

編號：F 430 系所：生物化學暨分子生物學研究所甲組 科目：分子生物學

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

※請依題號順序於答案卷上作答，未依題號順序作答者不予計分。

1. Please describe the molecular functions of telomerase and aminoacyl-tRNA synthetase in eukaryotes. (10%)
2. In eukaryotes, there are two different protein translation mechanisms, cap-dependent and internal ribosome entry site (IRES)-dependent. Please describe the main differences in protein translation between cap-dependent and IRES-dependent, and design the experiments to examine the translation efficiencies of both cap-dependent and IRES-dependent protein translation mechanisms. (15%)
3. Please describe the principle of polymerase chain reaction (PCR) and the standard temperature profiles of PCR. (15%)
4. Please construct an efficient protein expression vector in *E. coli* and describe the molecular functions of essential components in this vector. (15%)
5. Please describe the gene regulation mechanism of *E. coli* lactose (*lac*) operon and construct an inducible eukaryotic gene expression system based on the *E. coli lac* operon components. (15%)
6. Please compare the main differences in gene expression between prokaryotes and eukaryotes from gene structures, mRNA structural elements, and protein translation mechanisms. (15%)
7. Please describe the molecular structures of siRNA and shRNA, action mechanisms of RNAi-induced gene silencing, and potential applications of RNAi-based gene therapy. (15%)