高雄醫學大學 115 學年度學生轉系考試【普通化學】試題

說明：

一、 「**選擇題**」請以答案卡劃卡作答，限用黑色2B軟心鉛筆劃記於答案卡上，劃線要粗黑、清晰，不可出格，答案卡不得折損，修正作答請以軟性橡皮擦擦拭乾淨，且**不得**使用修正液（帶）修正，未遵照正確作答方法而致無法判讀者，考生自行負責，不得提出異議。

二、 考生應在答案卡上規定範圍內作答，且不得書寫任何與答案無關之文字、符號，違者該科不予計分。

三、 答案卡每人各一張，不得要求增補；試題與答案卡必須繳回，不得攜出試場。

*可使用工程型計算機

Multiple Choice, choosing the one alternative that best completes the statement or answers the question (**4 points each**).

1. You are asked to determine the perimeter of the cover of your textbook. You measure the length as 39.36 cm and the width as 24.83 cm. How many significant figures should you report for the perimeter?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

2. Many classic experiments have given us indirect evidence of the nature of the atom. Which of the experiments listed below did not give the results described?

(A) The Rutherford experiment proved the Thomson "plum-pudding" model of the atom to be essentially correct.

(B) The Rutherford experiment was useful in determining the nuclear charge on the atom.

(C) Millikan's oil-drop experiment showed that the charge on any particle was a simple multiple of the charge on the electron.

(D) The electric discharge tube proved that electrons have a negative charge.

(E) All of the above experiments gave the results described.

3. You are given a compound with the formula MCl2, in which M is a metal. You are told that the metal ion has 26 electrons. What is the identity of the metal?

(A) Fe (B) Al (C) Zn (D) Co (E) Ni

4. All of the following are in aqueous solution. Which is *incorrectly* named?

(A) $HC_2H_3O_2$, acetic acid (B) HBr, bromic acid (C) H_2SO_3, sulfurous acid

(D) HNO_2, nitrous acid (E) $HClO_3$, chloric acid

5. A substance, A_3B, has the composition by mass of 60% A and 40% B. What is the composition of AB_3 by mass?

(A) 40% A, 60% B (B) 50% A, 50% B (C) 14% A, 86% B

(D) 25% A, 75% B (E) none of these

6. A 2.80-g sample of an oxide of bromine is converted to 4.698 g of AgBr. Calculate the empirical formula of the oxide. (molar mass for AgBr = 187.78 g/mol)

(A) BrO_3 (B) BrO_2 (C) BrO (D) Br_2O (E) none of these

7. For the reaction $4FeCl_2(aq) + 3O_2(g) \rightarrow 2Fe_2O_3(s) + 4Cl_2(g)$, what volume of a 0.760 *M* solution of $FeCl_2$ is required to react completely with 6.36×10^{21} molecules of O_2?

(A) 5.26×10^3mL (B) 10.7 mL (C) 10.4 mL (D) 18.5 mL (E) 6.02 mL

8. Four identical 1.0-L flasks contain the gases He, Cl_2, CH_4, and NH_3, each at 0°C and 1 atm pressure. Which gas has the highest density?

(A) He (B) Cl_2 (C) CH_4 (D) NH_3 (E) all gases the same

9. Order the following in increasing rate of effusion: F_2, Cl_2, NO, NO_2, CH_4

(A) $Cl_2 < NO_2 < F_2 < NO < CH_4$
(B) $Cl_2 < F_2 < NO_2 < CH_4 < NO$
(C) $CH_4 < NO_2 < NO < F_2 < Cl_2$
(D) $CH_4 < NO < F_2 < NO_2 < Cl_2$
(E) $F_2 < NO < Cl_2 < NO_2 < CH_4$

10. Consider the following specific heats of metals.
The Specific Heat (J/(g°C) for Zinc, Magnesium, Iron, Silver, and Lead are 0.387, 1.02, 0.450, 0.237, 0.127, respectively. If the same amount of heat is added to 25.0 g of each of the metals, which are all at the same initial temperature, which metal will have the highest temperature?

(A) Zinc (B) Magnesium (C) Iron (D) Silver (E) Lead

11. Consider the following processes:

Processes	$3B \rightarrow 2C + D$	$(1/2)A \rightarrow B$	$E + A \rightarrow D$
ΔH (kJ/mol)	–125	150	350

Calculate ΔH for: $B \rightarrow E + 2C$

(A) 325 kJ/mol (B) 525 kJ/mol (C) –175 kJ/mol (D) –325 kJ/mol (E) none of these

12. What is the wavelength of light that is emitted when an excited electron in the hydrogen atom falls from n = 5 to n = 1? ($h = 6.626\times10^{-34}$ J·s)

(A) 1.05×10^{7} m (B) 9.50×10^{-8} m (C) 2.09×10^{-18} m
(D) 9.12×10^{-8} m (E) none of these

13. Consider the following orderings.
I. $Na^{+} < Mg^{2+} < Al^{3+} < Si^{4+}$ II. Be < Mg < Ca < Sr III. I < Br < Cl < F IV. Al < Si < P < Cl
Which of these give(s) a correct trend in ionization energy?

(A) III (B) II, IV (C) I, IV
(D) I, III, IV (E) none of them

14. Consider the following molecules.

I	II	III	IV	V	VI
BF_3	$CHBr_3$ (C is the central atom)	Br_2	$XeCl_2$	CO	SF_4

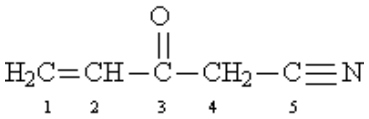
Select the molecule(s) that violate the octet rule.

(A) I, II, IV
(B) I, III, IV, VI
(C) III, V, VI
(D) I, IV, VI
(E) I, II, IV, VI

15. Which of the following statements is ***true***?

(A) Tetrahedral molecules (four identical bonds equally spaced) always has a dipole moment.
(B) Both HF and CO_2 are linear molecules and therefore polar.
(C) The correct order for molecules from most to least polar is $CF_2H_2 > CCl_2H_2 > CF_2Cl_2 > CH_4 = CCl_4$.
(D) The molecular structure of $SOCl_2$ is trigonal planar.
(E) The molecular structure of XeF_5^{+} is trigonal bipyramidal.

16. Consider the molecule:



Specify the hybridization of each carbon atom.

	C-1	C-2	C-3	C-4	C-5
(A)	sp^2	sp^2	sp^2	sp^3	sp
(B)	sp^2	sp^2	sp^2	sp^3	sp^3
(C)	sp^2	sp^2	sp^3	sp^3	sp^2
(D)	sp^2	sp^2	sp^3	sp^3	sp^3
(E)	sp^2	sp	sp	sp^2	sp

17. Which of the following statements is ***false***?

(A) The bond length of N_2 is shorter than N_2^+.
(B) The bond in of N_2 is stronger than N_2^-.
(C) The bond dissociation energy of N_2 is higher than N_2^-.
(D) The bond order of N_2 is 2.5.
(E) All of above are true.

18. Which one of the following decreases as the strength of the attractive intermolecular forces increases?

(A) the heat of vaporization
(B) the normal boiling temperature
(C) the extent of deviations from the ideal gas law
(D) the sublimation temperature of a solid
(E) the vapor pressure of a liquid

19. Determine the osmotic pressure of a solution that contains 0.048 g of a hydrocarbon solute (molar mass = 340 g/mol) dissolved in benzene to make a 350-mL solution. The temperature is 20.0°C.

(A) 0.50 torr (B) 2.5 torr (C) 3.3 torr (D) 7.4 torr (E) 6.9 torr

20. For a reaction: aA → Products, $[A]_0$ = 6.0 M, and the first two half-lives are 56 and 28 minutes, respectively. Calculate [A] at t = 105.9 minutes.

(A) 5.7 M (B) 12 M (C) 0.68 M (D) 0.33 M (E) none of these

21. Consider the following reaction: $CS_2(g) + 4H_2(g) \rightleftharpoons CH_4(g) + 2H_2S(g)$. The equilibrium constant K is about 0.31 at 900°C. What is the K_p at this temperature?

(A) 2.9×10^{3} (B) 3.2×10^{-3} (C) 3.3×10^{-5} (D) 3.0×10^{1} (E) 1.1×10^{-3}

22. The questions below refer to the following system:

$$Co(H_2O)_6^{2+} + 4\ Cl^- \rightleftharpoons CoCl_4^{2-} + 6H_2O$$
(pink) (blue)

When cobalt(II) chloride is added to pure water, the Co^{2+} ions hydrate. The hydrated form then reacts with the Cl^- ions to set up the equilibrium shown here. Which statement below describes the change that the system will undergo if silver nitrate is added?

(A) It should become more blue. (B) It should become more pink. (C) Water will be produced.
(D) The silver ion will react with the $CoCl_4^{2-}$. (E) Nothing will change.

23. Using the following K_a values, indicate the correct order of base strength.

HNO_2 Ka = 4.0×10^{-4} HF Ka = 7.2×10^{-4} HCN Ka = 6.2×10^{-10}

(A) $CN^- > NO_2^- > F^- > H_2O > Cl^-$

(B) $Cl^- > H_2O > F^- > NO_2^- > CN^-$

(C) $CN^- > F^- > NO_2^- > Cl^- > H_2O$

(D) $H_2O > CN^- > NO_2^- > F^- > Cl^-$

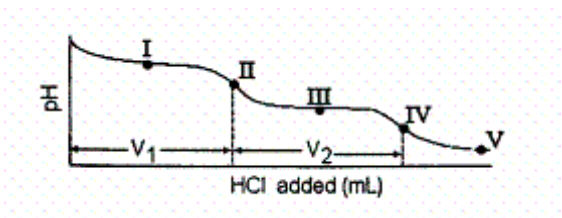
(E) none of these

24. The standard molar free energies of formation of $NO_2(g)$ and $N_2O_4(g)$ at 25°C are 51.840 and 98.035 kJ/mol, respectively. What is the value of K_p (in atm) for the reaction written as follows at 25°C? $2NO_2 \rightleftharpoons N_2O_4$

(A) 6.24×10^{11} (B) 1.00 (C) 9.76

(D) 4.38×10^{-36} (E) 7.99×10^{-9}

25. The titration curve for 50.00 mL 1.000M disodium ascorbate, Na_2As, with standard 1.000M HCl is shown below:



The pH at point I and III are 11.79 and 4.10, respectively, which of the following would be the pKa1 of the diprotic acid, H_2As

(A) 4.10 (B) 7.95 (C) 11.79 (D) 12.39 (E) none of these