

## Sample Question Paper - 4

**Maximum Marks: 80**

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during 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.
- Section A is compulsory. Attempt any four questions from Section B.
- The intended marks for questions or parts of questions are given in brackets [ ].

(i) Water conservation is key to the survival of plants that live in deserts. A first year botany student suggests that permanent closure of the stomata of such plants would be beneficial for their survival. How would you refuse his suggestion? [1]

- a. The stomata must be open to allow the plant to take in carbon dioxide for photosynthesis.
- b. The stomata must be open to allow the plant to take in oxygen for photosynthesis.
- c. Significant water loss would still occur through the epidermis even if the stomata are closed.
- d. Closing the stomata would curb the transpiration stream.

a) Option (a)                                      b) Option (d)

c) Option (b)                                      d) Option (c)

(ii) Centrioles radiate out fine micro tubular fibrils called astral rays and move apart from each other towards the opposite poles. This observation is made during [1]

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

(iii) The ventral root ganglion of the spinal cord contains cell bodies of the [1]  
a)association neuron  
b)motor neuron  
c)sensory neuron  
d)intermediate neuron

(iv) Which one of the following is a greenhouse gas? [1]  
a)Oxygen  
b)Nitrogen  
c)Methane  
d)Sulphur dioxide

(v) Which of the following chambers of heart first receives blood from the systemic [1]  
circulation?  
a)Right auricle  
b)Left ventricle  
c)Left auricle  
d)Right ventricle

(vi) **Assertion (A):** CFCs deplete the ozone layer. [1]  
**Reason (R):** CFCs are used as refrigerants and in fire extinguishers.  
a)Both A and R are true and R is the correct explanation of A.  
b)Both A and R are true but R is not the correct explanation of A.  
c)A is true but R is false.  
d)A is false but R is true.

(vii) The unfavourable alteration of environment due to human activities is termed as [1]  
a)pollution  
b)ecological disturbance  
c)catastrophe  
d)ecological degradation

(viii) The thin membranous sac serving as the reservoir of urine is [1]  
a)ureter  
b)kidney  
c)urinary bladder  
d)glomerulus

- (ix) The covered portion of the leaf in the experiment to demonstrate necessity of light during photosynthesis, is observed to remain yellow because it [1]
- a) did not receive sunlight                      b) was destarched  
c) All of these                                      d) lacked starch
- (x) The site of maturation of human sperm is the [1]
- a) prostate gland                                      b) epididymis  
c) interstitial cells                                      d) seminiferous tubule
- (xi) The region where crossing over in chromosome occurs is [1]
- a) chiasmata                                      b) spindle fibres  
c) cell plate                                      d) chromomere
- (xii) Father of Endocrinology is [1]
- a) Thomas Addison                                      b) Huxley  
c) Abel                                      d) Kimball and Murlin
- (xiii) The prime source of chlorofluorocarbon is [1]
- a) Domestic sewage                                      b) Industrial effluents  
c) Refrigeration equipments                                      d) Vehicular emission
- (xiv) The individual flattened stacks of membranous structures inside the chloroplast are known as:- [1]
- a) Thylakoids                                      b) Cristae  
c) Stroma                                      d) Grana
- (xv) A structure of neuron comprises of [1]
- a) cell body, synaptic knob,                                      b) cell body, dendrites, axon  
ganglia  
c) cell body, dendrites, ganglia                                      d) synaptic vesicles, ganglia,  
dendrites

2. **Question 2** [25]

(i) **Name the following:**

- i. The name of the process given to the uptake of minerals ions against the concentration gradient? [1]
- ii. The waxy layer on the epidermis of the leaf meant to reduce transpiration. [1]
- iii. The wax-like layer on the epidermis of leaves which reduces transpiration. [1]
- iv. Hormones that regulate the secretion of other endocrine glands. [1]
- v. The hormone that helps to increase the reabsorption of water from the kidney tubules. [1]

(ii) **Arrange and rewrite the terms in each group in the correct order so as to be in a logical sequence beginning with the term that is underlined.**

- i. The statement given below is incorrect. Rewrite the correct statement by changing the underlined words of the statement. [1]  
The Graafian follicle, after ovulation turns into a hormone producing tissue called corpus callosum.
- ii. Given below is the sets of five terms. Rewrite the each terms in logical sequence as directed at the end of the statement. [1]  
Motor neuron, receptor, sensory neuron, effector, association neuron (pathway of a nerve impulse).
- iii. Rewrite the completed explanation by inserting the key word in the space indicated by ^. [1]  
Osmosis is the movement of water molecule from its region of higher concentration to region of lower concentration through a ^ membrane.
- iv. The first process by which water gets into the seed coat during germination is osmosis. [1]
- v. Adenine : Thymine :: Cytosine : \_\_\_\_\_ [1]

(iii) **Fill in the blanks with suitable words:**



- i. Copy and complete the following by filling in the blanks 1 to 5 with appropriate words. [5]

The human female gonads are ovaries. A maturing egg in the ovary is present in a sac of cells called (i)\_\_\_\_\_. As the egg grows larger, the follicle enlarges and gets filled with a fluid and is now called the (ii)\_\_\_\_\_ follicle. The process of releasing the egg from the ovary is called (iii)\_\_\_\_\_. The ovum is picked up by the oviduct funnel and fertilization takes place in the (iv)\_\_\_\_\_. In about a week the blastocyst gets fixed in the endometrium of the uterus and this process is called (v)\_\_\_\_\_.

- (iv) **Choose the odd one out from the following terms and name the category to which the others belong:**

- i. Bile, Urea, Uric acid, Ammonia [1]  
ii. Addison's disease, Cushing's Syndrome, Acromegaly, Leukemia. [1]  
iii. ACTH, TSH, ADH, FSH [1]  
iv. Detergents, sewage, X-rays, oil spills [1]  
v. Formalin, Iodine, DDT, Lime [1]

- (v) **Match the items given in Column I with the most appropriate ones in Column II and rewrite the correct matching pairs.**

- i. Match the following columns. [5]

Column I	Column II
(a) Liver	(i) Knot-like tuft of blood capillaries in Bowman's capsule.
(b) Skin	(ii) Breakdown of proteins.
(c) Kidney	(iii) Sweat glands.
(d) Glomerulus	(iv) Bean-shaped excretory organ.

### Section B

**Attempt any 4 questions**

### 3. Question 3

[10]

- (i) What is gene mutation? [1]
- (ii) A couple got only four daughters in a row and no son. Do you agree that it is because the husband does not produce Y-bearing sperms? Justify. [2]
- (iii) Differentiate between S-phase and G<sub>2</sub>-phase. [2]
- (iv) In a cross between a pure breed, red-eyed female fruitfly and a white-eyed male, what percentage of the male offsprings will have white eyes? (White eyes are X-linked, recessive). [2]
- (v) Draw a well labelled diagram to show the anaphase stage of mitosis in an animal cell having four chromosomes. [3]

4. **Question 4** [10]

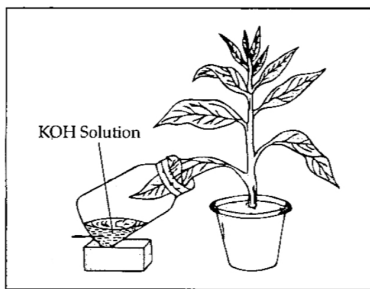
- (i) Which part of the human ear gives **Dynamic balance** and **Static balance** to the body? [1]
- (ii) Write the function of the following: [2]
  - i. Suspensory ligament
  - ii. Semicircular canals
- (iii) Explain the mechanism of focusing the image of a distant object in our eye when we raise our head after reading a book. [2]
- (iv) Compare the Central Neural System (CNS) and Peripheral Neural System (PNS). [2]
- (v) Draw a well labelled diagram of a neuron and name the following parts: [3]
  - i. Node of Ranvier
  - ii. Nissl's granules
  - iii. Cyton

5. **Question 5** [10]

- (i) Explain the term destarched plant. [1]
- (ii) Plants have several pigments that can catch light energy. Two of these are chlorophyll-a and chlorophyll-b, which harness light of different wavelengths. [2]

What advantage does a plant obtain by having molecules that act at different wavelengths?

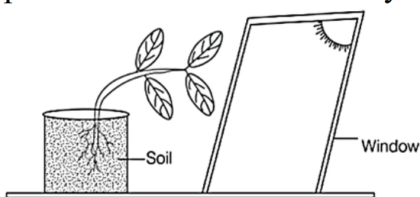
- (iii) What conditions enable RuBisCO to function as an oxygenase? Explain the ensuring process. [2]
- (iv) If you are planning an experiment to show the effect of light on photosynthesis, then [2]
- Will you select white light or green light? Justify your answer.
  - Why would you select a destarched plant?
- (v) The diagram given below represents an experiment to prove the importance of a factor in photosynthesis. Answer the questions that follow: [3]



- Which factor is being studied here?
- What is the purpose of keeping KOH in the flask?
- Write a well balanced chemical equation for the process of photosynthesis.

**6. Question 6** [10]

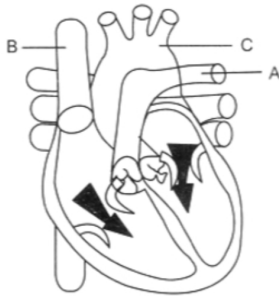
- (i) A cell having 32 chromosomes undergoes mitotic divisions. What will be the chromosome number (n) during metaphase? What would be the DNA content during anaphase? [1]
- (ii) Can there be DNA replication without cell division? [2]
- (iii) The diagram given below represents a plant growing in a glass jar. The glass jar is placed near a window. Study the diagram and answer the questions that follows: [3]



- a. Name the tropic movements shown by the shoot and roots.
- b. What is the stimulus that made the shoot bend towards the window?
- c. Which plant hormone caused the above effect?

**7. Question 7** **[10]**

- (i) Mention two characteristic features each for the two stages: Australopithecus and Neanderthal man. **[1]**
- (ii) Explain how vestigial organs give an idea about evolution. **[2]**
- (iii) Explain Darwin's concept of natural selection. **[2]**
- (iv) Is the use of contraceptives justified? **[2]**
- (v) The diagram given alongside represents the human heart in one phase of its functional activities. Study the same and answer the questions that follow. **[3]**



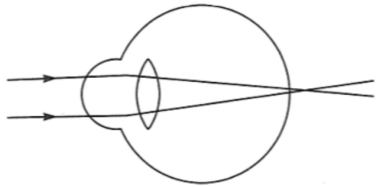
- a. Name the phase.
- b. Label the parts A, B, and C.
- c. Which part of the heart is contracting in this phase? Give a reason to support your answer.

**8. Question 8** **[10]**

- (i) Name the following. **[1]**
  - i. The tissue which is responsible for the transport of organic and inorganic substances.
  - ii. The root hairs are the extension of which cells?
- (ii) Why renal portal system is absent in mammals? **[2]**

(iii) Explain the cause of algal bloom in a water body. How does it affect an ecosystem? [2]

(iv) Given below is a diagrammatic representation of a defect of the human eye: [3]



a. Identify the defect.

b. Mention two reasons for the above defect.

c. Name the part of the eye responsible; for maintaining the shape of the eyeball.



# Solution

## Section A

1. Question 1: Choose the correct answers to the questions from the given options. (Do not copy the question, write the correct answers only.)

(i) **(a)** Option (a)

**Explanation:** {

The stomata must be open to allow the plant to take in carbon dioxide for photosynthesis.

(ii) **(c)** anaphase

**Explanation:** {

anaphase

(iii) **(a)** association neuron

**Explanation:** {

The ventral root ganglion of the spinal cord contains cell bodies of the association neurons.

(iv) **(c)** Methane

**Explanation:** {

Methane

(v) **(a)** Right auricle

**Explanation:** {

Right auricle

(vi) **(a)** Both A and R are true and R is the correct explanation of A.

**Explanation:** {

The ozone layer is getting depleted at the higher levels of the atmosphere due to the effect of chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers.

(vii) **(a)** pollution

**Explanation:** {

pollution

(viii) **(c)** urinary bladder

**Explanation:** {

urinary bladder

(ix) **(d)** lacked starch

**Explanation:** {

lacked starch

(x) **(b)** epididymis

**Explanation:** {

Sperm production occurs in the testis, but sperm maturation and storage take place in the epididymis.

(xi) **(a)** chiasmata

**Explanation:** {

chiasmata

(xii) **(a)** Thomas Addison

**Explanation:** {

Thomas Addison

(xiii) **(c)** Refrigeration equipments

**Explanation:** {

Refrigeration equipments

(xiv) **(d)** Grana

**Explanation:** {

Grana

(xv) **(b)** cell body, dendrites, axon

**Explanation:** {

Neuron consist of cell body, dendrites, axon.

## 2. Question 2

(i) Name the following:

i. 1. Active absorption

ii. 1. Cuticle

iii. 1. Cuticle

iv. 1. Tropic hormones

v. 1. Antidiuretic Hormone

2. ADH

3. vasopressin

(ii) Arrange and rewrite the terms in each group in the correct order so as to be in a logical sequence beginning with the term that is underlined.

i. The Graafian follicle, after ovulation turns into a hormone producing tissue called Corpus luteum.

ii. The correct pathway of nerve impulse is: receptor, sensory neuron, association neuron, motor neuron, effector.

- iii. Osmosis is the movement of water molecule from its region of higher concentration to region of lower concentration through a semipermeable membrane.
- iv. The first process by which water gets into the seed coat during germination is imbibition.
- v. Guanine

(iii) Fill in the blanks with suitable words:

- i. (i) follicle, (ii) graafian, (iii) ovulation, (iv) fallopian tube/oviduct/uterine tube, (v) implantation

(iv) Choose the odd one out from the following terms and name the category to which the others belong:

- i. **Odd term:** Bile

**Category:** Nitrogenous wastes/Excretory substances

- ii. **Odd term** - Leukemia

**Category** - Hormonal / Endocrinal disorders

- iii. **Odd term** - ADH

**Category** - Hormones of anterior lobe of pituitary gland.

- iv. Odd term - X-rays

**Category** - Sources of water pollution

- v. **Odd term:** Iodine

**Category:** Disinfectants

(v) Match the items given in Column I with the most appropriate ones in Column II and rewrite the correct matching pairs.

- i. (a) - (iii), (b) - (iv), (c) - (v), (d) - (ii)

## Section B

### 3. Question 3

- (i) Gene mutation is the change in sequence of DNA.
- (ii) No, the above situation does not mean that the husband does not produce Y-bearing sperms. It only means that in four consecutive pregnancies, the X-bearing sperms could fertilise the eggs which resulted in the birth of female children.

(iii)	<b>S-phase</b>	<b>G<sub>2</sub>-phase</b>
	It is called a synthetic phase.	It is called the pre-mitotic phase.
	Replication of DNA occurs.	RNA of all three types and proteins precursors of asters and spindle are synthesised in it.

It lasts for 6-8 hours

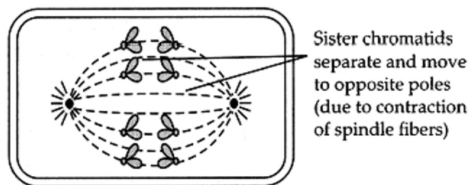
It lasts for 2-5 years.

- (iv) 0%. All the males and females will be red-eyed. Pure breed female (XX) is homozygous for normal X-chromosome. White-eyed male ( $X^oY$ ) is hemizygous for X-chromosome with a white eye mutation.

		Sperm	
		$X^o$	Y
Egg	X	$XX^o$	XY
	X	$XX^o$	XY

Both male and female offsprings will inherit a normal X-chromosome from the female.

- (v) Anaphase stage of mitosis in animal cell is given below:



#### 4. Question 4

- (i) **Dynamic** - semi-circular canals/ducts/tubes

**Static** - utricle, saccule, utricle, saccule, vestibule

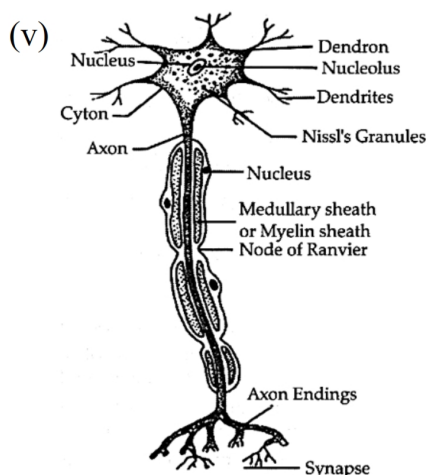
- (ii) i. Suspensory ligaments hold lens in position.

ii. Semicircular canals balances the body.

- (iii) While reading a book (near by vision), the lens of our eye is more convex or rounded but when we focus our eye on a distant object, the ciliary muscles are relaxed.

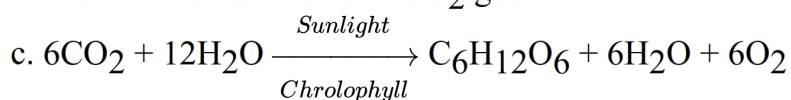
The lens becomes concave or flattened. This accommodation power of eye enables us to have a clear vision of objects at varying distances.

- (iv) The CNS includes the brain and the spinal cord and is the site of information processing and control. The PNS comprises of all the nerves of the body associated with the CNS (brain and spinal cord).



### 5. Question 5

- (i) Destarched plant is the one which is kept in the dark to remove the starch from the leaves. The process for destarching is done by keeping the plant in dark for 2-3 days.
- (ii) Chlorophyll has various pigments like a and b. These pigments have a tendency to absorb different light or different wavelengths. Thus, this characteristic feature of various pigments of chlorophyll makes them most effective for photosynthesis.
- (iii) Carboxylation is the most crucial step of the Calvin cycle, where  $\text{CO}_2$  is utilised for the carboxylation of RuBP. This reaction is catalysed by the enzyme RuBP carboxylase which results in the formation of 2 molecules of 3PGA. Since, this enzyme also has an oxygenation activity, it would be more correct to call it RuBP carboxylase-oxygenase or RubBisCO.
- (iv) i. We select white light for photosynthesis but not green because chlorophyll does not absorb all of white light but it does absorb most of it, other than the green. Photosynthesis does not occur in green light because chloroplasts (containing chlorophyll) absorb light in the red and in the blue part of spectra and reflect green light.  
ii. We will select a destarched plant (starch-free plant), because destarching ensures that any starch present after the experiment has been formed under experimental conditions.
- (v) a. Carbon dioxide is necessary for photosynthesis studied in the above experiment.  
b. KOH in the flask remove  $\text{CO}_2$  gas.



### 6. Question 6

- (i) The number of chromosomes during metaphase will be 32. Also the DNA content during anaphase will be same as in the parent cell.



(ii) In some cases such as formation of new mitochondria or chloroplast, DNA replication is not followed by cell division. Also, in some organisms karyokinesis is not followed by cytokinesis as a result of which multinucleate condition arises leading to the formation of syncytium (e.g.

liquid endosperm in coconut)

However, in most cases DNA replication is followed by cell division.

(iii)a. The tropic movements are phototropism by shoots and geotropism by roots.

b. Light is the stimulus that made the shoot bend towards the window.

c. Auxin causes the above effect.

## 7. Question 7

(i) **Neanderthal man** - Absolute bipedalism, large head, broad, flat, sloping forehead, less hair on body, large cranial capacity ( $1,500 \text{ cm}^3$ ).

**Australopithecus** - Protruding face, chin absent, prominent eyebrow ridges, flat nose, projecting face, cranial capacity ( $450 - 600 \text{ cm}^3$ ).

(ii) Those organs, which no longer have a function in our body are known as vestigial organs. These organs have reduced structurally as well as functionally. It appears that these organs were once well-developed and functional in ancestors and later on due to their less use they become reduced, e.g. vermiform appendix in man is reduced and functionless while in herbivores vermiform appendix along with caecum is used for digestion of cellulose. It gives an idea that human had herbivorous food habit and cellulose containing materials were major part of their food.

(iii) According to Darwin's concept of natural selection, the organisms, which are provided with favourable variations would survive because they are fittest to face their surrounding, while the organisms, which are unfit for surrounding variations are destroyed.

(iv) Use of contraceptives is justified because it helps to control the growth of population and prevents STDs (Sexually Transmitted Diseases). The unwanted pregnancies can also be avoided by the use of contraceptives.

(v) a. The phase represented in the above diagram is atrial systole.

b. The parts A, B and C in the given figure are labelled as:

A - Pulmonary artery, B - Superior vena cava, C - Aorta

c. In the upper chamber, i.e. both the atria are contracting in this phase because blood is flowing downwards (towards the ventricles).

## 8. Question 8

- (i)
  - i. Phloem
  - ii. Epidermal cells.
- (ii) Renal portal system is absent in mammals due to following reasons
  - i. The heart of mammals is four-chambered, due to which there is total separation of oxygenated and deoxygenated blood.
  - ii. Posterior portion of body gets oxygenated blood from heart. After oxidation, the blood does not contain much impurities that it should go to kidneys for filtration.
- (iii) Algal bloom is caused by the enrichment of nutrients in the water body, especially by the presence of phosphorus and nitrogen.

It affects the ecosystem in following ways

  - i. Deterioration of water quality.
  - ii. Death of aquatic organisms.
- (iv)
  - a. The defect is hypermetropia also known as farsightedness because the image is formed behind the retina.
  - b. The defect arises due to the following reasons:
    - i. The focal length of the eye becomes large.
    - ii. Eyeball becomes too short so that the image is formed behind retina.
  - c. Ciliary muscles are responsible for controlling/maintaining the shape of the eyeball.