.**

**2.List five function of the skin**

**3.List five function of kidney**

**4.What is reproductive system?**

**5.Explain reproduction in female farm animal.**

**WEEK SIX AND SEVEN**

**ANIMAL REPRODUCTION: EXPLANATION OF SOME REPRODUCTIVE PROCESSES**

**OESTRUS CYCLE**

**I.Oestrus cycle is the interval from the end of one heat period to the beginning of another.**

**II.It is also the period of “heat “ or “ oestrus “ for coitus or mating.**

**III.It is followed by a long period in which female animals will not show desire to mate.**

**IV.It is under the influence of hormone called oestrogen.**

**V.Thed oestrus cycle varies among farm animals.**

**e.g.**

**cow = 20 – 31 days**

**ewe = 17 – 21 days**

**sow = 14 - 28 days**

**doe (goat ) = 17 – 21 days**

**doe (rabbit ) = spontaneous**

**Heat period**

**1.The heat or oestrus period is the time when the female animal shows signs of its readiness to mate.**

**2.It is the period of sexual receptivity in female animal when the ovum or ova are released, that is period when ovulation takes place.**

**3.It occurs within the oestrus circle and controlled by oestrogen.**

**4.Heat period varies from one animal to another.**

**e.g.**

**Cow = 5-24hours**

**Ewe = 35-36hours**

**Sow = 40-48hours**

**Doe (goat ) = 40-50hours**

**Signs of heat in farm animal**

**i.The vulva becomes large, red and swollen.**

**ii.There is undue noise making or bellowing.**

**iii.A clear viscous secretion comes from the vagina and this arouses and excites the males.**

**iv.The animal becomes restless.**

**v.There is loss of appetite.**

**vi.It shows tendency to be ridden by other animals.**

**vii.The animal has abnormal high body temperature.**

**viii.Frequent urination and tail shaking.**

**MATING**

**i.Mating is also called coition or corpulation.**

**ii.Mating is the act in which the penis of the male is inserted into the vagina of the female leading to the ejaculation of sper-matozoa.**

**iii.Mating in farm animal may lead to fertilization.**

**iv.It is under the influence of hormone.**

**v.Mating is necessary before farm animal can reproduce sexually.**

**vi.For mating to occur, the female animal must be on heat.**

**vii.The penis must be erect before mating can occur.**

**viii.It takes place when the male mounts the female for sexual corpulation.**

**ix.It leads to the occurrence of ejaculation and semen containing sperms which is deposited in the vagina.**

**Types of Mating**

**(A)Natural mating: this occur when a male, after identifying a female on heat, will mate the animal .Examples of natural mating include:**

**i.Flock mating : both the male and the female animals are allowed to move together and mate freely.**

**ii.Pen mating : very few number of males are kept together with limited number of females so that they can mate anytime the female animal is on heat, e.g. four males together with twelve females.**

**iii.Stud or hand mating: the males are kept separately to be mated with individual females when on heat. After mating, the male is taking away.**

**(B)Artificial mating : this is called artificial insemination which involve the act of injecting spermatozoa artificially into the vagina of the female animal on heat. The sperm are collected**

**from a male animal with desirable characters. Such spermatozoa are stored at 1960c under liquid nitrogen unit it is used.**

**Advantages of Artificial Insemination**

**i.It is cheaper to import sperms than the male animal**

**ii.Sperms collected can be used to fertilize manty female animals of various sizes.**

**iii.It is more economical as it reduces the cost of feeding and managing male animals.**

**iv.Sperms (semen ) can be used over a long time even after the death of the male animal.**

**Gestation Period**

**i.This is the period between fertilization of an ovum to the birth of the young ones.**

**ii.It is also the period between conception and birth ( i.e. period of pregnancy ).**

**iii.Female animals, during this period, do not normally come on heat.**

**iv.It is under the control of a hormone-progesterone (pregnancy hormone). its high secretion prevents further ovulation during pregnancy and maintains pregnancy**

**v.It is a period of swelling of the abdomen.**

**vi.It is a period of swelling of the udder.**

**vii.It is a period of increase in life weight.**

**viii.The period varies from animal to animal for example:**

**Gestation period Range**

**Cow = 283 days**

**Ewe = 114 days**

**Sow = 150 days**

**Doe( goat)=151 days**

**Doe (rabbit) = 31days 275-285 days**

**112-116days**

**145-155days**

**150-155days**

**30-31days**

**OVULATION**

**i.Ovulation is the rupturing of the ovary wall (Graafian follicle ) to release mature eggs, ova or ovum into the fallopian tube in animals.**

**ii.It is under the control of pituitary gland hormones ( luteinizing hormone ) .**

**iii.It occurs in between or midway of oestrus cycle.**

**iv.It occurs when female animals are on heat or show desire to be mated.**

**v.Time of ovulation varies among farm animals, e.g. in Cow, it occurs 10-14 hours after oestrus.**

**In Sow, it occurs 24-36 hours after oestrus.**

**In Ewe, it occurs 20-24 hours after oestrus.**

**In Rabbit, it occurs immediately after or during mating.**

**Parturition**

**i.Parturition is the act of giving birth in farm animals.**

**ii.It marks the end of pregnancy.**

**iii.It marks the beginning of lactation**

**iv.When the developing foetus has reached full term in the uterus, and is ready to be born, the placenta breaks away from the uterus wall.**

**v.The foetus in the bag of membranes moves round the cervix and out through the vagina.**

**vi.At some point, the membrane bag breaks and fluid inside is release.**

**vii.The umbilical cord constricts in the middle, withers and breaks naturally.**

**viii.The placenta and the broken membranes comes out of the uterus as after birth.**

**ix.The act of parturition varies with farm animals. In:**

**(a)Cow , it is called calving.**

**(b)Sow , it is called farrowing.**

**(c)Ewe , it is called lambing.**

**(d)Doe (Goat ) , it is called kidding.**

**(e)Doe (Rabbit ) , it is called kiddling.**

**Sign of Approaching Parturition**

**i.The mammary glands enlarge and begin to secrete milks substance.**

**ii.The vulva swells and become soft.**

**iii.There may be thick mucus discharge.**

**iv.The animal becomes restless, lies down and gets up frequently.**

**v.The animal urinates frequently.**

**vi.The animal tries to build a net and beds, e.g. as in rabbit.**

**vii. Loss of appetite.**

**FERTILIZATION**

**I.This is the fusion of the male sex cell or gamete (sperm ) and the female sex cell or gamete ( ovum or egg ).**

**II.It occurs in the oviduct or fallopian tube.**

**III.It finally leads to the formation of zygote.**

**IV.It may occur when an animal is on heat.**

**Lactation**

**i.This is the period during which the female animal releases milk from its udder immediately after parturition and there after.**

**ii.The milk is used to feed the young ones.**

**iii.It is under the control of hormone, i.e, decrease in progesterone and increase in oestrogen and oxytocin.**

**iv.Lactation of milk let-down can be increased, or if the female animal refuses to produce milk, the animal can be injected with oxytocin injection. This injection will make the animal to secrete milk.**

**v.Lactation can also be stimulated by the presence of the young ones, presence of the milker, the use of hand to rub the udder and use of machine ( milking machine ) to milk the cow. Of all the farm animals, milk from goat is the richest and the best.**

**Structure of Mammary Gland ( Udder )**

**The mammary gland or udder is a larger and succulent organ surrounded by the skin. It is attached to the body of the animal by strong ligament. It is made up of large ducts which empty their content into a large gland cistern. It terminates with an alveoli from where milk is secreted. The contraction of the alveoli leads to the letting down of milk.**

**The mammary gland is made up of smooth muscles, sympathetic and sensory nerves. The number of glands varies with farm animals. For example :**

**Farm animal Name of female No of glands**

**Goat**

**Sheep**

**Cattle**

**Rabbit**

**Pig**

**Domestic fowl Doe**

**Ewe**

**Cow**

**Doe**

**Sow**

**Layer 2**

**2**

**4**

**Two lines of 10-14**

**Two lines of 10-14**

**None**

**The major equipment or instrument used in extracting milk from the mammary gland of farm animal is the milking machine.**

**Milking machines**

**Functions /uses : milking machines are used for milking or extracting fresh milk mechanically from the udder of the cattle ( Cow ) and other milk producing animals like sheep ( Ewe ) and goat ( Doe ).**

**Description : the milking machine is made up of an electric motor, vacuum pump, source of power, trap pail, vacuum controller, guage, gap, milk tank and four teat cups.**

**How the machine works: the milk is removed from the teat when the vacuum is applied to the outside of the teat cup liner. When the teat cup liner collapses, the teat is massaged and this action helps to prevent congestion in the teat walls and ensures regular flow of milk from the udder into the teat cups.**

**Milking machines are more efficient. They save labour, stop the cow from becoming strippers and reduce the danger of contamination. The quality of milk obtained depends on the care taken in cleaning and operating the machine.**

**The main substance that is extracted by the milking machine from farm animals like cow, ewe and goat is milk. The process by which the substance ( milk ) collected with the milking machine is made fit for human consumption is called, pasteurization.**

**Economic Importance of Milk**

**i.It is a source of protein in food.**

**ii.It can be used in raising foster calves, lambs or children.**

**iii.It is used in preparation of baby food.**

**iv.It supplies minerals to livestock.**

**v.It is used as an extender in artificial insemination practices.**

**vi.It is also used in the preparation of diary products such as butter, cheese, yougourt, etc.**

**Colostrum**

**i.Colostrum is the first milk produced immediately after the parturition/ delivery of the new born animal.**

**ii.The first five days of milk production is essentially colostrum which all young ones must have access to.**

**iii.It is the yellowish white milk, produced immediately after giving birth to the young ones**

**iv.It is very important for the new born animal to take colostrum because:**

**(a)It contains some antibodies against disease to which the mother has been exposed.**

**(b)It enables the new born to get immunity to disease.**

**(c)It is rich in protein especially albumin and globulins.**

**(d)It also contains vitamins A, E and B ( riboflavin ).**

**(e)It is highly digestible and has a laxatic effect which helps the young ones to expel the foetal dung ( an indication of functioning of digestive system )**

**PROCESS OF EGG FORMATION IN POULTRY**

**The process of egg formation is controlled by hormones. The egg is formed partly in the ovary and partly in the oviduct.**

**Ovary : the yolk is secreted by the ovary and enclosed in a follicle. The yolk increases in size by accumulating yolk materials carried from different parts of the body by blood stream. The germinal disc is attached to the top of the yolk. The follicle bursts to release the yolk.**

**Infundibulum : the yolk release by the ovary is taken up by the infundibulum, the internal terminal part of the oviduct. Fertilization of the egg occurs in this part of the oviduct, before the other components are added. However, complete formation of the egg is independent of weather the egg is fertilized or not. The egg spend 15minutes in the infundibulum before it moves to the magnum.**

**Magnum: In the magnum, the egg stays for three hours and part of the albumen is secreted on the yolk. Chalaza is also formed in this region. The egg now moves to the isthmus.**

**Isthmus: the egg stays here for 75 minutes and the two shell membranes are formed. The shape of the egg is also formed at this region after which it moves to the uterus.**

**Uterus: the egg stays here for 19-20 hours where the shell is formed from calcium carbonate secreted by glands of the uterus. Mineral solutions are also added to t6he egg after which it moves to the vagina.**

**Vagina: The egg stays here for a very long time before it is laid through the cloaca or vent. It takes almost 26hours for a complete egg to be formed and laid.**

**Structure of a Fertile Egg**

**The egg is oval or oblong in shape. It is either brown or white in colour. The differences in colour are due to differences in breeds.**

**Shell: The hard shell covers the egg externally. It is rich in calcium carbonate and**

**it protects the egg.**

**Membranes: immediately after the outer shell are outer and inner membranes. Both membranes give protection to the egg.**

**Airspace: the airspace is located on one of the pointed ends of the egg. It is found in-between the outer and inner membranes. The airspace is very important for respiration of the embryo.**

**Albumen: This is also called the, egg white. It account for over 50% of the total body weight of the egg. It is rich in protein.**

**Yolk: this is located at the centre of the egg. It is a yellowish jelly-like mass. It is rich in protein, mineral salt, vitamins and other food substance. It supplies the embryo nutrients.**

**Embryo : This is also called germinal disc. This is located at the centre of the yolk as a dark spot. The germinal disc is only found in fertile eggs. It develops to form the chick during incubation period.**

**Chalaza: The chalaza extends to both sides of the yolk. It is a piece of thick protoplasm. It holds the yolk and the embryo in place within the albumen.**

**MAIN REPRODUCTIVE HORMONES AND THEIR FUNCTIONS**

**Hormones are chemical substances which co-ordinate the activities of the body. They are secreted by ductless glands in the body and transferred through the blood to the target organs on which they exert their effects. Hormones concerned with reproduction in farm animals can be grouped into male and female reproductive hormones.**

**Male reproductive Hormones**

**Androgen ( Testosterone )**

**Functions**

**i.It stimulate the development of male secondary sexual characteristics and sex behavior (sex drive ).**

**ii.It promotes sperm production through spermatogenesis.**

**iii.It promotes the growth and development of accessory sex glands like seminal vesicle, prostate and cowper's glands.**

**iv.It influences nitrogen retention and protein synthesis.**

**Female Reproductive Hormones**

**1.Oestrogen**

**a)It influences the development of female secondary sexual characteristics.**

**b)It stimulates mammary gland development.**

**c)It stimulates the growth of the ducts system in the mammary gland.**

**d)It helps in the production of 'heat' in farm animals.**

**e)It promotes the production of eggs or ova through oogenesis.**

**2.Follicle Stimulating Hormones (FSH )**

**a)It stimulates the growth of the ovarian follicle.**

**3.Luteinizing hormones (LH )**

**a.It causes the rupture of the follicle and subsequent release of ova (i.e. ovulation ) .**

**b.It stimulates the secretion of ovarian hormones i.e. oestrogen and progesterone.**

**4.Progesterone ( Pregnancy hormone )**

**a.It ensures the development of uterus and implantion of the fertilized ovum.**

**b.It inhibits oestrus ( i.e. it prevents the ripening of more follicle) .**

**c.It causes the development of alveoli in mammary gland.**

**d.It ensures the continuance of pregnancy.**

**5.Oxytocin**

**a.It aids in the contraction of the female uterine muscles during pregnancy.**

**b.It affects mammary gland after birth by causing milk let-down or milk production .**

**c.It promotes the transport of spermatozoa in the female genital tract.**

**6.Relaxation**

**a.It causes the relaxation of the pelvic ligament during parturition for easy passage of the young ones.**

**Questions**

**1.What is testosterone?**

**2.What is oestrogen?**

**3.What is colostrum?**

**4.Explain heat period.**

**5.Explain gestation in farm animals.**

**WEEK EIGHT**

**TOPIC: ENVIRONMENTAL PHYSIOLOGY**

**MEANING: Environmental physiology refers to the effects of the environment on the growth and performance of farm land. Normal growth and performance are enhanced when climatic factors like temperature, rainfall, wind, relative humidity, sunlight, etc. are moderate. Excess or lack of these factors definitely will have a negative impact on the growth and overall performance of farm animals.**

**EFFECTS OF CHANGES IN CLIMATE ON GROWTH**

**Changes in climate have some effects on the growth of farm animals. These effects include:**

**i.High temperature of about 390c leads to proper development of chicks but excess of heat leads the chicks to pant.**

**ii.Extremes of either hot or cold conditions is unfavourable and reduces the performance of farm animals**

**iii.Wind aids the spread of disease (air borne disease, e.g. tuberculosis) which cause retarded growth or even death of farm animals.**

**iv.Extreme low temperature leads to retarded growth or even death of chicks.**

**v.High rainfall leads to the multiplication of tsetse flies which transmit trypanosomiasis and such diseases reduces the growth or even leads to death of farm animals.**

**vi.High relative humidity leads to heat stress in farm animals, e.g. cattle, poultry, pig, etc.**

**vii.High relative humidity affects food intake of farm animals.**

**viii.High intensity of radiation affects food intake of farm animals.**

**ix.High humidity in poultry houses causes mouldiness of feed; thereby leading to low feed intake and retarded growth.**

**x.Moderate wind velocity promotes good ventilation and this enhances the normal growth of farm animals. Extremes of wind have negative impacts on the growth of animals.**

**xi.Increase in temperature of blood flowing through the brain of birds initiate panting and this in turn leads to water loss through evaporation.**

**xii.In low temperatures, mortality in birds increases through huddling or suffocation (asphyxia).**

**xiii.At high temperatures, feed intake in chicks is reduced, leading to reduced level of growth.**

**xiv.At high temperatures also, feather coverage in chicks is poorly developed which may lead to pecking.**

**xv.At low temperatures, there is reduced feed efficiency as more nutrients are needed for body maintenance, leading to poor growth.**

**EFFECTS OF CHANGES IN CLIMATE ON REPRODUCTION**

**Changes in climate have some effects on reproduction of farm animals. These effects include;**

**i.Heat stress (i.e. high temperatures) causes abortion in farm animals.**

**ii.High relative humidity affects the productivity of farm animals.**

**iii.High intensity of radiation causes heat stress in farm animals thus reducing their reproductive capability.**

**iv.High temperature leads to low rate of conception or fertilization in farm animals.**

**v.At high temperature, frequency of mating the quality and quantity of semen in breeder birds decreases.**

**vi.At high temperature, fertility and hatchability in breeder birds decreases.**

**vii.High temperature decreases ovulation in animals.**

**viii.Light controls sexual maturity i.e. low light intensity is desirable during rearing of pullets to prevent early sexual maturity.**

**ix.High rainfall and high humidity causes the chilling of young ones soon after parturition.**

**x.High temperature decreases or reduces heat periods in farm animals leading to low reproductive capability.**

**EFFECTS OF CHANGES IN CLIMATE ON MILK PRODUCTION**

**Changes in climate have some effects on milk production by farm animals. These effects include;**

**i.High relative humidity favours the growth of disease pathogens that can reduce milk of production in farm animals.**

**ii.High intensity of radiation from the sun causes heat stress in animals thus reducing their milk production.**

**iii.High temperature reduces the rate of milk production in farm animals.**

**iv.High temperature and rainfall do not favour the rearing of diary animals.**

**v.High rainfall leads to the multiplication of tsetse flies which transmit trypanosomiasis in diary cows; thereby leading to low milk production.**

**vi.Extreme of rainfall do not favour the growth of grasses, leading to low feed intake and less milk production by farm animals.**

**EFFECTS OF CHANGES IN CLIMATE ON EGG PRODUCTION**

**Changes in climate have some effects on egg production in poultry birds. The effects include:**

**(a) Temperature**

**i.High temperature causes a reduction in feed intake while a low temperature encourages more feed intake.**

**ii.It reduces spermatogenesis and libido in males.**

**iii.High temperature causes heat stress and reduced activity.**

**iv.It may result in death of birds, particularly chicks and layers.**

**v.It increases water intake in hot weather and reduces water intake in cold weather.**

**vi.It is necessary for incubation of eggs.**

**vii.High temperature lowers egg production**

**viii.Egg storage period is reduced under high temperature.**

**ix.High temperature reduces hatchability of eggs.**

**Causes of Heat / Temperatures**

**i.Fans or air conditioners should be introduced.**

**ii.Enough windows or opening for ventilation should be provided.**

**iii.Windows should be covered with cloth materials to conserve heat.**

**iv.Vent should be provided at the roof tops.**

**v.Poor conductors of heat should be used as roofing sheet. Sun reflection sheet can also be used or the roof should be painted with white. Pens should also have ceiling boards under the roof.**

**vi.Room heaters or lanterns should be used to warm buildings when it is cold.**

**vii.During construction, keep open parts of buildings away from direct solar radiation ( i.e. East-West direction ).**

**Relative Humidity**

**i.It is very important in incubation of eggs**

**ii.High humidity compounds heat stress.**

**iii.Low humidity induces rapid water loss from the birds' body and thus increases their water intake.**

**iv.High humidity encourages the spread of diseases.**

**v.High humidity causes feed to go mouldy.**

**Control of Humidity**

**i.This can be control by fixing of humidifyers or open trays filled with water to increase humidity.**

**ii.Free ventilation should be allowed when the humidity is high.**

**iii.Spilling of water in poultry houses should be avoided to reduce humidity or dampness.**

**Light**

**i.It controls egg laying in hens.**

**ii.Duration of lightening controls time spent at feeding which regulates growth and the rate of feathering.**

**iii.Direct light of high intensity causes stress to the eye.**

**iv.Bright light makes the birds active.**

**v.Light makes objects visible.**

**Control of Light**

**i.In short day length, extra illumination should be provided.**

**ii.A reasonable part of the walls should be made up of wire or glass to promote lightening.**

**iii.Windows should be covered with dark cloth to reduce light intensity.**

**Questions**

**1.state five climatic factors?**

**2.State five effect of temperature changes in farm animals.**

**3.State five effect of temperature on growth in farm animals.**

**4.State five effect of relative humidity on poultry**

**5.Explain temperature in agricultural production.**

**WEEK NINE AND TEN**

**TOPIC : LIVE STOCK MANAGEMENT**

**POULTRY**

**Poultry refers to group of bids reared for food and other purposes. These include: domestic fowl, turkey, goose, guinea fowl and duck. These bids are reared mainly for meat, egg and manure. They are non-ruminants.**

**External features of Male Domestic Fowl**

**A female domestic fowl**

**Terms used in Poultry**

**Cock - Male fowl above one year of age**

**Cockerel - Male fowl below one year of age**

**Hen - Female fowl above one year of age**

**Pullet - Female fowl below one year of age**

**Chick - A young fowl (0 – 6 weeks old)**

**Capon - A castrated male fowl**

**Caponization - A process of castration in fowl**

**Treading - Act of mating in fowl**

**Grower - Fowl between 7 – 19 weeks of age**

**Layer - Female fowl over 20 weeks of age that can lay eggs**

**Broiler - Fowl reared for meat**

**Clutch - A group of young chicks**

**Flock - A group of fowls**

**Chicken - Meant of fowl**

**Breeds of Domestic Fowl**

**The various species of fowls may have had a common ancestor, the primitive fowl called gallus. The various breeds of fowls can be classified into three main groups: (a) egg producers e.g white leghorn, brown leghorn (b) the meat producers (broilers), e.g., Sussex Cornish, and Cochin (c) the dual purpose one (i.e. both meat and egg producers), e.g. Rhode Island Red, Plymouth Rock, and New Hampshire.**

**i.White leghorn - best egg producer**

**ii.Brown leghorn - egg producer**

**iii.Rhode Island Red - egg and meat producer**

**iv.Plymouth Rock - egg and meat producer**

**v.New Hampshire - egg and meat producer**

**vi.Sussex - good meat producer**

**vii.Cornish - good meat producer**

**viii.Cochin - good meat producer**

**Poultry Equipment and their Main Use**

**Equipment Main use**

**Folus - for housing poultry bids**

**Battery cage - housing of mainly layers**

**Debeakers - reducing beak lengths**

**Incubator - hatching fertile eggs**

**Candler - detecting unfertile eggs**

**Buckets - fetching water**

**Feeder/hoppers - feeding birds**

**Drinkers - provision of water**

**Hypodermic**

**syringe/Needle - injecting birds**

**Nesting box - for egg laying**

**Creep feed coop**

**and run - housing a brooding hen**

**Brooder - provision of warmth for chicks**

**Mash box - feeding young chicken**

**Egg tray/crates - collection of eggs/storing eggs**

**Roost/perch - for resting and sleeping upon by birds**

**Broom - to sweep off waste**

**Shovel - to remove poultry waste**

**Wheel barrow - carrying feed or waste**

**System of Poultry Management**

**The system of management defines the extent to which birds are exposed to sunshine, pasture and also housing pattern. There are three systems of poultry management. These are extensive, semi-intensive and intensive systems.**

**Extensive System**

**Under this system, the domestic fowls are allowed to roam about in search of food and water. There are no proper housing, care and feeding for these birds. Unlimited grassland is available to the birds population per hectare of land is minimal and production is usually very low. The use of technology is also limited. Example of the extensive system of rearing poultry is the free range system.**

**Free Range System**

**Under the free range system, birds are allowed free access to a range of grassland. The bids are allowed to run freely over a large fenced area where they experience nearly natural conditions. The birds are confined in a hut or a shed at night and are allowed to roam within the fence area during the day. During unfavourable weather conditions, the birds find shelter under trees, bushes or hedges within the range while some run to the range shed or hut to take cover.**

**Advantages of the Free Range/Extensive System**

**i.Initial capital requirement is small**

**ii.The labour involved is also very small**

**iii.It is most suitable for the management of breeding stock**

**iv.It minimizes the incidence of ectoparasites**

**v.Fowls get vitamins and minerals from the grasses they feed on, thereby promoting resistance to diseases.**

**Disadvantages of the Free Range/Extensive System**

**i.There is lack of land because it requires large area and so, not good for commercial purposes.**

**ii.It also requires large labour force to collect eggs**

**iii.It exposes the birds to extreme weather conditions**

**iv.Economic losses through predators, thieves and laying of eggs in the bush**

**v.When badly managed, it may result in the accumulation of germs and parasites**

**Semi-intensive System**

**The semi-intensive system is mid-way between intensive and extensive system. The bids are housed in a fixed building but are allowed to move about within a fenced area during the day. Their building are made up of wood and are raised above the ground with wire netting on the**

**floor to permit easy dropping of faeces. A good example of the semi-extensive system is the fold unit system.**

**Advantages of the Fold Unit/Semi-Extensive**

**i.The birds have access to natural vegetation which provides vitamins and minerals**

**ii.There is protection against adverse weather condition**

**iii.Labour is not needed for locking up the birds at night**

**iv.The birds are safe from the attack of wild animal**

**v.The birds are kept in small groups and culling is made easier**

**vi.The outbreak of any infection disease is easier to isolate and handle**

**vii.The system is useful for all ages and all kinds of birds**

**Disadvantages of the Fold Unit/Semi-Intensive System**

**i.There is a high cost per house when compared with the range system**

**ii.It leads to low egg production**

**iii.It also leads to high cost of feeding the birds**

**iv.Labour requirement is significant with ……..daily moving of the folds. More labour required to water and feed small units…..poultry**

**v.Vices such as feather picking, egg eating and cannibalism may occur**

**Intensive System**

**Under this system, the birds are confirm within the building and are not allowed to move out. It prevents the birds from having access…… pasture and sunshine. There is high stocking density which implies a closer contact among the birds. Feeds, water and all medications are provided for the birds. Two examples of the intensive system of poultry management are: (i) Deep Litter System (ii) Battery Cage System.**

**Deep Litter System**

**A poultry deep litter house**

**Features of a poultry Deep Litter House**

**i.The floor of the house is made concrete**

**ii.The walls are made of sandcrete, mud, zinc or wood, and usally about 60cm – 90cm high**

**iii.The roof is made of asbestos sheets, corrugated iron sheets or it is thatched**

**iv.The space between walls and roof is covered with wire-nettings for good ventilation**

**v.The floor is uniformly covered with wood shavings to serve as litter for absorbing poultry droppings**

**vi.Poultry se such as feeding and drinking toughs are placed in convenient places inside the pen**

**vii.Such equipment may be placed on the floor for the young chicks and on raised platforms or hung from the roofs for the older birds**

**viii.The number of birds housed depends on the size of the house and the age of the birds. Usually, three adult birds to 1m2 of floor space**

**ix.The direction of wind and sunshine is normally considered when sitting the deep litter house (east-west direction)**

**x.Disinfection bath or foot dips are usually provided at the entrance of the house to prevent introduction of disease pathogens by visitors**

**xi.Litter is normally changed periodically as occasions demand to prevent disease build-up**

**xii.The house may be partitioned into opens to house different age groups for convenience of management and avoidance of dieses spread**

**xiii.Laying nests are adequately provided**

**xiv.Gutter with insecticide – treated water around the house are provided to prevent the attack of solder ants**

**Apart from wood shaving, other suitable litter materials is include crushed cobs of maize (after removing the grains), crushed dry kenaf stems and peanut shells. Saw-dust must never be used as litter material because of certain disadvantages such as:**

**i.Due to its fineness, it is not durable as litter material**

**ii.The bids inhale the dust which creates chest congestion, leading to respiratory problems**

**iii.Saw-dust cakes up easily**

**iv.It habours more bacteria than other systems**

**v.It also contains more foreign bodies like nails, etc. than other systems**

**Advantages of the Deep Litter System**

**i.It increases efficiency in poultry management**

**ii.It facilitates the management of very large flock**

**iii.It maximizes the use of land**

**iv.It increases the rate of growth and production**

**v.It maximizes the use of labour**

**vi.It reduces the loss of eggs to vermins, snakes and thieves**

**vii.Birds are protected from harsh weather conditions**

**viii.It facilitates the ease of identification of sick birds**

**Disadvantages of the Deep Litter System**

**i.The cost of construction of deep litter house is high**

**ii.It requires a large quantity of litter which adds to the cost of production**

**iii.There is wastage of feed by birds**

**iv.Cannibalism and pecking of eggs are common**

**v.There is high spreading rate of disease and parasite**

**vi.The litter makes eggs dirty**

**vii.It is difficult to detect unproductive birds**

**viii.It is very difficult to catch birds on deep litter system**

**The Battery Cage System**

**In the cage system, the bird are housed in individual cages each accommodating a limited number of birds, mostly one or two. This individual cage compartment is the basic component unit of the cage system and it is essentially a laying nest with a slopping floor, and feed and water troughs.**

**It is constructed to permit ventilation from all sides. Usually the sides, top and floor are constructed with heavy galvanized iron.**

**The cages vary in their degree of automation. On the hand, all operations may have to be performed manually, while at the other extreme, practically all the various operations, including manure removal may be automated.**

**The poultry droppings fall into a mechanical scrapper. Under skilled management, the battery system of housing has proved to be best in regards to egg production, efficiency of food conversion and reduction in mortality.**

**Advantages of the Battery Cage System**

**i.This system is used as a labour saving device**

**ii.There is less trouble from parasitic disease such as worms and coccidiosis because the birds do not come in contact with the droppings**

**iii.There is a drop in feed consumption of labour 2.5kg per bird during laying period. Less feed is needed because the birds have less exercise and a more constant temperature**

**iv.It saves space as the batteries are set up in tiers**

**v.It provides the best opportunity for close individual supervision so that the capabilities and productiveness of each birth cage be ascertained**

**vi.Selection is made easier during culling. The birds are directly within view and reach**

**vii.The poultry house is less noisy; and higher eggs and body weights are attained by the birds**

**viii.There are fewer eggs with dirty shells**

**Disadvantages of the Battery Cage System**

**i.The battery equipment is more expensive and deteriorates quickly**

**ii.The battery equipment is suitable for only one purpose**

**iii.There is more possibility for technical faults/problems because of automation; higher maintenance costs are encountered**

**iv.The birds may be bored and battery or cage fatigue can develop**

**v.Complete feeds for cage layers are expensive**

**vi.More eggs cracked, especially very thin shelled eggs**

**Characteristic Features of a Good Layer**

**i.A good layer has a broad and square head**

**ii.It has a short beak**

**iii.It has a bright and bulging eyes**

**iv.It possesses smooth and lean face**

**v.It has a large but thin comb**

**vi.It has a bright red comb and wattles**

**vii.It has a soft and pliable abdomen**

**viii.There is absence of cannibalistic tendencies or aggressiveness**

**ix.It has a broad flexible pelvic bones**

**x.It possesses a wide, moist cloaca**

**xi.It has pale coloured shanks**

**xii.There is absence of broodiness**

**xiii.It possesses a glossy plumage**

**Incubation**

**Definition: Incubation is the process of providing fertilized eggs with optimum conditions of temperature, relative humidity and ventilation necessary for the development of chicks and their successful hatching.**

**Types of Incubation**

**There are two types of incubation. These are:**

**1.Natural Incubation: The natural incubation is done by the hen itself, after having a number of eggs. The hen gets broody i.e., it stops laying in order to incubate the eggs already laid. The hen lays up to 15 eggs and stops. It sits on the eggs and provides all conditions of temperature, relative humidity and ventilation required for the chicks to develop and hatch. It also turns its eggs on regular basis. This practice is common in the villages where chickens are raised extensively and places where there are no facilities incubation.**

**Natural incubation is not desirable in commercial poultry production because, when hens go broody, egg production stop i.e. the commercial enterprise will not realize a good number of eggs from it flock. The number of eggs that can be incubated by a hen at any time is very small**

**2.Artificial Incubation: This is designed to provide the ideal conditions naturally provided by hen. It uses man-made devices called, incubators to provide optimum conditions necessary for the development of the embryo into chick. The incubator is the most important equipment in hatchery. Many types of incubators, ranging in size from small to room type, are made. Eggs are set in trolleys.**

**Advantages of Artificial Incubation**

**a.Hens do not have to stop egg production, consequently, a large number of eggs are produced within a short period**

**b.Large number of eggs are incubated and hatched at the same time (incubators of over 100,000 egg capacity are even available)**

**Collection and Storage of Hatching Eggs**

**Collection: Hatching eggs are supposed to be collected at least 3 – 4 times a day. Under our tropical environment, it is good to collect more often than this. This will help to reduce deterioration and consequently reduce hatching potentials.**

**Storage: The body temperature of hen is between 41 – 420C. At the time the egg is dropped, it is at that body temperature and the embryonic development still continues. This reduces the hatching potential of the egg. Consequently eggs are stored in egg holding room for period ranging from two days to two weeks.**

**Storage conditions includes a temperature of about 180C and a relative humidity of 75 – 80%. Eggs are stored with the large end facing upward while turning of the eggs may not be necessary within the first two weeks but above two weeks, turning is advisable to prevent contact of embryos with shell membrane, which may cause dehydration or physical damage.**

**Measures for efficient operation of an egg incubator**

**I.Maintain the right temperature during incubation**

**II.Test run the incubator before you set eggs inside**

**III.Maintain the right RH during incubation**

**IV.Allow for adequate escape of CO2 from incubator**

**V.Ensure a regular power supply to the incubator**

**VI.Place incubator away from walls**

**VII.Candle eggs progressively**

**VIII.Fumigate incubator before setting eggs**

**IX.Incubator should be handled by trained and experienced personnel**

**Incubation Procedures**

**a.Prior to setting eggs in the incubator, the eggs should be brought out from cold room and left to attain room temperature in order to eliminate sweating**

**b.The incubator which must have been cleaned and disinfected is started early enough to attain optimum temperature and relative humidity before eggs are placed in it**

**c.The eggs are arranged in egg setting tray and placed in the incubator. It is good …..practice to fumigate the eggs before setting.**

**Optimum Incubation Conditions**

1. **Temperature: Temperature is usually 37 – 390C**
2. **Relative humidity: Relative humidity of 50 – 60% during the first 19 days and 75% during the last two to three days to prevent dehydrating the chicks in the hatched**

**iii. Ventilation (Air flow): Free movement of oxgen, nitrogen, carbon dioxide and water vapour through the shell is very essential for the developing embryo. Th… tolerant limit of carbon dioxide in incubator or hatcher is 0.5%**

1. **Egg Positioning During Incubation: Eggs are usually placed in the incubator with the large end facing upward. However some studies indicate that eggs set with the large ends downward hatch equally good and under natural conditions, the …….hatches eggs in horizontal position**
2. **Egg Turning: if eggs are left in one position throughout the incubation period they hatch poorly. This is because of physical damage caused by the y… sticking to one conditions, the hen turns the egg with her beak and body. However, moden incubators are also equipped with authomatic turning mechanism which turns the eggs …..to eight times a day.**

**Hatching**

**The 21days incubation period of domestic fowl can be seen as consisting of first 18 - ….. days incubation in the setter and last two to three days hatching in the hatcher.**

**Hatching Operation**

**a.Testing for fertility: Infertile eggs and dead embryo can be detected about six days after incubation by the process called candling. The machine used to detect living or dead and developing embryos is called the egg candler.**

**Candling consists of the passage of concentrated source of light through the egg in a dark room in order to see through the egg. It is usually not done in commercial basis because of the number of eggs involved. However, it is routinely done in research stations. At least two candling are done usually in six to seven days of incubation. With candling, you can determine fertile eggs. Here, live embryo shows a spider-like appearance in the egg. Infertile eggs are clear with no spider-like appearance.**

**During first candling, one can determine embryo that die during the first week called DI (died within first week) These eggs do not show any radiating blood vessels rather, blood vessels adhering to the shell or a pink blood ring may be seen (a) and (b)**

**Second candling (a) and (b) is done in the 18/19 day prior to transfer of the eggs from setter to the hatcher for hatching. If the first candling was well done, only dead embryos in the period between the first and second period will be tested out, the live embryo nearly fills the egg or moves when the egg is rotated and blood vessels become apparent. Dead embryos appear as a liveless mass of dark shadow. During the second candling, the live embryo fills the entire egg, i.e., D2**

**Efforts to Ensure Uniformity of Hatching**

**The steps that should be taken to ensure that the eggs hatch at about the same time include the following.**

**i.Setting eggs uniformly on the tray**

**ii.Timely and regular turning of eggs**

**iii.Ensure suitable environmental conditions i.e., temperature, relative humidity and ventilation**

**iv.**

**First candling of egg**

**v.Proper candling of the eggs**

**vi.Setting eggs at the same time**

**vii.Selecting eggs of the same size**

**viii.Holding period for egg before setting should not be more than 14 days (2weeks)**

**Operations Required After Hatching**

**Activities or operations normally carried out after hatching of eggs in the hatchery include:**

**i.Sexing of chicks into male and female**

**ii.Dry of chicks**

**iii.Intra-ocular (I) NDV vaccinations**

**iv.Sorting out abnormal chicks**

**v.Packing of normal and healthy chicks**

**Poultry Management**

**Breeding and Hatching: Fertilized eggs are incubated for 21 days using incubators after which, the eggs are hatched into young chicks. During the incubation period, adequate temperature, ventilation and relative humidity are maintained. Read more about incubator under machinery.**

**Rearing Poultry**

**Rearing is the sum total of all the processes involved in bringing birds to maturity. Rearing of fowl includes: providing suitable housing, feeding and health care for the chicks, grower and adult stock.**

**Brooding**

**Brooding is the term used for the management or caring for the chicks from the first day of age till they are about six weeks old.**

**Young chicks under a brooder lamp**

**Preparations for receiving Day old Chicks for Rearing**

**i.Clean and wash brooder house**

**ii.Repair broken or damaged floors, roofs and windows**

**iii.Disinfect brooder house**

**iv.Spread wood shaving to a depth of 6 – 8 cm in brooder house**

**v.Provide adequate floor space**

**vi.Provide reliable heat source**

**vii.Wash and dry feeders and drinkers**

**viii.Stock chick starter feed**

**ix.Keep handy a supply of vital medicants e.g. anti-stress**

**x.Net the windows to keep away flies, rodents etc.**

**xi.Ensure a dry brooder house before chicks arrive**

**xii.Make a small shallow trench filled with water or engine oil around brooder house to deter solder ants invasion**

**xiii.Place food dip with disinfectant at the entrance of brooder house**

**xiv.Warm up brooder house to 35 - 390 before arrive**

**Housing**

**Reasons for Good Housing in Poultry**

**i.This is to protect birds against adverse weather condition**

**ii.It is also to protect birds against disease's attack**

**iii.It assists to keep birds in age groups for proper management**

**iv.It protects birds from thieves**

**v.It protects birds from attack by wild animals, dangerous reptiles like snakes and from hawks**

**vi.Housing enhances maximum productivity in birds**

**vii.Good housing helps to increase the efficiency of feeding and feed utilization**

**viii.It facilitates management and veterinary care**

**The chicks, immediately after hatching, are sent to the brooder house where they receive extra heat either from stove or electric bulb in order to maintain their body temperature because they do not have sufficient feathers to keep their body warm. As the feathers develop, the chicks are broodly on littered floor with the house completely covered with ventilation. Feeds, water and other medications are provided for the chicks up till the end of the 6th week during which chicks are transferred to the growers' house.**

**From the 7th – 20th week, the bird, now called growers, are either raised in the growers' house. They are either raised in a deep litter house or in battery cage. The buildings are netted with concrete flooring and proper roofing to ensure the comfort of the birds. From the 21st week, the birds, now called lawyers, are reared in the layers' house which is either the deep litter house or the batter cage system, just like the growers.**

**All categories of poultry birds require balanced diet for proper growth and development. Their ration is enriched with proteins carbohydrates, vitamins and minerals. Cold and clean water is kept in the drinkers while the feeds are kept in the feeders for the birds.**

**Feeding of the Chicks**

**The feed given to the chicks is called the click's mash which contains high protein of about 18% to promote the rapid growth of the chicks. The feeds are provided "Al-Libitum" which mean: the feeds are always in the feeder for the chicks to eat.**

**Feeding of the Growers**

**The feed given to the growers is called the grower's mash. The feed is low in protein (13%) and is given to the birds from 7th – 20th week (of age). The birds are placed on restricted feeding. This means that the feed given to the growers is not always in the feeders because it is regulated or calculated to prevent excessive growth and delay the maturity of the growers. Water is also provided regularly in the drinkers.**

**Feeding of the Layers: The feed given to the layers is called layer's mash. This is also high in protein (16%) for proper growth and egg formation. In addition, the diet or mash is high in done meal or oyster shell which provides calcium and phosphorus for the formation of the egg shell. Lack of these minerals results in cracking of the eggs or soft – shelled eggs.**

**Health Care Sanitation: For proper growth and production of the birds, high level of health and sanitation must be maintained from day old chick till maturity of the birds. Administration of drugs, vaccination and sanitation must be carried out. The vaccination programme of the poultry.**

**Cleanliness of the poultry farm is also necessary. To ensure proper sanitation:**

**i.Sick or dead birds must be removed from the building**

**ii.Visitors should not be allowed into poultry houses**

**iii.The buildings should be disinfected regularly**

**iv.Water bath containing chemicals should be provided where visitors and workers must dip their legs before entering into the poultry house**

**v.Drinkers should be washed thoroughly**

**vi.Wet litters and mouldy feeds should be detect quickly and removed**

**vii.External parasites like lice, should be controlled by dipping birds in solutions containing chemicals to kill the parasites**

**viii.Internal parasites should also be control-led by regular deworming with certain chemicals to kill the parasites**

**PIG**

**Pigs are non-ruminant animals and they belong to the family called sudae. There are two main species of pigs-sus sacrofa and sus vittatus**

**Breed of Pig**

**i.Large White**

**ii.Large Black**

**iii.Duroc Jersey**

**iv.Poland China**

**v.Tamworth**

**vi.West African Dwarl pig**

**vii.Hampshire**

**viii.American Landrace**

**ix.Chester White**

**x.Belgium Pie Train**

**All the breed types are grouped into three classes:**

**(a)Meat type**

**(b)Land type and**

**(c)The Bacon type.**

**Pigs are reared mainly for meat, pig skin, bristle and manure**

**Parts of a Pig**

**Terminologies Used in Pig**

**Boar - A mature male pig**

**Sow - A mature female pig**

**Gilt - A female pig that is matured to reproduce or has reproduced once**

**Piglet - A young or baby pig**

**Weaner - Young pigs just separated from the mother**

**Fatterner - Old pigs reared for the market**

**Barrow - A castrated male pig**

**Farrowing - The act of parturition in pig**

**In sow - Pregnant sow**

**Dry Sow - Sow that is not pregnant**

**Port - The meat of pig**

**Bacon - Salted pig meat**

**Lard - Pig meat with fat**

**Characteristics of Pig**

**1.Pigs are very prolific animals. At 8 –m9 months of age, a gilt is matured and can farrow twice a year producing 8 – 10 piglest per litter.**

**2.It has a short gestation period of 114 days i.e. three months, three weeks and three days**

**3.They mature very early. A piglet get to 60-90kg market weight in 6 – 9 months**

**4.Pigs are good converters of feed into meant. They can easily convert industrial, agricultural and compounded feed into meat more cheaply and rapidly than most other domestic animals**

**5.Pigs have an excellent dressing percentage, i.e. the proportion of flesh to bone is high**

**6.Pigs require a very little investment in terms of building and equipment**

**7.Pigs are polyestrous animals. This means that, pigs can be bred at ant time of the year**

**8.The salvage value of pig is high, that is the price at which an old pig can be sold off is high**

**9.The initial investment in getting into the enterprise is small and returns come very quickly**

**10.Pork is a good source of protein. It is high in energy, attractive, nutritious, tasty and tender**

**System of Rearing Pigs**

**There are three systems of rearing pigs. These are Extensive, Semi-Intensive and Intensive System**

**1.Extensive System: In this system, the pigs are allowed to roam about and fend for themselves. This system has little or no capital investment and the cost of production is low. However, disease incidence and worm infestations are very high. The animals are exposed to adverse weather conditions**

**2.Semi-intensive System: In this system, housing is provided for the animals and they are allowed to move out to feed on natural vegetation. Paddocks are provided around the house which is fenced. The animals are allowed to move about thereby, exercising themselves to prevent fat built-up in the body. The system needs less capital investment by the labour requirement, disease incidence and parasite infestations are slightly high. Concentrate feeds are also provided.**

**3.Intensive System: All the pigs are confined within a building and are not allowed to move out. The pigs are raised inside the pens on either concrete or iron slated floor. Feeds, water and medications are supplied daily in adequately quantity and good sanitation is maintained. The system saves labour, provides conditions for good management standards and easy control of internal parasites. There is also protection from extremes of climate, predators and thieves. The feed efficiency is high, thus, the growth rate is also very high. The system requires high capital investment in terms of building and feeding**

**Housing**

**i.Pig house are sheds which provide shelter against harsh weather as well as provide proper hygienic conditions required to maintain healthy growth of the animals.**

**ii.Pig house should be constructed along the direction of the wind but should be far from residential areas.**

**iii.Pig house should have low walls made with bricks, stones or concrete cement with low walls to allow free flow of air**

**iv.The floor should be hard, impervioius to water but easy to clean. It should be cement concrete, iron or concrete slabs.**

**v.The floor should slope towards the drains with a gradient of 1:40, to ease cleaning. The surface of the floor should be slightly rough to prevent pigs from slippering**

**vi.The rood should be made from either asbestos, galvanized iron or aluminimum sheets**

**vii.All pens, except farrowing pens, are constructed the same, with the provision of feeders and drinkers**

**viii.Farrowing pens in addition to the feeders and drinkers should have rail guards so as to prevent the sow from lying over the piglets**

**ix.The farrowing pens should also have creep area where the food of the piglets are kept. Such partition prevents the sow from eating up the nutritious food for the piglets.**

**Feeding**

**i.Feed cost represents 70 – 80% of total cost of producing swine**

**ii.Feeds given to all categories of pigs should be balanced in nutrients, i.e., it should contain all nutrients required for growth and production**

**iii.Breeder's mash (15% protein) should be fed to breeders to prevent body fat deposition but keep them thrifty**

**iv.Flushing of the breeder should be done seven to 10 days before breeding and maintained until the animals are bred. Flushing is the process by which the feed intake of the gilt or sow is increased so that it can produce more eggs or ova and consequently more number of fertilized eggs or ova and large litters or piglets**

**v.Pregnant or in-sows should not be overfed during gestation period to prevent fat deposition which leads to small litter size and difficulty in parturition**

**vi.Laxatic diet, rich in high fibres (grasses) should be given to in-sows to aid easy parturition and lactation**

**vii.The young piglets should be given creep feed (22%) protein as from two weeks of age to promote rapid growth of the piglets.**

**viii.As soon as the piglets are weaned, they should be given weaners' mash which contains about 18% protein for about 14 weeks at an average rate of 1kg for a pig per day**

**ix.The pigs are also fed on fatteners' mash (14% protein) during the fattening state when pigs do not require high proteineous feed. The pigs are fed at an average rate of 2kg per pig in a day till they reach mar-ket weight of 60 – 90kg at seven months of age**

**x.Pigs being omnivorous animals of hotel food and other by-products of brewery dry wastes etc.**

**Health/Hygiene**

**Common sanitary measures to be adopted in pig farm include:**

**i.Clean pig pens regularly by scrubbing the floors**

**ii.Disinfect the pig house at regular intervals to make it germ free**

**iii.Clean the feeders and wasterers to prevent contamination**

**iv.Isolate any sick animal for treatment**

**v.Remove and bury dead animals**

**vi.Deworm the pigs with drugs and vaccinate them against disease**

**Common diseases of pigs**

**Common disease of pigs include: brucellosis, anthrax, bovine mastitis, hog cholera or swine fever, pleuropneumonia, enteristis or swine dysentery, transmissible gastro-enteritis etc.**

**1.Brucellosis or Contagious abortion: This disease is caused by a bacterium called Brucella abortus. Symptoms include: high fever, diarrhea and dysentery, posterior paralysis and premature abortions. The disease is transmitted through contaminated feed, water and infected animal. Control measures include: isolation of infected animals, proper sanitation and regular vaccination**

**2.Anthrax: This disease is caused by a bacterium and transmitted through contaminated feed, water, equipment and infected animals. Symptoms include: high fever, depression, blood oozing from nose, mouth, anus, or carcass, lack of appetite and sudden death. Control is by proper sanitation, vaccination and isolation of infected animals**

**3.Enteriles or Swine Dysentery: This is a bacterial disease that causes serious digestive tract disorder. Symptoms include high temperature, loss of appetite, frequent passage of water, four smelling faeces (which may be bloody) and loss of weight. Control measures include the administration of sulphur drugs and antibiotics such as terramycin and aureomycin**

**4.Hog Cholera or Swine Fever: This disease is caused by a virus. It affects pigs of all ages. Symptoms include: high body temperature, diarrhea and vomiting. The only control measure is to kill affected animals and bury them**

**5.Transmissible gastro-enteritis: This disease is caused by a bacterium and attacks piglets mostly. Symptoms include diarrhea, vomiting and sudden death. The faeces of affected piglets are usually white or green in colour. Antibiotics and sulphonamide drugs are used to cure the disease**

**Management of Pig**

**The management of pig from breeding to market size can be grouped into three phases**

**These are:**

**a.Breeding to farrowing or birth:**

**Breeders (gilts and boars) are housed in the breeders' house, made of concrete floor, low wall and galvanized iron roofing sheets. Boar and gilt should be at least eight months before they are bred. The gilt must have, at least, twelve well spaced functional treats and good temperament and should not be obese. Two weeks before mating, the gilt must be dewormed and sprayed with insecticide to removed internal and external parasites.**

**Flushing should be done seven to 10 days before breeding and maintained until the animals are bred. Flushing is the process by which the feed intake of the gilt or sow is mated on the second day of heat and second mating is done 24hours later. The gilt or sow should be well fed during gestation period but not overfed because there is the tendency for fat deposition which leads to small litter size, insufficient milk production and difficulty in parturition.**

**They should be fed on Breeder's mash. Breeders should be given sufficient exercise to prevent the deposition of fats. Sows and gilts should be given laxative diet, rich in high fibre (grasses) to aid easy parturition and lactation. Three to four days before farrowing, the sow or gilt should be taken to the farrowing house where they will give birth to piglets. Farrowing crates, rail guards, beddlings, feeding and watering troughs and heating device should be provided in the farrowing house. An attendant must be present to give a helping hand during farrowing, in case of any difficulty.**

**b.Birth of Piglets to Weaning:**

**i.When piglets are born, the mucus membrane is wiped from their nose to prevent suffocation**

**ii.The naval cord cut and dipped in iodine solution to prevent infection**

**iii.Heat is provided for the piglets to prevent them from chill**

**iv.The needle teeth of the piglets are clipped or cut off to prevent injury to the mother's teat and piglets during fighting**

**v.The piglets are given first dose of iron dextran injection at two or three days of birth and the second dose two to three weeks later to prevent pig anaemia**

**vi.All male piglets, not required for breeding, are castrated at about two weeks after farrowing**

**vii.Creep feeding also starts at about two weeks after farrowing. Creep feed is high in protein (22%) and other nutrients. It supplements milk in-take from the sow and also aids the growth of the piglets and their early weaning**

**viii.The piglets are ear-notched for the sake of easy identification**

**ix.They are finally weaned (i.e. separated from their mother) at 42 days or six weeks of age**

**c.Weaning to Finishing (Market Size)**

**i.Weaners are transferred to the growing or fatterner's house**

**ii.The pigs are first fed on weaner's mash and later changed to fattener's mash few weeks later**

**iii.The health care requirements of the pigs include administration of vaccines and drugs to prevent various diseases of pig**

**iv.Parasitic infection should also be prevented through regular deworming and spraying of pigs with insecticides**

**v.The pigs should be given exercise to prevent fat build-up in the body**

**vi.Wallows where pigs can cool down their body temperature should be provided because they are non-sweating animals**

**vii.Pigs, now fattener's reach market age when they are about five to six months old, depending on the level of nutrition and management**

**Rabbit**

**Rabbit just like pigs are monogastric or non-ruminant animals. They are medium – sized hopping mammals with long legs, long ears and short tail.**

**Rabbits are mainly reared for their meat. Rabbit meat is normally regarded as a white meat**

**External Features of a Rabbit**

**Terms Used for Rabbit**

**Buck - An adult male rabbit**

**Doe - An adult female rabbit**

**Kitten/Warren - A young or body rabbit**

**Hutch - The house of rabbit**

**Kidding - The act of parturition in rabbit**

**Pelt - The skin of rabbit**

**Litter - all the young ones (rabbits) produced at the sametime**

**by one doe**

**Sucking - feeding of young ones on the mother's breast milk**

**Dam - the mother of a set of young rabbits**

**Sire - the father of a set of young rabbits**

**General Characteristics of Rabbits**

**The general characteristics of rabbit include:**

**i.They have small medium – sized body**

**ii.They are easy to house**

**iii.Rabbits are very prolific animals or can produce many litters**

**iv.Rabbits have a short gestation period of 30 – 31days**

**v.They grow fst and reach maturity weight in about five to six months**

**vi.They are efficient converter of wide range of vegetable matter into meat**

**vii.The fur-covered skins can be processed as pelts for sale**

**viii.Rabbits are easy to handle or manage**

**ix.They have a weaning period of six to eight weeks**

**x.They make good quality meat, more delicious and nutritious than that of chicken**

**xi.They are susceptible to stress**

**xii.The rare of cannibalism is very high**

**xiii.They have high rate of dieses resistance**

**Breeds of Rabbits**

**Common breeds of rabbits include:**

**i.California white**

**ii.California red**

**iii.Flemish giant**

**iv.Chinchilla**

**v.New Zealand white**

**vi.Champagne d'Argent**

**vii. The crosses**

**viii.Angora**

**ix.Lop**

**x.Blue beveren**

**xi.New Zealand red**

**1.The Chinchilla: It is a grey-bodied animal and it can weigh up to 5kg at maturity. It is one of the best fur or pelt producers and also a meat producer**

**2.The New Zealand White: This is the most popular meat breed in use. It is a fur breed and can attain a mature weight of 4.5kg in eight months. It is a good converter of feed to meat with a high dressing percentage. It is also fast maturing breed**

**3.California White: It is a lighter breed and the adults may attain a mature weight of 3.5kg – 4.5kg. it is characterized by black markings on the ears, feet, tail and nose. It has a high growth rate and good flesh to bone ratio**

**4.The New Zealand Red: This breed is bright-red in colour and weighs over 3kg. it has a high growth and feed conversion characteristics**

**5.The Giant Flemish: This breed can weigh over 5kg and it is the largest of all the breeds. It is dark steel-grey in colour and produces a dense and hard pelt. It is a good meat producer**

**6.Angora: This breed requires a lot of care and attention. It is the only rabbit reared for its wool. Its most common colour is white. It has tuft of wood on its ears and feet**

**Important of Rabbits**

**i.Meat: The meat of rabbit is white, fine grained, tender and nutritious. The meat of rabbit is even more nutritious than that of poultry chicken**

**ii.Rabbit skin or pelt: The can be used for making jackets, head-gear, carpets or rugs and other decorative households or ornamental**

**iii.Manure: it has been discovered that rabbit manure is high in nitrogen and phosphorus and therefore can be used to improve the fertility of the soil.**

**iv.For research purpose: At National veterinary Research Institute (N.V.R. I), Vom, rabbits are kept largely as laboratory animals**

**Problems Militating Against Rabbit Production in Nigeria**

**Major problems which militate against commercial production of rabbits in Nigeria include:**

**i.Unpredictable breeding behavior of rabbits**

**ii.Incidence of respiratory disease, e.g., snuffles and pneumonia**

**iii.Inadequate sanitation and proper sanitation programmes**

**iv.High nest-box mortality of litters**

**v.Lack of ability to embark on mass production, because, most operation in rabbitary cannot be automated**

**vi.It is labour intensive**

**vii.Lack of capital also impedes large investment in rabbitery**

**viii.Inadequate supply and high cost of concentrate feeds**

**Housing of Rabbits**

**i.Rabbits are usually kept in hutches**

**ii.The hutches are arranged in single, double or triple tiers**

**iii.The waist – high, single tier hutches are preferable for they save time and labour in feeding and management**

**iv.Wooden or metal hutches with wire-netting surroundings are widely used**

**v.The hutches are placed under a building usually referred to as rabbitery. The rabbitery must well ventilated**

**vi.The floor of the rabbitery should be made with concrete for easy cleaning**

**vii.The roof should be made with corrugated iron sheets or asbestos sheets**

**viii.Hutches can also be placed in poultry deep litter-house**

**ix.The males are kept separate from the female within the rabbitery**

**x.Legs of hutches should be placed in dis-infectant bowl bowls to keep off termites and other insects attacks**

**Feeding**

**i.Rabbits are simple stomach herbivores, i.e., they feed mainly on plants**

**ii.Rabbits are given concentrates in form of pellets in small quantities**

**iii.The pellets given can be supplemented with aspilla Africana, sweet potato leaves, Amarantus, Water leaf, Centrosema spp, Emillia spp, Tridax spp, Calopogonium spp, etc.**

**iv.Rabbits can be given poultry grower's mash in the absence of rabbit pellets. This should however, be sprinkled with water to prevent wastage and nasal irritation.**

**v.The protein content of feeds for dry Does and Bucks should be 12 – 15% while that of pregnant does and nursing does is 16 – 20%**

**vi.The feed should be served in feeding troughs**

**vii.Water should be supplied all the time**

**Hygiene/Health**

**Common hygiene or sanitary measures to be adopted in rabbitery include:**

**i.Clean the floor of the rabbitery daily**

**ii.Disinfect the rabbitery at regular intervals to keep it germ free**

**iii.Clean the feed and water troughs to prevent contamination**

**iv.Remove dusts and cob-weds from the rabbitery**

**v.Isolate any sick animal for treatment**

**vi.Remove and bury dead animal**

**vii.Deworm the rabbits at regular intervals**

**viii.Treat the rabbits with drugs such as anti-biotics and coccidiostats (prophylactic)**

**ix.Keep the surrounding of the rabbitery weed-free**

**x.Provide a disinfectant bath or foot dip at the entrance to prevent introduction of germs into the rabbitery by visitors**

**Disease of Rabbits**

**Common diseases of rabbits include:**

**i.Coccidiosis**

**ii.Ear canker manger**

**iii.Enteritis**

**iv.Ringworm**

**v.Helinthiasis**

**vi.Sore hock**

**vii.Mixomytosis**

**viii.Mastitis (nipple inflammation**

**ix.Pneumonia**

**x.Bloat**

1. **Coccidiosis: Causative agent: Coccidiosis is caused by protozoon. The symptoms include:**
2. **Passing of soft faeces which may be blood stained**
3. **Loss of appetite**
4. **Loss of weight**

5. **Death in severe cases**

**Control: measure include;**

**a.Treatment of sick animals with coccidiostat**

**b.Raising rabbits on wire/raised cages**

**c.Prophylactic use of coccidiostats in feed**

2. **Enteritis: Causative agent: Entertis is cuased by protozoa feed changes, stress or through poisoning. Symptoms include:**
3. **High temperature**
4. **Diarrhoea which smells unpleasantly**
5. **Loss of appetite**
6. **Watery faeces**

**Control:**

**a.Avoid lumping together the young from different litters.**

**b.Apply appropriate drugs (antibiotic)**

**c.Maintain good sanitation practices**

**d.Adopt good feeding regime/programme**

3. **Ear Canker: Causative agent: Ear canker is caused by mange mite. Symptoms include:**
4. **Brown scab inside the auditory canal**
5. **Swelling and painful ear**
6. **Ear scratching**

**Control Measures:**

**a.Treat affected ear with appropriate drug (liquid paraffin on cotton wool)**

**b.Isolate affected animal**

**c.Invite a veterinary doctor**

1. **Use of miticides**

4. **Bloat: Causative agent: This disease is caused by feeding disorder (when animals eat too much green feed too fast) and also when feeding on mouldy feed. Symptoms include:**

**Distend stomach/abdomen and respiratory difficulty Brown scab inside the auditory canal**

**Control Measures:**

**a.Feed animals with balanced diet**

**b.Do not allow the animals to get too hungry before feeding**

3. **Ear Canker: Causative agent: Ear canker is caused by mange mite. Symptoms include:**
4. **Brown scab inside the auditory canal**
5. **Swelling and painful ear**
6. **Ear scratching**

**Control Measures:**

**d.Treat affected ear with appropriate drug (liquid paraffin on cotton wool)**

**e.Isolate affected animal**

**f.Invite a veterinary doctor**

1. **Use of miticides**

5. **Mixomitosis: Causative agent: It is caused by virus. Symptoms include:**
6. **Untriftiness**

7. **Running nose**
8. **High fever**

**Control Measures:**

**a.Isolate infected ones**

1. **Destroy (bury or burn) dead ones**
2. **Treat with antibiotics to reduce cross infection**

6. **Helminthiasis: Causative agent: Helminthasis is caused worms. Symptoms include:**
7. **Poor growth**
8. **Anaemia**
9. **Death in high infestation**
10. **constipation**

**Control Measures:**

1. **Deworm regularly**

**b.Practise good sanitation**

7. **Ringworm Helminthiasis: Causative agent: Ringworm is caused by fungus. Symptoms include:**
8. **Circumscribed lesion on skin**
9. **Loss of hair on affected skin**

**Control Measures:**

1. **Used of fungicide to cure lesions**
2. **Isolate animals**

8. **Sore-hock: Causative agent: Sore –hock is caused by pressing the hock against hard structure which leads to injury and infection. Symptoms include:**
9. **raising up the hock when in sitting position.**
10. **Loss of hair on affected skin**

**Control Measures:**

**a.Dress wound with disinfectant solution.**

**b.Cover wound with antibiotics dressing**

**Finishing of Rabbit to Market Weight**

**The adult doe does not have any particular heart period. The presence of a buck could stimulate the doe to come on heat. The gestation period of doe is 31 days.**

**Prior to kidding, nest boxes and bedding materials are provided for the dow in the hutch. The doe can give birth to four to eight litters at a time. The young ones are fed first with colostrum and after, two to three days on milk produced by the doe. After about four to eight weeks, the young rabbits (fryers) are weaned and they will start to feed on solid food and green feed as well. Growth is rapid and in the absence of diseases and parasites, coupled with good feeding programmes and management, the rabbit will mature after attaining 4 – 5 kg at four to six months of age.**

**Rabbits should never be lifted by their ears or legs as that might permanently injure them. Small rabbits or fryers may be lifted and carried comfortably without hurting them by grasping the loin (between the hips and ribs), with the heel of the hand towards the tail of the animal.**

**For heavy rabbits, grasp a fold of skin over the shoulder and lift, holding the rabbit against the body with its head under an arm, the fore-arm being extended along the side of the animal**

**and the head under its rump for support. This prevents struggling and the rabbit may be carried comfortably.**

**Cattle**

**Cattle belong to the group of animals known as Bovidae. They are ruminants having hollow horns and hoofs with an even number of toes. Cattle are reared for their meal, milk hide and skin, manure and as draught animals for work on the farm.**

**Breeds of Cattle**

**i.Azawal**

**ii.Wadara (Shuwa)**

**iii.Sokoto Gudali**

**iv.Red Bororo**

**v.White Fulani**

**vi.Muturu**

**vii.N'dama**

**viii.Kuri**

**ix.Keteku (Borgu)**

**x.Kuri**

**xi.Brown Swiss**

**xii.Holstein**

**xiii.Jersey**

**Parts of a Cow**

**The breeds of the cattle can also be categorized into three groups. These groups are:**

**a.Beef Cattle: Beef cattle are the cattle which have the ability to produce meat.**

**i.N'dama**

**ii.Kuri**

**iii.Red Bororo**

**iv.Brown Swiss**

**v.Sokoto Gudali**

**vi.Rahaji**

**vii.Keteku (Borgu)**

**b.Dairy Cattle: Diary cattle are the cattle which are reared mainly to produce milk. Examples are:**

**i.White Fulani**

**ii.Dexter**

**iii.Jersey**

**iv.Red poll**

**v.Holstein/freisian**

**vi.Kerry**

**vii.South devon**

**viii.Guerney**

**ix.Diary short horn**

**c.Dual Purpose Cattle: These are cattle capable of production milk and meat. Examples are:**

**i.Azawal**

**ii.Biu**

**iii.Muturu**

**iv.Wadara (shuwa)**

**Terminologies Used in Cattle**

**Bull - an adult male cattle**

**Cow - an adult female cattle**

**Calf - a young or baby cattle**

**Heifer - a growing female up to her first calving**

**Bull calf - a young female cattle**

**Steer - a castrated male cattle**

**Ox - a castrated adult male cattle**

**Vealer - a castrated female cattle**

**Serving - act of mating in cattle**

**Calving - act of giving birth (parturition)**

**Beef - meat of cattle**

**Diary cattle - cattle kept for milk production**

**Beef cattle - cattle reared for meat production**

**Herd - a group of cattle**

**Polled - cattle without horns**

**Humped - cattle without hump**

**Humpless - cattle without hump**

**Characteristics of West African bread of cattle**

**i.Very hardy**

**ii.Have greater tolerance to heat and humidity**

**iii.Withstand stress and can travel long distantness without water**

**iv.Tolerant to some diseases e.g. trypanosomiasis**

**v.Late maturing**

**vi.Have compact/blocky shaped body**

**vii.Are mostly of dual purpose (produced meat and milk)**

**viii.Generally long legged animals for use as draught animals**

**ix.Some are humped**

**x.Powerful shoulder for use as draught animals**

**xi.Loose, thin and pigmented skill**

**xii.Low milk yield small udder**

**xiii.Slow growth rate**

**xiv.Small body weight**

**Economic importance of Cattle**

**i.Cattle provide meat and milk for man**

**ii.Some cattle help to pull ploughs as work or draught animals**

**iii.They provide hides skin**

**iv.They provide blood meal and bone for farm animals as feed**

**v.Fertilizer can be obtained from blood bones and offals of cattle**

**vi.Cattle dung (faeces is very good source of manure**

**vii.Cattle provide employment and income to the people**

**viii.Cattle are also a source of revenue to some countries**

**ix.Cattles are also used for religious purposes as well as festivals in some places**

**x.Cattle are used for research work or educational purposes**

**GOAT**

**Goat is a hollow horned small ruminant also belonging to the family Bovidea of the genus capra. Goat is reared for its meat, milk and hide and skin e.g., morocco leather from Sokoto Red. Goat milk is the riches of all the milk produced by animals including man.**

**Parts of a Goat**

**Breeds of Goat**

**1.Sokoto Red**

**2.Bornu Red**

**3.West African long legged goat**

**4.West African dwarf goat**

**5.Bantu**

**6.Anglo-Nubian**

**7.Alphine**

**8.Saanen**

**9.Kano Brown**

**10.Bauchi type**

**11.Togenburg**

**12.Nubian**

**13.Boer**

**14.Anglo**

**15.Nandi**

**16.East African Small Goat**

**17.Angora**

**Terminologies Used in Goat**

**Buck (Billy) – Adult male goat.**

**Doe (Nanny) – Adult female goat.**

**Kid - A young or baby goat.**

**Wethe – A castrated male goat**

**Kidding – Act of giving birth (parturition) in goat**

**Chevon – Meat of goat.**

**Reasons for rearing Goats in West Africa**

**Reasons for rearing Goats in West Africa are:**

**For meat (food) production, for skin production, for milk production, highly prolific, producing twins and triplets two times a year, hardy animals which are exceptionally healthy, easier to keep, high economic value/feeding cost is low, for festivals and sacrificial offerings, for prestige purposes, for income, for employment, for educational purposes e.g, teaching and research.**

**General Characteristics of Goat**

**i.Goats are tough and hardy animals that can survive unfavourable environmental condition.**

**ii.They are small bodied animals.**

**iii.They can produce kids twice a year.**

**iv.Goats are reared mainly for skin, meat, milk and fibre.**

**v.Male goats are often bearded.**

**vi.Goats are very inquisitive animals.**

**vii.Both male and female goats have horns**

**viii.They are mostly reared on the extensive system of management.**

**ix.They have a gestation period of between 145-154days or four to five months.**

**x.They can browse on many forage plants. Hence, the cost of producing goats is cheap.**

**Systems of Rearing Goat**

**There are three main systems of rearing goat.**

**These are extensive, intensive and semi-intensive systems.**

**Extensive System: Under this system, the goat is allowed to roam about in search of pasture and water. A goat can thrive on any edible material and browses even in extreme condition of drought and rain. It can fend for itself under any condition. It requires very little care as no good housing, feeding and health care are provided. Although the system is cheap, the animals are exposed to adverse weather conditions and thieves.**

**Advantages of the Extensive System of Extensive Goats:**

**i.Low cost of labour**

**ii.Low cost of feeding**

**iii.Low capital investment e.g housing**

**iv.Ensure fair distribution of manure, manure (waste) is used for fertilizer.**

**Disadvantages of Extensive system of rearing goats:**

**i.It is difficult to implement a planned breeding programme.**

**ii.There is little effort to control pests.**

**iii.Animals fall victim to thieves and predators.**

**iv.It is difficult to control disease outbreak**

**v.Lots of effort needed in controlling the animals**

**vi.Productivity of animal is low i.e., low growth in meat and milk production.**

**Semi-Intensive System: In this system, goat are provided with house which protects them against adverse weather conditions like heat, cold, rain etc. however, they are allowed to come out and graze in the pasture which is fenced round the goat house. In some cases, feed is provided for the goats in the house which includes grass, household waste and other remnants. The system needs little initial capital outlay but large labour requirement. Disease and parasite incidence are slightly high.**

**Intensive System: In this system, the goats are confined within the stall in a building with limited access to grazing. As a result of this confinement, medications, water, balanced feed in terms of concentrates, forage plants (soilage) as well as salt licks to provide the necessary minerals and vitamins are provided. This system saves labour, increases production, maintains good records, and reduces mortality. It however requires high capital expenditure in terms of housing, medication and feeding.**

**Housing**

**Goat houses are intended to offer protection against bad weather, predators and to provide an ideal environment for the development of the animals. Common features of the goat house are:**

**i.It must provide shade from the sun and protection against the rain.**

**ii.It must be well ventilated and kept dry.**

**iii.The shape may vary from the circular type to rectangular structures with series of stalls.**

**iv.Walls can be made of bricks, mud or wood.**

**v.The roof could be made with metal sheets, asbestos sheets or plant material (thatched).**

**vi.Bedding material could be straw, wood shaving, etc. the materials chosen must be very absorbent.**

**vii.Under confined management system, loose housing system is preferred. Animals are not tied and can, therefore move about freely within the building.**

**viii.Each housing unit should be provided with a hay-rack or manger for feeding hay or silage.**

**ix.Gates should be strong and the fence should be made with woven wires, barded wires or chain link.**

**Feeding**

**i.The feed for goat must be a balanced diet, i.e it should contain protein, carbon-hydrate, vitamins and minerals to promote growth and production.**

**ii.A goat feeds mainly on roughages, i.e grasses, brouse plants and fodder plants.**

**iii.Common grasses than can be fed on by goat include giant star grass, carpet grass,etc and some fodder crop like ground-nut, cowpea, styllosanthes spp, etc.**

**iv.Goat can also feed on concentrate feeds to provide the required nutrients for fast growth and high production.**

**v.Goat can feed on household and kitchen waste as they are capable of converting these waste into meat.**

**vi.Zero-grazing (soilage) can be practiced for goat- a system where grasses and legumes are cut and taken to the goats in their pens.**

**vii.Rotational grazing can also be practiced, whereby goats are moved about in pad-docks as they graze on the pasture.**

**viii.Feeds should be provided in accordance with production, e.g, colostrums for kids while pregnant and lactating goats need more feed than dry goats.**

**Health care and Sanitation**

**Common routine measures that can be adopted for goat health care and sanitation include:**

**i.The goat pens and stalls should be washed and cleaned daily.**

**ii.Sick animals should be isolated and treated urgently.**

**iii.Dead animals should be buried.**

**iv.Goats should be dewormed on regular basis.**

**v.They should be dipped into solution containing chemicals to get rid of ectoparasites.**

**vi.Rotational grazing should be practiced to avoid parasite build-up.**

**vii.The environment ought to be clean at all time**

**Common diseases of goat include anthrax, brucellosis, tuberculosis, rinderpest, red water fever, etc. drugs and vaccines should be administered at the appropriate time to prevent the outbreak of these diseases.**

**Management of Goat**

**The management of goat from breeding to market weight or size is grouped into three phases. There are:**

**i.From breeding to kidding**

**ii.From kidding (birth to kid) to weaning and**

**iii.From weaning to finishing (market size)**

**Breeding to Kidding or Birth**

**Buck and doe meant for breeding are kept in a building which is well ventilated, railed and walled. The floors should be made with concrete and the roof with corrugated iron sheets. Buck and doe should be at least 12 months of age before they are used for breeding. Seven to**

**ten days of mating, the doe should be given a high plane of nutrition in order to increase the number of eggs ovulated, and consequently, an increase in the number of kids to be given birth to. This process of increasing the feed intake of goat is called FLUSHING.**

**Before flushing, it is advisable to deworm the goats to get rid of endoparasites. The buck is brought to make the doe (hand mating) during the heat period. The gestation period of the doe is about 145-150 days. During the gestation period, the doe should be allowed to graze in the pasture and supplementary feeds in form of concentrates should be fed to the doe. Clean drinkable water should be provided for the doe. Few days to parturition, adequate sanitation, comfortable bedding and clean water should be provided. Signs of approaching parturition include mucus discharge from vulva, undue noise making, frequent urination and restlessness. At kidding, the doe should not be disturbed unless in case of difficult kidding during which the attendant can render some help to save the doe and the kid.**

**Questions1.Exaplain the intensivesystem of pigmanagement**

**2Exaplain batterycage in poultry .**

**3.Hog means.**

**4State two dieases of cattle..**

**5.What is flushing.**