

1. Calculate relative rate of effusion of O_2 to CH_4 through a container containing O_2 and CH_4 in 3 : 2 mass ratio.

A. $\frac{3\sqrt{2}}{4}$

B. $\frac{3}{4\sqrt{2}}$

C. $\frac{3}{2\sqrt{2}}$

D. None of these

2. What is the final temperature of 0.10 mole monoatomic ideal gas that performs 75 cal of work adiabatically if the initial temperature is $227^\circ C$? (use $R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$)

A. 250 K

B. 300 K

C. 350 K

D. 750 K

3. The compressibility factor for nitrogen at 330 K and 800 atm is 1.90 and at 570 K and 200 atm is 1.10. A certain mass of N_2 occupies a volume of 1 dm^3 at 330 K and 800 atm. Calculate volume occupied by same quantity of N_2 gas at 570 K and 200 atm:

A. 1 L

B. 2 L

C. 3 L

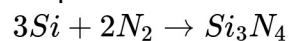
D. 4 L

4. At a certain temperature the equilibrium constant K_c is 0.25 for the reaction $A_2(g) + B_2(g) \rightleftharpoons C_2(g) + D_2(g)$

If we take 1 mole of each of the four gases in a 10 litre container, what would be equilibrium concentration of $A_2(g)$?

- A.** 0.331 M
 - B.** 0.033 M
 - C.** 0.133 M
 - D.** 1.33 M
5. For an electron placed in the third orbit of the hydrogen atom, calculate the number of revolutions per second made by it around the nucleus.
- A.** 4.2×10^{14}
 - B.** 4.2×10^{12}
 - C.** 2.4×10^{12}
 - D.** 2.4×10^{14}
6. Find the number of electrons present in a pure sample of $(NH_4)_2SO_4$ containing 8 moles of O-atoms?
- A.** 6.43×10^{25}
 - B.** 8.43×10^{25}
 - C.** 5.34×10^{25}
 - D.** 8.34×10^{25}

7. 21.44 moles of Si react with 17.62 moles of N_2 . How many moles of Si_3N_4 will be produced?



- A. 13.87 mol
- B. 5.42 mol
- C. 10.53 mol
- D. 7.15 mol
8. 0.52 g of a dibasic acid required 100 mL of 0.2 N $NaOH$ for complete neutralization.
The equivalent weight of acid is:
- A. 26
- B. 52
- C. 104
- D. 156
9. In an isobaric process, the ratio of heat supplied to the system (dq) and work done by the system (dw) for a diatomic gas is:

- A. 1 : 1
- B. 7 : 2
- C. 7 : 5
- D. 5 : 7

10. What is the change in internal energy when a gas contracts from 377 mL to 177 mL under a constant pressure of 2 atm, while at the same time being cooled by removing 124 J heat?

[Take: 1 L atm = 100 J]

- A. -24 J
- B. -84 J
- C. -14 J
- D. -64 J

11. Ratio of radii of orbits in two different orbits of H -atom is 4 : 9, then possible ratio of energy for these two orbits is:

- A. 2 : 3
- B. 3 : 2
- C. 2 : 9
- D. 9 : 4

12. What will be the average oxidation state of P in $K_4P_2O_7$?

- A. +4
- B. +5
- C. +2
- D. -3

13. 27.6 g of K_2CO_3 is thermally decomposed to give K_2O and CO_2 g. Calculate the volume of CO_2 formed at STP. (Molar mass of $K_2CO_3 = 138 \text{ g mol}^{-1}$)
- A. 11.20 L
 - B. 4.48 L
 - C. 3.20 L
 - D. 5.56 L
14. The geometry of electron pairs around I in IF_5 is:
- A. Octahedral
 - B. Trigonal bipyramidal
 - C. Square pyramidal
 - D. Pentagonal planar
15. Find the total number of $2c - 2e$ and $3c - 2e$ bonds in $Be(BH_4)_2$ respectively.
- A. 6, 4
 - B. 4, 6
 - C. 4, 4
 - D. 4, 8

16. The angular momentum of an electron in a certain orbit of Li^{+2} ion is $3.16 \times 10^{-34} \text{ kg m}^2 \text{ sec}^{-1}$. What will be the potential energy of electron in that orbit?

Given : $h = 6.62 \times 10^{-34} \text{ J sec}$

$$\pi = 3.14$$

$$3.16 \times 3.14 \approx 9.93$$

- A.** -13.6 eV
- B.** -27.2 eV
- C.** $+13.6 \text{ eV}$
- D.** -53.4 eV
17. An ideal gas is expanded from p_1, V_1, T_1 to p_2, V_2, T_2 under different conditions. The incorrect statement among the following is:
- A.** The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions
- B.** The change in internal energy of the gas is (i) zero, if it is expanded reversibly with $T_1 = T_2$ and (ii) positive, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$
- C.** Temperature of any system in thermal equilibrium is an example of intensive property
- D.** For an isothermal free expansion of an ideal gas into vacuum, $\Delta U = 0, q = 0, w = 0$
18. Uncertainty in position and momentum are equal. Uncertainty in velocity is at least:

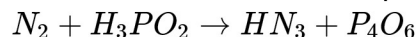
A. $\sqrt{\frac{h}{\pi}}$

B. $\sqrt{\frac{h}{2\pi}}$

C. $\frac{1}{2m} \sqrt{\frac{h}{\pi}}$

D. None of these

19. Redox reaction involves transfer of electrons between 2 chemical species.
 An unbalanced and incomplete example is shown below:



If the above reaction were unidirectional towards right, what fraction of P_4O_6 would be left unreacted if reaction were started with stoichiometric amount of reactants.

- A. $\frac{1}{2}$
- B. $\frac{3}{4}$
- C. $\frac{1}{3}$
- D. $\frac{2}{3}$

20. For the equilibrium



$K_p = 9 \text{ atm}^2$ at 37°C . A 5 L vessel contains 0.1 mole of $LiCl \cdot NH_3$. How many moles of NH_3 should be added to the flask at this temperature to derive the backward reaction for completion?

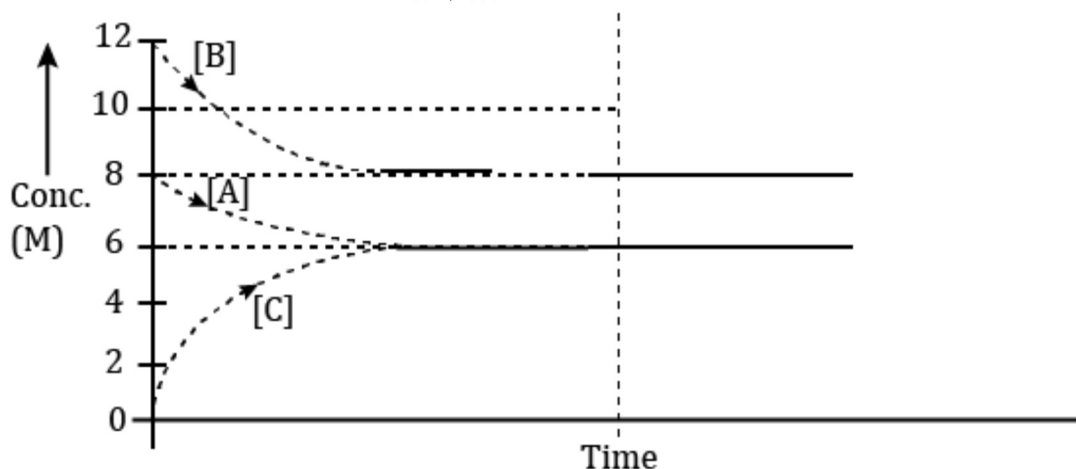
Use : $R = 0.082 \text{ atm L mol}^{-1} \text{ K}^{-1}$

- A. 0.2
- B. 0.59
- C. 0.69
- D. 0.79

21. Find the work done in J when one mole of an ideal gas in 10 litre container at 1 atm is allowed to enter into an evacuated bulb of capacity 100 litre

22. A substance on analysis gave the following percentage composition:
 $Na = 43.4\%$, $C = 11.3\%$ and $O = 45.3\%$. Calculate the empirical weight
 (Atomic weight in amu of $Na = 23$, $C = 12$, $O = 16$).

23. A certain volume of nitrogen gas at 0.8 atm takes 25 seconds to diffuse through a pin hole whereas the same volume of an unknown compound of xenon and fluorine at 1.6 atm takes 37 second to diffuse through the same hole. The molecule formed can be expressed as XeF_n . Find the value of n .
(Given: Molecular mass of Xe = 131 u)
24. The ionisation energy of hydrogen atom is 13.6 eV. What will be the ionisation energy of Li^{2+} ion?
25. Find the temperature (in K) at which 3 mol of SO_2 will occupy a volume of 10 L at a pressure of 15 atm.
[$a = 6.71 \text{ atm L}^2 \text{ mol}^{-2}$; $b = 0.0564 \text{ L mol}^{-1}$]
26. The percentage degree of hydrolysis in the equilibrium at salt concentration 0.0001 M is :
 $A^-(aq) + H_2O(l) \rightleftharpoons HA(aq) + OH^-(aq)$
(Given $K_a = 1.0 \times 10^{-6}$)
27. The gaseous reaction: $A(g) + nB(g) \rightleftharpoons mC(g)$ is represented by following curves. What is the value of $n + m$?



28. If two moles of $KMnO_4$ oxidises 3 moles of M^{x+} to MO_3^- in neutral medium. Find the value of x .
29. What volume of air in m^3 is needed for the combustion of 1 m^3 of a gas having the following composition in percentage volume: 2% of C_2H_2 , 8% of CO , 35% of CH_4 , 50% of H_2 and 5% of non-combustible gas. The air contains 20.8% (by volume) of oxygen.
30. Find the number of molecules among the following having two lone pair of electrons on central atom.
 I_3^+ , XeF_2 , XeF_4 , H_2O , NH_2^- , H_2S , H_2SO_4 , NF_3