**Topic 9 Study Guide – Plant Biology**

Remember, this is just a GUIDE. You should do other things to ACTIVELY MAKE YOUR BRAIN THINK other than reading through this. Make flashcards, go to my website and re-watch simulations, draw diagrams, build models, form study groups, or ANYTHING ELSE to help you learn. The more activities/things you do with info, the stronger your long-term memory becomes because you are making more connections with the material. To adequately prepare for the exam, you should be able to elaborate upon each of the understandings applications and skills set forth by the IB curriculum.

**Topic 9.1 – Xylem Transport**

Understandings:

* Transpiration is the inevitable consequence of gas exchange in the leaf.
* Plants transport water from the roots to the leaves to replace losses from transpiration.
* The cohesive property of water and the structure of the xylem vessels allow transport under tension.
* The adhesive property of water and evaporation generate tension forces in leaf cell walls.
* Active uptake of mineral ions in the roots causes absorption of water by osmosis.

Applications and Skills:

* Adaptations of plants in deserts and in saline soils for water conservation.
* Models of water transport in xylem using simple apparatus including blotting or filter paper, porous pots and capillary tubing.
* Drawing the structure of primary xylem vessels in sections of stems based on microscope images.
* Measurement of transpiration rates using potometers. (Practical 7)
* Design of an experiment to test hypotheses about the effect of temperature or humidity on transpiration rates.

**Topic 9.2 – Phloem Transport**

Understandings:

* Plants transport organic compounds from sources to sinks.
* Incompressibility of water allows transport along hydrostatic pressure gradients.
* Active transport is used to load organic compounds into phloem sieve tubes at the source.
* High concentrations of solutes in the phloem at the source lead to water uptake by osmosis.
* Raised hydrostatic pressure causes the contents of the phloem to flow towards sinks.

Applications and Skills:

* Structure–function relationships of phloem sieve tubes.
* Identification of xylem and phloem in microscope images of stem and root.
* Analysis of data from experiments measuring phloem transport rates using aphid stylets and radioactively-labelled carbon dioxide.

**Topic 9.3 – Plant Growth**

Understandings:

* Undifferentiated cells in the meristems of plants allow indeterminate growth.
* Mitosis and cell division in the shoot apex provide cells needed for extension of the stem and development of leaves.
* Plant hormones control growth in the shoot apex. [Auxin is the only named hormone that is expected.]
* Plant shoots respond to the environment by tropisms.
* Auxin efflux pumps can set up concentration gradients of auxin in plant tissue.
* Auxin influences cell growth rates by changing the pattern of gene expression.

Applications and Skills:

* Micropropagation of plants using tissue from the shoot apex, nutrient agar gels and growth hormones.
* Use of micropropagation for rapid bulking up of new varieties, production of virus-free strains of existing varieties and propagation of orchids and other rare species.

**Topic 9.4 – Plant Reproduction**

Understandings:

* Flowering involves a change in gene expression in the shoot apex.
* The switch to flowering is a response to the length of light and dark periods in many plants.
* Success in plant reproduction depends on pollination, fertilization and seed dispersal. [Students should understand the differences between pollination, fertilization and seed dispersal but are not required to know the details of each process.]
* Most flowering plants use mutualistic relationships with pollinators in sexual reproduction.

Applications and Skills:

* Methods used to induce short-day plants to flower out of season. [Flowering in so-called short-day plants such as chrysanthemums, is stimulated by long nights rather than short days.]
* Drawing internal structure of seeds.
* Drawing of half-views of animal-pollinated flowers.
* Design of experiments to test hypotheses about factors affecting germination.

**Key Concepts/Big Picture Items to Help Guide You:**

**To help study, I encourage you to answer these like they were essay questions BEFORE you check your work with the guiding bullets I supplied you with.**

* Explain the process of transpiration and water flow through plants
* Describe factors that affect the rate of transpiration
* Compare and contrast xerophytes and halophytes adaptation to deal with water stress
* Know what each hormone is responsible for: auxins, gibberellins, abscisic acid
* Know what a potometer is/does (see powerpoint)
* Describe how flowering is controlled in long vs short day plants (phytochrome pigments)
* Explain the role of auxin in phototropism
* Describe conditions needed for seed germination
* Draw and label the parts of a dicot seed and flower
* Describe active translocation in phloem tissue
* Explain the movement of minerals into the root from the soil
* Look back through plant packets and be able to compare/contrast structure of xylem and phloem – know how to pick them out into diagrams of stem/roots
* Explain the importance of pollinators to reproduction in angiosperms

Helpful Tip: OLD STUFF THAT KEEPS POPPING UP IN QUESTION BANKS TO BE PRACTICING AND REMEMBERING

-DNA replication

-Light Dependent reactions

-Glycolysis

-Steps of Cell Division: Interphase, Mitosis, Cytokinesis

**GUIDING BULLETS**

* Explain the process of transpiration and water flow through plants
  + Evaporation of water from leaf sets up transpiration pull - causes suction/tension
  + Water leaves leaf through stomata
  + Water replaced by pulling more water in through roots via osmosis
  + Root hairs maximize absorption- active transport of mineral ions into roots (more solute in roots)
  + Water pulled up xylem via cohesion and adhesion (hydrogen bonding) – via capillary action
  + Moves roots to leaves
  + Cell walls reinforced with lignin to withstand low pressure/tension in xylem
* Describe factors that affect the rate of transpiration
* Wind, heat, humidity, light
* Compare and contrast xerophytes and halophytes adaptation to deal with water stress
* Know what a potometer is/does (see powerpoint)
* Tool used to measure rates of transpiration
* Bubble in glass tube moves as water evaporates from leaves
* Describe how flowering is controlled in long vs short day plants
  + Phytochromes - two interconvertible forms – Pr (inactive) and Pfr (active)
  + Which one made during night/day
  + Pfr either promoter or inhibitor to flowering in long vs short day plants
  + Critical night length plays a role in getting Pfr concentrations right for blooming
* Explain the role of auxin in phototropism
* Auxin stimulates cell elongation by pumping H+ ions into cell wall – lowers pH – loosens connection between cellulose so more stretchy – also activates elastins to make cell wall more stretchy – influx of water into vacuole then helps elongate cell
* Accumulates on dark side of plant
* Causes plant to bend toward light since cells on dark side are longer than cells on light side
* Describe conditions needed for seed germination
* Oxygen – aerobic respiration (ATP)
* Optimum temp/pH – enzymes - Different temp requirements for diff seeds, so germinate at different times of year
* Water – rehydrates seed and activates gibberellin to start metabolic processes
* Draw and label the parts of a dicot seed and flower
* Describe active translocation in phloem tissue
  + Transports sugars (sucrose) and amino acids from source to sink
  + Travels through sieve tubes that are connected by sieve plates
  + Organic substances loaded into sieve tubes by companion cells (through plasmodesmata)
  + Loading - Actively transport H+ ions our of phloem cell using ATP, and co-transports sugars into phloem as H+ flows back in
  + High solute concentration at source causes water to move in to phloem via osmosis
  + Buildup of water causes high hydrostatic pressure, which pushes sap towards sink (lower water pressure)
  + Translocation = mass flow of sap
* Explain the movement of minerals into the root from the soil
* H+ ions pumped out of root and help loosen grip of minerals on soil
* Minerals flow into roots accompanied by mass flow of water
* Look back through plant packets and be able to compare/contrast structure of xylem and phloem – know how to pick them out into diagrams of stem/roots
* Explain the importance of pollinators to reproduction in angiosperms