மொறட்டுவை பல்கலைக்கழக பொறியியற் பீட தமிழ் மாணவர்கள் நடாத்தும் க.பொ.த உயர்தர மாணவர்களுக்கான 8 ஆது

முன்னோடிப் பரீட்சை - 2017

பல்தேர்வு விடைத்தாள் / M C Q Answer Sheet

பாடமும் பாட எண்ணும் Subject and Subject No: Biology | 09

பிரிவு Stream | மாவட்ட இல. District No. | சுட்டெண் Index No.

சுட்டெண்ணும் ஏனைய விபரங்களும் சரியானது என்பதற்கான மேற்பார்வையாளரின் கையொப்பமும் திகதியும்.
Supervisor's Signature and Date for correct index number and other details.

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
(01)	2	(11)	1	(21)	5	(31)	3	(41)	4
(02)	2	(12)	2	(22)	2	(32)	1, 3	(42)	2
(03)	1	(13)	3	(23)	5	(33)	1	(43)	5
(04)	3	(14)	4	(24)	5	(34)	5	(44)	1
(05)	5	(15)	3	(25)	5	(35)	2, 3	(45)	4
(06)	4	(16)	3	(26)	1	(36)	3	(46)	5
(07)	3	(17)	2, 4	(27)	2	(37)	4	(47)	1
(08)	1	(18)	5	(28)	1	(38)	4	(48)	5
(09)	1	(19)	3	(29)	3	(39)	2	(49)	3
(10)	3	(20)	4	(30)	3	(40)	3	(50)	5

Mora E-Tamils 2019 | Examination Committee

BCAS CAMPUS

சரியான விடைகளின் எண்ணிக்கை
No. of correct answers

Marking scheme

Part II (A) - Structured essay

1. A.

i. a) 1. Ribose sugar 2. Adenine nitrogenous base 3. Tri phosphate group ×3

b) 1. Releases energy instantly/ releases energy by single reaction.

2. Reforms quickly.

3. Mobility within cell. ×3

c) 30.6 kJ ×1

ii. Prokaryotes have circular DNA and eukaryotes have linear DNA.

DNA of prokaryotes is naked and DNA of eukaryotes is associated with histone protein.

Prokaryotes do not have introns and eukaryotes have introns.

Prokaryotic DNA is found in cytoplasm and eukaryotic DNA is found in nucleus or in some cellular organelles. (Any two) ×2

iii. Ability to store genetic information in the sequence of bases.

Ability to self-replicate using complementary strands.

Undergoes structural changes rarely causing mutation.

Have stable universal simple structure.

Found in most of the organisms. ×4

iv. a. Provide site for protein synthesis in ribosome / provide site for joining of amino acids in ribosome/ form the structure of ribosome. ×1

b. CAU ×1

v. 1. RNA polymerase ×1

2. Restriction endonuclease ×1

×17

B.

i. All living organisms are composed of one or more cells.

The basic structural and functional unit of an organism is cell.

All the cells arise from the pre-existing cells. ×3

ii. a. Side by side movement of phospholipid tails. ×1

b. Dynamic boundary of a cell

Permits the entry of water, ions and certain organic molecules.

Regulates the exit of waste materials.

Maintains an osmotic balance with in the cell.

Receives information through receptors and transmit signals to co-ordinate activities between cells.

×5

iii. a. Ratio between the volume of carbon dioxide released and volume of oxygen in taken during respiration in a unit time. ×1

b. Respirometer

iv. a. Matrix of mitochondria b. NADH, $FADH_2$ ×3

v. a. Globular proteins catalysing catabolic and anabolic reactions and synthesised in living cells/ Globular proteins that are catalysing metabolic or biological reactions and synthesised naturally in living cells. ×1

b. Reduce activation energy. ×1

c. Substance that is structurally similar to substrate, joins with active site of enzyme temporarily and reduce the rate of enzyme reaction. ×1

×17

C.

i. 1. Have peptidoglycan on cell wall.

2. Have one type of RNA polymerase enzyme.

3. Protein synthesis initiates with formyl methionine.

4. Sensitive to antibiotics. (Any three) ×3

ii. 1. a, c 2. b, c 3. d, h, j 4. d, g 5. d ×10

iii. 1. Pterophyta 2. Coniferophyta ×2

iv. 1. Ascomycota 2. Chytridiomycota 3. Rhodophyta ×3

×18

17+ 16 + 18 = 51 × 2 = 102 Max=100 marks

2. A.

i. In the upper left quarter of abdominal cavity of human directly below the diaphragm. ×1

ii. a. Presence of oblique muscle layer in muscularis externa. ×1

b. 1. Chief cells 2. Parietal cells 3. Mucus cell ×3

c. Provide medium for enzymatic reactions by water.

HCl destroys micro organisms.

HCl converts prorennin into rennin.

HCl converts pepsinogen into pepsin.

Deactivates the action of ptyalin or salivary amylase.

Provides acidic medium or provides suitable pH for the action of pepsin.

Assists in lubrication of food by mucous/ protects gastric wall from injuries.

Intrinsic factor helps in absorption of Vitamin B_{12}. ×3

iii. Hepatic portal vein ×1

iv. a. Sodium taurocholate, Sodium glycocholate ×2

b. 1. Emulsification of fat.

2. Helps in absorption of fat. ×2

v. 1. Secretin 2. Cck-pz ×2

×15

B.

i. a. They are components of structural material of plant and they are the elements essential for the completion of life cycle in plants. ×1

b. 1. MoO_4^{2-} 2. BO_3^-/ $B_4O_7^{2-}$ ×3

ii. 1. Calcium 2. Potassium/Chlorine ×2

iii. a. Measurable mobility/moving capacity of water molecules related to its kinetic energy. ×1

b. Temperature/ pressure/ dissolved substances/ hydrophilic substances ×2

iv. a. Xylem vessel element ×1

b. 1. Conduction of water and mineral salts.

2. Mechanical support ×2

v. 1. Appoplast 2.Symplast 3. Vacuolar pathway ×3

vi. K^+ is actively in taken into guard cells in the presence of light.

As the solute potential in guard cells increases, water potential decreases and water enters in to guard cells by osmosis

And turgidity of guard cell increases

This causes stomatal opening.

In night times, due to reverse reaction K^+ ions moves out of guard cells

Stomata are closed. X4

×20

C.

i. a. Monocyte b. 2-10% ×2

ii. a. Epicardium, myocardium, endocardium ×3

b. 1. Branched fibres at the ends.

2. Intercalated discs ×2

iii. a. It is the structure that initiates heart beat and determines the its basic rhythm ×1

b. Near the opening of superior vena cava

in the posterior wall of right auricle ×2

iv. Closing of bicuspid valves

Closing of tricuspid valves

Opening of aortic valves and flow of blood into both aortic arches ×3

v. a. Sixth pair b. Reptilia, Amphibia ×2

×15

15 + 20 + 15 = 50 × 2 = 100 Max

3. A.

i. a. It is the electric potential difference or cellular potential difference across inside and outside surface of plasma membrane of axon when nerve impulses are not conducted.

×1

b. 1. Difference in concentration of specific ions inside the cell compared with the extra cellular fluid.

2. Selective permeability of the plasma membrane to K^+ ions, Na^+ ions.

3. Na^+- K^+ pump ×3

ii. Preganglionic neuron of sympathetic nervous system arises from thoracic and lumber region. In parasympathetic nervous system, it arises from brain stem and sacral region.

In sympathetic nervous system, preganglionic neurons are short. In parasympathetic nervous system, they are long.

In sympathetic nervous system, postganglionic neurons are long. In parasympathetic nervous system, they are short. ×3

iii. 1. Constricts/ excretion of urine decreases

2. Inhibits secretion

3. Dilates pupil/ increase the amount of light entering into eye.

4. Increases contraction ×4

iv. a. 1. Acetyl choline 2. Noradrenaline ×2

b. By the breakdown of acetyl choline into acetyl and choline using the enzyme choline esterase. ×1

v. In sub-arachnoid space. ×1

vi. a. It is a relatively fixed sudden, involuntary response pattern to a simple stimulus. ×1

b. Medulla oblongata ×1

×17

B.

i. Matrix of bone has supply of blood vessels. Cartilage does not.

Bone has harvesian system. Cartilage does not.

Bone has Voltman's canal. Cartilage does not.

Bone has osteoclast, osteoblast. Cartilage has chondrocyte. ×3

ii. Talus, tibia, fibula ×3

iii. Longitudinal, transverse arches

Found as perpendicular ×2

iv. a. 1. H zone 2. A band 3. I band 4. Z line ×4

b. P- Myosin Q- Actin ×2

v. a. Sliding filament theory ×1

b. Binding site of myosin head in actin filament is exposed by moving troponin-tropomyosin complex and assists in formation of cross bridges. ×2

×17

C.

i. 1. Epididymis

2. Seminal vesicles

3. Fallopian tube

4. Uterus ×4

ii. 1. Fusion of the sperm with the vitalline membrane.

2. Release of enzymes outside from vitalline membrane.

3. Cortical reaction ×3

iii. a. Chorion, allantois ×2

b. Prevention from coagulation of blood of foetus due to Rh factor and different blood groups and relatively high blood pressure of maternal circulation. ×2

iv. 1. Oestrogen 2. Progesterone 3.hCG ×3

v. 1. Gonorrhoea 2. Syphilis ×2

×16

17 + 17 + 16 = 50 × 2 = 100 marks

4. A.

i. Changes that occurring in the genetic material or genome suddenly and randomly and can be inherited/ transmitted to the subsequent generation. ×1

ii. 1. Errors during recombination of DNA.

2. Errors during crossing over at meiosis.

3. Variation of number of chromosomes due to errors in pairing of chromosomes/ structural variation of chromosomes. ×3

iii. 1. Sickle cell anaemia 2. Thalassemia 3. Haemophilia ×3

iv. a. 1. Large population size 2. Random mating

3. Non-occurrence of mutation 4. Non-occurrence of selection

5. No immigration and emigration (Any four) ×4

b. $q^2 = 0.04$ $q = 0.2$

$p + q = 1$ $p = 0.8$ $2pq = 2 \times 0.8 \times 0.2 = 0.16 = 16\%$ ×2

v. a. Progeny has more advantageous features than parents due to increase in heterozygous condition and genetic diversity by out breeding method. ×1

b. Reduction in fertility ×1

vi. 1. High reproductive potential

2. Static population size

3. Diversity with in a population ×3

×18

B.

i. Record related to the vulnerable or threatened species OR record related to the global vulnerable status/ conservation status of plant and animal species. ×1

ii. 1. Extinct in the wild (EW)

2. Critically endangered (CR)

3. Endangered (EN)

4. Vulnerable (VU) ×4

iii. 1. Bunadala National Park

2. Madu Ganga sanctuary/ Annaiwilundawa sanctuary/ Vankalai Sanctury/ Kumana wetland clusters ×2

iv. *Loris tardigradis* (Slender loris)/ Otter/ Leopard (Any two) ×2

v. a. Utilization of resources in present with less destruction in order to ensure utilization its benefits by future generation/ utilization of resources without empty them ensuring its long term utilization. ×1

b. 1. Soil 2. Pure water 3. Pure air ×3

vi. 1. Carboniferous 2. Permian 3. Triassic ×3

×16

C.

i. a. Formation of toxic nature in food due to the addition of exotoxins which are secreted out side the body of microorganisms due to their metabolic activity. ×1

b. 1. *Clostridium botulinum* – neuro toxin

2. *Staphylococcus aureus* – entero toxin ×4

ii. 1. pH 2. Moisture content 3. Nutrient content

4. Biological structure of food ×4

iii. Prevention of entry of microorganisms into food(aseptic)

Prevention of the growth and activity of microorganism in food

Removal or killing of microorganism in food ×3

iv. 1. Presence of coliforms indicates the possibility of presence of other pathogens.

2. Able to ferment lactose and forms a gas within 48 hours. ×2

v. Aerobic or facultative anaerobic

Gram negative

Non- endospore forming ×2

×16

18 + 16 + 16 = 50 × 2 = 100 marks

Part II (B) - Essay

Answers

1. a. Briefly describe the lifecycle of a typical angiosperm.

b. Explain briefly the way of adaptation of angiosperms for terrestrial life during the evolution process from non-flowering plant.

Life cycle

1. Flowering plants have alternation of generation with
2. Haploid gametophyte generation and
3. Diploid sporophyte generation.
4. Sporophytes are dominant,
5. Free living,
6. Have well developed stem, root and leaf,
7. Produce flower as reproductive organ.
8. Androecium has stamens.
9. Stamens have anther and filaments.
10. Anther has pollen sacs.
11. Pollen grains are produced
12. From pollen mother cells in pollen sacs
13. By meiosis.
14. Pollen sacs ruptures and pollen grains are released.
15. Gynoecium is made of carpels.
16. It has stigma, style and ovary.
17. Locules have ovules/ ovules are not exposed.
18. Female gametophyte is found in ovule.
19. It is known as embryo sac.
20. It has three antipodal cells,

21. Two synergids,
22. One egg cell and
23. Two polar nuclei/ secondary nuclei.
24. During pollination, pollen grains reaches stigma.
25. Pollen grains germinate on stigma and produce male gametophyte.
26. Male gametophyte has two male gametes.
27. Pollen tube grows through style
28. And reaches embryo sac in ovule.
29. It is a chemotrophic movement.
30. Wall of pollen tube bursts and releases male gametes into embryo sac.
31. One male gamete fertilizes with egg
32. And forms diploid zygote.
33. Other male gamete fertilizes with secondary nucleus/ two polar nucleus
34. And forms triploid endosperm.
35. This is known as double fertilization.
36. After fertilization, ovary develops into fruit,
37. Ovules become seeds,
38. Zygote becomes embryo,
39. Endosperm nucleus forms endosperm.
40. Seeds germinates/ embryo develops into sporophyte again.

Adaptations for terrestrial life.

41. Xylem tissue has vessels.
42. Phloem has sieve tube, companion cells.
43. Sex organs in flowers are well protected.
44. Flowers have adaptations for cross pollination.
45. Megaspores are surrounded by a sheath/ production of ovules.
46. Absence of free living male/female gametophyte.
47. Pollen tube carries male gametes/ fertilization without utilizing external water.
48. Production of immobile male gametes.
49. Occurrence of double fertilization/ storage of food for embryo after fertilization.
50. Seeds are found in fruits.
51. Embryo is protected inside the seed.
52. Have efficient mechanisms for the dispersal of fruits and seeds.
53. Formation of perennial seeds.

Any 50 × 3 = 150 marks

2. Explain the contribution of endocrine gland in the homeostasis of human.

1. Process that maintains internal environment of man as constant is known as homeostasis.
2. In homeostasis of human, chemical components such as concentration of blood glucose
3. Ions
4. Water
5. Body temperature are helping in maintaining constant level.
6. Standard blood glucose concentration in human blood is 80-120mg/100 ml.
7. When the concentration of blood glucose increases above the standard level, receptors of glucose level increase are stimulated
8. Secretion of insulin by β cells in islets of Lagerkhan's of pancreas increases.
9. Secretion of glucagon is inhibited.
10. Insulin is conducted through blood and reaches muscle cells, liver cells and connective tissue cells.
11. It increases the permeability of glucose through membrane of these cells.
12. So, excess glucose in blood reaches these cells.
13. Glucose is converted into glycogen in liver cells and muscle cells.
14. This glycogen is stored in liver cells and muscle cells.
15. Insulin increases cellular respiration utilizing glucose in most of the cells including liver cells and muscle cells, and induces the breakdown of glucose into carbon dioxide and water.
16. In adipose cells, glucose is converted into fat and fatty acids using insulin. Fat is stored in adipose cells.
17. Insulin prevents the increase of glucose level in blood by preventing the breakdown of glycogen into glucose.
18. Due to these activities, increased glucose level decreases and reaches normal level. Secretion of insulin is inhibited. Stimulation of receptors of glucose level increase is stopped.
19. When the level of blood glucose level decreases below the standard level, due to stimulation of receptors of glucose level decrease
20. Secretion of glucagon by α cells in the islets of Langerkhan's of pancreas increases. Due to this, secretion of insulin is inhibited.
21. Adrenalin from adrenal gland
22. Thyroxin from thyroid gland
23. Cortisol from adrenal cortex
24. Growth hormone from anterior pituitary gland are secreted
25. These hormones and glucagon are conducted through blood and reaches muscle cells, liver cells and adipose cells.

26. In liver and muscle cells, glycogen is converted into glucose by hormones like glucagon, adrenalin, thyroxin, growth hormone and reaches the blood.
27. In liver cells, protein is converted into glucose by the stimulation of cortisol and reaches the blood.
28. Fat is converted into glucose by the action of glucagon and reaches blood.
29. Due to these reasons, decreased blood glucose level increases and reaches the standard level.
30. Secretion of hormones is inhibited.
31. Standard body temperature of man is 36.8°C or 37°C.
32. When body temperature decreases below the standard body temperature, by the stimulation of bulb of Krause and free nerve endings
33. Heat gain centre of hypothalamus is stimulated
34. Hormones like thyroxin, adrenalin are secreted
35. These hormones increase the metabolic rate and oxidation of fat in liver cells. This causes increase in heat production.
36. So, decreased body temperature increases and reaches standard body temperature.
37. When water content in blood decreases or osmotic pressure in blood increases
38. It is sensed by osmotic pressure receptors in hypothalamus
39. Due to this, posterior pituitary gland is stimulated and ADH is released
40. It increases permeability of water through distal convoluted tubule
41. And collecting duct
42. And increases reabsorption of water
43. High osmotic urine is excreted
44. Increased osmotic pressure decreases and reaches normal level
45. With the decrease of osmotic pressure, ADH secretion decreases
46. Water is not reabsorbed in distal convoluted tubule and collecting duct.
47. When Na^+ decreases in blood or blood pressure decreases, juxta glomerular complex secretes renin.
48. Plasma protein known as angiotensinogen is converted into angiotensin 1.
49. Then it is converted into angiotensin 2 and stimulates adrenal cortex to secrete aldosterone.
50. Aldosterone increases reabsorption of Na^+ in distal convoluted tubule of nephron.
51. K^+ secretion is stimulated.
52. Na^+ level in blood increases and reaches standard level.
53. Aldosterone also increases reabsorption of water in distal convoluted tubule.
54. Blood volume increases. Decreased blood pressure increases.

$50 \times 3 = 150$ marks

3. State the major global environmental issues and give a description on their contributing factors and effects.

1. Global environmental problems are global warming
2. Depletion of ozone layer
3. Acid rain
4. Desertification

Global warming

5. Prevention of a part of thermal waves or infrared rays that reaches the earth surface being radiated back to space is known as greenhouse effect.
6. This is caused by greenhouse gases.

Greenhouse gases and their sources

7. Carbon dioxide
8. Increase in atmosphere due to combustion of fossil fuels
9. Deforestation
10. Methane
11. Increases in atmosphere due to animal husbandry and anaerobic decomposition of organic matter.
12. Chloro fluoro carbon increases due to
13. Usage of pressurized liquid substances (sprays)
14. Old refrigerants
15. Released from old air conditioners
16. Nitrogen oxides
17. Increases due to increased usage of fertilizers
18. Due to increase of greenhouse gases on earth, greenhouse effect also increases.
19. Due to this, a part of solar radiation is prevented from being radiated back to space
20. And causes global warming

Effects of global warming

21. Due to the thermal expansion of water, volume of ocean increases
22. Rise of sea level due to melting of polar ice caps and glaciers.
23. Loss of many habitats due to rise of sea level.
24. Increase of drought condition and increase of demand for irrigation.
25. Because of increase of temperature, climatic patterns
26. Rainfall pattern changes causing variation in distribution of plants and animals.
27. So, boundaries of forests, grasslands and deserts vary.
28. And agricultural yield decreases.

29. Increase of forest fire changes vegetation patterns
30. Affects bio diversity

Depletion of ozone layer

31. Due to increase of usage of pressurized liquids,
32. Refrigerator, air conditioner
33. Chloro fluoro carbon is released into atmosphere.
34. This causes the thinning of ozone layer.
35. Due to this, more ultra violet rays from sun reaches earth.

Effects

36. Increase of risk of cataract due to increase of UV radiation reaching earth surface.
37. And also causes cancer and reduction of immunity
38. Lowers crop yields through interference with photosynthesis

Acid rain

39. Due to the excess combustion of fossil fuels, sulphur dioxide
40. Oxides of Nitrogen increase in atmosphere.
41. These gases dissolve in water in atmosphere and forms acid rain

Effects

42. Monuments
43. Limestone buildings are damaged
44. Destruction of marble buildings
45. Affects buildings and bridges due to corrosion of metals.
46. Decrease of soil fertility by the removal of Calcium, magnesium ions.
47. Increase of concentration of heavy metals in soil solution or increase of intake of heavy metals by plants.
48. Increase of acidity of water ways.
49. Increase of toxic level in water ways due to dissolution of heavy metals.
50. So, production of fish decreases, eggs of fish are affected, number of aquatic organisms decreases.
51. Death of forest trees due to scorching of leaves.
52. Decrease in photosynthesis.
53. Death of cattle, soil microorganisms, fungal filaments. Death of nitrogen fixing microorganisms.
54. Loss of bio diversity

Any 50 × 3 = 150 marks

4. a. Briefly describe the advantages of using microbial process over chemical process in industries.

b. Briefly describe five of the major commercially used microbial processes.

a. Advantages of using microbial process

1. Microorganisms convert cheap raw materials into useful end products.
2. As microorganisms have high growth rate,
3. Metabolic diversity,
4. Able to use different substrates,
5. High metabolic rate
6. Their reactions are quick.
7. As microbial reactions occur in natural environmental conditions,
8. Provision of high temperature
9. High pressure,
10. High energy is not essential.
11. Human labour and application of traditional industrial methods may be required.

b. Microbial processes are

12. Production of compost
13. Bio gas production
14. Extraction of metal from low grade metal ores
15. Retting
16. Bio remediation or production of vinegar

Production of compost

17. Composting is the decomposition of organic matter by a mixed population microorganisms in a warm moist aerobic environments.
18. Plant residues and organic matter are added to increase plant yield.
19. This process mainly depends on decomposition activity of microorganisms.
20. Ability of microorganism to decompose and release nutrients is utilizes here.
21. In warm moist aerobic environment,
22. Carbon- nitrogen ratio is maintained at 30:1
23. And organic matters are decomposed quickly by mixed population of microorganisms.

Retting

24. Coconut fibres are obtained by soaking coconut coir.
25. Fibres are attached to one another by middle lamella.
26. When they are immersed in water, by the extra cellular enzymes

27. Secreted by aerobic and anaerobic bacteria,
28. Without destroying cellulose and lignin
29. Middle lamella is dissolved and fibres are separated.

Production of bio gas

30. Bio gas is produced by the anaerobic decomposition of organic matter
31. A microorganism known as *Methanococcus* is mainly used in this process.

Extraction of metal

32. By the metabolism of chemo autotrophic bacteria such as
33. *Thiobacillus ferroxidans, Thiobacillus thiooxidans*
34. Copper is extracted from the metal ores containing Iron sulphide($CuFeS_2$)
35. By the oxidation of metal ore, organisms forms H_2SO_4, Fe^{2+} and immobilize copper as $CuSO_4$.
36. This process is known as microbial leaching.
37. Then $CuSO_4$ solution is electrolysed and metal copper is obtained.
38. $FeSO_4$ produced here is cycled again for the microbial activity.

Bioremediation

39. The process utilizes the ability of microorganism to degrade and remove wastes is called bioremediation.
40. Here microorganisms already present in an environment or microorganisms introduced to that environment (managed) are utilized
41. And their reaction on pollutants is catalysed
42. And pollutants are removed by decomposing them or detoxifying them.
43. It is presently used for accelerating waste water decomposition,
44. In textile industries, food processing and chemical plants,
45. Removing oil spills from aquatic environment/ accelerating compositing process
46. Removing toxic metals such as chromium, mercury.

Production of vinegar

47. Consists of two steps. Fermentation of carbohydrate to produce ethanol
48. Oxidative conversion of ethanol to acetic acid
49. Phloem sap of coconut tree or inflorescence is used.
50. Sucrose present in this sap is hydrolysed into glucose
51. By enzymes such as sucrose or invertase secreted by yeast cells (*Saccharomyces cerevisiae*)
52. This glucose is converted into ethanol and carbon dioxide due to anaerobic alcoholic fermentation in yeast cells.
53. This ethanol is oxidized aerobically to produce acetic acid by the bacteria *Acetobacter, Glucanobacter.* This is known as vinegar.

Any 50 × 3 = 150 marks

5. a. Briefly describe the structure of genes and its relationship with proteins.

b. Briefly describe the major steps in the human gene cloning in the bacterial cells.

c. Explain the applications of DNA recombinant technology in agriculture.

a. Structure of genes and its relationship with proteins.

1. A part of sequence of nitrogenous bases in a DNA molecule,
2. That is responsible for the synthesis of a polypeptide chain is known as gene.
3. Sequence of nitrogenous bases in gene
4. Determines the sequence of amino acids in protein.
5. This determines the primary structure of protein.
6. As the sequence nitrogenous bases differs in various genes,
7. Different primary structures of proteins are formed.

b. The major steps in the human gene cloning in the bacterial cells.

8. Identification of gene producing useful protein.
9. Extraction of DNA from animal source.
10. Separation of DNA by precipitating
11. Using density gradient centrifugation method.
12. Cutting the gene to be inserted as pieces by using suitable type of Restriction endonuclease enzyme.
13. Separation of pieces using Agarose gel electrophoresis.
14. Identification of DNA to be used using a DNA probe.
15. Selection of a suitable bacteria with plasmid (with small circular DNA molecules in cytoplasm).
16. *E.coli* bacteria with
17. Known antibiotic resistant gene are commonly used.
18. Bacterial plasmid acts as carrier of DNA/ plasmid carries gene to the host cells.
19. Plasmid is separated by centrifugation.
20. Isolated by agarose gel electrophoresis.
21. The same type of restriction endonuclease used for cutting gene initially, is used to cut plasmids.
22. Isolated DNA pieces obtained from animal source is joined with cut part of plasmid to form recombinant plasmid
23. Using DNA ligase enzyme.
24. Recombinant DNA is inserted into bacterial cell.
25. This occurs by bacterial transformation.
26. Transferred to culture media of recombinant bacteria to form colonies.
27. More number of bacteria (of animal gene) are produced.
28. Using vector/ marker genes in plasmid with resistant

29. In a selected media
30. Successfully transformed colonies are identified.
31. Useful animal proteins are produced by recombinant bacteria.
32. Example – human insulin
33. Human growth hormone/ human blood clotting factors/ antigrowth hormone

Applications of DNA recombinant technology in agriculture

34. Most crop plants with useful characters introduced from other species are used in agriculture.
35. Examples – corn, soya, cotton, Canola varieties.
36. Making plants resistant to insects or pests.
37. Using genes from the bacteria *Bacillus thuringiensis.*
38. Resistance to pests or insects is made in crop plants by forming exotoxins poisonous to larvae of pests
39. In corn, soya, cotton, Canola.
40. In papaw or papaya
41. This technology is used to obtain resistance
42. Against ring spot viral disease or viral diseases.
43. Production of nutritional foods.
44. By introducing a bacteria known as *Erwinia*
45. Into paddy crops
46. Rice rich in beta carotene called “golden rice” is produced.
47. This improves health of human.
48. By using T_i plasmids of
49. The bacteria *Agrobacterium tumifaciens* as carrier,
50. And introducing the gene resistance to the a substance called glyphosphate
51. Into crop plants,
52. Plants resistant to weedicides are produced.
53. Example – soya
54. Production of plant resistant to drought.
55. Production of plants resistant to salinity.

Any 50 × 3 = 150 marks

6. Give short notes on the following.

a. C_4 plants.

1. Some C_4 plants are *Saccharum (*sugarcane), *Zea mays, Amaranthus.*
2. Chloroplasts found in mesophyll cells
3. And bundle sheath cells are structurally different.
4. Cytosol/cytoplasm of mesophyll cells have CO_2 accepter named Phospho Enol Pyruvate which is a three carbon compound.
5. It fixes atmospheric carbon dioxide and forms first stable product Oxalo acetate which is a four carbon compound.
6. This reaction is catalysed by an enzyme called PEP carboxylase.
7. Then Oxalo acetate is converted in to four carbon compound Malate by using NADPH formed in light reaction.
8. Malate reaches bundle sheath cells through plasmodesmata, dissociates in the presence of light
9. And releases pyruvate, CO_2 and hydrogen.
10. Pyruvate again reaches bundle sheath cells through plasmodesmata and regenerated as Phospho Enol Pyruvate using ATP.
11. CO_2 joins with the five carbon compound in chloroplast of bundle sheath cell called Ribulose Bisphosphate
12. And forms unstable six carbon compound.
13. This reaction is catalysed by RuBP carboxylase.
14. Unstable six carbon compound instantly dissociates to form a three carbon compound called Phospho Glyceric Acid.
15. It is reduced as Phospho glyceraldehyde by using a part of ATP formed in light reaction and whole NADPH formed during decomposition of malate.
16. A part of phosphor glyceraldehyde is converted into hexose sugar by a sequence of reactions.
17. Most part of Phospho glyceraldehyde is converted into RuMP by a series of reactions and then it is regenerated as Ribulose Bisphosphate using remaining ATP .

b. Regulation of hormones in male reproductive system.

1. Hypothalamus secretes GnRH.
2. It reaches anterior pituitary gland and stimulates
3. Secretion of FSH
4. And LH.
5. For the maturation of spermatids as sperm cells, FSH
6. Stimulates sertoli cells
7. And initiates spermatogenesis.

8. LH stimulates Leydig's cells of testis
9. And stimulates the secretion of testosterone.
10. Testosterone stimulates the growth and development of germinal epithelium.
11. By this, it increases the rate of conversion of spermatogonia into sperm cells.
12. It increases secondary sexual characters.
13. Secretion of GnRH is inhibited by negative feedback mechanism with the increase of testosterone level.
14. Due to this, secretion of FSH and LH decrease.
15. Testosterone can directly act on anterior pituitary gland to reduce the secretion of LH.
16. When rate of spermatogenesis is high, inhibin is secreted from sertoli cells.
17. Ait reduces the secretion of FSH.
18. When rate of spermatogenesis is less, inhibin is not secreted. So secretion of FSH increases and spermatogenesis increases.

c. Phloem translocation

1. Tissue from which translocation of food begins is called source.
2. The part of destination of food is called the sink.
3. Sucrose sugar is synthesised in mesophyll cells of leaf by photosynthesis and translocated through sieve tube of phloem tissue in solution state.
4. Sucrose in mesophyll cells of leaf (source) is conducted through transfer cells (specialized companion cells) in leaf veins
5. Into sieve tube, against concentration gradient actively using metabolic energy.
6. This process is called as phloem loading.
7. Due to this process, solute potential in sieve tube increases and water potential in it decreases.
8. So, water from xylem tissue reaches sieve tube by osmosis.
9. So, hydrostatic pressure in it increases.
10. Then, this sucrose solution is translocated to storage organ or sink by pressure flow as mass flow in slow rate.
11. In storage organ (sink), by transfer cells actively against concentration gradient
12. Sucrose is conducted to cells of storage organ. This process is called phloem unloading.
13. Due to this, water potential in sieve tube increases. So, by exosmosis, water reaches xylem tissue.
14. Phloem translocation occurs in both directions. Amount of substance conducted also huge.
15. Sucrose, amino acids
16. Vitamins, plant growth substances like ethylene/ some substances applied to plants/ organic substances like K^+, PO_4^{3-} are conducted in phloem translocation.

$51 \times 3 = 153$ marks, Max = 150 marks