



Problems and Sheet Discussion

Course on States of Matter for Class XI



Question

from Ridham

THQ SIR YOUR GUIDANCE HELPED ME TO CONTROL NERVOUSNESS

1



ARITRA AMBUDH DUTTA

310 marks • 2h : 59m : 57s : 528ms

2



You

308 marks • 2h : 59m : 12s : 413ms

3



Raghav Singla

306 marks • 2h : 59m : 56s : 401ms

#4



Aaditya Agarwal 1

303 marks • 3h : 1s : 874ms

#5



Drish Menghani

296 marks • 2h : 58m : 33s : 685ms

#6



Utkarsh

289 marks • 2h : 16m : 53s :
656.0000000009313ms

#7



Shravan Agrawal

289 marks • 2h : 59m : 1s : 912ms

#8



Krishna Awasthi

287 marks • 2h : 59m : 37s : 487ms

SECTION-I : Single Correct Type

This section contains **20 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. You will be awarded **3 marks** if only the correct option is chosen and zero mark if none of the option is chosen. **(-1)** marks will be awarded for incorrect answers in this section.

Level : Easy

Topic : Gaseous State

Concept : Ideal gas equation

Subconcept : Ideal gas equation

1. In a sealed rigid container ideal gas is heated, which property must not change
- (A) Pressure
 - (B) Energy of molecules
 - (C) Average speed of molecules
 - (D) Density

Ans. (D)

Sol. At constant volume all properties change except density with temperature.

Level : Moderate

Topic : Gaseous State

Concept : Mixed concept

Subconcept : Mixed concept

2. Consider the following statements-
- (a) An oleum sample can be labelled as 127%
 - (b) Mole fraction is temperature dependent
 - (c) Slope of 'log V' v/s 'log T' graph is constant. (At constant P & n for ideal gas)
 - (d) 1 gm of $C_6H_{12}O_6$ contains more number of atoms than 1 gm of CH_3COOH

Select the correct code regarding true & false statement -

- (A) FFTF (B) TFTF (C) TFFT (D) FFTF

Ans. (A)

Sol. (a) Maximum % labelling can be 122.5 %

(b) mole fraction is mass by mass relationship so it is temperature independent

(c) $\log v = \log \frac{nR}{P} + \log T$

Slope = 1

(d) Since ratio of atoms of C, H, O is same in both molecule.

Level : Easy
Topic : Gaseous State
Concept : Maxwell equation
Subconcept : Maxwell equation

3. In a certain sample of gas at 25°C the number of molecules having speeds between 4 km sec^{-1} and 4.1 km sec^{-1} is N . If the total number of gas molecules at the same temperature are doubled what will happen?

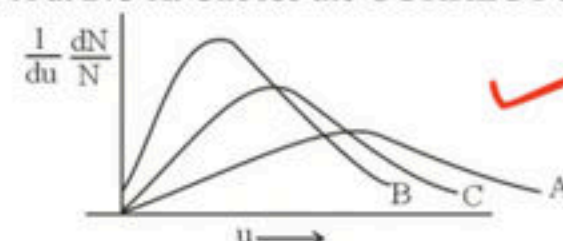
- (A) Value of most probable velocity will remain same
(B) Value of most probable velocity will double
(C) Fraction of molecules between 4 km sec^{-1} and 4.1 km sec^{-1} will become $2N$
(D) Number of molecules between 4 km sec^{-1} and 4.1 km sec^{-1} will remain same.

Ans. (A)

Sol. Since temperature is constant, the most probable velocity remains the same, but the number of particles will double.

Level : Moderate
Topic : Gaseous State
Concept : Maxwell equation
Subconcept : Maxwell equation

4. The curve C is for the gas X at 273 K . Choose the **CORRECT** statement.



- (A) Curve A may be of a heavier gas but at same temperature
(B) Curve B may be of the same gas but at 373 K
(C) Curve A may be of the same gas but at 373 K
(D) Curve B may be of the lighter gas but at same temperature

Ans. (C)

Sol. Fact as per Maxwell equation.

Level : Easy
Topic : Periodic Table
Concept : Periodic Table
Subconcept : Periodic Table

5. Whose name is not associated with the development of periodic table?

- (A) Prout's (B) Newlands (C) Rutherford (D) Lothar Meyer

Ans. (C)

Sol. Rutherford is not associated with the development of periodic table.

Level : Moderate

Topic : Periodic Table

Concept : Periodic Table

Subconcept : Periodic Table

6. Eka-aluminium and Eka-silicon are known as :

- (A) Gallium and Germanium (B) Aluminium and Silicon
(C) Iron and sulphur (D) Proton and Silicon

Ans. (A)

Sol. EKa : Aluminium \Rightarrow Ga

EKs : Silicon \Rightarrow Ge

Level : Moderate

Topic : Periodic Table

Concept : Periodic Table

Subconcept : Periodic Table

7. Among the given elements, select those, which is at the peak of Lothar Meyer Curve?

- (A) V (B) Se (C) La (D) K

Ans. (D)

Sol. Alkali metals are placed at peak of Lothar Meyer curve.

Level : Moderate

Topic : Periodic Table

Concept : Periodic Table

Subconcept : Periodic Table

8. Select the **INCORRECT** match :

- (A) Bridge element : K, Mg
(B) Diagonal relationship : (Li \rightarrow Mg), (Be \rightarrow Al), (B \rightarrow Si)
(C) First lanthanoid : Ce
(D) Typical elements : Na, Mg, Al, S

Ans. (A)

Sol. IIIrd group elements are Bridge element Ce is first lanthanoid.

Level : Moderate
Topic : Periodic Table
Concept : Periodic Table
Subconcept : Periodic Table

9. Select the **CORRECT** match :
(A) Hg → Transition element (B) Si → Bridging element
(C) Xe → Representative element (D) Sc → Typical element

Ans. (B)

Sol. Hg → d-block element but not transition element
Xe → noble gas
Sc → d-block element are not typical element.

Level : Moderate
Topic : Periodic Table
Concept : Ionisation Energy
Subconcept : Ionisation Energy

10. A neutral atom (Ar) is converted to (Ar³⁺) by the following process



The correct order of E₁, E₂ and E₃ energies is :

- (A) E₁ < E₂ < E₃ (B) E₁ > E₂ > E₃ (C) E₁ = E₂ = E₃ (D) E₁ > E₂ < E₃

Ans. (A)

Sol. I.E.₃ > I.E.₂ > I.E.₁

Level : Moderate
Topic : Periodic Table
Concept : Atomic Size
Subconcept : Atomic Size

11. The ionic radii of N³⁻, O²⁻ and F⁻ are respectively given by :
(A) 1.36, 1.40, 1.71 (B) 1.36, 1.71, 1.40 (C) 1.71, 1.40, 1.36 (D) 1.71, 1.36, 1.40

Ans. (C)

Sol. Order of size = N³⁻ > O²⁻ > F⁻
 $\frac{9}{10} > \frac{7}{10} > \frac{8}{10}$

Level : Moderate
Topic : Periodic Table
Concept : Periodic Table
Subconcept : Periodic Table

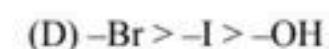
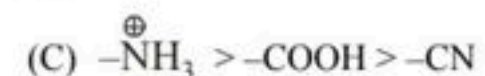
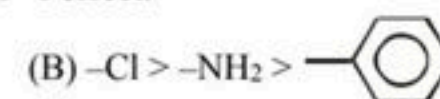
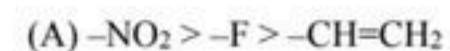
12. Which of the following options is **CORRECT**?
- (A) Decreasing I.E.₂ : $F > N > O$
(B) Increasing atomic size : $B < Be < Li < Na$
(C) Metallic bond strength : $Na < Zn < Ca$
(D) Increasing electron affinity : $O^{2-} < O^- < O^+ < O$

Ans. (B)

- Sol. (A) I.E. = $O^+ > F^+ < N^+$
 $2p^3 \quad 2p^4 \quad 2p^2$
(B) Size = $B < Be < Li < Na$
(C) Metallic strength = $Na < Ca < Zn$
(D) E.A. = $O^{2-} < O^- < O < O^+$

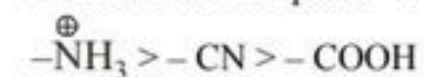
Level : Easy
Topic : Inductive Effect
Concept : -I Effect
Subconcept : -I Effect

13. Which of the following is incorrect order of -I effect.



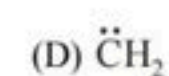
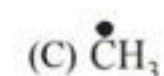
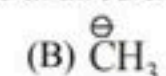
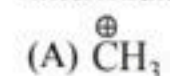
Ans. (C)

Sol. Correct order of option "C" is

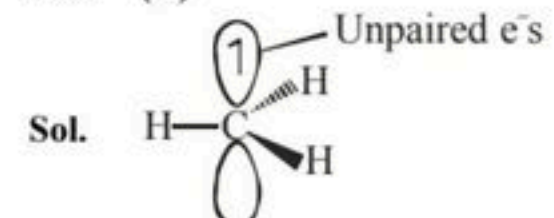


Level : Easy
Topic : Intermediate
Concept : Free radical
Subconcept : Free radical

14. Intermediate with one unpaired electron is :

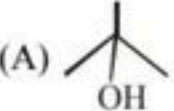
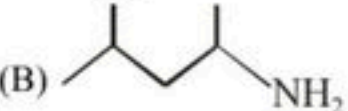
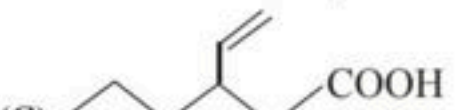
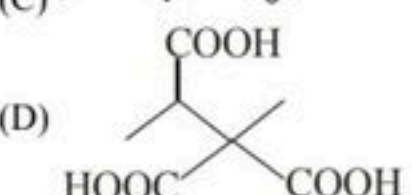


Ans. (A)

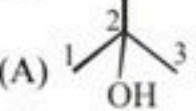
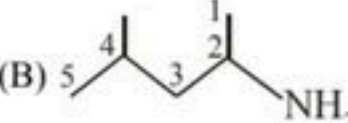
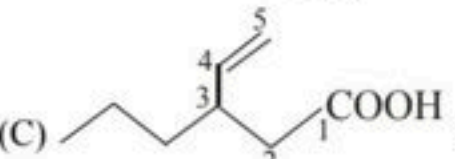


Level : Tough
Topic : Nomenclature
Concept : IUPAC
Subconcept : IUPAC

15. Compound with correct IUPAC name

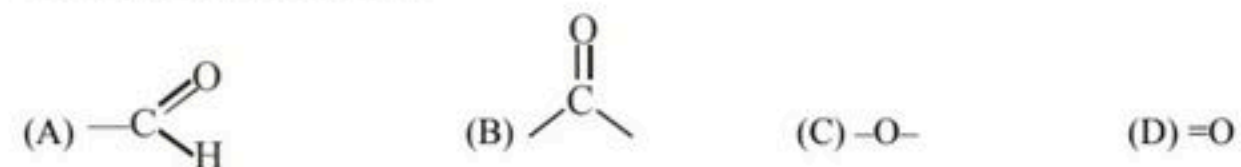
- (A)  1, 1 – Dimethyl Ethan-1-ol
- (B)  1, 3 Diethyl Butan-1-amine
- (C)  3-Ethenyl Hexanoic Acid
- (D)  Butan- 2,2,3- Tri Carboxylic Acid

Ans. (D)

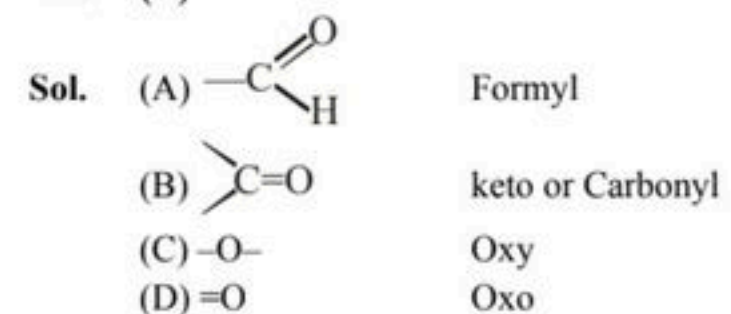
- Sol. (A)  2-Methyl Propane-2-ol
- (B)  4-Methyl Pentan-2-amine
- (C)  3-Propyl Pent-4-enoic acid

Level : Moderate
Topic : Functional Group
Concept : Prefix
Subconcept : Prefix

16. Oxo is used as a prefix for



Ans. (D)



Level : Moderate
Topic : Nomenclature
Concept : IUPAC
Subconcept : IUPAC

17. In IUPAC namiry of organic compounds IUPAC name must have always :

- (A) Prefix & suffix (B) Prefix & word root
(C) Word root & suffix (D) Prefix, word root & suffix

Ans. (C)

Sol. Word Root & suffix like meth & ane for methane (CH_4)

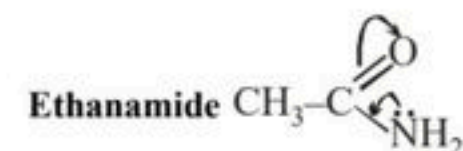
Level : Moderate
Topic : General Organic Chemistry
Concept : Resonance
Subconcept : Resonance

18. Which statement is correct :

- (A) Inductive effect is distance independent effect
- (B) Hetrolytic bond fission takes place in non polar solvent
- (C) Resonating structures are hypothetical
- (D) Lone pair of N atom in ethanide is localised

Ans. (C)

Sol. (A) is incorrect because Inductive effect is distance dependent
 (B) is incorrect because Hetrolytic bond fission takes place in polar solvent
 (C) Correct statement because only resonance hybrid is real
 (D) is incorrect because one pair of N atom in ethanamide is delocalised due to resonance phenomenon



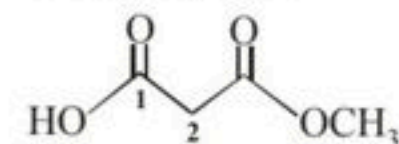
Level : Moderate
Topic : Nomenclature
Concept : IUPAC
Subconcept : IUPAC

19. Correct IUPAC name of compound 3-methoxy-3-oxo-propanoic acid :

- (A) 3-methoxy carbonyl propanoic acid
- (B) 2-methoxy carbonyl propanoic acid
- (C) 2-methoxy carbonyl ethanoic acid
- (D) methyl-2-carboxy ethanoate

Ans. (C)

Sol. Given compound is



Correct IUPAC name 2 methoxy carbonyl ethanoic acid

Level : Easy

Topic : Nomenclature

Concept : IUPAC

Subconcept : IUPAC

20. Position of $-\text{CH}_3$ as per IUPAC in compound methyl butyne is –

- (A) 1 (B) 2 (C) 3 (D) 4

Ans. (C)

Sol. Only possible structure $\overset{4}{\text{CH}_3}-\overset{3}{\underset{\text{CH}_3}{\text{CH}}}-\overset{2}{\text{C}}\equiv\overset{1}{\text{CH}}$

SECTION-II : Integer Value Correct Type

This section contains **10 questions**. For each question, enter the correct numerical value (in decimal notation, truncated / rounded off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30) using the mouse and the on screen virtual numeric keypad in the place designated to enter the answer. You will be awarded **3 marks** if correct numerical value is entered as answer. **No negative marks** will be awarded for incorrect answers in this section.

Level : Moderate
Topic : Gaseous State
Concept : Bimolecular collision
Subconcept : Bimolecular collision

1. Two flask A and B have equal volume at 100K and 200K and have pressure 4 atm and 1 atm respectively. The flask A contains H_2 gas and B contains CH_4 gas. The collision diameter of CH_4 is twice that of H_2 . Calculate ratio of mean free path of CH_4 to H_2 .

Ans. (2)

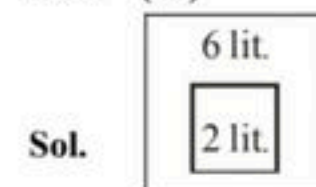
$$\text{Sol. } \frac{\lambda_{CH_4}}{\lambda_{H_2}} = \left(\frac{\sqrt{2}\pi\sigma^2 P}{KT} \right)_{H_2} \times \left(\frac{KT}{\sqrt{2}\pi\sigma^2 P} \right)_{CH_4}$$

$$= \frac{1^2 \times 4}{100} \times \frac{200}{2^2 \times 1} = 2$$

Level : Easy
Topic : Gaseous State
Concept : Dalton's law
Subconcept : Dalton's law

2. A 2 liter rigid container is present inside a large 6 liter container. 2 liter container contain 12 mole of H_2 & 10 mole of He. While 6 litre container contains 20 mole of He and 18 mole of CH_4 . There is an orifice on one wall of small container which can be operated by a remote control device. Calculate total number of moles present inside small container when orifice is opened for sufficiently long time.

Ans. (20)



Moles in small container $H_2 = 12$

He = 10

Large container $H_2 = 20$
 $CH_4 = 18$

Total moles = 60

Total volume 6 litre. So 2 lit. volume

Contains 20 mole



Level : Tough
Topic : Gaseous State
Concept : Gratan's law
Subconcept : Gratan's law

3. Gas A taken in a closed rigid container is allowed to decompose partially to the reaction. ✓
 $A(g) \longrightarrow 2B(g) + 3C(g)$
 The gaseous mixture formed effuses 1.5 times faster than a gas having molecular weight 105 under similar condition. Find the mole fraction of C in the gaseous mixture formed.
 Given : Mol. wt. of A = 140
 Mol. wt. of B = 64
 Mol. wt. of C = 4

Ans. (0.5)

Sol. $\frac{r_{\text{mix}}}{r_{\text{gas}}} = \frac{3}{2} = \sqrt{\frac{105}{M_{\text{mix}}}}$
 $\frac{9}{4} = \frac{105}{M_{\text{mix}}}$
 $M_{\text{mix}} = \frac{140}{3}$
 $A \rightarrow 2B + 3C$
 $1-\alpha \quad 2\alpha \quad 3\alpha$
 $\frac{140}{3} = \frac{140}{1+4\alpha}$
 $1+4\alpha = 3$
 $\alpha = \frac{1}{2}$
 Md. Fraction of
 $C = \frac{3\alpha}{1+4\alpha} = \frac{\frac{3}{2}}{\frac{3}{2}} = \frac{1}{2} = 0.5$

Level : Easy
Topic : Mole concept
Concept : Concentration term
Subconcept : Concentration term

4. In order to remove Pb^{2+} from 10 litre H_2O , Na_2H_2 EDTA (0.4 M, 100 mL) is required.
 $PbCl_2(aq.) + Na_2H_2 \text{ EDTA} \rightarrow 2NaCl + PbH_2 \text{ EDTA}$
 Hence millimoles of $PbCl_2$ present in 1 litre of H_2O is.

Ans. (4)

Sol. mmoles of EDTA = 40 numbers
 mmoles of EDTA = m moles of Pb^{2+} in 10 lit.
 mmoles is 1 lit. = 4

A) 5
B) 4
C) 3
D) 2
E) 1

Level : Moderate
Topic : Mole concept
Concept : Concentration term
Subconcept : Concentration term

5. 500 ml of 2M CH_3COOH solution is mixed with 600 ml 12% w/v CH_3COOH solution then calculate the final molarity of solution.

Ans. (2)

12 gm CH_3COOH is present in 100 ml of solution

120 gm CH_3COOH is present in 1000 ml of solution

$$M_2 = \frac{120}{60} = 2, \text{ Now we are mixing}$$

500 ml, 2M CH_3COOH + 2M, 600 ml CH_3COOH

$$M_1V_1 + M_2V_2 = M_3V_3$$

$$500 \times 2 + 600 \times 2 = M_3 \times 1100, M_3 = \frac{2200}{1100} = 2$$

Level : Moderate
Topic : Mole concept
Concept : Concentration term
Subconcept : Concentration term

6. Calculate the minimum volume (in Lt) of $\frac{M}{672}$ H_2O_2 solution, which can produce at least 1 gm each of I_2 and KOH , as per the following reaction :



Ans. (6)

$$n_{\text{H}_2\text{O}_2} = \frac{1}{672} \times V = \frac{1}{2} \times n_{\text{KOH}}$$

$$\Rightarrow \frac{1}{672} \times V = \frac{1}{2} \times \frac{1}{56}$$

$$\Rightarrow V = 6 \text{ Lts.}$$

$$\frac{1}{56} \times \frac{1}{2} = \text{mol of } \frac{1}{2} = M \times V$$

Level : Moderate
Topic : Periodic Table
Concept : Periodic Table
Subconcept : Periodic Table

7. A has exceptional outer electronic configuration as $4d^{10}, 5s^0$. Which period does it belongs to?

Ans. (5.00)

Sol. The exceptional outer electronic configuration suggest that the expected configuration of A $4d^8, 5s^2$. Thus, it belongs the 5th period.

A) 10 9
B) 9 8
C) 9 10
D) 7 16
E) 6 57





Question

from Ridham

SIR EK QUESTION ME 2 REPEATED OPTIONS THE AUR
WAHI ANS THA TO MAI CHHOD AYA

Question 32

YOU DIDN'T ATTEMPT

Consider the following statements-

- (a) An oleum sample can be labelled as 127%
- (b) Mole fraction is temperature dependent
- (c) Slope of 'log V' v/s 'log T' graph is constant. (At constant P & n for ideal gas)
- (d) 1 gm of $C_6H_{12}O_6$ contains more number of atoms than 1 gm of CH_3COOH

Select the correct code regarding true & false statement -

FFTF

CORRECT ANSWER

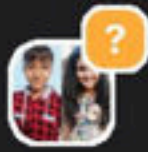
TFTF

TFTT

FFTF



Solution [View](#)



Question

from Divya n

T.P.A. - 2

Name → Divya Agrawal
Batch → VIRTUE 2.0

Subject	P	M	C		
			PC	OC	IOC
Attempted	15/30	11/30	16/10	10	9/10
Time taken	55 min	73 min	50 min		
Correct	12/30	10/30	4/10	6/10	7/10
Incorrect	3/30	1	2/10	2/10	2/10
Unanswered	15/30	19/30	4/10	2/10	1/10
Mistakes done :-					
① Incorrect reading		0.69	0.33, 55		35.39
② Conceptual mistake	Q. 2, 1, 2, 1			43.50	
③ Calculation mistake					
④ Answer filling mistake					
Incorrect Questions no.	2, 21, 26	64	33, 35	43.50	35.39



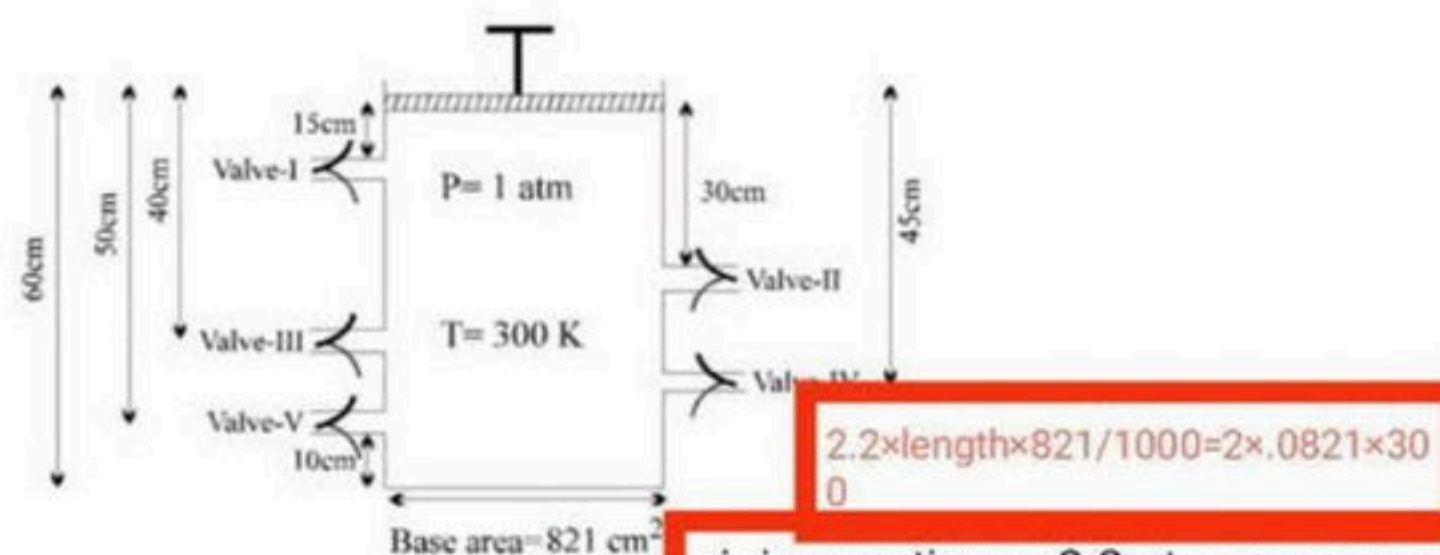
Question

from Aman

Sir doubt h iss ques m

- Q.12 A container fitted with frictionless massless piston consist of five **valves-I, II, III, IV and V**. These valves open automatically if pressure exceed over **1.5, 2.2, 2.5, 4.4** and **4.8 atm** respectively. Under the given initial conditions (mentioned in given diagram) system is in state of equilibrium. Piston is now pressed in downward direction very slowly.

[Note: Consider the diameter of valve tube negligible and temperature remain constant.]



$$2.2 \times \text{length} \times 821 / 1000 = 2 \times .0821 \times 300$$

sir is question m 2.2 atm pressure
par hum length nikal rhe h to 300/1
1 cm aa rhi

Select the correct option(s):

- (A) **Valve-II** will be opened first
- (B) As the piston crosses the valve which will be opened first, the remaining number of moles in container are $\frac{5}{3}$.
- (C) **Valve-V** will be the second valve which open
- (D) Number of moles will zero as piston crosses **Valve-V**

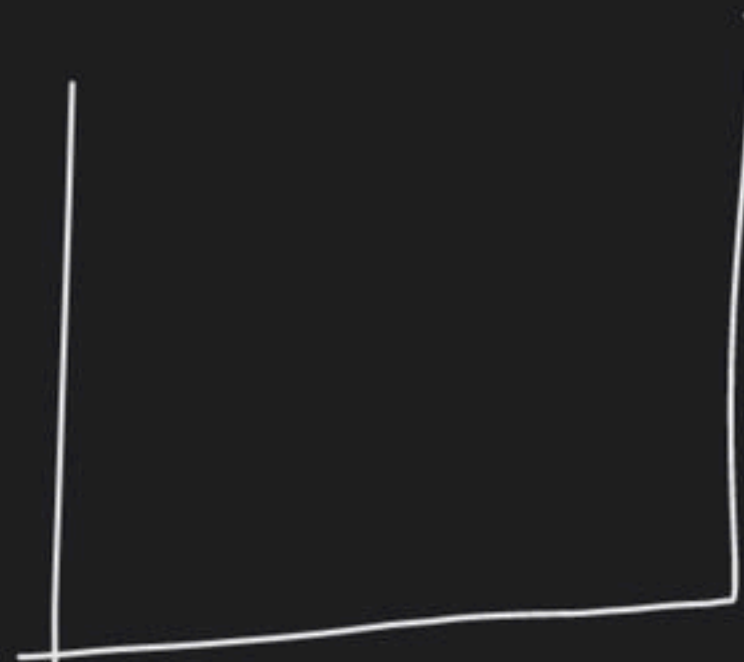
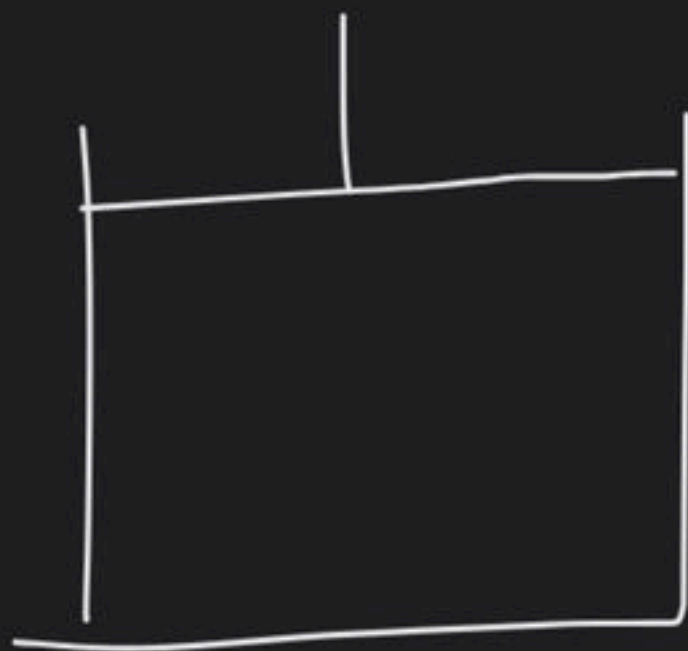
300/11 to 30 se kam h to 2.2 atm p
ressure to phle hi hojayega to valve
to khul jaani chahiye???

$Z < 1$

attraction

$Z > 1$

repulsion



① Berthlot eqⁿ

$$\left(p + \frac{a}{TV_m^2} \right) (V_m - b) = RT$$

② Dietrich eqⁿ

$$p e^{-\frac{a}{V_m RT}} (V_m - b) = RT$$

(iii)

Virial eqⁿ : \rightarrow

$$\frac{PV_m}{RT} = A + \frac{B}{V_m} + \frac{C}{V_m^2} + \dots$$

B, C, \dots temperature dependent virial const
which are determined exp

$$A = 1$$

$B = \text{second virial}$

$C = \text{third virial}$

Boyle's temperature

$$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$$

$$\left(P = \frac{RT}{V_m - b} - \frac{a}{V_m^2}\right) \times \frac{V_m}{RT}$$

$$\frac{PV_m}{RT} = \frac{V_m}{V_m - b} - \frac{a}{V_m RT}$$

$$Z = \left(1 - \frac{b}{V_m}\right)^{-1} - \frac{a}{V_m RT}$$

$$(1-x)^{-1} = 1 + x + x^2 + \dots$$

$$\frac{b}{V_m}$$

if $x < 1$

$$Z = 1 + \frac{b}{V_m} + \frac{b^2}{V_m^2} + \dots$$

$$- \frac{a}{V_m RT}$$

(A) +ive
(B) -ive

$$Z = 1 + \left(b - \frac{a}{RT} \right) \frac{1}{V_m} + \frac{b^2}{V_m^2} + \dots$$

At low pressure +

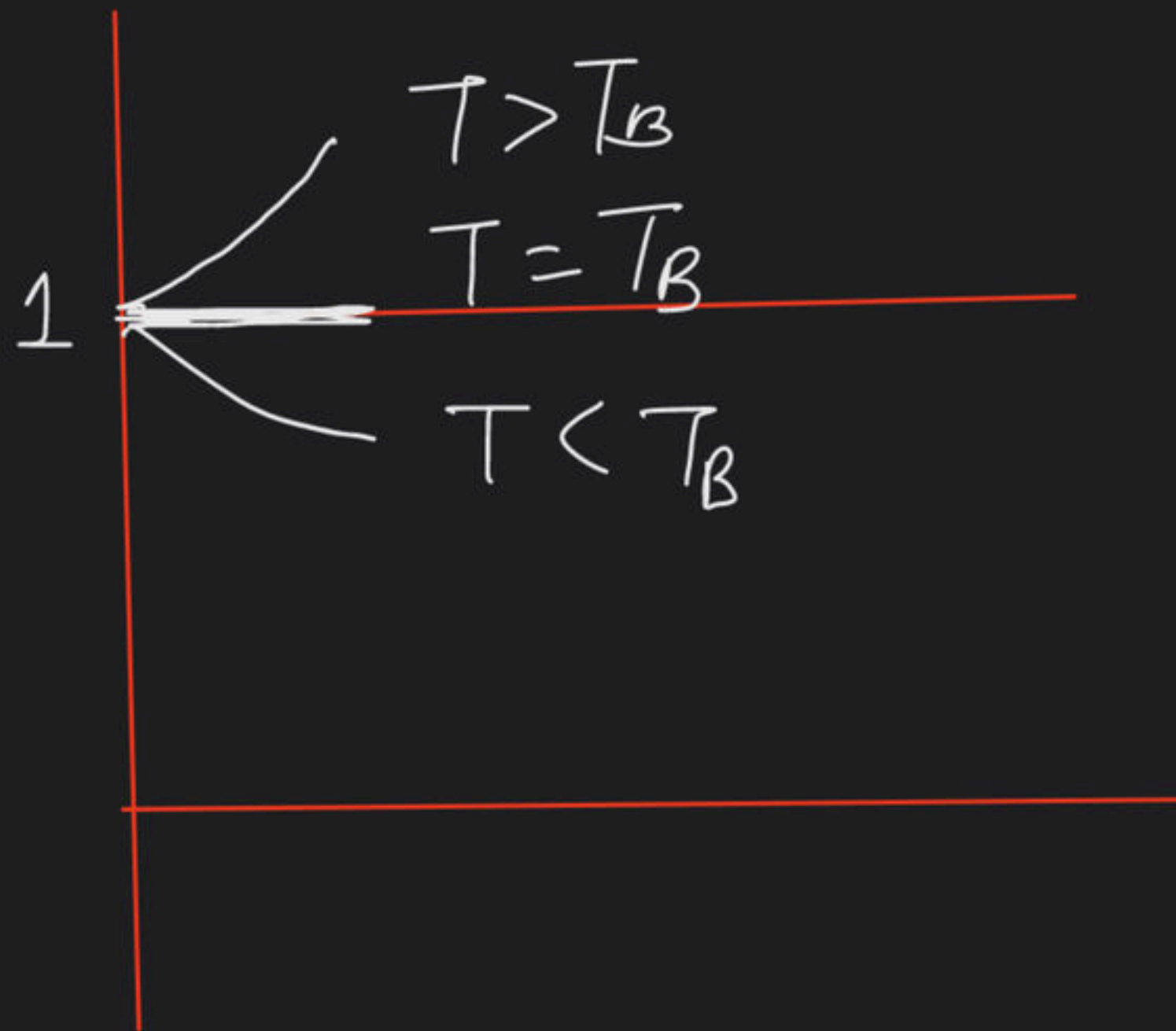
$$b - \frac{a}{RT} = 0$$

$$T_B = \frac{a}{Rb}$$



Boyle's temp

+ low pressure



$$\underline{\underline{T_B = \frac{a}{Rb}}}$$

Liquification of Real Gases (Critical const)

0-1 1-15

solid

liq gas

Glans

fluid

Level : Moderate
Topic : Periodic Table
Concept : Periodic Table
Subconcept : Periodic Table

8. Find the number of elements having lower EA_2 than EA_1 of Cl.
O, S, P, I, As, Si, Al, Li, K

Ans. (9.00)

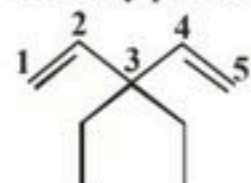
Sol. EA_1 is higher as compared to EA_2 for all the elements in periodic table.

Level : Tough
Topic : Nomenclature
Concept : IUPAC
Subconcept : IUPAC

9. If p_1, p_2 are position of side chains & p_3, p_4 are positions of double bonds as per IUPAC for compound diethylpentadiene then find value of $\left| \frac{p_1 + p_2}{p_4 - p_1} \right|$ is

Ans. (2)

Sol. The only possible compound is



$$(p_1, p_2) = (3, 3)$$

$$(p_4, p_3) = (1, 4) \text{ or } (4, 1)$$

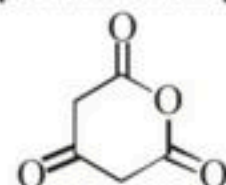
$$\text{Hence } \left| \frac{3+3}{4-1} \right| = \frac{6}{3} = 2$$

Level : Moderate
Topic : Nomenclature
Concept : IUPAC
Subconcept : IUPAC

10. Degree of unsaturation for any compound is total number of π bond & number of rings present in that compound. Degree of unsaturation in 3-oxo pentandioic anhydride is :

Ans. (4)

Sol. 3-oxo pentandioic anhydride is



Hence degree of unsaturation

= total number of π bond + total number of rings

$$= 3 + 1$$

$$= 4$$