

國立臺北科技大學

九十五學年度學士班二、三年級轉學生招生考試 四技三年級 分子科學與工程系 專業科目 (二) 普通化學試題

填 准 考 證 號 碼

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注意事項：

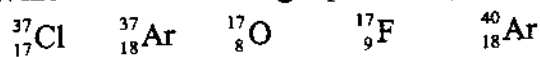
1. 本試題共 40 題，配分共 100 分，每題 2.5 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Three length scales ordered from smallest to largest are:
 - a. microscale, nanoscale, macroscale.
 - b. microscale, macroscale, nanoscale.
 - c. macroscale, nanoscale, microscale.
 - d. nanoscale, microscale, macroscale.
 - e. none of the above.
2. Which of the following is not the symbol of an element?
 - a. Cu.
 - b. Ni.
 - c. CO.
 - d. Ag.
 - e. C.
3. Which of the following represents a pair of allotropes?
 - a. oxygen and ozone.
 - b. hydrogen and water.
 - c. methane and ethane.
 - d. diamond and glass.
 - e. carbon and carbon dioxide.
4. When an atom loses electrons, _____ are formed.
 - a. nuclei.
 - b. alpha particles.
 - c. protons.
 - d. neutrons.
 - e. ions.

5. Which of the following statements is not true ?

- a. $^{95}_{42}\text{Mo}$ contains 53 neutrons.
- b. $^{51}_{23}\text{V}$ has an atomic number of 23.
- c. $^{12}_6\text{C}$ has the same number of protons, neutrons and electrons.
- d. $^{66}_{30}\text{Zn}$ has the same number of electrons and protons.
- e. $^{56}_{26}\text{Fe}$ has the same number of neutrons and protons.

6. Which of the following represent a pair of isotopes ?



I II III IV V

- a. I and II.
- b. I and III.
- c. I and IV.
- d. II and V.
- e. III and IV.

7. The formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is an example of a(n):

- a. structural formula.
- b. functional group formula.
- c. inorganic formula.
- d. ball and stick model.
- e. condensed formula.

8. The compound 2,2,3,4-tetramethylpentane is an isomer of:

- a. hexane. b. decane. c. heptane. d. octane. e. nonane.

9. Which compound is incorrectly named?

- a. $\text{Fe}(\text{OH})_3$ iron(III) hydroxide.
- b. NH_4NO_3 ammonium nitrate.
- c. $\text{K}_2\text{Cr}_2\text{O}_7$ potassium dichromate.
- d. $\text{Ba}(\text{OH})_2$ barium hydroxide.
- e. Na_2SO_4 sodium sulfite.

10. A compound is composed of 56.4% phosphorus and the remainder oxygen. Determine the empirical formula of the compound.

- a. PO_5 .
- b. P_2O .
- c. P_3O_2 .
- d. P_2O_3 .

注意：背面尚有試題

e. P_2O_5 .

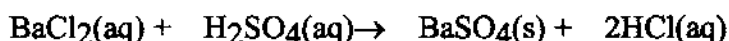
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11. Which reaction will not occur?

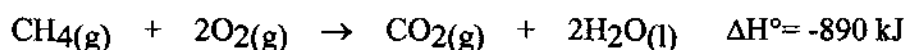
- a. $Al(s) + SnCl_2(aq) \rightarrow AlCl_3(aq) + Sn(s)$.
- b. $H_2(g) + AgNO_3(aq) \rightarrow HNO_3(aq) + Ag(s)$.
- c. $Mg(s) + CuSO_4(aq) \rightarrow Cu(s) + MgSO_4(aq)$.
- d. $Mg(s) + CaSO_4(aq) \rightarrow MgSO_4(aq) + Ca(s)$.
- e. $Ba(s) + HCl(aq) \rightarrow BaCl_2(aq) + H_2(g)$.

12. Which of the methods described below will yield 500 mL of a 0.100 M $KMnO_4$ solution?

- a. Add exactly 500 mL of water to 7.90 g of $KMnO_4$.
- b. Add exactly 500 mL of water to $KMnO_4$.
- c. Dissolve 7.90 g of $KMnO_4$ in water and dilute to exactly 500 mL.
- d. Dissolve 15.8 g $KMnO_4$ in water and dilute to exactly 500 mL.
- e. Dilute 220 mL of 1.00 M $KMnO_4$ to exactly 500 mL.

13. Determine the mass of $BaSO_4$ that is produced by the reaction of 45.0 mL of 0.155 M H_2SO_4 and 60.0 mL of 0.125 M $BaCl_2$. Assume that $BaSO_4$ is totally insoluble. (Ba:137)

- a. 1.45 g.
- b. 1.62 g.
- c. 1.79 g.
- d. 3.24 g.
- e. 0.775 g.

14. What is the enthalpy change when 22.5 g of CH_4 are burned in excess O_2 ?

- a. -39.5 kJ.
- b. -890 kJ.
- c. -1250 kJ.
- d. +890 kJ.
- e. +1250 kJ.

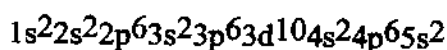
15. Arrange the following four electromagnetic spectral regions in order of increasing energy.
visibleultravioletinfraredradio

- a. visible, ultraviolet, radio, infrared.
- b. radio, ultraviolet, visible, infrared.
- c. radio, infrared, visible, ultraviolet.
- d. infrared, ultraviolet, visible, radio.
- e. infrared, visible, ultraviolet, radio.

16. The designation for the principal quantum number is:

- a. n.
- b. s.
- c. m_l .
- d. l .
- e. m_s .

17. Give the element that has the electron configuration:



- a. In. b. Pd. c. Fe. d. Ni. e. Sr.

18. Arrange the elements given in order from largest to smallest atomic radii.

Al Ca Sr Mg S

- a. $Sr > Ca > Mg > Al > S$.
 b. $Sr > Ca > S > Al > Mg$.
 c. $Al > Sr > S > Ca > Mg$.
 d. $Ca > Mg > Sr > Al > S$.
 e. $Mg > Al > S > Ca > Sr$.

19. Which statement about covalent bonds is incorrect?

- a. Covalent bonds enable atoms to have stable noble gas electron configurations.
 b. Covalent bonds form between non-metals.
 c. Covalent bonds have an associated bond energy.
 d. A single covalent bond is made up of two electrons.
 e. Covalent bonds cannot be broken.

20. Which bond is longest?

- a. C-O. b. C-P. c. C-H. d. C-C. e. C-N.

21. Using VSEPR Theory to predict the electron-pair geometry and the O-N-O bond angles for NO_2^- .

- a. bent, 120° .
 b. linear, 180° .
 c. trigonal planar, 120° .
 d. tetrahedral, 90° .
 e. bent, 180° .

22. Determine the hybridization around the central atom in KrF_4 .

- a. sp. b. sp^2 . c. sp^3 . d. sp^3d . e. sp^3d^2 .

23. If a 2.0-liter sample of gas experiences a decrease in pressure from 1.74 atm to 0.555 atm at $25^\circ C$, what is the resulting volume (in L) at $25^\circ C$?

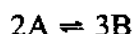
- a. 0.48 L. b. 0.64 L. c. 1.9 L. d. 6.3 L. e. 20 L.

24. A "free radical" is which of the following?

- a. formed from the combination of two photons.
 - b. a negatively charged species.
 - c. a species that exists only in theory, not in reality.
 - d. an atom or a molecule containing an unpaired electron.
 - e. very stable and unreactive.
25. Which choice is an example of an amorphous solid?
- a. NaCl. b. ionic solid. c. iron. d. quartz. e. glass.
26. In a _____ semiconductor the charge carriers are the holes because _____.
- a. s-type; there are extra electrons which move freely.
 - b. s-type; they can move into the conduction band.
 - c. s-type; they are not locked into one location.
 - d. p-type; electrons move to fill a hole, thus leaving a hole elsewhere.
 - e. p-type; there are extra electrons that can move freely.
27. Which of the following is a component of natural gas?
- a. benzene. b. butane. c. butanol. d. octane. e. propanol.
28. The chemical name for the pain reliever aspirin is _____ acid.
- a. aspartic. b. salicylic. c. lysergic. d. acetylsalicylic. e. propionic.
29. Consider the hypothetical reaction
- $$A + 3B \rightarrow 2C + D$$
- The rate of reaction is _____ times $\Delta[B]/\Delta t$ and _____ times $\Delta[C]/\Delta t$.
- a. -2; -3. b. -1/3; 1/2. c. 1/2; -1/3. d. -1/2; -1/3. e. -1; 2/3.
30. The rate of the chemical reaction involving two substances, A and B, is measured. It is found that if the initial concentration of A used is doubled, keeping the B concentration the same, the rate doubles. If the concentrations of both A and B are doubled, the rate is eight times that measured in the first experiment. The rate law for this reaction is rate =
- a. $k[A][B]$. b. $k[A]^2[B]$. c. $k[A][B]^2$. d. $2k[A][B]$. e. $k[A][B]/2$.
31. Which statement is true about a catalyst?
- a. It increases the activation energy involved in a reaction.
 - b. It can be the same phase as the reactants (heterogeneous) or a different phase (homogeneous).
 - c. It is formed during an early step in the reaction and consumed in a later step.

- d. It does not participate in the reaction.
e. It does not appear in the overall equation for the reaction.

32. For the reaction



$K_c = 1.37$. If the concentrations of A and B are equal, what is the value of that concentration?

- a. 0.685 M. b. 0.822 M. c. 1.17 M. d. 1.37 M. e. 1.88M.

33. The process of dissolving is favored if the _____ interactions are weaker than the _____ interactions.

- a. solute-solvent; solute-solute and solvent-solvent.
b. solvent-solvent; solute-solute and solute-solvent.
c. solute-solute and solvent-solvent; solute-solvent.
d. solute-solvent and solvent-solvent; solute-solute.
e. solute-solute; solute-solvent and solvent-solvent.

34. Given that the value of k_f for water is $1.86^\circ\text{C}/m$, what is the freezing point of an aqueous solution of NaCl prepared by mixing 427.0 g solute with 1.000 kg of water?

- a. -4.36°C . b. -7.94°C . c. -13.6°C . d. -15.7°C . e. -18.3°C .

35. Methylamine, CH_3NH_2 , acts as a weak base in water. The products of the reaction are _____ and _____.

- a. OH^- and CH_3NH_3^+ .
b. H_3O^+ and CH_3NH_3^+ .
c. H_3O^+ and OH^- .
d. OH^- and CH_3NH^- .
e. H_3O^+ and CH_3NH^- .

36. Which of the following is a conjugate acid-base pair?

- a. CH_3COO^- and H_2O .
b. H_3O^+ and OH^- .
c. CH_3COOH and CH_3COO^- .
d. CH_3COOH and H_3O^+ .
e. CH_3COOH and OH^- .

37. A buffer solution may result if K_3PO_4 is mixed with

- a. HCl .
b. K_2HPO_4 .

注意：背面尚有試題

- c. NaOH.
- d. either HCl or K_2HPO_4 .
- e. either K_2HPO_4 or NaOH.

38. A buffer solution is 0.080 M in lactic acid ($K_a = 1.8 \times 10^{-4}$) and 0.070 M in sodium lactate.

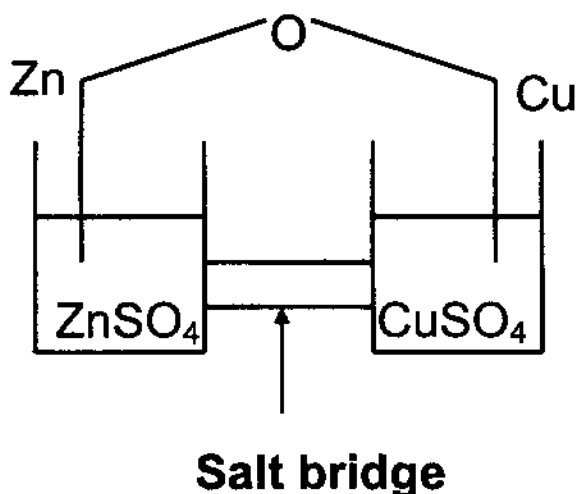
The pH of the solution is

- a. 2.86.
- b. 3.68.
- c. 3.80.
- d. 4.18.
- e. 4.62.

39. Which process is reactant-favored?

- a. decomposition of iron ore into pure iron.
- b. the melting of ice at 25°C .
- c. diffusion of the odor of cooking food.
- d. the freezing of water at -5°C .
- e. burning a candle.

40. Consider an electrochemical cell as shown, with Zn in $ZnCl_2(aq)$ and Cu in $Cu(NO_3)_2(aq)$, and a salt bridge containing $KNO_3(aq)$. The overall chemical reaction is $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$. Which statement is correct?



- a. One mole of electrons is transferred in this reaction.
- b. Copper is oxidized at the anode.
- c. Electrons travel from the Zn to the Cu.
- d. This is an example of a concentration cell.
- e. Zinc is reduced at the cathode.