

**Total 100 points**

**A. Explain the terms: (2 points each, total 10 points)**

1. aquaporin
2. Casparian strip
3. rhizosphere
4. heat shock protein
5. phytochrome

**B. Essay: (10 points each, total 90 points)**

1. Please diagram to illustrate that various compartments within chloroplasts (A) and mitochondria (B) are used for electron transport coupled to ATP synthesis through the establishment of a proton circuit (C).
2. Please diagram to illustrate the cyclic electron transport (A) and the Q-cycle (B) of photosynthesis.
3. Please diagram to illustrate the ion flow in the guard cell coordinated by ABA and  $\text{Ca}^{++}$  during stomatal closure.
4. Please diagram to illustrate the simultaneous operation of the photosynthetic carbon reduction cycle and the oxidative pentose phosphate cycle in the chloroplast.
5. Please diagram to illustrate the pressure flow in xylem and phloem and the loading and unloading of sucrose through the possible symplastic and apoplastic pathways.
6. Please diagram to illustrate the metabolic interaction between the chloroplast, cytosol, and mitochondrion in a leaf mesophyll cell.
7. Please diagram to illustrate the germination and seedling development of common bean (A), pea (B), and corn (C). Please indicate the epicotyl, hypocotyl, coleoptile and cotyledons.
8. Please diagram to illustrate the signal transduction pathway through MAP kinase cascade to gene activation.
9. Please explain the gene-for-gene model, hypersensitive reaction, and systemic acquired resistance in plant defense responses against pathogens.