1. The ovary of an insect is composed of ovarian tubules, known as ovarioles. Each ovariole contains multiple egg chambers arranged sequentially along the tubule. Before fertilization, each egg is considered a single cell. After fertilization, the egg develops into a multicellular organism. Provide two reasons why a fertilized egg can develop into a multicellular organism. **(6%)**

2. DNA has been established as the genetic material in most insects, and DNA sequencing is a critical tool for species identification. Typically, scientists use PCR (polymerase chain reaction) to amplify DNA for sequencing. However, PCR may fail to work with DNA isolated from insects. Provide two reasons why PCR might not function in such cases. **(6%)**

3. In insects, chemical A blocks the movement of ribosomes along mRNA, while chemical B suppresses DNA repair. **(15%)**
   (1) Does chemical A inhibit transcription or translation of a gene? (3%)
   (2) If DNA repair is inhibited by chemical B, how will this affect transcription? (3%)
   (3) Following question (2), how will it affect translation? (3%)
   (4) If chemicals A and B are insect pesticides, they may cause insects to generate pesticide resistance. If this is the case, please explain why pesticide resistance is generated. (6%)

4. Explain the relationship between ecdysone, ecdysis, and metamorphosis in insects. **(9%)**

5. Explain: **(4%)**
   What is the function of halteres in Diptera?

6. 解釋名詞：(每一名詞四分共 12 分)
   (1) Mushroom body
   (2) Peritrophic membrane
   (3) Parthenogenesis

7. 銀葉粉蝨、小菜蛾、東方果實蠅均是重要之農作害蟲，試述此三種害蟲之危害特性及其對應之化學防治策略？(10 分)

8. 請說明 AI (Artificial Intelligence) 於昆蟲學研究上的運用及未來性？(10 分)

9. 請說明何謂作物害蟲的 economic injury level，如何估算？並說明在實際應用上的限制因子(瓶頸)? (8 分)

見背面

10. 褐飛蝨 (small brown planthopper) 與白背飛蝨 (Whitebacked planthopper) 一直是水稻重要害蟲，下表為兩種飛蝨對幾種殺蟲藥劑的反應資料，請與 Lab. strain 比較，討論兩種飛蝨害蟲對藥劑之耐受性，並提出後續防治殺蟲劑施用之建議方案? (20 分)

表

	Small brown planthopper		White-backed planthopper		Lab. strain
Insecticide	Slope	LC_{50} (95% CL; mg/L)	Slope	LC_{50} (95% CL; mg/L)	LC_{50}
Chlorpyrifos 陶斯松	2.17	1.93 (1.37±3.71)	1.87	1.87 (1.08±4.66)	1.93
Terbufos 托福松	1.99	20.6 (14.78±25.4)	2.98	16.65 (3.71±28.26)	3.61
Imidacloprid 益達胺	1.17	0.27 (0.17±0.51)	1.89	2.81 (2.17±3.41)	0.27
Thiamethoxam 賽速安	1.2	0.29 (0.20±0.44)	0.33	0.38 (0.27±0.50)	0.29
Acetamiprid 亞滅培	2.81	4.14 (3.32±5.1)	3.56	4.50 (3.57±5.43)	4.14
Nitenpyram 烯啶蟲胺	2.7	0.39 (0.20±0.57)	0.58	0.56 (0.41±0.69)	0.39
Buprofezin 布芬淨	2.2	0.43 (0.32±0.54)	1.84	0.27 (0.39±0.66)	0.43

註：Nitenpyram 是一種新尼古丁類藥劑

試題隨卷繳回