

中央警察大學 112 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、請說明細胞中哪些類別的基因遭突變較容易形成癌症 (cancer) ?
癌細胞具有哪些特性？

二、針對蛋白質在細胞膜上所扮演之功能，請說明主要有哪些分類？

三、請計算 50 mM 的醋酸溶液於 2.7、4.7 及 5.7 等 3 種不同 pH 值時，其醋酸離子 (CH_3COO^-) 及醋酸 (CH_3COOH) 於溶液中之濃度各為多少？(請列出其計算流程，濃度以 mM 表示，並計算至小數點第 3 位，假設醋酸的 pKa 為 4.7)

四、請繪出下列各種異構物的結構：

- (一) open-chain form of D-glucose
- (二) open-chain form of D-fructose
- (三) α -D-glucopyranose
- (四) α -D-fructopyranose
- (五) β -D-fructofuranose

五、請簡要繪出 Transmission electron microscope (TEM)及 Scanning electron microscope(SEM)之結構圖，並說明其呈像原理之差異。

六、Suppose a motor drives a block on a spring at a frequency ω , and the natural frequency of the spring-block system is ω_0 . If damping is

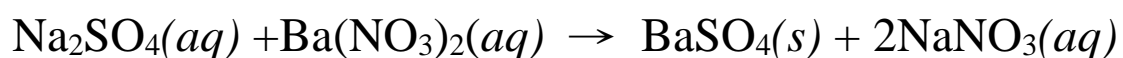
negligible, by what factor does the amplitude of oscillation change when the driving frequency is increased from $\omega = 2\omega_0$ to $\omega = 3\omega_0$?

- 七、A person standing in the middle of a long straight road sees a truck with its headlights on approaching in the distance. The truck's headlights are 3 m apart. Assuming the headlights are point sources emitting yellow light of wave-length 600 nm and the diameter of the human pupil is 5 mm, approximately how far is the truck from the person when he can first resolve the two headlights as separate sources?
- 八、Automobile airbags inflate when sodium azide (NaN_3) contained in the bags explodes during a collision. Calculate the volume of gas produced at STP conditions if 32.5 g of sodium azide are used to inflate a side-impact airbag according to the following equation:



Molar mass of $\text{NaN}_3 = 65.01 \text{ g/mol}$

- 九、The tampered bottle of Coke was analyzed for the presence of sulfate ion by adding barium nitrate to trigger the precipitation of barium sulfate. Determine the limiting reagent and the theoretical yield of barium sulfate given that a solution containing 1.60 g of sodium sulfate is mixed with a solution containing 2.40 g of barium nitrate.



Molar mass of $\text{Na}_2\text{SO}_4 = 142.05 \text{ g/mol}$

Molar mass of $\text{Ba}(\text{NO}_3)_2 = 261.34 \text{ g/mol}$

- 十、Xeroderma pigmentosum (XP) is a rare genetic disorder characterized by an extreme sensitivity to ultraviolet (UV) radiation. Individuals with XP have a reduced ability to repair DNA damage caused by UV light, which leads to an increased risk of skin cancer and various other skin abnormalities. What molecular lesion is most likely to accrue in individuals with XP?