

1. Please describe how bacteria obtain nitrogen from environments and convert these molecules into cellular materials. (10%)
2. Please describe the function(s) of the following chemicals in **selective** or **differential media** and name one medium that contains the chemical (15%).
 - (1) Bromothymol blue (BTB) (3%)
 - (2) 2,3,5-triphenyl tetrazolium chloride (TTC) (3%)
 - (3) Crystal violet (3%)
 - (4) Tween 80 (3%)
 - (5) Glucose (3%)
3. You are assigned to characterize the microbes in soil samples collected from a river bank (河岸). Please answer the following questions.
 - (1) How to analyze bacteria, fungi, nematodes, and viruses in the samples? (5%)
 - (2) Assuming the samples contain bacteria and fungi, what steps will you take to identify them? (10%)
 - (3) Which approach can you take to analyze the diversity of microbial life in the soil samples? (5%)
4. Please explain the following terms and their importance in microbiology (30%)
 - (1) Louis Pasteur (1822-1895) (2%)
 - (2) Robert Koch (1843-1910) (5%)
 - (3) Autoclave (3%)
 - (4) Differential staining (4%)
 - (5) DNA-DNA hybridization (6%)
 - (6) Autoinducer (5%)
 - (7) Cell wall (5%)
5. Please describe the steps of bacterial cell cycle, starting from the synthesis of new cell materials to the final step of cell division. (10%)
6. Based on the nature of interactions, plant-associated microorganisms are regarded as commensals, which acquire their nutrients from the plant without causing visible damage to the host, mutualists, which positively influence plant health and development, and pathogens, which cause visible damage to the plant. Please use examples to describe the 3 types of interactions between plants and microbes and possible mechanisms for establishing the interactions. (15%)