Real Gases

1. **The value of compressibility factor for one mole of a gas under critical states is**

   1) 3/8   2) 2/3   3) 8/27   4) 27/8

2. **Van der Waal's equation for one mole of CO_2 gas at low pressure will be**

   1) $\left(P + \dfrac{a}{V^2}\right)V = RT$ 2) $P = \dfrac{RT}{V-b}$ 3) $p\,v = RT$ 4) $P(V-b) = RT - \dfrac{a}{V^2}$

3.

Gas	O_2	N_2	NH_3	CH_4
a (in L^2 atm mol^{-2})	1.360	1.390	4.170	2.253

   From the above data, the gas that can be most easily liquefied is

   1) O_2 2) N_2 3) NH_3 s4) CH_4

4. **Which of the following are correct statements?**

   1) Vander Waal's constant a, is a measure of attractive force.

   2) Vander Waal's constant b, is also called co-volume or excluded volume.

   3) b has units $L\,mol^{-1}$.

   4) All of the above.

5. **Compressibility factor for H_2 behaving as real gas is**

   1) 1   2) $\left(1 - \dfrac{a}{RTV}\right)$ 3) 1+Pb/RT   4) RT/1-a

6. **If $\overline{V}$ is the observed molar volume of real gas and $\overline{V_{id}}$ is the molar volume of an ideal gas then Z is**

1) $\overline{V\,V_{id}}$
2) $\dfrac{\overline{V}}{\overline{V_{id}}}$
3) $\dfrac{\overline{V_{id}}}{\overline{V}}$
4) $\dfrac{\overline{V}^{\,2}}{\overline{V_{id}}}$

7. Volume of a molecule is related to Vander Waal's constant 'b' and 'Avogadro Number No' by equation

1) $V = \dfrac{b}{N_0}$
2) $V = 4bN_0$
3) $V = \dfrac{4b}{N_0}$
4) $V = \dfrac{b}{4N_0}$

8. Consider following statements.

(A): The gas whose critical temperature is above room temperature can be liquified by applying sufficient pressure to the gas.

(B): The gas whose critical temperature is below room temperature can be liquified by the temperature below T_c.

Select correct statement.

1) A
2) B
3) both
4) none

9. The deviation from the ideal gas behaviour of a gas can be expressed as

1) $Z = \dfrac{P}{VRT}$
2) $Z = \dfrac{PV}{nRT}$
3) $Z = \dfrac{nRT}{PV}$
4) $Z = \dfrac{VR}{PT}$

10. In Van der Waal's equation of state of the gas law, the constant 'b' is a measure of

1) Intermolecular repulsions

2) Intermolecular collisions per unit volume

3) Volume occupied by the molecules

4) Intermolecular attraction

11. Assertion (A): Compressibility factor for hydrogen varies with pressure with positive slope at all pressures.

Reason (R): Even at low pressures, repulsive forces dominate in hydrogen gas.

1) A & R are true, R explains A.   2) A & R are true, R does not explain A.

3) A is true R is false.   4) A is false R is true.

12. **The critical temperature of a substance is defined as**

1) The temperature above which the gas decomposses

2) The temperature above which a substance can exist only as a gas

3) Melting point of the substance

4) Boiling point of the substance

13. **When a compressed gas is allowed to expand through a porous plug at temperature above its inversion temperature, there is**

1) A fall in temperature

2) A rise in temperature

3) Neither a fall nor a rise in temperature

4) A fall in temperature first, followed by a rise in temperature.

14. **The Joule Thomson coefficent is zero at**

1) Inversion temperature   2) Critical temperture

3) Absolute temperature   4) Below 0^0C

15. **NH_3 can be liquefied at ordinary temperature without the application of pressure. But O_2 cannot, because**

1) Its critical temperature is very high.

2) Its critical temperature is low.

3) Its critical temperature is moderate.

4) Its critical temperature is higher than that of ammonia.

16. The gas which can be liquified under high pressure at 4^0C is

1) Nitrogen   2) Hydrogen   3) Oxygen   4) Ammonia

17. A gas can be liquefied by

1) Cooling   2) Compressing   3) Both   4) None

18. The gas causes heating effect during Joule Thomson effect at ordinary temperture is

1) O_2 2) CO_2 3) H_2 4) SO_2

19. The cooling caused by the expansion of a compressed gas below its inversion temperature without doing external work is called

1) Joule Thomson effect   2) Inversion effect

3) Boyle effect   4) All of these

20. When an ideal gas undergoes unrestricted expansion

1) Cooling occurs as the molecules are at above inversion temperature.

2) No cooling occurs as no attractive interactions exist among molecules.

3) Cooling occurs as molecules collide with each other.

4) Cooling does not occur as their work done is equal to loss in kinetic energy.

21. A gas X causes heating effect when allowed to expand. This is because

1) X is an Inert gas   2) X has very low inversion temperature

3) X is ideal gas   4) X has very low boiling point

22. A gas can be liquefied by pressure alone when its temperature is

1) Higher than its critical temperature   2) Lower than its critical temperature

3) Equal to its critical temperature   4) None

23. **Most favourable conditions to liquefy a gas are**

   1) Low T and high P   2) High T and low P

   3) Low T and low p   4) High T and high p

24. **The behaviour of temporary gases like CO_2 approaches that of permanent gases like N_2, O_2 etc   at**

   1) Below critical temperature

   2) Above critical temperature

   3) Above absolute zero temperature

   4) Below absolute zero temperature

25. **The relationship between P_c, V_c and T_c is**

   1) $P_cV_c = RT$ 2) $P_cV_c = 3RT_c$ 3) $3 P_cV_c = 8RT_c$ 4) $8 P_cV_c = 3RT_c$

26. **The compressibility factor for H2 and He is usually:**

   1) >1   2) =1   3) < 1   4) Either of these

27. **A real gas most closely approaches the behaviour of an ideal gas at:**

   1) 15 atmosphere and 200 K   2) 1 atmosphere and 273 K

   3) 0.5 atmosphere and 500 K   4) 15 atmosphere and 500 K

28. **In the Van der Waals equation the constant "a" and "b" with temperature shows which trend?**

   1) Both remains same   2) 'a' remains same, 'b' varies

   3) 'a' varies, 'b' remains same   4) Both varies

29. **The pressure of real gas is less than the pressure of an ideal gas because of**

   1) Increase in the number of collision   2) Finite size of the molecules

   3) Increase in the kinetic energy   4) Intermolecular forces

30. **Which forces of attraction are responsible for liquefaction of H_2?**

   1) Coulombic forces   2) Dipole forces and Van der waals' forces

3) Hydrogen bonding   4) None of these

KEY

1) 1   2) 1   3) 3   4) 4   5) 3   6) 2   7) 4   8) 3   9) 2   10) 3

11) 1 12) 2 13) 2   14) 1   15) 2 16) 4 17) 3 18) 3   19) 1 20) 2

21) 2 22) 2 23) 1   24) 2   25) 4 26) 1 27) 3 28) 4 29) 4 30) 2