This is a booklet of your biology course written in a special manner for you. This is a programme consisting of short meaningful sentences giving information to be learnt. Each paragraph has six to seven words left out and you will see blanks like this one. Read the sentence that follows the blanks also, this second sentence will make you think of the answers/words suitable to the blanks. Now let us try doing it in this booklet.

1. Cover the left hand side margin with the paper strip or 'slider' given to you with this booklet. Read the paragraph and think of the words to be filled against each blank. Read the sentence that follows the blanks also, this second sentence will make you think of the answers. After thinking of the answer-words to be filled in, move the slider down to the next item and you will get the correct answers to the blanks. You will not move the _________ until you have your answers in the blanks. Only after reading the second _________ that follows the blanks you will _________ of the correct answers. You will get the correct _________ in the left hand side of the margin under the _________.

Read the sentence that follows the blanks. It will make you think of suitable answer. You can confirm your answers by moving the slider to the next item.

2. The sentences that follow the blanks will make you think of the suitable answer-words to the blanks. After thinking the answer, move the slider down to the next item and you will get correct answers under the slider. This is your biology book, it is a new kind of biology book. You will come across some _________ in the paragraphs. You think of the _________ to be filled in. Read the sentence that follows the _________. This sentence will make you _________ of the correct _________ to be filled in the _________. Only after _________
the answers in the blanks, you can move the ________ to the next ________, beneath which you can get the correct answers.

This new kind of biology book has a paragraph of meaningful sentences having blanks, these blanks are followed by a sentence which will make you think of the correct answer. A slider is given to you, cover the left margin with it, when you move the slider to the next item you will get correct answers.

You will learn better if you follow the same procedure described above for all the frames in the programme hereafter.

Now proceed
Some visual stimulus objects emit light, this light is a form of 'radiant energy'. A light bulb is an example of a visual stimulus object that emits radiant energy. There are various visual stimulus objects in a person's surroundings that emit radiant energy. A stimulus object such as a light bulb, itself produces the radiant energy that it emits. Other visual stimulus objects, however, do not produce radiant energy. But rather they reflect radiant energy coming from other sources.

Some objects, for example, a door does not produce light in the form of radiant energy, but they reflect it coming from other sources.

For example, a light bulb in a room produces radiant energy that strikes the wall, much of it is absorbed by the wall, only the residual part is then reflected from the wall and is transmitted to the organism's visual receptor/apparatus/organ that we call the eye. Another example of a stimulus object that itself emits radiant energy is a lighted match. A desk is an example of a stimulus object that reflects, rather than emits radiant energy. One way to describe radiant energy is in terms of waves. In case of auditory stimuli, we talk of sound waves. In case of visual light waves, we shall talk about light waves. A stimulus object such as a light bulb, gives off a radiant energy that can be described in terms of light waves.

All types of fast moving energy, viz., sound, light, etc., can be described in terms of waves.

Light waves are produced by stimulus objects that give off radiant energy. When a stimulus object gives off radiant energy, light waves are produced.

Light waves travel very fast. They travel...
at a velocity of 1,86,000 miles per second. The eye can be excited by certain frequencies of radiant energy; it cannot be excited by other frequencies. Light waves travel at a velocity of miles per second. The eye can be excited by certain frequencies of radiant energy, it cannot be excited by other frequencies.

All frequencies of light waves do not excite the human eye. Only frequencies in a certain range can do so.

The frequencies that can excite the eye make the visible spectrum. The visual stimuli that we can see are the frequencies of radiant energy which is a part of the visible spectrum. The human eye can only be excited by frequencies of radiant energy that fall within the visible spectrum. Frequencies of radiant energy that fall above or below the visible spectrum cannot excite/activate the human eye. A light wave is radiant energy that has a frequency in the region of the visible spectrum. The visible spectrum can be divided into __________ for the different __________ for example the __________ particular frequency within the ____________

velocity
1,86,000
excited, frequencies
radiant-energy
frequencies

figure 1
Visible spectrum is the band of light, where we have the frequencies of the seven colours.

5. Light, bulbs and Sun are examples of stimulus objects that emit radiant energy in the form of light waves. Some objects themselves emit radiant energy in the form of light waves other objects reflected. A book or picture are the example of objects that do not emit radiant energy but they reflect it from other sources. The eye can be excited by light wave that are either emitted or reflected from other sources.

Figure 2 shows the figure of human eye. In figure 2 we see a light ray entering the human eye. It first passes through the lens and then the pupil. The light finally falls on the retina of the eye.

Light passes through the eye in a particular order. Study figure 2 carefully.

6. The size of the pupil is controlled by a group of muscles. As these muscles contract and relax, the pupil opens and closes. The pupil is the black centre of the eye.
we see when we look into a person's eye. The pupil is simply an opening or hole that changes in size to allow smaller or larger amount of light. As varying amount of light enters the eye, the opening that we call the pupil changes in size. The opening in the eye through which light travels is called the pupil. The lens of the eye is similar in function to the lens of the camera. The function of the lens of the eye is to focus light from a stimulus object, to form an image of the object on the retina.

The lens changes its thickness to allow required amount of light to enter the eye, and form an image of the object on the retina.

Certain muscles of the eye are attached to the lens, as these muscles contract and relax, the lens changes in shape. By changing its shape, the lens ensures that a sharp image of the stimulus object falls on the retina. Hence, when we look at a stimulus object, a picture or an image of it falls on a retina of the eye. Most of the inside of the eye is covered by the retina. The light from a stimulus object passes through the lens and is focused on the inside of the eye called the retina. When the lens changes its shape, it focuses on the retina of the eye.

Light enters the eye through the pupil, travels through the lens and is finally focused on the retina.

The reason that sharp image falls on the retina of the eye is that the lens focuses it. The function of the lens is to focus light from the stimulus object, so a sharp image of it will fall on the retina. If the lens did not focus properly light from the stimulus object, the image on the retina would be dim rather than sharp and clear. The retina of the eye contains two kinds of tiny
cells called rods and cones. There are very large number of these tiny cells called _________ and _________ in the _________ of the _________ Just to give you rough idea it has been found that approximately 120,000,000 rods and 6,500,000 _________ are found in the _________ of the human _________.

The retina covers most of the inside of the eye and contains a large number of tiny cells called rods and cones.

9. Rods and cones are found in the retina. These cells are called rods and cones because of their shape. As you can see in figure 3, rods are cylindrical in shape whereas cones are rather tapered to become pointed at the ends. Rods and cones are excited when an image of a stimulus object falls on the retina. Rods however are used in black and white vision, whereas cones are used in colour vision. You can always remember this difference if you note that the first two letters of cones and colour are the same. Hence _________ are used in black white _________ and the _________ are used in _________ vision. For example

Figure 3
If you look at a coloured object the cones are the cells of which are excited.

When you look at a red rose, the cones are the cells that are excited.

Because they are used in black-white vision rods are the cells that function at night time. Thus if a person looks at a stimulus object at night rods are excited, but cones are not excited. Connected to the rods and cones are two other types of cells called 'bipolar cells' and 'ganglion cells' in the retina. The rods and cones are at the bottom or back of the retina. Just above the layer that contains rods and cones we find the bipolar cells. The bipolar cells are connected to the rods and cones. The type of cell that is connected to the rods and cones is called as the bipolar cell and ganglion cells are in the bottom layer of the retina. Just above them are the nerve fibre cells.

The retina has three types of cells, viz., the 'rods and cones', 'bipolar cells' and the 'ganglion cell'.

The name of the cell that is connected to rods and cones is the bipolar cell. As can be seen in figure 4 the bipolar cells are connected to another type.
of cells called the ganglion cell. The name of the cell that is connected to the bipolar cell is the ganglion cell. Rods and cones are connected to the bipolar cells which in turn are connected to ganglion cells. As can be seen in Figure 4 the end of the ganglion cell is a tiny nerve fibre. The tiny fibre of the cell can conduct a nerve impulse. We can thus see that the retina contain three layers of . At the bottom are found the and .

The retina contains three types of cells, study Figure 4, carefully.

Consider light from an object, refer Figure 5. The passes through the and and project and of the object on the surface of the.
Light enters the eye in a particular fashion, study figure 5 carefully and answer.

13. When the radiant energy from the stimulus object falls on the retina, a chemical reaction starts. Light passes on the retina; this sets off a chemical reaction that stimulates rods and cones. Light wave from a stimulus object fall on the retina to form an image. The radiant energy of those light waves produce chemical reaction. The chemical reactions that excites the _______ and _______. When rods and cones are _______ a nerve impulse is set off. This nerve _______ is than transmitted to the bipolar _______.

Chemical reaction excites the rods and cones, and the impulses are transmitted from them to the bipolar cells.

14. Rods and cones are excited by the chemical reaction. Nerve impulses are set off and those impulses pass along the various cell of the retina. Nerve impulses generated by the rods and cones in received by the bipolar cells and is then passed on to the ganglion cells. The bipolar cells transmit nerve impulses to the ganglion cells. You will recall that the ends of the ganglion cells are tiny nerve fibres. These nerve fibres of the ganglion cells make up the optic-nerve. The nerve fibres form a major nerve called the optic nerve. The major _______ called the _______ nerve runs from the _______ to the _______. Write the parts of the eye in the blanks provided.
Nerve impulses from the bipolar cells are transmitted to the ganglion cells. The nerve fibres of the ganglion cells join to form a major nerve called the optic nerve.

Figure 6 shows a major nerve called the optic nerve leaving the eye. The nerve impulse travels from the retina to the brain. Light enters the eye and travels through the pupil, the lens, and finally falls on the retina. The optic nerve is made up of nerve fibres of ganglion cells. Note the blind spot in figure 6. The blind spot is a place in the retina where the tiny nerve fibres of the ganglion cells meet to form the optic nerve. Because the blind spot consists only of nerve fibres, it does not contain cones and rods. Since there are no cones and rods in the blind spot, a stimulus object falling at that place cannot set off a nerve impulse.

The blind spot does not contain any rods and cones. Hence, this spot cannot carry nerve impulses.

Rods and cones are not found at the blind spot of the retina. Thus an image of the object at this spot does not set off a nerve impulse, and we cannot see that part of a stimulus object that falls there.
on the blind spot. Thus light rays from an object falls on the retina, rods and cones on the retina are stimulated and set off nerve impulse. The nerve impulses set off by the rods and cones are transmitted to the bipolar cells. The nerve impulse is then conducted along the __________ __________ and is thus transmitted to the __________ cells. When the nerve impulse is received by the __________ cells that __________ is conducted along the __________ nerve to the __________

Nerve impulses are transmitted from the rods and cones to the brain in the following order: rods, cones, bipolar cells, ganglion cells, optic nerve, brain.