國立彰化師範大學107學年度碩士班招生考試試題

系所：化學系　　科目：綜合化學

☆☆請在答案紙上作答☆☆　　

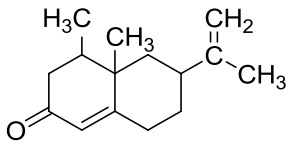
一、 選擇題 (3% each)

1. The _____ is the smallest concentration that can be reported with a certain level of confidence.
   (A) accuracy (B) outlier (C) selectivity (D) detection limit

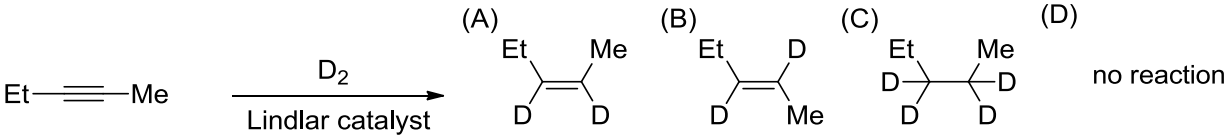
2. _____ is a sample that contains all components of the matrix except the analyte.
   (A) Duplicate sample (B) Reagent blank
   (C) Spiked sample (D) Standard reference material

3. A _____ is the interface between dissimilar liquids. A potential develops across the interface.
   (A) salt bridge (B) liquid junction (C) double layer (D) matrix

4. How many chirality centers in the following compound？
   (A) 0 (B) 1 (C) 2 (D) 3



5. Which is the major product in the following reaction？



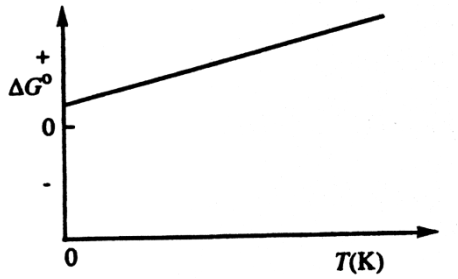
6. When the following reaction reaches the equilibrium at 1.0 atm, it is at the normal melting point (m.p.) of the phosphoric acid. Use the provided thermodynamic data, estimate the m.p. of the phosphoric acid.
   (A) 285 K (B) 305 K (C) 315 K (D) 347 K

$$H_3PO_4(s) \rightleftarrows H_3PO_4(l)$$

Substance	$H_3PO_4(s)$	$H_3PO_4(l)$
ΔH^0_f (kJ mol^{-1})	-1284.4	-1271.7
S^0 (J K^{-1} mol^{-1})	110.5	150.8

7. The figure below is the ΔG^0 vs. *T* for a chemical reaction, which better describes the thermodynamic properties of the reaction？

(A) $\Delta H^0>0$, $\Delta S^0>0$　(B) $\Delta H^0>0$, $\Delta S^0<0$　(C) $\Delta H^0<0$, $\Delta S^0>0$　(D)$\Delta H^0<0$, $\Delta S^0<0$



8. The first step toward the destruction of the atmospheric O_3 layer is through the photodissociation of C-Cl bonds in the chlorofluorocarbon. What is the longest wavelength of the photon able to achieve the reaction？ The energy of C-Cl bond is 339 kJ mol^{-1} . Plank constant = 6.626×10^{-34} J·s

(A) 253 nm　(B) 353 nm　(C) 453nm　(D) 553 nm

9. Which of the following amine is the strongest base toward $B(^tBu)_3$？

(A) NH_3　(B) NH_2Me　(C) $NHMe_2$　(D) NMe_3

10. Which one of the following is the strongest acid in water？

(A) $HClO_4$　(B) $HClO_3$　(C) $HClO_2$　(D) HOCl

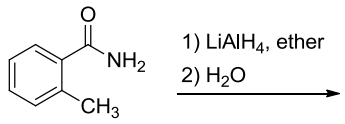
二、 問答題

1. Calculate the analytical and equilibrium molar concentrations of the solute species in an aqueous solution that contains 285 mg of trichloroacetic acid (163.4 g/mol), in 10.0 mL (the acid is 73% ionized in water). (5% each, total 10%)

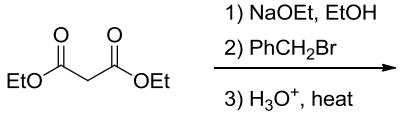
2. The potential for the reaction $K^+ + e^- \leftrightarrow K_{(s)}$ is –2.936 V. Does this also imply that K^+ is a good reducing agent？ Why？ (6%)

3. Draw the chemical structure of the major product in the following reactions. (5% each, 15% total)

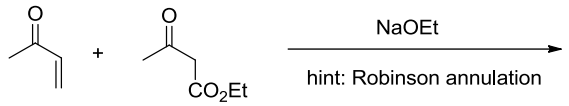
(a)



(b)



(c)



4. Derive the integrated rate law and $t_{1/2}$ for a zero order elementary reaction $A \rightarrow P$ (8%)

5. 夏天天氣很熱，以前阿嬤會向地上潑水，說是可以消暑。可是，在冬天天氣很冷的時候，高山果園會結霜或結冰，果農也會在果樹下潑水，以保護所種植的柑橘不致於凍傷，請問阿嬤和果農為什麼這樣做，背後科學的原因是什麼？ (7%)

6. Prepare a molecular orbital energy diagram for O_2, showing clearly how the atomic orbital interact to form MOs and filling the electrons in the diagram. (8%)

7. Determine the point group of the following compounds (a) CO (b) CH_4 (4%)

8. Give the oxidation number and formal charge of every atom in the following molecules (a) BF_3 (b) SO_3^{2-} (6%)

9. Draw the Lewis dot structures of the following compounds (a) ICl_3 (b) ClO_3^- (6%)