

CLASSIFICATION II

DEFINE#

**PRINCIPLES USED IN CLASSIFYING
ORGANISMS;**

- ❖ **ANATOMICAL STRUCTURE**
- ❖ **EMBYONIC DEVELOPMENT**
- ❖ **PHYSIOLOGICAL PROCESSES**

BINOMIAL NOMENCLATURE

**LIVING ORGANISMS ARE PLACED IN 7
TAXONS;**

5 KINGDOMS;

- ❖ **MONERA (BACTERIA)**
- ❖ **PROTOCTISTA (PROTOZOA, ALGAE,
AMOEBAS)**
- ❖ **FUNGI OR MYCOPHYTA**
 - ❖ **PLANTAE**
 - ❖ **ANIMALIA**

1. KINGDOM MONERA/ PROKARYOTA

GENERAL CHARACTERISTICS

❖ **UNICELLULAR**

❖ **HAS CELL MEMBRANE AND CELL
WALL **MADE OF MUERIN****

❖ **PROKARYOTIC CELLS**

❖ **ORGANELLES ARE **NOT MEMBRANE
BOUND****

❖ **REPRODUCE **ASEXUALLY****

❖ **MOST MOVE BY FLAGELLA**

❖ **SOME AUTOTROPHS WHILE OTHERS
HETEROTROPHS**

❖ **RESPIRE ANAEROBICALLY**

❖ **HAVE SLIMY OUTER COVER OVER THE
CELL WALL CALLED CAPSULE MADE
OF MUCIN**

DISTINGUISHING CHARACTERISTICS

❖ PROKARYOTIC CELLS

- ❖ CELLWALL MADE OF MUERIN OR PEPTIDOGLYCAN**
- ❖ NO MEMBRANE IN ORGANELLES**
- ❖ THEY HAVE A CAPSULE OVER THE CELL WALL**

STRUCTURE OF THE BACTERIA

SIMPLE STRUCTURE;

- ❖ **RIBOSOME INSIDE**
- ❖ **CYTOPLASM**
- ❖ **CELL WALL AND MEMBRANE**
- ❖ **FLAGELLUM**
- ❖ **PLASMID - CIRCULAR DNA**
- ❖ **THE CAPSULE**

SIGNIFICANCE OF BACTERIA

- ❖ **DECOMPOSITION** ALLOWING RECYCLING OF NUTRIENTS IN ECOSYSTEM
 - ❖ **NITROGEN FIXING** IN THE SOIL E.G RHIZOBIUM
- ❖ **MANUFACTURE VITAMINS** IN THE COLON K AND B12
- ❖ **INDUSTRIAL PROCESSING OF FOOD** E.G YOGHRT
- ❖ **DESTROY HARMFUL MATERIALS IN SEWAGE** IN WATER RECYCLING PLANTS

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❖ **USED IN MAKING SILAGE AND BIOGAS**

❖ **SECRETION OF CELLULASE
DIGESTING CELLULOSE AND LIGNASE
DIGESTING LIGNIN IN RUMINANTS**

❖ **GENETICALLY ENGINEERED
BACTERIA ARE USED AS SOURCE OF
PROTEIN E.G PRODUCTION OF
INSULIN**

IMPORTANCE OF BACTERIA

❖ **CAUSE DECAY** HENCE **FOOD SPOILAGE**

❖ **MANY CAUSE DISEASES** E.G
STREPTOCOCCUS PNEUMONIA AND
VIBRIO CHOLERA

❖ **DENITRIFICATION** HENCE **REDUCE**
NITROGEN IN THE SOIL. E.G
PSEUDOMONAS DENITRIFICANTS

2. KINGDOM PROTOCTISTA

THEY MAINLY INCLUDE **ALGAE** AND **PROTOZOA**

GENERAL CHARACTERISTICS

- ❖ **EUKARYOTIC**
- ❖ **BOUND ORGANELLES**
- ❖ **UNI AND MULTICELLULAR**
- ❖ **AUTOTROPHS OR HETEROTROPHS**
- ❖ **MOVE BY PSEUDOPODIA, CILLIA AND FLAGELA**
- ❖ **SOME ARE SESSILE**
- ❖ **REPRODUCE ASEXUALLY BY **FISSION**, **FRAGMENTATION** OR **SPORULATION****

SINGLE CELLED ALGAE
#CHLAMYDOMONOUS#

- ❖ THESE ARE **PLANT-LIKE** PROTOCTISTA
 - ❖ THEY **CONTAIN CHLOROPHYL**
 - ❖ **AUTOTROPHIC**
- ❖ SOME HAVE **THALLOID BODY** PLANS WHICH IS SIMPLE FLATTENED WITH MANY CELLS NOT DIFFERENTIATED
 - ❖ THEY INHABIT **AQUATIC ENVIRONMENTS**, PONDS, LAKES, SLOW MOVING STREAMS, RIVERS AND SEAS.

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EXAMPLE THE CHLAMYDOMONAS

###DIAGRAM

- ❖ **DOUBLE FLAGELLUM**
- ❖ **SMALL VACUOLE**
 - ❖ **CYTOPLASM**
- ❖ **LARGE CHLOROPLAST**
- ❖ **CENTRAL NUCLEUS**
 - ❖ **CELL WALL**
 - ❖ **STARCH GRAINS**
 - ❖ **PYRENOIDS**

FILAMENTOUS ALGAE

#SPYROGYRA#

**SPYROGYRA IS THE MOST COMMON
ALGAE**

**FILAMENTOUS MEANS ITS MADE OF
MANY CELLS**

**EACH CELL HAS A LARGE NUCLEUS
CELL BOUND BY RIGID CELL WALL
CELL WALL COVERED BY MUCILAGE**

EXAMPLE THE SPYROGYRA CELL

###DIAGRAM

- ❖ CYTOPLASM
- ❖ CELL WALL
- ❖ CENTRAL NUCLEUS
- ❖ SPIRAL CHLOROPLAST
- ❖ PYRENOIDS

SIGNIFICANCE OF ALGAE

❖ **DIATOMITE IS A PRODUCT OF ALGAE
DIATOMS**

❖ **PRIMARY SOURCE OF FOOD FOR FISH**

❖ **LAB CULTURES PREPARATION TO
GROW BACTERIA AND FUNGI**

❖ **BAITS FOR FISHERMEN**

❖ **LICHEN HELPING IN SOIL FORMATION
ARE FORMED USING ALGAE AND FUNGI**

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- ❖ **USED AS FOOD AND MEDICINES**
 - ❖ **CAUSE SKIN DISEASES I.E DERMATITIS**
- ❖ **USED AS ORGANIS FERTILIZERS TO RESTORE SOIL FERTILITY**
- ❖ **IN SEWAGE TREATMENT AS THEY EXTRACT INORGANIC TOXINS AND NUTRIENTS.**

PROTOZOA

❖ **THEY ARE ANIMAL LIKE
PROTOCTISTA**

❖ **MICROSCOPIC AND UNICELLULAR**

❖ **ARE HETEROTROPHIC EXCEPT A FEW
LIKE EUGLENA THAT IS
AUTOTROPHIC**

❖ **LOCOMOTE BY PSEUDOPODIA, CILIA
AND FLAGELLA**

❖ **ASEXUAL REPRODUCTION**

**PROTOZOA IS DIVIDED INTO SEVERAL
PHYLA;**

- ❖ **RHIZOPODA,**
- ❖ **CILIOPHORA OR CILIATA,**
- ❖ **MASTIGOPHORA OR FLAGELLATA**
- ❖ **SPOROZOA OR APICOMPLEXA.**

PHYLA RHIZOPODA

#AMOEBA#

EXAMPLE AMOEBA

###DIAGRAM

- ❖ NUCLEUS
- ❖ FORMING PSEUDOPODIA
- ❖ CONTRACTILE VACUOLE
- ❖ IRREGULAR SHAPE
- ❖ CELL MEMBRANE

CHARACTERISTICS OF PHYLUM RHIZOPODA

- ❖ MOVE BY **PSEUDOPODIA**
- ❖ **UNDIFFERENTIATED BODY**
 - ❖ SINGLE NUCLEUS
- ❖ **FREE LIVING AS SOME ARE PARASITIC**
 - ❖ ARE PHAGOCYTOTIC
 - ❖ EUKARYOTIC

**PHYLA CILIOPHORA/
CILIATA
#PARAMECIUM#**

EXAMPLE PARAMECIUM

###DIAGRAM

- ❖ **FOOD VACUOLE ATTACHED TO ORAL GROVE**
 - ❖ **CONTRACTILE VACUOLE**
 - ❖ **MEGA AND MICRO NUCLEUS**
 - ❖ **NUMEROUS CILIA**
 - ❖ **ANAL PORE**
- ❖ **ORAL GROVE TO TAKE IN FOOD**
 - ❖ **CYTOPHARYNE TO SUCK IN
MACROMOLECULES**

CHARACTERISTICS OF CILIOPHORA

- ❖ USE **CILIA** FOR LOCOMOTION

- ❖ **DIFFERENTIATED** BODY

- ❖ **TWO NUCLEI**

- ❖ ARE FREE LIVING

- ❖ VISIBLE TO NAKED EYE

- ❖ **BINARY FISSION** MAIN REPRODUCTION

**PHYLA MASTIGOPHORA/
FLAGELLATA
#TRYPANOSOME#**

EXAMPLE TRYPANOSOME

###DIAGRAM

- ❖ **UNDULATING MEMBRANE**
 - ❖ **FREE FLAGELLUM**
 - ❖ **CYTOPLASM**
 - ❖ **NUCLEUS**
 - ❖ **EUKARYOTES**

CHARACTERISTICS OF MASTIGOPHORA

- ❖ **USE FLAGELLA** FOR LOCOMOTION

- ❖ **SINGLE NUCLEUS**

- ❖ **EUKARYOTES**

- ❖ **MOST FREE LIVING** A SOME PARASITIC

- ❖ **REPRODUCE ASEXUALLY** BY BINARY
FISSION AS SOME **SEXUALLY** BY
SYNGAMY

#SYNGAMY IS THE FUSION OF TWO
GAMETES IN MEIOSIS

**PHYLA SPOROZOA/
APICOMPLEXA
#PLASMODIUM#**

EXAMPLE PLASMODIUM

###DIAGRAM

- ❖ MITOCHONDRION
- ❖ LARGE NUCLEUS
- ❖ POLAR RINGS
- ❖ APICAL ENDS
- ❖ RIBOSOMES
- ❖ CELL MEMBRANE

CHARACTERISTICS OF MASTIGOPHORA

- ❖ **ASEXUAL REPRODUCTION BY BINARY FISSION**
- ❖ **HAVE NO LOCOMOTORY MEANS**
 - ❖ **MOSTLY PARASITIC**
- ❖ **HAVE A PLASTID CALLED APICOPLAST TO PENETRATE THE HOST**
 - ❖ **NO CONTRACTILE VACUOLES**

IMPORTANCE OF PROTOZOANS

- ❖ TRYCHONYMPHA IN TERMITES ASSISTS
IN **CELLULASE DIGESTION**
- ❖ FREE LIVING PROTOZOA **BREAK DOWN
ORGANIC MATTER IN WATER** HENCE
USED IN WATER PURIFICATION
- ❖ RADIOLARIAN FOSSILS USED TO **TRACE
OIL LOCATION** IN THE SOIL
- ❖ **ENRICH SOIL** BY EXCREATING P AND N
IN THEIR COMPOUND FORM.

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❖ **CONTROL POPULATION OF BACTERIA
BY PREDATING ON THEM**

❖ **PHOTOSYNTHESIS THUS PURIFY AIR**

❖ **CAUSE DISEASES LIKE;**

➤ **TRYPANOSOMIASIS OR NAGANA**

➤ **MALARIA BY PLASMODIUM**

➤ **AMOEBIIC DYSENTRY BY *Entamoeba histolytica***

3. KINGDOM FUNGI/ MYCOPHYTA

A GROUP COMPRISING 800K SPECIES

- 1. UNICELLULAR E.G YEAST**
- 2. MULTICELLULAR SAPROPHYTES LIKE
TOADSTOOL, MUSHROOMS,
PUFFBALLS AND MOULDS**
- 3. PARASITES LIKE TINEA, CANDIDA
AND PHYTOPHTHORA**

**THE STUDY OF FUNGI IS CALLED
MYCOLOGY**

CHARACTERISTICS OF FUNGI

❖ **REPRODUCE ASEXUALLY** BY SPORE
FORMATION

❖ **HAVE VEGETATIVE BODY** CALLED MYCELIUM

❖ **CELLWALLS MADE OF CHITIN** WHILE FEW
MADE OF **CELLULOSE**.

❖ **HETEROTROPHS**; SOME SYMBIOTIC,
SAPROPHYTIC AS OTHERS PARASITIC

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❖ **THEY DO NOT MOVE**

❖ **STORE CARBOHYDRATES IN FORM OF GLYCOGEN**

❖ **STORE LIPIDS IN FORM OF OILS**

❖ **THEY INHABIT DAMP PLACES**

❖ **THEY MAY BE AQUATIC.**

EXAMPLES OF FUNGI

1. #BREAD MOULD#

Rhizopus stolonifera

THE BREAD MOULD

####DIAGRAM

- ❖ **IT IS SAPROPHYTIC GROWING ON
DECAYING FOOD**
- ❖ **HAS LARGE NON SEPTATE HYPHAE**
 - ❖ **WELL DEVELOPED MYCELIUM**
- ❖ **IT HAS RHIZOID ROOT STRUCTURES
FOR SUPPORT, ABSORPTION OF
NUTRIENTS AND WATER**

####

❖ **THE VERTICAL HYPHAE HAS A FRUITY
TIP CALLED SPORANGIOPHORE
WHICH BEARS THE SPORANGIA
PRODUCING SPORES**

❖ **REPRODUCES ASEXUALLY BY SPORE
FORMATION**

EXAMPLES OF FUNGI

2. PHYTOPHTHORA INFESTANTS

THE PHYTOPHTHORA INFESTANT

####DIAGRAM

❖ **PARASITIC GROWING ON TOMATO,
POTATO AND CACAO PLANT**

❖ **CAUSES BLIGHT DISEASE**

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❖ **HAS A MYCELIUM OF BRANCHED SEPTATE HYPHAE SPREADING THROUGH INTERCELLULAR LEAF SPACES.**

####DIAGRAM

❖ **THIS BRANCHES INTO HAUSTORIA PENETRATING INTO THE MESOPHYLL CELLS TO OBTAIN NUTRIENTS.**

❖ **LOWER THE MYCELIUM IS THE SPORANGIOPHORE EMERGING FROM THE STOMATA. THEY GIVE RISE TO SPORANGIA.**

**##SHOWING DIAGRAM
OF AFFECTED PLANT
PARTS**

EXAMPLES OF FUNGI

3. YEAST

THE YEAST

####DIAGRAM

- ❖ **UNICELLULAR FUNGUS** THAT THRIVES ON SUGAR
- ❖ FOUND ON **RIPENING FRUITS** AND **BODY PARTS** LIKE MOUTH
- ❖ REPRODUCE **ASEXUALLY** BY BUDDING
- ❖ CAUSES CANDIDIASIS, RINGWORM, ATHLETE FOOT

####SHOW DIAGRAMS

EXAMPLES OF FUNGI

4. MUSHROOMS

THE MUSHROOMS

####DIAGRAM

❖ ASEXUAL REPRODUCTION BY **SPORE FORMATION**

❖ BELONGS TO THE **BASIDIOMYCETES** GROUP

❖ IT IS A **SAPROPHYTE**

❖ IT THRIVES ON **ORGANIC REMAINS** AND
APPEARS MAINLY IN **RAINY SEASONS**

❖ BASIC BODY HAS **PILEUS** OR **CAP**, **STRIPE**
AND **HYPHA**

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- ❖ **ON THE LOWER SIDE OF PILEUS ARE GILLS OR HYMENIUM**
- ❖ **THE GILLS HAVE STRUCTURES CALLED BASIDIA**
 - ❖ **BASIDIA PRODUCES SPORES**
- ❖ **THE STRIPE ACTS AS STEM HOLDING THE PILEUS AND GILLS ABOVE SOIL FOR EFFECTIVE SPORE DISPERSAL.**
- ❖ **IT HAS FALSE ROOTS CALLED HYPHA OR MYCELIUM FOR SUPPORT AND NUTRIENT ABS.**

IMPORTANCE OF FUNGI

❖ **SOME MUSHROOMS USED AS FOOD**
E.G AGRICUS CAPESTRIS

❖ **YEAST USED IN BREAD BAKERY**

❖ **PENICILIUM IS USED AS AN
ANTIBIOTIC**

❖ **SAPROPHYTIC FUNGI THEY ARE
DECOMPOSERS**

####

❖ THEY ARE **BIOLOGICAL INSECTICIDES**
TO CONTROL PLANT PESTS E.G
BEAUVERIA BASSIANA CONTROLLING
ASH BORER.

❖ SYMBIOTIC FUNGUS HELPS IN
GROWTH OF THE PLANT BY
ABSORBING WATER AND MINERALS
FROM THE SOIL WHEREBY IT
RECEIVES FOOD FROM THE PLANT.

HARMFUL EFFECTS OF FUNGI

❖ **SOME CAUSE DISEASES E.G
PHYTOPHTHORA INFESTANT CAUSING
POTATO BLIGHT**

❖ **SAPROPHYTIC FUNGUS E.G RHIZOPUS
NIGRICANS CAUSES FOOD SPOILAGE.**

❖ **DRY ROT FUNGI CAUSES ROT IN TIMBER
USED IN FURNITURE AND BUILDINGS**

❖ **SOME FUNGI RELEASE TOXINS USED IN
MAKING BIOLOGICAL WEAPONS.**

❖ **SOME FUNGI ARE POISONOUS WHEN
CONSUMED.**

4. KINGDOM PLANTAE

COMPRISES ALL THE PLANTS.

THEY ARE AUTOTROPHIC

THEY ARE MULTICELLULAR

THEY ARE EUKARYOTIC

DIVIDED INTO 3 DIVISIONS;

❖ **BRYOPHYTA**

❖ **PTERIDOPHYTA**

❖ **SPERMATOPHYTA**

GENERAL CHARACTERISTICS

- ❖ **ALL EUKARYOTES**
- ❖ **HAVE CELLULOSE CELLWALLS**
- ❖ **GREEN DUE TO CHLOROPHYL**
- ❖ **MOVEMENT BY TROPISM AND NASTIES**
- ❖ **BOTH SEXUAL AND ASEXUAL**
- ❖ **ALTERNATION OF GENERATION/
METAGENESIS**

A. DIVISION BRYOPHYTA

THESE ARE THE SIMPLEST LAND PLANTS
THEY ARE BELIEVED TO HAVE EVOLVED
FROM FUNGI.

THEY CONSIST MOSSES AND LIVERWORTS.

GENERAL CHARACTERISTICS

- ❖ **NO TRUE ROOTS, LEAVES AND STEMS**
 - ❖ **NO VASCULAR TISSUE**
 - ❖ **RHIZOIDS ACT AS ROOTS**

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❖ **NO CUTICLE ON LEAVES. DUE TO THIS
THEY ARE POORLY ADAPTED TO LIFE
ON LAND**

❖ **THEY INHABIT DUMP AND COOL
PLACES**

❖ **THEY ARE PHOTOSYNTHETIC**

❖ **SHOW ALTERNATION OF GENERATION;**

➤ **THEY GIVE RISE TO SPOROPHYTE
GENERATION WHICH GIVES RISE TO
GAMETOPHYTE GENERATION.**

EXAMPLES OF BRYOPHYTA

LIVERWORTS AS AN EXAMPLE (CLASS HEPATICAEE)

####DIAGRAM

- ❖ **THIN FLATTENED THALLOID BODY**
- ❖ **NUMEROUS UNICELLULAR RHIZOIDS ON LOWER SURFACE. THEY ARE NOT BRANCHED**
- ❖ **MALE ORGAN IS THE ANTHERIDIUM PRODUCING MALE GAMETES**
- ❖ **THE FEMALE PART IS THE ARCHEGONIUM**

**THESE GAMETES (BIFLAGELLATES)
SWIM IN WATER AND FUSE TO FORM A
DIPLOID ZYGOTE**

**THE ZYGOTE THEN GROWS IN A
SPOROPHYTE, ATTACHED AND
NOURISHED BY THE GAMETOPHYTE.**

MOSSES AS AN EXAMPLE (CLASS MUSCI)

#####DIAGRAM

- ❖ **GAMETOPHYTE IS LEAFY WITH STEM LIKE STRUCTURE WHERE LEAVES ARE SPIRALLY ARRANGED**
- ❖ **RHIZOIDS ARE MULTICELLED AND BRANCHED**
- ❖ **THE ANTHERIDIUM AND ARCHEGONIUM ARE FOUND ON SAME PLANT BUT ON DIFFERENT STALKS. EACH SURROUNDED BY LEAVES. #####**

ANTHERIDIA RELEASES MOTILE SPERMS
THAT SWIM IN WATER **TO FERTILIZE THE**
EGG IN THE ARCHEGONIUM.

THE **DIPLOID ZYGOTE FORMED** DEVELOPS
INTO A SPOROPHYTE ON THE
GAMETOPHYTE.

❖ THE SPORE CAPSULE (**SPORANGIUM**) IS
HELD WELL ABOVE THE GROUND BY A
LONG STALK CALLED **THE SETA**.

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**WHEN MATURE THE CAPSULE
RELEASES HAPLOID SPORES
DISPERSED BY WIND.**

**IF THEY FALL ON MOIST SURFACE,
THEY WILL GERMINATE INTO
GAMETOPHYTES.**

2. DIVISION
PTERIDOPHYTA
(FILICINOPHYTA)

- ❖ **IT INCLUDES FERN AND HORSE TAILS**
- ❖ **THEY VARY IN SIZES INCLUDING SMALL PLANT TO LARGE TREES.**

####DIAGRAM

GENERAL CHARACTERISTICS

- ❖ **WELL DEVELOPED ROOT, STEM AND LEAVES**
- ❖ **THEY HAVE COMPOUND LEAVES CALLED FRONDS**
- ❖ **THE FRONDS HAVE LEAFLETS CALLED PINNA(E)**
- ❖ **WELL DEVELOPED VASCULAR SYSTEM**

####

❖ **SHOW ALTERNATION OF GENERATION;**
THE SPOROPHYTE (FERN PLANT) IS A
DORMINANT GENERATION WHILE THE
GAMETOPHYTE IS A MINUTE HEART
SHAPED STRUCTURE CALLED PROTHALLUS
CONFINED TO WET SHADDDY PLACES.

❖ **THE STEM IS A SHORT HORIZONTAL**
RHIZOME

####

- ❖ **THE SPORE BEARING STRUCTURE CALLED SORI ARE FORMED ON THE LOWER SIDE OF THE FRONDS.**
- ❖ **THEY HAVE ADVENTITIOUS ROOTS FOR ABSORPTION OF NUTRIENTS AND SUPPORT**

3. DIVISION
SPERMATOPHYTA
(SEED BEARING)

- ❖ THESE ARE **SEED BEARING PLANTS**
- ❖ THEY ARE THE **MOST SUCCESSFUL PLANTS FOUND ON THE LAND**
- ❖ THIS DIVISION CONSISTS OF **GREEN PLANTS** ALSO REFERRED TO AS **HIGHER PLANTS.**

GENERAL CHARACTERISTICS

❖ **BODY DIFFERENTIATED** INTO ROOTS,
STEMS AND LEAVES

❖ HAVE A **VASCULAR TISSUE**

❖ THEY HAVE **SUPPORT TISSUES;**
COLLENCHYMA AND THE PARENCHYMA
FOR **STORAGE**

❖ **SEXUAL AND ASEXUAL** REPRODUCTION

MALE GAMETOPHYTE IS **THE POLLEN**
WHILE THE FEMALE IS **THE EMBRYO SAC.**

ADAPTATIONS OF THE SPERMATOPHYTES TO REPRODUCTION

DEVELOPMENT OF POLLEN GRAINS

- ❖ **POLLEN GRAIN IS TRANSFERRED BY WIND OR INSECT TO THE FEMALE GAMETOPHYTE UNLIKE BRYOPHYTES AND PTERIDOPHYTES RELYING ON WATER.**

DEVELOPMENT OF POLLEN TUBE

- ❖ **THE MALE GAMETES ARE TRANSFERRED TO THE EMBRYO SAC VIA THE POLLEN TUBE.**

DEVELOPMENT OF SEEDS FOR REPRODUCTION.

SUB DIVISIONS OF SPERMATOPHYTA

1.

GYMNOSPERMATOPHYTA

PINE, FIR, CEDAR AND CYPRESS AS EXAMPLES

GENERAL CHARACTERISTICS

❖ **NON FLOWERING**

❖ **PRODUCE SEEDS ON CONES FOUND IN
THE STEM**

❖ **NEEDLE SHAPED LEAVES**

❖ **XYLEM HAS TRACHEIDS ONLY**

❖ **PHLOEM LACK COMPANION CELLS**

❖ **GROW WELL IN HIGH ALTITUDE AREAS.**

**CLASSES OF THE SUB
DIVISION
GYMNOSPERMATOPHYTA
*1. CLASS CONIFERALES***

PINE AND CYPRESS AS EXAMPLES

GENERAL CHARACTERISTICS

- ❖ **THEY ARE TREES OR SHRUBS**
- ❖ **THEY ARE EVERGREEN**
- ❖ **THEY HAVE NEEDLE LIKE LEAVES**
- ❖ **THEY HAVE A THICK WAXY CUTICLE**
- ❖ **MALE CONES FORM CLUSTERS
AROUND THE BASE OF TERMINAL BUD**

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- ❖ **FEMALE CONES APPEAR ON
TERMINAL BUDS ON YOUNG SHOOTS**
- ❖ **SEEDS PRODUCED AT THE BASE OF
FEMALE CONES**
- ❖ **WELL DEVELOPED VASCULAR
SYSTEM.**
- ❖ **XYLEM IS HEAVILY LIGNIFIED THUS
TREES ARE USED TO MAKE TIMBER**

**CLASSES OF THE
DIVISION
GYMNOSPERMATOPHYTA
*2. CLASS CYCADALES***

CYCADALES, BOWENIA AS EXAMPLES

GENERAL CHARACTERISTICS

- ❖ **PALM LIKE APPEARANCE**

- ❖ **LONG COMPOUND LEAVES**

- ❖ **THICK, SHORT AND UNBRANCHED
STEM**

- ❖ **CONES ARE FORMED AT THE APEX OF
THE STEM.**

- ❖ **WELL DEVELOPED VASCULAR SYSTEM**

**CLASSES OF THE DIVISION
GYMNOSPERMATOPHYTA**

***3. CLASS GINKGOALES/
GINKGOPHYTE***

2. SUBDIVISION

ANGIOSPERMAPHYTA

GENERAL CHARACTERISTICS

- ❖ **THEY ARE FLOWERING**
- ❖ **SEEDS ENCLOSED IN AN OVARY**
- ❖ **THE OVARY DEVELOPS INTO A FRUIT**
- ❖ **SEXUAL AND ASEXUAL REPRODUCTION THROUGH VEGETATIVE PROPAGATION**
- ❖ **WELL DEVELOPED VASCULAR SYSTEM**
- ❖ **WELL DEVELOPED ROOTS, STEM AND LEAVES**

####

THEY ARE GROUPED INTO THE FOLLOWING.

❖ **HERBS** - SMALL PLANTS WHICH NEVER
BECOME WOODY

**COMPLETE LIFE CYCLE IN ONE OR TWO
YEARS.**

❖ **SHRUBS** - LARGER THAN HERBS,
HAVE WOODY STEMS AND LIVE FOR MANY
YEARS

❖ **TREES** - TALL AND WOODY **LIVING FOR
YEARS**

CLASSES OF ANGIOSPERMATOPHYTA

THE SUB DIVISION HAS TWO CLASSES;

❖ MONOCOTYLEDONNAE

**EXAMPLES; GRASS, MAIZE,
SUGARCANE, BANANAS, COCONUT
PALM AND SISAL.**

❖ DICOTYLEDONNAE

**❖ BEANS, CABBAGE, MANGO TREE,
BLACK JACK AND CITRUS PLANT.**

DIFFERENCE BETWEEN MONOCOT AND DICOTS

MONOCOTS	DICOTS
ONE COTYLEDON	TWO COTYLEDON
PARALLEL VEINS	NETWORK VEINS
SCATTERED V. BUNDLES	RINGLIKE V. BUNDLES
FIBROUS ROOT	TAP ROOTS
FLORAL PARTS MULTIPLE OF 3	FLORAL PARTS MULTIPLE OF 4

KINGDOM ANIMALIA

**THESE COMPRISE OF ALL ANIMAL AND
ANIMAL-LIKE CHARACTERISTICS.**

GENERAL CHARACTERISTICS

❖ **MULTICELLULAR**

❖ **HETEROTROPHIC**

❖ **EUKARYOTIC CELLS**

❖ **MOST LOCOMOTE BUT FEW SESSILE**

❖ **MOST REPRODUCE SEXUALLY BUT
FEW ASEXUAL**

THE PHYLUM UNDER KINGDOM ANIMALIA

- ❖ **PORIFERA E.G SPONGES**
- ❖ **CNDIARIA OR COELENTERATA E.G JELLYFISH**
- ❖ **PLATYHELMINTHES E.G TAPEWORMS, FLUKES**
- ❖ **NEMATODA E.G ROUNDWORMS**
- ❖ **ANNELIDA E.G EARTHWORMS, LEECH**
- ❖ **ARTHROPODA E.G CRABS, SPIDERS**
- ❖ **MOLLUSCA E.G SNAIL**
- ❖ **ECHINODERMATA E.G STARFISH**
- ❖ **CHORDATA E.G ALL VERTEBRATES**

1. PHYLUM PORIFERA

- ❖ **THEY ARE ALL SPONGES**
- ❖ **THEY ARE MARINE**
- ❖ **THEY ARE FILTER FEEDERS**
- ❖ **REPRODUCE SEXUALLY AND ASEXUALLY THROUGH BUDDING**
- ❖ **THEY MOVE VERY SLOWLY**
- ❖ **MOSTLY ADULTS ARE SESSILE**

2. PHYLUM CNIDARIA/ COLEENTERATA

(JELLY FISH, HYDRAS)

- ❖ **THEY ARE ALL MARINE ANIMALS**
- ❖ **HAVE TENTACLES WITH STINGING CELLS**
- ❖ **THEY HAVE RADIAL SYMMETRY**
- ❖ **THEY HAVE TWO LIFE CYCLES; POLYP AND MEDUSA**
 - ❖ **THEY ARE DIPLOBLASTIC**
 - ❖ **HYDROSTATIC SKELETON**
- ❖ **MANY LIVE IN COLONIES AS SOME SOLITARY**

3. PHYLUM
PLATYHELMINTHES
(TAPEWORM, FLUKES,
TURBELLARIA)

- ❖ **BODY IS DORSOVENTRALLY FLATTENED**
- ❖ **THEY ARE BILLATERALLY SYMMETRICAL**
 - ❖ **THEY ARE TRIPLOBLASTIC**
- ❖ **THEY ARE DO NOT HAVE A COELOM
HENCE ACOELOMATE**
 - ❖ **BODY IS UNSEGMENTED**
- ❖ **MOSTLY PARASITIC. FEW ARE FREE
LIVING**
- ❖ **SEXUAL AND ASEXUAL REPRODUCTION**
 - ❖ **HERMAPHRODITES**

4. PHYLUM NEMATODA
(ROUND WORMS
ASCARIS
LUMBRICOIDES)

- ❖ **ALL ROUND WORMS**
- ❖ **BODY COVERED WITH THICK CUTICLE**
- ❖ **MOST ARE PARASITIC**
- ❖ **GROW BY CELL ELONGATION**
- ❖ **EXHIBIT SEXUAL AND ASEXUAL REPRODUCTION BY PARTHENOGENESIS**
- ❖ **SOME ARE HERMAPHRODITES**

5. PHYLUM ANNELIDA
***(EARTHWORMS, LEECH,
POLYCHEATAE)***

❖ **BILATERALLY SYMMETRICAL**

❖ **THEY HAVE A COELOM**

❖ **BODY COVERED BY EXTERNAL CUTICLE**

❖ **HAVE PARAPODIA STRUCTURES FOR
MOVEMENT**

❖ **THEY ARE SEGMENTED WORMS**

❖ **THEY HAVE A CLOSED CIRCULATORY
SYSTEM**

❖ **SEXUAL AND ASEXUAL REPRODUCTION
BY BUDDING AND FISSION**

6. PHYLUM MOLLUSCA

***(SNAILS, SLUGS,
OYSTERS, OCTOPUS,
SQUIDS)***

❖ **BILATERALLY SYMMETRICAL**

❖ **THEY ARE TRIPLOBLASTIC WITH THREE LAYERS**

❖ **FERTILISATION INTERNAL OR EXTERNAL**

❖ **BODY IS UNSEGMENTED**

❖ **BODY COVERED BY MANTLE OR SHELL**

❖ **INHABIT AQUATIC AND TERRESTRIAL REGIONS**

❖ **HAS HAEMOCOEL FOR BLOOD CIRCULATION**

❖ **COMPLEX DIGESTIVE SYSTEM**

❖ **SEXUAL REPRODUCTION**

**7. PHYLUM
ECHINODERMATA
(*STARFISH, SEA
URCHINS, BRITTLE
STAR*)**

- ❖ **LAVAL BILATERAL SYMMETRY AND RADIAL SYMMETRY FOR ADULTS**
 - ❖ **THEY ARE TIPLOBLASTIC**
 - ❖ **HAVE ORGAN SYSTEM GRADE ORGANISATION**
 - ❖ **MARINE ANIMALS**
 - ❖ **THEY HAVE A COELOM**
 - ❖ **BODY UNIQUELY SHAPED**
- ❖ **SOME SEXUAL AND SOME ASEXUAL REPRODUCTION**

8. PHYLUM ARTHROPODA

***(SPIDERS, INSECTS,
CRABS, PIG, COWS)***

THIS IS **THE LARGEST ORGANISM
CONSTITUTION OF LIVING ORGANISMS.
THEY **OCCUPY 75%** OF HABITATS ON LAND
AND WATER.**

DISTINGUISHING CHARACTERISTICS

- ❖ **BODY COVERED WITH EXOSKELETON
MADE OF CHITIN**
- ❖ **JOINTED APPENDAGES**
- ❖ **SEGMENTED BODIES**

####

THE PHYLUM HAS FIVE CLASSES;

❖ CRUSTACEA

❖ ARACHNIDA

❖ DIPLOPODA

❖ INSECTA

❖ CHILOPODA

A. CLASS CRUSTACEA
***(CRAYFISH, CRABS,
SHRIMPS, LOBSTERS,
PRAWNS)***

- ❖ **THEY HAVE TWO ANTENNAE PAIRS**
- ❖ **THEY HAVE CEPHALOTHORAC WHICH IS COVERED DORSALLY BY HARD SHIELD CALLED CARAPACE.**
- ❖ **THE CARAPACE FORMS EXTERNAL GILLS FOR GASEOUS EXCHANGE**
 - ❖ **THEY HAVE COMPOUND EYES**
- ❖ **THEY HAVE 5 OR MORE PAIR OF JOINTED LEGS**

####

- ❖ **THEY HAVE A VERY TOUGH EXTERNAL CUTICLE MAKING UP THE SHELL.**
- ❖ **THEY HAVE THREE PAIR OF MOUTH PARTS**
- ❖ **THEY REPRODUCE SEXUALLY**

B. CLASS ARACHNIDA
***(TICKS, SCORPIONS,
SPIDERS AND MITES)***

❖ **THEY HAVE CEPHALOTHORAX AND ABDOMEN**

❖ **FOUR PAIR OF LEGS ATTACHED TO THE CEPHALOTHORAX**

❖ **THE CEPHALOTHORAX HAS TWO PAIR OF JOINTED APPENDAGES PROJECTING INTERIORLY.**

1. CHELICERAE - USED TO PIERCE PREY AND SUCK ITS BODY FLUIDS

2. PEDIPALPS - LEG LIKE N SENSITIVE TO TOUCH

####

- ❖ **GASEOUS EXCHANGE IS THROUGH BOOK LUNGS, GILL STRUCTURES FOUND IN THE ABDOMEN. SOME HAVE TRACHEAL SYSTEM FOR G.E**
- ❖ **THEY HAVE SIMPLE EYES.**
- ❖ **THEY REPRODUCE SEXUALLY**

C. CLASS CHILOPODA
(CENTIPEDES)

❖ **DIVIDED INTO HEAD AND TRUNK**

❖ **HAVE MANY SEGMENTS**

❖ **EACH SEGMENT HAS A PAIR OF LEGS**

❖ **ONE PAIR OF ANTENNAE**

❖ **HAVE SHARP MOUTH PARTS CALLED
MANDIBLES**

ONE PAIR OF SIMPLE AND COMPOUND EYES

❖ **BODY IS DORSOVENTRALLY FLATENED**

❖ **THEY HAVE POISONOUS CLAWS**

❖ **THEY ARE CARNIVORES**

D. CLASS DIPLOPODA
(MILLIPEDES)

- ❖ **BODY DIVIDED INTO 3 PARTS, HEAD, SHORT THORAX AND TRUNK**
 - ❖ **BODY IS CYLINDRICAL**
 - ❖ **HAS PAIR OF ANTENNAE**
- ❖ **HAS MANDIBLES FOR FEEDING**
- ❖ **MANY SIMPLE EYES ON THE HEAD**
- ❖ **BODY HAS VERY MANY SEGMENTS**
- ❖ **G.E IS THROUGH TRACHEAL SYSTEM**
 - ❖ **THEY ARE HERBIVORES**

E. CLASS INSECTA
(ALL INSECTS)

❖ **THEY ARE THE MOST ABUNDANT ARTHROPODS. THEY COMPRISE OF 50% OF ANIMAL SPECIE.**

GENERAL CHARACTERISTICS

❖ **BODY DIVIDED INTO 3 PARTS**

❖ **THEY HAVE 3 PAIRS OF LEGS**

❖ **SOME HAVE WINGS FOR FLIGHT AS SOME DOESN'T**

❖ **HEAD HAS COMPOUND EYES WITH SEVERAL SIMPLE EYES. ###**

❖ **HAVE A PAIR OF ANTENNAE**

❖ **THREE MOUTH PARTS;**

✓ **MANDIBLES**

✓ **MAXILLAE**

✓ **LABIA**

❖ **HAVE MALPHIGIAN TUBULES FOR
EXCRETION**

❖ **G.E IS THROUGH TRACHEAL SYSTEM**

❖ **SEXUAL REPRODUCTION**

9. PHYLUM CHORDATA

*(ANIMALS WITH
BACKBONE)*

THESE ARE ANIMALS **HAVING A BACKBONE OR A NOTOCHORD. THEY INCLUDE; MAMMALS, BIRDS, FISHES, REPTILES, AMPHIBIANS.**

GENERAL CHARACTERISTICS

- ❖ THEY HAVE A NOTOCHORD HENCE THE NAME**
- ❖ HAVE DORSAL TUBULAR NERVE CORD**
- ❖ THE NERVE CORD DEVELOPS INTO BRAIN AND THE SPINAL CORD**

####

- ❖ THEY HAVE **VISCERAL AND PHARYNGEAL CLEFT** AT THE EMBRYONIC STAGE. IN FISH THIS DEVELOPS INTO GILLS
- ❖ THEY HAVE A **POST ANAL TAIL** AT SOME LIFE STAGE
 - ❖ THEY HAVE **VENTRAL HEART**
- ❖ THEY HAVE **SEGMENTED MUSCLE BLOCKS** CALLED THE MYOTOMES.
- ❖ THEY HAVE AN **ENDOSKELETON**

####CLASSES----□

1. CLASS PISCES

(ALL FISH SPECIES)

THEY ARE MAINLY FISH.

THEY COMPRISE OF TWO SUBCLASSES;

- 1. OSTEICHTHYES - BONY FISH SUCH
LIKE TILAPIA AND TROUT**
- 2. CHONDRICHTHYES - CARTILAGENOUS
FISH SUCH LIKE SHARK AND RAYFISH**

####

- ❖ **MAINLY AQUATIC**
- ❖ **GILLS FOR G.E**
- ❖ **MOVE BY FINS**
- ❖ **BODY COVERED BY SCALES**
- ❖ **HAVE LATERAL LINE FOR STIMULI DETECTION**
- ❖ **HEART HAS TWO CHAMBERS**
- ❖ **THEY REPRODUCE SEXUALLY**
- ❖ **EYES COVERED BY NICTATING MEMBRANE**
 - ❖ **SOME ARE CANIVORES AS SOME HERBOVORES.**

2. CLASS AMPHIBIA

***(FROGS, TOADS,
SALAMANDER,
AMPHIUMA)***

- ❖ **HIND LIMB LONGER THAN FORE LIMB**
- ❖ **THREE CHAMBERED HEART. TWO ATRIA**
- ❖ **G.E IS THROUGH SKIN, LUNG OR GILLS IN LAVAL AND TADPOLE STAGE**
- ❖ **HAVE TWO EYES AND BEHIND THEM IS THE EARDRUM**
- ❖ **THEY ARE POIKILOTHERMIC**
- ❖ **SEXUAL REPRODUCTION WHERE THEY LAY EGGS IN WATER.**

3. CLASS REPTILIA

***(SNAKES, TURTLE,
LIZARDS, DINOSAUR,
CHAMELEON,
CROCODILE)***

- ❖ **HAVE DRY SKIN WITH SCALES TO PREVENT WATER LOSS AND DESSICATION**
- ❖ **SOME HEART HAS 3 CHAMBERS. CROCODILE HAS 4 CHAMBERS**
- ❖ **THEY ARE POIKILOTHERMIC**
- ❖ **THEY EXCREATE NITROGENOUS WASTE IN FORM OF URIC ACID.**
 - ❖ **SEXUAL REPRODUCTION**
- ❖ **EGG FERTILIZED INTERNALLY AND LAID ON LAND.**

4. CLASS AVES

***(HEN, DOVE, TURKEY,
QUAILS)***

- ❖ **BODY COVERED WITH FEATHERS**
 - ❖ **LEGS HAVE SCALY SKIN**
 - ❖ **WINGS FOR FLIGHT**
 - ❖ **BEAKS FOR FEEDING**
 - ❖ **HOLLOW BONES (PNEUMATIC)**
- ❖ **STERNUM IS ENLARGED TO FORM FLIGHT MUSCLES**
 - ❖ **G.E IS BY LUNGS**
- ❖ **THEY ARE HOMOEOTHERMIC**

5. CLASS MAMMALIA
***(PIG, DOG, COW, MAN,
ELEPHANT, BAT)***

**THEY LIVE IN WIDE RANGE OF HABITATS I.E,
LAND AND IN WATER.**

GENERAL CHARACTERISTICS

- ❖ **HAVE MAMMARY GLANDS** HENCE THE NAME
 - ❖ **BODY COVERED WITH FUR OR HAIR**
 - ❖ **THEY ARE HETERODONTS AND
HETEROTROPHS**
 - ❖ **HAVE AN EXTERNAL EAR**
 - ❖ **G.E IS BY LUNGS**
 - ❖ **MOST HAVE A WOMB**
 - ❖ **SEXUAL REPRODUCTION**

**IDENTIFICATION IF
LIVING ORGANISM**

TAXONOMISTS HAVE DEVISED A WAY USED TO IDENTIFY ORGANISMS BASED ON EXTERNAL FEATURES.

1. IN ANIMALS BELOW ARE OBSERVED;

- ❖ LEGS - NUMBER AND SIZES**
- ❖ WINGS - PRESENCE AND NUMBER**
- ❖ EYES - PRESENCE TYPE AND NUMBER**
- ❖ BODY SURFACE - SMOOTH, HAIRY,
FEATHERY**
- ❖ BODY SYMMETRY - SYMMETRICAL OR
ASSYMETRICAL #####**

- ❖ **FEEDING STRUCTURES - NUMBER AND TYPE**
- ❖ **FEEDING TYPE - CARNIVORES, OMNIVORES OR HERBIVORES**
- ❖ **BODY SEGEMENTATION**
- ❖ **NUMBER OF BODY PARTS**

####

2. IN PLANTS BELOW ARE OBSERVED;

- ❖ THE ROOT SYSTEM - TAP, FIBROUS, PROP ETC**
- ❖ STEM CROSS SECTION - SMOOTH, ROUGH, HAIRY OR THORNY, CIRCULAR OR ANGULAR**
- ❖ FLOWERS - INFLOURESCENCE TYPE (GROUP OF FLOWERS ARRANGED IN A STEM), NUMBER OF FLOURAL PARTS, SHAPE AND COLOR**

####

- ❖ **THE LEAF** - 1. **COLOR** **####DIAGRAM**
2. **VENATION** - **NETWORK OR PARALLEL**
3. **MARGIN** - **SMOOTH OR SERRATED**
4. **APEX** - **ROUND, POINTED OR LOBED**
5. **PHYLOTAXY** - **OPPOSITE, ALTERNATE
OR WHORLED**
6. **LEAF TYPE** -
SIMPLE; **PETIOLATE/ APETIOLATE**
COMPOUND; **PINNATE, BIPINNATE,**
TRIFOLIATE OR PALMATE

COMMON USED KEY IS THE DICHOTOMOUS KEY.

WHAT IS A DICHOTOMOUS KEY?

**THIS IS A TABLE CONSISTING OF
CONTRASTING FEATURES AND
CHARACTERISTICS OF ORGANISMS.**

**❖ THE TWO CONTRASTING FEATURES IN THE
KEY ARE CALLED COUPLET WRITTEN AS;**

1a.....

1b.....

USING A DICHOTOMOUS KEY

- ❖ **CONSIDER SINGLE CHARACTERISTIC AT EACH LEVEL AT A TIME**
- ❖ **THESE TWO CHARACTERISTICS ARE USED TO IDENTIFY DIFFERENT ORGANISM**
- ❖ **THE SEPARATION CONTINUES UNTILL ALL ORGANISMS HAVE BEEN IDENTIFIED**

####DIAGRAM OF TABLE

- ❖ **ONCE IDENTIFICATION HAS BEEN DONE, THE STEPS ARE WRITTEN IN A TABLE AS SHOWN..**

RULES OF CONSTRUCTING A DICHOTOMOUS KEY

- ❖ **SELECT ONE CHARACTER AT A TIME**
- ❖ **EACH CHARACTER IS IDENTIFIED USING A NUMBER.**

#####SHOW E.G

**IF IT'S A LEAF TYPE, FOCUS ONLY ON
SIMPLE OR COMPOUND LEAVES.**

####

❖ **START WITH THE MAJOR CHARACTERISTIC THAT WILL SPLIT THE GROUP INTO TWO.**

❖ **FINISH UP WITH THE MINOR CHARACTERISTIC UNTIL EACH SPECIMEN IS ISOLATED.**

####EXAMPLE

**IF COMPARING MANY ORGANISM,
SEPARATE FROM;**

✓ ***PLANTS***

✓ ***ANIMALS***

❖ **AVOID GENERALIZATION. .**

AVOID SAYING E.G SHORT OR LONG PLANTS

**INSTEAD USE VALUES LIKE SHORTER THAN
1M OR LONGER THAN 1M**

❖ **FIRST STATEMENT SHOULD BE POSITIVE
WHILE THE SECOND A NEGATIVE OF THE
FIRST.**

❖ **WRITE TABLE OF IDENTIFICATION**

####

❖ **AVOID USING NEGATIVE WORDS 'NOT'
OR 'NO'**

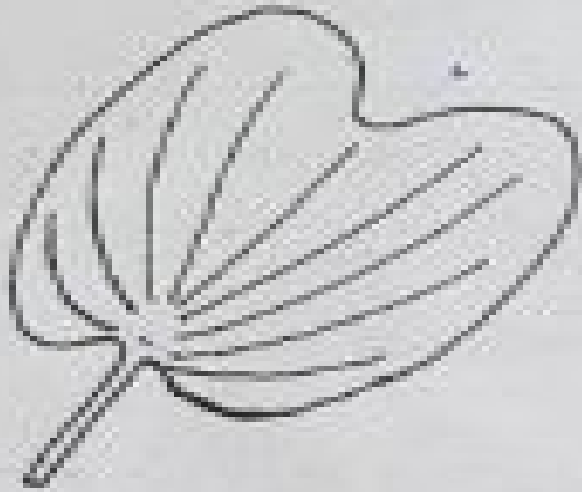
**ONLY USE THEM WHEN YOU CANT
AVOID.**

**WHEN THERE IS A CHARACTERISTIC
THAT YOU CAN MENTION, DO SO.**

**E.G DON'T SAY RED COLORED LEAVES
NOT RED COLORED LEAVES**

EXAMPLE 1 OF DICHOTOMOUS KEY CONSTRUCTION

USING THE 5 LEAVES



Leaf A



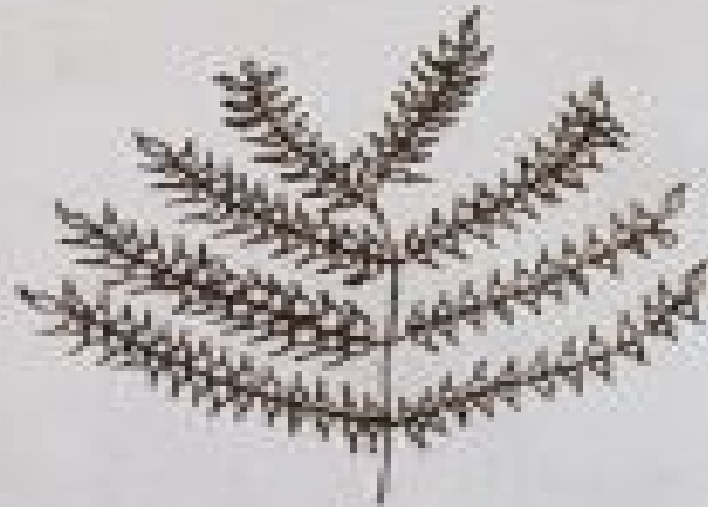
Leaf B



Leaf C



Leaf D



Leaf E

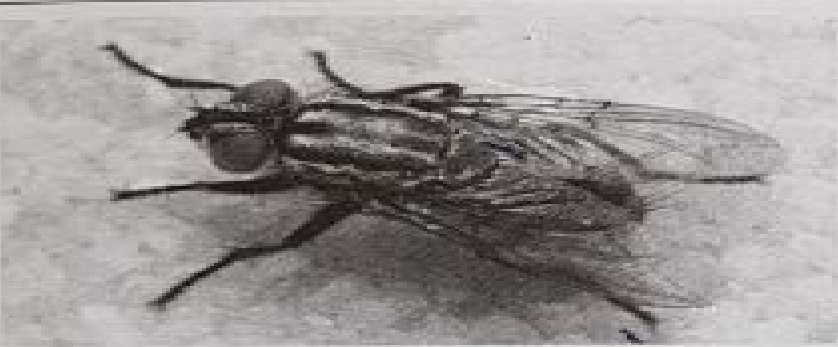
- 1.a. **Leaf simple**.....go to 2
 - b. **Leaf compound**.....go to 3
- 2.a. **Leaf blade lobed**.....Bauhinia
 - b. **Leaf blade pointed**.....Mango
- 3.a. **Leaf attached to one leaf stalk**.....Cassia
 - b. **Leaf attached to many stalks**.....Go to 4
- 4.a. **Leaflets round at apex**.....Flamboyant
 - b. **Leaflets joined at apex**.....Jacaranda

**AFTER THE KEY, DRAW A TABLE WITH
THE STEPS FOLLOWED TO IDENTIFY**

LEAF	ORGANISMS AS BELOW	IDENTITY
A	1(a), 2(a)	Bauhinia
B	1(a), 2(b)	Mango
C	1(b), 3(a)	Cassia
D	1(b), 3(b), 4(a)	Flambouyant
E	1(b), 3(b), 4(b)	Jacaranda

EXAMPLE 2 OF DICHOTOMOUS KEY CONSTRUCTION

USING THE 8 ANIMALS



A



B



C



D



F



G



H

- 1.a. **Animal with wings.....go to 2**
 - b. **Animal without wings.....go to 3**
- 2.a. **With one pair of wing.....Housefly**
 - b. **With two pair of wings.....Dragonfly**
- 3.a. **With three pairs of legs.....Ant**
 - b. **More than three pairs of legs.....go to 4**
- 4.a. **With four pair of legs.....Spider**
 - b. **More than four pairs of legs.....go to 5**

**5.a. With two pairs of antennae.....go to
6**

**b. With one pair of antennae.....go to
7**

**6.a. With six pair of legs.....Water
Skater**

**b. With ten pair of legs.....Fresh water
shrimp**

**7.a. With cylindrical body.....
.....Millipede**

**b. With dorso ventral flat body.....
Centipede**

LEAF	STEPS	IDENTITY
A	1(a), 2(a)	Housefly
B	1(b), 3(b), 4(a)	Spider
C	1(a), 2(b)	Dragonfly
D	1(b), 3(b), 4(b), 5(a), 6(a)	Water Skater
E	1(b), 3(b), 4(b), 5(b), 6(b)	F. Water Shrimp
F	1(b), 3(b), 4(b), 5(b), 7(b)	Centipede

END OF TOPIC CLASSIFICATION II

