

1. Please explain the following terms and its involvement in microbial life or functions. (40 points)

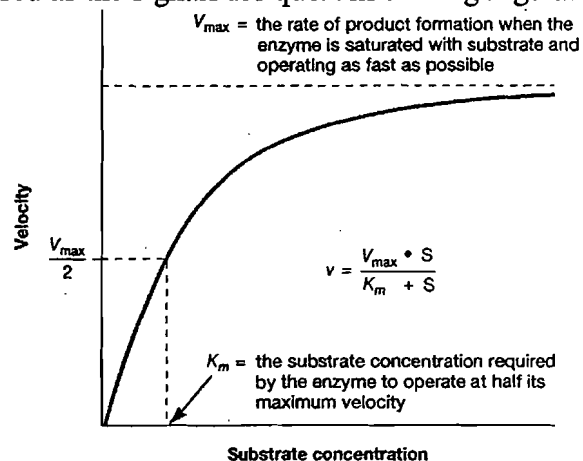
- (1) Haploid (7 points)
- (2) Bioremediation (7 points)
- (3) Plasma membrane (6 points)
- (4) Conidiospore (7 points)
- (5) Capsule (6 points)
- (6) 16S/18S rRNA (7 points)

2. Please match each microbial group [(1)-(5)] with a correct description listed from A to J. (4 points for each microbial group, total 20 points for this question)

(1) H1N1, (2) *Rhizobium*, (3) *Escherichia*, (4) *Caenorhabditis elegans*, (5) *Penicillium*

- A. The organism is a free-living, transparent nematode which lives in temperate soil environments and feeds on bacteria that develop on decaying vegetable matter. It has many of the same organ systems as other animals.
- B. The organism aggregates under fish's eyes to form a luminous organ.
- C. It is a subtype of Influenza A virus that causes influenza flu in humans. Preliminary genetic characterization found that the hemagglutinin (HA) and the neuraminidase (NA) genes of the virus are similar to those of American swine flu viruses and European swine flu isolates, respectively.
- D. Members of the genus are enteric bacteria in the family *Enterobacteriaceae* that are commonly found in the gastrointestinal tracts of warm-blood animals. Some strains of the genus are human pathogens.
- E. Members of the genus are molds that have major importance in the environment, food and drug production. It produces penicillin that kills or stops bacterial growth in living tissues.
- F. It traps protozoa by constricting rings and grows hyphae into the immobilized prey to withdraw nutrients.
- G. Members of the genus can colonize plant cells to form root nodules where they express nitrogenase to convert gaseous nitrogen ( $N_2$ ) to ammonia ( $NH_3$ ).
- H. Members of the group are obligate parasites of plants that die quickly in artificial medium.
- I. Members in the group are prokaryotes that infect plants by transferring its DNA into the nucleus.
- J. Members of the group are prokaryotes that do not have cell walls.

3. (1) Please explain what quorum sensing regulation is and (2) use the graph shown on below to explain how autoinducers (e.g. homoserine lactones) are used as the signals for quorum sensing regulation (15 points).



4. Please use an example to describe how to isolate and classify a microorganism (virus, bacterium, fungus, or nematode) to get its scientific name (names of genus and species). (15 points)

5. Please list 4 mechanisms that can make a microbe resistant or tolerant to antibiotics. (10 points)