
2011

Section: A

Questions: 1 – 8

ii-iii

Section: B

Questions: 9 – 18

iii- vi

Section: C

Questions: 19 – 27

vi-x

Section: D

Questions: 28 – 30

viii-xii

Section: A

Question: 1

Name the embryonic stage that gets implanted in the uterine wall of a human female. [1]

Answer:
Blastocyst

Question: 2

State the importance of biofortification. [1]

Answer:
Importance of biofortification includes breeding of crops for improvement of nutritional quality, higher level of vitamins, proteins, minerals and healthier fats.

Question: 3

Biotechnologists refer to *Agrobacterium tumefaciens* as a natural genetic engineer of plants. Give reasons to support the statement. [1]

Answer:
It can transfer gene naturally and can deliver a piece of TDNA and has tumor inducing plasmid.

Question: 4

How do algal blooms affect the life in water bodies? [1]

Answer:
Algal blooms affect the life in water bodies as it pollutes water, deteriorates the water quality, oxygen depletion, water becomes toxic and BOD increases.

Question: 5

Name the common ancestor of the great apes and man [1]

Answer:
Dryopithecus or Ramapithecus

Question: 6

Write a difference between net primary productivity and gross productivity. [1]

Answer:
Gross productivity:
Rate of production of organic matter during photosynthesis.

Net primary productivity:
Available biomass for the consumption to heterotrophs

Question: 7

Mention the contribution of genetic maps in human genome project. [1]



Answer:

The contribution of genetic maps in human genome project includes sequencing of genes, DNA finger printing, and tracing human history, chromosomal location for disease associated sequence.

Question: 8

Name the phase all organisms have to pass through before they can reproduce sexually.[1]

Answer:

Junvenile

Section: B

Question: 9

Name the enzyme produced by Streptococcus bacterium. Explain its importance in medical sciences. [2]

Answer:

Streptokinase

Question: 10

How 'Rosie' is considered different from a normal cow? Explain. [2]

Answer:

Rosie is a transgenic cow. Rosie produced human protein enriched milk containing human alpha lactalbumin.

Question: 11

State the use of Biodiversity in modern agriculture. [2]

Answer:

A source of hybrids, GM plants, bio pesticides, organic farming, bio-fertilizer, improved varieties of plants, disease resistant plants or any other relevant use.

Question: 12

Write the full form of VNTR. How is VNTR different from 'Probe'? [2]

Answer:

Full form of VNTR is Variable Number Tandem Repeats. Probe is labeled or radioactive single stranded hybridize DNA fragments.

Question: 13

Differentiate between benign and malignant tumors. [2]

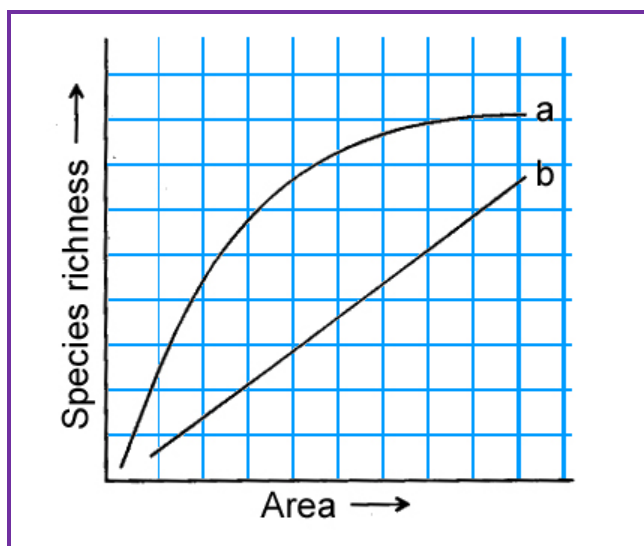


Answer:

Benign tumors	Malignant tumors
Non-cancerous	Cancerous
Remains confined	Spreads to other parts of the body
No metastasis	Shows metastasis
Causes limited damage	Cause serious damage

Question: 14

[2]



The above graph shows Species-Area relationship. Write the equation of the curve 'a' and explain.

Answer:

$$S = CA^Z = 1$$

- Within a region, species richness increases with increasing explored area but only up to a limit.
- Relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

OR

Differentiate between in situ and ex situ approaches of conservation of biodiversity.

Answer:

In situ	Ex situ
Protection of endangered species	Protection of endangered species by removing them from the natural habitat
By protecting the natural habitat ecosystem	By placing under special care

Question: 15

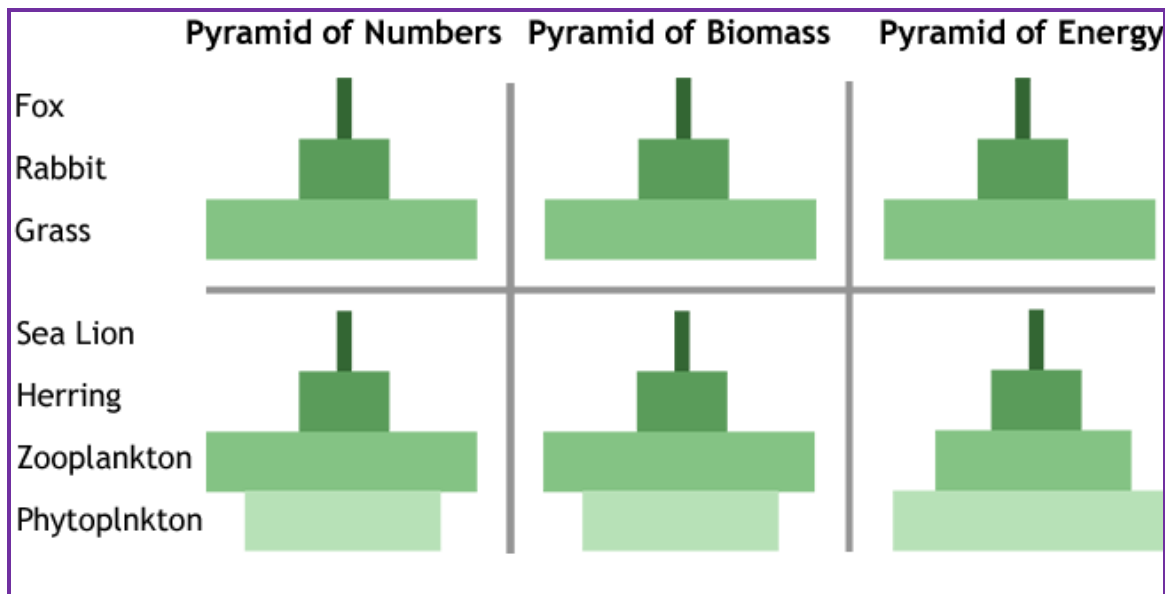
The cell division involved in gamete formation is not of the same type in different organisms. Justify.

[2]



Answer:

Parents may be haploid or diploid but the gametes have to be haploid, diploids undergo meiosis to produce haploid gametes, haploids undergo mitosis to produce gametes.

Question: 16

Identify the type of the given ecological pyramid and give one example each of pyramid of number and pyramid of biomass in such cases. [2]

Answer:

Inverted pyramid.

- Inverted pyramid of biomass in a lake: phytoplankton → Zooplankton → fishes.
- Inverted pyramid of number: tree → insects → birds

Question: 17

Describe the Lactational Amenorrhea method of birth control. [2]

Answer:

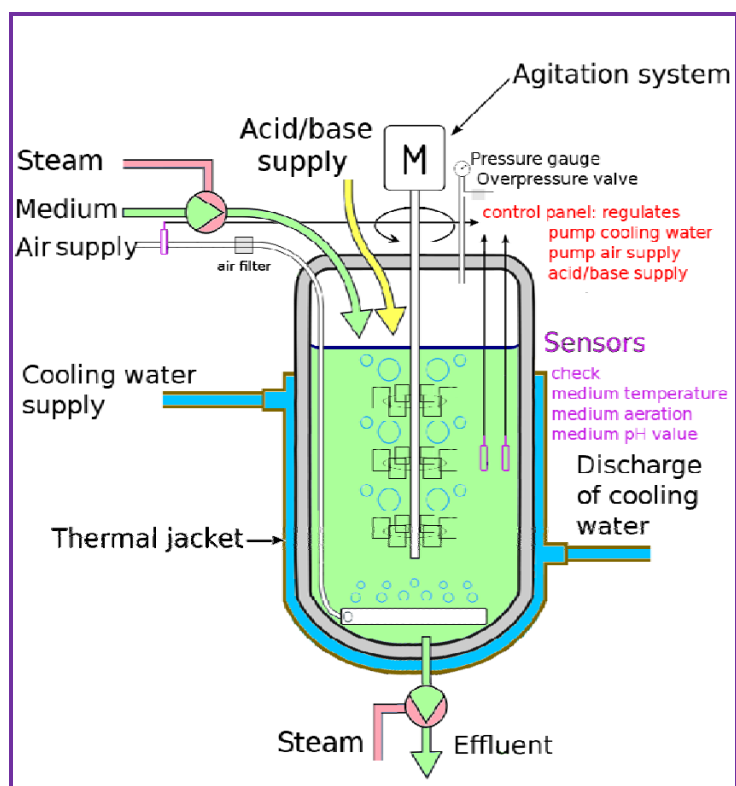
Lactational amenorrhea is the natural postnatal infertility that occurs when a woman is amenorrheic and fully breast feeding. If not combined with chemicals or devices, Lactational amenorrhea method (LAM) may be considered natural family planning. This method of birth control has benefits for the baby as well.

Ecological breastfeeding can be 99% effective, and this is where the true benefits come in for the infant. To effectively practice ecological breastfeeding, breast milk must be the only source of nutrition for the first six months, as well as source of comfort. No bottles, pacifiers, or fingers should be offered for soothing.

Breastfeeding should occur frequently, more often than every 4 hours in the day and every 6 at night as recommended for LAM.



Question: 18



Name the type of bioreactor shown. Write the purpose for which it is used.

[2]

Answer:

The above type of bioreactor shown is simple stirred tank bioreactor. Large scale production of recombinant protein, raw materials is biologically converted into specific products or enzymes using microbial plants and animals and human cells.

Section: C

Question: 19

Draw a labeled diagram of the reproductive system in a human female.

[3]

Answer:

See topics on 'Female reproductive system'.

Question: 20

Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution. Explain each concept with the help of a suitable example.

[3]

Answer:

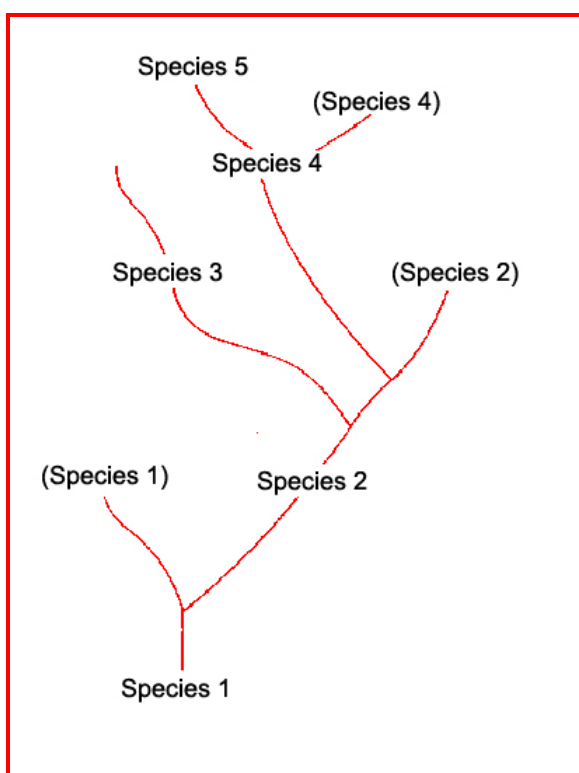
According to Darwin's theory of evolution,

Natural selection may be defined as the process by which the organisms which are better adaptive to a particular kind of environment tends to survive, leading in the elimination of the organism less adaptive to that environment. These organisms are naturally selected and



reproduce to pass on their genetic qualities suitable to that environment making their species best suitable to that particular environment. An example of natural selection is that of peppered moth. Originally, the peppered moth had light coloration as it camouflaged them against the light colored trees. During industrial revolution, there was widespread pollution which led to the deposition of black soot on the tree barks. So, this led to a decrease in the population of light colored moths as they were easily visible on dark trees. At the same time, the population of dark colored moths increased as they were better suited to that environment.

Branching descent may be defined as the process by which new species originate from a single common descendant. This can be demonstrated like a tree of life where two new organisms' branch out from a single common ancestor, further branching keeps on taking place from those new organisms formed. When these new organisms formed from a common ancestor becomes geographically isolated and becomes a lot different from each other and becomes adapted to a particular kind of environment, it results in the formation of a new species. The given figure represents an example of branching descent where species 1 is the common ancestor and over the course of time different species developed from it.



Question: 21

Scientists have succeeded in recovering healthy sugarcane plants from a diseased one. [3]

- a. Name the part of the plant used as explant by the scientists.

Answer:

The part of the plant used as explant by the scientists is the meristem.

- b. Describe the procedure the scientists followed to recover the healthy plants.



Answer:

Restoration ecology, as a scientific discipline is theoretically rooted in conservation biology. Although, restoration ecology may be viewed as a sub-discipline of conservation biology, foundational differences do exist between the disciplines' approaches, focuses and modes of inquiry.

- c. Name the technology used for crop improvement.

[3]

Answer:

See topics on 'Steps of crop improvement'.

Question: 22

- a. Name the enzyme that catalyzes the transcription of hnRNA.

[3]

Answer:

RNA polymerase II.

- b. Why does the hnRNA need to undergo changes? List the changes hnRNA undergoes and where in the cell such changes take place.

Answer:

Pre-mRNA is synthesized from a DNA template in the cell nucleus by transcription. Pre-mRNA comprises the bulk of **heterogeneous nuclear RNA (hnRNA)**. The term hnRNA is often used as a synonym for pre-mRNA, although, in the strict sense, hnRNA may include nuclear RNA transcripts that do not end up as cytoplasmic mRNA.

Question: 23

- a. Write the scientific names of the two species of filarial worms causing filariasis.

[3]

Answer:

Wuchereria bancrofti is a parasitic filarial nematode (roundworm) spread by a mosquito vector.

- b. How do they affect the body of infected person(s)?

Answer:

Lymphatic filariasis affects the body by causing severe swelling in an arm, leg, breast, or the genital area. The skin of the affected area becomes very susceptible to bacterial infection. The skin can then become thickened and hard, a condition known as elephantiasis.

- c. How does the disease spread?

Answer:

The disease spreads from person to person by mosquito bites. When a mosquito bites a person who has lymphatic filariasis, microscopic worms circulating in the person's blood enter and infect the mosquito. People get lymphatic filariasis from the bite of an infected mosquito. The microscopic worms pass from the mosquito through the skin, and travel to the lymph vessels. In the lymph vessels they grow into adults. An adult worm lives for about 5–7 years. The adult worms mate and release millions of microscopic worms, called microfilariae, into the blood. People with the worms in their blood can give the infection to others through mosquitoes.



Question: 24

Name the genus to which baculoviruses belong. Describe their role in the integrated pest management programs. [3]

Answer:

Nucleopolyhedro virus:

They control only species specific pest, do not affect non target organisms and beneficial insects are conserved and they aid in IPM problems and no negative impact on plants or other animals.

Question: 25

Unambiguous, universal and degenerate are some of the terms used for the genetic code. Explain the salient features of each one of them. [3]

Answer:

The genetic code is universal as it is highly conserved amongst all known organisms. The use of DNA and RNA as coding material is seen in prokaryotes, eukaryotes, archae and even viruses. The molecular structure of the code is identical with adenine, cytosine, guanine and thymine acting as the coding bases in DNA and uracil replacing thymine in RNA. As well as being universal the code is also unambiguous as each set of three bases (each codon) is associated with a specific amino acid, or act as set functional features such as indicating where to start/stop translation. Although each codon encodes for a specific amino acid, more than one codon can code for each amino acid during translation. This is referred to as degeneracy or redundancy and reduces the likelihood that a mutation in the code will alter the resultant amino acid sequence.

Question: 26

Water is very essential for life. Write any three features both for plants and animals which enable them to survive in water scarce environment. [3]

Answer:

Three features which enable both plants and animals to survive in water scarce environment are ephemeral mode, deep tap roots, deciduous leaves, waxy cuticle, sunken stomata, and succulence to store water.

OR

How do organisms cope with stressful external environmental conditions which are localized or of short duration?

Answer:

Organisms cope with stressful external environmental conditions which are localized or of short duration by migrating temporarily from the stressful habitat to a hospitable area, form thick walled spores, form dormant seeds, hibernate during winter, aestivate during summer.

Question: 27

a. State the consequence if the electrostatic precipitator of a thermal plant fails to function.

[3]

Answer:

Particulate matter will pollute the air.



-
- b. Mention any four methods by which the vehicular air pollution can be controlled. [3]

Answer:

Four methods by which the vehicular air pollution can be controlled are:

Use of CNG or phasing out of old vehicles, use of unleaded petrol, use of low sulphur fuel, use of catalytic converters.

Section: D

Question: 28

[5]

Give reasons why,

- a. Most zygotes in angiosperms divide only after certain amount of endosperm is formed.

Answer:

To obtain nutrition from the endosperm for the developing embryo.

- b. Groundnut seeds are exalbuminous and castor seeds are albuminous.

Answer:

In groundnut endosperm is completely consumed and in castor seeds endosperm persists.

- c. Micropyle remains as a small pore in the seed coat of a seed.

Answer:

This is due to the entry of water and oxygen for germination.

- d. Integuments of an ovule harden and the water content is highly reduced, as the seed matures.

Answer:

It protects the embryo; keep the seed viable until favorable conditions return for germination.

- e. Apple and cashew are not called true fruits.

Answer:

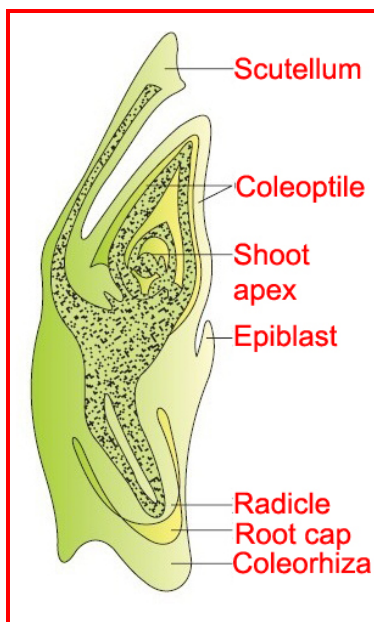
Ovary is not taking part in fruit formation and the thalamus contributes to fruit formation.

OR

- a. Draw a labeled diagram of L.S of an embryo of grass (any six labels).

Answer:





b. Give reasons for each of the following:

i. Anthers of angiosperm flowers are described as dithecal.

Answer:

Each bilobed anther has two thecas.

ii. Hybrid seeds have to be produced year after year.

Answer:

Progeny show segregation, they do not maintain hybrid characters.

Question: 29

Describe the mechanism of pattern of inheritance of ABO blood groups in humans. [5]

Answer:

See topics on <'Inheritance pattern of human blood groups'>

OR

a. Why hemophilia is generally observed in human males? Explain the conditions under which a human female can be hemophilic.

Answer:

Hemophilia is caused due to the recessive gene on X chromosome.

Y has no allele for this. If a male is X^hY then he is hemophilic. If male inherits X^h from the mother he is hemophilic. If female inherits X^hX^h , one from the carrier mother and one from her hemophilic father then she can be hemophilic.

b. A pregnant human female was advised to undergo M.T.P. It was diagnosed by her doctor that the fetus she is carrying has developed from a zygote formed by an XX-egg fertilized by Y-carrying sperm. Why was she advised to undergo M.T.P?



Answer:

Embryo has XXY and Klinefelter's syndrome.

Question: 30

[5]

- i. Describe the characteristics a cloning vector must possess.

Answer:

The characteristics that a cloning vector must possess are:

- It should have ori or origin of replication.
- It has selectable marker, genes encoding for an antibiotic resistance and genes encoding for α galactosidase.
- Has cloning site or recognition site for the restriction enzyme to recognize.

- ii. Why DNA cannot pass through the cell membrane? Explain. How a bacterial cell is made 'competent' to take up recombinant DNA from the medium?

Answer:

DNA is a hydrophilic molecule. So it cannot pass through the cell membrane.

Bacterial cell is made competent by treating with specific concentration of Ca^{++} ion or divalent ions, incubating them on ice, heat shock for a short period and placing it back on ice again.

OR

If a desired gene is identified in an organism for some experiments, explain the process of the following:

- i. Cutting this desired gene at specific location

Answer:

The process involves:

- ✓ Identifying the restriction endonuclease that recognizes the palindromic nucleotide sequence of the desired gene.
- ✓ The restriction endonuclease inspects the DNA sequences that finds and recognizes the site.
- ✓ It cuts each of the double helix at the specific point a little away from the center of the palindromic site which is between the same two bases on the opposite strand.
- ✓ Makes the overhanging stretch single stranded portion as a sticky end.

- ii. Synthesis of multiple copies of this desired gene

Answer:

The process involves,

- By PCR
- Desired gene is synthesized in vitro
- DNA is denatured
- Annealed using two sets of primers
- Thermo stable Taq polymerase extends the primers using nucleotides provided in the reaction and genomic DNA as template
- Amplified fragments are ligated.

