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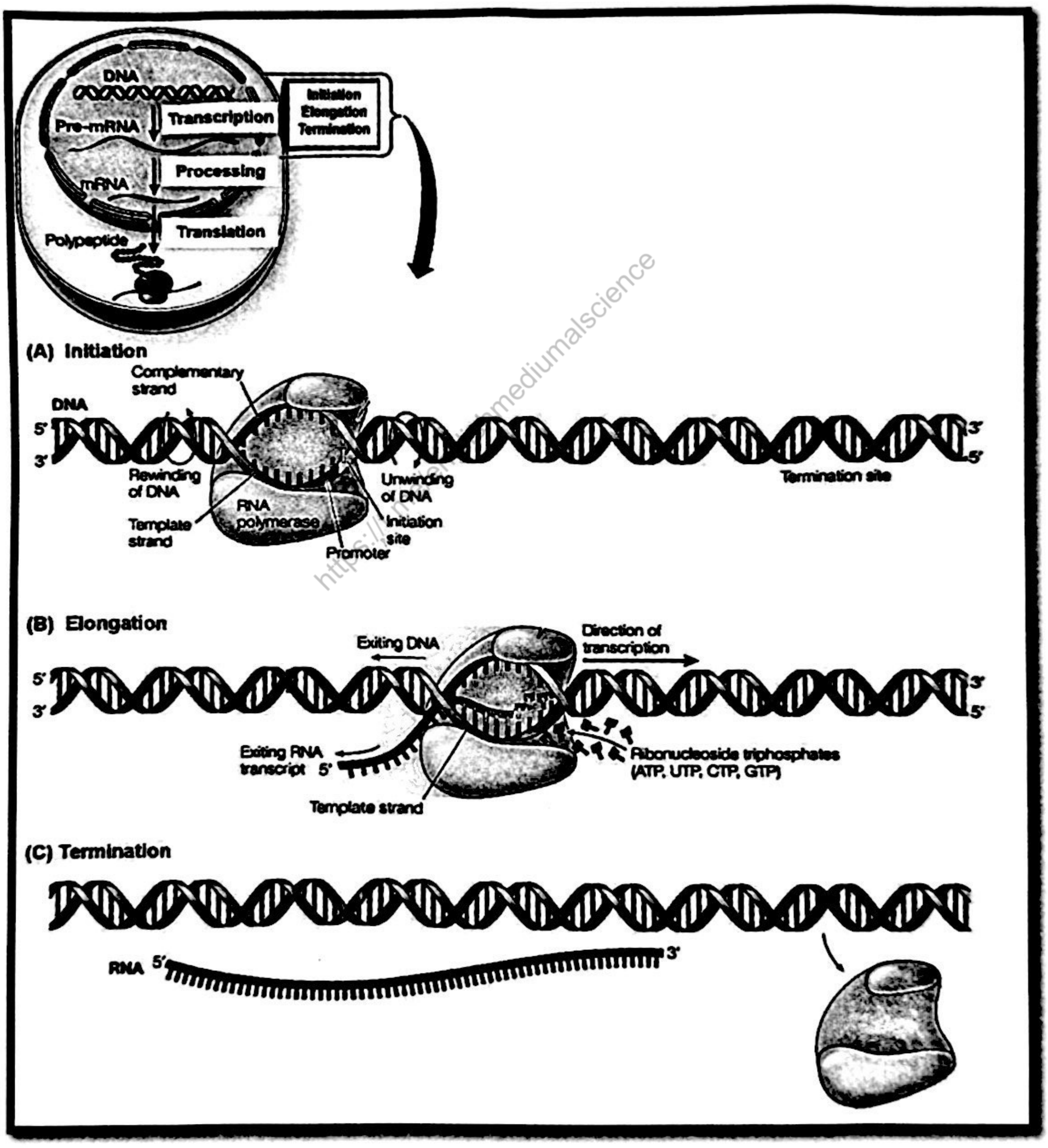
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Department of Examinations – Sri Lanka

G.C.E. (A/L) Examination – 2024

09 – Biology

Marking Scheme



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This has been prepared for the use of marking examiners. Some changes would be made according to the views presented at the Chief Examiners' meeting.

Amendments to be included

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G.C.E. (A/L) Examination - 2024
09 - Biology
Distribution of Marks

- Paper I - 1 x 50 = 50

Paper II

Part A - Structured Essay (Answer all four questions)

Question No. 01	-	100
Question No. 02	-	100
Question No. 03	-	100
Question No. 04	-	100

100 x 4 = 400

Part B - Essay (Answer four questions only)

Question No. 05	-	150
Question No. 06	-	150
Question No. 07	-	150
Question No. 08	-	150
Question No. 09	-	150
Question No. 10	-	150

150 x 4 = 600

Total Marks = 400 + 600 = 1000

Paper II Marks = 1000

Paper I Marks = 50

Final Marks $= 50 + \left(\frac{1000}{20}\right)$

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Common Techniques of Marking Answer Scripts.

It is compulsory to adhere to the following standard method in marking answer scripts and entering marks into the mark sheets.

1. Use a red color ball point pen for marking. (Only Chief/Additional Chief Examiner may use a mauve color pen.)

2. Note down Examiner's Code Number and initials on the front page of each answer script.

3. Write off any numerals written wrong with a clear single line and authenticate the alterations with Examiner's initials.

4. Write down marks of each subsection in a △ and write the final marks of each question as a rational number in a □ with the question number. Use the column assigned for Examiners to write down marks.

Example: **Question No. 03**

(i) ..... √ $\frac{4}{5}$

(ii) ..... √ $\frac{3}{5}$

(iii) ..... √ $\frac{3}{5}$

03 (i) $\frac{4}{5}$ + (ii) $\frac{3}{5}$ + (iii) $\frac{3}{5}$ = $\frac{10}{15}$

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MCQ answer scripts: (Template)

1. Marking templets for G.C.E.(A/L) and GIT examination will be provided by the Department of Examinations itself. Marking examiners bear the responsibility of using correctly prepared and certified templates.

2. Then, check the answer scripts carefully. If there are more than one or no answers Marked to a certain question write off the options with a line. Sometimes candidates may have erased an option marked previously and selected another option. In such occasions, if the erasure is not clear write off those options too.

3. Place the template on the answer script correctly. Mark the right answers with a '√' and the wrong answers with a '0' against the options column. Write down the number of correct answers inside the cage given under each column. Then, add those numbers and write the number of correct answers in the relevant cage.

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Structured essay type and assay type answer scripts:

1. Cross off any pages left blank by candidates. Underline wrong or unsuitable answers. Show areas where marks can be offered with check marks.

2. Use the right margin of the overland paper to write down the marks.
3. Write down the marks given for each question against the question number in the relevant cage on the front page in two digits. Selection of questions should be in accordance with the instructions given in the question paper. Mark all answers and transfer the marks to the front page, and write off answers with lower marks if extra questions have been answered against instructions.
4. Add the total carefully and write in the relevant cage on the front page. Turn pages of answer script and add all the marks given for all answers again. Check whether that total tallies with the total marks written on the front page.

Preparation of Mark Sheets.

Except for the subjects with a single question paper, final marks of two papers will not be calculated within the evaluation board this time. Therefore, add separate mark sheets for each of the question paper. Write paper 01 marks in the paper 01 column of the mark sheet and write them in words too. Write paper II Marks in the paper II Column and wright the relevant details.

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ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය / க.பொ.த. (உயர் தர)ப் பரீட்சை - 2024

විෂය අංකය பாட இலக்கம்	09	විෂයය பாடம்	Biology

ලකුණු දීමේ පටිපාටිය / புள்ளி வழங்கும் திட்டம்

I පත්‍රය / பத்திரம் I

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

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✪ **විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :**

එක් පිළිතුරකට / ஒரு சரியான விடைக்கு ලකුණු 01 බැගින් / புள்ளி வீதம்

මුළු ලකුණු / மொத்தப் புள்ளிகள் — × 50 = 50

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Part A - Structured Essay

1. (A) (i) State the function of each of the following proteins.

(a) Serum albumin : Transport fatty acids ..... **01 pt**

(b) Ovalbumin : Storage in eggs ..... **01 pt**

(ii) (a) Why are amino acids considered as amphoteric molecules?

Because they have an alkaline (amino) group and an acidic (carboxyl) group within the(same)molecule / because they have an alkaline nature and acidic nature in the(same)molecule. **01 pt**

(b) State two differences between animal fats and plant fats.

- Animal fats do not contain double bonds / made up of saturated fatty acids while plant fats contain (one or more) double bonds / made up of unsaturated fatty acids.
- Animal fats are solid at room temperature while plant fats are liquid at room temperature **02 pts**

(iii) (a) Name a protein with alpha helix structure, which is a component of intermediate filaments of the animal cytoskeleton.

Keratin **01 pt**

(b) Name a compound present in the cell walls of both bacteria and cyanobacteria but not in the cell walls of archaebacteria.

Peptidoglycan **01 pt**

(iv) (a) What acts as the object for the eyepiece lens when a specimen is observed through a compound light microscope?

The (magnified) image of the specimen produced by the objective (lens) **01 pt**

(b) What is used to stain specimens for observation through the transmission electron microscope?

Heavy metals examples for heavy metals are not accepted **01 pt**

(v) State two functions carried out by both rough and smooth endoplasmic reticulums and two functions carried out only by smooth endoplasmic reticulum (SER).

(a) By both :
- Synthesis of phospholipids /Production
- Production of transport vesicles

02 pts

(b) By SER only :
- Detoxification
- Synthesis of oils / steroids
- Storage of Ca^{2+}(ions) /Calcium ions
- Metabolism of carbohydrates (any two)

02 pts

(B) (i) Name the most abundant glycoprotein in the extracellular matrix of animal cells.

Collagen **01 pt**

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(ii) (a) Name the subcellular component that carries out each of the following activities in cells.

Transporting residue material out of the cell : Lysosomes

Cytoplasmic streaming : Cytoskeleton 02 pts

(b) Which organelle in plant cells is involved in the formation of the cell plate during cytokinesis?

Golgi apparatus 01 pt

(iii) During which phase of mitosis are the chromosomes located at the middle of the cell?

Metaphase 01 pt

(iv) Name two cell types in the human body that are at G_0 phase.

Nerve cells, Muscle cells (Any type of muscle cell Skeletal / cardiac / Smooth) / Neurons 02 pts

(v) (a) State the precise site at which each of the following is carried out during cellular respiration.

Breakdown of glucose to pyruvate : Cytosol

Production of oxaloacetate : Matrix of mitochondria 02 pts

(b) Name the final hydrogen acceptor in each of the following.

Ethyl alcohol fermentation : Acetaldehyde

Lactic acid fermentation : Pyruvate 02 pts

(C) (i) (a) State what is meant by cofactors of enzymes.

Non proteinaceous compounds that are essential for the catalytic activities of certain enzymes (entire definition should be there) 01 pt

some enzymes ✓

(b) Name two inorganic cofactors.

Zn^{2+}, Fe^{2+}, Cu^{2+}, K^{+} (any two) Can write in words 02 pts

ex zinc ions, ferrus ions, cupric ions

(ii) (a) How does ADP carry out allosteric regulation of an enzyme?

- Acts as an allosteric activator
- Binds to the regulatory / Allosteric site of the enzyme (and stimulates the production of ATP)
- Stabilises the shape with functional ~~activities~~. active sites 03 pts

(b) Name a solution that can be used as an indicator to demonstrate amylase activity on starch.

- I_2 solution
- I_2 / KI (I_2 - KI) (any one) 01 pt

(iii) (a) Where are the photosystems located in chloroplasts?

Thylakoid membranes / Granna 01 pt

(b) State the wave lengths of light absorbed by chlorophyll-a molecules in photosystem I and photosystem II.

Photosystem I : 700 nm

Photosystem II : 680 nm 02 pts

Unit must be there. No units no marks

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(iv) **State three ways by which the cyclic electron flow differs from the linear electron flow in the light reaction of photosynthesis.**

- Occurs in PS I only.
- NADPH is not produced / only ATP is produced.
- Oxygen is not released. **03 pts**

O_2 • Splitting of water / Hydrolysis does not occur

(v) **Photosynthetic plants were highly abundant in the Phanerozoic eon. Name the three eras of the Phanerozoic eon.**

Palaeozoic, Mesozoic , Cenozoic **03 pts**

40 pts x 2½ marks

Total = 100 marks

2. (A) (i) State five features of organisms of domain Eukarya that are common to all or some organisms of domain Archaea.

- Presence of histones associated with DNA
- Presence of introns in genes
- Initiator amino acid in protein synthesis is methionine
- Presence of several kinds of RNA polymerases
- Growth is not inhibited by antibiotics / streptomycin / chloramphenicol
- Unbranched hydrocarbons in membrane lipids (any five) **05 pts**

(ii) **State three substances other than cellulose that are present in the cell walls of some protists and name an organism/group of organisms that contains each of these substances.**

* Give marks only if substance is given

Substance		Organism/Group of organisms	
Alginic acid	-	*Sargassum* / Brown algae.	02 pts
Pectin	-	Diatoms	02 pts
Silica	-	Diatoms	02 pts

} Do not have to repeat diatoms if they have written pectin & silica together.

(iii) **What are the structures that form the ovule of seed plants?**

Megaspore , Megasporangium , Integument **03 pts**

* Do not deduct for wrong answers.

(iv) **State five characteristic features of phylum Nematoda that can be observed when a specimen of *Ascaris* (round worm) is examined externally.**

- Cylindrical body with tapering ends
- Sensory papillae in the anterior end
- No segmentation / unsegmented body
- Presence of excretory pores in the body wall
- No special locomotory structures
- Bilateral symmetry
- No (distinct) cephalization (any five) **05 pts**

(B) (i) State two functions of hair like trichomes.

- Reduce water loss only reduce not prevent.
- Reflect excess light **02 pts**

(ii) What form the symplastic route of radial transport in plants?

- Cytosol
- Plasmodesmata **02 pts**

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(iii) What is the form of intake of sulphur into plants?

SO_4^{2-} / Sulphate ions **01 pt**

(iv) Why do land plants carry out internal fertilization?

To prevent desiccation of gametes **01 pt**

(v) What are known as statoliths that help to detect gravity by vascular plants?

Specialized plastids containing (dense) starch grains **01 pt**

(C) (i) State the structural features of a skeletal muscle tissue that can be observed under the light microscope.

- Multinucleated / Many nuclei per cell
- Striated / Striations
- Long cells
- Cylindrical cells (any three) if says long or cylindrical

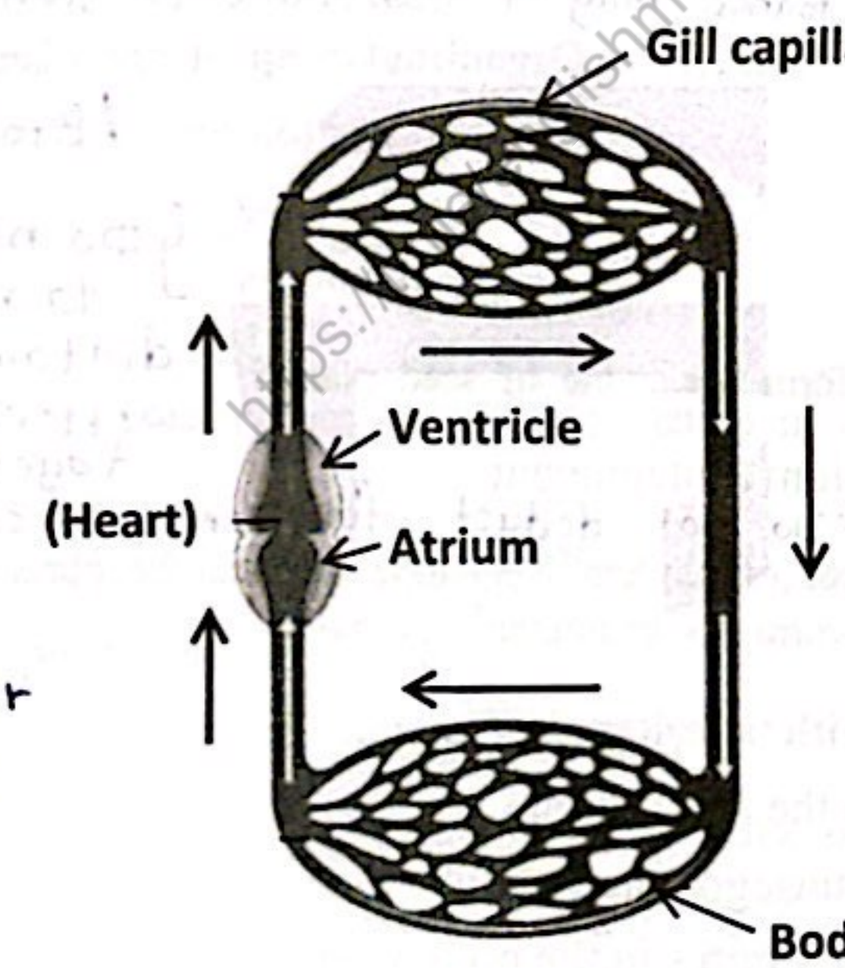
03 pts

(ii) State the functions performed by tongue in the nutrition of humans. -no marks

- Mixing food with saliva
- Making food bolus
- Facilitating swallowing
- Pushing the food bolus into the posterior part of the oral cavity and into the pharynx

05 pts

(iii) Using a labelled diagram, indicate the direction of blood flow in the single circulation of fish.



* atrium / ventricle should be there.
* Gill capillaries / Body capilleries should be there.

Labelled diagram **01 pt**

(No marks for flow chart)

Unlabelled / partially labelled / incorrect -

Direction of blood flow **01 pt**

* No marks for flow chart-

(iv) How do the fluids and proteins lost during capillary exchange of substances return to blood in humans?

Via two large lymphatic ducts which drain into (two) veins at the base of neck **02 pts**

(v) (a) Indicate the correct pathway through which erythrocytes in the inferior vena cava reach the aorta.

(Inferior vena cava) → Right atrium → Right ventricle → Pulmonary artery
↓
(Lung capillaries)
↓
(Aorta) ← Left ventricle ← Left atrium ← Pulmonary veins

Instead of arrows comas can be written.

01 pt

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(b) Why have respiratory pigments evolved in complex animals?

To transport oxygen from respiratory surface to tissues / organs as oxygen is less soluble in watery medium / blood 01 pt

40 pts x 2½ marks
Total = 100 marks

3. (A) (i) (a) Why are respiratory structures needed for animals?

1) Gas exchange through body surface is not adequate to fulfil the energy requirements as the body size is increased and 2) becomes complex. 02 pts

(b) State the difference between the vital capacity and total lung capacity of humans.

Vital capacity is the maximum volume of air which can be inhaled and exhaled whereas total lung capacity is the maximum volume of air that lungs can hold. 01 Pt

total of all lung capacities is not accepted. ~~02 pts~~

Removed due to translation error T. paper.

(ii) Name two types of 'antigen presenting cells' in humans. No Marks

(iii) (a) State the advantage of excreting nitrogenous waste as ammonia for many aquatic invertebrates.

Energy cost for production (for excretion) is less (compared to other wastes) 01 pt

(b) What is the process by which most water is reabsorbed in the nephrons of humans?

Osmosis 01 pt

(c) State the location at which the nephridia of annelids open internally.

Coelom 01 pt

(iv) (a) What is chronic kidney disease?

Gradual loss of kidney function over time 01 pt

(b) Name the endocrine disorder that would lead to kidney failure in humans.

Diabetes / Diabetes mellitus / Diabetes incipidus 01 pt

(v) (a) State how the nervous system of arthropods is organised.

Brain and ventral nerve cord with segmented ganglia 01 pt

(b) From which part of the human embryonic brain does each of the following structures originate?

Pons Varolii : Hind brain

Pineal body : Forebrain 02 pts

(B) (i) (a) Where are the nerve cell bodies located in the cerebrum of man?

Cerebral cortex / Superficial part / Superficial region 01 pt

(b) Write in correct sequence, the pathway of transmission of impulses in a typical reflex arc in man.

Sensory receptor → afferent / sensory neuron → Inter neuron → Effector/tissue/organ ← Efferent/motor neuron 01 pt

Comas also accepted

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(c) Name the disorder of the human nervous system that is associated with distorted perception of reality.

Schizophrenia **01 pt**

(ii) (a) State the arrangement of cells in the human retina starting from the innermost cell layer.

bipolar cells both should be there

Ganglion cells, bipolar cells / bipolar neurons, photoreceptors / rods and cones, pigmented (epithelial) cells. **01 pt**

epithelium

(b) How is a single image perceived in binocular vision in humans?

1) Due to fusion of left, middle and right of visual field images from two eyes in the occipital lobe 2) of cerebrum

(if occipital lobe is not mentioned consider as **01 pt**) **02 pts**

(iii) What is perceived as sound in hearing?

Nerve impulses generated as a result of transduction of pressure waves produced in the surrounding air by vibrating objects **01 pt**

(iv) (a) What is an endocrine gland?

Ductless gland consisting of (group of) specialized cells which secrete hormones / chemical messengers **01 pt**

(b) State the reasons for hypothyroidism in humans.

Triiodothironin / T_3 & Thyroxin

- Insufficient secretion of thyroid hormones / T_3 and T_4 (both should be written
- Lack of TSH production (by anterior pituitary)
- Iodine deficiency (any two) ~~02 pts~~ 03 pts

(v) (a) How does luteinizing hormone promote spermatogenesis in man?

1) By stimulating Leydig cells to produce testosterone and 2) other androgens **02 pts**

(b) What are the main structural changes that occur in the uterus of a mature, normal woman during the uterine cycle in preparation for the arrival of fertilised ovum?

- Thickening of the endometrium
- Enlarging arteries in the endometrium
- Growth of endometrial glands (Uterine / uterine wall – is not accepted) **03 pts**

(C) (i) (a) Name the two hormones responsible for the preparation of uterus for receiving the fertilised ovum.

Progesterone, Estradiol / Estrogen **02 pts**

(b) What is the foetal membrane associated with the development of urinary bladder in humans?

Allantois **01 pt**

(ii) Name a sexually transmitted infection in man caused by a virus other than HIV.

Genital Herpes **01 pt**

(iii) (a) Name a group of animals that move by taking water into the body and squirting it out in bursts.

Squids **01 pt**

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(b) What is the role of Ca^{2+} in shortening of sarcomeres in the skeletal muscles?

(Contribute to) exposing myosin binding sites on actin (molecules) **01 pt**

(iv) (a) State the functions of sinuses in the human skull.

- Provide resonance to voice
- Reduce weight of skull **02 pts**

(b) What is the structural arrangement in the upper limb of human which permits power grip?

(Hinge) joints between metacarpels and phalanges **01 pt**

(c) Name the joint that bears the body weight of the human when standing.

Hip joint /(ball and socket) joint formed by head of femur with acetabulum (of the hip bone of pelvis) **01 pt**

(v) (a) What is a gene?

Basic unit by which genetic information is passed from parents to offspring / Nucleotide sequence of DNA at a specific locus on a chromosome / Basic physical and functional unit of inheritance **01 pt**

(b) What is known as mutation breeding in crop plants?

1) Inducing desirable mutations using chemical or 2) physical agents **02 pts**

↑ must

40 pts x 2½ marks

Total = 100 marks

4. (A) (i) Nucleotide sequence of a part of a DNA coding strand for a polypeptide and relevant amino acids are given in diagram X.

(a) Name the types of specific point mutations if nucleotide sequence of X is altered due to substitution as shown in diagrams Y and Z.

X : CGTTTTTTACCTATA
Arg Phe Leu Pro Ile

Y : CGTTTTTCACCTATA
Arg Phe Ser Pro Ile

Z : CGTTTTTTGCCTATA
Arg Phe Leu Pro Ile

Y : Missense mutation

Z : Silent Mutation **02 pts**

(b) Write the mRNA nucleotide sequence corresponding to the part of the DNA coding strand given in X.

CGUUUUUUACCUAUA **01 pt**

T is replaced by U

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(ii) (a) **What is meant by vector in gene technology?**

Vehicle that carries the required DNA into a host for multiplication ~~or~~/ cloning. **01 pt**

(b) **Give two examples for cloning vectors.**

Plasmid, Bacteriophage , YACs / Yeast artificial chromosome -s. Any **02 pt**

(iii) **Why is recycling of materials in an ecosystem important?**

Because the materials available for living organisms are limited/After the death of an organism, materials should be made available to other organisms **01 pt**

(iv) **Name three biomes where the temperature reaches 35°C or above.**

Desert, Chaparral, Temperate broad leaf forest. **03 pts**

(v) (a) **What is meant by ethical value of biodiversity?**

- All living beings have the right to live
- Humans/we have no right to decide which species/organisms should exist **02 pts**

(b) **What is the purpose of Kyoto protocol?**

Reduction of emission of greenhouse gases / GHGs **01 pt**

(B) (i) **State the specific physical method that can be used to sterilize each of the following.**

(a) Hospital waste : Incineration **01 pt**

(b) Air in operating theatres : UV radiation / Ultraviolet radiation **01 pt**

(c) Enzyme solutions with microbial cells larger than 0.45 µm :

Membrane filtration **01 pt**

(d) Inoculation loops : Direct flaming **01 pt**

(ii) **Name a chemoautotrophic bacterial genus that oxidises NO_2^- to NO_3^- in soil.** If Sp. no marks

Nitrobacter Spellings should be correct. Should be underlined. **01 pt**

(iii) **State two modes of respiration present in both mycoplasma and unicellular protists.**

Aerobic , Facultative anaerobic / obligatory anaerobes - ~~no marks~~ **02 pts**

(iv) **Name a simple stain used to observe the cellular shape of bacteria.**

Methylene blue/ Crystal violet / Safranin **01 pt**

(v) **If a student is provided with two sets of petri dishes with sterile solidified nutrient agar and a phenol solution, write in correct sequence the procedure that should be followed to test the effect of phenol on microorganisms in air.**

All or none
4 or 0

- Expose both sets of nutrient agar plates / petri dishes to air for (about) 10 minutes.
- Close one set of petri dishes after rinsing with phenol.
- Close / keep closed the other set.
- Incubate for 24-48 hours and observe for number of colonies (in both sets)

(All 4 points should be in correct order. otherwise no marks) **04 pts/ 0 pt**

2nd & 3rd bullet points can be interchanged. for any point

(C) (i) (a) **What is the role of methanotroph microorganisms present in oceans?**

Consumption of methane before it reaches the atmosphere / Consumption (80% of) methane generated in the ocean **01 pt**

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(b) How are mycorrhizae beneficial to plants?

- Increasing the area of nutrient / mineral / water uptake.
- Reaching small pores in soil where roots cannot reach.
- Increasing the uptake of immobile nutrients / P / Zn / Cu **03 pts**

(ii) (a) Name two species of genetically modified microorganisms used to produce human insulin.

Escherichia coli E. coli ← not accepted
Saccharomyces cerevisiae S. cerevisiae **02 pts**

Spellings should be correct. Should be underlined.

(b) State the cause for algal blooms seen in some freshwater bodies.

Accumulation of excessive amounts of phosphates and nitrates into water bodies.
(If only eutrophication is written consider as **01 pt.**)

02 pts

(iii) (a) Why is activated carbon used in some drinking water treatment plants?

To remove toxic chemicals / toxic substances. **01 pt**

(b) What does the presence of coliform bacteria in drinking water indicate?

- Fecal contamination / fecal pollution
- Potential Contamination by / presence of pathogenic microorganisms

(any one) **01 pt**

(iv) (a) Name a type of microorganism that cause spoilage of each of the following foods.

Food stored at 4°C : Psychrophilic bacteria
Food containing sugar : Osmophilic / Xerophilic molds / yeast **02 pts**

molds

(b) How does *Aspergillus flavus* cause food intoxication in humans?

By producing Aflatoxins **01 pt**

(v) State two uses of nano device sensors in nanomedicine.

- To monitor blood pressure / Measure / Detect / Determine / Test.
- To monitor blood oxygen levels
- To monitor hormone concentrations (Any two) **02 pts**

40 pts x 2½ marks
Total = 100 marks

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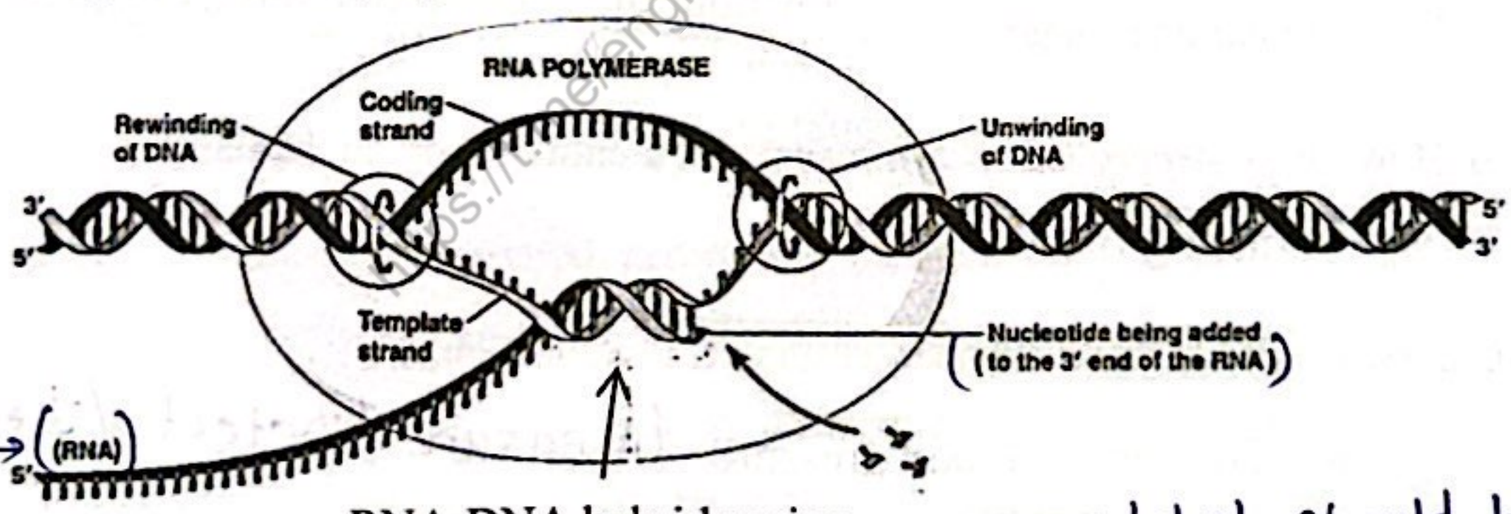
Paper II : Part B - Essay

5. (a) Describe the transcription process in polypeptide synthesis of eukaryotes.

(b) Explain the structure of the plasma membrane of a living cell.

(a)

1. This is the initial process of polypeptide synthesis.
2. During this process nucleotide sequence of DNA is copied into mRNA.
3,4,5. There are three steps in this process. They are initiation, elongation and termination. ← found at any place give marks
6. Initiation occurs at a specific site/promoter site/promoter.
7. This site includes a transcription initiation site and other nucleotides.
8. One DNA strand acts as the template (for transcription).
9,10. RNA polymerase/polymerizing enzyme binds to the promoter site, in correct orientation and
11. unwinds the two DNA strands.
12. (During elongation) RNA polymerase starts adding/ adds complementary ribonucleotides on/against the DNA template
13. in 5' to 3' direction.
14. RNA polymerase moves forward and
15,16,17. DNA double strand unwinds, exposing DNA template, allowing pairing with ribonucleotides.
18. This is continued until RNA polymerase reaches the (transcription) termination site.
19. Two DNA strands rewind at the other end.
(When new mRNA/pre mRNA is synthesized, RNA polymerase releases the DNA template / RNA polymerase falls off).



no need to mark

every label should be there.

Fully labeled correct diagram: 5 marks

even if one label is missing. → **Partially labeled correct diagram: 3 marks**

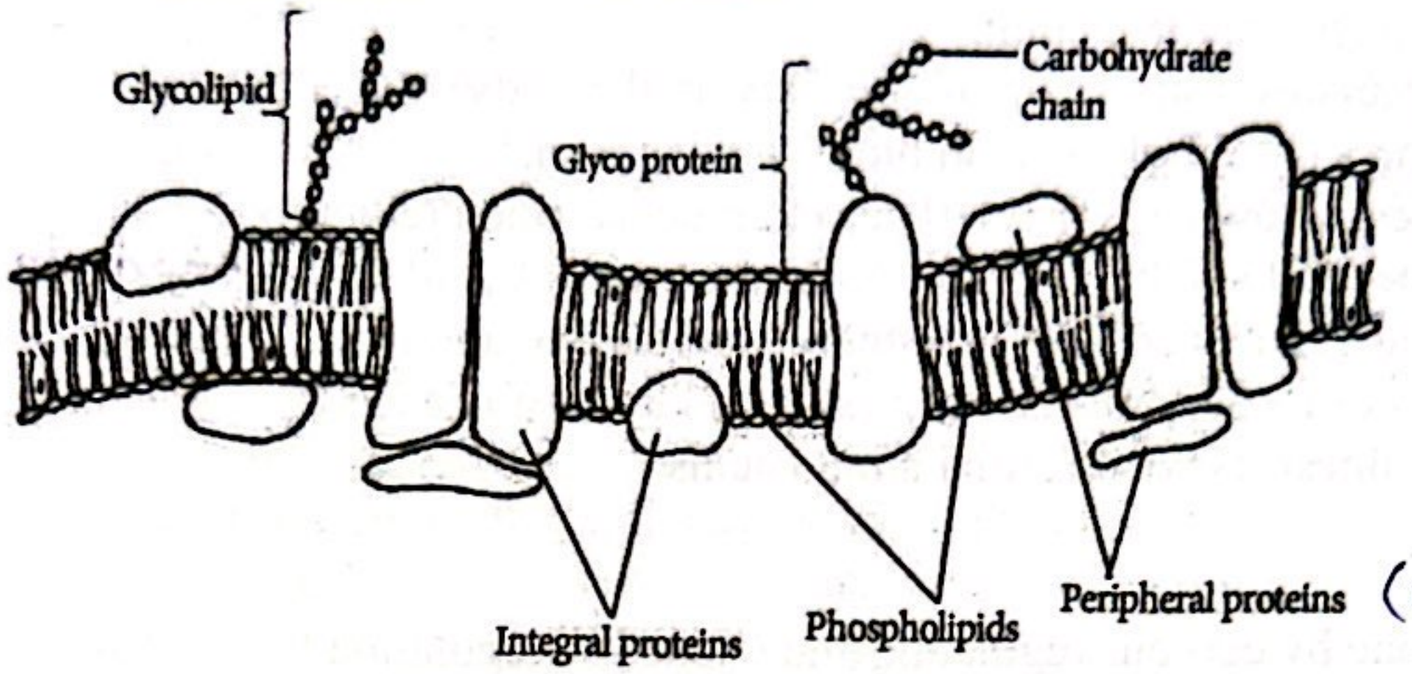
Unlabeled diagram: 0 marks

(b)

1. Structure of plasma membrane is explained by fluid mosaic model.
2. Plasma membrane is mainly made up of phospholipids and proteins.
3. Phospholipids are arranged in a bilayer and
4, 5. have (hydrophilic) heads which face outward and
6,7. (hydrophobic) tails which face inward. / lipid bilayer
8,9. Protein molecules/integral proteins are embedded in the membrane / lipid bilayer randomly.
10,11. Some (integral proteins) penetrate all the way through the membrane and they are called transmembrane proteins.
12. (Most of) the transmembrane proteins have (hydrophilic) channels.

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13. Some (integrated) (integral) proteins penetrate only part of the way into membrane/partially embedded.
14,15,16. Some proteins are not embedded (in the lipid bilayer) and are loosely bound; they are called peripheral proteins
17,18. (Short branched) carbohydrates bind to proteins and lipids and
19,20. form glycoproteins and glycolipids.



(one arrow is enough)

Fully labeled correct diagram: 5 marks
Partially labeled correct diagram: 3 marks
Unlabeled diagram: 0 marks

19+20 = 39 points
Any 35 points x 4 = 140 marks
Two diagrams: 5x2 = 10 marks
Maximum 150 marks

6. Describe the defence mechanisms shown by plants against pests and pathogens.

1. Some defence mechanisms already exist in plants.
2. Some are induced (by pathogens and pests).
3, 4. These are structural and chemical mechanisms.
Defence mechanisms include the following:
5, 6. Presence of epidermis with tightly packed cells;
7. Presence of cuticle/wax layers;
8, 9. Amount and quality of wax;
10, 11. Structure and thickness of epidermal cell walls;
12,13,14. Size, location and shape of stomata;
15,16,17. Presence of pricks, thorns, and trichomes;
18, 19. Formation of cork and abscission layer;
20, 21. Containing waxy (hydrophobic) material known as suberin;
22. Presence/deposition of resins (in heart wood);
23. Morphological / structural changes in the cell wall;
24. Presence/production of secondary metabolites
25, 26. such as toxic compounds, e.g. cyanogenic glycosides,
27, 28. Alkaloids e.g. nicotine,
29, 30. Phenolic compounds, e.g. flavonoids,
31, 32. Lignin, tannin,
33,34,35. Terpenoids e.g. azadiractin, lectin.
36,37,38. Production of enzymes that degrade fungal cell walls or damage insect organs.

Any 37 points x 4 =148 marks
If more than 37 points written add 2 marks
Maximum 150 marks

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7. (a) Briefly describe the role of liver in human nutrition.

(b) Explain how digestion is regulated in man.

(a)

= Produces

1, 2. Secretes / synthesizes bile which contains bile salts.
3, 4. Helps in digestion and absorption of fats
5. through emulsification.
6. Regulates distribution of nutrients (in the body).
7, 8. Stores excess glucose in blood as glycogen.
9. Breaks down glycogen (back) to glucose when required.
10. Stores fat soluble vitamins / vitamins A, D, E and K, ← need to write all 4
11,12. (some) water soluble vitamins / vitamin B_{12} and iron (Fe) / copper (Cu). ← copper ion
13,14. Stores fat and breaks down (stored) fat when needed.
15. Synthesizes nonessential amino acids.

(b)

1,2. Done by nervous regulation and endocrine regulation
3. Nervous regulation is done through nervous reflexes.
4. Examples: When food reaches mouth, saliva is secreted;
5. When food reaches stomach, its wall is stretched,
6,7. stimulating the release of gastric juice and churning
8. and release of gastrin. / Secretion ✓
9. Gastrin stimulates production of gastric juices.
10,11. Fatty acids and/or amino acids in chyme
12,13,14. stimulates/triggers release of cholecystokinin and secretin from duodenum.
15,16. Cholecystokinin stimulates/triggers release of bile from gall bladder
17,18. and digestive enzymes from pancreas. Secretion
19.20. Secretin stimulates release of HCO_3^- from pancreas.
21. When chyme is rich in fat, digestion in stomach slows down due to
22,23. high levels of cholecystokinin and secretin
24,25. which inhibit secretions of gastric juice and peristalsis.

15 + 25 = 40 points
Any 37 points X 4 =148 marks
If more than 37 points written add 2 marks
Maximum 150 marks

8. (a) Briefly describe separately the major changes that take place in the human foetus during second and third trimesters of pregnancy.

(b) Explain modern reproductive technology that can be used in resolving infertility problems in humans.

(a)

Second trimester

1. Organ systems completely developed.
2. Foetus assumes distinctively human features.
3. Foetus grows to (about) 30 cm in length.
4. Foetus is very active.

Third trimester

5. Foetus grows rapidly.
6. Most organ systems become fully functional.
7, 8. Foetus grows to (about) 50 cm in length, and weighs (about) 3-4 kg.
9, 10. Foetus fills the space within the uterus, (and therefore) foetal activity / movement decreases.

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(b)

1,2,3. Modern reproductive technology includes hormone therapy, surgery, and assisted reproductive technology. *Anywhere in the answer if they have given gi
4,5. Hormone therapy is used to increase sperm production in infertile males, and egg production in infertile females. marks
6,7. Ducts in the reproductive system which are improperly formed, or blocked are corrected by surgery.
8.9. In vitro fertilization / IVF is a series of procedures used to assist with / allow conception (of a child)
The IVF process involves
10,11. removal of oocyte(s) from an ovary, and obtaining sperm (from a male) and singular/plural
12,13. allow fertilization, under laboratory conditions.
14,15. Fertilized eggs are incubated, until they reach (at least) 8 cells and
16,17. embryos are implanted in a woman's uterus/transferred to woman's uterus for implantation, for continuation of its development.
18. As acrosome reaction has to take place
19,20. thousands of sperm / 50000-100000 sperm are needed per one oocyte, to fertilize one egg/to achieve fertilization.
21,22. Intra-cytoplasmic Sperm Injection/ICSI, is a method used to address male infertility.
23, 24. This is done if mature sperm are defective, or low in numbers (in such males),
25, 26,27. Whole sperm, or a spermatid nucleus is injected (directly) into the cytoplasm of an oocyte, which is removed from a woman's ovary.
28,29. Fertilized egg is returned to the (woman's) uterus, for implantation.
30. (ICSI) needs only one selected sperm per oocyte.

10 + 30 = 40 points
Any 37 points X 4 =148 marks
If more than 37 points written add 2 marks
Maximum 150 marks

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9. (a) Explain the Darwin-Wallace theory of evolution.

(b) Briefly discuss the factors that contribute for global warming.

(a)

1,2. It is based on observations and their interpretations.
Observations:
3. Populations vary in (inherited) traits/characters. / Members of a population show (genetic) variations.
4. More offspring than the environment can accommodate are produced (overproduction).
Interpretations:
5,6. Certain traits are capable of better survival/have high potential for survival and reproduction.
7. They produce more offspring and
8,9. the abundance of favourable characters in the population is increased (over generations), due to favourable variations / variations in abilities for survival and reproduction.
10,11,12. Favorable characters are protection/escaping from predators, tolerating physical, and stress conditions,
13,14. obtaining food, resistance to disease,
15,16. fertilization probability, and number of offspring produced.

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17. There is competition (among individuals) and
18. fittest individuals survive/survival of the fittest.
19. Natural selection of favourable traits occurs.
20. (Hence) this theory is also termed as the theory of natural selection.

Abbreviation also accepted

(b)

1. Main reason/factor is the emission of greenhouse gases (GHGs) (into atmosphere) / increase in atmospheric concentration of GHGs.
2. This happens due to emission of CO_2 / increase in CO_2 content in atmosphere
3,4,5. due to burning of fossil fuels, solid waste and forests.
6. Emission of CH_4 / increase in CH_4 content
7. due to anaerobic decomposition of manure / waste management,
8,9. cattle farming / enteric fermentation and paddy cultivation;
10. Emission of N_2O / increase in N_2O content
11. due to fertilizer production / fertilizer use,
12. nitric acid production, and
13. fossil fuel combustion in internal combustion engines. or
14. Emission /increase in content of industrial gases / PFCs / perfluorocarbons / HFCs / Hydrofluorocarbons / SF_6 / Sulphur hexafluoride; Any one example.
15. Increase in /suspension of black carbon particles in lower atmosphere
16. due to incomplete combustion of fossil fuels/other organic matter.
17. Reduction of carbon sequestration / removal of CO_2 from atmosphere
18. due to deforestation / reduction in vegetation cover,
19,20. destroying of phytoplankton, due to depletion of ozone layer.

20 + 20 = 40 points
Any 37 points X 4 =148 marks
If more than 37 points written add 2 marks
Maximum 150 marks

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10. Write short notes on the following.

(a) Human sex linked characteristics

(b) Prions

(c) Applications of stem cells

(a) Human sex linked characteristics

1. These are the characters carried on / expressed by sex chromosomes /X and Y chromosomes.
2. Characters expressed by/carried on X chromosomes are X linked characters and
3. those genes are (called) X-linked genes.
4. Characters expressed by/carried on Y chromosome are Y linked characters and
5. those genes are (called) Y-linked genes.
6. In females X-linked recessive characters / disorders are expressed (only) in homozygous condition and
7. In males, even one X-linked recessive allele is expressed. /in males x linked recessive
8,9. Examples are red green colour blindness and haemophilia. character is expressed because they have (only) one x chromosome
10. In red green colour blindness, perceiving differences in red and green colour is difficult.
11,12. In haemophilia, blood clot formation (during an injury) is delayed, due to absence of (one or more) proteins required for blood clotting.
13,14. Y linked characters/ disorders are transferred and expressed only in males.
15. e.g. inability to produce normal sperm

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(b) Prions

1. Size is smaller than viruses.
2, 3. Prions are proteinaceous, infectious particles.
4. They do not have nucleic acids.
5. They can replicate with the help of a host's gene that codes the prion protein.
6,7,8. Prions cause neurological diseases in some birds and mammals.
9. Example: Transmissible Spongiform Encephalopathies (TSEs) / developing large vacuoles in brain giving sponge like appearance,
10. Mad cow disease,
11. Creutzfeldt-Jakob Disease (CJD) (in man).
12. Prions are involved in human to human disease transmission which occurs due to
13. transfusion of infected blood and
14. (prion) infected organ/tissue transplantation.

(c) Applications of stem cells

1. (Growing healthy) stem cells are used to identify/understand birth defects and
2. to treat birth defects.
3. Used in genetic manipulation (for delivering genes) / in gene therapy.
4. creating whole tissues in the laboratory/tissue engineering and
5. repairing damaged tissues/ heart muscles and
6. repairing damaged spinal neurons.
7. Blood stem cells / haemopoietic stem cells (taken from the bone marrow of a healthy immunologically capable donor) are used to replenish bone marrow in leukemia patients.
8,9. These are used to treat Stroke, Heart disease,
10,11. Parkinson disease, Alzheimer's disease, and
12. Diabetes ~~etc.~~

15 +14+12 = 41 points
Any 37 points X 4 =148 marks
If more than 37 points written add 2 marks
Maximum 150 marks

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