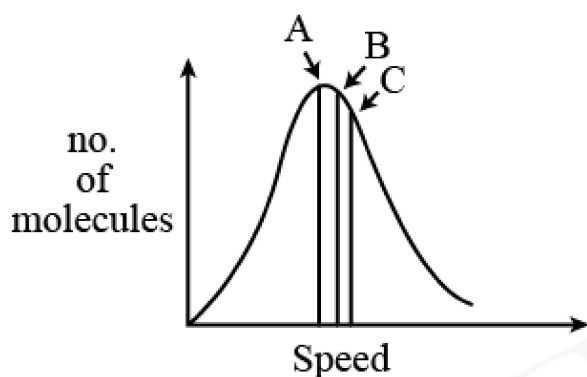


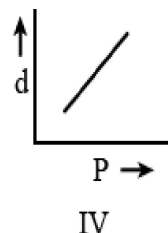
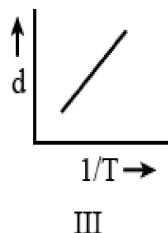
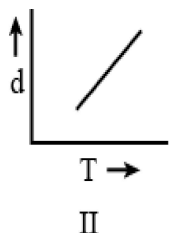
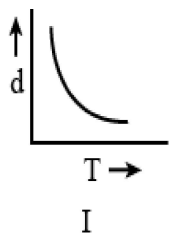
1. Identify the correct labels of A , B and C in the following graph from the options given below:

Root mean square speed (u_{rms}); most probable speed (u_{mp}); Average speed (u_{av})



- A.** $A - u_{mp}$; $B - u_{av}$; $C - u_{rms}$
- B.** $A - u_{mp}$; $B - u_{rms}$; $C - u_{av}$
- C.** $A - u_{av}$; $B - u_{rms}$; $C - u_{mp}$
- D.** $A - u_{rms}$; $B - u_{mp}$; $C - u_{av}$
2. The predominant intermolecular forces present in ethyl acetate, a liquid, are:
- A.** London dispersion, dipole - dipole and hydrogen bonding
- B.** Hydrogen bonding and London dispersion
- C.** Dipole-dipole and hydrogen bonding
- D.** London dispersion and dipole-dipole

3. Which one of the following graph is not correct for an ideal gas?



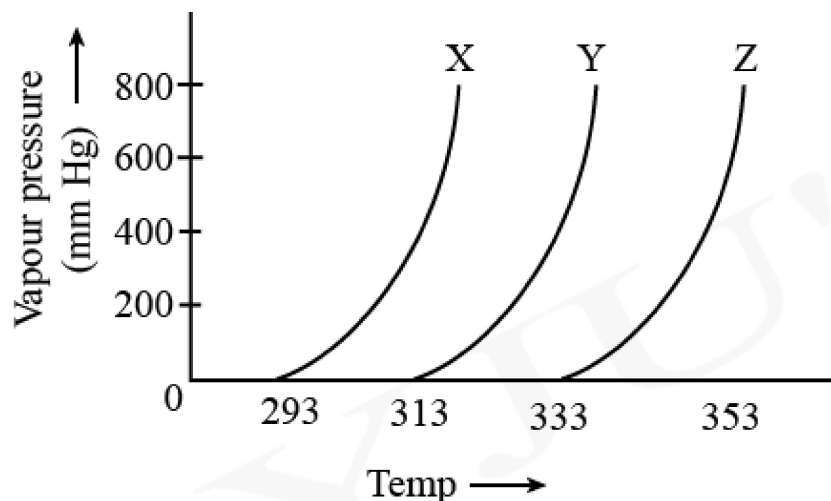
- A. (I)
- B. (IV)
- C. (III)
- D. (II)

4. A graph of vapour pressure and temperature for the three different liquids X, Y and Z is shown:

The following interference are made:

- (A) X has higher intermolecular interaction compared to Y.
- (B) X has lower intermolecular interaction compared to Y.
- (C) Z has lower intermolecular interaction compared to Y.

The correct interference(s) is/are:



- A. (A) and (C)
 - B. (A)
 - C. (C)
 - D. (B)
5. 0.5 moles of gas A and x moles of gas B exert a pressure of $200Pa$ in a container of volume 10 m^3 at 1000 K .
Given R is the gas constant in $JK^{-1}\text{ mol}^{-1}$, x is:

- A. $\frac{2R}{4 + 12}$
- B. $\frac{2R}{4 - R}$
- C. $\frac{4 - R}{2R}$
- D. $\frac{4 + R}{2R}$

6. The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. The pressures of the gases for equal number of moles are:

A. $2P_A = 3P_B$

B. $2P_A = 3P_B$

C. $P_A = 2P_B$

D. $3P_A = 2P_B$

7. An open vessel at 27°C is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is:

A. 750°C

B. 500°C

C. 750 K

D. 500 K

8. Consider the van der Waals constants, a and b, for the following gases.

Gas	Ar	Ne	Kr	Xe
a ($\text{atm dm}^6 \text{mol}^{-2}$)	1.3	0.2	5.1	4.1
b ($10^{-2} \text{dm}^3 \text{mol}^{-1}$)	3.2	1.7	1.0	5.0

Which gas is expected to have the highest critical temperature?

A. Xe

B. Ne

C. Kr

D. Ar

9. At a given temperature T , gases Ne, Ar, Xe and Kr are found to deviate from ideal gas behaviour. Their equation of state is given as $P = \frac{RT}{V - b}$ at T .

Here, b is the van der Waals constant. Which gas will exhibit steepest increase in the plot of Z (compression factor) vs P ?

- A. Kr
- B. Ar
- C. Xe
- D. Ne

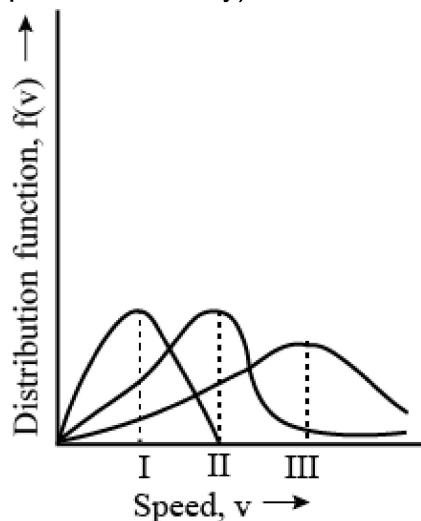
10. Consider the following table:

Gas	a ($kPa \text{ dm}^6 \text{ mol}^{-2}$)	b ($\text{dm}^3 \text{ mol}^{-1}$)
A	642.32	0.05196
B	155.21	0.04136
C	431.91	0.05196
D	155.21	0.4382

a and b are vander waals constant. The correct statement about the gases is:

- A. Gas C will occupy lesser volume than gas A; gas B will be lesser compressible than gas D
- B. Gas C will occupy more volume than gas A; gas B will be lesser compressible than gas D
- C. Gas C will occupy more volume than gas A; gas B will be more compressible than gas D
- D. Gas C will occupy lesser volume than gas A; gas B will be more compressible than gas D

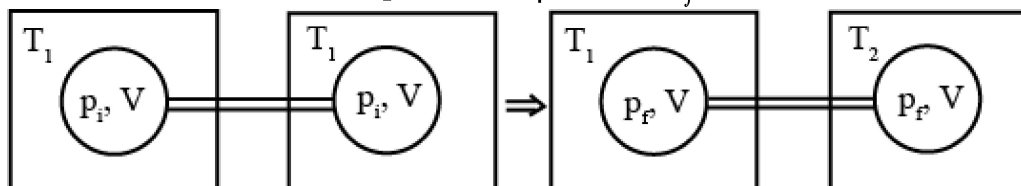
11. Points I, II and III in the following plot respectively correspond to u_{mp} (most probable velocity).



Choose the correct order in increasing order of their most probable velocity.

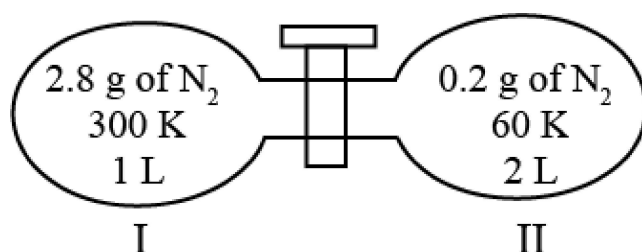
- A. u_{mp} of $N_2(300K)$; u_{mp} of $H_2(300K)$; u_{mp} of $O_2(400K)$
- B. u_{mp} of $H_2(300K)$; u_{mp} of $N_2(300K)$; u_{mp} of $O_2(400K)$
- C. u_{mp} of $O_2(300K)$; u_{mp} of $N_2(300K)$; u_{mp} of $H_2(400K)$
- D. u_{mp} of $N_2(300K)$; u_{mp} of $O_2(400K)$; u_{mp} of $H_2(300K)$
12. Assuming ideal gas behaviour, the ratio of density of ammonia to that of hydrogen chloride at same temperature and pressure is: (Atomic wt. of Cl 35.5 u)
- A. 1.46
- B. 1.64
- C. 0.46
- D. 0.64

13. When does a gas deviate the most from its ideal behaviour?
- At low pressure and low temperature
 - At low pressure and high temperature
 - At high pressure and low temperature
 - At high pressure and high temperature
14. The initial volume of a gas cylinder is 750.0 mL. If the pressure of gas inside the cylinder changes from 840.0 mm Hg to 360.0 mm Hg, the final volume the gas will be :
- 1.750 L
 - 3.60 L
 - 4.032 L
 - 7.50 L
15. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure P_i and temperature T_1 are connected through a narrow tube of negligible volume as shown in the figure below. The temperature of one of the bulbs is then raised to T_2 . The final pressure P_f is:



- $2P_i \left(\frac{T_1 T_2}{T_1 + T_2} \right)$
- $P_i \left(\frac{T_1 T_2}{T_1 + T_2} \right)$
- $2P_i \left(\frac{T_1}{T_1 + T_2} \right)$
- $2P_i \left(\frac{T_2}{T_1 + T_2} \right)$

16. At 1990 K and 1 atm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value of K_p for the reaction $\text{Cl}_{2(g)} \rightleftharpoons 2\text{Cl}_{(g)}$ under the above condition is $x \times 10^{-1}$. The value of x is _____.
(rounded off to the nearest integer)
17. The volume occupied by 4.75 g of acetylene gas at 50° C and 740 mm Hg pressure is ____ L.
(Rounded off to the nearest integer)
[Given $R = 0.0826\text{ L atm K}^{-1}\text{ mol}^{-1}$]
18. 3.12 g of oxygen is adsorbed on 1.2 g of platinum metal. The volume of oxygen adsorbed per gram of the adsorbent at 1 atm and 300 K in L is _____.
[$R = 0.0821\text{ L atm K}^{-1}\text{ mol}^{-1}$]
19. A home owner uses $4.00 \times 10^3\text{ m}^3$ of methane (CH_4) gas, (assume (CH_4) is an ideal gas) in a year to heat his home. Under the pressure of 1.0 atm and 300 K , mass of gas used is $x \times 10^5\text{ g}$. The value of x is _____. (Nearest integer)
(Given $R = 0.083\text{ L atm K}^{-1}\text{ mol}^{-1}$)
20. Two flasks I and II shown below are connected by a valve of negligible volume.



When the valve is opened, the final pressure of the system in bar is $x \times 10^{-2}$. The value of x is _____.
(Integer answer)

[Assume - ideal gas: $1\text{ bar} = 10^5\text{ Pa}$.

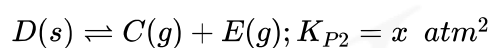
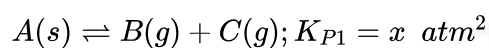
Molar mass of $\text{N}_2 = 28.0\text{ g mol}^{-1}$ $R = 8.31\text{ J mol}^{-1}\text{ K}^{-1}$

21. An empty *LPG* cylinder weighs 14.8 kg . When full, it weighs 29.0 kg and shows a pressure of 3.47 atm . In the course use at ambient temperature, the mass of the cylinder is reduced to 23.0 kg . The final pressure inside the cylinder is ____ *atm*.
(Nearest Integer)
(Assume *LPG* to be an ideal gas)
22. A car tyre is filled with nitrogen gas at 35 psi at 27°C . It will burst if pressure exceeds 40 psi . The temperature in $^\circ\text{C}$ at which the car tyre will burst is _____. (Rounded off to the nearest integer)
23. The pressure exerted by a non- reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10 L vessel at 27°C is ____ *kPa*
(Round off to the Nearest Integer).
[Assume gases are ideal, $R = 8.314\text{ J mol}^{-1}\text{ K}^{-1}$
Atomic masses : $C = 12.0\text{ u}$, $H : 1.0\text{ u}$, $O : 16.0\text{ u}$]
24. An *LPG* cylinder contains gas at a pressure of 300 kPa at 27°C . The cylinder can withstand the pressure of $1.2 \times 10^6\text{ Pa}$. The room in which the cylinder is kept catches fire. The minimum temperature at which the bursting of cylinder will take place is ____ $^\circ\text{C}$. (Nearest Integer)
25. A certain gas obeys $P(V_m - b) = RT$. The value of $\left(\frac{\delta Z}{\delta P}\right)_T$ is $\frac{xb}{RT}$. The value of x is _____.
(Z : compressibility factor)

1. The equilibrium constant at 298K for a reaction $A + B \rightleftharpoons C + D$ is 100. If the initial concentration of all the four species were 1 M each, then equilibrium concentration of D (in molL^{-1}) will be.

A. 0.818
B. 1.818
C. 1.182
D. 0.182

2. Two solids dissociated as follows



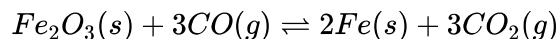
The total pressure when both the solids dissociate simultaneously is:

A. $x^2 + y^2$
B. $\sqrt{x^2 + y^2}$
C. $2(\sqrt{x + y})$
D. $\sqrt{x + y}$

3. The INCORRECT match in the following is :

A. $\Delta G^0 < 0, K < 1$
B. $\Delta G^0 < 0, K = 1$
C. $\Delta G^0 > 0, K < 1$
D. $\Delta G^0 < 0, K > 1$

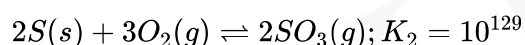
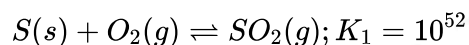
4. The following reaction occurs in the Blast Furnace where iron ore is reduced to iron metal:



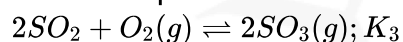
Using Le Chatelier's principle, predict which one of the following will not disturb the equilibrium?

- A. Removal of CO_2
- B. Removal of CO
- C. Addition of CO_2
- D. Addition of Fe_2O_3

5. For the following reactions, equilibrium constants are given:



Find the equilibrium constant for



- A. 10^{181}
- B. 10^{154}
- C. 10^{25}
- D. 10^{77}

6. At a certain temperature in a 5L vessel, 2 moles of carbon monoxide and 3 moles of chlorine were allowed to reach equilibrium according to the reaction, $CO + Cl_2 \rightleftharpoons COCl_2$

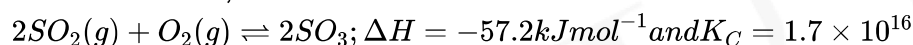
At equilibrium, if one mole of CO is present then equilibrium constant (K_c) for the reaction is:

- A. 2.5
- B. 4
- C. 2
- D. 3

7. The gas phase reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$ is an exothermic reaction. The decomposition of N_2O_4 in equilibrium mixture of $NO_2(g)$ and $N_2O_4(g)$ can be increased by:

- A. increasing the pressure
- B. addition of an inert gas at constant pressure
- C. lowering the temperature
- D. addition of an inert gas at constant volume

8. For the reaction,



Which of the following statement is INCORRECT?

- A. The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required
- B. The equilibrium will shift in forward direction as the pressure increases
- C. The equilibrium constant decreases as the temperature increases
- D. The addition of inert gas at constant volume will not affect the equilibrium constant

9. The equilibrium constant for the reaction at $298K$ is:

Given that: $\Delta H^\circ = -29.8 kJ mol^{-1}$

$$\Delta S^\circ = -0.100 kJ K^{-1} mol^{-1}$$

- A. 1.0×10^{10}
- B. 1.0×10^{-10}
- C. 10
- D. 1

10. An acid buffer is obtained on mixing :

- A. 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M $NaOH$
- B. 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M $NaOH$
- C. 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa
- D. 100 mL of 0.1 M HCl and 200 mL of 0.1 M $NaCl$

11. Arrange the following solutions in the decreasing order of pOH

- (A) 0.01 M HCl
- (B) 0.01 M $NaOH$
- (C) 0.01 M CH_3COONa
- (D) 0.01 M $NaCl$

- A. $(A) > (C) > (D) > (B)$
- B. $(B) > (D) > (C) > (A)$
- C. $(B) > (C) > (D) > (A)$
- D. $(A) > (D) > (C) > (B)$

12. The pH of a 0.02 M NH_4Cl solution will be:

[Given $K_b(NH_4OH) = 10^{-5}$ and $\log 2 = 0.301$].

- A. 4.65
- B. 5.35
- C. 4.35
- D. 2.65

13. The solubility of $Ca(OH)_2$ in water is :

[Given : The solubility product of $Ca(OH)_2$ in water 5.5×10^{-6}]

A. 1.77×10^{-6}

B. 1.11×10^{-6}

C. 1.11×10^{-2}

D. 1.77×10^{-2}

14. If solubility product of $Zr_3(PO_4)_4$ is denoted by K_{sp} and its molar solubility is denoted by S , then which of the following relation between S and K_{sp} is correct?

A. $S = \left(\frac{K_{sp}}{929} \right)^{1/9}$

B. $S = \left(\frac{K_{sp}}{216} \right)^{1/7}$

C. $S = \left(\frac{K_{sp}}{144} \right)^{1/6}$

D. $S = \left(\frac{K_{sp}}{6912} \right)^{1/7}$

15. 5.1 g NH_4SH is introduced in 3.0 L evacuated flask at $327^\circ C$. 30% of the solid NH_4SH decomposed to NH_3 and H_2S as gases. The K_P of the reaction at $327^\circ C$ is

($R = 0.082 \text{ L atm mol}^{-1}$,

molar mass of $S = 32 \text{ g mol}^{-1}$,

molar mass $N = 14 \text{ g mol}^{-1}$.

A. $1 \times 10^{-4} \text{ atm}^2$

B. $4.9 \times 10^{-4} \text{ atm}^2$

C. 0.242 atm^2

D. $0.242 \times 10^{-4} \text{ atm}^2$

16. For a reaction $X + Y \rightleftharpoons 2Z$ 1.0 mol of X, 1.5 mol of Y and 0.5 mol of Z were taken in a 1 L vessel and allowed to react.
At equilibrium, the concentration of Z was 1.0 mol L^{-1}
The equilibrium constant of the reaction is $\frac{x}{15}$. The value of x is
17. The molar solubility of $Zn(OH)_2$ in 0.1 M NaOH solution is $x \times 10^{-18} M$.
The value of x is(Nearest integer)
(Given: The solubility product of $Zn(OH)_2$ is 2×10^{-20})
18. A_3B_2 is a sparingly soluble salt of molar mass M ($g \text{ mol}^{-1}$) and solubility x g L^{-1} . The solubility product satisfies $K_{SP} = a \left(\frac{x}{M} \right)^5$. The value of a is _____(Integer answer).
19. The pH of a solution obtained by mixing 50 mL of 1 M HCl and 30 mL of 1 M NaOH is $x \times 10^{-4}$. The value of x is _____(Nearest integer).
[log2.5=0.3979]
20. A homogeneous ideal gaseous reaction $AB_{2(g)} \rightleftharpoons A_{(g)} + 2B_{(g)}$ is carried out in a 25 litre flask at $27^\circ C$. The initial amount of AB_2 was 1 mole and the equilibrium pressure was 1.9 atm. The value of K_p is $x \times 10^{-2}$. The value of x is (Integer answer)
21. Assuming that $Ba(OH)_2$ is completely ionised in aqueous solution under the given conditions the concentration of H_3O^+ ions in 0.005 M aqueous solution of $Ba(OH)_2$ at 298K is _____ $\times 10^{-12} \text{ mol L}^{-1}$. (Nearest integer)
22. Sulphurous acid (H_2SO_3) has $K_{a1} = 1.7 \times 10^{-2}$ and $K_{a2} = 6.4 \times 10^{-8}$. The pH of 0.588 M H_2SO_3 is _____ (Round off to the Nearest Integer).
23. Two solution, A and B, each of 100L was made by dissolving 4g of NaOH and 9.8g of H_2SO_4 in water, respectively. The pH of the resultant solution obtained from mixing 40L of solution A and 10L of solution B is_____.

24. Value of $f K_p$ for the equilibrium reaction

$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$ at 288 K is 47.9. The K_C for this reaction at same temperature is(Nearest integer)

$$(R = 0.083 \text{ LbarK}^{-1} \text{ mol}^{-1})$$

25. For the reaction $A(g) \rightleftharpoons B(g)$ at 495 K, $\Delta_r G^\circ = -9.478 \text{ kJmol}^{-1}$. If we start reaction in a closed container at 495 K with 22 millimoles of A, the amount of B in the equilibrium mixture ismillimoles. (Round off to the Nearest integer). [$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$; $\ln 10 = 2.303$]