SCIENCE
Solved Paper-3 (Biology), 2016
(One hour and a half)

Answers to this paper must be written on the paper provided separately.
*You will **not** be allowed to write during the first **15** minutes.*
This time is to be spent in reading the Question Paper.
The time given at the head of this Paper is the time allowed for writing the answers.

---

*Attempt **all** questions from **Section I** and any **four** questions from **Section II.**.*
The intended marks for questions or parts of questions are given in brackets [ ].

SECTION I (40 Marks)
Attempt ***all*** questions from this section

QUESTION 1

(a) Name the following: **[5]**

(i) The exchange of chromatid parts between the maternal and the paternal chromatids of a pair of homologous chromosomes during meiosis.
Ans. Crossing over / Chiasmata / genetic recombination (cross over = 0).

(ii) the number of individuals inhabiting per unit area.
Ans. Population density.

(iii) The immunity acquired by providing readymade antibodies from outside for treating certain infectious diseases.
Ans. Passive immunity.

(iv) The pollutants that cannot be broken down to simple and harmless products.
Ans. Non biodegradable.

(v) The part of the brain that carries impulses from one hemisphere of the cerebellum to the other.
Ans. Pons / pons varolii.

(b) Choose the correct answer from each of the four options given below : **[5]**

(i) A plant cell may burst when :

(a) Turgor pressure equalises wall pressure (b) Turgor pressure exceeds wall pressure
(c) Wall pressure exceeds turgor pressure (d) None of the above

Ans. (b) Turgor pressure exceeds wall pressure

(ii) The individual flattened stacks of membranous structures inside the chloroplasts are known as :

(a) Grana (b) Stroma
(c) Thylakoids (d) Cristae

Ans. (c) Thylakoids

(iii) The nephrons discharge their urine at the :

(a) Urinary bladder. (b) Urethra
(c) Renal pelvis (d) Renal pyramid

Ans. (c) Renal pelvis

(iv) Gigantism and Acromegaly are due to :

(a) Hyposecretion of Thyroxine (b) Hyposecretion of Growth hormone
(c) Hypersecretion of Thyroxine (d) Hypersecretion of Growth hormone

Ans. (d) Hypersecretion of Growth hormone

(v) The mineral ion needed for the formation of blood clot is :

(a) Potassium (b) Sodium

(c) Calcium (d) Iron

Ans. (c) Calcium

(c) In each set of terms given below, there is an odd one and cannot be grouped in the same category to which the other three belong. Identify the odd term in each set and name the category to which the remaining three belong.

Example : Ovary, Fallopian tube, Ureter, Uterus

Odd term : Ureter

Category : Parts of female reproductive system **[5]**

(i) Sewage, Newspaper, Styrofoam, Hay.

Ans. *Odd* : Styrofoam, *Category* : Biodegradable.

(ii) Thymine, Cytosine, Adenine, Pepsin.

Ans. *Odd* : Pepsin, *Category* : Nitrogenous bases.

(iii) Malleus, Iris, Stapes, Incus.

Ans. *Odd* : Iris, *Category* : Ear ossicles/bones of middle ear.

(iv) Cortisone, Somatotropin, Adrenocorticotropic hormone, Vasopressin.

Ans. *Odd* : Cortisone, *Category* : Pituitary hormones.

(v) Typhoid, Haemophilia, Albinism, Colour blindness.

Ans. *Odd* : Typhoid, *Category* : Genetic diseases / Heriditary diseases / Non infectious diseases.

(d) Complete the following paragraph by filling in the blanks (i) to (v) with appropriate words : **[5]**

The amount of urine output is under the regulation of a hormone called (i) _____ secreted by the (ii) _____ lobe of the pituitary gland. If this hormone secretion is reduced, there is an increased production of urine. This disorder is called (iii) _____ . Sometimes excess glucose is passed with urine due to hyposecretion of another hormone called (iv) _____ leading to the cause of a disease called (v) _____ .

Ans. (i) ADH / Antidiuretic hormone / Vasopressin (adh = 0)

(ii) Posterior / urophysis

(iii) Diabetes insipidus / water diabetes

(iv) Insulin

(v) Diabetes mellitus / Sugar diabetes / Glycosuria / Hyperglycemia.

(e) State the exact location of the following structures : **[5]**

(i) Centromere.

Ans. Attaching sister chromatids (sister is operative).

(ii) Chordae tendinae.

Ans. Connects papillary muscles to bicuspid /mitral valve and tricuspid valves.

(iii) Thyroid gland.

Ans. In front of neck just below larynx / in front of neck below Adam's apple / in front of trachea below larynx. (Base of the neck / below sound box = 0).

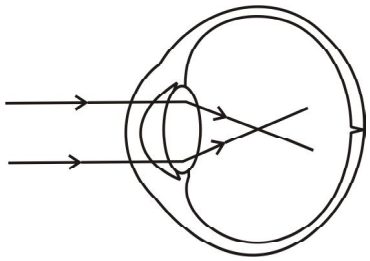
(iv) Ciliary body.

Ans. Extension of choroid / part of choroid.

(v) Proximal convoluted tubule.

Ans. Cortex of kidney just below the Bowman's capsule.

(f) Given below is a diagram depicting a defect of the human eye, study the same and then answer the questions that follow : **[5]**



(i) Name the defect show in the diagram.

Ans. Myopia / Short sightedness (short sight = 0).

(ii) What are the two possible reasons that cause this defect.

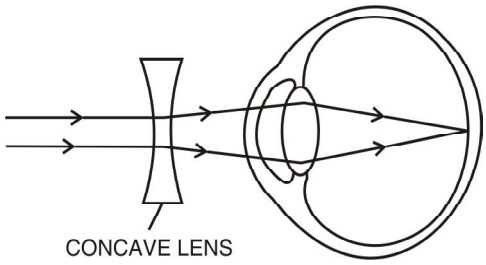
Ans. Lens is **too** curved / lens is **too** convex, eyeball is lengthened from **front to back**.

(iii) Name the type of lens used to correct this defect.

Ans. Concave lens / Diverging lens / Biconcave lens.

(iv) With the help of a diagram show how the defect shown above is rectified using a suitable lens.

Ans.



(g) Given in the box below are a set of 14 biological terms. Of these, 12 can be paired into 6 matching pairs. Out of the six pairs, one has been done for you as an example. **[5]**

Example : Endosmosis — Turgid cell

Identify the remaining *five* matching pairs :

Cushing's syndrome, Turgid cell, Iris, Free of rod and cone cells, Colour of eyes, Hypoglycemia, Active transport, Acrosome, Addison's disease, Blind spot, Hyperglycemia, Spermatozoa, Endosmosis, Clotting of blood.

Ans. (i) Free of rod and cone cells — Blind spot.

(ii) Cushing's syndrome — Hyperglycemia

(iii) Turgid cell — Endosmosis

(iv) Iris — Colour of eyes

(v) Addison's disease — Hypoglycemia

(h) State the main function of the following : **[5]**

(i) Lymphocytes of blood.

Ans. Produces antibodies / neutralizes toxins of germs / neutralizes antigens / provides immunity.

(ii) Leydig cells.

Ans. Secretes / produces testosterone / produces male sex hormones.

(iii) Guard cells.

Ans. Regulates opening and closing of stomata / stomatal pore / stoma / regulates rate of transpiration.

(iv) Eustachian tube.

Ans. Equalizes **air** pressure on either side of tympanum / eardrum.

(v) Corpus luteum.

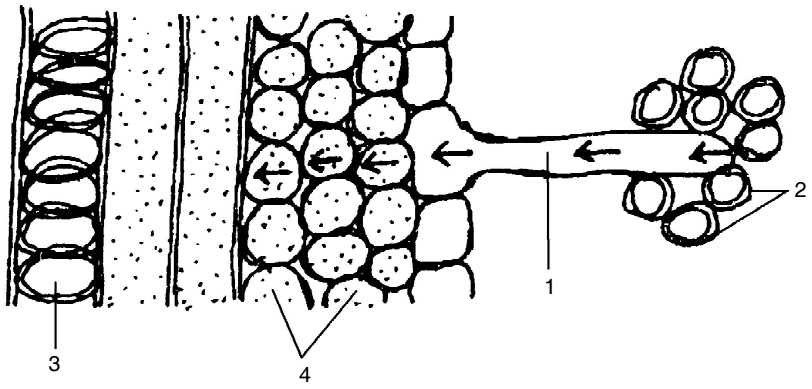
Ans. Secretes /produces progesterone.

SECTION II (40 Marks)

*Attempt any **four** questions from this Section*

QUESTION 2

(a) The figure given below is a diagrammatic representation of a part of the cross section of the root in the root hair zone. Study the same and then answer the questions that follow :



(i) Name the parts indicated by the guidelines 1 to 4.

Ans. 1— Root Hair, 2— Soil particles, 3— Xylem, 4— Cortex / Cortical cells.

(ii) Which is the process that enables the passage of water from the soil into the root hair ?

Ans. Endosmosis.

(iii) Name the pressure that is responsible for the movement of water in the direction indicated by the arrows. Define it.

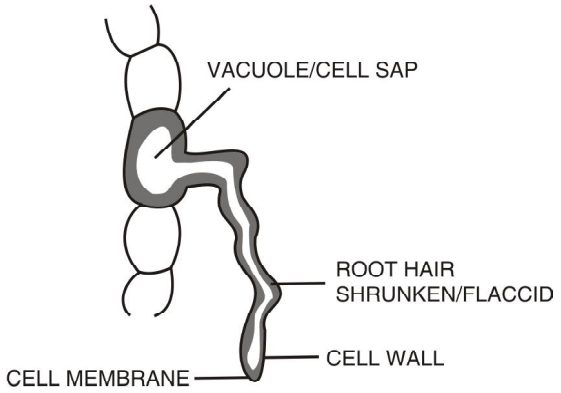
Ans. Root Pressure. Root pressure is the pressure set up due to the alternate turgidity and flaccidity of the root air cell and the cells of the cortex pushing the water from the soil to the xylem of the root and upwards in the xylem to a certain height.

(iv) Due to an excess of this pressure sometimes drops of water are found along the leaf margins of some plants especially in the early mornings. What is the phenomenon called ?

Ans. Guttation.

(v) Draw a well labelled diagram of the root hair cell as it would appear if an excess of fertiliser is added to the soil closed to it.

Ans.



(b) Differentiate between the following pairs on the basis of what is mentioned in brackets : **[5]**

(i) Human skin cell and Human ovum (number of chromosomes).

Ans. Skin — 46/23 pairs / Ovum — 23.

(ii) Sperm duct and fallopian tube (function).

Ans. Sperm duct — carries / transmits sperms from epididymus to urethra / penis.

Fallopian tube — receives mature egg from ovary / region where fertilization occurs in the female.

(iii) Red Cross and WHO (one activity).

Ans. Red Cross — to extend relief and help to victims of war, flood, fire etc // procure and supply blood to victims of war and accidents , // to render first aid in any accident // educate people on accident prevention ……. etc. (any one).

WHO — To collect and supply information on epidemics like cholera typhoid etc // promote and support projects for research on diseases//suggest quarantine measures to prevent spread of diseases // lay pharmaceutical standards for important drugs …..etc. (any one).

(iv) Rod cells and cone cells (pigment).

Ans. Rod cells — rhodopsin / visual purple (spelling important e.g. rodosphin–0).

Cone cells — iodopsin (spelling important).

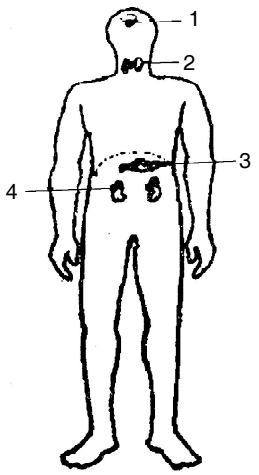
(v) LUBB and DUP (names of the valves whose closure produce the sound).

Ans. LUBB — Atrioventricular valves /Bicuspid and Triscuspid.

DUP — semilunar valves of aorta and pulmonary artery.

QUESTION 3

(a) Given below is the outline of the human body showing the important glands : **[5]**



(i) Name the glands marked 1 to 4.

Ans. 1— Pituitary 2— Thyroid 3— Pancreas 4— Adrenal.

(ii) Name the hormone secreted by part 2. Give one important function of this hormone.

Ans. Thyroxine controls the basal metabolism of cells.

(iii) Name the endocrine part of the part numbered 3.

Ans. Islet of Langerhans // islet cells.

(iv) Why is the part labelled I called the master gland ? Which part of the forebrain controls the gland labelled 1 ?

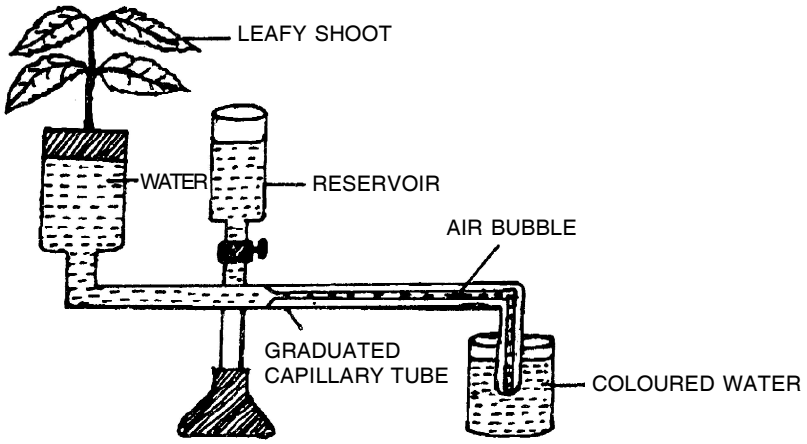
Ans. Its secretions controls the working of the other endocrine glands in the body .

Hypothalamus / Diencephalon.

(v) Name the gland that secretes the 'emergency hormone'.

Ans. Adrenal gland.

(b) The diagram of an apparatus given below demonstrates a particular process in plants. Study the same and answer the questions that follow : **[5]**



(i) Name the apparatus.

Ans. Ganong's potometer (Ganong's operative).

(ii) Which phenomenon is demonstrated by this apparatus ?

Ans. Rate of transpiration in plants.

(iii) Explain the phenomenon mentioned in (ii) above.

Ans. Transpiration is the loss of water in the form of water vapour from the leaves / aerial parts of the plant.

(iv) State two limitations of using this apparatus.

Ans. Introducing an air bubble is not easy // twig does not remain alive for long // measures rate of absorption more than transpiration // environmental conditions affect position of air bubble.

(v) What is the importance of the air bubble in the experiment ?

Ans. Helps to measure the volume of water lost from the shoot in a given time.

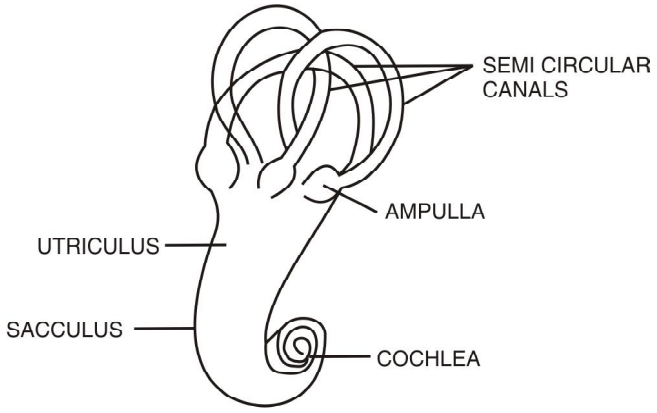
(vi) Name the structures in a plant through which the above process takes place.

Ans. Stomata, lenticels, Cuticle.

QUESTION 4

(a) (i) Draw a well-labelled diagram of the membranous labyrinth found in the human ear. **[5]**

Ans.



(ii) Based on the diagram drawn above in (i) give a suitable term for each of the following description :

1. The sensory cells that helps in hearing.
2. The part that is responsible for static balance of the body.
3. The membrane covered opening that connects the middle ear to the inner ear.
4. The fluid present in the middle chamber of cochlea.
5. The structure that maintains dynamic equilibrium of the body.

Ans. 1. Organ of Corti. 2. Utriculus and Sacculus.
3. Oval window. 4. Endolymph
5. Semicircular canals and ampulla.

(b) Give the Biological / technical term for the following : **[5]**

(i) Complete stoppage of menstrucal cycle in females.
Ans. Menopause.

(ii) Pigment providing colour to urine.
Ans. Urochrome.

(iii) The vein which drains the blood from the intestine to the liver.
Ans. Hepatic Portal vein.

(iv) The canal through which the testes descend into the scrotum just before the birth of a male baby.
Ans. Inguinal canal.

(v) The process causing an undersirable change in the environment.
Ans. Pollution (Pollutant = 0).

(vi) The removal of nitrogenous wastes from the body.
Ans. Excretion.

(vii) The repeating components of each DNA strand lengthwise.
Ans. Nucleotide.

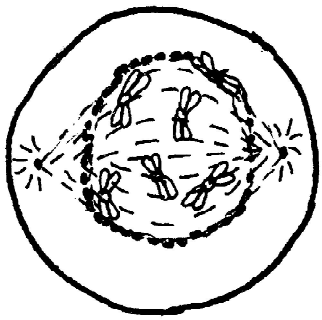
(viii) An alteration in the genetic material that can be inherited.
Ans. Mutation.

(ix) The process of uptake of mineral ions against the concentration gradient using energy from the cell.
Ans. Active transport.

(x) Blood vessels carrying blood to the left atrium.
Ans. Pulmonary veins.

QUESTION 5

(a) The given diagram shows a stage during mitotic division in an animal cell : **[5]**

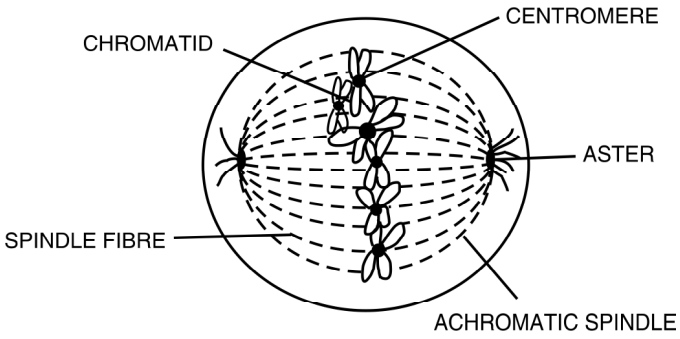


(i) Identify the stage. Give a reason to support your answer.

Ans. Prophase. Chromosomes are in the duplicated state, Spindle and spindle fibres are visible, Centrioles have moved to opposite poles and spindle is formed …etc (any one).

(ii) Draw a neat labelled diagram of the cell as it would appear in the next stage. Name the stage.

Ans.



(iii) In what two ways in mitotic division in an animal cell different from the mitotic division in a plant cell?

Ans.	**Plant cell**	**Animal cell**
	1. No asters formed	Centrioles form asters
	2. Cytokinesis by cell plate formation	Cytokinesis by furrowing of cytoplasm

(iv) Name the type of cell divsion that occurs during :

A. Growth of a shoot

B. Formation of pollen grains.

Ans. A. Mitosis B. Meiosis

(b) Given scientific reasons for the following statements : **[5]**

(i) Colour blindness is more common in men than in women.

Ans. Colour blindness is due to sex linked inheritance, the recessive gene / allele for colourblindness is attached to the X chromosome and hence is more likely to occur in men because they have the XY sex chromosome.

(ii) The medulla oblongata controls all involuntary actions like breathing, beating of the heart etc. and hence injury to it results in instant death.

Ans. The medulla oblongata controls all involuntary actions like breathing, beating of the heart etc and hence injury to it results in instant death.

(iii) When an ovum gets fertilized, menstrual cycle stops temporarily in a woman.

Ans. When fertilization occurs and implantation occurs , the progesterone level increases and prevents maturation of another follicle leading to a temporary stop of the menstrual cycle.

(iv) Mature erythrocytes in humans lack nucleus and mitochondria.

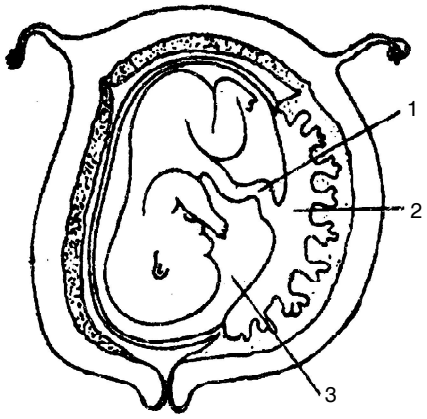
Ans. Mature erythrocytes lack nucleus thereby making them biconcave and increasing the surface area for absorption of Oxygen, they lack mitochondria and hence do not use the oxygen to release energy but transports all the oxygen to the body cells.

(v) Blood flows in arteries in spurts and is under pressure.

Ans. Blood flows in spurts and under pressure in an artery as it transports blood from the left ventricle which is at a high pressure and also because it has a narrow lumen.

QUESTION 6

(a) The diagram given below is that of a developing human foetus. Study the diagram and then answer the questions that follow : **[5]**



(i) Label the parts numbered 1 to 3 in the diagram.

Ans. 1— Umbilical cord 2— Placenta 3— Amniotic fluid

(ii) Mention any two functions of the part labelled 2 in the diagram.

Ans. Provides for exchange of respiratory gases, excretory substances, nutrients between the mother and the developing foetus (any two).

(iii) Explain the significance of the part numbered 3 in the diagram.

Ans. Protects the embryo from physical damage by sudden shocks or jerks, Prevents sticking of the foetus to the amnion, Keeps an even pressure all round the embryo.

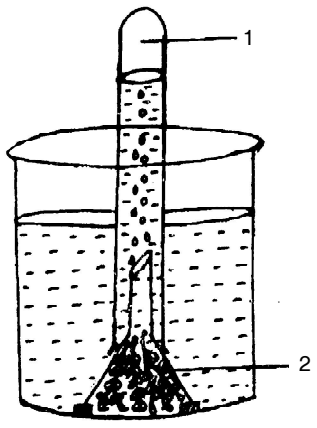
(iv) Define the term 'Gestation'. What is the normal gestational period of the developing human embryo ?

Ans. Gestation is the period of **complete development** of the foetus in the womb of the mother. Normal gestational period is 280 days.

(v) Mention the sex chromosomes in a male and female embryo.

Ans. Male— XY Female— XX.

(b) The following diagram demonstrates a physiological process taking place in green plants. The whole set up was placed in bright sunlight for several hours. Study the diagram and answer the questions that follow : **[5]**



(i) What aspect of the physiological process is being examined ?

Ans. Oxygen is given out during Photosynthesis.

(ii) Explain the physiological process mentioned in (i) above.

Ans. Photosynthesis is the process by which green parts of a plant manufacture starch in the presence of sunlight (light), carbon dioxide and water.

(iii) Label the parts numbered 1 and 2 in the diagram.

Ans. 1. Oxygen 2. Water weeds / elodea or any named submerged water plant.

(iv) Write a well-balanced chemical equation for the physiological process explained in (ii) above.

Ans. $6CO_2 + 12H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

(v) What would happen to the rate of bubbling of the gas if a pinch of sodium bicarbonate is added to the water in the beaker ? Exaplin your answer.

Ans. Bubbling would increase as Sodium bicarbonate is a source of carbon dioxide which would help in increased photosynthesis and thereby increased production of oxygen.

QUESTION 7

(a) A homozygous tall plant (T) bearing red coloured (R) flowers is crossed with a homozygous dwarf (t) plant bearing white (r) flower : **[5]**

(i) Give the gentype and phenotype of the plant of F_1 generation.

Ans. Genotype — TtRr Phenotype — Tall with Red Flowers.

(ii) Mention the possible combinations of the gametes that can be obtained from the F_1 hybrid plant.

Ans. TR, Tr, tR, tr.

(iii) State the Mendel's law of Independent Assortment.

Ans. Mendel's Law of Independent Assortment states that when there are two pairs of contrasting characters the distribution of the members of one pair into the gametes is undependent of the distribution of the other pair.

(iv) Mention the phenotypes of the offsprings obtained in F_2 generation.

Ans. Tall Red, dwarf Red, Tall white, dwarf white.

(v) What is the phenotypic ratio obtained in F_2 generation ?

Ans. 9 : 3 : 3 : 1.

(b) Briefly explain the following terms : **[5]**

(i) Reflex action.

Ans. Reflex action is an involuntary, spontaneous/immediate / quick response to a stimulus.

(ii) Power of accommodation.

Ans. The ability of the human eye to focus/ change the focal length so as to see objects at different distances.

(iii) Photophosphorylation.

Ans. The conversion of ADP molecules to ATP molecules during the light reaction of photosynthesis.

(iv) Hormone.

Ans. Hormones are secretions from certain glands in the body poured into the blood and acting on target organs or cells bringing about coordination in the body of the individual.

(v) Synapse.

Ans. The point of contact between the terminal dendrites of one neuron and the dendrons / dendrites of another neuron.