

**Quarterly examination Sep'2016**  
**Bio-Botany Answer Key**

**I: Choose the correct answer****14x1=14**

1. *Strelitzia reginae*
2. Bio-systematics
3. Vessels
4. Starch sheath
5. Beadle and Tatum
6. *Oenothera lamarchiana*
7. Renin inhibitors
8. *Bacillus thuringiensis*
9. Caliciflorae
10. *Solanum melongena*
11. Parenchyma
12. 3.4 Å
13. Polygalactronace
14. *Jatropha gossypifolia*

**II: Answer any seven Questions****7x2=21****15. How is ICBN evolved?**

- i. In 1930, the *fifth* International Botanical Congress was held at *Cambridge, England* to *frame rules* and regulations for naming plants. [1]
- ii. The *twelfth* meeting was held at *Leningrad, USSR* in July 1975. [1]
- iii. Based on the resolutions of this meeting, the current system of *International Code of Botanical Nomenclature* was *adapted* from 1978. [1]

**16. Food plants of Solanaceae**

	<i>Plant name</i>	<i>Useful Part</i>	<i>Use</i>
1	<i>Solanum tuberosum</i> [1]	Tubers	vegetable
2	<i>Solanum melongena</i> [1]	Tender fruits	vegetable
3	<i>Lycopersicon esculentum</i>	Fruits [1]	delicious vegetables

**17. Cyathium inflorescence**

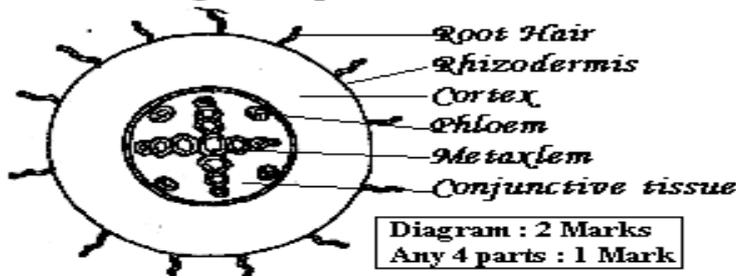
- i. Cyathium is a *collection of unisexual flowers* arranged in cymose manner on a condensed axis and enclosed within a *cup-shaped involucre*. [1]
- ii. Each cyathium has a *single central female flower* surrounded by two to many male flowers. [1]
- iii. Each *male flower* is represented by a *single stamen*. They are arranged in centrifugal manner. [1]
- iv. The pedicel in female flower is short or long. If it is short, the female flower remains hidden within the involucre. If it is long, the *female flower comes out of involucre*.
- v. Extra floral *nectar secreting gland* is also located in the cyathium.

**18. The fruits of *Musa paradisiaca* [any 3 points 3x1=3]**

	Useful part	Use
1	Fruits	Edible
2	Tender bananas, shaft and flowers	Vegetable
3	Leaves	plates on festive occasions
4	Sap obtained from sheathy leaf bases	antidote for cobra bite

19.

Parts of ground plan of dicot root



20. Difference between bundle cap and bundle sheath

	Bundle cap	Bundle sheath
1	Bundle cap is present in dicot stem [1]	Bundle sheath is present in monocot stem
2	Sclerenchyma cells occur in patches outside the phloem in each vascular bundle [1]	Vascular bundle is surrounded by a sheath of Sclerenchyma cells
3	Eg. Sunflower [1]	Eg. Maize

21. What is a respiratory cavity or sub-stomatal cavity?

- i. The *air space* that is found next to the stoma is called respiratory cavity or sub-stomatal cavity. [2]
- ii. Spongy cells facilitate the exchange of gases with the help of air spaces. [1]

22. Draw and label the parts of Telocentric and Acrocentric Chromosome

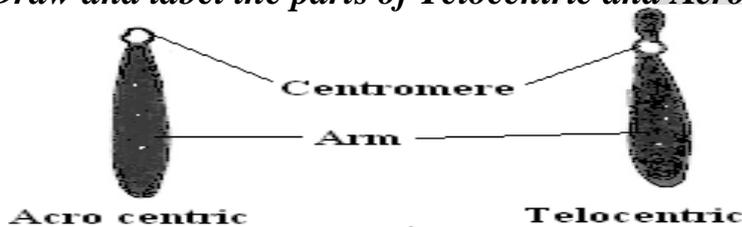


Diagram. 2  
Parts . 1

23. Name the enzymes involved in the making of DNA hybrid

- i. Restriction endonuclease 1 ½
- ii. DNA ligase 1 ½

24. What is bioremediation

- i. Bioremediation is defined as the use of living micro-organisms to degrade environmental pollutants or prevent pollution. [2]
- ii. Pollution of land and water due to the oil slicks can be remedied. [1]
- iii. The contaminated sites are restored and future pollution is prevented.

II: Answer any four questions. question no 25 is compulsory 4x5=20

25. Describe biosystematics? Write the aims and two methods of study. Biosystematics may be defined as ‘taxonomy of living populations’. [1]

Aims of biosystematics

Camp and Gily 1943, coined the term ‘biosystematics’.  
The aims of biosystematics are as follows.

- i) To *delimit* the naturally occurring *biotic community* of plant species. [1]
- ii) To *recognise* the various groups as separate biosystematic categories such as ecotypes, ecospecies, cenospecies and comparium. [1]

**Methods in the study of biosystematics [any two methods 2x1=2]**

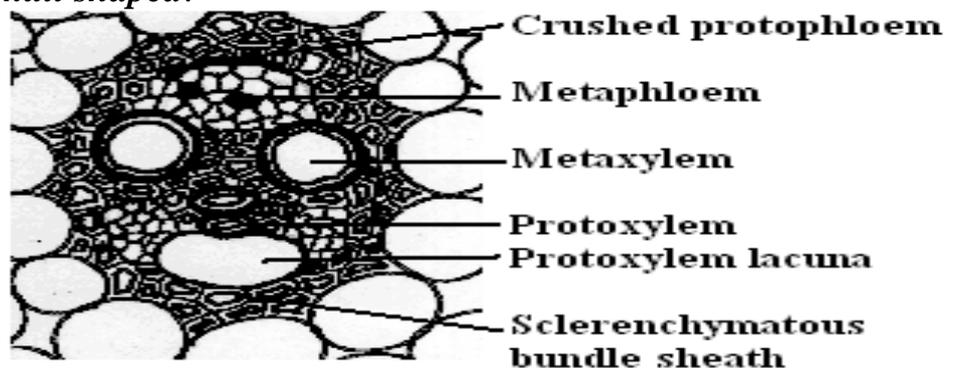
- i) It involves thorough **sampling analysis** of the taxonomic species under study. Its population, cultivation, geographical range, cytology, anatomy, palynology, phytochemistry, chromosomal number and behavior are keenly observed and studied for finding any genetic differences that may arise among different populations.
- ii) It includes **determination of ability of different populations** to interbreed among one another to form a variant species with its vigor and fertility. This will reveal the presence or absence of breeding barriers between taxa at various levels.
- iii) It involves the **study of similarity of chromosomes** in the hybrids during meiosis.

**26. Describe the economic importance of Malvaceae.**

	<b>Plant name</b>	<b>Useful part</b>	<b>Uses</b>
1	<b>Fibre plants [any one]</b> Gossypium barbadense G. herbaceum Hibiscus cannabinus	Cotton fibres are obtained from the surface of seeds. bast fibres	commercial value [1] making ropes
2.	<b>Food plants [any one]</b> Abelmoschus esculentus Hibiscus sabdariffa H. cannabinus, H. sabdariffa	tender fruit leaves and sepals leaves and sepals	[1] vegetable pickles, jam and jelly delicious 'chutney'
3	<b>Timber Plants</b> Thespesia populnea (portia tree)	Timber (wood)	making boat, furniture and agricultural implements [1]
4	<b>Medicinal plants [any one]</b> Abutilon indicum Malva sylvestris Althaea rosea	Root and leaves Roots	fever [1] whooping cough and dysentery
5	<b>Ornamental plants [any one]</b> Althaea rosea      Hibiscus rosa-sinensis      [1] H. schizopetalus      -      dissected petals		

**27. Describe the vascular bundle of monocot stem**

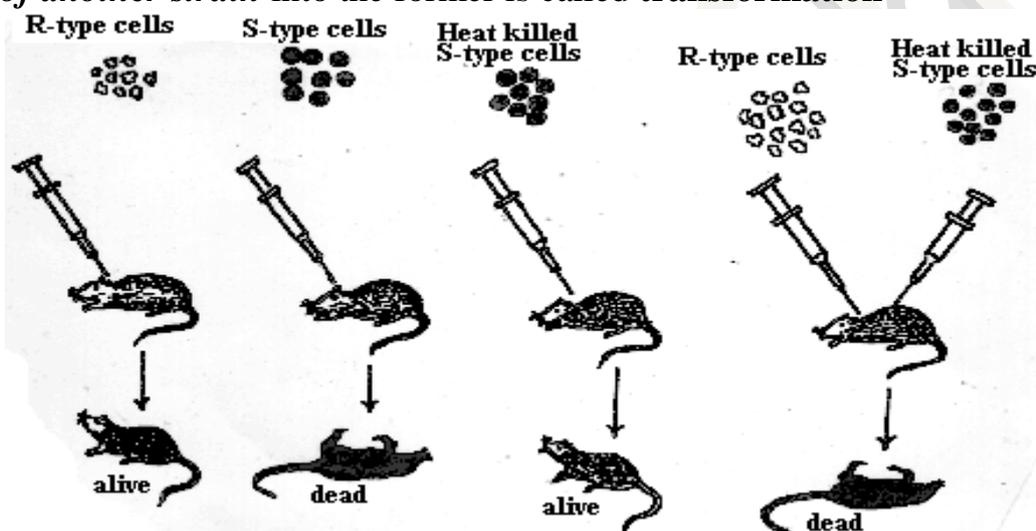
- i. Vascular bundles are **scattered** in the parenchymatous ground tissue.
- ii. Each vascular bundle is surrounded by a sheath of sclerenchymatous fibres called **bundle sheath**. [any three points 3x1=3 + diagram .1 , parts: 1]
- iii. The vascular bundles are **conjoint, collateral, endarch** and closed.
- iv. Vascular bundles are **skull shaped**.



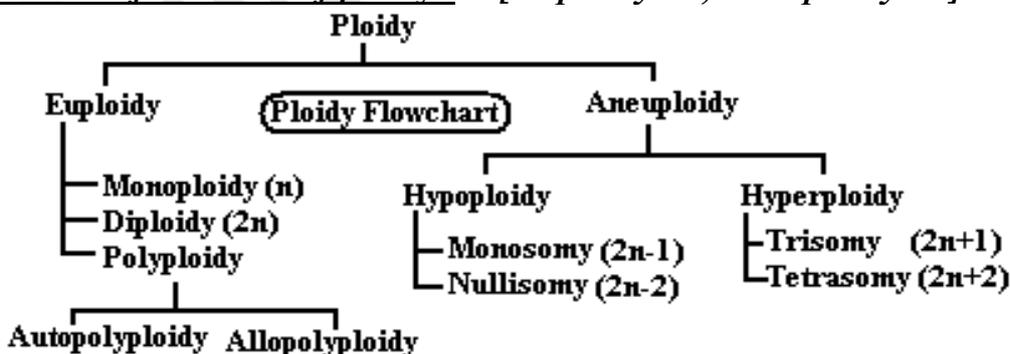
**Vascular bundle of monocot stem**

**28. Explain Fredrick Griffith experiments on mouse [Description : 4, Diagram: 1]**

- i. In 1928, the bacteriologist Frederick Griffith conducted an experiment using *Diplococcus pneumoniae*.
- ii. He studied two strains of virulent *Diplococcus* causing pneumonia.
- iii. The virulent strain synthesized a smooth polysaccharide coat and produces smooth colonies. This strain was called **strain-S**.
- iv. Another strain which lacked the proper polysaccharide coat is harmless and produces rough colonies. This strain was called **strain-R**.
- v. When Griffith injected **S-type** of cells into the mouse, the mouse **died**.
- vi. When **R-type** cells were injected into the mouse, the mice did **not die**.
- vii. He injected **heat killed S-type** cells into the mouse. The mouse did **not die**.
- viii. When the **mixture of heat killed S-type** cells and **R-type** cells was injected into the mouse, the mouse was **dead**.
- ix. The living rough strain of *Diplococcus* had been transformed into S-type cells. That is the hereditary material of heat killed S-type cells had transformed R-type cells into virulent smooth strains.
- x. Thus the phenomenon of *changing the character of one strain by transferring the DNA of another strain* into the former is called **transformation**



**29. Write the flow chart of ploidy [Euploidy : 2, Aneuploidy : 3]**



**30. Explain the principles involved in plant tissue culture**

The principles involved in plant tissue culture is totipotency, differentiation, dedifferentiation and redifferentiation. [1]

**Totipotency:** The inherent potential of any living plant cell to develop into entire organism is called totipotency. This is unique to plant cells. [1]

**Differentiation:** The meristematic tissue is differentiated into simple or complex tissues. [1]

**Dedifferentiation:** Reversion of mature tissue into meristematic state leading to the formation of callus is called dedifferentiation. [1]

**Redifferentiation:** The ability of the callus to develop into shoot or root or embryoid. [1]

**31. Explain the role of Bt toxin in the crop protection against pest**

- i. Genes from *Bacillus thuringiensis* [1] (Bt2) have been introduced into several crops, including tomato and cotton, and field-testing has demonstrated impressive results against many pests.
- ii. Spore preparation of this bacterium is used as a biological insecticide during the last 20 years.
- iii. Insecticidal activity depends on a **toxic protein** called **delta endotoxins**. [1]
- iv. The toxin gene (Bt2) from *Bacillus thuringiensis* has been isolated and used for **Agrobacterium**. [1]
- v. Ti plasmid mediated transformation of tobacco, cotton and tomato plants.
- vi. The transgenic plants were resistant to the *Manducta sexta*, a pest of tobacco. [1]
- vii. India had acquired technology from U.S.A. for introducing Bt toxin gene in cotton for the development of resistance against pests in this major cash crop of India.
- viii. Widespread use of insecticides, fungicides and pesticides for crop protection undoubtedly has damaging effects on the environment and hence it is important to improve the **control of pests and diseases by genetic means**. [1]
- ix. Genetic modification of plants is an attempt for ecofriendly measures against environmental degradation.
- x. Through genetic modification, the oil-producing soya bean was tailored to produce a wide range of industrial lubricants, cosmetic compounds and detergents that are biodegradable.
- xi. A whole new area of biotechnology has been opened up and plants are made to synthesize many novel substances including functional human antibody fragments.

**III: Answer any two questions.**

**2x10=20**

**32. Describe the male and female flowers of *Ricinus communis*. Draw the floral diagram and floral formula of female flower**

**Male Flower:**

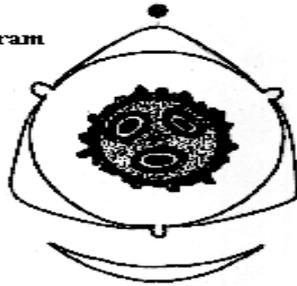
- i. **Flower:** Bracteate, ebracteolate, pedicellate, actinomorphic and incomplete [1]
- ii. **Perianth:** Tepals 5, arranged in single whorl, gamophyllous, valvate aestivation and odd tepal is posterior in position. [1]
- iii. **Androecium:** Stamens many, polyadelphous, filaments branched and united to form five branches. Anthers are ditheous, globose, basifixed, introrse and dehiscent by longitudinal slits. [1]
- iv. **Gynoecium:** Absent but pistillode is present.

**Female Flower**

- i. **Flower:** Bracteate, ebracteolate, pedicellate, actinomorphic, incomplete and hypogynous. [1]
- ii. **Perianth:** Tepals 3 arranged in single whorl and gamophyllous showing valvate aestivation. [1]
- iii. **Androecium:** Absent but staminode is present.
- iv. **Gynoecium:** Ovary superior, tricarpeal and syncarpous. Ovary trilobular with

- one ovule in each locule on axile placentation. Styles 3, deep red and long. Bifid with feathery stigma. [1]
- v. **Fruit:** Fruit is called regma. It is covered by spinous outgrowths. The fruit splits into three one seeded cocci. [1]
- vi. **Seed :** Endospermous.

Floral Diagram



[2]

Floral Formula

Br., Ebr1, A, ♀, P (3), A 0, G (3) [1]

**33. Write an essay on the structure, location, types of functions of parenchyma**

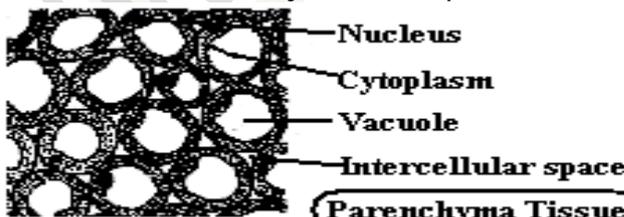
**Location:** Parenchyma is generally present in all organs of the plant. It constitutes the **ground tissue** in a plant. [1]

**Structure:**

- i. Parenchyma is the **precursor** of all the other tissues.
- ii. Parenchyma is a **living tissue** and made up of **thin walled cells**. [1/2]
- iii. The **cell wall** is made up of **cellulose**. [1/2]
- iv. Parenchyma cells may be **oval, spherical, rectangular, cylindrical** or stellate. [1/2]
- v. The cells are usually polyhedral with **10 to 12 facets**. [1/2]

**Types and functions**

- i. In water plants, the parenchyma **found in the cortex** region possesses well-developed large intercellular spaces called air spaces.
- ii. The **air filled parenchyma** tissue is called **aerenchyma** [1]. It helps the plant to float in water. eg. Nymphaea and Hydrilla.
- iii. The parenchyma cells that are **stored with starch grains** are called **storage parenchyma**. eg. stem and root tubers. [1]
- iv. In the petioles of banana and Canna, **star shaped parenchyma** cells are found. These cells are called **stellate parenchyma**. [1]
- v. In green parts of the plants, the **parenchymatous cells have chloroplasts**. These cells are called **chlorenchyma**. Its important function is photosynthesis [1]



Parenchyma Tissue [Diagram - 2. Parts -1]

**34. Describe the internal structure of dicot leaf**

Internal structure of dicotyledonous leaves reveals **epidermis, mesophyll and vascular tissues**

**Epidermis** [2]

- i. A dicotyledonous leaf is generally **dorsiventral**. It has upper and lower epidermis.
- ii. The epidermis is usually made up of a **single layer** of cells that are **closely packed** with cuticle.

iii. The minute openings found on the epidermis are called **stomata**. Stomata are more in number on the lower epidermis than on the upper epidermis.

iv. The epidermis **gives protection** to the mesophyll tissue and the cuticle helps to check transpiration

**Mesophyll** [2]

i. The entire tissue between the upper and lower epidermis is called the mesophyll it consists of **two regions** namely palisade parenchyma and spongy parenchyma.

ii. **Palisade parenchyma** cells are seen beneath the upper epidermis. It consists of vertically elongated **cylindrical cells** in one or more layers. These cells are **compactly arranged** without intercellular spaces. Palisade parenchyma cells contain **more chloroplast**. The function of palisade parenchyma is **photosynthesis**.

iii. **Spongy parenchyma** lies below the palisade parenchyma. These cells are **irregularly shaped**. These cells are very **loosely arranged** with numerous airspaces. The spongy cells contain **lesser number of chloroplasts**. Spongy cells facilitate the **exchange of gases** with the help of air spaces.

iv. The **air space** that is found next to the stoma is called **respiratory cavity** or substomatal cavity.

**Vascular tissues** [2]

i. Vascular tissues are present in the **veins** of leaf.

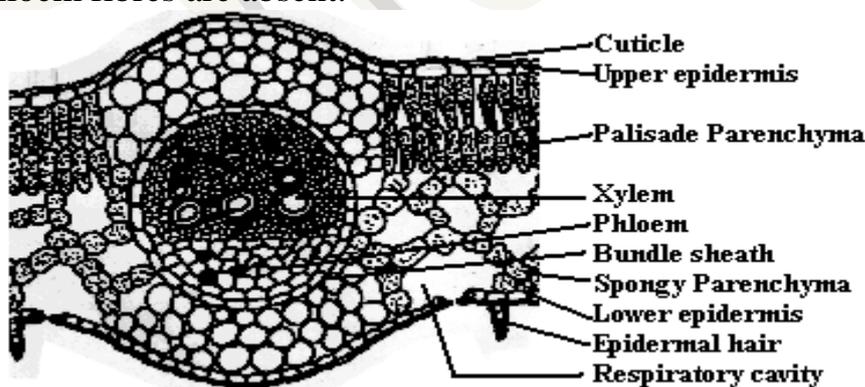
ii. Vascular bundles are **conjoint, collateral** and **closed**.

iii. Xylem is present towards the upper epidermis, while the phloem towards the lower epidermis.

iv. Vascular bundles are surrounded by a compact layer of parenchymatous cells called **bundle sheath** or border parenchyma.

v. **Xylem** consists of metaxylem **vessels** and protoxylem vessels. Protoxylem vessels are present towards the upper epidermis. Xylem consists of vessels and **xylem parenchyma**. Tracheids and xylem fibres are absent.

vi. **Phloem** consists of **sieve tubes, companion cells** and **phloem parenchyma**. Phloem fibres are absent.



[Diagram - 2. Parts -2]

**35. Write an essay on DNA recombinant technology**

Altering the genome of an organism by introducing genes of interest is known as gene manipulation or DNA recombinant technology. [1]

**Basic techniques**

Restriction endonucleases discovered in 1970 are involved in cutting DNA at specific sites. Hence they are called molecular scissors. [½]

The enzyme DNA ligase [½] discovered in 1966 acts like a paste molecule to join DNA fragments.

**The events of recombinant DNA technology [4x1=4]**

1. The DNA of donor organism or gene of interest is isolated and cut into fragments using restriction endonucleases.
2. They are attached to a suitable replicon. Such replicon is known as vector or cloning vehicle, which is nothing but the extra chromosomal circular DNA found in the cytoplasm of Escherichia coli is called plasmid. The plasmids are the most suitable vectors.
3. The DNA of the vector is cut into fragments using the same restriction endonucleases. Using the enzyme DNA ligase, the DNA fragments of donor and vector are joined together. This process is called splicing. As a result of splicing hybrid DNA or recombinant DNA (rDNA) is obtained.
4. The rDNA is introduced into the host cells such as E.coli, Bacillus subtilis, Streptomyces sp. etc.,
5. the host cells are treated with the enzyme cellulase. So that the cell wall of host becomes permeable to the entry of rDNA.

The host organism follows the instructions of “foreign rDNA”.

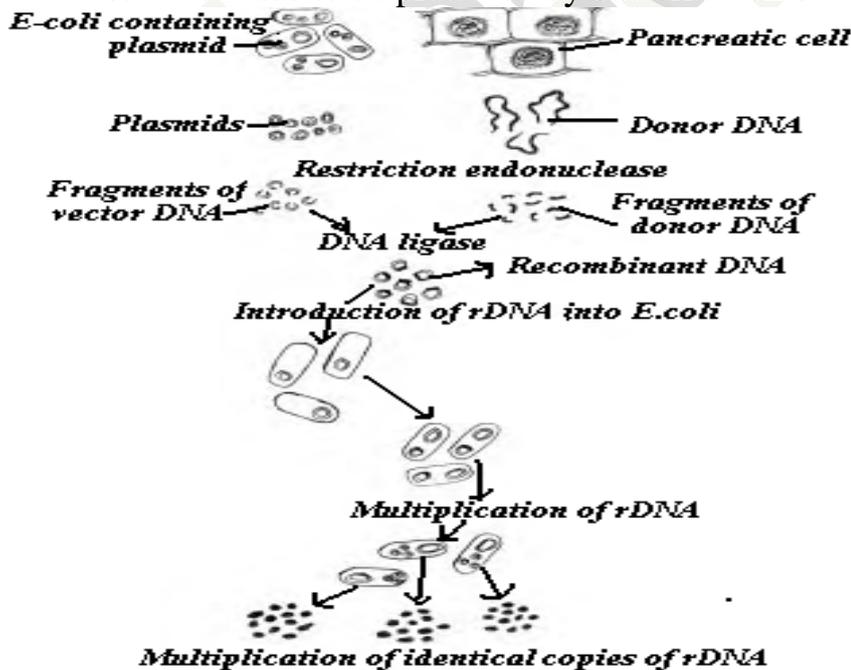
It continues to multiply with the foreign DNA or gene of interest.

After a short time, this results in a colony of bacteria having rDNA fragments.

Each colony is grown separately to obtain multiplication of rDNA fragments.

At the end we get a number of colonies having

identical copies of rDNA fragments. This is called molecular cloning or gene cloning. Once the gene for the production of human insulin from pancreatic cells is introduced into E.coli, the recipient cell produces human insulin. This is the way by which the human insulin is made to be produced by bacterial cell such as E.coli.



[Diagram: 2  
Parts : 2]

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