

國立臺北科技大學九十四學年度學士班轉學考試

分子系 普通化學試題

填 准 考 證 號 碼

第一頁 共四頁

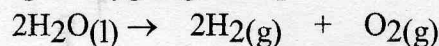
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注意事項：

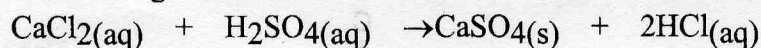
1. 本試題共 40 題，共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

1. Which of the following cannot be determined from a balanced chemical equation?
 - a. The number of moles of reactants and products.
 - b. The number of molecules of reactants and products.
 - c. The relative mass of each reactant and product.
 - d. Whether the reaction will proceed as written.
 - e. The number of atoms of each element reacting.

2. In the reaction given below, how many grams of water are consumed if 2.0 g of hydrogen gas and 16.0 g of oxygen gas are produced?



- a. 2.0 g
 - b. 4.0 g
 - c. 18.0 g
 - d. 20.0 g
 - e. 36.0 g
3. Classify the following reaction.



- a. combination
 - b. decomposition
 - c. displacement
 - d. combustion
 - e. exchange
4. The Roman numerals in the reaction given represent the coefficients in the balanced chemical equation. What are the values of the coefficients?



I II III IV

- | | | | |
|------|---|---|---|
| a. 2 | 3 | 2 | 3 |
| b. 4 | 6 | 1 | 6 |
| c. 3 | 1 | 3 | 2 |
| d. 3 | 1 | 1 | 3 |
| e. 2 | 3 | 1 | 3 |

5. What is the maximum possible quantity of product obtained from a chemical reaction called?

- limiting reactant
- theoretical yield
- percent yield
- molecular weight of the product
- stoichiometric coefficients

6. The efficiency of a particular synthesis method is evaluated by determining the:

- limiting reactant
- theoretical yield
- percent yield
- molecular weight of the product
- stoichiometric coefficients

7. Which statement about strong acids is true?

- Strong acids are weak electrolytes.
- Strong acids are very concentrated.
- Strong acids are almost entirely converted to ions when dissolved in water.
- Acetic acid is a strong acid.
- All of the above are true.

8. Which of the following is a reducing agent?

- O₂
- F₂
- Br₂
- I₂
- Na

9. A 25.00 mL sample of H₂SO₄ solution is neutralized by exactly 41.63 mL of 0.1363 M NaOH. What is the molarity of the H₂SO₄ solution?

- a. 0.2270 M
b. 0.2726 M
c. 0.06815 M
d. 0.1135 M
e. 0.05675 M

10. For most chemical reactions, the only energy is transferred through:

- a. heat
b. heat and light
c. work
d. heat and work
e. heat, light and work

11. The combustion of 1.47 g of methanol produces 29.3 kJ of heat. Determine the 'H for the reaction and its sign.



- a. -638 kJ
b. +938 kJ
c. +638 kJ
d. -938 kJ
e. -1.35 kJ

12. Light has a frequency of 6.75×10^{14} hertz. What is its wavelength? The speed of light is 3.00×10^8 m/s.

- a. 2.25×10^6 nm
b. 444 nm
c. 2.25×10^{-3} nm
d. 2.25×10^5 nm
e. 4.44×10^{-7} nm

13. Light has a wavelength of 548 nm. What is its frequency? The speed of light is 3.00×10^8 m/s.

- a. 5.47×10^{14} Hz
b. 1.86×10^{-6} Hz
c. 5.47×10^5 Hz
d. 1.83×10^{-15} Hz
e. 1.64×10^2 Hz

14. Which azimuthal quantum numbers can exist for $n = 4$?

- a. $l = 0$
b. $l = 0, 1$

c. $l = 0, 1, 2$

d. $l = 0, 1, 2, 3$

e. $l = 0, 1, 2, 3, 4$

15. What is the electron configuration of Al^{3+} ?

a. $1s^2 2s^2 2p^5$

b. $1s^2 2s^2 2p^6 3s^2 3p^1$

c. $1s^2 2s^2 2p^4$

d. $1s^2 2s^2 2p^2$

e. $1s^2 2s^2 2p^6$

16. Which of the following has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6$?

a. Ca^{+2}

b. Cl^{-1}

c. Ar

d. K^{+1}

e. all of the above

17. Atoms or ions with unpaired electrons are:

a. isoelectronic

b. paramagnetic

c. diamagnetic

d. ferromagnetic

e. lanthanides

18. Consider the carbon skeleton shown below. To form a primary alcohol, the functional group can be bonded to which carbon atom(s)?

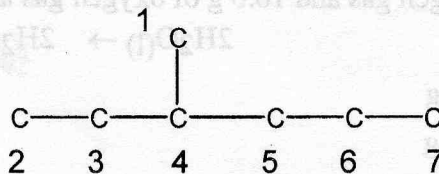
a. 4

b. 2 or 6

c. 3, 5, or 6

d. 1, 2, or 7

e. any of them



19. How many **different** secondary alcohols can be made from the carbon skeleton shown below?

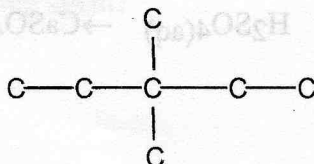
a. 0

b. 1

c. 2

d. 3

e. 4



20. How many of these functional groups contain either a carbon atom doubly bonded to an oxygen atom, a hydrogen atom singly bonded to an oxygen atom, or both: alcohol, aldehyde, carboxylic acid, ketone?

a. 0

- b. 1
c. 2
d. 3
e. 4
21. The importance to our environment of the high specific heat capacity of water is that
a. liquids can rise in plant stems because of capillary action.
b. temperature changes are moderated near large bodies of water.
c. thermal energy is rapidly transferred within living things.
d. this causes ice to float.
e. freezing water releases a large amount of heat, thus warming the environment.
22. In face-centered cubic unit cells, ____ of the atom on each face of the unit cell is counted as part of that unit cell.
a. all
b. none
c. $1/2$
d. $1/4$
e. $1/8$
23. In body-centered cubic unit cells, ____ of the atom in the center of the unit cell is counted as part of that unit cell.
a. all
b. none
c. $1/2$
d. $1/4$
e. $1/8$
24. In an ionic compound such as NaCl, which consists of a fcc lattice of chloride ions, each sodium ion has ____ chloride ions surrounding it as nearest neighbors.
a. 8
b. 6
c. 4
d. 1
e. 0
25. Which are properties of all metals (except Hg)?
I. Good conductors of heat and electricity
II. Easily formed into sheets or wires
III. Shiny
IV. Chemically unreactive

V. Soluble in water

- a. all of these
- b. none of these
- c. I, II, III
- d. I, II, IV
- e. III, IV, V

26. Which statement about metallic bonding is not correct?

- a. In the presence of an electrical field, the electrons migrate toward the positive charge.
- b. The valence electrons move freely around the nuclei, allowing conduction of heat.
- c. The flexibility of metals results from the mobility of the electron charge, which allows the nuclei to be moved without disrupting the overall structure of the metal.
- d. It describes the freely moving valence electrons as an "electron sea."
- e. The metal nuclei behave as negatively charged ions.

27. Ultrapure silicon for use in the semiconductor industry can be obtained by the process of

- a. doping.
- b. distillation.
- c. chromatography.
- d. zone refining.
- e. electroplating.

28. Elements most likely to be used for doping silicon in making semiconductors are

- a. Ba, La, & Y.
- b. Ne, Ar, & Kr.
- c. Ga, As, & B.
- d. Au, Ag, & Cu.
- e. Li, Na, & K.

29. Because graphite contains carbon atoms that are covalently bonded to three other carbon atoms in the same layer, it is classified as a(an) _____ solid.

- a. planar network
- b. amorphous
- c. three-dimensional network
- d. metallic
- e. ionic

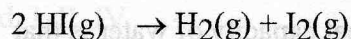
30. A sample of crude oil undergoes fractional distillation. _____ is collected at the top of the distillation tower, and _____ at the bottom.

- a. Gasoline; kerosene
- b. Diesel and jet fuel; gasoline
- c. Kerosene; high molecular weight fractions

- d. Methane and ethylene; high molecular weight fractions
e. Methane and ethylene; diesel and jet fuel
31. Which of the following could not be the units of a rate constant?
a. min^{-1}
b. M min^{-1}
c. $\text{M}^{-1} \text{min}^{-1}$
d. $\text{M}^2 \text{min}^{-1}$
e. $\text{M}^{-2} \text{min}^{-1}$
32. Which statement about a rate constant is correct?
a. Its units are always M min^{-1} .
b. Its value generally decreases as temperature increases.
c. Its value depends on the concentration of the reactant(s).
d. Its value at a particular temperature depends on the reaction involved.
e. It is symbolized by "K".
33. The rate law for a given reaction is $\text{rate} = k[\text{reactant}]^2$, with $k = 2.64 \times 10^{-4} \text{ M}^{-1} \text{ min}^{-1}$. If the initial concentration is 0.0250 M, what is the initial rate, with the correct units?
a. $4.36 \times 10^{-11} \text{ M min}^{-1}$
b. $1.65 \times 10^{-7} \text{ min}^{-1}$
c. $6.60 \times 10^{-6} \text{ M min}^{-1}$
d. $1.65 \times 10^{-7} \text{ M min}^{-1}$
e. $6.60 \times 10^{-6} \text{ min}^{-1}$
34. A reaction displays first-order kinetics. It therefore follows that a plot of _____ versus time is linear, and that the slope of this plot = _____.
a. $[\text{reactant}]$; $-k$
b. $[\text{reactant}]$; k
c. $1/[\text{reactant}]$; $-k$
d. $1/[\text{reactant}]$; k
e. $\ln[\text{reactant}]$; $-k$
35. For a first-order reaction, which expression describes the relationship between the rate constant, k , and the half-life, $t_{1/2}$?
a. $t_{1/2} = 2 / k$
b. $t_{1/2} = \ln 2 / k$
c. $t_{1/2} = k / 2$
d. $t_{1/2} = \ln 2 \times k$
e. $t_{1/2} = k / \ln 2$
36. The rate constant for the first-order conversion of A to B is 3.33 hr^{-1} . How much time will be required for the concentration of A to reach 75% of its original value?
a. 0.086 hr

- b. 0.83 hr
- c. 0.96 hr
- d. 2.50 hr
- e. 4.44 hr

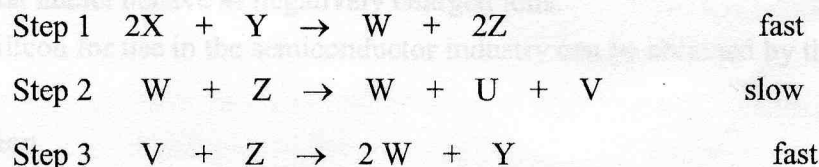
37. The rate constant for the reaction



doubles on raising the temperature from 410 °C to 425 °C. The activation energy, in J/mol, is

- a. 5.3×10^5 .
- b. 1.8×10^5 .
- c. 9.1×10^4 .
- d. 6.7×10^4 .
- e. -1.9×10^5 .

For the following three questions, consider the following reaction mechanism:



38. The intermediates in this reaction are

- a. Z and V.
- b. X and Y.
- c. Y only.
- d. W and Y.
- e. There are no intermediates in this reaction.

39. The catalysts in this reaction are

- a. Z and V.
- b. X and Y.
- c. Y only.
- d. W and Y.
- e. There are no catalysts in this reaction.

40. The rate-limiting step in this reaction is Step _____, because _____.

- a. 3; the last step is always the rate-limiting step
- b. 2; it uses a product of the first step
- c. 2; it is the slow step
- d. 1; it is bimolecular
- e. 1; the first step must occur before any others can occur