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國立臺北科技大學 110 學年度碩士班招生考試

系所組別：3720 分子科學與工程系有機高分子碩士班乙組

第一節　化工熱力學　試題

注意事項：

1.本試題共 24 題，共 100 分。選擇題 20 題每題 3 分，簡答題 4 題每題 10 分。
2.不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3.全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、選擇題：(每題 3 分，共 60 分)

1. _____ What are the important variables controlling the physical properties of a gas?
a. pressure　b. temperature　c. volume　d. all of the above　e. color

2. _____ Compared to a real gas at very high pressure, and ideal gas occupies?
a. more volume　b. less volume　c. same volume　d. unpredictable　e. no correlation

3. _____ Which of the following statement is not the assumption of kinetic theory?
a. The gas consists of molecules of mass m in ceaseless random motion
b. The size of the molecules is negligible
c. The molecules do not interact with each other
d. The molecules make perfectly elastic collisions when they are in contact
e. Internal modes of motion are excited when molecules making collision

4. _____ According to kinetic theory, the most probably speed increases with T and with decreasing molar mass, and simultaneously the distribution becomes broader?
a. increases with T
b. decreases with T
c. increases with molar mass
d. distribution becomes narrower
e. none of the above answer is correct

5. _____ Under the same condition, compare the root mean square (r.m.s.) speed (c), the mean speed (c"), and the most probably speed (c*) of molecules?
a. c* > c" > c
b. c" > c* > c
c. c > c" > c*
d. c* = c" = c
e. none of the above answer is correct

6. _____ Please estimate the time taken to complete adsorb one monolayer of CO at 300 K under the ambient pressure of 10^{-6} Torr.
a. 3 seconds
b. 300 seconds
c. 30 minutes
d. 3 hours
e. none of the above answer is correct

7. _____ Which of the following condition is not for real gas?
a. high pressure
b. high temperature
c. low mean free path
d. condensation may occur
e. none of the above answer is correct

8. _____ Which of the following statement is not correct for repulsive forces?
a. only significant when molecules are almost in contact
b. short-range interaction
c. the gas is less compressible
d. assist expansion
e. none of the above answer is incorrect

9. _____ The molar volume of a perfect gas at 500 K and 100 bar is 0.416 dm^3mol^{-1}. The molar volume of CO_2 under the same conditions is 0.366 dm^3mol^{-1}. Which interaction dominate the CO_2 behavior at 500 K?
a. repulsive forces
b. attractive forces
c. van der Waals forces
d. electronic forces
e. none of the above answer is correct

10. _____ The temperature at which the properties of the real gas coincide with those of the perfect gas as $P \rightarrow 0$?

注意：背面尚有試題

a. critical temperature
b. Boyle temperature
c. boiling temperature
d. frozen temperature
e. none of the above answer is correct

11. _____ The critical temperature of O_2 is 154.8 K. At which temperature that O_2 can not be liquified by compression alone?
a. 100 K
b. 120 K
c. 140 K
d. 160 K
e. none of the above answer is correct

12. _____ About the van der Waals equation, which statement is incorrect?
a. is the approximate equation of state for real gas
b. van der Waals coefficients are characteristic of each gas
c. van der Waals coefficients are independent of the temperature
d. combine effect of repulsion and attraction
e. none of the above answer is incorrect

13. _____ Gibbs energy always increases when the pressure of the system is increased at constant temperature and composition. Which phase of the molar Gibbs energy is more sensitive to pressure?
a. gas
b. liquid
c. solid
d. the change of molar Gibbs energy to pressure does not depend on material phase
e. none of the above answer is incorrect

14. _____ Which of the below statement is incorrect?
a. Real gases at the same reduced volume and same reduced temperature exert the same reduced pressure
b. Ideal gases at the same volume and same temperature exert the same pressure
c. Real gases at the same volume and same temperature exert the same pressure
d. Ideal gases at the same reduced volume and same reduced temperature exert the same reduced pressure
e. none of the above answer is incorrect

15. _____ Which of the below statement is correct for closed system?
a. can exchange energy but not matter with surrounding
b. can exchange matter but not energy with surrounding
c. neither matter nor energy can crosses the boundary of the system
d. both matter and energy can crosses the boundary of the system
e. none of the above answer is correct

16. _____ Work done in a free expansion is?
a. positive
b. negative
c. zero
d. dependent on temperature
e. none of the above answer is correct

17. _____ Which of the below properties is not the intensive property?
a. pressure
b. temperature
c. density
d. heat
e. specific volume

18. _____ Can the maximum work done by the system be greater than the decrease of internal energy?
a. Yes, if the change occurs with a decrease in system entropy
b. Yes, if the change occurs with an increase in system entropy
c. No, the maximum work done by the system is always smaller than the decrease of internal energy
d. No, the maximum work done by the system is equal to the decrease of internal energy
e. No, the maximum work done by the system is not related to the change of internal energy

19. _____ In an isothermal process, the internal energy of gas
a. decrease
b. no change
c. increase
d. unpredictable change
e. depends on the pressure

20. _____ Which of the below statement is incorrect for the isothermal compressibility?

a. can be obtained from the slope of the plot of volume against pressure at constant temperature

b. for ideal gas, the isothermal compressibility is inversely proportional to pressure

c. The higher the pressure of the gas, the lower its compressibility

d. is a measure of the fractional change in volume when the pressure is increased by a small amount at constant temperature

e. none of the above answer is incorrect

二、簡答題：(每題分數如題前說明，每題 10 分，共 40 分)

1. (本題總分 10%) Please give two experimental results to show the existence of real gas.

2. (本題總分 10%) Use the principle of corresponding states to suggest the pressure and temperature at which 1.0 mol of CO_2 will be in states that correspond to 1.0 mol N_2 at 1.0 atm and 25 °C. (For N_2, Pc = 33.54 atm, Tc=126.3 K, For CO_2, Pc = 72.9 atm, Tc = 304.2 K. Pc: critical pressure; Tc: critical temperature)

3. (本題總分 10%) Give physical explanation why constant-pressure heat capacity (Cp) is larger than constant-volume heat capacity (Cv)?

4. (本題總分 10%) How to determine the spontaneous direction of change?