ICSE Class 10 Biology Specimen Paper 1

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Maximum Marks: 80 | Time Allowed: Two hours | Reading Time: 15 minutes

Section A is compulsory. Attempt any four questions from Section B.

General Instructions

Write your answers on the separate answer paper provided. The first 15 minutes are for reading the paper, and you may not write during that time. Marks for each question, or part of a question, are shown in brackets. Answer in your own words and keep to the point. Where a question asks for a diagram, draw it in pencil, make it large enough to label clearly, and label the parts with straight lines that do not cross.

SECTION A (40 Marks)

Attempt all questions from this Section.

Question 1 [15]

Choose the correct answer for each part. Write only the option you choose.

(i) The stage of mitosis in which the chromosomes arrange themselves along the equator of the cell is:

(a) prophase (b) metaphase (c) anaphase (d) telophase

(ii) The two chromatids of a chromosome are held together at the:

(a) telomere (b) chromomere (c) centromere (d) centriole

(iii) In a fully turgid plant cell the wall pressure is:

(a) zero (b) equal and opposite to the turgor pressure

(c) greater than the turgor pressure (d) twice the turgor pressure

(iv) Most of the water lost by a green plant escapes through the:

(a) lenticels (b) cuticle (c) stomata (d) hydathodes

(v) The light dependent reaction of photosynthesis takes place in the:

(a) stroma (b) grana (c) cytoplasm (d) cell wall

(vi) Oxygenated blood is carried from the lungs to the heart by the:

(a) pulmonary artery (b) superior vena cava (c) hepatic portal vein (d) pulmonary vein

(vii) The structural and functional unit of the kidney is the:

(a) nephron (b) neuron (c) alveolus (d) nephridium

(viii) The hormone that lowers the level of glucose in the blood is:

(a) glucagon (b) adrenaline (c) insulin (d) thyroxine

(ix) The junction across which an impulse passes from one neuron to the next is the:

(a) node of Ranvier (b) synapse (c) ganglion (d) dendrite

(x) Balance and posture of the body are controlled by the:

(a) cerebrum (b) medulla oblongata (c) hypothalamus (d) cerebellum

(xi) In human beings the sex of the child is decided by:

(a) the sex chromosome contributed by the father (b) the sex chromosome contributed by the mother

(c) the age of the mother (d) the number of autosomes in the zygote

(xii) A cross between a tall pea plant of genotype Tt and a dwarf pea plant gives offspring in the ratio:

(a) 3 tall : 1 dwarf (b) all tall (c) 1 tall : 1 dwarf (d) 1 tall : 3 dwarf

(xiii) A population pyramid with a very broad base indicates a population that is:

(a) declining (b) growing rapidly (c) stationary (d) ageing

(xiv) The gas that contributes most to the greenhouse effect is:

(a) oxygen (b) nitrogen (c) hydrogen (d) carbon dioxide

(xv) Eutrophication of a lake is brought about mainly by:

(a) an excess of nitrates and phosphates (b) an excess of dissolved oxygen

(c) a fall in the temperature of the water (d) the removal of aquatic weeds

Question 2 [10]

(i) State two ways in which a root hair is suited to the absorption of water. **[2]**

(ii) State one function of adrenaline and name the gland that secretes it. **[2]**

(iii) Name the organ in the human female in which fertilisation takes place and the organ in which the embryo develops. **[2]**

(iv) Give two differences between an artery and a vein. **[2]**

(v) State what is meant by biodegradable waste and give one example of it. **[2]**

Question 3 [15]

(i) State three ways in which the structure of a leaf is suited to photosynthesis. **[3]**

(ii) Draw a labelled diagram of a reflex arc and name, in order, the parts through which the impulse travels. **[3]**

(iii) State the significance of meiosis. Name the stage at which crossing over takes place and state why crossing over is important. **[3]**

(iv) In pea plants tallness (T) is dominant over dwarfness (t). Work out the cross between two heterozygous tall plants and give the phenotypic and the genotypic ratio of the offspring. **[3]**

(v) Explain the term population explosion and state two reasons for it in a developing country. **[3]**

SECTION B (40 Marks)

Attempt any four questions from this Section.

Question 4 [10]

(a) Define each of the following terms: chromatid, homologous chromosomes, diploid number. **[3]**

(b) Name the four stages of mitosis in the order in which they occur, and describe briefly what happens during anaphase. **[3]**

(c) State four differences between mitosis and meiosis. **[4]**

Question 5 [10]

(a) Define osmosis, diffusion and plasmolysis. **[3]**

(b) Describe the path taken by a molecule of water from the soil until it enters the xylem of the root. **[3]**

(c) Define transpiration. State two conditions that increase the rate of transpiration and two ways in which transpiration is useful to a plant. **[4]**

Question 6 [10]

(a) Write the balanced equation for photosynthesis and name the two stages into which the process is divided. **[3]**

(b) Describe an experiment to show that carbon dioxide is necessary for photosynthesis. **[3]**

(c) Define tropism. Name the hormone responsible for phototropism and explain how a shoot bends towards light coming from one side. **[4]**

Question 7 [10]

(a) Name the four chambers of the human heart and name the blood vessel that brings blood into each atrium. **[3]**

(b) Explain what is meant by double circulation and state why it is of advantage to a mammal. **[3]**

(c) Give three differences between breathing and respiration, and state the part played by the diaphragm during inspiration. **[4]**

Question 8 [10]

(a) Name the parts of a nephron in the order in which the filtrate passes through them, and state where ultrafiltration takes place. **[3]**

(b) Define reflex action. Give one example of a natural reflex and name the part of the central nervous system that controls most reflexes. **[3]**

(c) Name the hormone secreted by each of the following and state one function of each: the thyroid gland, the islets of Langerhans, the adrenal medulla, the anterior lobe of the pituitary. **[4]**

Question 9 [10]

(a) State Mendel's law of segregation. Explain the terms genotype and phenotype. **[3]**

(b) Explain, with the help of a cross, how the sex of a child is determined in human beings. **[3]**

(c) Name two gases that cause acid rain and state where they come from. State two harmful effects of acid rain and one step that would reduce it. **[4]**

ANSWER KEY AND MARKING SCHEME

Marks shown in italics are the step marks an examiner would award. Accept any correct alternative wording, and accept a correct labelled diagram in place of a description where the candidate has given one.

Question 1 [15]

(i) (b) metaphase. The spindle fibres draw the chromosomes to the equatorial plate, where they are held by their centromeres.

(ii) (c) centromere.

(iii) (b) equal and opposite to the turgor pressure. The wall pushes back on the contents with a force that balances the outward push once the cell is fully turgid.

(iv) (c) stomata. Nearly all of the water lost in transpiration leaves through the stomatal pores of the leaf.

(v) (b) grana. The chlorophyll that traps light is held in the thylakoid membranes that make up the grana.

(vi) (d) pulmonary vein. It is the only vein in the body that carries oxygenated blood.

(vii) (a) nephron.

(viii) (c) insulin. It increases the uptake of glucose by the cells and its storage in the liver as glycogen.

(ix) (b) synapse.

(x) (d) cerebellum.

(xi) (a) the sex chromosome contributed by the father. The mother can give only an X, while the father gives either an X or a Y.

(xii) (c) 1 tall : 1 dwarf. Tt crossed with tt gives Tt and tt in equal numbers.

(xiii) (b) growing rapidly. A broad base means a very large number of individuals in the youngest age groups.

(xiv) (d) carbon dioxide.

(xv) (a) an excess of nitrates and phosphates, washed in from fertilised fields and sewage, which causes algae to multiply rapidly.

1 mark for each correct option. No marks are deducted for a wrong option.

Question 2 [10]

(i) The root hair is a long and narrow outgrowth of a single epidermal cell, so a very large surface is offered to the soil water. Its wall is thin and permeable, and the cell sap inside is more concentrated than the soil solution, so water passes in by osmosis.

1 mark for each correct point, maximum 2.

(ii) Adrenaline prepares the body to meet an emergency, raising the heart rate, the breathing rate and the level of glucose in the blood. It is secreted by the medulla of the adrenal gland.

Function 1. Gland 1.

(iii) Fertilisation takes place in the fallopian tube, also called the oviduct. The embryo develops in the uterus.

Fallopian tube 1. Uterus 1.

(iv) An artery carries blood away from the heart while a vein carries blood towards the heart. An artery has a thick muscular elastic wall and a narrow lumen, while a vein has a thin wall and a wide lumen. Veins have valves along their length to stop the backflow of blood, and arteries, apart from those leaving the heart, do not.

1 mark for each correct difference, maximum 2.

(v) Biodegradable waste is waste that can be broken down into simple harmless substances by the action of bacteria and other decomposers. Examples are vegetable peel, paper, cotton cloth and cattle dung.

Definition 1. Example 1.

Question 3 [15]

(i) The leaf is broad and flat, so a large surface is exposed to sunlight. It is thin, so carbon dioxide has only a short distance to travel to reach the mesophyll cells. The mesophyll cells, particularly the palisade layer just under the upper surface, are packed with chloroplasts that hold the chlorophyll. The lower surface carries numerous stomata for the exchange of gases, and a network of veins brings water and carries away the food

made.

1 mark for each correct point with its reason, maximum 3.

(ii) The impulse travels from the receptor in the skin along a sensory neuron to the dorsal root of the spinal nerve, into the grey matter of the spinal cord, across a relay neuron, out along a motor neuron through the ventral root, and finally to the effector, which is a muscle. The diagram should show the receptor, sensory neuron, spinal cord with grey and white matter, relay neuron, motor neuron and effector, all labelled.

Correct labelled diagram 2. Correct order of the pathway 1.

(iii) Meiosis halves the chromosome number, so that when two gametes fuse the diploid number of the species is restored generation after generation. It also mixes the parental characters and so produces variation. Crossing over takes place during prophase I, in the pachytene stage, and it is important because the exchange of segments between homologous chromosomes produces new combinations of genes and so adds to the variation in the offspring.

Significance 1. Prophase I 1. Importance of crossing over 1.

(iv) The cross is Tt x Tt. The gametes from each parent are T and t. The offspring are TT, Tt, Tt and tt. Three of the four are tall and one is dwarf, so the phenotypic ratio is 3 tall : 1 dwarf. The genotypic ratio is 1 TT : 2 Tt : 1 tt.

Gametes and cross set out 1. Phenotypic ratio 3 : 1 1. Genotypic ratio 1 : 2 : 1 1.

(v) Population explosion is a sudden and very steep rise in the size of a population over a short period, caused by the birth rate staying high while the death rate falls sharply. Reasons include better medical care, control of epidemic disease and a lower infant mortality, which cut the death rate; and early marriage, a preference for a large family and illiteracy, which keep the birth rate high.

Explanation 1. 1 mark for each reason, maximum 2.

Question 4 [10]

(a) Chromatid: one of the two identical threads of a duplicated chromosome, joined to its partner at the centromere. Homologous chromosomes: a pair of chromosomes of the same size and shape, one from each parent, carrying genes for the same characters at the same positions. Diploid number: the full number of chromosomes present in a body cell of a species, written as 2n, in which the chromosomes occur in homologous pairs.

1 mark for each definition.

(b) The four stages in order are prophase, metaphase, anaphase and telophase. During anaphase the centromere of each chromosome splits, the two chromatids separate, and the spindle fibres pull one chromatid of each pair to each of the opposite poles of the cell, so that both poles receive an identical set of chromosomes.

Four stages in the correct order 2. Description of anaphase 1.

(c) Mitosis takes place in body cells, meiosis in the reproductive cells of the gonads. Mitosis consists of a single division, meiosis of two divisions one after the other. Mitosis gives two daughter cells, meiosis gives four. Mitosis keeps the chromosome number the same as the parent cell, while meiosis halves it. The daughter cells of mitosis are genetically identical to the parent, while those of meiosis differ from one another because of crossing over and the independent assortment of chromosomes.

1 mark for each correct difference, maximum 4.

Question 5 [10]

(a) Osmosis: the movement of water, or of a solvent, from a region of higher concentration of water to a region of lower concentration through a semipermeable membrane. Diffusion: the spreading out of the particles of a substance from a region where they are more concentrated to one where they are less concentrated, until they are evenly spread. Plasmolysis: the shrinking away of the protoplasm from the cell wall when a plant cell is placed in a strongly hypertonic solution and loses water by osmosis.

1 mark for each definition.

(b) The soil solution is more dilute than the cell sap of the root hair, so water enters the root hair by osmosis through its semipermeable cell membrane. The sap of the root hair is now more dilute than that of the cell next to it, so water passes on to that cell by osmosis. In this way water moves from cell to cell across the cortex and the endodermis, each cell in turn drawing from the one before it, until it reaches the xylem vessels of the root.

Entry into the root hair by osmosis 1. Movement from cell to cell across the cortex 1. Entry into the xylem 1.

(c) Transpiration is the loss of water, in the form of water vapour, from the aerial parts of a plant, chiefly through the stomata of the leaves. The rate is increased by dry air of low humidity, by a rise in temperature, by moving air or wind, and by bright light, which opens the stomata. Transpiration is useful because the stream of water it draws up carries dissolved mineral salts from the root to the leaves, and because the evaporation of water from the leaf surface cools the leaf and keeps it from overheating in the sun.

Definition 1. Two conditions 1. Two uses 2.

Question 6 [10]

(a) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$, the reaction taking place in sunlight in the presence of chlorophyll. The two stages are the light dependent reaction, which takes place in the grana, and the light independent reaction or dark reaction, which takes place in the stroma.

Balanced equation with conditions 1. Light dependent stage 1. Light independent stage 1.

(b) Destarch a potted plant by keeping it in the dark for about two days. Enclose one leaf, still attached to the plant, in a flask containing potassium hydroxide solution, which absorbs the carbon dioxide from the air inside, and seal the mouth of the flask round the stalk. Enclose a second leaf in a similar flask containing only water, to act as the control. Place the plant in sunlight for several hours, then test both leaves for starch with iodine solution. The leaf from the flask with potassium hydroxide gives no blue black colour, while the control leaf does, which shows that carbon dioxide is necessary for photosynthesis.

Destarching 1. Set up with the control 1. Result and conclusion 1.

(c) Tropism is a growth movement of a part of a plant in response to a stimulus coming from one direction, the direction of the movement being decided by the direction of the stimulus. The hormone responsible for phototropism is auxin. When light falls on a shoot from one side, the auxin moves to the shaded side, so the cells on that side receive more auxin and grow longer than those on the lit side. The unequal growth makes the shoot curve towards the light, so the shoot is positively phototropic.

Definition 1. Auxin named 1. Movement of auxin to the shaded side 1. Unequal growth causing the bend 1.

Question 7 [10]

(a) The four chambers are the right atrium, the right ventricle, the left atrium and the left ventricle. The right atrium receives deoxygenated blood from the superior and inferior vena cava. The left atrium receives oxygenated blood from the pulmonary veins.

Four chambers 1. Vena cava into the right atrium 1. Pulmonary veins into the left atrium 1.

(b) Double circulation means that in one complete round of the body the blood passes through the heart twice. In the pulmonary circulation the right side of the heart sends deoxygenated blood to the lungs and the oxygenated blood returns to the left atrium; in the systemic circulation the left side sends oxygenated blood to the body and the deoxygenated blood returns to the right atrium. It is an advantage because the oxygenated and deoxygenated blood are kept completely separate, and because the blood is given a fresh push at full pressure before it is sent round the body, so the tissues are supplied quickly and efficiently.

Meaning with both circuits 2. Advantage 1.

(c) Breathing is a physical process while respiration is a chemical one. Breathing is only the taking in and giving out of air by the lungs, while respiration is the oxidation of food within the cell to release energy. Breathing takes place in the respiratory organs alone, while respiration takes place in every living cell. Breathing releases no energy, while respiration releases energy and stores it as ATP. During inspiration the muscular diaphragm contracts and flattens from its domed shape, which increases the volume of the thoracic cavity from top to bottom, lowers the pressure inside, and so draws air into the lungs.

1 mark for each difference, maximum 3. Role of the diaphragm 1.

Question 8 [10]

(a) The filtrate passes through the Bowman's capsule, the proximal convoluted tubule, the loop of Henle, the distal convoluted tubule and then the collecting duct. Ultrafiltration takes place in the Bowman's capsule, where blood under high pressure in the glomerulus is filtered through the capillary walls.

Parts in the correct order 2. Ultrafiltration in the Bowman's capsule 1.

(b) A reflex action is a rapid, automatic and involuntary response of the body to a stimulus, which takes place without the will of the individual. An example of a natural reflex is the blinking of the eye when an object comes suddenly near it, or the withdrawal of the hand from a hot object. Most reflexes are controlled by the spinal cord, which is why they are often called spinal reflexes.

Definition 1. Example 1. Spinal cord 1.

(c) Thyroid gland: thyroxine, which controls the rate of metabolism and is necessary for normal growth and mental development. Islets of Langerhans: insulin, which lowers the level of glucose in the blood by helping the cells to take it up and the liver to store it as glycogen. Adrenal medulla: adrenaline, which prepares the body for an emergency by raising the heart rate, the breathing rate and the blood glucose level. Anterior lobe of the pituitary: growth hormone, which controls the growth of the bones and of the body as a whole.

1 mark for each gland, the hormone and one function both being needed.

Question 9 [10]

(a) Mendel's law of segregation states that the two factors of a pair of contrasting characters remain together in the parent without blending, and separate from each other at the time of gamete formation, so that each gamete receives only one factor of the pair. Genotype is the genetic make up of an organism, the set of genes it carries, written for example as Tt. Phenotype is the outward appearance of an organism for a character, what can actually be seen, for example tall.

Law 1. Genotype 1. Phenotype 1.

(b) The mother has two X chromosomes and so forms only one kind of egg, carrying an X. The father has one X and one Y chromosome and so forms two kinds of sperm in equal numbers, half carrying an X and half carrying a Y. If an X bearing sperm fertilises the egg the zygote is XX and the child is a girl; if a Y bearing sperm fertilises it the zygote is XY and the child is a boy. The chance of either is therefore one in two, and the sex of the child depends on the father.

Mother forms one kind of egg 1. Father forms two kinds of sperm 1. Cross worked out with the 1 : 1 result 1.

(c) The gases are sulphur dioxide and the oxides of nitrogen. They come from the burning of coal and other fossil fuels in power stations and factories, and from the exhaust of motor vehicles. In the air they dissolve in water vapour to form sulphuric and nitric acid, which fall as acid rain. Acid rain lowers the pH of lakes and rivers and kills fish and other aquatic life, it damages the leaves of trees and leaches nutrients out of the soil, and it corrodes buildings and monuments made of marble and limestone. It can be reduced by removing sulphur from fuel before it is burnt, by fitting scrubbers to factory chimneys, and by using cleaner sources of energy.

Two gases with their source 1. Two harmful effects 2. One step to reduce it 1.