AQUARIUM
&
ORNAMENTAL FISH

1. WHAT ARE ORNAMENTAL FISHES?

Ornamental fishes can be defined as attractive colorful fishes of peaceful nature that are kept as pets in confined spaces of an aquarium or a garden pool with the purpose of enjoying their beauty for fun and fancy. Ornamental fishes are also called “live jewels” for their beautiful colors and playful behavior.

2.WHY SHOULD WE KEEP THEM?

- Keeping ornamental fishes as pets prove advantageous to us in several ways:

a) Keeping ornamental fishes as pets in home aquaria or garden pools gives pleasure to the young and the old alike.

b) Keeping ornamental fishes have many advantages over other pets viz

i) No barking or mewing in the middle of the night.

ii) No biting or scratching visitors.

iii)No shedding of fur of feathers all over the house.

iv)No botheration of cleaning the floor or cage everyday compared to dogs, cats, birds etc.

v) Relatively less expensive pets and less cumbersome to maintain

c) Relaxation of mind, particularly when we feel tired or depressed.

d) The hobby opportunity to watch the behavior of these tiny creatures from close quarters and develops a sense of attachment with nature.

e) Ornamental fishes kept in an aquarium or garden pool become an attractive focal point and add to the aesthetic beauty of the home and its surroundings.

f) The hobby of keeping ornamental fishes can be groomed as a source of self –employment by taking to various types of ancillary such as:

i) Culture of native varieties of ornamental fishes and their export

ii)Supply of accessory apparatus viz., filters, aerators, reflectors, lighting, heating equipments, decorative dolls, nature and artificial plants, natural and artificial food etc.

It can be used as a source of income generation by rendering services of aquaria upkeep at hotels, airports, water parks and other such public places.

3. ORIGIN OF KEEPING ORNAMENTAL FISHES AS PETS:

i. The hobby of keeping ornamental fishes as pets is said to have originated with keeping of gold fish in glass bowls in China several hundred years ago.

ii. During the 17th century, the gold fish were introduced to several countries and became most popular in England and Scotland during 1854 – 1662.

iii. Since 1850, the hobby also became popular in USA.

iv. World's first aquarium started in England in 1853. Native fishes were initially kept and domesticated as pets. The practice, however, spread rapidly and the world was combed for small brightly colored specimens that would live in narrow confines of glass aquaria.

v. The major technical advances in aquarium maintenance took place after the 2nd world war with the development of air travel to add to the rapid transport and safety.

vi. The number of domesticated fishes continued to grow and bred generation after generation in captivity. The guppy, platy, swordtail, molly, zebra fish, angel, fighter etc have been hybridized, selectively bred and consequently all of them now differ significantly from their wild ancestors in color, shape and reproductive cycle.

vii. In India, the hobby of keeping ornamental fishes bloomed with the opening of the “TARAPOREVALA” aquarium in Mumbai in 1951 and also several aquarium societies in the city.

4. USEFULNESS:

Aquaria have tremendous potential as ever changing sources of enjoyment and education. They can even provide opportunities for saving certain species from extinction, e.g. *Skiffia francesae.*, a goodie from Mexico which, today, still survives in Aquaria after the inadvertent introduction of platies into its natural habitat in the 1970's.

5. LIMITATIONS:

1. Whatever the size of an aquarium, it will always represent an enclosed artificial environment to a larger or lesser extent.
2. In such closed systems natural processes of breakdown and renewal can not take place quite like they do in nature.
3. In general terms, the larger an aquarium is, the easier it will be to maintain, and the lower the risks of major environmental fluctuation will be.
4. Aquaria have their limitations too, of course, some species may be either too large or may require too much space, to make aquarium spawning a possibility.

6. WHAT IS AN AQUARIUM?

An aquarium is a container which displays the aquatic organisms in a simulated natural environment by introducing aquatic plants, rocks, gravels, artificial decorative etc and maintaining physico-chemical and biological parameters there in with the aid of equipments controlling aeration, water movement, temperature, suspended organic matter, illumination etc besides feeding.

In effect, an aquarium is a biological entity in which each of its elements – water, glass, light, sand, gravel, plants, fish must be there, make a harmonious whole, with the same balance as exists in nature.

7.TYPES OF AQUARIA:

In a broad sense, aquaria are divided in two categories:

a.Fresh water aquaria

b.Marine aquaria

Moreover, brackish water aquaria are in existence.

i. FRESH WATER AQUARIA→

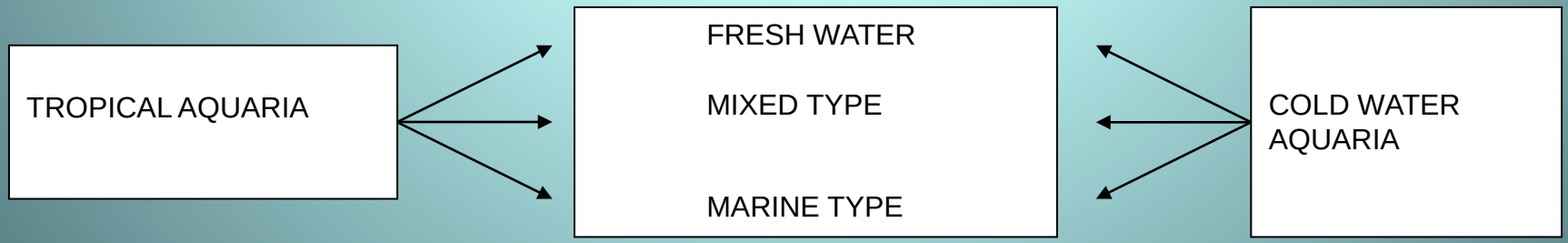
Aquarium that houses fish and plants of freshwater world. Freshwater contains small amount of salts and gases in solution. Fresh water may be classed as 'hard' or 'soft' according to the sodium and calcium it contains in compounds.

ii. MARINE AQUARIA→

Marine aquarium is a biological entity which houses marine flora and fauna in a harmony. Sea water differs from fresh water by its salt content.

8.TROPICAL AND COLD WATER AQUARIA:

According to geographical position, aquaria are again divided into tropical and cold water aquaria. Both tropical and temperate aquaria may be fresh, marine and mixed type.



Introduction of new species and varieties of freshwater fish and their successful adaptation in aquaria has expanded almost exclusively restricted to so called tropical species, but introduction of 'Cold water' species to this 'tropical domain' and vice-versa has created a mixture of colourful aquatic world. In fact, there is a clearly detectable trend towards mixed tropical/ cold water community aquaria.

(A) TROPICAL AQUARIA:

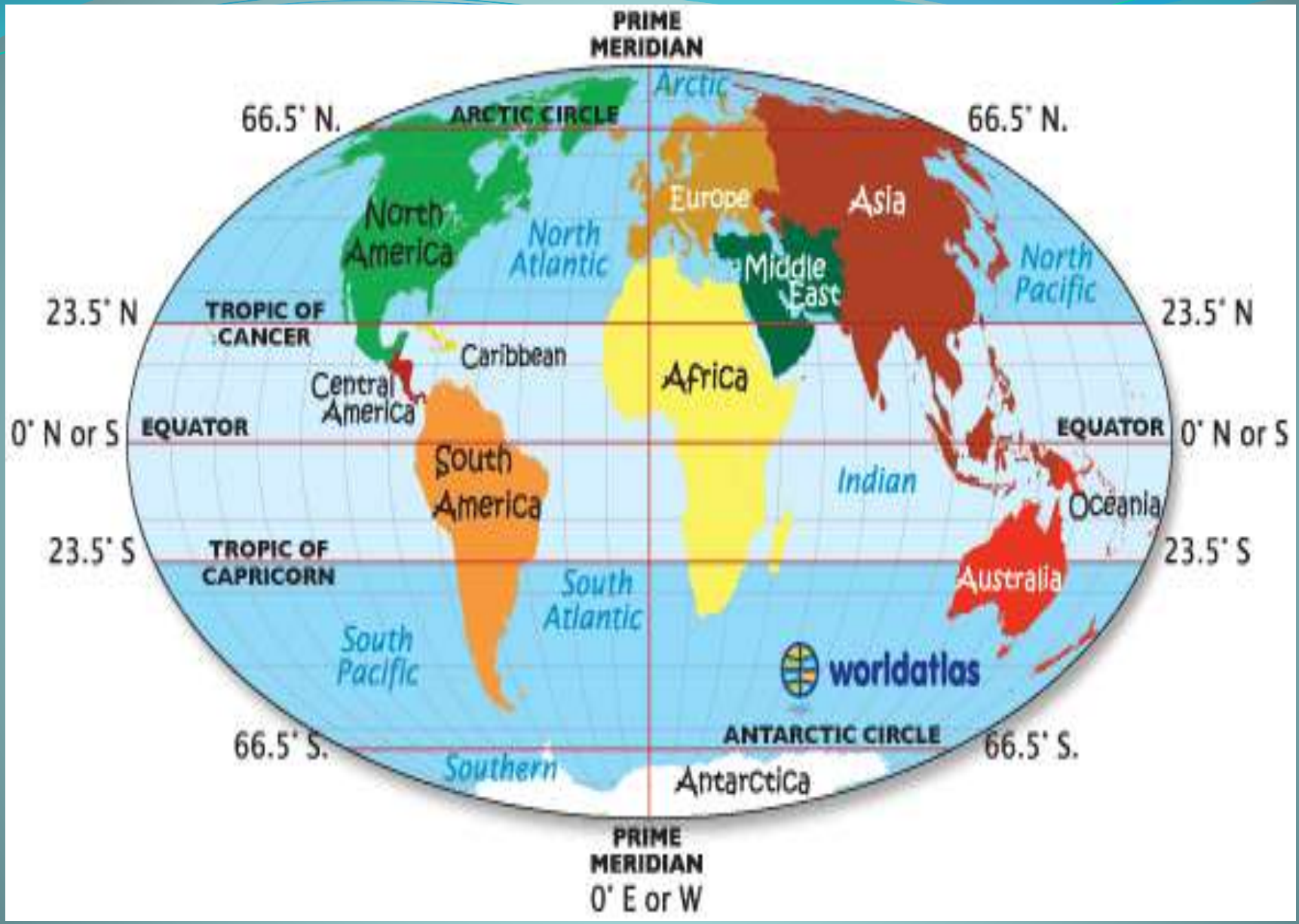
i) When an aquarium is described as ‘tropical’ it is usually assumed to be ‘one in which fish and plants from tropical parts of the world are housed”.

ii) Yet, when we look at this broad classification in a little more details, some flaws begin to be apparent.

iii) How, for instance do we define tropical? Where do we actually draw the line?

iv) All countries that are located between the tropics of cancer and Capricorn, and the fish that are found in them, can be said to be tropical without too much fear of contradiction (Fig-1). For example, Brazil and its fishes are universally and correctly regarded as tropical.

v) China, on the other hand, is often regarded as tropical but in fact only its southern most tip is within the tropics. Yet the paradise fish, found in non-tropical China (Taiwan, Korea and South Vietnam) is usually thought of as a tropical fish, although it can withstand cool temperatures.


PRIME MERIDIAN
66.5° N.
ARCTIC CIRCLE
Arctic
66.5° N.
North America
North Atlantic
Europe
Asia
Middle East
North Pacific
23.5° N
TROPIC OF CANCER
23.5° N
Caribbean
Central America
Africa
0° N or S
EQUATOR
EQUATOR
0° N or S
South America
Indian
Oceania
23.5° S
TROPIC OF CAPRICORN
23.5° S
Australia
South Atlantic
South Pacific
worldatlas
66.5° S.
ANTARCTIC CIRCLE
66.5° S.
Southern
Antarctica
PRIME MERIDIAN
0° E or W

vi)There are, in addition, other species which can withstand temperatures below those normally considered in the aquarium hobby to represent the tropical range, i.e., about 22°C and above. For example, Rosy barbs can tolerate a temperature of around 15°C quite comfortably during the winter months. However, they cannot breed at the temperature and it this criterion that may be considered the critical one.

vii) In general terms, therefore, a tropical aquarium requires the provision of artificial heat for the successful breeding of most of the species it contains. This is of course a relative definition because the heating would be superfluous if the aquarium were in a country where the climate is already tropical.

viii) One of the most interesting aspects of keeping a tropical freshwater aquarium is the breeding of fish.

B) COLD WATER AQUARIA:

i) When an aquarium is described as ‘cold water’ it is usually assumed to be ‘one in which fish and plants from temperate parts of the world are housed’.

ii) Temperate is the word generally used for such regions as Europe and USA. Yet again, this broad classification has its share of flaws. Where, for example, do we fit in those regions of the world generally regarded as ‘sub-tropical’?

iii) Barbs and the ever popular guppy (tropical fish) can be kept outdoors in a number of temperate countries during all but the most severe winters without additional heating.

iv) In general terms, a cold water or temperate aquarium is one which does not require the provision of artificial heat either for the maintenance or successful breeding of the fish it houses.

v) As with tropical aquaria above, this definition is a relative one. Fishes are very interesting and that should be noted that with in a brief period of time they manage perfectly with the situation. To them it makes no difference at all whether they are tropical, cold water or what ever.

9. HOME WORK:

Before setting up of any type of aquaria, i.e. fresh water or marine, an aquarist must consider the following considerations:

1. Listing of compatible fish species with available space provided.
2. Listing of available attractive fish species and selection.
3. Availability of ornamental fish species.

i) SPACE→ Space is an important factor for an aquarium and this is often calculated in terms of oxygen requirement based on length of fish (length excluding tail when full grown) and surface area of the tank.

For temperate freshwater fishes, fish of 2.5cm requires 194 cm^2 (1 inch/ 30 sq inches) of surface area and for tropical freshwater fishes it requires 2.5 cm per 64cm^2 (1 inch/10 sq inches)

For marine the formula is 2.5 cm of fish requires 18 L water (1 inch / 2 gallons).

ii) Selection of fish→

a) Habitat and feeding behavior of a fish should be considered before selecting for aquarium. Wrong information or any error may be catastrophic for the fishes.

b) Fishes will suffer if they are exposed in wrong environment in a wrong way. An aquarist should know everything properly and rightly.

iii) Size and temperament→

a) Size and temperament are just as important as compatibility. Not all species feed exclusively on other fishes. It is natural for larger fishes to eat smaller ones.

b) Except strict vegetarian tank mates, smallest fish would be too big to fit into the largest month.

c) Some species are territorial in nature and are usually aggressive towards conspecific and also towards other species.

d) Feeding habitat is an important factor, slow and steady eaters will not get any food if their other tank mates are fast swimming and greedy one.

e) Uneventful cohabitation may affect fish behaviour as in dealer's tank. Relative crowding lack of décor and their age may change the temperament.

Beside these, a network with other aquarists and professional dealers may be established for better accumulation of knowledge. A good dealer is a useful source of information on fishes and fish keeping and will never influence to purchase totally incompatible fishes,

e.g., Oscar, Cichilid and the Neon Tetra in an aquarium.

10. Establishment of an Aquarium (Fresh water):

A. Choosing the aquarium tank:

Aquarium tank is a prime important equipment for setting up of an aquarium. An aquarist must consider its shape, size and material used

Tanks may be of several kinds:

1. Metal frame tank
2. Plexi-glass tank
3. All glass tank

Metal frame tank→ very common type tank with a metal frame work, usually made of enameled iron, a light alloy or stainless steel and glass walls sealed with putty.

Plexi-glass tank→ made up of high quality plexi-glass, not particularly hard. Scratches easily and tends to lose its clarity. Tends to yellow with time.

All glass tank→ aquaria, built entirely of glass and banded by 'silicon adhesive' afford very resilient joints and yet retain some degree of elasticity.

Before purchasing a new tank check:

- Whether tanks are made from new glass of a thickness appropriate to their size.
- Presence of air bubbles some where in the walls do not withstand water pressure.

Keep in mind: a liter of water weighs a kilo, so a 200 liter tank will, when full, weigh 200 kilos.

A tank with a capacity of 125-250 L is most conventional. A good size would be an 80 cm tank (80*40*40cm) or a meter tank (100*50*50cm). The most popular size of home aquarium is 60 cm length * 30 cm width * 40 cm height, with a capacity of 57 L (15 gallons).

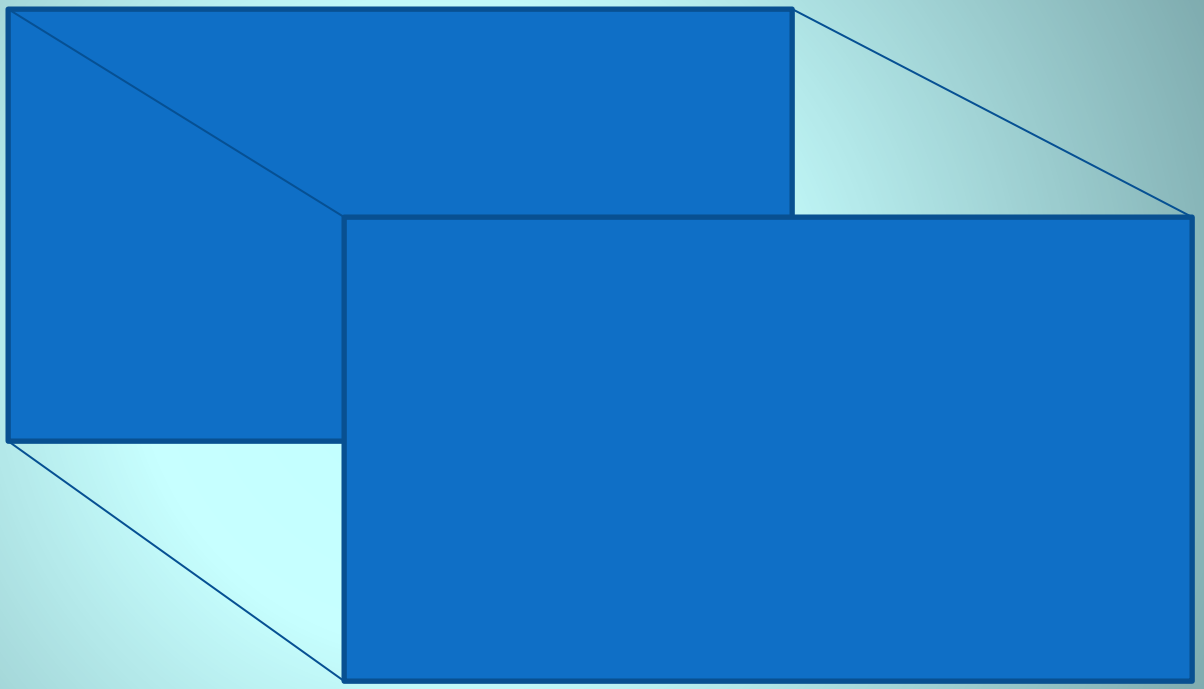
Tanks are usually measured → Length x Depth x Height

Size of an aquarium is designed in such a way that length will be twice as long as its depth and height. This general principle is generally maintained for spreading equal water pressure.

Shallow and wide tanks are preferable, as they have more surface area to facilitate oxygenation through atmospheric contact.

Further, such tanks can accommodate more number of fish than tanks having lesser surface area but with equal quantity of water.

Aquarium Tank



B. Bottom:

The base of an aquarium is known as bottom on which bed is prepared. The bed is prepared for two basic purposes:

- To make the fish feel more at home, and
- To provide a growing medium for aquatic plants.

Unless a particular species of fish has special requirements, the composition of the bed is mostly dictated by the needs of the plant.

C. Stand:

Wooden/metallic structure on which aquarium is placed. This must be flat and level and capable of carrying the load of entire set.

D. Hood:

Hood is the top most covering of an aquarium to keep the fishes confined in the tank, minimize water loss by evaporation, offers more protection against intruders and helps in light attachment.

Hood may be of several kinds but the materials used and construction must be such that there is no danger of contamination.

E. Ideal site for setting the Aquarium:

For setting the aquarium, one must find a stand on which the aquarium can set so that it is at eye level. In living and study rooms, a small low table also be used for this purpose.

Recently, aquarium is considered as an integral part of interior décor and is fitted into the décor of the house in several ways viz.

a. Built into a wall, there by giving an effect of an animated picture,
b. As a room divider,
c. Built into a book-case and
d. For making aquarium cum-indoor garden.

Aquarium tank should not be located at a place where it faces direct or excess sunlight. Too much of sunlight cause over heating and promote excessive algal growth in the aquarium tank.

Once a suitable place is selected, it is insured that the supporting place has plain and even surface. Uneven surface produces stress on glass and may prove disastrous when aquarium is filled with water. This problem could be overcome by thermocol cushion beneath the tank.

F. Lighting arrangement:

Proper illumination is important for healthy functioning of a home aquarium. Apart from providing visual display of ornamental fishes to their best affect, it also stimulates growth of the fishes and plants. Light intensities, quality and duration are important aspects to be looked into.

As a thumb rule, 40 watts of tungsten light or 10 watts of fluorescent tube work ideally for every square foot of water surface.

Lighting for 10 to 15 hours a day is considered enough.

Fluorescent tube lights are preferred over tungsten bulbs as they have a longer life, less heating effect and low running cost.

Now a days, specially designed 'glow lux' tube lights are available having a facility of good balance between infrared and ultraviolet light. The ultraviolet light provides energy to plants for producing chlorophyll and gives better shape to the plants. The infrared light on the other hand, is particularly important for photosynthesis.

Recently, spot lights for aquarium are available in markets which provide a very attractive light and shade effect, allowing light to be concentrated where needed without over illuminating the entire aquarium.

G. Heating arrangements:

The ornamental fishes kept as pets in home aquarium (except gold fish) come from different tropical countries and are accustomed to live at 22°C to 30°C. In places along the coast line, the climate remains quite conducive, there being not much abrupt difference between the temperatures at day and night. At other places in the country, however, measures are required to be taken to heat the water in winter, especially at night.

Tropical fish and plants in a temperate climate inevitably involve artificially heating in water in the aquarium.

Heating is most commonly dove by using immersion heaters with adjustable thermostat. The power of a heater is selected on the basic rule of heating having 10 watts per 5 liters of water for tanks of 120 cm length and 6 watts per 4.5 liters of water for tanks of 60 cm length. The wattage of heating required depends on tank volume and ambient room temperature.

To provide the best circulation of heat the elements should be hidden as low as possible in the tank, but not on or in the bed because if it is, then its efficiency is reduced. Heating in aquaria is a very risky job. Be ensure that your thermostats are highly sensitive otherwise a second thermostat can be connected into the circuit.

H. Aeration:

During summer months, the water in the aquarium will have to be cooled down to at least 29°C. This is best done by having an aerator, connected to a diffuser by a plastic or rubber tube. The aerator forces a stream of air bubbles into the water. The diffuser, which may be a block of pumice stone, breaks up air bubbles to finer size. The diffusers should be kept just above the bottom of the tank so that a circulation of the water is attained by the bubbles rising up. The aerator should be kept at a level higher than the water level of the aquarium.

Besides lowering the temperature, the aerator also helps in increasing the dissolved oxygen content in the water. Oxygen requirement of an aquarium is closely related with water temperature and increased temperature results in increased metabolic rate and hence oxygen requirement. Aeration serve to circulate oxygen around the aquarium and also required for the running of filtration systems, toys, etc. Artificial aeration also supports 50% more fish than the number of fish normally maintained without aeration, but with partial changes of water. This is mainly due to air bubbles which drive the CO_2 laden bottom water by taking it to the surface.

H. Filters:

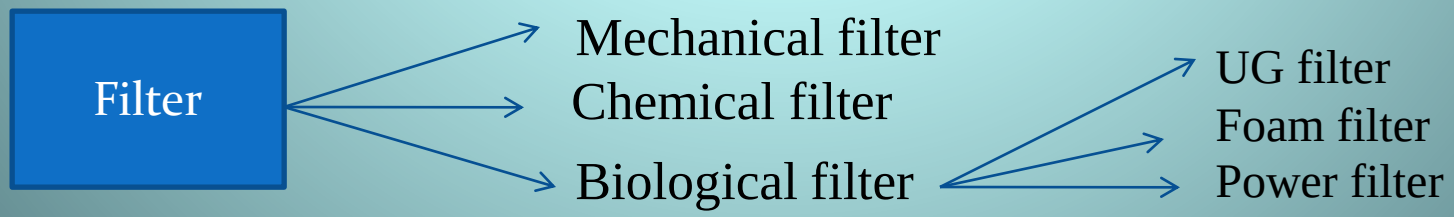
Harmful substance like ammonia and nitrates produced mainly through fish metabolites, keep on accumulating in the aquarium. They may exceed the lethal limits and eventually poison the fish. Arrangement for removing these harmful substances and getting clear water in aquarium is filtration and the device is known an filter.

Filters are of three types :

1. Mechanical filter
2. Chemical filter and
3. Biological filter

Biological filter is again broadly divided into 3 types:

a) UG filter b) Foam filter and c) Power filter



1. Mechanical filtration:

During mechanical filtration, solids are trapped by filter, they are however, still part of the aquarium system until the medium is replaced or cleaned. The commonest media used are filter floss, plastic foam and gravel /sand.

2. Chemical filtration:

In this process the used media can alter the chemical composition of the water. For example, the alteration of pH using peat or lime rich material reduction of hardness by ion exchange resins etc. Chemical media also trap solids mechanically.

3. Biological filtration:

Principle: Biological filtration involves enhancing natural populations of the bacteria which operate the nitrate cycle by providing the conditions they require- surface to colonize, supplies of wastes to process and for those which convert nitrites to nitrates, a constant supply of oxygen. Biological filtration takes place in any mechanical or chemical filtration system which has been left undisturbed long enough to developed a bacteria population.

a) UG filter:

Structure : Biological filtration media are plastic, ceramic and glass. Generally it comprises a corrugated and pored asbestos acrylic plates fixed about 10 cm above the bottom with a non soluble adhesive on all the sides of the tank. At the end of the plate, a glass cylinder of about 8 cm diameter opened at both ends is inserted through an opening made in the plate. After fixing the plate, the gravel is spread over the floor of the plate to a depth of 5 - 7 cm.

Gravel size is an important factor in mechanical trapping of suspended particles. Dark colored coarse sand of 3-5 mm size and 5- 7 cm thickness above the filter-plate works ideally for filtration.

The gravel terrace should slope from back to front. Coarse gravels should be avoided, as food particles may get caught beyond the reach of the fish, further, water flow may be too fast and the biological filter will not function properly owning to the limited surface area and poor development of bacteria.

Functions of filters:

Bacteria helps in purification of water. When ammonia loaded water is passed through the gravel bed, it is subjected to the action of aerobic nitrifying bacteria that oxidizing toxic ammonia into nitrite by nitrosomonas bacteria which get further oxidized by nitrobacter groups into nitrites which is less toxic to the fish and finally gets absorbed by the plants.

Importance of biological filter:

The water of the aquarium tank is likely to get polluted due to the excretory products of fish, plants, dead organisms and uneaten food rich in nitrogen compounds.

Among the nitrogen compounds, the un-ionized toxic gas ammonia is formed directly through the excretion of gills and indirectly from various excretory products such as urea, uric acids and amino acids which are mineralized by the action of bacteria to form ammonia.

An ammonia concentration beyond 0.45 mg/ L is toxic to fish.

When the fish exposed to high levels of ammonia, the haemoglobin of the blood losses the ability to combine with oxygen or to liberate CO_2.

It is reported that aquarium fish may excrete ammonium in the range 0.3- 4.0 gm/ kg fish per day.

Further the ammonia content is mainly influenced by the pH. It is known to increase 10 times at an increase of 1 unit in pH. Hence, it is necessary to oxidized the ammonia to nitrite (NO_2) and subsequently to nitrate (NO_3) which is non- toxic up to 400mg/ L to fish and usually as a nutrient salt by the plant

In aquarium tank where biological filter is fixed, the water used by fish and loaded with ammonia passes through the gravel bed and filter plate and gets stored at the bottom most chamber of the tank i.e. below the biological filter. While passing through the gravel bed, the ammonia loaded water is subjected to the action of aerobic nitrifying bacteria such as Nitrosomonas and Nitrobactor accumulated naturally in the gravel bed due to the constant circulated of water.

The Nitrosomonas metabolites (oxidizes) ammonia to nitrite, which is further oxidized by Nitrobactor into nitrate. Thus the nitrate loaded water which occupies the lowest chamber of the tank is then air lifted to the surface. Thus, the water is circulated again and again.

b) Foam filter:

It is a simple cylindrical plastic box with some holes, both in the base and the top cover. The box contains a thick layer of foam and air lift pump when air is passed, the lift pump draws the water passing through the foam, trapping all the suspended particles and the nitrifying bacteria colonizing in foam, break down fish wastes and unutilized food. The filter is simple, easy to install and maintain. When foam gets dirty, it is rinsed in clean water and again placed in the plastic box. Foam filters work well for small and medium sized aquarium only.

c) Power filter:

These filters are generally used in large aquaria which are heavily stocked and require high turnover of water. It can be fitted inside or outside of the tank. A high power water pump passes the aquarium water through a container with one or more layers of filter media and performs both biological and mechanical filtration. No air pump is required for such type of filters. The filtering materials are often a foam or wood and needs regular cleaning.

I. Decorative toys:

A number of decorative toys are available for attractive look to the aquarium. They include plastic bubbles in the guise (appearance) of mermaid (sea creature) under water diver, oyster shells, angler, human skull, frog etc. Artificial rocks, logs, roots, and plants are also available. Plastic plants should be of good quality. Ordinary plastic plants may release toxic chemicals. Plastic plants have advantage over the natural plants as fish can not eat them. These plants are more durable and do not need regular illumination.

J. Putting the base of sand or gravels:

1) Putting a layer of sand or gravels at the bottom of the aquarium tank helps in creating s simulated natural environment

2) It facilitates fixing of aquarium plants and supports their growth. A medium sized (2-3 cm) sand or gravel is ideal for the purpose.

3) Adequate quality of sand or gravel is needed to cover about 5 to 6 cm height at the bottom. This provides required depth to hold the plants as also to facilitate aquarium landscaping.

4) The sand or gravels should be so spread that it slopes down from back to front. About 8 kg of sand or gravel are enough for tank with the 60 cm x 30 cm bottom.

K. Planting:

Although fishes can be kept in a plantless tank but usually tanks are planted. Plants have a threefold effect viz. they serve a decorative purpose, provide shelter and a sense of security to the fish and during day time, they absorb the injurious gas (CO_2) given off by the fish in breathing and produce O_2 which can be utilized by the fish. More over they also serve in spawning and as food for certain fishes.

Decoration of aquarium tank with plants is an art that can be practiced with imagination, experience and availability of plants. ***Vallisneria*** and ***Sagittaria*** are two of the commonest aquarium plants. They have the appearance of grass (hence called eel or tape grass) and are ideal for back ground. Bushy plants like ***Ludwigia*** and ***Ceratophyllum*** should be used to fill up the corners. ***Echinodorus*** (Amazon sword plant) is a perfect centre piece while small plants viz. Marigrass etc. are used to decorate the front portion.

❖Before planting, plants should be disinfected so as to kill harmful germs, parasites, insects and other enemies of fish.
❖This is done by dipping them in 0.1% potassium permanganate solution for 20 minutes and then thoroughly washed in running water.

Not all plants need to be planted; some float and others require attachment to rocks or wood. The floating plants may be necessary for tanks where **gouramis** are bred; the fragments of these plants are used by these fish for the construction of bubble nests for breeding.

In addition to plants, stones can also be used to beautify the aquarium. Sharp edged stones, shells and corals should be avoided as these might injure fishes. The shells and corals also leached out into the water and turn it alkaline. Arches made of stones offer good shelter to fishes.

L. Water filling:

Water contributes the immediate environment for the fishes. Aquarium should be filled with clear potable water. If tap water is chlorinated, it has to be aerated overnight before adding to aquarium.

Pouring water directly will cause stirring of the sand and gravel and make the water murky. To avoid this, a shallow pot should be kept on the sand and the water gently poured into this. It will overflow gently over the brim and fill the tank without disturbing the sand.

M. Tank conditioning:

Once the aquarium has been filled, the switch of the air pump and light is put on. The filter is kept in running condition for 2-3 days. During this time, the water will be cleared and the plants will take their position. If any plant gets uprooted or requires any change, it should be done before introducing the fish. After having done all these, you can evaluate the final effect and make needful changes accordingly.

N. Which fish to choose and how many?

After conditioning, the aquarium is ready to receive fishes. The desirable species of ornamental fishes in required numbers are purchased from the market. The fishes should be first acclimatized to aquarium temperature for 30 to 40 minutes and then only released in the aquarium.

COMPATIBLE GROUP OF ORNAMENTAL FISHES FOR HOME AQAURIA

1.Guppy, 2. Sword tail, 3. Platy, 4. Black tail, 5. Bleeding heart tetra, 6. Widow tetra, 7. Zebra danio, 8. Tiger barb, 9. Angel fish, 10. Blue gourami & 11. Loach

- Fishes that are healthy, swimming upright and move actively with well defined colour patterns on them should be selected.
- Fishes with deformed bodies, broken fins, white spot or open wounds on the body, showing ungraceful movement should be avoided.
- Healthy fishes can be transported in oxygen filled plastic bags.

It is always better to quarantine newly acquired fishes for a period ranging from one to three days, disinfect them by giving a dip treatment in a mild solution of $KMnO_4$ or **Methylene blue** to ensure that are free from any disease or parasitic infection.

Normally, the number of fishes to be kept in an aquarium is a relative fact. Care should be taken that the tank does not get over crowded. Normally, the recommended rate of stocking of ornamental fish is-a fish of 2.5 cm require 50 sq cm of water surface. On this basis, an aquarium of 60 cm x 30 cm offering 1800 cm^2 of surface area can hold **36 fishes** of 2.5 cm size, 18 of 5 cm and 12 cm of 7.5 cm.

On the basis of above calculation, a composite structure of ornamental fishes to be kept in an aquarium may be as under:

Moly	: 4	Angel	: 4
Guppy	: 4	Serpae tetra	: 4
Platy	: 4	Glass fish	: 2
Sword tail	: 4	Crocodile	: 2
Widow tetra	: 2	Tiger barb	: 2
Zebra danio	: 4	**Total: 36 fishes**	

O. Food & feeding:

A variety of artificial feeds in the form of floating pellets, powder granules, flakes, tablets etc. are available. The feeds can be procured and kept in bottles or containers at room temperature. Fishes should be fed with very small quantities of feed one to four times a day. Instead of dropping entire ration of feed at a time, it is better to give a small pinch and wait for a few minutes within which the fishes pickup all the particles. If completely consumed, then another small pinch of feed can be given. Over feeding makes the water dirty, depletes dissolved oxygen and emits foul smell due to putrefaction. Such conditions cause stress to the fish and make them susceptible to various infectious bacterial diseases.

In addition to the artificial feed, the fishes in the aquarium should also be provided with live feed from time to time. Organisms like tubifex worms, daphnia, mosquito larval form etc. serve ideally as food for the aquarium fishes. Earthworm can be collected from garden soil, cut into very small pieces, washed and fed to the fishes. The biggest advantage with the use of live food is that it does not make the aquarium water dirty and also helps in making up any nutritional deficiency.

P. Regular maintenance :

A few minutes of watching everyday for any noticeable change in the aquarium water, plants or fishes will give you the idea about its proper up keep. For regular maintenance of home aquarium, it is better to have a check-list prepared and see that they are scrupulously attended to. The more important points to be looked into are:

i) Regular water change (20-30% every two or four weeks)
ii) Cleaning of algal scum from the glass at periodical interval.
iii) Removal of dead fishes, if noticed inside the aquarium.
iv) Racking the surface layer of the substrate and removal of dirt etc. by vacuum device every week
v) Pruning of excess plant growth, when noticed
vi) If aquarium water turns cloudy after one or two months, it indicates the need to change water.
vii) Water loss caused by evaporation should be made up once a week

Besides above, some notes of safety should also be kept in mind, viz.:

a) Never try to move a filled up aquarium, the glass could crack with pressure

b) Always remember that electricity and water could be a deadly combination. Therefore, all electric fittings should be completely water proof.

c) Always keep the heater/ thermostat completely immersed. If they are removed from water while in operation, they may crack.

d) Do not locate the aquarium near a door as frequent banging will stress the fishes. Knocking on the glass is equally undesirable.

e) Try to keep atmospheric pollution in the room, such as cigarette, smoke etc. to a minimum level. The quality of air in the room is almost as important to fishes, as the quality of water, since the two interact.

f) When unhealthy fishes are noticed, they should be removed from the tank and treated immediately.
g) Snails should not be added to aquarium tank; they may carry diseases and eat plants.
h) Large fishes should not be kept with small fishes to prevent predation and injury to small fishes.
i) Don’t use tap water directly. It should be aerated overnight to remove chlorine. Chlorinated water is harmful to fishes.
j) Over feeding of fishes should be avoided at all cost. It spoils the quality of water resulting in death of fishes.

Q. Physico-chemical properties of water used in fresh water Aquaria:

Water constitutes the immediate environment for the fishes. The fish is in intimate contact with the water and any contamination will affect it. The fish itself discharges many substances into the water, for example, feces, urine and ammonium (via the gills) and make the situation unhygienic. To avoid this hazardous situation ideal condition of physico-chemical properties of water should be maintained.

1) Dissolved Oxygen (DO) :

Fish, like all animals, need oxygen to sustain life and they breathe through their gills, without oxygen a fish dies: with insufficient oxygen it is sluggish and soon become ill-health. In short, oxygen is as vital to a fish as to a human being. Dissolve oxygen requirement of fish varies from species to species.

Dissolve oxygen requirement of air breathing fishes is less than other fishes. Generally dissolve oxygen concentration of 5-6 ppm is adequate for aquarium fishes.

2) Carbon-dioxide (CO_2):

Carbon-dioxide in water is an important criterion. Level of carbon-dioxide is greatly controlled by aquatic plants. During photosynthesis, plants tend to give off oxygen and to absorb CO_2.

The O_2 derived from plants will not itself be sufficient to provide enough for the fish, nor will the amount of CO_2 absorbed by the plant be enough to clear from the water all that the fish exhale.

The expulsion of CO_2 and the reception of O_2 by the water is much enhanced if the water n the aquarium is in motion: a pump will, by making the water circulate, allow up to 50% more fish to be kept in any given tank.

The water needs to be able to receive additional oxygen from the air at the surface, and to give off CO_2 at a surface.

3) Hardness:

Hardness of water is primarily a measure of the amount of calcium and magnesium present in. it is desirable that in an aquarium the total hardness will not differ greatly from total alkalinity. Low concentration of Ca^{++} or Mg^{++} in water is known as soft water and hard water is vice versa. Soft water with little Ca^{++} /Mg^{++} usually also has a low alkalinity, while hard water tends to have a high alkalinity.

4) Alkalinity:

Total alkalinity of water is a measure of its total concentration in carbonates of calcium and magnesium. Total alkalinity 100-200 ppm is ideal for aquarium fish.

5) pH:

pH is the negative logarithm of the hydrogen ion activity. Water pH of an aquarium is very important. It is better to maintain pH at neutral i.e. 7.0.

THANK YOU