

國立中山大學 105 學年度碩士暨碩士專班招生考試試題

科目名稱：普通物理【醫科所碩士班選考】

題號：428005

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題） 共1頁第1頁

1. 一物體以 V_0 之初速與地面成 θ 角拋出，在 t_1 秒時它的高度為 h (P 點)， t_2 秒後它的高度又回到 h 高 (Q 點)，球 P、Q 二點間的距離。(10%)
2. 在同一鐵軌上 A 車以 V_A 的速度行駛，後方 B 車以較快速度 V_B 趕來，當二車相距 d 時，B 車以等速減速度 a 煞車，問 a 值有何限制，二車才不會相撞。(10%)
3. 有一靜止物體由空氣中自由落下，此時空氣阻力為 $f = kv$ ， k 為比例常數， v 為物體的速率，試求該物體之
 - (a) 運動方程式 (5%)
 - (b) 終端速率 (terminal speed) (5%)
 - (c) 任意時刻之加速度、速度及位置 (10%)
4. 請寫出牛頓之三運動定律。(10%)
5. 何謂莫耳比熱 (molar specific heat)? 若 He, O₂, CO₂ 為理想氣體，分別求出其等體積莫耳比熱，並說明其異同。R: gas constant。(15%)
6. 長 3.0 公分、寬 2.0 公分的平板電容器隔之以厚 1.0 mm 的紙，(a) 其電容為何? (b) 可置於此電容器電極上最大的電荷量為何? (紙的介電係數為 3.7，紙的介電強度為 16×10^6 V/m)。(20%)
7. 有 n 個完全相同的電池，每個的電動勢為 ε ，內電阻為 r ，求下列情況之電流 (a) 單一電池與一電阻器 R 相連接? (b) n 個電池並聯，與一個電阻器 R 連接? (c) n 個電池串聯與一個電阻器 R 連接? (15%)

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共 4 頁第 1 頁

一、選擇題（每題答案可能 1 至多個，全部選對使得題分。每題 3 分，共 20 題）

1. Consider the titration of 25 mL of 0.10 M acetic acid (CH_3COOH , $K_a=1.8\times 10^{-5}$) with 0.10 M sodium hydroxide solution:
(A) Before titration, the initial pH of 0.10 M HOAc solution is equal to 1.0
(B) After adding 12.5 mL of 0.10 M NaOH to the solution, the pH of the solution is equal to 4.74
(C) At equivalence point, the pH of the solution is equal to 7.0
(D) Methyl red could be used as the indicator in this titration
2. Which of the following statements is (are) true?
(A) The net reaction in a hydrogen-oxygen fuel cell is the conversion of H_2 and O_2 to water
(B) Oxidation and reduction accompany all chemical changes.
(C) Oxidation and reduction describe the loss and gain of electron(s), respectively.
(D) Oxidation and reduction result in a change in the oxidation states of the species involved.
3. Which of the following are structural isomers?
(A) optical isomers
(B) geometric isomers
(C) coordination isomers
(D) linkage isomers
4. Which of the following compounds has the highest boiling point?
(A) CH_4
(B) CO
(C) O_2
(D) N_2
5. Calculate the pH of a solution that contains 3.25 M HCN ($K_a = 6.2\times 10^{-10}$), 1.00 M NaOH and 1.50 M NaCN.
(A) 8.28
(B) 8.86
(C) 9.18
(D) 9.25
6. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
(A) H_2S and HCl
(B) NO and NO_2
(C) NH_4 and NH_4Cl
(D) CH_4 and CO_2
7. The solubility product of $\text{AgCl}_{(s)}$ is 1.8×10^{-10} under standard condition. What is its ΔG° ?
($\log 1.8 = 0.255$)
(A) 13.3 kcal/mol
(B) 1.33 kcal/mol
(C) 133 kcal/mol
(D) 0.133 kcal/mol

試題隨卷繳回

背面有題

國立中山大學 105 學年度碩士暨碩士專班招生考試試題

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8. Choose the correct conversion in the followings:
- (A) $15 \text{ nm} = 1.5 \times 10^{-9} \text{ m}$
 - (B) $75 \text{ mg} = 7.5 \times 10^{-2} \text{ g}$
 - (C) $5 \text{ }\mu\text{l} = 5 \times 10^{-6} \text{ L}$
 - (D) $104^\circ\text{F} = 72^\circ\text{C}$
9. A student weighs out 0.5681 g of potassium hydrogen phthalate (KHP, molar mass = 204.0 g/mol) and titrate to the equivalence point with 21.54 mL of a stock NaOH solution. What is the concentration of the stock NaOH solution?
- (A) 0.01293 M
 - (B) 0.1293 M
 - (C) 0.06463 M
 - (D) $6.463 \times 10^{-3} \text{ M}$
10. A 0.5865 g sample of lactic acid ($\text{C}_3\text{H}_6\text{O}_3$) is burned in a calorimeter whose heat capacity is $4.812 \text{ kJ}/^\circ\text{C}$. The temperature increase from 23.10°C to 24.95°C . Calculate the molar heat of combustion of lactic acid.
- (A) -8.902 kJ/mol
 - (B) -15.18 kJ/mol
 - (C) -1366 kJ/mol
 - (D) none of the above
11. A system which undergoes an adiabatic change (i.e., $q = 0$) and does work on the surroundings has:
- (A) $w < 0, \Delta E < 0$
 - (B) $w > 0, \Delta E < 0$
 - (C) $w > 0, \Delta E > 0$
 - (D) $w < 0, \Delta E > 0$
12. Which of the following statements about voltaic and electrolytic cell is (are) correct?
- (A) The anode will definitely gain weight in a voltaic cell.
 - (B) Oxidation occurs at the cathode of both cells.
 - (C) The free energy change, ΔG , is negative for the voltaic cell.
 - (D) The electrons in the external wire flow from cathode to anode in an electrolytic cell.
13. According to the valence bond theory, which hybridization orbital of Xe atom in XeF_2 is used to bond with F atom?
- (A) sp
 - (B) sp^2
 - (C) sp^3
 - (D) dsp^3
14. The density of a gas was measured at 2.50 atm and 127°C and found to be 2.00 g/L. What is the molecular mass of the gas?
- (A) 13.1 g/mol
 - (B) 26.3 g/mol
 - (C) 227.7 g/mol
 - (D) 2661 g/mol

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15. For one mole of the following gases at 25°C and 1 atm: H₂, He, and CH₄, choose the correct statement.
- (A) The average kinetic energy: H₂ > He > CH₄
 - (B) The average molecular speed: H₂ > He > CH₄
 - (C) The effusion rate of the molecules: H₂ > He > CH₄
 - (D) The density of the gas: H₂ > He > CH₄
16. For a solution of 34 wt% HNO₃, calculate the molarity of the acid if the density of the solution is identical to pure water.
- (A) 8 M
 - (B) 6.1 M
 - (C) 5.4 M
 - (D) 7.1 M
17. For the following central atom (underlined), which one has the sp² hybrid orbitals?
- (A) PF₃
 - (B) SO₃
 - (C) BCl₃
 - (D) CH₂O
18. Calculate the ΔS_{sys} for the reversible, isothermal compression of 2.0 mole of ideal gas molecules from 1.0 atm and 4.0 L to 20 atm and 0.20 L at 298K.
- (A) -26.4 J/K
 - (B) -63.5 J/K
 - (C) -54.3 J/K
 - (D) -49.8 J/K
19. Which one of the following orders of bond lengths is correct.
- (A) SiCl₄ > CF₄ > GeBr₄
 - (B) GeBr₄ > CF₄ > SiCl₄
 - (C) CF₄ > GeBr₄ > SiCl₄
 - (D) GeBr₄ > SiCl₄ > CF₄
20. Which of the following combinations of names and formulas is (are) incorrect?
- (A) PCl₅: Phosphorus pentachloride
 - (B) NO₂⁻: nitrate
 - (C) NaHCO₃: sodium carbonate
 - (D) ClO₄⁻: perchlorate

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二、問答與計算題(請於答案卷中標示題號並依續作答)

1. Consider the reaction of butane with oxygen to produce carbon dioxide and water.
 - (a) Please write down the balanced chemical equation for this reaction. (2%)
 - (b) If 3.0×10^3 g of butane is reacted with 3.0×10^3 g of oxygen, please indicate the limiting reactant. (2%)
 - (c) What mass of carbon dioxide and water will be produced? (assuming 100% yield) (6%)
2. The volume of a sample of pure HCl gas was 189 mL at 25°C and 108 mmHg. If was completely dissolved in about 100 mL of water and titrated with a NaOH solution; 15.5 mL of NaOH solution were required to neutralized the HCl. Calculate the molarity of the NaOH solution. (Atomic Mass H: 1.0; Cl:35.5) (5%)
3. Biochemists have discovered more than 400 mutant varieties of hemoglobin, the blood protein that carries oxygen throughout the body. A physician studying a variety associated with a fatal disease first finds its molar mass. She dissolves 21.5 mg of the protein in water at 5.0°C to make 1.50 mL of solution and measures an osmotic pressure of 0.87 mmHg. What is the molar mass of this variety of hemoglobin? ($R = 0.082 \text{ atm}\cdot\text{L}/\text{mol}\cdot\text{K}$) (5%)
4.
 - (a) Arrange the following elements in order of increasing atomic radii: Cs, F, K, Cl. (2%)
 - (b) Arrange the following elements in order of increasing first ionization energy: Na, Ng, Al, Si. (2%)
 - (c) Arrange the following elements from most negative to least negative electron affinity: K, Br, Cs, Cl. (2%)
5. The decomposition reaction of compound A, to compound B and C is first order with $k = 2.8 \times 10^{-7} \text{ s}^{-1}$ at 1000°C . $A \rightarrow B + C$ (4%)
 - (a) What is the half-life of this reaction at 1000°C ?
 - (b) How many days would pass before a 2.00-gram sample of A had decomposed to the extent that 0.75 gram of A remained?
(Fw of A is 76.0 g/mol; Fw of B is 44 g/mol)
6. What is a buffer solution? What constitutes a buffer solution? (4%)
7. Define the "azeotropes" and "Van't Hoff's Law". (6%)

背面有題

國立中山大學 105 學年度碩士暨碩士專班招生考試試題

科目名稱：解剖學【醫科所碩士班選考】

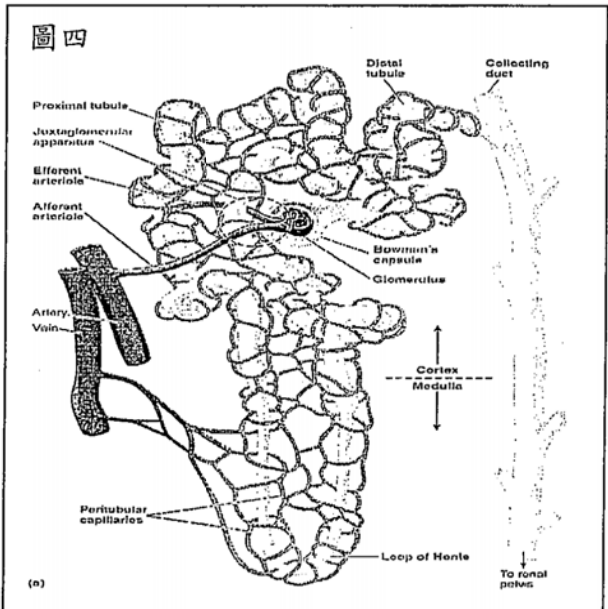
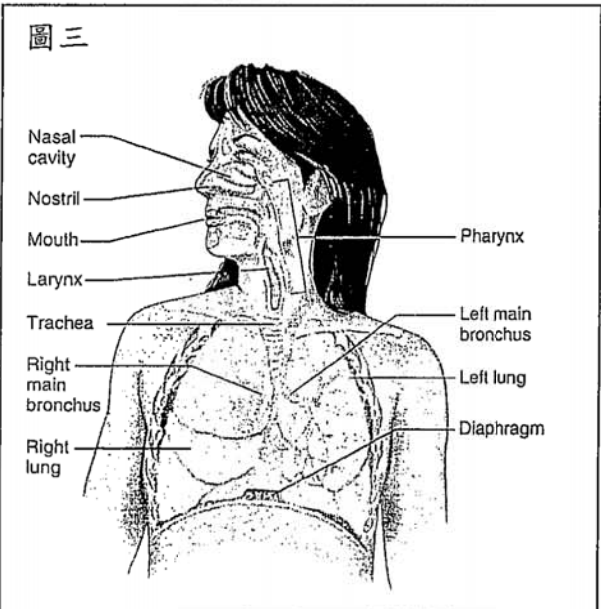
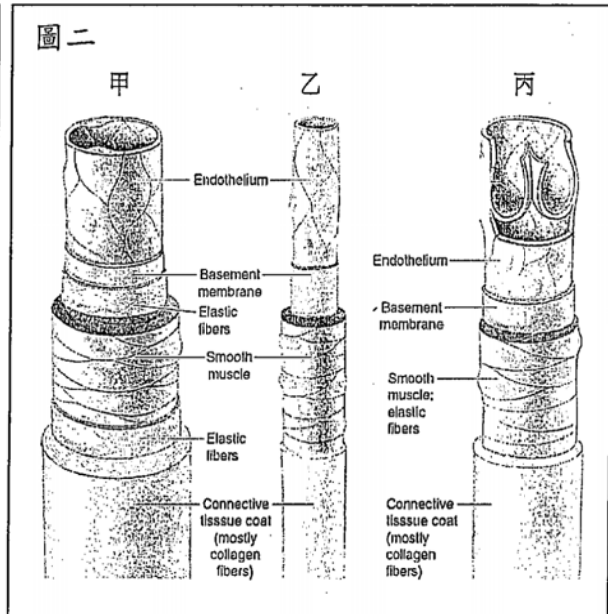
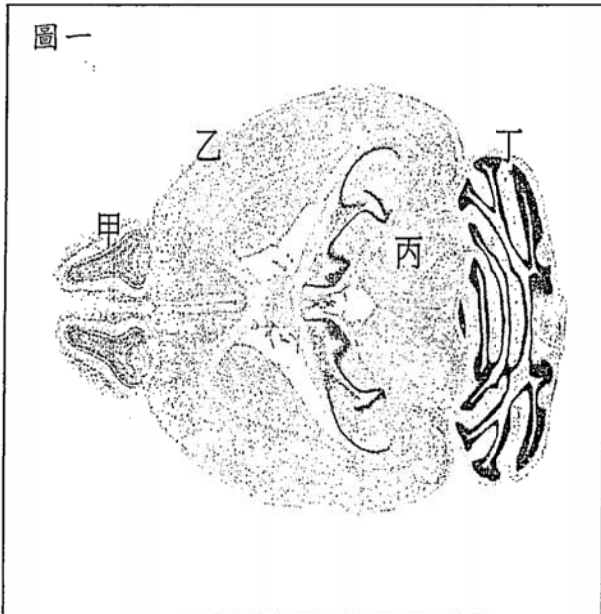
題號：428006

※本科目依簡章規定「不可以」使用計算機(混合題)

共 2 頁第 1 頁

一、單選題(每題 4 分，共 20 分)

1. 圖一為甲苯酚紫(cresyl violet)染色的大鼠腦切片，請問此切片屬於何種方位切片？
(A) 水平 (B) 矢狀 (C) 冠狀 (D) 縱向切面
2. 請問圖一哪個部位屬於小腦？
(A) 甲 (B) 乙 (C) 丙 (D) 丁
3. 圖二為人類血管組織圖。請問哪條血管的結構較屬於“動脈”？
(A) 甲 (B) 乙 (C) 丙 (D) 甲與丙
4. 圖三為人體呼吸系統的架構圖，請問哪個構造可以主動收縮並调控上呼吸道阻力？
(A) Trachea (B) Diaphragm (C) Larynx (D) Lung
5. 圖四為人類腎元結構圖，請問腎臟的再吸收作用主要是由哪個結構負責？
(A) Collecting duct (B) Proximal tubule (C) Efferent arteriole (D) Glomerulus



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共 2 頁第 2 頁

二、問答題(共 50 分)

1. 請說明 Oxytocin 製造與釋放的位置並說明此激素的功能。(10 分)
2. 請描繪胃壁組織結構並說明下列胃壁細胞(mucous cell, parietal cell, chief cell, enteroendocrine cell)的功能。(15 分)
3. 請描繪不同種類的肌肉(骨骼肌、平滑肌與心肌)細胞並列表說明型態與功能的差異。(10%)
4. 請詳細說明感壓反射(baroreflex)的感受、整合與輸出的神經解剖路徑及核區並說明此反射之功能。(15 分)

三、閱讀與實驗設計(共 30 分)

1. 利用解剖學的方法驗證神經迴路的活性一直是解剖學家嘗試的研究，請閱讀下方文章內容並寫出中文摘要。(15%)
2. 請設計實驗驗證 c-Fos 與 pERK 可以標示運動神經系統的神經元活性。(15%)

文章來源

c-Fos and pERK, which is a better marker for neuronal activation and central sensitization after noxious stimulation and tissue injury?

Open Pain J. 2009 Jan 1; 2: 11-17.

c-Fos, the protein of the protooncogene *c-fos*, has been extensively used as a marker for the activation of nociceptive neurons in the spinal cord for more than twenty years since Hunt et al. first reported that peripheral noxious stimulation to a hind paw of rats leads to a marked induction of c-Fos in superficial and deep dorsal horn neurons in 1987. In 1999, Ji et al. reported that phosphorylated extracellular signal-regulated kinase (pERK) is specifically induced by noxious stimulation in superficial dorsal horn neurons. Accumulating evidence indicates that pERK induction or ERK activation in dorsal horn neurons is essential for the development of central sensitization, increased sensitivity of dorsal horn neurons that is responsible for the generation of persistent pain. Further, molecular mechanisms underlying ERK-mediated central sensitization have been revealed. In contrast, direct evidence for c-Fos-mediated central sensitization is not sufficient. After a noxious stimulus (e.g., capsaicin injection) or tissue injury, c-Fos begins to be induced after 30-60 minutes, whereas pERK can be induced within a minute, which can correlate well with the development of pain hypersensitivity. While c-Fos is often induced in the nuclei of neurons, pERK can be induced in different subcellular structures of neurons such as nuclei, cytoplasm, axons, and dendrites. pERK can even be induced in spinal cord microglia and astrocytes after nerve injury. In summary, both c-Fos and pERK can be used as markers for neuronal activation following noxious stimulation and tissue injury, but pERK is much more dynamic and appears to be a better marker for central sensitization.

背面有題

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題號：428003

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共 2 頁第 1 頁

一、選擇題（單選題，每題 4 分，共計 60 分）

- Which of the following is a client-side script language?
(A) Java (B) PHP (C) JavaScript (D) Perl
- Which is NOT an object oriented programming language?
(A) Pascal (B) Java (C) C++ (D) Smalltalk
- Consider the following program.

```
x=2; i=1;
while (x<300) {
  x=x*x;
  i=i+1;
}
```

What is the value of i at the end of the program?
(A) 4 (B) 5 (C) 6 (D) 7
- 1 TB is equal to
(A) 2^{50} bytes (B) 2^{40} bytes (C) 2^{30} bytes (D) 2^{20} bytes
- The postfix expression of $((a+b)*c/d-a*b)$ is
(A) $a+b*c/d-a*b$ (B) $abc*+d/-ab*$ (C) $*+abc/d-*ab$ (D) $ab+c*d/ab*-$
- Which of the followings is a networking protocol used by servers on a network to allocate IP addresses to computers?
(A) FTP (B) HTTP (C) DHCP (D) SSH
- Which of the memory storage types can be accessed the fastest by CPU?
(A) Register (B) Cache memory (C) Main memory (D) Hard disk
- Which of the following is an iteration keyword in the programming language C?
(A) return (B) while (C) if (D) switch
- Which of the following operating systems is a Linux distribution?
(A) Ubuntu (B) RedHat (C) CentOS (D) all of above
- Which RAID technology duplicates data on two (or more) drives?
(A) RAID 0 (B) RAID 1 (C) RAID 2 (D) RAID 5
- Which of the following data structures is suitable for handling recursive calls?
(A) queue (B) array (C) stack (D) hash
- If you want to send an E-mail to your friend, what protocol do you need?
(A) SMTP (B) POP3 (C) IMAP (D) SNMP
- 八進位的 $(20)_8$ 相當於十六進位的多少？
(A) 1 (B) 10 (C) 16 (D) 20
- 二進位數值 10101011_2 之 2 的補數(2's complement)值為何？
(A) 01010100_2 (B) 01010110_2 (C) 01010011_2 (D) 01010101_2
- 假設網路 140.117.0.0 的網路遮罩(Netmask)為 255.255.24.192，下列何者屬於不同的子網路？
(A) 140.117.80.80 (B) 140.117.26.72 (C) 140.117.48.96 (D) 140.117.23.71

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二、問答題（每題 8 分，共計 40 分）

1. 請說明何謂組譯器(Assembler)，編譯器(Compiler)及直譯器(Interpreter)。
2. 試說明關聯式資料庫中，第一正規化(First Normal Form, 1NF)、第二正規化(Second Normal Form, 2NF)及第三正規化(Third Normal Form, 3NF)的意義。
3. 請解釋下列名詞（每小題4分）
 - (1) Dynamic Programming
 - (2) DNS
4. 請將十進位數字49.375分別轉換為二進位、八進位表示法。
5. 請寫一簡單的虛擬程式碼(Pseudo Code)，印出1到100之間的所有質數。

背面有題