

# Biology [Set 1]

Academic Year: 2017-2018

Marks: 70

Date: July 2018

**Question 1A:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

In an octamer of the nucleosome, core DNA consist of \_\_\_\_\_ base pairs

- 46
- 146
- 246
- 346

**Answer:** In an octamer of the nucleosome, core DNA consist of 146 base pairs

**Question 1B:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

A versatile anther is an adaptation for \_\_\_\_\_ type of pollination.

- anemophilous
- entomophilous
- hydrophilous
- ornithophilous

**Answer:** A versatile anther is an adaptation for anemophilous type of pollination.

**Question 1C:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

\_\_\_\_\_ is an example of GM crop developed for its nutritional value by using soil bacterium Erwinia.

- IR8
- Taichung Native - I
- Vijaya
- Golden rice

**Answer:** Golden rice is an example of GM crop developed for its nutritional value by using soil bacterium Erwinia.

**Question 1D:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

The energy enters the ecosystem through \_\_\_\_\_.  
consumers

decomposers  
omnivores  
producers

**Answer:** The energy enters the ecosystem through **producers**.

**Question 1E:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

Identify free-living bacterial bio-fertilizer.

Rhizobium  
Azotobacter  
Nostoc  
Bacillus thuringiensis

**Answer:** Identify free-living bacterial bio-fertilizer – **Azotobacter**

**Question 1F:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

\_\_\_\_\_ is a soil bacterium which causes crown gall tumours in dicotyledonous plants.

Agrobacterium tumefaciens  
Bacillus thuringiensis  
Haemophilus influenzae  
Escherichia coli

**Answer:** **Agrobacterium tumefaciens** is a soil bacterium which causes crown gall tumours in dicotyledonous plants.

**Question 1G:** Select and write the most appropriate answer from the given alternatives for the following subquestion: [1]

Which of the following harmful radiation is absorbed by ozone layer of the stratosphere?

X-ray  
Visible light  
Ultraviolet rays  
Gamma rays

**Answer:** Which of the following harmful radiation is absorbed by ozone layer of the stratosphere - **Ultraviolet rays**.

**Question 2Ai:** Answer the following question in 'One' sentence only: [1]

Define 'mutation breeding'.

**Answer:** Mutation breeding, sometimes referred to as "variation breeding", is the

process of exposing seeds to chemicals or radiation in order to generate mutants with desirable traits to be bred with other cultivars.

**Question 2Aii:** Answer the following question in 'One' sentence only: [1]

Enlist the histones which form an octamer of nucleosome.

**Answer:** Eight molecules of histones (two each of H2A, H2B, H3 and H4) get organized to form histone octamer.

**Question 2Aiii:** Answer each question in 'One' sentence only: [1]

Name 'any one' therapeutic product of blood proteins made by using r-DNA technology.

**Answer:** Insulin is the therapeutic product of blood proteins made by using r-DNA technology.

**Question 2Aiv:** Answer each question in 'One' sentence only: [1]

Name the strain of yeast used in industrial production of wine.

**Answer:** *Saccharomyces cerevisiae* is used in industrial production of wine.

**Question 2Av:** Answer each question in 'One' sentence only: [1]

Identify which one of the following is a test cross.

$Tt \times Tt$

$TT \times tt$

$Tt \times tt$

**Answer:**

$Tt \times tt$  is a test cross.

A test cross is a cross between F1 hybrid ( $Tt$ ) and a recessive parent ( $tt$ ).

**Question 2Avi:** Answer each question in 'One' sentence only: [1]

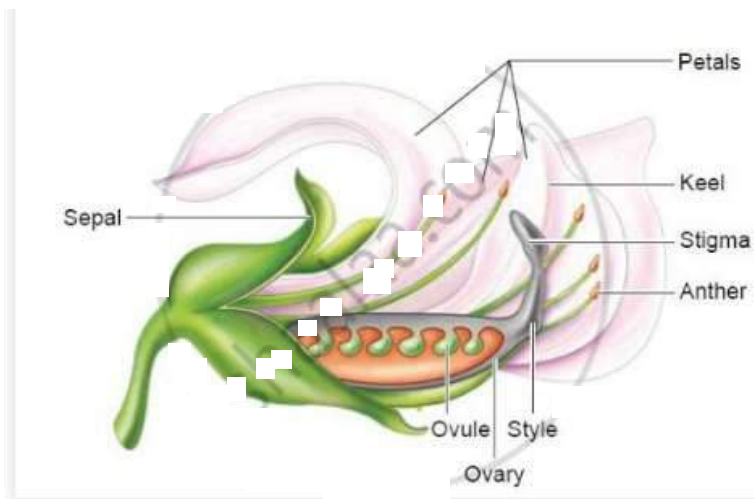
Define stock and scion.

**Answer:**

The cut stem of a plant having roots (and fixed in soil) is called stock and the cut stem of another plant (without roots) is called scion.

**Question 2B:** Sketch and label 'structure of a pea flower'. [2]

**Answer:**



**Question 2Ci:** Attempt any TWO of the following: [2]

'The gene for sickle cell anaemia in homozygous condition is lethal and produces sickle cell trait in heterozygous carrier'. Explain.

**Answer:** Sickle cell trait describes a condition in which a person has one abnormal allele of the hemoglobin beta gene (is heterozygous), but does not display the severe symptoms of sickle cell disease that occur in a person who has two copies of that allele (is homozygous). Those who are heterozygous for the sickle cell allele produce both normal and abnormal hemoglobin (the two alleles are codominant with respect to the actual concentration of hemoglobin in the circulating cells).

Sickle cell disease is a blood disorder wherein there is a single amino acid substitution in the hemoglobin protein of the red blood cells which causes these cells to assume a sickle shape, especially when under low oxygen tension. Sickling and sickle cell disease also confer some resistance to malaria parasitization of red blood cells, so that individuals with sickle-cell trait (heterozygotes) have a selective advantage in environments where malaria is present.

**Question 2Cii:** Attempt any TWO of the following: [2]

Enlist the applications of tissue culture.

**Answer: 1. Rapid Clonal Propagation:**

A clone is a group of individuals or cells derived from a single parent individual or cell through asexual reproduction. All the cells in callus or suspension culture are derived from a single explant by mitotic division.

**2. Soma-clonal Variation:**

Genetic variation present among plant cells of a culture is called soma-clonal variation. The term soma-clonal variation is also used for the genetic variation present in plants regenerated from a single culture. This variation has been used to develop several useful varieties.

### 3. Transgenic Plants:

A gene that is transferred into an organism by genetic engineering is known as transgene. An organism that contains and expresses a transgene is called transgenic organism. The transgenes can be introduced into individual plant cells.

### 4. Induction and Selection of Mutations:

Mutagens are added to single cell liquid cultures for induction of mutations. The cells are washed and transferred to solid culture for raising mutant plants. Useful mutants are selected for further breeding.

### 5. Resistance to Weedicides:

It is similar to induction of mutations. Weedicides are added to culture initially in very small concentrations. Dosage is increased in subsequent cultures till the desired level of resistance is obtained. The resistant cells are then regenerated to form plantlets and plants.

**Question 2Ciii:** Attempt any TWO of the following: [2]

Describe 'any two' factors affecting the rate of photosynthesis.

**Answer:** Three main factors affect the rate of photosynthesis:

**Light intensity:** Increasing light intensity will increase the rate of photosynthesis, until the maximum amount of light is being absorbed. The main photosynthetic pigment in green plants is chlorophyll, which absorbs red and blue wavelengths (explaining their green appearance). So it's more efficient to use only these wavelengths.

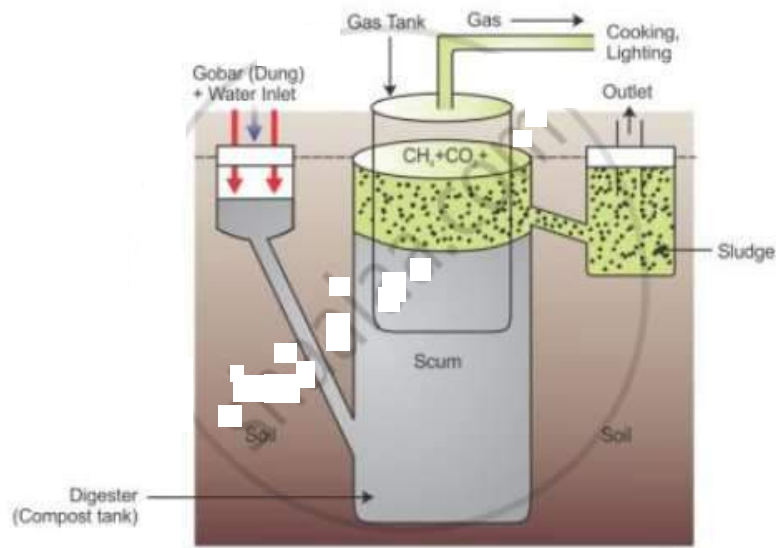
**Carbon dioxide:** The rate of photosynthesis will increase up to an optimal CO<sub>2</sub> concentration of ~0.4% (normal atmospheric levels are ~0.04%). Above 0.4%, stomata begin to close, hindering diffusion into the leaves.

**Temperature:** 25°C is the optimal temperature for photosynthesis. Below 10°C, enzymatic activity is very low - but above 40°C, crucial enzymes begin to denature (e.g. PSI, PSII, ATP synthase and Rubisco).

**Question 3Ai:** Attempt any TWO of the following: [3]

Explain in brief biogas production process with the help of a labelled figure.

**Answer:** Biogas is a mixture of gases produced from decomposable organic matter by the activity of various anaerobic bacteria that can be used as a fuel.



Mechanism of biogas production:

1. The biogas plant tank is fed with a mixture of dung or waste materials from kitchen and night soil along with water.
2. The biogas tank is covered with a floating lid which keeps on rising as the gas is produced in the slurry due to the microbial activity of methanogens like *Methanobacterium*.
3. Methanogens grow anaerobically on cellulosic material in cowdung to produce a large amount of methane, CO<sub>2</sub> and H<sub>2</sub>.
4. The biogas plant has an outlet, which is connected to a pipe to supply biogas. The leftover slurry is removed through another outlet and is used as fertiliser.
5. Biogas is used as a fuel for heating and cooking, lighting, power for irrigation and other purposes as an alternative for firewood, kerosene, electricity and LPG. It is considered as an ecofriendly and pollution free source of energy.

**Question 3Aii:** Attempt any TWO of the following: [3]

Define 'deforestation'. Comment on its effects

**Answer: Defination:**

Deforestation means cutting down the trees to a large extent be it forests, any barren land or trees we see on our way to school every day. Natural forests are being destructed to use the land for cultivation, building houses, factories, logging, making space for cattle grazing, extraction of oil, mining, construction of dams or to obtain wood for making furniture and using it as fuel.

**Some of the effects of deforestation are:**

### **Greenhouse Gas Emissions**

Gases such as methane and carbon dioxide trap heat in Earth's atmosphere, leading change in climate. Trees absorb the carbon dioxide and release oxygen and water into the atmosphere and this contributes to global warming. Cutting carbon dioxide adds to the environment and then this lack of the tree creates an absorption deficit.

Deforestation leads to the emission of greenhouse gas.

### **Soil Erosion**

Cutting down on trees leads to clearance of forests and so soil erosion occurs.

Exposure of the soil to the sun's heat dries up the moisture inside the soil. Nutrients evaporate and it affects the bacteria that help to break down organic matter. Due to this, rain washes the soil surfaces and erosion takes place. Large amounts of soil wash into local streams and rivers and cause damage to hydroelectric structures and irrigation infrastructure.

### **Biodiversity Losses**

Deforestation alters land and so that many of the plants and animals do not survive. With more deforestation, the entire species can extinct. This is the 'biodiversity loss'. Many wonderful species of plants and animals have been lost, and many others remain endangered. As each species of an ecosystem rely upon other species, loss of one species can have far-reaching consequences for other species. We lose about 50 to 100 species of animals each day due to the destruction of their habitats. Millions of plants and animal species are on the verge of extinction due to deforestation.

### **Floods**

Deforestation leads to land erosion because the trees maintain the surface of the mountains. The water level of the rivers increases suddenly, causing floods. When it rains, trees absorb and store a large amount of water with the help of their roots. Chopping down of trees disrupts the flow of water and leads to floods in some areas.

### **Question 3Aiii: Attempt any TWO of the following: [3]**

With the help of a suitable example illustrate 'Palindrome'.

A palindromic sequence is a sequence made up of nucleic acids within double helix of DNA and/or RNA that is the same when read from 5' to 3' on one strand and 5' to 3' on the other, complementary, strand. It is also known as a palindrome or an inverted-reverse sequence.

The pairing of nucleotides within the DNA double-helix is complementary which consist of Adenine (A) pairing with either Thymine (T) in DNA or Uracil (U) in RNA, while Cytosine (C) pairs with Guanine (G). So if a sequence is palindromic, the nucleotide sequence of one strand would be the same as its reverse complementary strand.

An example of a palindromic sequence is 5'-GGATCC-3', which has a complementary strand, 3'-CCTAGG-5'. This is the sequence where the restriction endonuclease, BamHI, binds to and cleaves at a specific cleavage site. When the complementary strand is

read backwards, the sequence is 5'-GGATCC-3' which is identical to the first one, making it a palindromic sequence.

Another restriction enzyme called EcoR1 recognizes and cleaves the following palindromic sequence:

5' - G A A T T C - 3'  
3' - C T T A A G - 5'

