

中央警察大學 109 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 2 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、鑑識人員欲進行子彈速度之測量以釐清相關案情。若以二繩垂直懸掛一質量為 1980 公克之木塊所形成之彈道鐘擺（ballistic pendulum），進行質量為 20 公克子彈速度之測量，若子彈以水平速度 V_i 射入此擺，並滯留其中，而碰撞後木塊連同子彈之速度為 V_f ，請問在碰撞中消耗之動能對原有動能之比例為何。（需列出演算過程，且最後之數值請簡化至以百分比表示。）

二、請說明：

（一）界面活性劑（Surfactant）清除污垢之原理。

（二）請以「人造奶油」的製造，說明氫化（Hydrogenation）加成反應。

三、為檢測人體是否受某種 RNA 病毒之感染，請提出一個檢測 RNA 病毒核酸的方法並說明之。

四、以酒精來殺菌，為何 75% 酒精之殺菌力較 95% 為佳？若由 95% 酒精欲製備得 760 毫升（mL）之 75% 酒精，請說明製備之過程。

五、請解釋下列名詞：

（一）Maternal inheritance

（二）Synapsis in meiosis

六、The numerical aperture of a microscope is given as the average of the NA of the objective and the condenser. If the NA of the condenser is 1.25, when would it be appropriate to use this equation?

七、A graduated cylinder is carefully filled with four different solutions, each with a different density. Next, a mixture of soil containing four primary minerals is placed into the cylinder. Sketch the appearance of the cylinder; identify each layer and the location of each mineral in the cylinder, assuming perfect layering of solutions.

Solution 1: 50 mL, $D=4.25$ g/mL

Solution 2: 25 mL, $D=2.45$ g/mL

Solution 3: 50 mL, $D=3.34$ g/mL

Solution 4: 25 mL, $D=1.80$ g/mL

Mineral 1: oldhamite, $D=2.58$ g/mL

Mineral 2: realgar, $D=3.56$ g/mL

Mineral 3: haycockite, $D=4.35$ g/mL

Mineral 4: graphite, $D=2.16$ g/mL

八、A suspect is apprehended in an assault case and is found to have smears of makeup on his clothing. The victim was known to have been wearing a distinctive pearl-white makeup. The pearl effect in cosmetics is from a bismuth compound, BiOCl . Bismuth can be detected by monitoring the light emitted from an ICP at 223.1 nm. Calculate the energy and frequency corresponding to this wavelength.

九、Calculate the number of grams of C4 military explosive ($\text{C}_3\text{H}_6\text{N}_6\text{O}_6$) detonated if the resulting explosion produces 117.4 g of nitrogen gas (please balance the equation first).

十、Describe each term as it relates to hair: root, cuticle, cortex, medulla, tip. Include drawings and/or examples with your description for each term.