

Gases

(1) Ideal Gases (Theories)

-2014 I(7)

(7) Which of the properties 1) to 4) is not appropriate for ideal gas?

- 1) The volume of an individual atom or molecule is zero.
- 2) There is no interaction among the atoms and molecules.
- 3) It transforms into liquid or solid at low temperatures.
- 4) It obeys Boyle's law.

-2016 I(7)

(7) Which of the descriptions 1) to 4) is not appropriate for ideal gas?

- 1) The volume of constituent atoms or molecules is neglected.
- 2) The interaction between atoms or molecules is neglected.
- 3) The transformation to liquid or solid is observed under appropriate conditions.
- 4) The compressibility, PV/RT (P : pressure, V : volume, R : gas constant, T : absolute temperature) is independent of the pressure.

-2018 I(7)

(7) Which of the descriptions 1) to 4) is not correct for ideal gas?

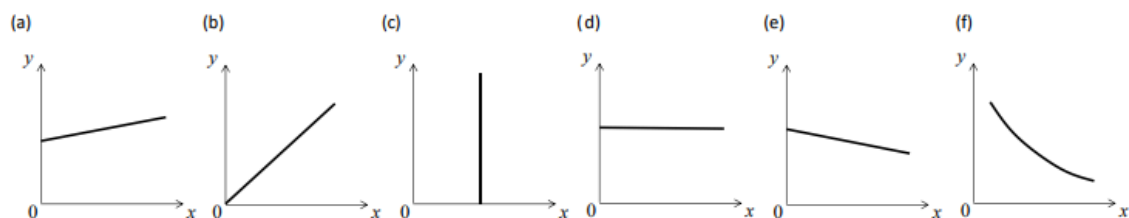
- 1) The pressure is inversely proportional to the temperature at a constant volume.
- 2) The volume is proportional to the temperature at a constant pressure.
- 3) The pressure is inversely proportional to the volume at a constant temperature.
- 4) The pressure is proportional to the number of gas molecules or atoms at a constant volume and temperature.

-2020 III(1)-(3)

(1) Which of graphs (a) to (f) in the figure below shows the relation between P (x -axis) and V (y -axis) for a fixed amount of gas at constant T ?

(2) Which of graphs (a) to (f) in the figure below shows the relation between T (x -axis) and P (y -axis) for a fixed amount of gas at constant V ?

(3) Which of graphs (a) to (f) in the figure below shows the relation between P (x -axis) and PV/T (y -axis) for a fixed amount of gas?



(2) Ideal Gases (Calculations)

-2007 I(2)

(2) Which of the following gases 1) to 5) has a density of 1.96g/l at 0°C and 1-atm pressure?

- | | | |
|------------|-------------|----------------------|
| 1) oxygen | 2) nitrogen | 3) hydrogen chloride |
| 4) propane | 5) butane | |

-2007 I(7)

(7) It is found that 0.42g of a gaseous compound containing only hydrogen and carbon occupies 410ml at a temperature of 300K and a pressure of 0.90atm . Assuming the gaseous compound is an ideal gas, what is the molecular formula of the compound?

- | | | |
|---------------------------|---------------------------|---------------------------|
| 1) CH_4 | 2) C_2H_6 | 3) C_2H_4 |
| 4) C_2H_2 | 5) C_3H_8 | 6) C_3H_6 |

-2008 I(8)

(8) The stopcock between a 2-liter bulb containing nitrogen gas at 25°C and 5 atm and a 3-liter bulb containing argon gas at 25°C and 10 atm is opened.

When equilibrium between the bulbs has been reached at 25°C , the gas pressure in the two bulbs is

- | | | | |
|-----------|-----------|-----------|-----------|
| 1) 3 atm | 2) 4 atm | 3) 6 atm | 4) 8 atm |
| 5) 15 atm | 6) 20 atm | 7) 30 atm | 8) 40 atm |

-2009 I(4)

(4) A mixed gas of 4.0 l composed of gas A (molecular weight 4.0) and gas B (molecular weight 20) at 0 °C and 1-atm pressure has a mass of 3.0 g. What is the molar ratio (gas A) : (gas B) in this mixture?

- 1) 1:4 2) 1:3 3) 1:2 4) 1:1 5) 2:1 6) 3:1 7) 4:1

-2010 Q8

Q8 Given that air is a mixture of N₂ and O₂ with a volume ratio of 4:1, from ①–⑤ below choose the one that identifies a gas that has a larger density than air at the same temperature and pressure.

8

- ① CH₄ ② C₃H₈ ③ HF ④ N₂ ⑤ NH₃

-2019 III

III Calculate the values appropriate to (a) and (b) in the paragraph below to two significant figures. Use the following values if necessary; the atomic weights of Ne and Ar are 20 and 40, respectively, and the gas constant is $8.3 \times 10^3 \text{ Pa L mol}^{-1} \text{ K}^{-1}$.

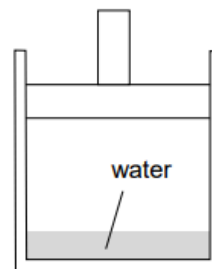
There is a mixture of gaseous neon and argon in a sealed vessel, the volume of which is 2.0 L at 300 K. The masses of neon and argon in the vessel are 1.0 g and 4.0 g, respectively. The molar fraction of neon is (a), and the partial pressure of argon is (b) MPa. Here, it is assumed that both neon and argon are ideal gases and that they do not react with each other.

-2020 III(4)

(4) When nitrogen and water were added into a volume-variable reactor with a smooth piston as shown in the figure below, the volume of gas was 3.0 L and the total pressure was 4.3×10^4 Pa. Temperature was kept at 27°C. The saturated vapor pressure of water is 3.0×10^3 Pa at 27°C. Dissolution of N₂ gas in water is negligible.

(4-1) Calculate the partial pressure of nitrogen to two significant figures.

(4-2) The piston was moved to decrease the volume of gas to 2.0 L at constant temperature of 27°C. Calculate the total pressure to two significant figures.



(3) Miscellaneous

-2008 I(7)

(7) The solubility of oxygen in 1.0l water is 28ml at 25°C and 1.0 atm. How much oxygen can be dissolved in 1.0l of water at 25°C and 4.0 atm?

- 1) 7ml 2) 14ml 3) 28ml 4) 84ml 5) 112ml

-2010 Q19

Q19 Hydrogen (H_2) is added to 0.10 mol of fat which contains only oleic acid $C_{17}H_{33}COOH$ as the fatty acid component. How much hydrogen (in L) at the standard state is necessary to saturate the fat completely. From ①–⑤ below choose the closest value.

19 L

- ① 0.67 ② 1.12 ③ 2.24 ④ 4.48 ⑤ 6.72