

中央警察大學 108 學年度碩士班入學考試試題

所 別：鑑識科學研究所

科 目：自然科學

作答注意事項：

1. 本試題共 10 題，每題各占 10 分；共 3 頁。
2. 不用抄題，可不按題目次序作答，但應書寫題號。
3. 禁用鉛筆作答，違者不予計分。

一、警方為偵辦某槍擊案件，需進行涉案槍枝的試射。若子彈之質量為 0.03 公斤，垂直射穿一厚度為 0.05 公尺之木板，而木板之平均阻力為 9000 牛頓，子彈射穿木板後之速度減為每秒 100 公尺。請計算子彈進入木板前的速度。

二、某一鑑識實驗室欲配製下列試劑，依其敘述請分別說明應如何配製：

(一) 某一乾燥藥品（水溶性）之質量為 1 nmole，若欲配製成濃度為 $0.5\mu\text{M}$ 之水溶液，請說明應如何配製。

(二) 實驗室人員欲將 A 及 B 二種物質混合在一起以供進行反應所需，若該二種物質之現有庫存濃度分別為 2 倍 (A) 及 5 倍 (B)，而混合後的濃度皆須為 1 倍，請說明應如何配製總體積為 10 毫升之水溶液。

三、針對 DNA 分析之技術，請說明何謂 RFLP (Restriction Fragment Length Polymorphism)。該技術曾被應用於犯罪現場的生物跡證與嫌犯的生物檢體之分析比對。

- 四、鑑識人員在刑案現場蒐證時採集到一少量之固態物質，送回實驗室進行分析後發現，其難溶於水，加本氏液（Benedict's reagent）並隔水加熱呈淡藍色，燃燒後得到二氧化碳及水蒸氣、無臭味；加濃硫酸則變焦黑。請由上述結果研判此物質最可能為葡萄糖、蛋白質或植物纖維中的哪個；並請說明原因。
- 五、請分別說明牛頓（Isaac Newton）所提出之 3 個運動定律；並請依牛頓運動定律針對下列問題進行計算：
某物體之質量為 50 公斤，若其加速度為 5 公尺/秒²，則其作用力應為多少？
- 六、A witness with perfect eyesight who viewed a suspect from a distance of 200 m in daylight, claims that he was wearing a striped jumper, with the stripes being around 4 cm wide. Is this statement scientifically reasonable? At what distance would that claim be acceptable?
- 七、Amido black is a dye used to visualize fingerprints left in blood. A water-based solution of amido black uses 0.10 M citric acid. How many grams of citric acid are required to prepare 500.0 mL of solution, given the formula of citric acid is C₆H₈O₇?
- 八、Police suspect a person has been repeatedly poisoned with arsenic and have taken samples of the victim's hair. The hair sample was cut into 1.0cm lengths, as shown below, and analyzed for arsenic. The first, fifth, and eighth samples tested positive for arsenic. Based on the fact that hair grows at a rate of 0.5 mm per day, determine the time intervals for which the victim was exposed to arsenic.
- 九、A burglar gains access to an upstairs window by using a ladder. If the height of the window is 4.3 m above the ground and the impression marks from the ladder are found 1.2 m out from the wall, calculate the length of the ladder and the angle it makes to the ground.

十、In the case of a fatal drunk driving accident, the alcohol consumed throughout the evening can be determined by sampling the vitreous humor. However, moments before the fatal crash, the deceased consumed an extremely large portion of alcohol. Will this be reflected in the vitreous humor or not?