

## Past BT-401 PAPERS SOLVED QUESTIONS

**Wild forms** are wild species from which crop species are directly derived. They are easy to cross with the concerned crop species.

The **wild relatives** include all other species. Which are related to the crop species by descent during their evolution.

### Different method of cryopreservation? Types of cryopreservation?

There are various methods of storage :

1. Cryopreservation - generally involves storage in liquid nitrogen.
2. Cold storage involves storage in low and non-freezing temperatures
3. Low pressure – it involves partially reducing the atmospheric pressure of surrounding.
4. Low oxygen storage involves reducing the oxygen level but maintaining the pressure.

Genetic materials that are typically cryogenically preserved include sperm, oocytes, embryos and somatic cells.

Local migration occurs because of heavy rain, flood, excessive cold & hot. Return to that area when crisis is over. The flowering of certain plants and ripening of fruits also cause local migration

Many different species have unique bodily processes that can cure human diseases. e.g. the toxins produced by dartpoison frogs in the rain forest have yielded information about how alkaloid compounds behave in living organisms. Scientists also study bears for clues about how they recycle blood toxins during hibernation to find potential solutions to kidney disorders. Plants from forests are useful for medicinal purposes.

The **markhor** is the national animal of Pakistan.

**Advantages of Out breeding:** • Out breeding often produces offspring of superior quality because it increases homozygosity (the occurrence of two alleles for the same trait at corresponding positions on homologous chromosomes) • Sharply reduce the risk of deleterious recessive genes being expressed • One of the benefits of out breeding is less chance of genetic abnormalities • The ability to make a breed stronger

**Disadvantages of Out breeding: outbreeding** species. 3 Can destroy well-adapted genotypes because the offspring (genotypes) from sexual reproduction are not guaranteed to be viable, as is the case with selfing.

**Policy** is a set of common rules and regulations, which forms as a base to take day to day decisions **Strategy** is a plan of action while the **policy** is a principle of action

The Global Strategy for Plant Conservation (GSPC) is a program of the UN's Convention on Biological Diversity founded in 1999. It is a Plan to Save the World's Plant Species - grew out of the Convention on Biological Diversity and is being fed into government policy around the world.

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“Antibiotic is chemical substance produced by microorganisms that can kill or inhibit the growth of other microorganisms”

**MUHAMMAD IMRAN**

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**Genetic resources.** Genetic resources for food and agriculture are the raw materials upon which the world relies to improve the productivity and quality of domesticated plant and animal populations, as well as to maintain healthy populations of wild species, including those used in forestry and fisheries.

## 12. Gene flow and gene drift?

**Gene Flow:** "The introduction of genetic material (by interbreeding) from one population of a species to another"

**Genetic Drift:** "Random changes in gene frequency especially in small populations when leading to preservation or extinction of particular genes"

## 13. Richness of microorganism and total no?

- Numbers of species described and currently accepted in most groups of microorganisms worldwide are respectively 143,000 & 18,500
- 120 new species of bacteria and 1,500 new species of fungi are added to science each year • This clearly demonstrating that knowledge of these groups is grossly inadequate

## 14. Gene Bank?

Gene bank refers to a place or organization where germplasm can be conserved in living state. Gene banks are also known as germplasm banks.

## 15. Cause of extent?

There are five major **causes of extinction**: habitat loss, an introduced species, pollution, population growth, and overconsumption. Through the activity, students will create a list of reasons why animals can become **extinct**.

## 16. Cause of migration?

Causes of Migration

- Shortage of food supply on the breeding ground
- Environmental factors
- Internal factors
- Photoperiodism
- Fat deposition

## 17. Gene Environment interaction?

Gene–environment interaction (or genotype–environment interaction or  $G \times E$ ) is when two different genotypes respond to environmental variation in different ways.

There are two different conceptions of gene–environment interaction. • biometric and developmental interaction

## 18. National strategy for PGRFA?

A National Strategy for PGRFA is the blueprint for the management of a country's PGRFA as a continuum of interventions in order to achieve clearly defined time bound goals.

## 19. What Allopatric speciation?

Gene flow blocked by physical barriers results in Allopatric speciation

## 20. Factor of genetic diversity?

- Mutations • Speciation • Errors in Meiosis

## 21. How extinct species cause destruction of ecosystem?

Species of animals cannot live away from each other. They work together to form an ecosystem. Extinction of one species can effect other by effecting food chain .They depend upon each other and their environment to survive. So in this way it can destroy whole ecosystem

## Long 5 Marks

## 22. Discuss global strategy for plant conservation?

The Global Strategy for Plant Conservation (GSPC) is a program of the UN's Convention on Biological Diversity founded in 1999. It is a Plan to Save the World's Plant Species - grew out of the Convention on Biological Diversity and is being fed into government policy around the world.

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The GSPC highlights the importance of plants and the ecosystem services they provide for all life on earth, and aims to ensure their conservation.

**The GSPC has 5 main objectives:**

1. Plant diversity is well understood, documented and recognized
2. Plant diversity is urgently and effectively conserved
3. Plant diversity is used in a sustainable and equitable manner
4. Plant diversity is used in a sustainable and equitable manner
5. The capacities and public engagement necessary to implement the strategy have been developed.

## 23. Step of Conserve the plant genetics resource?

**Plant genetic diversity is vulnerable to “genetic erosion”, the loss of individual alleles/genes and of combinations of alleles/genes, such as those found in locally adapted landraces. ... PGR, the only source of plant genetic diversity, provides valuable traits needed for meeting the challenges of adapting crop varieties.**

## 24. Method of horizontal gene transfer in bacteria?

**Vertical Gene transfer:** “The transfer of genes from parents to offspring.”

**Horizontal gene transfer: horizontal gene transmission** among **bacteria**, especially from a donor **bacterial** species to different recipient species, is conjugation

## 25. Threat Angr?

- Despite the importance of animal genetic resources and their diversity, their diversity has been continually decreasing over time.
- One of the greatest threats to livestock diversity is pressure from large-scale commercial production systems to maintain only high-output breeds.
- Changes in climate will have an impact on livestock and food production in many ways.
- Some major disease threats that livestock currently face include, rinderpest, foot and mouth disease, and Peste des petits ruminants (PPR), also known as sheep and goat plague.

## 26. Inbreeding types?

- Close inbreeding • Mild inbreeding • Line inbreeding

## 27. Freezing method?

**Freezing. Freezing**, in food processing, **method** of preserving food by lowering the temperature to inhibit microorganism growth. The **method** has been used for centuries in cold regions, and a patent was issued in Britain as early as 1842 for **freezing** food by immersion in an ice and salt brine.

## 28. CHARACTERISTICS OF gene pool. 3

It includes all the variants or alleles of every gene. • It includes all the genes present in the population. • In most cases, the population includes individuals of the same species. • A gene pool includes even those genes whose effects are not visible in an individual.

## 29. Threats to AnGR 5

Despite the importance of animal genetic resources and their diversity, their diversity has been continually decreasing over time.

One of the greatest threats to livestock diversity is pressure from large-scale commercial production systems to maintain only high-output breeds.

Changes in climate will have an impact on livestock and food production in many ways.

Some major disease threats that livestock currently face include, rinderpest, foot and mouth disease, and Peste des petits ruminants (PPR), also known as sheep and goat plague

## 30. type of wild plant 2

Some of the common wild plant genetic resources are as follow;

- Prickly Acacia/Keekar • Coral Tree • Deodar Cedar • Dalbergia Sissoo /Sheesham Tree • Calotropis procera/Giant milkweed • Alovera • Marijuana

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### 31. when founder effect occurs?2

In population genetics, the founder effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population.

### 32. type of genetic stocks(3)

Genetic stocks,:

broadly defined as plants or populations generated and/or selected for genetic studies, represent a unique and growing class of extremely valuable germplasm which, depending on crop, type of genetic stock and user community may represent genetic resources of either transient or long-lasting value

#### Genetic stocks:

Genetic stocks can be divided into three general groups cytological

stocks mutants stock

Germplasm set

### 33. reason for grading up(3)

Grading up Breeding of animals of two different breeds where the animals of an indigenous breed/genetic group is mated by an improved pure breed for several generations towards attaining the superior traits of the improved breed

Grading up is continuous use of purebred sires of the same breed in a grade herd. By fifth generation, the graded animals may reach almost purebred levels.

### 34. how animals figure out that where they are going (5)

Scientists aren't really sure exactly how some animals figure out how to get to where they are going. They think that:

- Some animals use landmarks like rivers and streams to find their way.
- Some animals may navigate by the position of the sun and stars.
- Some animals use smell to figure out where they are going.
- Some species that may use the Earth's magnetic field to navigate.

### 35. What is outbreeding

#### Out-breeding:

Out-breeding is the mating of animals of the same breed but which have no closer relationship than at least 4 to 6 generations. Out breeding is the recommended breeding practice for most purebred sheep breeders.

### 36. Why do we need to conserve plant genetic resources

Conservation of plant genetic resources is necessary for food security and agrobiodiversity Biodiversity provides a valuable source of compounds to the medical, food and crop protection industries. Maintenance of ecosystem Genetic resources need to be conserved so that they may be used in crop research and be used as sources of genes for crop improvement.

### 37. Effect of bottleneck effect on alleles frequency

Allele frequencies in a group may be very different from those of the population prior to the event,.

Even some alleles may be missing entirely.

The smaller population will also be more susceptible to the effects of genetic drift for generations (until its numbers return to normal).

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Effect potentially causing even more alleles to be lost. In human evolution

It is theorized, based on genetic evidence, that a few tens of thousands of years ago the population of Homo sapiens was reduced for a period to a few thousand or tens of thousands of people. Such a bottleneck would explain the extremely low level of genetic diversity found within our species, when contrasted with others, such as Chimps **Cheetah**

All Cheetah shared a small number of alleles. Less than 1% diversity As if all cheetahs are identical twins

### **Bottleneck effect**

10,000 years ago Ice age Last 100 years Poaching and loss of habitat

## **38. types of ex situ conservation**

### **Gene Bank**

Gene bank refers to a place or organization where germplasm can be conserved in living state. Gene banks are also known as germplasm banks.

### **Seed Gene Bank**

A place where germplasm is conserved in the form of seeds is called seed gene bank. Seeds are very convenient for storage because they occupy smaller space than whole plants.

### **Field Gene Bank**

Field gene banks also called plant gene banks are areas of land in which germplasm collections of growing plants are assembled.

### **Botanical Garden**

A botanical garden or botanic garden is a garden dedicated to the collection, cultivation and display of a wide range of plants labeled with their botanical names

## **39. Difference between gene flow and genetic Draft 5**

Gene flow "The introduction of genetic material (by interbreeding) from one population of a species to another

Genetic drift is the phenomenon of change in the frequency of alleles (variants of a gene) in a population of organisms due to chance or random events

## **40. What is Threatend of species 3**

Threatened species are any species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future. Species that are threatened are sometimes characterized by the population dynamics measure of critical dispensation, a mathematical measure of biomass related to population growth rate.

## **41. What is demosticate plant 2**

Some domesticated plant resources in Pakistan are as follow; • Fruit Trees • Citrus Fruits • Nut Trees • Legumes • Cereals • Vegetables • Herbs and Shurbs etc

## **42. Difference between close breeding and linear breeding**

Close Inbreeding Animals are very closely related and can be traced back to more than one common ancestor. Closest form of inbreeding in domestic animals involves mating between full brothers and sisters (full siblings) Second closest form of inbreeding involves mating between grand-parents and grand-offspring, half brothers and sisters (half siblings)

Line Breeding Mating animals that are more distantly related which can be traced back to one common ancestor.

e.g. Cousins Grandparents to grand offspring, Half-brother to half-sister.

Line breeding increases genetic purity amongst the animals of progeny generations.

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### 43. What is mild breeding

Mild Inbreeding

Mating of relatives beyond 2nd generation and upto 6th generation.

### 44. What is domesticate plant

“Plant domestication is the process whereby wild plants have been evolved into crop plants through artificial selection.”

### 45. When bubal hartebeest are extinct (2)

The animals were hunted to extinction and the last known Bubal hartebeest was killed in Algeria sometime between 1945 and 1954, according to the International Union for Conservation of Nature

### 46. What are the reason of migration to be triggered (3)

The trigger for the migration may be:

1. local climate
2. local availability of food
3. The season of the year
4. For mating reasons

### 47. Give one example of gene environment interaction in plant (5)

In Drosophila

Mean bristle number on Drosophila could vary with changing temperatures.

In plants

Seven genetically distinct yarrow plants were collected and three cuttings taken from each plant. One cutting of each genotype was planted at low, medium, and high elevations, respectively. When the plants matured, no one genotype grew best at all altitudes, and at each altitude the seven genotypes fared differently. For example, one genotype grew the tallest at the medium elevation but attained only middling height at the other two elevations. The best growers at low and high elevation grew poorly at medium elevation. The medium altitude produced the worst overall results, but still yielded one tall and two medium-tall samples. Altitude had an effect on each genotype, but not to the same degree nor in the same way

Phenylketonuria (PKU)

It is a human genetic condition caused by mutations to a gene coding for a particular liver enzyme. In the absence of this enzyme, an amino acid known as phenylalanine does not get converted into the next amino acid in a biochemical pathway, and therefore too much phenylalanine passes into the blood and other tissues. Change in environment (lowering Phenylalanine consumption) can affect the phenotype of a particular trait, demonstrating a gene-environment interaction.

### 48. Gene sanctuary:

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- A gene sanctuary is an area where plants are conserved. It includes both biosphere reserves as well as national parks. India has set up its first gene sanctuary in the Garo Hills of Meghalaya for wild relatives of citrus. Efforts are also being made to set up gene sanctuaries for banana, sugarcane, rice and mango.

#### 49. Huntington disorder

Huntington's disease (aka Huntington's chorea) is a genetic disorder which results in slowly progressing brain cell death. There are two distinct populations in which the disorder occurs much more often.

1. The first group is the Afrikaner population of South Africa.
2. The second group is the residents of the Lake Maracaibo region of Venezuela.

#### 50. Sympatric speciation

Sympatric speciation is speciation that occurs when two groups of the same species live in the same geographic location, but they evolve differently until they can no longer interbreed and are considered different species. This is often result of Reproductive isolation

#### 51. One example gene interaction in plants?

Seven genetically distinct yarrow plants were collected and three cuttings taken from each plant. One cutting of each genotype was planted at low, medium, and high elevations, respectively. When the plants matured, no one genotype grew best at all altitudes, and at each altitude the seven genotypes fared differently. For example, one genotype grew the tallest at the medium elevation but attained only middling height at the other two elevations. The best growers at low and high elevation grew poorly at medium elevation. The medium altitude produced the worst overall results, but still yielded one tall and two medium-tall samples. Altitude had an effect on each genotype, but not to the same degree nor in the same way

#### 52. Differ b/w outbreed and inbreed?

"The intentional breeding of distantly related or unrelated individuals for the

purpose of producing offspring of superior quality."

There are three types of outbreeding

- Cross breeding
- Grading up
- Species cross

"Inbreeding, the mating of individuals or organisms that are closely related through common ancestry."

- Inbreeding is useful in the retention of desirable characteristics or the elimination of undesirable ones

It also results in decreased vigour, size, and fertility of the offspring due to combined effect of harmful genes that were recessive in both parents

- There are 3 types of Inbreeding;
- Close inbreeding
- Mild inbreeding
- Line inbreeding

#### 53. Genetic resources of micro-organisms

Genetic resources of micro-organisms means genetic material of actual or potential value from microorganisms.

1. Invertebrates Genetic Resources

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**Invertebrates** include a great number of species that perform valuable functions in agro-ecosystems.

#### 54. When west african black rhinos were be extinct?

##### West African Black Rhinoceros :

The West African black rhinoceros (*Diceros bicornis longipes*) was a subspecies of the black rhino that was declared extinct in 2011.

#### 55. What is 6 article of agriculture genetic resources?

##### Article 6: Sustainable Use of Plant Genetic Resources:

The Contracting parties shall develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture.

#### 56. What is cryopreservation?

##### Cryopreservation:

Cryo is Greek word. (kryos – frost).

It literally means preservation in “frozen state.”

It is a process where tissues, organelles, cells, extracellular matrix, organs or any other biological constructs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temp (typically -80 degree Celsius using solid carbon dioxide or -196 degree Celsius using liquid nitrogen).

#### 57. How may ways bacteria have transfer their DNA horizontally?

“Horizontal gene transfer is known to occur between different species, such as between prokaryotes and eukaryotes, between the three DNA-containing organelles of eukaryotes, the nucleus, the mitochondrion and the chloroplast.”

- Horizontal gene transfer is basically the transfer of genes between organisms via methods other than asexual or sexual reproduction.
- Genes and the characteristics code for are passed down from parent to progeny.
- There are three ways for bacteria to transfer their DNA horizontally
- **Conjugation**
- The transfer of DNA directly from one cell to another through cell-cell contact often involving **plasmids**
- **Transformation**
- Bacteria are capable of taking up DNA directly from their environment and incorporating it into their genomes known as **natural transformation**
- **Transduction**
- Transduction is the transfer of DNA from one cell to another by a virus

#### 58. migration with example?

##### Migration

“**Migration** is the relatively long-distance movement of individuals, usually on a seasonal basis.”

e.g. Some crustaceans migrate for breeding

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## 59. Founder effect with example?

### Founder Effect :

In population genetics, the founder effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population. **The Amish People**

Around 200 German immigrants settled in Pennsylvania

Within community marriages

Developed syndrome named Ellis-van Creveld syndrome

Common symptoms are;

Haemophilia

Dwarfism (1/14 carry the gene)

Still births/infant deaths

Physical deformities

## 60. Quarantine regulations

Plant quarantine regulations are promulgated by the national and the state governments to prevent the introduction and spread of harmful pests and pathogens. Plant quarantine will be justified only when the pest has no natural means of spread and when they are based on biological considerations only, i.e., pest/pathogen introduction risks and the available safeguards.

In general, risks are more with the introduction of vegetative propagules than with true seed. In case of true seed, risks are more with deep-seated infections than with the surface borne contamination of pests/pathogens. Again, risks are far greater with pathogens like viruses, downy mildews, smuts and many bacteria carried inside the seed without any external symptoms. When vegetative propagules are introduced, rooted plants, and other underground plant parts like rhizomes, suckers, runners, etc. carry higher risks than budwood, scions and unrooted cuttings. In any case, bulk introductions are always risky as thorough examination and treatment in such cases is very difficult and planting area is far too large to prevent the establishment and spread of the introduced pest/disease.

## 61. What is Genetic Resources?

Genetic resources are sometimes called the "first resource" of the natural resources on this planet - the others being land, air, and water.

The diversity of genetic resources for food and agriculture (i.e. plants/crops, animals, aquatic resources, forests, micro-organisms and invertebrates) plays a crucial role in meeting basic human food and nutritional needs

## 62. What is Gene Pool?

The combination of all the genes present in a given population is called the gene pool of that population."

It includes all the variants or alleles of every gene.

It includes all the genes present in the population.

In most cases, the population includes individuals of the same species.

- A gene pool includes even those genes whose effects are not visible in an individual. A number of animal species, such as mountain lions in the Americas, and leopards in South Africa, are threatened by human activities.
- Their habitat has been divided into fragments, surrounded by towns and farmlands.
- This results in interbreeding among smaller populations,

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- The small gene pool makes them susceptible to diseases.

### 63. What is importance of domestic animal Resources?

“Animals that are not wild and is kept as a pet or to produce food” For example;

- Dog
- Buffalo
- Goat
- Sheep
- Cattle
- Cat

Importance of Domestic Animal Resources:

Domesticated animal resources are important as follow;

Animals provide milk

- Hair from goat and sheep is used for making woolen clothing, shawls and blankets
- Some drugs are especially obtained from animals. Ex. Heparin an anticoagulant is used to control clots in blood, is obtained from ox lungs and pig intestines
- Animal's meat is the part our of diet
- Animals are a great source of leather which is used for making foot wear, belts, wallets bags, furniture

### 64. Ecosystem is facing massive destruction extinction species. How?

- There are following major causes of extinction;
- Climate change
- Habitat destruction
- lack of genetic diversity
- Better-adaptive condition
- Pollution
- Human over-population
- Poaching and hunting

Climate Change

- Almost half of plant and animal species have experienced local extinctions due to climate change
- Global warming could trigger not just local but global extinctions of animals and plants
- Species already threatened by habitat destruction, pollution, alien invasion and overhunting are more vulnerable to climate change
- Diversity of species in any one ecosystem could be affected by rises in average temperatures or a shift of climate regime

### 65. Inbreeding ? (2 marks)

“Inbreeding, the mating of individuals or organisms that are closely related through common ancestry.”

- Inbreeding is useful in the retention of desirable characteristics or the elimination of undesirable one's
- It also results in decreased vigour, size, and fertility of the offspring due to combined effect of harmful genes that were recessive in both parents.

### 66. Endangered species with example (2)

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“A species of plant or animal that is in immediate danger of becoming extinct and needs protection to survive.”

- Endangered species are like fire alarms. They tell us about problems in our home we call Earth.

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Endangered species must be protected for better health of earth and ecosystem balancing.

○ Some most endangered species in Pakistan are as follow;

- The Indus River dolphin
- Markhor
- Asian Black Bear • Snow Leopard

### 67. Method of storage ? 3 marks

The maintenance of the frozen cells or material at specific temperature is very important.

In general the temperature is kept -70 to -196 degree.

Prolong storage is done at temperature of -196 degree in liquid nitrogen.

To prevent damage, continuous supply of nitrogen is done.

### 68. Breeding in details and it's type ?

A breed is a group of domestic animals with a homogeneous appearance, behavior, and other characteristics that distinguish it from other animals.

Pure-breeding

Inbreeding

Out-breeding

Line breeding

Crossbreeding

**Pure-breeding:**

Pure-breeding is the mating of males and females of the same breed or type.

purebred flock can be managed as a single flock because all animals are of the same breed.

The goal of purebred sheep production is to provide superior genetics (seed stock) to the commercial sheep industry. **Inbreeding:**

Inbreeding is a system of breeding in which closely related animals are mated.

Technically, inbreeding is defined as the mating of animals more closely related than the average relationship within the breed or population concerned.

The primary genetic consequence of inbreeding is to increase the frequency of pairing of similar genes.

**Out-breeding:**

Out-breeding is the mating of animals of the same breed but which have no closer relationship than at least 4 to 6 generations. Out breeding is the recommended breeding practice for most purebred sheep breeders.

**Crossbreeding:**

Crossbreeding is the mating of animals of different breed compositions or types.

However, it does not denote indiscriminate mixing of breeds, but rather is a systematic utilization of different breed resources to produce crossbred progeny of a specific type.

Crossbreeding is used extensively in the commercial sheep industry and the majority of slaughter lambs are crossbred.

### 69. Nagoya protocol?

**Nagoya Protocol**

The *Nagoya Protocol* focuses on the equitable sharing of genetic material (plant, animal, microbial, other) including the traditional knowledge associated with the genetic resources, and the benefits that arise from their use.

### 70. Bottleneck effect?

**Bottleneck Effect**

“The bottleneck effect is a sharp lowering of a population's gene pool because of an environmental, or humancaused, change.”

**Founder Effect**

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“The effect on the resulting gene pool that occurs when a new isolated population is founded by a small number of individuals possessing limited genetic variation relative to the larger population from which they have migrated”

## 71. Names of nut trees?

### Nut Trees

Nut Trees in Pakistan are as follow;

- Almonds
- Walnut
- Tree Nuts
- Almonds
  
- Almonds fall in the family of peaches, plums and nectarines.
  
- Seeds of these plants are edible as Almonds
  
- Almond plants blossom into beautiful pink flowers in spring in addition to yielding fruits in summer.

## 72. What is cryopreservation?

Until two decades ago the genetic resources were getting depleted owing to the continuous depredation by man.

It was imperative therefore that many of the elite, economically important and endangered species are preserved to make them available when needed.

Many methodologies have been devised for long term preservation of material.

There are various methods of storage :

1. **Cryopreservation** - generally involves storage in liquid nitrogen.
2. **Cold storage** - it involves storage in low and non freezing temperature.
3. **Low pressure** – it involves partially reducing the atmospheric pressure of surrounding.
4. **Low oxygen storage** - it involves reducing the oxygen level but maintaining the pressure.
5. Cryo is Greek word. (krayos – frost).
6. It literally means preservation in “frozen state.”

It is a process where tissues, organelles, cells, extracellular matrix, organs or any other biological constructs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temp (typically -80 degree Celsius using solid carbon dioxide or -196 degree Celsius using liquid nitrogen).

The objective of cryopreservation is to minimize damage to biological materials, including tissues, mammalian cells, bacteria, fungi, plant cells, and viruses, during low temperature freezing and storage.

Cryopreservation can be done at

- Over solid carbon dioxide (at -79 degree)
- Low temperature deep freezer (at -80 degree)
- In vapor phase nitrogen ( at -150 degree)

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○ In liquid nitrogen (at -196 degree) ➤ Examples include:

○ Semen in semen cryopreservation

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- Blood
- Special cells for transfusion
- Stem cells. It is optimal in high concentration of synthetic serum, stepwise equilibration and slow cooling.
- Umbilical cord blood
- Tissue samples like tumors and histological cross sections
- Eggs (oocytes) in oocyte cryopreservation
- Embryos at cleavage stage (that are 2, 4 or 8 cells) or at blastocyst stage, in embryo cryopreservation
- Ovarian tissue in ovarian tissue cryopreservation
- Plant seeds or shoots may be cryopreserved for conservation purposes.

### 73. Different steps of Allopatric speciation?

1. A geographic change separates members of a population into more than one group.
2. Different gene mutations occur and build up in the different populations over time.
3. The populations become so different that members of the different populations can no longer breed with each other anymore if were they to be in the same habitat in the same time. If this is the case, allopatric speciation has occurred.

### 74. Domesticated Animal Resources

“Animals that are not wild and is kept as a pet or to produce food”

e.g. Dog, Buffalo, Goat, Sheep, Cattle

### 75. mild breeding 2marks

Mild Inbreeding

Mild Inbreeding

- Mating of relatives beyond 2nd generation and upto 6th generation.

### 76. disadvantage of inbreeding 3marks

Disadvantages of Inbreeding:

- An increase in the prevalence of inherited disorders
- A decrease in viability
- A decrease in reproductive ability, and
- The loss of genetic diversity (i.e. decrease in genetic variation).
- Developmental disruption, higher infant mortality and a shorter life span
- Reduction of immune system function.

### 77. uses of sheesham 3marks

Dalbergia Sissoo /Sheesham Tree

- Dalbergia Sissoo, also known as Indian Rosewood, is the source of Sheesham wood.

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- The tree is native to India and Pakistan and grows all over the SubHimalayan Regions • Its leaves are compound, and produces pink-white flowers that resemble a pea flower.
- It gives a dry fruit that is a thin and papery pale brown pod.
- The tree mainly offers timber

## 78. MGRP how work in Pakistan 5 marks

- In ecosystems, microorganisms are important as;
  - Symbionts (endophytes, mycorrhizae, and in insect guts),
  - In nitrogen fixation (rhizobia, cyanobacteria, cyanobacteria-containing lichens),
  - In the biodegradation of dead animal and plant material,
  - In controlling the size of populations of plants and insects through natural bio-control

Importance of MGR:

- Antibiotic is chemical substance produced by microorganisms that can kill or inhibit the growth of other microorganisms
- Antibiotics kill or inhibit other organisms by interfering the metabolic process in the bacterium that is not found in the host.
- Plant growth promotion through soil microorganisms,
- In the understanding and surveillance of microbial plant pathogens
- Biological control,
- beneficial symbiosis in the guts of ruminant livestock,
- Production of chemicals of direct benefit to agriculture

Workhorses in agro-industrial processes.

Role of Micro organism in food production system:

- Fermentation,
- Probiotics,
- Production of chemicals of benefit to food production,
- Understanding and surveillance of health hazardous microorganisms such as food toxins and food borne pathogens.

Microbial Genetic Resources Program:

- To establish a long term microbial preservation facility as “National Culture Collection of Pakistan (NCCP)” for collection and preservation of microbial genetic resources from Pakistani ecology for basic and applied microbiology and biotechnology research following the Best Practice Guidelines of OECD (2001).
- To distribute the economically important strains to scientific community, institutions and industry on commercial basis for research or utilization in industrial processes as a regular activity of the NCCP by following national and international laws and regulations.

## 79. What is Aquatic genetic resources?

Aquatic genetic resources include all genetic resources living in water

➤ It include;

- Fish
- Cyclostomes
- Mussels
- Decapods
- Marine mammals
- Aquatic plants
- All other water dwelling organisms

There is a huge diversity of aquatic species in the world's water bodies

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## 80. Types Of Breed

Now, there are about 340 breeds recognized by the Fédération Cynologique Internationale (FCI), the world governing body of dog breeds, sometimes known as the World Canine Organization. But the standards for breed recognition vary from country to country – the American Kennel Club currently recognizes only 167 breeds.

## 81. Genetic Drift

### Genetic Drift

“Random changes in gene frequency especially in small populations when leading to preservation or extinction of particular genes.

## 82. What is allele?

An **allele** is a variant form of a given gene. Sometimes, different **alleles** can result in different

## 83. What is indigenous breed 2

originating in and characteristic of a particular region or country; native (often followed by to): the plants **indigenous** to Canada; the **indigenous** peoples of southern Africa. innate; inherent; natural (usually followed by to): feelings **indigenous** to human beings.

## 84. Define species.

a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding. The species is the principal natural taxonomic unit, ranking below a genus and denoted by a Latin binomial, e.g. *Homo sapiens*

## 85. What is environment gene interactions

**Gene–environment interaction** (or genotype–environment interaction or G×E) is when two different genotypes respond to **environmental** variation in different ways. A norm of reaction is a graph that shows the relationship between **genes** and **environmental** factors when phenotypic differences are continuous.

## 86. Forest genetic resources 2

**Forest genetic resources** (FGR) are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value.

## 87. Inbreeding depression 2

**Inbreeding depression** is the reduced biological fitness in a given population as a result of **inbreeding**, or breeding of related individuals.

## 88. Component

- Access to Genetic resources
- Sharing of benefits

## 89. How overhunting cause to extinction of animals 3

Human hunters are responsible for wiping out the population of large animals. Researchers found that most of the animals that time died because of increased hunting. Horn of Rhino ivory of elephants, the fur and organs of tigers, the deliciousness of tuna and the supposedly medicinal effect of shark’s fin etc are some reasons for over-hunting.

## 90. CAUSES OF EXTINCTION

The causes of extinction are as follows

1. Climate change
2. Habitat destruction
3. lack of genetic diversity
4. Better-adaptive condition
5. Pollution
6. Human over-population

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### 91. Threats on AnGR 5

- Despite the importance of animal genetic resources and their diversity, their diversity has been continually decreasing over time.
- One of the greatest threats to livestock diversity is pressure from large-scale commercial production systems to maintain only high-output breeds.
- Changes in climate will have an impact on livestock and food production in many ways.
- Some major disease threats that livestock currently face include, rinderpest, foot and mouth disease, and Peste des petits ruminants (PPR), also known as sheep and goat plague.

### 92. Different freezing methods in Cryopreservation 5

- Slow freezing and thawing
- Rapid freezing and thawing
- Vitrification
- Ultrarapid freezing

### 93. Slow Freezing- Slow thawing

With this method organs are labeled into vials after equilibration with a cryoprotectant solution and then cooled at rate of 0.5-2 °C per minute down to -1 °C. Seeding is then induced and a holding period of 5 to 15 minutes allows equilibration of the temperature. Thereafter embryos are cooled to -60°C or lower at a rate of 0.3 to 0.5°C per minute before being transfer to liquid nitrogen. Frozen embryos must be slowly thawed at a rate of less than 25°C per minute to prevent osmotic shock

### 94. Rapid cooling and rapid thawing

In this technique , however cooling is terminated at -30 to -40 °C and embryos are then plunged into liquid nitrogen for rapid cooling to -196°C. Thawing is therefore performed rapidly (200 to 500°C per minute) to prevent recrystallization

### 95. Vitrification

Vitrification is the process of cooling where the water in the tissue becomes glass rather than crystals. Glass is a liquid that is too cold (too viscous) to flow. In other words vitrification is solidification due to increased viscosity rather than crystallization.

### 96. Ultra rapid Freezing

In this technique serial equilibration of embryos in high concentration of DMSO (3-5 M) supplemented with sucrose (0.3 to 0.5 M). The embryos are then plunged into liquid Nitrogen. Thawing is then done with warm water bath ( approximately 500°C per minute).

### 97. Which are the causes of loss of genetic diversity... 2 marks

#### Anthropogenic activities effecting Genetic Diversity:

Any change in the environment, natural or human induced causes a selection of events that only the fittest survive. Anthropogenic impact is apparent in the coastal zone. Man made activities increases the number of changes occurring to individual and populations. Such pressure is exerted by:

- Artificial selection (harvesting, aquaculture)
- Degradation of habitats
- The release of farmed fish into the wild.

Anthropogenic activities reduce the sum of genes available. It leaves behind a population that is less capable of tolerating any further natural or anthropogenic ally caused changes in environment.

### 98. Enlist Extinct animals of Pakistan.. 3 marks

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1. West African Black Rhinoceros
2. Pyrenean Ibex
3. Passenger Pigeon
4. Quagga
5. Caribbean Monk Seal
6. Seamink
7. Tasmanian Tiger
8. Tecopa Pupfish
9. Great Auk
10. Javan Tiger
11. Bubal Hartebeest
12. Steller's sea cow
13. Dodo

### 99. Difference between allopatric and sympatric speciation.. 3 marks

"Gene flow blocked by physical barriers results in Allopatric speciation"

- It is geographical isolation that doesn't allow population of the same species to exchange genetic material
  - Physical barriers to gene flow both "natural" and "artificial"
  - Natural physical barriers include mountain ranges, oceans or vast deserts
  - Artificial physical barriers are man-made barriers such as "The Great China Wall", barrages or dams etc
- Example: Darwin finches (adaptive radiation).**

### 100. Sympatric Speciation

Sympatric speciation is speciation that occurs when two groups of the same species live in the same geographic location, but they evolve differently until they can no longer interbreed and are considered different species.

This is often result of Reproductive isolation

Examples of Sympatric Speciation: In Apple Maggot Flies

### 101. Types Reproductive isolation

- ↳ Pre-zygotic isolation
- ↳ Post-zygotic isolation

### 102. How do allopatric and sympatric speciation differ

Allopatric speciation is speciation that results when a population is separated by a physical barrier. It is also referred to as geographic speciation. Sympatric speciation is speciation that occurs without physical separation of members of the population.

### 103. Biometric Gene environment interaction.. 5 marks..

- The biometric (or statistical) conception has its origins in research programs that seek to measure the relative proportions of genetic and environmental contributions to phenotypic variation within populations.
- Biometric gene–environment interaction has particular currency in population genetics and behavioral genetics. Any interaction results in the breakdown of the additivity of the main effects of heredity and environment, but whether such interactions are present in particular settings are an empirical question.
- Biometric interaction is relevant in the context of research on individual differences rather than in the context of the development of a particular organism.

### 104. Migration with example?

"**Migration** is the relatively long-distance movement of individuals, usually on a seasonal basis." e.g.

Some crustaceans migrate for breeding

**Animal migration** is the relatively long-distance movement of individuals, usually on a seasonal basis. It is found in all major animal groups, including birds, mammals, fish, reptiles, amphibians, insects, and crustaceans. Migration is a behavioral adaptation that helps animal's survival.

### 105. Trigger for the migration

The trigger for the migration may be:

1. local climate
2. local availability of food
3. the season of the year
4. for mating reasons

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### 106. Steps of alloptic speciation?

1. A geographic change separates members of a population into more than one group.
2. Different gene mutations occur and build up in the different populations over time.
3. The populations become so different that members of the different populations can no longer breed with each other anymore if were they to be in the same habitat in the same time. If this is the case, allopatric speciation has occurred. **Example: Darwin finches (adaptive radiation).**

### 107. Founder effect with example?

In population genetics, the founder effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population.

A founder effect occurs when a new colony is started by a few members of the original population. This small population size means that the colony may have:

- Reduced genetic variation from the original population.
- A non-random sample of the genes in the original population.

### 108. Quarantine regulation?

Quarantine practices in most countries have at least three common functions.

1. The first is exclusion or regulatory actions to prevent or reduce the risk of entry of exotic pathogens, pests, or parasites along artificial pathways.
2. Second is the containment, suppression, or eradication of pests or pathogens that have been recently introduced.
3. Third is the assisting of exporters to meet the quarantine requirements of importing countries.

### 109. What is special about agricultural genetic resources?

- To feed the world, we all need these resources.
- Agricultural resources have been shared and exchanged over thousands of years. Mostly it is impossible to identify a single country of origin.
- Countries and regions are "interdependent": they all depend for their food and agriculture on crops that originated elsewhere.

### 110. Write demerits o in situ and ex situ conservation? 3 marks

#### In-situ Conservation

- Genetic diversity may have already been dramatically decreased
- Conditions that threatened the organisms in the area may still be present, e.g. disease or interspecific competition
- Poachers and Eco tourists may see the thriving area as an opportunity and may cause damage

#### Ex situ Conservation

- Usually only a small number of individuals can be cared for.
- It can be difficult and expensive to create and sustain the right environment.
- The animals that are habituated (used to) human contact may be less likely to exhibit natural behaviors and may be more likely to catch a disease from humans.
- This type of conservation is usually less successful as many species can't breed successfully in captivity or don't adapt to their new environment when moved to a new location.

### 111. Some most endangered species in Pakistan are as follow;

- The Indus River dolphin • Markhor • Mountain Weasel • Asian Black Bear • Snow Leopard

### 112. Mild inbreeding 2marks

Mating of relatives beyond 2nd generation and upto 6th generation

### 113. Disadvantage of inbreeding 3marks

- An increase in the prevalence of inherited disorders
- A decrease in viability
- A decrease in reproductive ability, and

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- The loss of genetic diversity (i.e. decrease in genetic variation).
- Developmental disruption, higher infant mortality and a shorter life span Reduction of immune system function

#### 114. What is special about Agricultural genetic resources? (2 marks)

- To feed the world, we all need these resources.
- Agricultural resources have been shared and exchanged over thousands of years. Mostly it is impossible to identify a single country of origin.
- Countries and regions are interdependent: they all depend for their food and agriculture on crops that originated elsewhere.

#### 115. Bottleneck effect?

It is a sharp lowering of population's gene pool because of environmental or human caused change.

#### 16. Gene sanctuary:

- A gene sanctuary is an area where plants are conserved. It includes both biosphere reserves as well as national parks. India has set up its first gene sanctuary in the Garo Hills of Meghalaya for wild relatives of citrus. Efforts are also being made to set up gene sanctuaries for banana, sugarcane, rice and mango.

#### 117. Huntington disorder

Huntington's disease (aka Huntington's chorea) is a genetic disorder which results in slowly progressing brain cell death. there are two distinct populations in which the disorder occurs much more often.

1. The first group is the Afrikaner population of South Africa.
2. The second group is the residents of the Lake Maracaibo region of Venezuela.

#### 118. One example gene interaction in plants?

Seven genetically distinct yarrow plants were collected and three cuttings taken from each plant. One cutting of each genotype was planted at low, medium, and high elevations, respectively. When the plants matured, no one genotype grew best at all altitudes, and at each altitude the seven genotypes fared differently. For example, one genotype grew the tallest at the medium elevation but attained only middling height at the other two elevations. The best growers at low and high elevation grew poorly at medium elevation. The medium altitude produced the worst overall results, but still yielded one tall and two medium-tall samples. Altitude had an effect on each genotype, but not to the same degree nor in the same way

#### 119. Why Hart's Tongue Ferns threatened? 3 marks

##### Appearance

Hart's Tongue Fern is a rare treat for the eyes; it is so green, glossy, and large that it defies reality.

##### Habitat

This fern is found in close association with outcrops of dolomitic limestone, in coulees, gorges and in cool limestone sinkholes in mature hardwood forests.

##### Why It's Threatened?

Quarrying, recreation and residential development have all destroyed these plants and their habitat. Canadian populations are threatened by lumbering and the development of land for ski resorts and country estates, among other activities.

#### 120. Different steps of Allopatric speciation?

1. A geographic change separates members of a population into more than one group
2. Different gene mutations occur and build up in the different populations over time.
3. The populations become so different that members of the different populations can no longer breed with each other anymore if were they to be in the same habitat in the same time. If this is the case, allopatric speciation has occurred.

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## Breeding

“The activity of keeping animals or plants in order to produce animals or plants that have particular qualities”

## Inbreeding

“**Inbreeding**, the mating of individuals or organisms that are closely related through common ancestry.”

### 121. What is the major objective of cryopreservation? 2M

Cryo is Greek word. (kryos – frost). It literally means preservation in “frozen state.” It is a process where tissues, organelles, cells, extracellular matrix, organs or any other biological constructs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temperature.

### 122. What is the criteria for any National Park? 3Marks

National park is an area which is strictly reserved for the betterment of the wildlife & biodiversity, and where activities like developmental, forestry, poaching, hunting and grazing on cultivation are not permitted.

- In these parks private ownership rights are not allowed.
- Their boundaries are well marked and circumscribed.
- They are usually small reserves spreading in an area of 100 sq. km. to 500 sq. km.
- In national parks, the emphasis is on the preservation of a single floral or faunal species.

### 123. What is horizontal gene transfer? 3M

**Ans:** “Horizontal gene transfer is known to occur between different species, such as between prokaryotes and eukaryotes, between the three DNA-containing organelles of eukaryotes, the nucleus, the mitochondrion and the chloroplast.”

### 124. Differentiate between Out breeding and in breeding? 5M

“**Inbreeding**, the mating of individuals or organisms that are closely related through common ancestry.”

“**Outbreeding**, the intentional breeding of distantly related or unrelated individuals for the purpose of producing offspring of superior quality.”

### 125. Difference between gene pool and genetic drift.

**Ans:** The combination of all the genes present in a given population is called the gene pool of that population.

Genetic drift is the phenomenon of change in the frequency of alleles (variants of a gene) in a population of organisms due to chance or random events

### 126. Three main wild animal genetic resources

1. Zoological garden
2. Wildlife Sanctuaries
3. Game reserve

### 127. Facts about passenger pigeon

**Ans:** The passenger pigeon may have once constituted 25 to 40 percent of the bird population.

The 19th century brought widespread hunting and trapping of the birds, which severely diminished their populations.

The last passenger pigeon, named “**Martha**” died at age 29 at the Cincinnati Zoo in 1914.

### 128. Biosphere reserve

**Ans:** Biosphere reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use.

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They are internationally recognized, nominated by national governments and remain under sovereign jurisdiction of the states where they are located.

### 129. Reproductive isolation .5

**Ans:** Sympatric speciation is speciation that occurs when two groups of the same species live in the same geographic location, but they evolve differently until they can no longer interbreed and are considered different species. This is often result of Reproductive isolation.

The mechanisms of reproductive isolation are a collection of evolutionary mechanisms, behaviors and physiological processes critical for speciation. They prevent members of different species from producing offspring, or ensure that any offspring are sterile.

These barriers maintain the integrity of a species by reducing gene flow between related Species

### Types Reproductive isolation

- **Pre-zygotic isolation**
- **Post-zygotic isolation**

### 130. Why we use precautionary measures to save genetic resources?

**Ans:** attention to genetic resources means attention to the vast diversity among and between species of animals, plants, and microorganisms.

Genetic resources must be maintained as an investment for the future.

Genetic resources are of tremendous practical and historical significance for human life from daily survival to generating the wealth of nations, yet their crucial role in supporting human society is frequently overlooked and undervalued.

Genetic conservation is an integral part of a much broader activity concerned with protecting the many plants, animals, microorganisms, and communities of organisms that help to mold and stabilize the environment and maintain the quality of air, water, and soil.

Conservation ensures that future generations will benefit from earth's biological resources.

Conserving genetic resources is a means of safeguarding the living materials exploited by agriculture, industry, forestry, and aquaculture to provide food, feed, medicines, fiber for clothing and furnishing, fuel for cooking and heating, and the food and industrial products of microbial activity.

### 131. Types of cryoprotectants

There are two types of cryoprotectants:

- Membrane permeating which can freely diffuse the membrane such as glycerol (G), ethylene glycol (EG) and dimethyl sulfoxide (DMSO);
- Non membrane permeating which cannot permeate the cell membrane such as sugars

### 132. Varieties of cultivation 2

**Ans:** Varieties in cultivation are the easiest to use in the breeding program. And they form a major part of working collections. They are good source of gene for yield, quality etc. they can be introduced in a new area and directly released for cultivation.

### 133. Natural selection

A natural process that results in the survival and reproductive success of individuals or groups

### 134. Antibiotics with exapmle 3

**Ans:** Antibiotic is chemical substance produced by microorganisms that can kill or inhibit the growth of other microorganisms

Antibiotics kill or inhibit other organisms by interfering the metabolic process in the bacterium that is not found in the host.

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**Example:** Penicillins, Tetracyclines

### 135. Advantages and disadvantages of ex situ conservation 5

**Ans: Merits**

- It can be used to protect individual animals in a controlled environment. This means that issues such as predation and hunting can be monitored and managed more easily.
- It can be used to reintroduce species that have left an area.

**Demerits**

- Usually only a small number of individuals can be cared for.
- It can be difficult and expensive to create and sustain the right environment.
- The animals that are habituated (used to) human contact may be less likely to exhibit natural behaviors and may be more likely to catch a disease from humans.
- This type of conservation is usually less successful as many species can't breed successfully in captivity or don't adapt to their new environment when moved to a new location.

### 136. Why national strategy of PGRFA needed 5

In practical terms, a National Strategy for PGRFA may help a country in setting priorities, assigning budgetary and other resources, building capacity, and designing the seamless dovetailing of all aspects of national PGRFA management in service of its own goals.

As a result, a country will be in a position to safeguard its PGRFA assets; facilitate to access to needed genetic materials and govern the sharing of the accruing benefits; add value to them through crop improvement; and sustainably intensify crop production as may be needed.

### 137. Huntington disorder 3

**Ans:** Huntington's disease (aka Huntington's chorea) is a genetic disorder which results in slowly progressing brain cell death. there are two distinct populations in which the disorder occurs much more often.

### 138. Ratio of vegetables in Pakistan 3

- Pakistan covering 75% of the total area under vegetables, accounting for 74% of the total production.
- The major share in the production is of Punjab (63%) followed by Sindh (14%), Baluchistan (12%) and KPK (11%).
- Maximum area is grown under potatoes and about 88 % occurs in Punjab.
- About 46% of onion is cultivated in Sindh and 25% in Punjab.
- Chili is at the third position of which 84% is cultivated in Sindh.

### 139. What special about agriculture genetic resources?

Agricultural resources have been shared and exchanged over thousands of years. Mostly it is impossible to identify a single country of origin.

Countries and regions are "interdependent": they all depend for their food and agriculture on crops that originated elsewhere. conservation and sustainable use, fair and equitable benefit-sharing, for sustainable agriculture and food security

### 140. What the term of animal genetic resource of food and agriculture?

The term "animal genetic resources for food and agriculture" is often shortened to "farm animal genetic resources" or simply "animal genetic resources" and sometimes referred to as "livestock biodiversity" or simply "livestock diversity".

### 141. Enlist causes of migration?

The trigger for the migration may be:

- local climate
- local availability of food
- The season of the year
- For mating reasons

Some animals travel relatively short distances to find food or more favorable living or breeding conditions.

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## 142. Write two types of ex situ conservation?

Gene bank

Botanical garden

## 143. Write about special of wildbeest for migration?

The Great Migration isn't called great by chance. Every year in the Great Rift Valley of Tanzania and Kenya, which are located in Africa, more than 1.5 million wildebeest migrate northwest across the grassy plains of the Serengeti. Zebras and other grazing animals also take part in this migration. These animals are constantly on the search for food, following the grasses that flourish during the rainy season.

## 144. define progenitor

**Ans:** Progenitor of the horse as we know it no longer exists in the wild, though it likely resembled the related przewalski's horse.

## 145. Why *Acalypha rubrinervis* tree is said to be a string tree?

**Ans:** *calypha rubrinervis* (string tree or stringwood) is an extinct plant in the spurge family (Euphorbiaceae), from the island of Saint Helena in the South Atlantic Ocean. It was called string tree on account of the thin pendulous inflorescences which resembled red strings.

## 146. Danger of aquatic pollution on aquatic species

- Pollution caused by industrial effluents and wastewater of private households has severely damaged the habitats of many fish species
- Nutrient input through farming has resulted in algal blooms
- Oil tanker disasters causing oil spills destroyed entire coastal areas
- Above issues can cause a loss of general fitness of the animals, remain stunted in growth and become less fertile
- Famous example of effect of aquatic pollution is "MINAMATA Disease." This disease was spread due to consuming mercury poisoned fishes by people

## 147. Define microbial genetic resources programs working in Pakistan 5

To establish a long term microbial preservation facility as "National Culture Collection of Pakistan (NCCP)" for collection and preservation of microbial genetic resources from Pakistani ecology for basic and applied microbiology and biotechnology research following the Best Practice Guidelines of OECD (2001).

To distribute the economically important strains to scientific community, institutions and industry on commercial basis for research or utilization in industrial processes as a regular activity of the NCCP by following national and international laws and regulations.

## 148. Advantages and disadvantages of outbreeding

**Advantages:**

- Out breeding often produces offspring of superior quality because it increases homozygosity (the occurrence of two alleles for the same trait at corresponding positions on homologous chromosomes)
  - Sharply reduce the risk of deleterious recessive genes being expressed
  - One of the benefits of out breeding is less chance of genetic abnormalities
  - The ability to make a breed stronger
- Disadvantages:**
- Introduction of new genes into population

## 149. What happen when population of moths of white colour migrate to another population brown colored moths and mate? (2)

- Animal discomfort accidentally produce traits that are damaging to the health of the animal

**Ans:** A population of moths that are white in color migrate to a population of brown colored moths and successfully mate to give rise to viable offspring. Here, we can say that there is a change in the allele frequency. Over time, the number of these white moths will increase.

## 150. Write any five types of genetic resources? 5

**Ans:** Types of Genetic Resources

1) Plant Genetic Resources

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- 
- 2) Animal Genetic Resources
  - 3) Forest Genetic Resources
  - 4) Aquatic Genetic Resources
  - 5) Genetic Resources of Microorganism
  - 6) Invertebrates Genetic Resources
- 1) **Plant Genetic Resources** for Food and Agriculture (PGRFA) are the raw material that farmers and plant breeders use to improve the quality and productivity of crops. They can be defined as any genetic material of plant origin of actual or potential value for food and agriculture, e.g. seeds, tubers, mature plants etc.
  - 2) **Animal genetic resources (AnGR)** is used to include all animal species, breeds and strains that are of economic, scientific and cultural interest to humankind in terms of food and agricultural production for the present or the future.
  - 3) **Forest genetic resources (FGR)** are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value.
  - 4) **Aquatic genetic resources** also comprise all water-dwelling genetic resources.
  - 5) **Genetic resources of micro-organisms** means genetic material of actual or potential value from micro-organisms.

### 151. Write note on the indus dolphin?

- The Indus River dolphin is one of the world's rarest mammals
- It is second most endangered freshwater river dolphin
- Approximately 1,100 specimens of this species exist today in a small fraction of their former range
- Population of this species has gradually declined due to various factors e.g. water pollution, poaching, fragmentation of habitat due to barrages and dolphin stranding in the irrigation canals

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## **SUBJECTIVE PART:**

### **2 Marks Short Questions:**

1. **Forest Genetic Resource? 2marks**

**Answer:** FGR are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value.

2. **Sympatric Speciation? 2marks**

**Answer:** Sympatric speciation is speciation that occurs when two groups of the same species live in the same geographic location, but they evolve differently until they can no longer interbreed and are considered different species.

3. **What is plant domestication? 2 marks**

**Answer:** "Plant domestication is the process whereby wild plants have been evolved into crop plants through artificial selection."

4. **Which form is closest to inbreeding? 2 marks (NOT CONFIRMED)**

**Answer:**

- Closest form of inbreeding in domestic animals involves mating between full brothers and sisters (full siblings).
- Second closest form of inbreeding involves mating between grand-parents and grand-offspring, half brothers and sisters (half siblings)

5. **Inbreeding depression? 2marks**

**Answer:** Inbreeding depression is the reduced biological fitness in a given population as a result of inbreeding, or breeding of related individuals.

6. **Endemic species? 2marks**

**Answer:** Any species whose range is restricted to a limited geographical area.

7. **Name four causes of extinction? 2marks**

**Answer:** The causes of extinction are as follows

1. Climate change
2. Habitat destruction
3. Lack of genetic diversity
4. Better-adaptive condition
5. Pollution
6. Human over-population
7. Poaching and hunting

8. **Color moths mating? 2 marks**

**Answer:** Populations of moths that are white in color migrate to a population of brown-colored moths and successfully mate to give rise to viable offspring. Here, we can say that there is a change in the allele frequency. Over time, the number of these white moths will increase.

9. **AnGR stand for? 2marks**

**Answer:** The term AnGR stand for Animal genetic resources.



**10. Breeding lines? 2marks**

**Answer:**

- These are lines/ populations developed in breeding programs have narrow genetic base and often contain valuable gene combination.
- This group nearly contain homozygous line or mutant lines and lines derived from biology programs, including transgenic lines.

**11. Why Acalypha rubrinervis is called string tree? 2marks**

**Answer:** calypha rubrinervis (string tree or stringwood) is an extinct plant in the spurge family (Euphorbiaceae), from the island of Saint Helena in the South Atlantic Ocean. It was called string tree on account of the thin pendulous inflorescences which resembled red strings.

**12. Write the application of cryopreservation in medical science? 2marks**

**Answer:** Low temperature have been used in medicine and to prevent food spoilage since ancient time. Now- a- days it is used in fertility treatment the transport of human organs and the long- term storage of biological specimens, either for future or simply as a record of biodiversity.

**13. Genetic drift? 2 marks**

**Answer:** "Random changes in gene frequency especially in small populations when leading to preservation or extinction of particular genes".

**14. What is progenitor? 2 marks**

**Answer:** a person or thing from which a person, animal, or plant is descended or originates; an ancestor or parent

**15. What are aquatic genetic resources? 2 marks**

**Answer:** "Aquatic genetic resources include all genetic resources living in water"  
For Examples: Fish, cyclostomes, mussels, decapods, marine mammals.

**16. What does it mean "functionally extinct"? 2 marks**

**Answer:** A species may become functionally extinct when only a handful of individuals survive, which are unable to reproduce due to; • Poor health, • Age, • Sparse distribution over a large range, • A lack of individuals of both sexes.

**17. What is the major objective of cryopreservation? 2 marks**

**Answer:** The objective of cryopreservation is to minimize damage to biological materials, including tissues, • mammalian cells, bacteria, fungi, plant cells, and viruses, during low temperature freezing and storage.

**18. Define pure breeding? 2 marks**

**Answer:** Pure-breeding is the mating of rams and ewes of the same breed or type. A purebred flock can be managed as a single flock because all ewes and rams are of the same breed.

**19. How to identify Gene Environment interaction? 2marks**

**Answer:** There are two main methods to analyze gene environment interaction

1. Traditional Genetic Designs
2. Molecular Analyses

**20. Define wild plant resources? 2 marks**

**Answer:** Wild plant resources refer to those that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently."

**21. What is genetic material? 2 marks**

**Answer:** Genetic material is any material of plant, animal, microbial or other origin containing functional units of heredity.

**22. Define varieties in cultivation? 2 marks**

**Answer:** Varieties in cultivation are the easiest to use in the breeding program. And they form a major part of working collections. They are good source of gene for yield, quality etc. they can be introduced in a new area and directly released for cultivation.

**23. Define protected areas? 2 marks**

**Answer:** "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values"

**24. How hart's tongue fern become threatened? 2 marks**

**Answer:** Quarrying, recreation and residential development have all destroyed these plants and their habitat. Canadian populations are threatened by lumbering and the development of land for ski resorts and country estates, among other activities

**25. Differentiate b/w close and line inbreeding. 2marks**

**Answer:**

<b>Close inbreeding</b>	<b>Line inbreeding</b>
Animals are very closely related and can be traced back to more than one common ancestor.	Mating animals that are more distantly related which can be traced back to one common ancestor
c.g. full brothers and sisters	e.g. Cousins Grandparents to grand offspring, Half-brother to half-sister

**26. Types of in situ conservation? 2 marks**

**Answer:** There are three types of in situ conservation.

1. National park
2. Biosphere reserve
3. Gene sanctuary

**27. Define breed? 2marks**

**Answer:** A breed is a group of domestic animals with a homogeneous appearance, behavior, and other characteristics that distinguish it from other animals.

**28. Ultrarapid Freezing? 2 marks**

**Answer: Ultrarapid Freezing:** In this technique serial equilibration of embryos in high concentration of DMSO (3-5 M) supplemented with sucrose (0.3 to 0.5 M). The embryos are then plunged into liquid Nitrogen.



**29. Gene sanctuary? 2 marks**

**Answer:** The genetic diversity is sometimes conserved under natural habitat. In other words, areas of great genetic diversity are protected from human interference. These protected areas in natural habitat are referred to as gene sanctuaries.

**30. Grading up? 2 marks**

**Answer:** Breeding of animals of two different breeds where the animal of an indigenous breed/genetic group is mated by an improved pure breed for several generations towards attaining the superior traits of the improved breed.

**31. Anthropogenic hazards to migration.? 2 marks**

**Answer:** . Anthropogenic hazards to migrants

- Barriers (fences, dams & skyscrapers)
- Water, air craft and fishes practices
- Telegraphic wires, towers and light houses
- Illegal hunting

**32. How genetic drift change the frequency of gene?? 2 marks**

**Answer:** Genetic drift is the phenomenon of change in the frequency of alleles (variants of a gene) in a population of organisms due to chance or random events.

**3 MARKS SHORT QUESTIONS:**

**1. Enlist extinct animals of Pakistan? 3 marks**

**Answer:** Extinct animals of the Pakistan are:

- |                                  |                        |                       |
|----------------------------------|------------------------|-----------------------|
| 1. West African Black Rhinoceros | 2. Pyrenean Ibex       | 3. Passenger Pigeon   |
| 4. Quagga                        | 5. Caribbean Monk Seal | 6. Sea mink           |
| 7. Tasmanian Tiger               | 8. Tecopa Pupfish      | 9. Great Auk          |
| 10. Javan Tiger                  | 11. Bubal Hartebees    | 12. Steller's sea cow |
| 13. Dodo                         |                        |                       |

**2. Difference between allopatric and sympatric speciation? 3 marks**

**Answer:**

<b>Allopatric speciation</b>	<b>Sympatric speciation</b>
Allopatric speciation is speciation that results when a population is separated by a physical barrier.	Sympatric speciation is speciation that occurs without physical separation of members of the population.
It is geographical isolation that doesn't allow population of the same species to exchange genetic material	The speciation that occurs when two groups of the same species live in the same geographic location, but they evolve differently until they can no longer interbreed and are considered different species
e.g. Darwin finches	e.g. In Apple Maggot Flies



3. Differentiate of ex situ and in situ conservation? 3 marks

Answer:

Ex situ conservation	In situ conservation
It involves placing of threatened animals and plants in special care unit for their protection	This method involves protection of endangered species in their natural habitats
There are two types of ex situ conservation 1. Gene bank 2. Botanical garden	There are three Types of in situ conservation 1. National park 2. Biosphere reserve 3. Gene sanctuary
It helps in recovering populations or preventing their extinction under stimulated conditions that closely resemble their natural habitats.	It helps in recovering populations in the surroundings where they have developed their distinct features.

4. Define migration and its causes? 3 marks

Answer: Migration is the relatively long-distance movement of individuals, usually on a seasonal basis. It is found in all major animal groups, including birds, mammals, fish, reptiles, amphibians, insects, and crustaceans. Migration is a behavioral adaptation that helps animal's survival.

**Causes of Migration**

- Shortage of food supply on the breeding ground
- Environmental factors
- Internal factors
- Photoperiodism
- Fat deposition

5. Local migration? 3 marks

Answer: Local migration occurs because of heavy rain, flood, excessive cold & hot. Return to that area when crisis is over. Flowering of certain plants and ripening of fruits also cause local migration

6. Vertical and horizontal gene transfer? 3 marks

Answer:

**Vertical gene transfer:** The transfer of genes from parents to offspring. It may be through sexual or asexual reproduction

**Horizontal Gene Transfer:** Horizontal gene transfer is basically the transfer of genes between organisms via methods other than asexual or sexual reproduction. Genes and the characteristics code for are passed down from parent to progeny.

There are three ways for bacteria to transfer their DNA horizontally

1. Conjugation
2. Transformation
3. Transduction

7. What are endanger species explain with examples? 3 marks

Answer: "A species of plant or animal that is in immediate danger of becoming extinct and needs protection to survive."

For Examples:

- The Indus River dolphin
- Markhor
- Asian Black Bear
- Snow Leopard
- Marco Polo sheep
- Marbled Teal
- White-Headed Duck
- Musk Deer

**8. Nagoya Protocol? 3 marks**

**Answer:** The Nagoya Protocol focuses on the equitable sharing of genetic material (plant, animal, microbial, and other) including the traditional knowledge associated with the genetic resources, and the benefits that arise from their use.

**9. How overhunting cause to extinction of animals? 3 marks**

**Answer:** Human hunters are responsible for wiping out the population of large animals. Researchers found that most of the animals that time died because of increased hunting. Horn of Rhino ivory of elephants, the fur and organs of tigers, the deliciousness of tuna and the supposedly medicinal effect of shark's fin etc are some reasons for over-hunting

**10. Names of wild Animal genetic resources of Pakistan? 3 marks**

**Answer:** Some most important wild animal resources in Pakistan are as follow:

- Snow Leopard • Alpine Markhors • Asiatic Cobra • Muggger Crocodile • Himalayan Brown Bear • Indus River Dolphin • Asian Black Bear • Fishing Cat

**11. Types of cryoprotectants? 3 marks**

**Answer:** There are two types of cryoprotectants.

1. Membrane permitting which can freely diffuse the membrane such as glycerol (G), ethylene glycol (EG) and dimethyl sulfoxide (DMSO)
2. Non Membrane permitting which cannot permeate the cell membrane such as sugars

**12. What are the triggers for migration? 3 marks**

**Answer:** The trigger for the migration may be:

1. local climate
2. local availability of food
3. the season of the year
4. for mating reasons

**13. Seasonal migration? 3 marks**

**Answer:** Respond to change in the season tropical & sub tropical countries area, this occurs at the beginning or end of the warm season. This type of migration is for food or breeding. They migrate from the south to the north during summer. e.g. snow bunting, red wing, shore lark.

**14. Compare insitu conservation and exsitu conservation demerits? 3 marks**

**Answer:**

**Demerits of insitu conservation:**

- Genetic diversity may have already been dramatically decreased
- Conditions that threatened the organisms in the area may still be present, e.g. disease or interspecific competition

**Demerits of exsitu conservation:**

- Usually only a small number of individuals can be cared for.
- It can be difficult and expensive to create and sustain the right environment.

**15. Passenger pigeon? 3marks**

**Answer:** The passenger pigeon may have once constituted 25 to 40 percent of the bird population. The 19th century brought widespread hunting and trapping of the birds, which severely diminished their populations. The last passenger pigeon, named "Martha" died at age 29 at the Cincinnati Zoo in 1914.



**16. Vegetables growth ratio in Pakistan? 3 marks**

**Answer:** 74% of the total production

**17. Causes of migration? 3**

**Answer:**

- Shortage of food supply on the breeding ground
- Environmental factors
- Internal factors
- Photoperiodism
- Fat deposition

**18. What is horizontal gene transfer? 3 marks**

**Answer:** Horizontal gene transfer is known to occur between different species, such as between prokaryotes and eukaryotes, between the three DNA-containing organelles of eukaryotes, the nucleus, the mitochondrion and the chloroplast."

**19. Bottleneck effect with example? 3 marks**

**Answer:** The bottleneck effect is a sharp lowering of a population's gene pool because of an environmental, or human-caused, change."

It is an extreme example of genetic drift that happens when the size of a population is severely reduced. Events like natural disasters (earthquakes, floods, fires) can decimate a population, killing most individuals and leaving behind a small, random assortment of survivors.

**20. Cryopreservation? 3 marks**

**Answer:** Cryo is Greek word. (kayos – frost). It literally means preservation in "frozen state."

Cryo-preservation or cryo-conservation is a process where organelles, cells, tissues, extracellular matrix, organs or any other biological constructs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temperatures (typically -80 °C using solid carbon dioxide or -196 °C using liquid nitrogen).

**21. Endangered species in Pakistan? 3 marks**

**Answer:** "A species of plant or animal that is in immediate danger of becoming extinct and needs protection to survive."

Some most endangered species in Pakistan are:

- The Indus River dolphin • Markhor • Asian Black Bear • Snow Leopard • Marco Polo sheep
- Marbled Teal • White-Headed Duck • Musk Deer

**22. How plant genetic resources are important? 3 marks**

**Answer:**

- Plant genetic resources are the building blocks and fundamental not only in crop improvement program, but also for the very survival of the species in time and space.
- Plant genetic resources include all our agricultural crops and even some of their wild relatives because they too often have valuable traits.
- Plant genetic resources are components of biodiversity which sustain the humankind

23. Effect of over fishing on aquatic genetic resources? 3 marks

Answer:

- The large numbers of many marine fish species and the wide ranging habitats seems virtually impossible that one fish species could be eradicated through overfishing.
- Fisheries can drastically lower the numerical abundance of individual stocks or even entire fish species by overfishing. For example, various cod and herring stocks in the North Atlantic

24. Types of genetic stock? 3 marks

Answer: Genetic stocks can be divided into three general groups:-

1. Cytological stocks
2. Mutants stock
3. Germplasm set

25. Importance of domestic animal resources? 3 marks

Answer:

**Domesticated animal resources are important as follow:**

- Animals provide milk
- Hair from goat and sheep is used for making woolen clothing, shawls and blankets
- Some drugs are especially obtained from animals. Ex. Heparin an anti-coagulant is used to control clots in blood, is obtained from ox lungs and pig intestines
- Animal's meat is the part our of diet
- Animals are a great source of leather which is used for making foot wear, belts, wallets bags, furniture

26. Differ b/w outbreeding and inbreeding? 3 marks

Answer:

Outbreeding	Inbreeding
"The intentional breeding of distantly related or unrelated individuals for the purpose of producing offspring of superior quality."	"Inbreeding, the mating of individuals or organisms that are closely related through common ancestry."
There are 3 types of out breeding. <ol style="list-style-type: none"><li>1. Cross breeding</li><li>2. Grading up</li><li>3. Species cross</li></ol>	There are 3 types of inbreeding <ol style="list-style-type: none"><li>1. Close inbreeding</li><li>2. Mild inbreeding</li><li>3. Line inbreeding</li></ol>

27. Describe Number & Richness Genetic Resources of Microorganism? 3marks

- Answer: Numbers of species described and currently accepted in most groups of microorganisms worldwide are respectively 143,000 & 18,500. 120 new species of bacteria and 1,500 new species of fungi are added to science each year • This clearly demonstrating that knowledge of these groups is grossly inadequate

28. Difference between Wild form and wild relatives? 3 marks

Answer:

**Wild form:** Wild forms are wild species from which crop species are directly derived. They are easy to cross with the concerned crop species.

**Wild relatives:** The wild relatives include all other species. Which are related to the crop species by descent during their evolution.



**29. Difference between genetic drift and gene flow? 3 marks**

**Answer:**

- Gene flow occurs via mixing of genes with other populations while genetic drift takes place when the allele frequency is changed between two generations of a population.
- Genetic drift takes place between two generations whereas gene flow takes place between two populations
- Genetic drift occurs in only one species while gene flow could take place between either two populations or two species.
- Physical barriers matter for the gene flow but not for the genetic drift.

**30. Note on Nut trees? 3 marks**

**Answer:** Nut Trees in Pakistan are as follow:

- Almonds • Walnut • Tree Nuts

Almonds fall in the family of peaches, plums and nectarines. Seeds of these plants are edible as Almond. Almond plants blossom into beautiful pink flowers in spring in addition to yielding fruits in summer.

**31. What is Out breeding? 3 marks**

**Answer:** "The intentional breeding of distantly related or unrelated individuals for the purpose of producing offspring of superior quality."

**Types of Out breeding:**

There are 3 types of out breeding.

1. Cross breeding
2. Grading up
3. Species cross

**32. In which population Huntington's diseases often occur? 3 marks**

**Answer:** Huntington's disease (aka Huntington's chorea) is a genetic disorder which results in slowly progressing brain cell death. There are two distinct populations in which the disorder occurs much more often.

1. The first group is the Afrikaner population of South Africa.
2. The second group is the residents of the Lake Maracaibo region of Venezuela.

**5 MARKS LONG QUESTIONS:**

**1. Reproductive isolation? 5 marks**

**Answer:** The mechanisms of reproductive isolation are a collection of evolutionary mechanisms, behaviors and physiological processes critical for speciation. They prevent members of different species from producing offspring, or ensure that any offspring are sterile. These barriers maintain the integrity of a species by reducing gene flow between related species.

**Types Reproductive isolation** • Pre-zygotic isolation • Post-zygotic isolation

**2. Detail note on global strategy for plant Conservation(GSPC)? 5 marks**

**Answer:**

The Global Strategy for Plant Conservation (GSPC) is a program of the UN's Convention on Biological Diversity founded in 1999

**Vision of GSPC:-**

"Without plants, there is no life. The functioning of the planet, and our survival, depends on plants. The Strategy seeks to halt the continuing loss of plant diversity"

### Objectives:

The GSPC has 5 main objectives:

1. Plant diversity is well understood, documented and recognized
2. Plant diversity is urgently and effectively conserved
3. Plant diversity is used in a sustainable and equitable manner
4. Plant diversity is used in a sustainable and equitable manner
5. The capacities and public engagement necessary to implement the strategy have been developed.

### 3. Merits and demerits of ex situ? 5 marks

Answer:

Merits:-

- It can be used to protect individual animals in a controlled environment. This means that issues such as predation and hunting can be monitored and managed more easily.
- It can be used to reintroduce species that have left an area.

Demerits:-

- Usually only a small number of individuals can be cared for.
- It can be difficult and expensive to create and sustain the right environment.
- The animals that are habituated (used to) human contact may be less likely to exhibit natural behaviors and may be more likely to catch a disease from humans.
- This type of conservation is usually less successful as many species can't breed successfully in captivity or don't adapt to their new environment when moved to a new location.

### 4. Write down the Threats on AnGR? 5 marks

Answer: **Threats to AnGR:-**

- Despite the importance of animal genetic resources and their diversity, their diversity has been continually decreasing over time.
- One of the greatest threats to livestock diversity is pressure from large-scale commercial production systems to maintain only high-output breeds.
- Changes in climate will have an impact on livestock and food production in many ways.
- Some major disease threats that livestock currently face include, rinderpest, foot and mouth disease, and Peste des petits ruminants (PPR), also known as sheep and goat plague.

### 5. Different freezing methods in Cryopreservation? 5marks

Cryopreservation is based on the ability of certain small molecules to enter cells and prevent dehydration and formation of intracellular ice crystals, which can cause cell death and destruction of cell organelles during the freezing process.

The sensitivity of cells to low temperature depends on the plant species. There are four different types of methods :

1. **Slow freezing method** - the tissue or plant material is slowly frozen at slow cooling rate. The advantage is the plant cells are partially dehydrated and survive better.
2. **Rapid freezing method** - it involves plunging the vials in liquid nitrogen. The temperature decreases from -300 to -1000 degree rapidly.
3. **Combined freezing method** - this is combination of both slow and rapid freezing method. The process is carried out in step wise like manner.
4. **Dry freezing method** - in this method dehydrated cells and seeds are stored.



6. **Purpose of National strategy of PGRFA? 5 marks**

**Answer:** A National Strategy for PGRFA is the blueprint for the management of a country's PGRFA as a continuum of interventions in order to achieve clearly defined time bound goals.

- A well-designed National Strategy needs to be tailored to the particular circumstances and needs of the country
- should be amenable to review and updating as country situations change.
- The National Strategy for PGRFA should also be complementary to other national, regional and global conservation strategies or initiatives.

7. **Note on Indus Dolphin? 5marks**

**Answer:** .

**The Indus River Dolphin**

The Indus River dolphin is one of the world's rarest mammals. It is second most endangered freshwater river dolphin. Approximately 1,100 specimens of this species exist today in a small fraction of their former range. Population of this species has gradually declined due to various factors e.g. water pollution, poaching, fragmentation of habitat due to barrages and dolphin stranding in the irrigation canals.

8. **Write five types of genetic resources? 5 marks**

**Answer:**

**Types of Genetic Resources**

**1. Plant genetic resources**

Plant Genetic Resources for Food and Agriculture (PGRFA) are the raw material that farmers and plant breeders use to improve the quality and productivity of crops.

**2. Animal genetic resources**

Animal genetic resources (AnGR) is used to include all animal species, breeds and strains that are of economic, scientific and cultural interest to humankind in terms of food and agricultural production for the present or the future.

**3. Forest genetic resources**

Forest genetic resources (FGR) are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value.

**4. Aquatic genetic resources**

Aquatic genetic resources also comprise all water-dwelling genetic resources.

**5. Genetic resources of micro-organisms**

Genetic resources of micro-organisms mean genetic material of actual or potential value from micro-organisms.

**6. Invertebrates Genetic Resources**

Invertebrates include a great number of species that perform valuable functions in agro-ecosystems

9. **Advantages and disadvantages of out breeding? 5 marks.**

**Answer: Out breeding:** "The intentional breeding of distantly related or unrelated individuals for the purpose of producing offspring of superior quality."

**Advantages of Out breeding:**

- Out breeding often produces offspring of superior quality because it increases homozygosity (the occurrence of two alleles for the same trait at corresponding positions on homologous chromosomes)
- sharply reduce the risk of deleterious recessive genes being expressed
- One of the benefits of out breeding is less chance of genetic abnormalities
- The ability to make a breed stronger

**Disadvantages of out breeding:**

- Introduction of new genes into population
- Animal discomfort: accidentally produce traits that are damaging to the health of the animal.

**10. What are the obstacles of cryopreservation? 5 marks**

**Answer:**

- Actually the freezing point of water is 0 degree centigrade while the cryoscopy temperature can be as low as -90 degree centigrade.
- Very expensive Technique
- Ice formation can result in the needle shaped crystals resulting in the damage to cell membrane.
- Unequal distribution or over distribution of cryoprotectants.
- Moreover, thermal gradients can induce mechanical stress due to uneven expansion or contraction in the biomaterial.
- The cooling rate required for optimal survival varies by several orders of magnitude between different cell types.
- Mass transfer limitations

**11. Why National strategy for PGRFA needed? 5 marks**

**Answer:** In practical terms, a National Strategy for PGRFA may help a country in setting priorities, assigning budgetary and other resources, building capacity, and designing the seamless dovetailing of all aspects of national PGRFA management in service of its own goals. As a result, a country will be in a position to safeguard its PGRFA assets; facilitate to access to needed genetic materials and govern the sharing of the accruing benefits; add value to them through crop improvement; and sustainably intensify crop production as may be needed

**12. How the climate change cause the extinction?5 marks**

**Answer:** Almost half of plant and animal species have experienced local extinctions due to climate change. Global warming could trigger not just local but global extinctions of animals and plants. Species already threatened by habitat destruction, pollution, alien invasion and overhunting are more vulnerable to climate change. Diversity of species in any one ecosystem could be affected by rises in average temperatures or a shift of climate regime

**13. How wildebeest related to migration.5 marks**

**Answer:** The Great Migration isn't called great by chance. Every year in the Great Rift Valley of Tanzania and Kenya, which are located in Africa, more than 1.5 million wildebeest migrate northwest across the grassy plains of the Serengeti. Zebras and other grazing animals also take part in this migration. These animals are constantly on the search for food, following the grasses that flourish during the rainy season.

**14. Explains the term " animal genetic resources for food and agriculture"? 5 marks**

**Answer:** The term "animal genetic resources for food and agriculture" is often shortened to "farm animal genetic resources" or simply "animal genetic resources" and sometimes referred to as "livestock biodiversity" or simply "livestock diversity".

**Values of animal genetic resources:** • Direct use value • Indirect use value • Option value • Bequest value • Existence value

**List of animal species for food and agriculture:**



## List of animal species used for food and agriculture

Widespread species	
Species	No. of breeds
Pig	350
Goat	320
Sheep	850
Cattle	815
Buffalo	70
Horse	350
Donkey/Ass	70
Dromedary	50
Bactrian Camel	6

7

### 15. Biometric gene environment interaction? 5 marks

#### Answer

- The biometric (or statistical) conception has its origins in research programs that seek to measure the relative proportions of genetic and environmental contributions to phenotypic variation within populations.
- Biometric gene–environment interaction has particular currency in population genetics and behavioral genetics. Any interaction results in the breakdown of the additivity of the main effects of heredity and environment, but whether such interaction is present in particular settings is an empirical question.
- Biometric interaction is relevant in the context of research on individual differences rather than in the context of the development of a particular organism.

### 16. Future for cryopreservation? 5 marks

**Answer:** Vitrification method of cryopreservation may bring new opportunities to research protocols. It is still an experimental procedure. There are two major concern about vitrification - toxicity of high concentration of cryoprotectants used and microbial contamination of liquid nitrogen. Several IVF programs have adopted the vitrification method as the sole procedure for day-3 human embryos and for human blastocysts, with excellent survival and pregnancy rates. The challenge now is to find a protocol to successfully vitrify human oocytes for which the slow freezing method has yet to produce acceptable

### 17. How climate change effect species extinction? 5marks

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**5 marks**

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## Q.2; How animal figure out that where they are going?

**Ans;** Scientists aren't really sure exactly how some animals figure out how to get to where they are going. They think that:

- Some animals use landmarks like rivers and streams to find their way.
- Some animals may navigate by the position of the sun and stars.
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Genetic drift takes place between two generations whereas gene flow takes place between two populations •

Genetic drift occurs in only one species while gene flow could take place between either two populations or two species.

Physical barriers matter for the gene flow but not for the genetic drift.



## **BT401 MIDTERM PAST FILE NO 2**

### **1. Write two derived resources? (Question is not correct) I think it's ( write two themes)**

There are two important themes with regard to genetic resources.

- First one is sharing of benefits
- The second relates to food security

### **2. ABSA stands for \_\_\_\_\_**

Access and Benefit Sharing Agreement

### **3. How to check viability of cryopreservation?**

There is possibility of death of cells due to storage stress. Thus viability can be found at any stage. It is calculated by formula :

$$\left( \frac{\text{No of cells growing}}{\text{No of cells thawed}} \right) \times 100$$

### **4. How gene conservation help to maintain ecosystem?**

Genes are the link from generation to generation of all living matter. Therefore, attention to genetic resources means attention to the vast diversity among and between species of animals, plants, and microorganisms. It is essential for maintaining and enhancing the efficiency and the resilience of production systems, as well as contributing to sustainable diets and to the delivery of ecosystem services, such as pest and disease regulation.

### **5. How a species figure out how they get of any place?**

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### **6. When West African Black Rhinoceros were be extinct?**

The West African black rhinoceros (*Diceros bicornis longipes*) was a subspecies of the black rhino that was declared extinct in 2011.

### **7. What is Gene Pool?**

"The combination of all the genes present in a given population is called the gene pool of that population."

### 8. What is indigenous breed?

Genetic group is mated by an improved pure breed for several generations towards attaining the superior traits of the improved breed.

### 9. How many ways bacteria have transfer their DNA horizontally?

There are three ways for bacteria to transfer their DNA horizontally

1. **Conjugation:** The transfer of DNA directly from one cell to another through cell-cell contact often involving plasmids
2. **Transformation:** Bacteria are capable of taking up DNA directly from their environment and incorporating it into their genomes known as natural transformation
3. **Transduction:** Transduction is the transfer of DNA from one cell to another by a virus.

3marks short question

### 10. What are the criteria for any National Park?

National park may be define as a area declared by state for the purpose of protecting, propagating wildlife there in or its natural environment for their scientific educational and recreational value

### 11. Disadvantage of inbreeding?

It often results in decreased vigour, size, and fertility of the offspring because of the combined effect of harmful genes that were recessive in both parents.

### 12. Uses of sheesham?

Dalbergia Sissoo, also known as Indian Rosewood, is the source of Sheesham wood. The tree is native to India and Pakistan and grows all over the Sub-Himalayan Regions. Its leaves are compound, and produces pink-white flowers that resemble a pea flower. It gives a dry fruit that is a thin and papery pale brown pod. The tree mainly offers timber.

### 13. Define tertiary gene pool?

**Tertiary Gene Pool (GP3):**

The genetic material which leads to production of sterile hybrids on crossing with primary gene pool is termed as tertiary gene pool or gene pool three (GP3). It includes material which can be crossed with GP1, but the hybrids are sterile. Transfer of gene from such material to primary gene pool is possible with the help of special techniques.

### 14. How pollution is a threat to many species?

Marine animals are exquisitely sensitive to traces of toxic chemicals in lakes, oceans and rivers. Drastic changes in oxygen levels, caused by industrial pollution, can suffocate entire populations. Large bodied animal and rare species are more prone to the changes caused by humans to the planet. Constant exposure to pollution can render plants and animals more susceptible to dangers including starvation, loss of habitat and disease



### 15. Pollution is the main cause of threat to large no. of species proves this argument?

Aquatic pollution:

- Pollution caused by industrial effluents and wastewater of private households has severely damaged the habitats of many fish species.

### 16. How bottleneck effect on gene frequency?

“The bottleneck effect is a sharp lowering of a population's gene pool because of an environmental, or human-caused, change.”

Allele frequencies in a group may be very different from those of the population prior to the event, even some alleles may be missing entirely. The smaller population will also be more susceptible to the effects of genetic drift for generations (until its numbers return to normal). Effect potentially causing even more alleles to be lost.

### 17. Steller' sea cow and Dodo ?

**Steller' s sea cow** :The largest mammals, other than whales, to have existed in the holocene epoch, the Steller's sea cow reached up to nine metres in length but was hunted to extinction in 1768, within 27 years of its discovery by Europeans.

**Dodo**: Perhaps the most famous extinct species, the dodo - endemic to Mauritius - was wiped out in just a few decades. The first recorded mention of the flightless bird was by Dutch sailors in 1598; the last sighting of one in 1662. It owes much of its fame to its appearance in Alice's Adventures in Wonderland.

### 18. How gene flow occur in human?

In human beings gene flow usually comes about through the actual migration of human populations, either voluntary or forced. Gene flow is the exchange of genes between two separate populations.

For example: Blue-eyed people from Sweden move to a small town in Mexico where people all have brown eyes. When they mate, some of their children now have blue eyes.

### 19. What is low oxygen and low pressure storage?

**Low-pressure and Low-oxygen Storage:**

For conservation of cultured plant materials low-pressure storage (LPS) and low-oxygen storage (LOS) have been developed. These are alternative methods of cryopreservation and cold storage.

### 20. Effects of lesser genes in a population?

Populations with a lesser number of genes in their gene pool will be susceptible to problems. This may cause them to become endangered or even perish altogether, i.e., become extinct.

Populations with a large gene pool will have more chances of survival; those with small gene pools are in danger of acquiring genetic diseases, deformities, and infertility.

21. **why it is necessary to take precautionary measure to prevent genetic diversity?**

- The loss of genetic diversity is difficult to see or measure. In contrast, the reduction and extinction of populations is far easier to see.
- Extinction is not only the loss of whole species, but is also preceded by a loss of genetic diversity within the species.
- This loss reduces the species ability to perform its inherent role in the whole ecosystem.
- The loss of genetic diversity within a species result in the loss of useful and desirable traits (e.g. resistance to parasites).
- Reduced diversity eliminate options to use untapped resources for food production, industry, medicine.

22. **One example gene interaction in plants?**

Seven genetically distinct yarrow plants were collected and three cuttings taken from each plant. One cutting of each genotype was planted at low, medium, and high elevations, respectively. When the plants matured, no one genotype grew best at all altitudes, and at each altitude the seven genotypes fared differently. For example, one genotype grew the tallest at the medium elevation but attained only middling height at the other two elevations. The best growers at low and high elevation grew poorly at medium elevation. The medium altitude produced the worst overall results, but still yielded one tall and two medium-tall samples. Altitude had an effect on each genotype, but not to the same degree nor in the same way.

23. **Explain the factors which result the extinction of species?**

Some major effects of extinction are as follow;

- Destruction of Ecosystems
- Upsetting the balance of nature
- Medical study
- Bees and pollination
- **Destruction of Ecosystems**

Species of animals cannot live away from each other. They work together to form an ecosystem. Extinction of one species can effect other by effecting food chain .They depend upon each other and their environment to survive. So in this way it can destroy whole ecosystem

- **Upsetting the balance of nature**

A keystone species is an important to an ecosystem. The grizzly bear is a keystone species. It catch and eat salmon. As the bears move from rivers and streams back to the land, they bring nutrients from the fish to the land in their waste. These nutrients keep the forest healthy so the many animals and plants can live. Without grizzly bears, the forest ecosystem could collapse. But the grizzly bear is now listed as a threatened species. Its extinction can upset the whole balance of the nature.

- **Medical study**



Many different species have unique bodily processes that can cure human diseases. e.g. the toxins produced by **dart-poison frogs** in the rain forest have yielded information about how alkaloid compounds behave in living organisms. Scientists also study bears for clues about how they recycle blood toxins during hibernation to find potential solutions to kidney disorders. Plants from forests are useful for medicinal purposes.

- **Bees and pollination**

Bees are responsible for pollinating more than 250,000 species of plants. "Colony collapse disorder" is wiping out entire populations of the insect. Scientists have yet to discover its true cause. Continued losses could threaten the supply of crops like almonds, apples and cucumbers. From all species, humans rely upon for food 87 rely on pollinators mainly honeybees. Only 28 different crops could survive without such assistance.

#### 24. What is 6 article of agriculture genetic resources?

##### Article 6: Sustainable Use of Plant Genetic Resources:

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#### 25. What are the advantages of germplasm storage?

Conventional seed storage offers several advantages:

1. Seeds of many valuable species can survive long-term storage
2. Good storage facilities are now available in most of the world, and they are used extensively for tree seed storage for various regeneration purposes
3. Seed storage is a relatively cheap method for conserving a broad range of germplasm
4. Large land areas are not tied up in conservation
5. International exchange of genetic material is facilitated by seed storage

#### 26. 4.Conservation of genetic resource is important for saving of life? comment on it.

Genetic resources are sometimes called the "first resource" of the natural resources on this planet - the others being land, air, and water. **The diversity of genetic resources for food and agriculture (i.e. plants/crops, animals, aquatic resources, forests, micro-organisms and invertebrates) plays a crucial role in meeting basic human food and nutritional needs.** Genes are the link from generation to generation of all living matter. Therefore, attention to genetic resources means attention to the vast diversity among and between species of animals, plants, and microorganisms. **It is essential for maintaining and enhancing the efficiency and the resilience of production systems, as well as contributing to sustainable diets and to the delivery of ecosystem services, such as pest and disease regulation.**

Genetic resources must be maintained as an investment for the future. Genetic resources are of tremendous practical and historical significance for human life from daily survival to generating the wealth of nations, yet their crucial role in supporting human society is frequently overlooked and undervalued. Genetic conservation is an integral part of a much broader activity concerned with protecting the many plants, animals, microorganisms, and communities of organisms that help to mold and stabilize the environment and maintain the quality of air, water, and soil. Conservation ensures that future generations will benefit from earth's biological resources. Conserving genetic resources is a means of safeguarding the living materials exploited by agriculture, industry, forestry, and aquaculture to provide food, feed, medicines, fiber for clothing and furnishing, fuel for cooking and heating, and the food and industrial products of microbial activity.

27. State the new approaches followed by developing and developed countries to increase food supply and protecting the resources on which they depend?

28. What are the approaches for preservation?

#### Why preservation is important?

Until two decades ago the genetic resources were getting depleted owing to the continuous depredation by man. It was imperative therefore that many of the elite, economically important and endangered species are preserved to make them available when needed. Many methodologies have been devised for long term preservation of material.

#### Methodologies

There are various methods of storage :

1. **Cryopreservation** - generally involves storage in liquid nitrogen.
2. **Coldstorage** - it involves storage in low and non freezing temperature.
3. **Lowpressure** – it involves partially reducing the atmospheric pressure of surrounding.
4. **Lowoxygenstorage** - it involves reducing the oxygen level but maintaining the pressure.

29. Ecosystem is facing massive destruction extinction species. How?

#### Mass Extinction:

Extinction event (also known as a **mass extinction** or **biotic crisis**) is a widespread and rapid decrease in the biodiversity on Earth.”

Biologists suspect we’re living through the sixth major mass extinction. Earth has witnessed five, when more than 75% of species disappeared. Paleontologists spot them when species go missing from the global fossil record.

“We don’t always know what caused them extinct but most had something to do with rapid climate change”



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## Q.7 Why hart tongue farn threatened?

**Ans;**Quarrying, recreation and residential development have all destroyed these plants and their habitat. Canadian populations are threatened by lumbering and the development of land for ski resorts and country estates, among other activities.

**5 marks**

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