Botany 1502 Final Examination Preparation Questions

Multiple choice Questions from BOT1501

Plate tectonics ultimately helps to explain

- A the creation of mountains and volcanoes
- B continental drift
- C changes in the ocean floor
- D both A and B are correct
- E A, B and C are correct

In the scientific name Capsicum annum, Capsicum is the ___ and annum the___

- Class, order
- Genus, species epithet
- Kingdom, phylum
- Family, genus
- None of the above

The ground tissue of the fundamental tissue system includes

- A parenchyma
- B collenchyma
- C fibres
- D A and B are correct
- E all of the above are correct

Cellulose

- A Is a major component of the cell walls of plants
- B Is a type of alkaloid
- C Is a raw material that is used in photosynthesis

- D Is composed of a chain of glucose molecules
- E A and D are correct

<table>
<tr><td>Study unit</td><td>Content to study</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Prokaryotes

1</td><td>The classification of prokaryotic organisms</td><td>Prokaryotic organisms comprise of two domains : the domain Bacteria and the domain Archaea in this study unit we pay particular attention to the domain Bacteria</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>The characteristics of cyanobacteria</td><td>Important characteristic :

Motility: Some cyanobacteria execute sliding movements (apart from passive upward and downward movements in the water column by means of gas vacuoles). Others are immobile.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>discuss the classification, morphology, reproduction and biological importance of the cyanobacteria</td><td>Reproduction of cyanobacteria</td><td><u>Discuss the different methods of reproduction found in cyanobacteria.</u>

Reproduction occurs only vegetatively and asexually by means of cell division, fragmentation (the formation of hormogones) and a variety of spores (eg hormospores, exospores and endospores, akinetes and heterocysts). No sexual reproduction takes place.

<table>
<tr><td>Fragmentation</td><td>Process whereby a piece of a filament breaks off and the fragments continue to grow called a hormogone.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Spore formation:</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Hormospore</td><td>Sometimes a hormogone is surrounded by a thick, resistant wall and then it is known as a hormospore. A</td></tr>
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				hormospore can survive unfavourable conditions.	
			Exospores and endospores	Exospores are abscised to the outside, while endospores are formed in the cell and are released when the cell bursts open.	
			Akinetes	During unfavourable conditions a vegetative cell enlarges and a thick, resistant wall is formed around the cell. Nutritional reserves are also stored in such cells. Once more favourable conditions return, the akinete may germinate and divide through mitosis to form a new filament.	
			Heterocysts	Specialised cells that have the primary function of nitrogen fixation. Although their primary function is not survival and reproduction, they can survive unfavourable conditions for a limited period of time because of the presence of the thick, resistant cell wall. Because they do not have food reserves, they cannot survive as long as akinetes. Once favourable conditions return, heterocysts can also germinate and divide	

			through mitosis to form a new filament (thus they play a role in asexual reproduction).
	The biological importance of cyanobacteria	Write brief notes on advantageous cyanobacteria. 1 They form the basis of the aquatic food chain 2 Oxygen is produced during the process of photosynthesis. 3 Nitrogen-fixing cyanobacteria are very important in the production of rice. 4 Certain cyanobacteria are used as food, especially in the oriental countries (Japan and China). Spirulina is becoming a very popular health food, even locally, because of its high protein and vitamin content. 5 food colouring and in the cosmetics industry (eg in the manufacturing of eye shadow). 6 Some cyanobacteria produce antibiotics that are used in medicine. 7 Cyanobacteria are often added to sewerage water (which is rich in nitrogen and phosphates). Because nitrogen and phosphates are their main nutrients, they remove these from the sewerage. The quality of the water improves and at the same time the blue-green bacteria serve as food for fish. 8 May also suppress leukemia and other types of cancer.
		The use of prokaryotes to clean up ecologically contaminated areas such as sites of oil spills is known as • Rehabilitation • Bioremediation • Recycling • Extraction • None of the above	

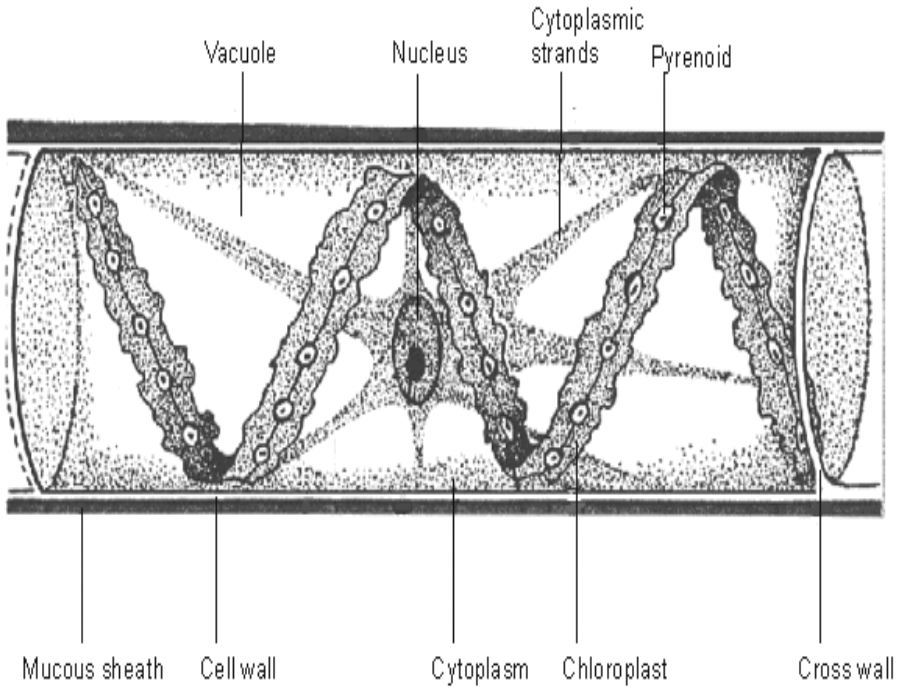
Algae **2**	**The evolution of algae**	**<u>What is the Endosymbiotic Theory?</u>** Mitochondria were once free living bacteria that fused with another cell & set up a symbiotic relationship **What are the evidences supporting this theory?** 1) Double membrane structure 2)Prokaryotic DNA 3)Prokaryotic ribosomes **<u>Endosymbiont Theory</u>** Theorizes that larger prokaryote took in proteobacteria and cyanobacteria through endocytosis, made endosymbiotic relationships with them; smaller prokaryotes slowly lost function and became mitochondria and chloroplasts **Evidence** In mitochondria and chloroplasts, double membranes; ribosomes whose size and shape resemble those of bacteria; divide by binary fission; DNA
	The structure of flagella in eukaryotic cells	The number of flagella per cell, their length, position of implantation and so forth, differ in different types of algae.
	Phylum Euglenophyta	**<u>Discuss the characteristics of the Euglenophyta under the following headings:</u>** **<u>motility/locomotion</u>** **<u>cell covering</u>** **Motility:** Flagella enable the cell to swim through the water. Apart from swimming, certain Euglenophyta representatives may also change their shape; this type of movement is known as metabolic motion. During this type of movement, the cell may contract to form a small, round ball, and then again extend itself to form a long cell, not all Euglenophyta can change shape this depends on the flexibility /mobility of the cell covering.

		Cell covering: There is usually no cell wall outside the cell membrane. On the inside of the cell membrane there is, however, a protective cell covering called a pellicle. An additional cell covering, called a lorica, is present outside the cell membrane in some representatives. **<u>Briefly explain what you understand by the following terms:</u>** **Contractile vacuole:** Functions to get rid of excess water that enters the cell (osmoregulation and excretion). **Cytosome:** may be regarded as a primitive digestive tract. **Pharyngeal rods:** are used to catch and draw prey into the cytosome. Indigestible parts are ejected to the outside with the aid of the pharyngeal rods. **<u>Explain BRIEFLY (one word or two) how each of the following is accomplished:</u>** <u>Feeding in heterotrophic Euglenophyta. (3)</u> **Detection of light intensity in *Euglena* and *Chlamydomonas*. (2)** Red eye spot
	Phylum Dinophyta	**<u>Discuss the characteristics of the Dinophyta under the following headings:</u>** **<u>pigments</u>** **Pigments:** fucoxanthin. The pigment fucoxanthin gives the algae a brown colour in freshwater and a red colour in seawater. **<u>Write brief notes on the Dinophyta as problem algae.</u>** Marine representatives of the Dinophyta are often problem algae certain species cause toxic red tides in the ocean. During

		red tide, high concentrations of dinoflagellate cells release toxins that poison filter-feeders (such as mussels). Toxins accumulate in the mussels and if sea birds or even humans were to eat the mussels, they are also poisoned. **<u>Explain BRIEFLY (one word or two) how each of the following is accomplished:</u>** **Osmoregulation and excretion in the Dinophyta. (2)** Pusule
	Phylum Bacillariophyta (diatoms)	**<u>Discuss the characteristics of the Bacillariophyta (diatoms) under the following headings:</u>** **<u>motility/locomotion</u>** **<u>cell covering</u>** **Motility:** The two most common forms are the centric and pennate diatoms. Centric diatoms are immotile Some pennate diatoms can execute sliding movements because the raphe secretes mucilage. **Cell wall:** the frustule, which consists mainly of silica and is extremely resistant and may therefore remain preserved for a long period of time hence fossils of diatoms

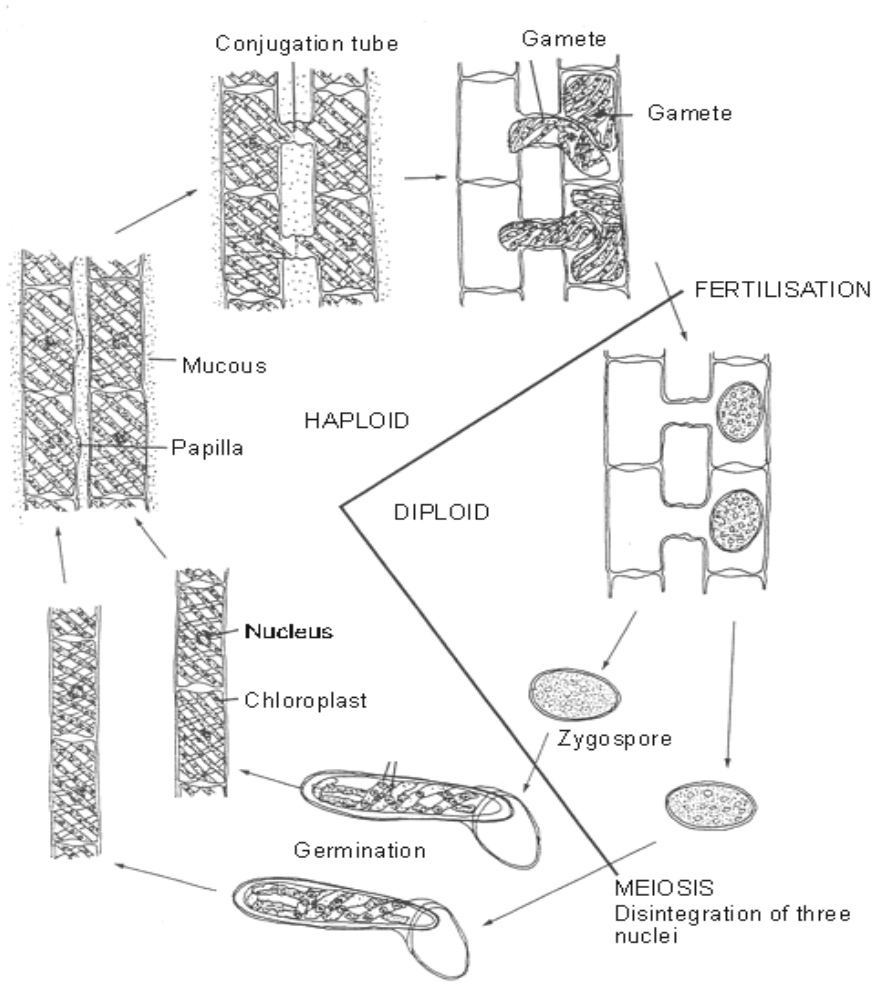
<u>Describe the reproduction of diatoms</u>.
The most common method of reproduction is by means of cell division (asexual reproduction), but sexual reproduction, through the formation of special spores, may also take place.
<u>Sexual reproduction can only take place if the following requirements are met:</u>
The cells must have reached a minimum size (30±40% of the maximum size).

		The environmental conditions must be right. If the above requirements are met, the vegetative cells form gametes. The fertilisation of gametes leads to the formation of an auxospore, which develops and grows and will ultimately produce a large cell. Thus auxospore formation makes it possible for diatom cells to readjust their cell size so that vegetative growth and reproduction can be continued. Unlike other groups of algae, sexual reproduction in the Bacillariophyta is principally a mechanism to correct cell size. **<u>Explain BRIEFLY (one word or two) how each of the following is accomplished:</u>** <u>Movement of diatoms. (3)</u> The two most common forms are the centric and pennate diatoms. Centric diatoms are immotile. Pennate diatoms may also be immotile, but some have a longitudinal groove in the frustule through which mucilage is secreted. This groove is called a raphe. The mucilage enables such pennate diatoms with **raphes** to make sliding movements when in contact with a substrate. No flagella are found in vegetative diatom cells. **<u>Re establishment of cell size in the bacillariophyta (2)</u>** Special sexual spores, the **auxospores**, are formed during sexual reproduction. When these spores germinate, the cell size is corrected.

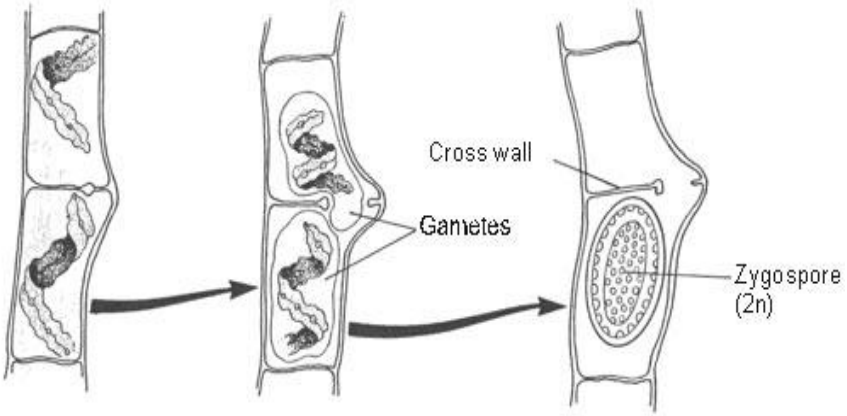
	Phylum Chlorophyta (green algae)	**<u>Describe how asexual and sexual reproduction takes place in the Volvocaceae</u>.** Volvox reproduces sexually by means of oogamy. During the asexual reproduction of Volvox a gonidium divides to give rise to a daughter colony. The daughter colony undergoes inversion, so that the flagella are directed outward. During sexual reproduction a packet of sperm is formed through repeated mitotic divisions of an antheridium. One sperm cell will fertilise an egg cell of a female colony, forming a diploid zygote with a spinous wall. This zygote can survive unfavourable conditions. **<u>Draw a fully labelled drawing of the structure of Spirogyra (5)</u>**  *<u>Diagrammatic representation of the structure of Spirogyra</u>* **<u>Describe the type of reproduction that Spirogyra undergoes</u>. (9)** Spirogyra reproduces asexually or sexually. In asexual reproduction, fragmentation takes place, and

		Spirogyra simply undergoes the intercalary mitosis to form new filaments. Sexual Reproduction occurs by means of conjugation and is of two types: Scalariform and lateral conjugation. **In scalariform conjugation**, two filaments lie next two each other, encased in mucous. Papillae are extended that finally connect to form a conjugation tube. The contents of opposite cells round off to form gametes. At this point the conjugation tube opens and, by means of amoeboid movement, one gamete moves through the conjugation tube to the other gamete, where fertilisation takes place (anisogamy). Both gametes can also move toward each other and fertilisation takes place in the conjugation tube (isogamy). A diploid zygote is formed and it develops a thick, resistant wall. The zygote with the thick wall is called a zygospore. The zygospore undergoes meiosis and a cell with four haploid nuclei is formed. Three of these nuclei disintegrate, so that the cell ends up with only one haploid nucleus. The filament grows further through the process of mitosis. **In lateral conjugation**, only one filament is involved and two adjacent cells in the same filament conjugate.

Draw a fully-labelled diagram showing the process of conjugation in *Spirogyra*. (10)



Scalariform conjugation in Spirogyra



Lateral conjugation in Spirogyra

		Explain BRIEFLY (one word or two) how each of the following is accomplished: Conjugation in *Spirogyra*. (3) **Briefly describe the structure and the reproductive structures of Chara.** Chara usually reproduces asexually, but sexual reproduction also occurs. The male reproductive structure is called a globule. The globule is round and orange when mature. Sperm cells are formed in the globule. The female reproductive structure is called a nucule; it is oval and houses a single egg cell.
	The biological importance of algae	**List 4 advantages and 4 disadvantages of algae. (8)** Advantages of algae. 1 Algae form the basis of the aquatic food chain and aquatic life would therefore not have been possible without them. Algae are also an important source of food for humans and animals. 2 Algae yield a large variety of substances that can be used industrially, commercially and domestically. 3 Algae yield compounds that are used in medicines. 4 Because algae are rich in nutrients, they can be used as fertiliser. Disadvantages of algae. 1 Algae may obstruct the gills of fish and cause their death. 2 Blooms impart smells and tastes to the water and increase the cost of water purification. 3 Some algae (Dinophyta) and cyanobacteria may secrete toxic compounds that can poison humans and animals. 4 The decomposition of algae may lead to oxygen depletion causing fish deaths.

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Bryophytes
3</td><td>An overview of bryophytes</td><td><u>Define Alternation of generations</u>

Alternation of generations is used to describe the life cycle of plants.

The sporophyte and gametophyte generations alternate with each other in the plant life cycle.

<table><tr><td>Sporophyte</td><td>Gametophyte</td></tr><tr><td></td><td></td></tr><tr><td>multicellular diploid form</td><td>multicellular haploid form</td></tr><tr><td></td><td></td></tr><tr><td>bears sporangia</td><td>bears gametangia</td></tr><tr><td></td><td></td></tr><tr><td>produces spores through meioisis</td><td>produces gametes through mitosis</td></tr><tr><td></td><td></td></tr></table></td></tr>
<tr><td></td><td></td><td><table><tr><td>Alternation of generations occurs in bryophytes.</td></tr><tr><td>The gametophyte generation is the dominant stage in the lifecycle.</td></tr><tr><td>The sporophyte plant is dependent on the gametophyte plant for water and grows semi-parasitically on it.</td></tr></table></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>The classification of bryophytes</td><td>Three phyla of bryophytes can be distinguished, popularly known as the liverworts, the hornworts and the (leafy) mosses

<u>Use s table to compare the life cycles of three phyla of bryophytes that you have studied use the following headings</u>
<u>The structure of the gametophyte plant</u>
<u>Pattern of growth of the gametophyte</u>
<u>The structure of the sporophyte</u>
<u>Structure that disperses spores</u>
<u>Position of the archegonium and antheridium (20)</u></td></tr>
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		Division Bryophyta (leafy mosses)	**Division Hepatophyta (liverworts)**	**Division Anthocerotophyta (horn worts)**
		Gametophyte consists of protonema and gametophore	Gametophyte consists only of gametophore	
		Gametophyte leafy	Gametophyte leafy or flattend	
		Multicellular rhizoids	Unicellular rhizoids and multicellular scales	
		Antheridia and Archegonia on top of gametophores (in antheridial and archegonial heads)	Anteridia and archegonia in specialized branches of gametophores (antheridiophores and archegoniophores)	
		Water absorbant paraphysis between antheridia and archegonia	No paraphysis present between antheridia and archegonia	
		Spore dispersal aided by specialised cells in sporangium wall (operculum, annulus, peristome)	No specialised cells in sporangium wall. Open with longitudinal slits, elaters assist with spore dispersal	
		Spores dispersed over relatively long distances	Spores dispersed over relatively short distances	

		<u>Explain how bryophytes reproduce asexually.</u> By means of fragmentation or brood bodies (eg gemmae). **<u>Sexual reproduction of bryophytes</u>** The gametophyte plants produce gametes (sperm cells and egg cells) in gametangia. Sperm cells are produced in an antheridium and egg cells are produced in an archegonium. A sperm cell is released and fertilises an egg cell in the archegonium and a diploid zygote (2n) is formed. The formation of the zygote is the end of the haploid gametophyte generation and the beginning of the diploid sporophyte generation. The zygote grows out of the archegonium (on top of the gametophyte plant) and forms a sporophyte plant which is dependent on the gametophyte plant for water and, to a lesser extent, for nutrients as well. The sporophyte plant (2n) produces spores (n) in the sporangium (2n) through the process of meiosis. The formation of spores constitutes the beginning of the haploid gametophyte generation and the end of the diploid sporophyte generation. Spores germinate and produce a protonema, which in turn again will give rise to gametophyte plants.

Seedless vascular plants **4**	**The evolution of seedless vascular plants**	**Seedless vascular plants of the carboniferous period** 1. Were still small and relatively rare 2.Possessed xylem and phloem but lacked flowers and fruit 3.Occurred in the same environments as early birds and mammals 4.Precede bryophytes which evolved at least 100 million years later 5. Both 2 and 4 **It is important that you know the life cycle of a homosporous and bisexual fern Give special attention to vegetative and reproductive structures.** Sporophytic vegetative stages produce spores on megaphylls (fronds or fern leafs). Fronds are often compounded and contain leaflets or pinnae that are attached to a rachis. Sporangia are carried on the underside of fronds in groups called sori. Sori can be naked or covered by an indusium. Spores released, germinate and develop in a bisexual photosynthetic gametophyte. Reproductive cells (sperm and egg cells) are produced in antheridia and archegonia respectively. After fertilisation of an egg cell in an archegonium, a zygote develops into an embryo. It is initially dependent upon the gametophyte plant, but develops into a mature sporophyte consisting of a rhizome with adventitious roots and leaves.
	Type of living seedless vascular plants	**Jointed hollow stems, with whorled microphylls are characteristic of** • Quillworts • Horsetails • Ferns • All seedless vascular plants • Club mosses

		Which of the following statements are true about psilotum • It lacks true roots and true leaves • The sporophytes live as independent plants • The gametophytes are small, inconspicuous and non photosynthetic • Sporophytes produce tri- lobed sporangia within which spores are produced by meiosis • All of the above are true
		The rachis of a fern is • An uncoiled immature frond • A covering over a sorus • An extension of the petiole of the leaf • A type of sporophyll • A cone shaped structure that contains spores **In ferns the annulus functions in** • Spore production • Gamete production • Transport of nutrients • Spore dispersal • Production of microphylls **Seedless vascular plants have____ to conduct water and dissolved minerals, and _____to conduct dissolved sugar** • A cuticle, xylem • Phloem,stoma • Phloem,xylem • Stoma, a cuticle • Xylem, phloem **Enations are** • A type of sporangium • Specialised buds produced along the stems of horsetails • The sporangia bearing branches of rhinophytes • Immature fern leaves • Tiny leaf like structures on the stems of Psilotum

		Groups of sporangia on the fertile leaves are called • Pinnae • Fronds • Fiddleheads • Indusial • sori
Gymnosperms 5	**An overview of Gymnosperms**	The evolution of the seed enabled seed plants to be much more successful on land than their seedless ancestral forms. In Gymnosperms their seeds are produced naked (exposed) on modified leaves (sporophylls), rather than being enclosed within fruits like in the angiosperms and that they bear cones (strobili) rather than flowers like in the angiosperms.
	Types of living Gymnosperms	They are divided into four phyla: Phylum Coniferophyta Phylum Cycadophyta Phylum Ginkgophyta Phylum Gnetophyta **Explain what you understand by the concept of alternation of generations in plants.** The sporophyte is the diploid multicellular form in the life cycle, bears sporangia and produces spores through meioisis, while the gametophyte is the haploid multicellular form in the life cycle, bears gametangia and produces gametes through mitosis. The sporophyte and gametophyte generations alternate with each other in the plant life cycle. The haploid gametophyte generation starts with meiosis and ends with fertilisation, while the diploid sporophyte generation starts with fertilisation and ends with meiosis.

		Life cycle of a Pine (15) It is not necessary to make drawings of every stage as in The only drawings which are important are the structures of the strobili, the final stage of megagametophyte development just before meioisis and the four-cell stage of microgametophyte development just after meiois (stage in which pollination takes place). In tracing the events in the life cycle focus on the following main stages: 1 **Development of haploid microgametophyte (male gametophyte) endosporicallly:** Many microspores are formed through meiosis of many microsporocytes inside the microsporangia of pollen cones. Each microspore (pollen grain) undergoes a number of mitotic divisions it is not necessary for you to know all these divisions, **only the four-cell stage** in which two prothallial cells, a generative cell and a tube cell are formed this is also the stage at which pollination will take place. Further development of the microgametophyte will take place after pollination. **Make sure that you know the functions of the generative and tube cells**. 2 **Pollination and germination of microspores (pollen grains).** Study the function of the pollination droplet. 3 **Development of haploid megagametophyte (female gametophyte) endosporically:** Four megaspores are formed through meiosis of one megasporocyte (megaspore mother cell) inside the megasporangia of ovulate cones. Please take note that megasporangium + integument = ovule. Only one of the megaspores develops into a megagametophyte that will later develop archegonia, each with a single egg. **4 Fertilisation**: Pollen tubes (from germinating pollen grains) grow through the megasporangium taking two sperms each to the archegonia. Multiple archegonia are fertilised and initially

		more than one embryo develops polyembryony. Only one embryo will survive. 5 **Seeds:** Consist of an embryo, food supply (megagametophyte tissue) and a protective seed coat (take note that the ovule will become the seed after fertilisation integument form seed coat). Pine seeds are winged and are therefore wind dispersed.
		In the life cycle of a pine tree • Germinating seeds develop into sporophytes • Microspores are produced by mitosis within a microsporangium • Each megaspore gives rise to a pollen grain • Pollen cones unlike ovulate cones tend to become woody as they mature • All of the above **Adaptations of many conifers to cold , dry conditions include** • Needle like leaves • Absence of vessel elements • Recessed stomata • A hypodermis • All of the above **The world's tallest plants are members of which group?** • Ginkophyta • Gnetophyta • Cycadophyta • Coniferophyta • Ginkophyta and gnetophyta **The phylum of gymnosperms that contains just a single living species is** • Coniferophyta • Cycadophyta • Ginkophyta

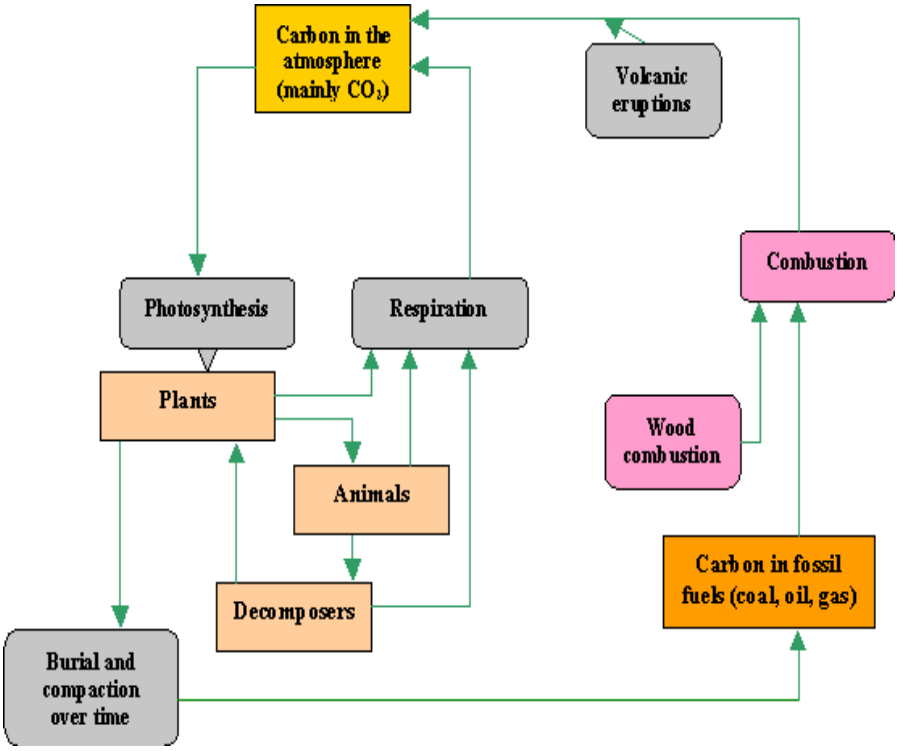
		• Gnetophyta • None of these **In gymnosperm seeds the developing embryo is nourished by** • The pollen tube • <u>Megagametophyte tissue</u> • Endosperm • The micropyle • Prothallial cells
Angiosperms 6	**Sexual reproduction in flowering plants**	**<u>Describe the concept of double fertilization (4)</u>** Double fertilization is a process in the flowering plant life cycle in which there are two fertilizations; One of the fertilizations results in the formation of a zygote, whereas the second results in the formation of endosperm. Endosperm is the 3n nutritive tissue that is formed at some point in the development of all angiosperm seeds. **<u>By means of a labelled diagram, describe the life cycle of an angiosperm. Use blocks of information to explain each stage(15)</u>** <u>The only drawings which are important are the flower structure and the structure of the embryo sac (mature female gametophyte) with 7 cells and 8 nuclei</u>. In tracing the events in the life cycle, focus on the following main stages: 1 **Development of haploid microgametophyte (male gametophyte) endosporically:** Each anther in the stamens consists of four microsporangia (pollen sacs) in which microsporocytes form microspores through meiosis. Each microspore forms a tube cell (form pollen tube later) and a generative cell (form two sperms later). **Make sure that you can describe the different wall layers of a pollen grain**. Take also note that further development takes place after pollination.

		2 **Development of haploid megagametophyte (female gametophyte) endosporically:** A megasporocyte in a megasporangium (inside ovules), enclosed in an ovary, will undergo meiosis to form four megaspores. Note that megasporangium = nucellus and that megasporangium + integument = ovule. Only one of the megaspores develops into a megagametophyte. Note that in most angiosperms the megagametophyte only consists of eight nuclei (four nuclei at each end of the cell). One nucleus at each end moves to the center (2 polar nuclei). The remaining three nuclei at each end form cells 1 egg, 2 synergids at one side and 3 antipodal cells at the opposite side. Mature gametophyte is called an embryo sac (contain 7 cells and 8 nuclei). Also note that the megagametophyte is fully developed before fertilisation. 3 **Pollination:** Stigma receives pollen. Make sure that you understand why pollen of any plant doesn't germinate on the stigma of any other plant. More details on different types of pollination will be given under the next heading in section 3.2: Self-pollination and cross-pollination are both common in angiosperms. 4 **Fertilisation:** Tube cell in pollen grain forms pollen tube, grows down style into one of the synergid cells in the embryo sac. Two sperms move from pollen tube into synergid. **Study also the unique process of double fertilisation that will take place in angiosperms, focusing on the products of double fertilisation and differences in double fertilisation between angiosperms and gnetophytes.**
	The evolution of flowers and fruits	After fertilisation and seed development, the ovary (and sometimes other parts of the flower) will expand to produce a fruit. Note that this is in botanical terms what a fruit is in common usage the term fruit is only used for juicy and sweet fruits (apples, oranges, lemon), while the term vegetable is used for fruits which are not sweet (tomatoes,green beans).
	A sampling of Angiosperm diversity	

		In angiosperms the microgametophyte corresponds to the pollen grain • Nucellus • Stamen • Ovule • Carpel **Which of the following characteristics does not apply to angiosperms?** • Dominant sporophyte • Gametophytes that are smaller than those of gymnosperms • Lack of vessel elements • The capacity for self pollination in most species • Production of the fruits from mature ovaries **The pistil has three sections** • a stigma, style and anther • An anther, filament and ovule • At stigma, style and ovary • An ovary, ovule and sepal • A corolla, stamen and sepal **Seed plants lack which of the following structures?** • Ovules surrounded by integuments • Microspores and megaspores • Vascular tissues • A large nutrionally independent sporophyte • A large nutrionally independent gametophyte **Which of the following statements is false?** • Seeds include a source of nourishment of the developing embryo. • A selective disadvantage of seeds is that the seed coat is highly vulnerable to invasion by fungi and bacteria. • Most plants that produce seeds also produce nonflagellated sperm. • Many seeds can remain dormant during long periods of

		drought or low temperatures. • In seed plants fertilization can occur without the presence of water. **The endosperm** • A is produced by double fertilization • B provides nourishment for the embryo • C arises from triploid nucleus in most angiosperms • D both B and C are correct • E A, B and C are correct **Diocecious plants produce** • Carpellate and staminate flowers on separate plants • Carpellate and staminate flowers on the same plant • Bisexual flowers • Both bisexual and unisexual flowers on the same plant • No flowers
Ecology and the biosphere 7	**Abiotic factors**	Definition: Ecology The study of the interrelationships of living organisms and their environment. Definition Abiotic factors They are physical factors occurring in the Earth's atmosphere and these environmental factors can influence the biotic (living) component in the ecological system (or ecosystem). **Define the two concepts of tolerance and limiting factors.** **Limiting factors**: are environmental factors that limit population sizes in a particular ecosystem. Examples: temperature, water, predation/ herbivory, light, fire, nutrition**.** **Tolerance factors** is minimum and maximum limits for physical conditions (such as temperature) and concentrations of chemical substances beyond which no members of a particular species can survive.

Describe the carbon cycle in a typical terrestrial ecosystem. (15)



The terrestrial carbon cycle

Terrestrial ecosystems draw carbon dioxide from the atmosphere and use it in photosynthesis. All plants act as a sink for carbon dioxide because it is a necessary gas for photosynthesis. Of the terrestrial ecosystems, forests have the highest rates of productivity, thus utilizing carbon at a higher rate compared to oceans.

Briefly explain why ozone is an important atmospheric gas and what the effects of ozone depletion would be on plants (5)

The Ozone layer is a thin layer in the atmosphere made up of oxygen atoms that absorb harmful ultraviolet radiation (UV-B) from reaching the earth's surface. Without the layer of ozone in the atmosphere, it would be very difficult for

		anything to survive on the surface. The ozone is being depleted by chemicals released into the atmosphere like CFCs. The problem is when CFC's reach the ozone layer, it is broken down by the UV -B rays and it is these free chlorine atoms that do the damage to the ozone. **Effects on Plants:** Excessive UV-B radiation inhibits the growth processes of almost all green plants, by reducing leaf size and limiting the area available for energy capture during photosynthesis There is concern that ozone depletion may lead to a loss of plant species. These changes can have important implications for plant competitive balance, plant diseases, and biogeochemical cycles. Reliable scientific information on the effects of UV on plants is limited. Many organisms have developed mechanisms for protecting themselves from UV-B, for example by avoiding exposure, shielding themselves with pigment and repairing damaged DNA or tissue damage. However, for many organisms these mechanisms may not be sufficient to protect against increased levels of UV-B.
		In the nitrogen cycle the process of nitrification involves the conversion of... • Nitrogen gas to nitrite by legumes • Niytrite to nitrogen gas by decomposers • Nitrogen gas to ammonium by soil bacteria • Ammonium to nitrate and nitrite by soil bacteria • Nitrate to nitrogen gas by legumes

Ozone depletion in the atmosphere...

- Is slowed down by the breakdown of CFC's
- Is an important concern since ozone helps shield the earths surface from UV radiation
- Is least severe over Antarctica
- Has little to no effect on plants though it is of concern to human health
- All of the above are correct

Ecosystems

Definition: Ecosystem

Living and nonliving things in an environment, together with their interactions

What is biodiversity hotspot (3)

Relatively small areas of land that contain an exceptional number of species and are at hight risk from human activities.

Name the three biodiversity hotspots of global importance in south Africa and briefly discuss each one of them (12)

The Cape Floristic region	**The Succulent Karoo region**	**The Maputaland-Pondoland-Albany**
Winter rainfall	Winter rainfall	All year round summer rainfall
Vegetation: small leaved evergreen shrubs	Vegetation: dwarf leaf succulent shrubs	Almost impenetrable dense woody semi succulent

		thorny shrubs
One of the Floristic kingdoms of the world	Most species rich semi desert on the planet	
Ecological factors: nutrient poor soils, winter climate, fire, animal plant interactions.	Ecological factors: availability of water	
Economic uses: recreation, exotic plantations.	Economic uses: agriculture, mining ,tourism	Economic uses: agriculture, grazing, exotic plantations

<u>Name the different terrestrial biomes of the world and give one diagnostic characteristic of each biome (12)</u>

Fynbos

Savanna

Desert- very dry with hot days and cold nights

Taiga

Tundra

Tropical dry forest

		Tropical rain forest frequent rainfall Temperate forest Temperate grassland
	Populations	Define ``population" A population is a group of organisms of the same species which live together at the same time in one geographical area and are capable of or have the opportunity to reproduce with other mature members of the group. **Biological species concept (5)** The biological species concept, which defines a species as a population of organisms that can interbreed to produce viable, fertile offspring, however they cannot breed with other groups. **Explain briefly Natural selection (6)** The process in nature by which, according to Darwin's theory of evolution, only the organisms **best adapted to their environment** tend to **survive and submit their genetic characteristics** in increasing numbers **to succeeding generations**.

Briefly explain the difference between Density dependence and density independence (5)

Density-independent factor	Density-dependent factor
a factor that affects a population in a manner that does not vary according to the density of the population, it is acting on its own, for example, fire and floods and other natural disasters	a factor that affects a population based on its population, including, amount of resources (food, water, shelter, disease, etc).
Density dependent factors are those that regulate the growth of a population depending on its density	Density independent factors are those that regulate population growth without depending on its density.
Examples of density dependent factors are food, shelter, predation, competition, and diseases while examples of density independent factors are natural calamities like floods, fires, tornados, droughts, extreme temperatures, and the disturbance of the habitat of living organisms.	
Density dependent factors usually operate in large populations	Density independent factors operate in both large and small populations.
Density dependent factors depend upon the gain and loss rates	Density independent factors act on their own

		Density factors usually cause the population to either increase or decrease according to the positive or negative affect it has on an ecosystem. Define carrying capacity (K) The carrying capacity refers to the number of individuals of a species that can be supported by the environment. **Briefly explain the difference between r- and k- type of populations (6)** **r- type** refers to the intrinsic growth rate of natural increase. Species of r-selected populations have a rapid growth rate, high production of seed and generally a short life-span (annual or bi-annual). **K- type** selected populations refer to the carrying capacity and represent the number of individuals of a population that can co-exist in a given habitat. K-selected species allocate a greater proportion of their available resources to functions that increase the competitive ability and survival and a lesser proportion to the reproductive output. The life-span of K-selected species is generally longer and experience fewer fluctuations in population numbers and are therefore more resistant to environmental fluctuations. r-selected populations are more driven by density-independent factors and can rapidly occur in unpredictable (or uncertain) or highly variable climatic conditions. K-selected populations on the other hand are density-dependent and occur in habitats where the climatic conditions are more predictable (certain) and constant What is a survivorship curve A graph showing the number of individuals surviving to each age for a given species.

Typically, the number of individuals of the population is plotted on the *y*-axis of the graph and the age of survivorship is plotted on the *x*-axis of the graph.

There are three types of survivorship curves and they are simply referred to as type I, type II, and type III.

Briefly explain the difference between the following: Survivorship curves I and III (5)

The difference between survivorship curve l and lll is that:

Type l survivorship	**Type lll survivorship**
Characteristic in species producing few offspring	Characteristic in species producing large number of offspring.
mortality is greatest in old age	Greatest mortality is experienced early in life with low rates of deaths for those surviving
convex curve on a graph	concave curve on a graph

Type ll intermediate between type l and type lll constant mortality and survival

In populations of organisms with a type 1 survivorship curve the death rate...

- Increases markedly in old age
- Is the same for all age groups
- Is the highest for young individuals
- Shows no particular pattern over different age groups
- Is always low at all ages

		Exponential growth of a population is possible under what sort of conditions? • When competition for resources is intense • When the death rate exceeds the birth rate • When the death rate is equal to the birth rate • When resources are unlimited • When population size exceeds the carrying capacity
	Interactions between organisms in ecosystems	**<u>Name and briefly explain the two categories of interactions between organisms in the environment. Give examples of interactions that fall within each of these categories.(10)</u>** Interactions between organisms in an ecosystem are divided into two categories: <u>1 Interactions in which at least one species benefits (commensalisms and mutualism)</u> **Commensalism:** one organism benefits and the other is unaffected. Example: Epiphytes use plants as support, they anchor themselves onto tree branches but do not obtain nutrients or water directly from the trees. Thus the Epiphyte benefits from this interaction and the other plant is unaffected. Sometimes the epiphytic plant can grow very large and the roots may start to strangle its support, especially if the roots of the epiphyte reach the ground. Then this interaction of commensalism changes to a competition between the two organisms (epiphyte and support). **Mutualism:** both partners benefit. Example: The mycorrhizal symbiotic relationship the fungi, as well as the host plant benefit. <u>2 Interactions in which at least one species is harmed (predation, herbivory and parasitism)</u>

		Predatation: is a relationship in which one organism (the predator) kills and devours another organism (the prey). **Parasitism:** is a symbiotic relationship in which one member the parasite benefits and the other the host is adversely affected. The parasite obtains nourishment from its host and although a parasite may weaken its host it rarely kills it. Example: Mistletoes are some of the best known parasitic seed plants. They are known to parasitize conifer and hardwood trees, particularly in the tropics. Mistletoes anchor themselves to their host by means of adventitious roots that penetrate and branch through the host tissues. Mistletoes are water robbers; that is they take water and minerals from their host. Herbivory can sometimes be divided into two categories: Organisms that consume living tissue are referred to as biophages and those that consume dead tissue are called saprophages. Biophages may include three consumer categories: (1) true parasites, including pathogenic microbes, (2) browsers and grazers who comsume only part of the plant (woody or herbaceous), and (3) predators who consume the whole plant (which will lead to the death of the plant) or plant propagules. Interactions between organisms in ecosystems • Commensalism and mutualism (interactions in which at least one species benefits) • Predation, herbivory and parasitism (interactions in which at least one species is harmed) • Plants compete for resources with members of their own and other species

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<td>Co evolution is illustrated by
• A grasses and grazing animals
• B flowering plants and insect pollinators
• C flowering plants and herbivores
• D both B and C are correct
E all of the above are correct</td>
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<td>Communities and ecosystems</td>
<td><u>Briefly explain the difference between Primary and secondary succession (5)</u>

<table>
<tr><th>Primary succession</th><th>Secondary succession</th></tr>
<tr><td></td><td></td></tr>
<tr><td>is the change in species composition over time in an area not previously inhabited by plants or other organisms</td><td>is the change in species composition over time in an area already substantially modified by a pre-existing community</td></tr>
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<tr><td>no soil exists when Primary succession begins</td><td>soil is already present at these sites</td></tr>
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<tr><td>Bare rock surfaces, such as recently formed volcanic lava and rock scraped clean by glacial action, are examples of sites where Primary succession might occur.</td><td>An abandoned field and an area cleared by a forest fire are common examples of sites where Secondary succession occurs.</td></tr>
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<td>Secondary succession...
1.Is usually slower than primary succession
2. Begins on the bare rock
3.<u>Can occur after disturbances such as fires or storms on sites where soil is already present</u>
4.Both 1 and 3 are correct
5.1,2 and 3 are correct</td>
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		In ____ the selecting agent is the environment, whereas in ____ the selecting agent is humans • Natural selection, convergent evolution • Mutation, artificial selection • Homoplasy, homology • Artificial selection, natural selection • Natural selection, artificial selection
Ecosystems dynamics	**Human population growth**	World population has doubled, Food insecurity and malnutrition have, not been eliminated, one out of every seven people does not have food security. There is therefore an immense pressure on agricultural sectors to improve crop yields even more. Genetically modified (GM) plants and intercropping practices are two important solutions to the problem of food insecurity. **What are the advantages and disadvantages of genetically modified plants? (10)** **Advantages:** • Foods are more resistant and stay ripe for longer so they can be shipped long distances or kept on shop shelves for longer periods. • Increase crop yields as more genetically modified crops can be grown on relatively small parcels of land, creates an essential sustainable way to feed the world. • Plants better resistant to weeds, pest and other diseases. • Increase nutritional content. • More capable of thriving in regions with poor soil or adverse climates. • Can reduce costs and labour intensity for farmers. • Some of the most exciting advances in genetically modified plants are for edible vaccinations the genetic

		engineering of plants has the potential to provide edible plant vaccines that could be used to immunize individuals against a wide variety of infectious diseases. • New products for example; scientist identified the gene responsible for caffeine in coffee beans ; by excluding this gene decaffeinated coffee beans can be grown naturally. **Disadvantages:** • Herbicide resistant and pesticide resistant crops could give rise to super weeds and super pests that would need newer stronger chemicals to destroy them. • Genetically modified crops cross pollinate with nearby non genetically modified plants and could create ecological problems. • New Allergy types may develop. • Not enough research and testing have been done on genetically modified plants, genetic engineering is a new field, and long term results are unclear. Some people question if they are safe for consumption. • Safety for the environment.
Conservation biology 8	**Human impacts on ecosystems**	Definition: Conservation biology The scientific study Earth's biological diversity with the aim of protecting species, their habitats, and ecosystems from human threats **Discuss what is mean by the "drivers of environmental change" and give one example. Also discuss what plans the national government of South Africa has in place to combat negative impacts on the environment (10)**

		Environmental drivers are broad categories of factors that influence biodiversity directly. Drivers (human induced or natural) are the primary agents driving change in the environment. They include the underlying socio-economic and political agents of change, such as population growth and the desire for increased consumption. Drivers can also be described as 'wants'. Some indirect drivers such as governance structures, socio-cultural perceptions, population demographics and technological dependence can also be included. Driving forces emanating from natural processes (e.g. solar cycles) are possible, but are typically too infrequent, not well understood or operate over timescales that do not relate easily to the 5-yearly reporting framework of the Environment Outlook process. <u>An example of a driver of environmental change in South Africa can include:</u> <u>Mining</u> Mining exert extensive pressures on natural and socio-economic landscapes. As a driver of socio-economic and environmental change, the short-term economic gains from mining often result in long-term problems, which prove difficult to mitigate, ranging from sinkholes and water pollution to Alteration of landscapes and scenery, ghost towns, human health deterioration and unemployment. The impacts of mining vary with the type of operation and the size of the ore body. <u>Government of South Africa is working on improving the negative impacts on the environment by:</u> Collaborating with various environmental organisations from all over the world sharing ideas research and implementing environmental tools or laws which regulate various activities

		and protect the environment such as who can build, what can be built, and where can they build; who can fish or mine, cut trees and shoot animals, as well as where and when this can happen other ways include: <u>The most important drivers that cause environmental change in South Africa, include</u> . energy . mining . manufacturing . transport . agriculture . settlements . tourism . recreation **<u>Briefly explain the difference between the following: UNCCD and CBD Conventions (5)</u>** **United nations convention to combat desertification (UNCCD)** Objective is to improve land productivity, to restore (or preserve) land, to establish more efficient water usage and to introduce sustainable development in affected areas and improve the living conditions of the population affected by drought and desertification. **The convention on biological diversity (CBD)** Objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. **<u>Explain the differences between indigenous, exotic and invader plants. (12)</u>** **Indigenous:** A plant is indigenous to an area, if it would naturally be found there without mans influence. Example, the

		Protea cynaroides is indigenous and widely distributed throughout South Africa, but is especially common in areas in which fynbos grows in abundance. **Exotics:** are those plants that have been brought in from other places around the world, and very often require a lot of resources to keep them happy. **Invasives:** are plants that have usually been brought in as exotics, but are so well adapted to their surroundings that they spread uncontrollably, pushing out indigenous plants, and consuming precious resources at the same time. Example, Jacaranda trees were introduced to South Africa in 1880 for ornamental purposes. After 100 years until now the trees have invaded most parts of South Africa especially Pretoria. Pretoria is now called the Jacaranda City and most people think that Jacaranda trees are native at Pretoria while they were imported from Argentina. **<u>Name the categories of weeds and invader plants as stipulated by the CARA legislation and briefly discuss what role this legislation plays in the conservation and protection of the biodiversity in south Africa (10)</u>** The Conservation of Agricultural Resources Act No 43 of 1983 (CARA) of the National Department of Agriculture that makes provision for the conservation of the natural agricultural resources of South Africa through: • Maintaining the production potential of land. • Combating and preventing erosion. • Preventing the weakening or destruction of water sources. • Protecting vegetation. • Combating weeds and invader plants.

The regulations make provision for four groups:

The first three groups consist of undesirable alien plants while the fourth consists of indigenous species which are indicators of bush encroachment. The categories include the following:

Category 1 plants (declared weeds)	**Category 2 plant invaders (commercial value)**	**Category 3 plant invaders (ornamental value)**	**Bush encroachers**
These are **prohibited plants that will no longer be tolerated on land or on water surfaces, neither in rural nor urban areas.** These plants may no longer be planted or propagated, and all trade in their seeds, cuttings or other propagative material is	These are plants with the proven potential of becoming invasive, but which nevertheless have certain beneficial properties that warrant their continued presence in certain circumstances.	These plants are undesirable because they have the **proven potential of becoming invasive,** but most of them are popular ornamentals or shade trees that will take a long time to be replaced. Propagative material of these plants,	Declared indicators of bush encroachment concern only land owners in rural areas. Bush encroachment is a term used for ``stands of plants where individual plants are closer to each other than three times the mean crown diameter". **Plants in this group are not exotics, but indigenous (native) plants that tend to become abnormally**

		prohibited.		such as seeds or cuttings, may no longer be planted, propagated, imported, bought, sold or traded in anyway.	**abundant when the area is degraded due to mismanagement.**
		Plants are a source of • Oxygen • Fossil fuels • Spices • Alkaloids • <u>All of the above are correct</u> **Which of the following statement(s) is/are true about the human use of plants?** • Most of our food ultimately comes from jus a few kinds of plants • Some alkaloids have important uses as medicines • Wood consists of the dead cells of certain plants • Plants are the source of spices and many alcoholic drinks • <u>All of the above are correct</u>			
	The future				