Ideal Gas

1. $\underline{H_2C_2O_4} + \underline{2NaOH}$

moles of oxalic acid × 2 = moles of NaOH

$$\frac{5 \times 0.1}{\cancel{1000}} \times 2 = \frac{9 \times M}{\cancel{1000}}$$

$$\frac{1}{9} = M$$

Ideal Gas

3

1 mol Solution contains 0.1 mol

Solute	Solvent
0.1 mol	0.9 mol
$0.1 \times M_1$	$0.9\, M_2$

$M = m$

vol of solution = mass of Solvent

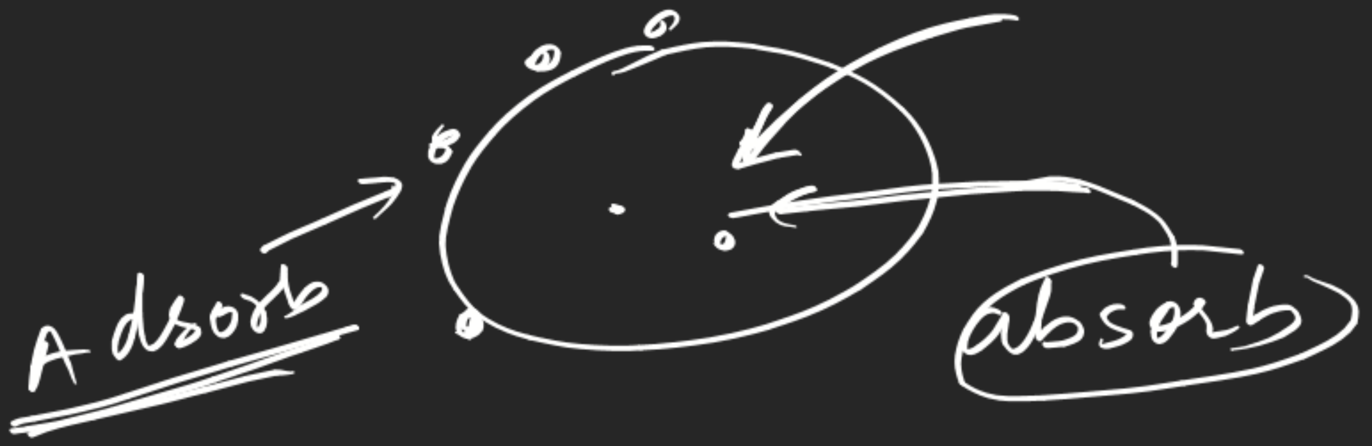
$$\text{Vol. of soln} = \frac{0.1 \times M_1 + 0.9 M_2}{2} = 0.9\, M_2$$

Ideal Gas

(6)

$0.5\,M\ CH_3COOH$ $\quad$ 50 ml

$0.49\,M\ CH_3COOH$



$$0.01 \times \frac{50}{1000} = \text{mole adsorbed by charcoal}$$

$$0.01 \times \frac{50}{1000} \times N_A \quad \text{———} \quad 3.01 \times 10^2\ m^2$$

$$1 \quad \text{———} \quad \frac{3.01 \times 10^2\ m^2}{0.01 \times \frac{50}{1000} \times N_A}$$

Ideal Gas

(4) $3.2\,M$ H_2X $(M = 80)$ $d_{solvent} = 0.4\ gm/ml$

1000 ml solution contains 3.2 mol H_2X

1000 ml vol of solvent 〃 3.2 mol

400 gm solvent —— 3.2

$$m = \frac{3.2}{400} \times 1000 = \frac{32}{4} = 8$$

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Ideal Gas

2 mol
8.21 lit
300 K

$\rightarrow$

$2 \times 9/10$ —— $2 \times 9/10$
$8.21 \longrightarrow \frac{3}{4}\, 8.21$
$300\,K$ —— $300\,K \longrightarrow 1200\,K$

$$P = \frac{2 \times \cancel{0.0821} \times 300}{\cancel{8.21}\ 100}$$

$= 6\,atm$

$$P_1/n_1 = P_2/n_2$$

$$\frac{6}{\cancel{2}} \times \frac{\cancel{2} \times 9}{10} = P_2 \longrightarrow$$

$5.4 = P_2$

$$P_2V_2 = P_3V_3$$

$$5.4 \times \cancel{V} = \frac{3}{4} \cancel{V} \times P_3$$

$P_3 = 7.2$

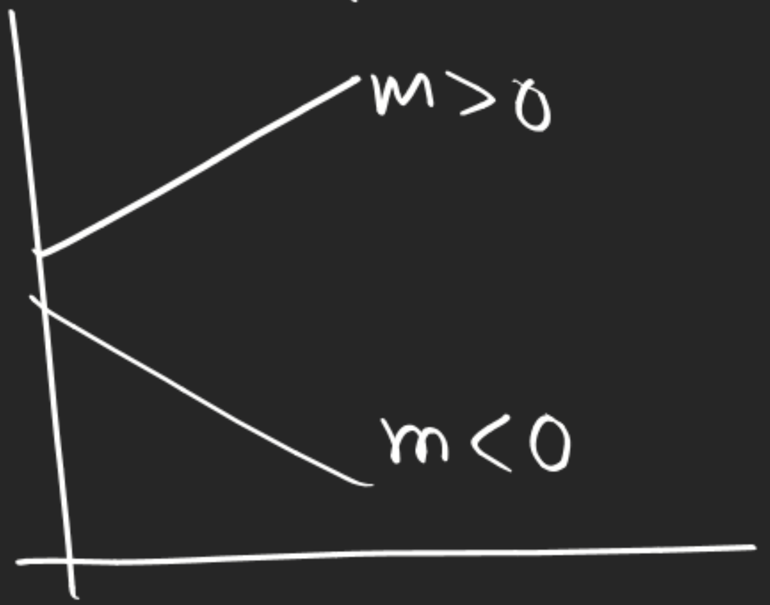
28.8

Some important Graphs

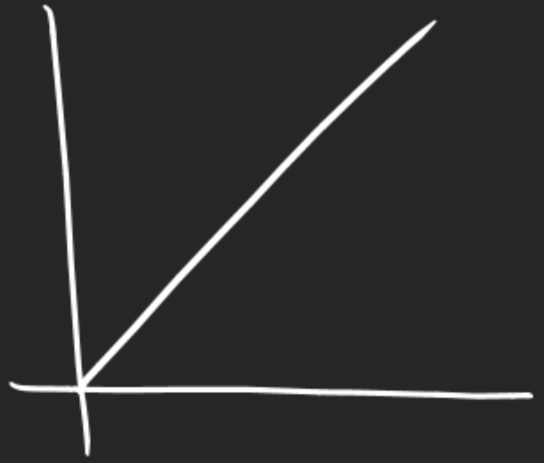
① straight line

$$y = mx + c$$

slope (m) intercept (c)



$$y = mx$$



$\boxed{m \,\&\, c \text{ are const}}$

$(x_1, y_1) \quad (x_2, y_2)$

$$\underline{y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)}$$

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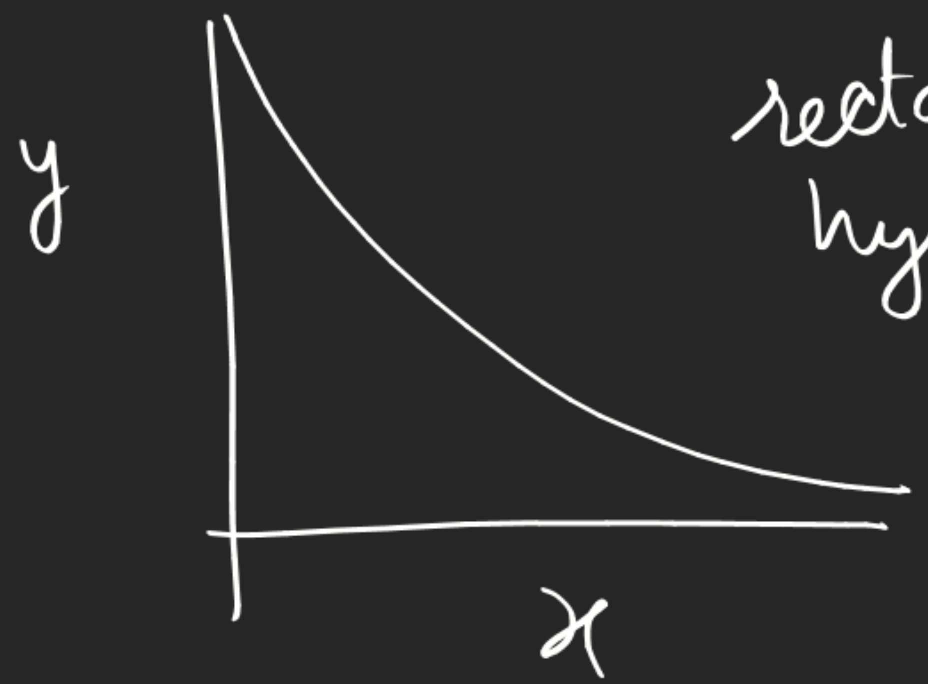
Ideal Gas

(2) hyperbolic curve

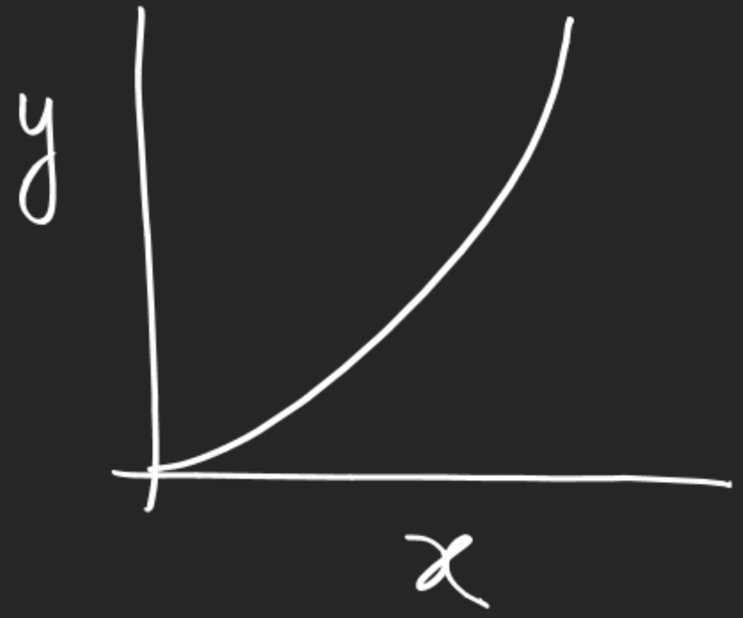
$$y = \frac{c}{x}$$

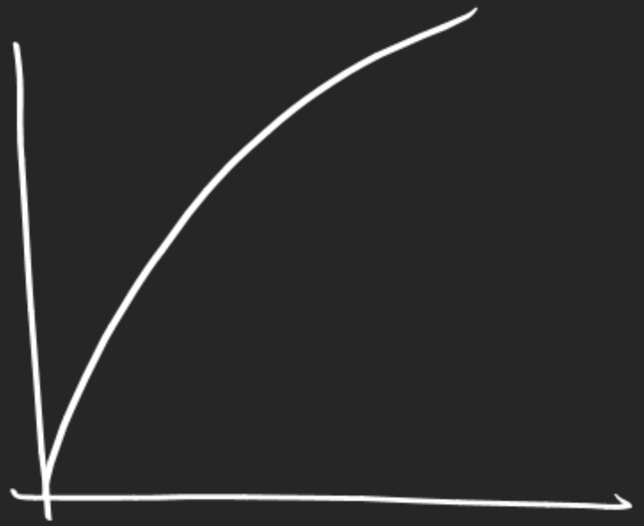


rectangular hyperbola

(3) Parabolic curve

$$y = cx^2 \qquad y^2 = cx$$





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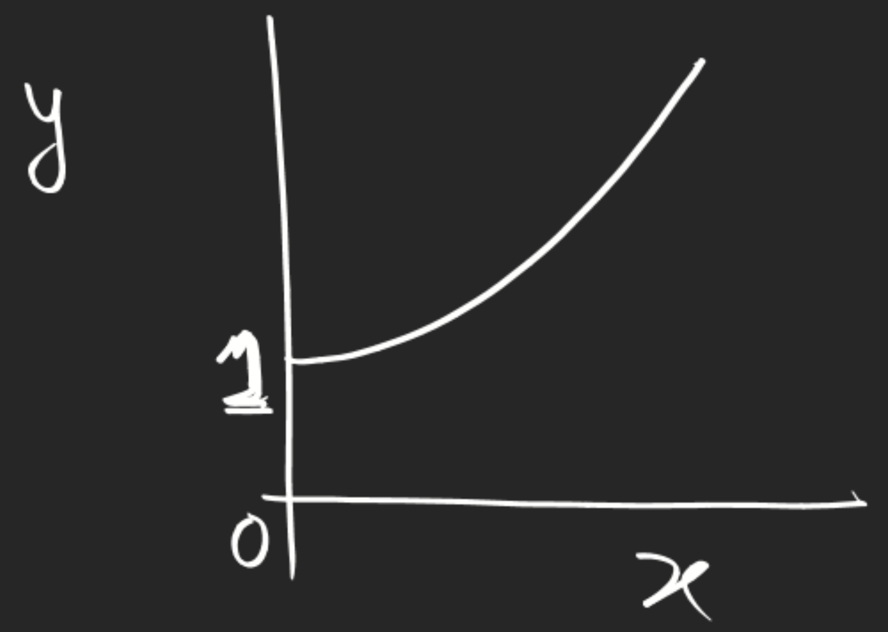
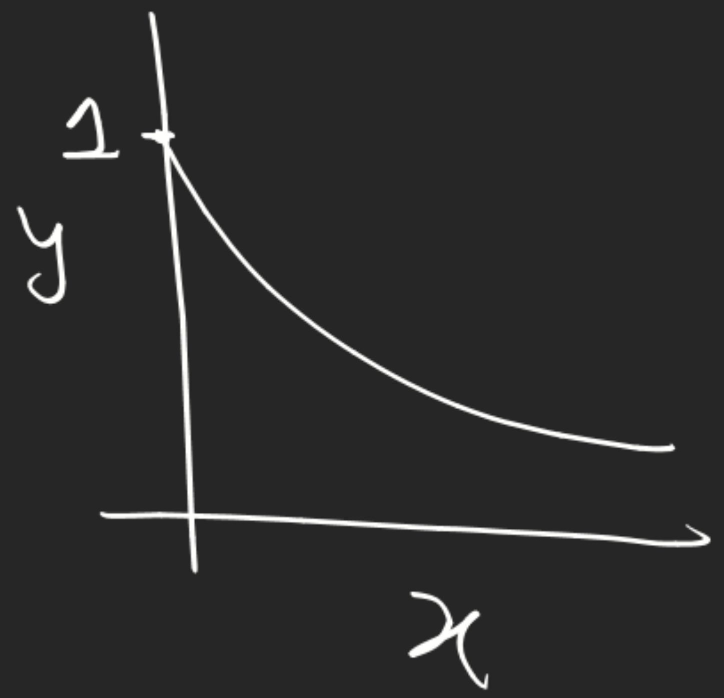
Ideal Gas

4 Exponential curve

$y = e^{x}$

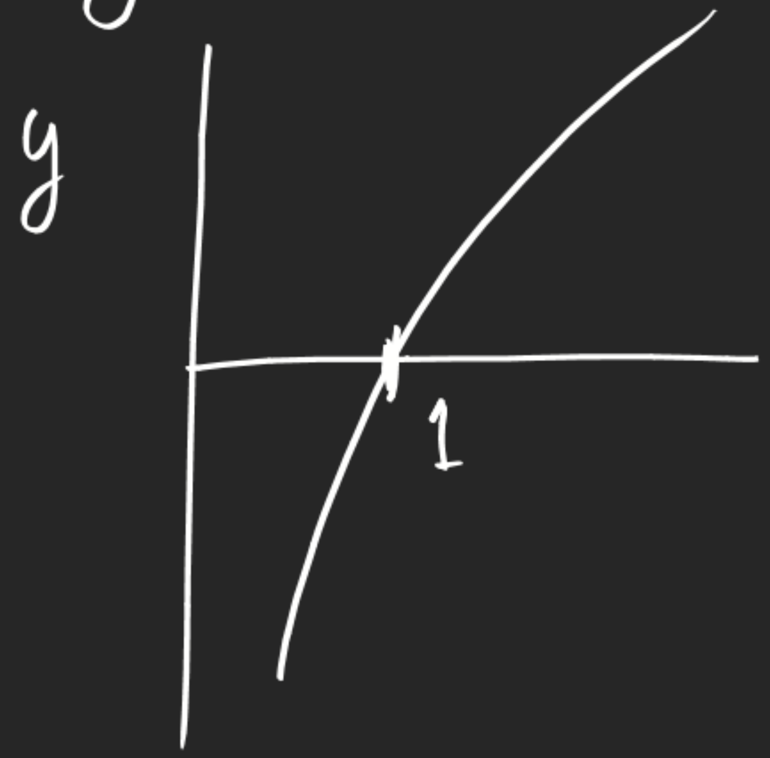


$y = e^{-x}$



5 Logrithmic curve

$y = \ln x$



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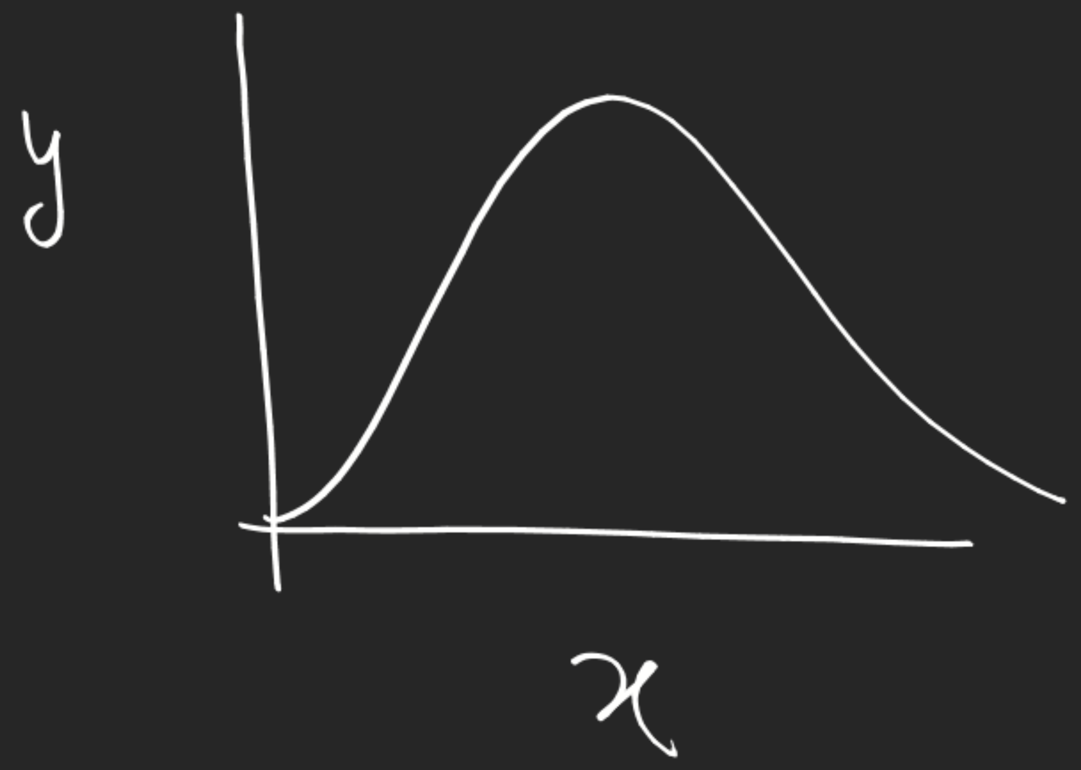
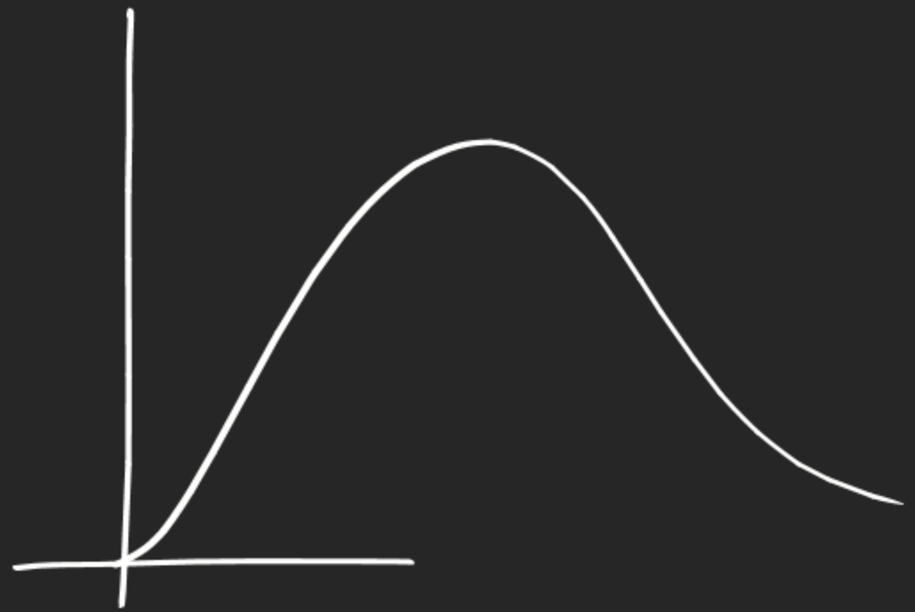
6

$$y = \underline{x}\ \underline{e^{-x}}$$



$$y = x^2 e^{-x^3}$$



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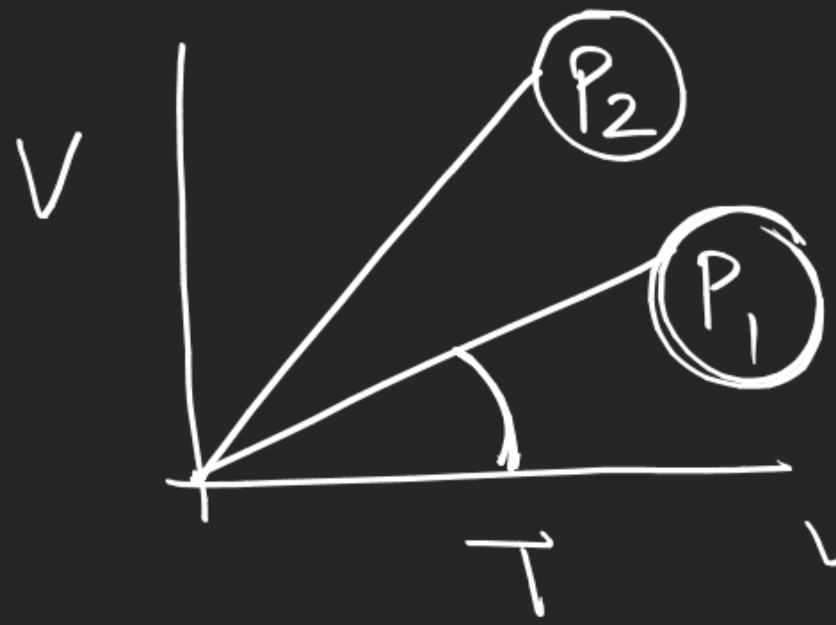
Ideal Gas

Curve based on $PV = nRT$

① V vs T $(n, P = \text{Const})$



$$V = \boxed{\frac{nR}{P}}\, T$$

(A) $P_1 > P_2$ ✓

(B) $P_1 < P_2$

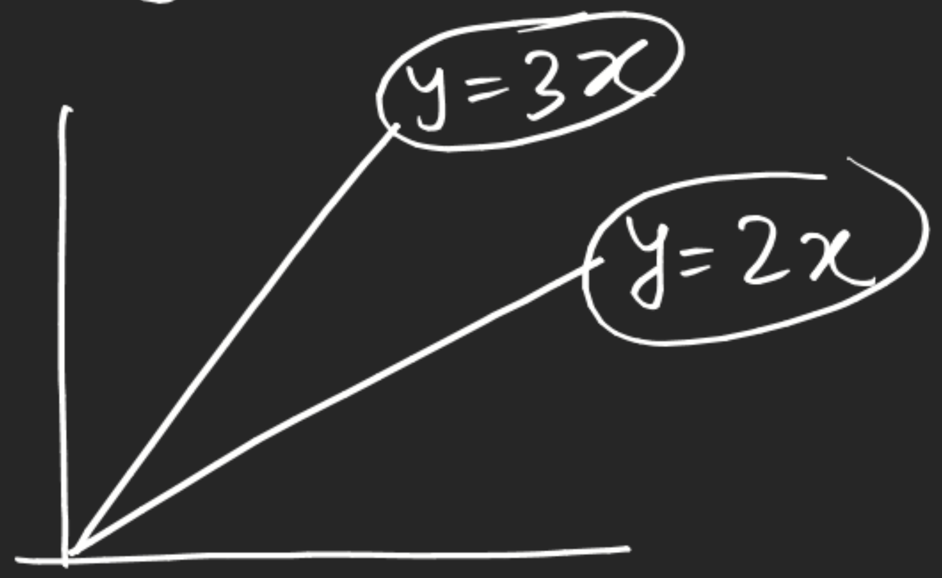
(C) $P_1 = P_2$

$$\frac{\cancel{nR}}{P_1} < \frac{\cancel{nR}}{P_2}$$

$$\underline{P_2 < P_1}$$

① $y = 2x$

② $y = 3x$



$$y = \underline{m}x$$

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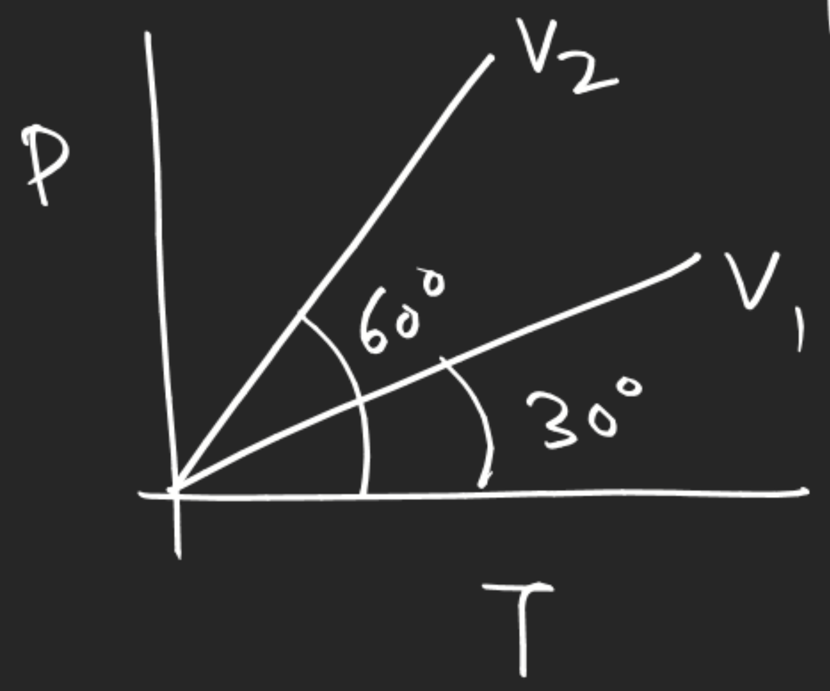
Ideal Gas

(11) P vs T



$$P = \left(\frac{nR}{V}\right)T$$

$$\frac{nR}{V_1} = \tan 30^\circ = \frac{1}{\sqrt{3}} \Rightarrow V_1 = \sqrt{3}\,nR$$

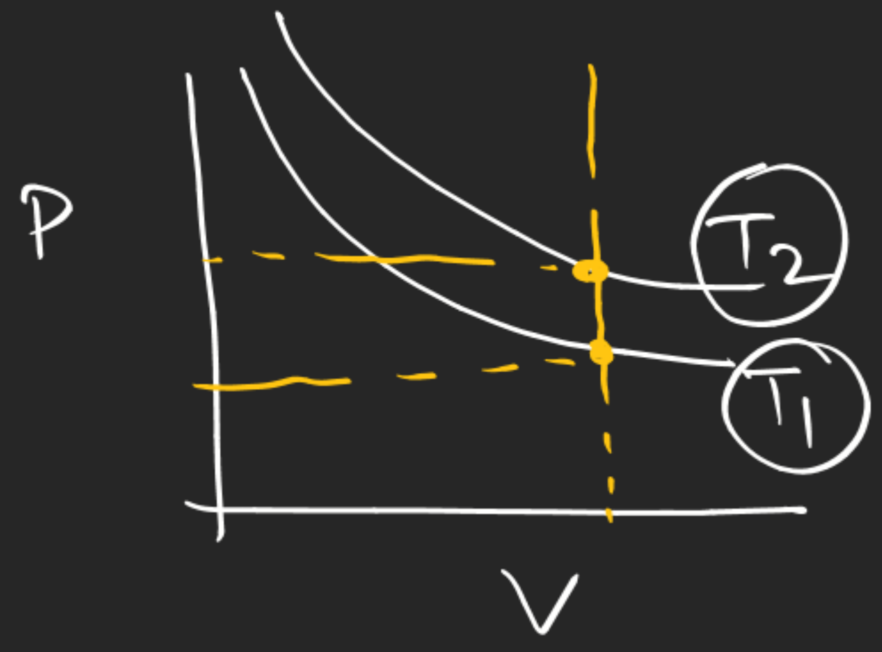
$$\frac{nR}{V_2} = \tan 60^\circ = \sqrt{3} \Rightarrow V_2 = \frac{1}{\sqrt{3}}nR$$

$$\boxed{V_1 > V_2}$$

$$\boxed{V_1 > V_2}$$

Ideal Gas

(3) P vs V $(n, T = \text{Const})$



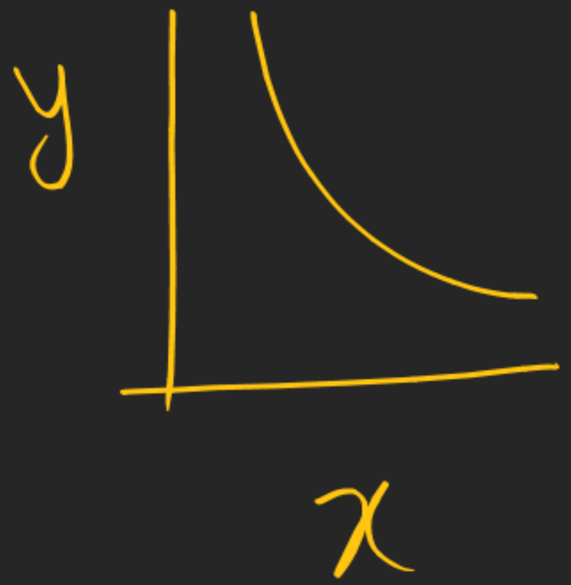
$$P = nRT \frac{1}{V}$$

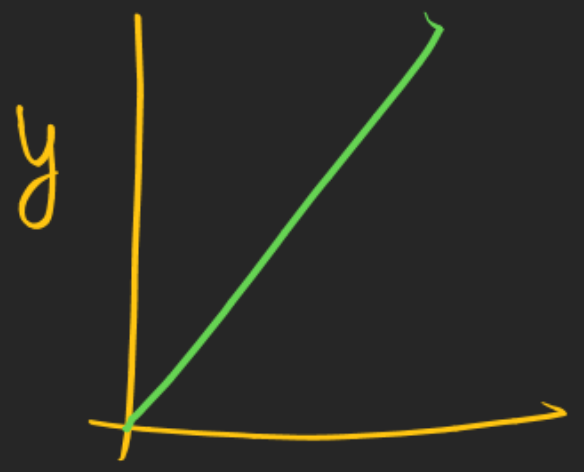
$$P = \frac{C}{V}$$

$$T_2 > T_1$$

Boyle's law

(4) $y = C\left(\frac{1}{x}\right) = C\,X$





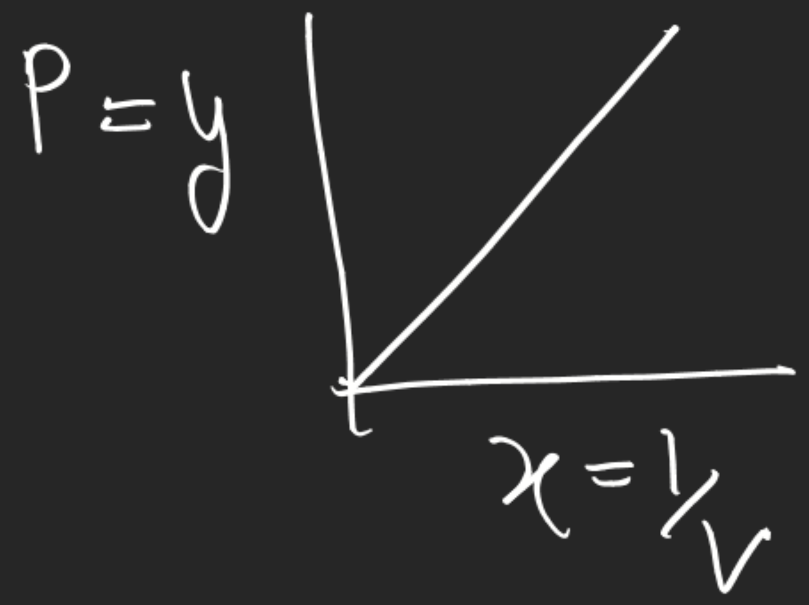
$$X = \frac{1}{x}$$

Ideal Gas

(4) P vs $\left(\frac{1}{V}\right)$

$$P = nRT\left(\frac{1}{V}\right)$$

$$y = (nRT)\,x$$

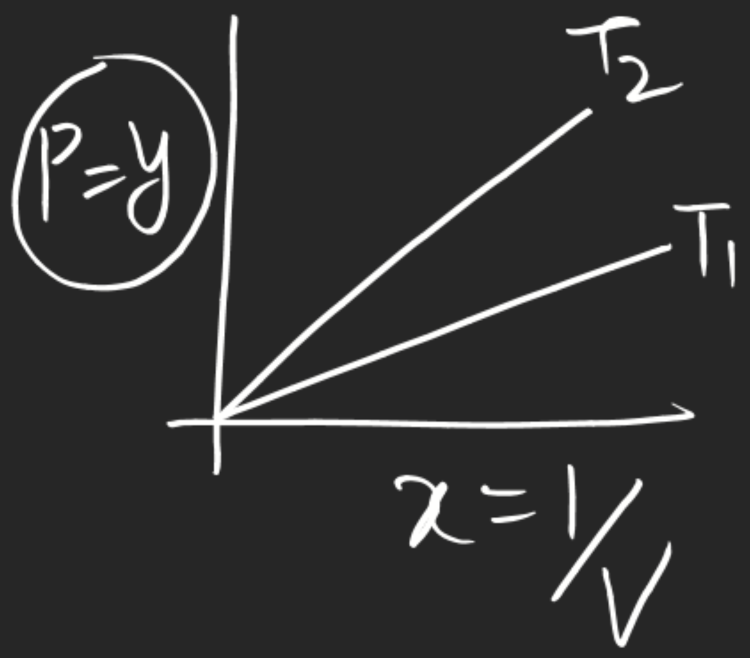


$P = y \qquad 1/V = x$

$$PV = nRT$$

$$y\,\frac{1}{x} = nRT$$

$$\boxed{y = (nRT)\,x}$$

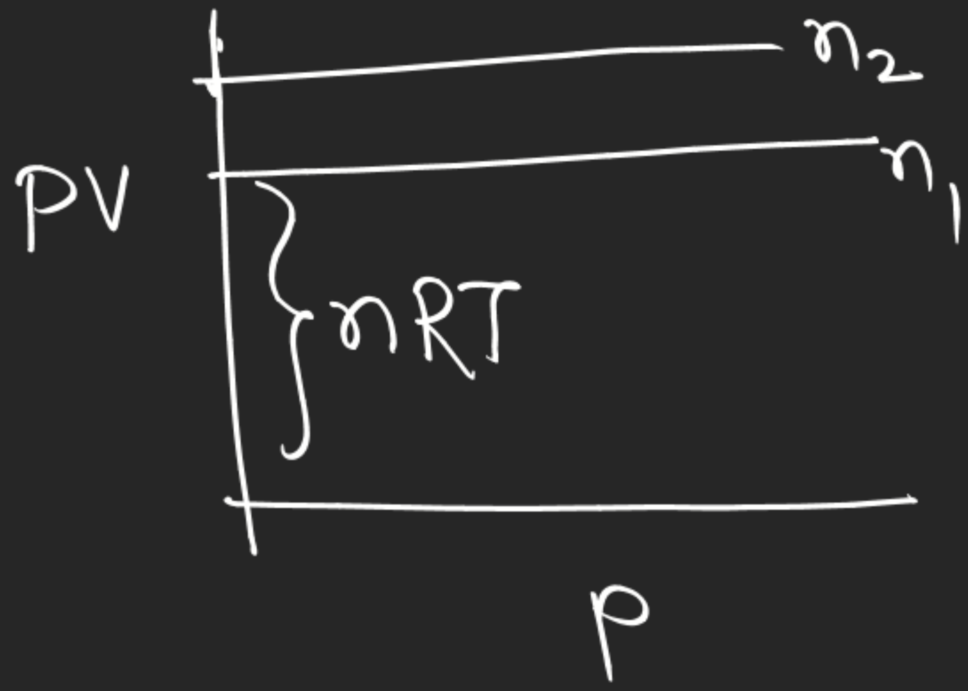


$T_2 > T_1$

Ideal Gas

5. PV vs P $n, T = \text{const}$

$$PV = nRT = \text{Const}$$



$$n_1 < n_2$$

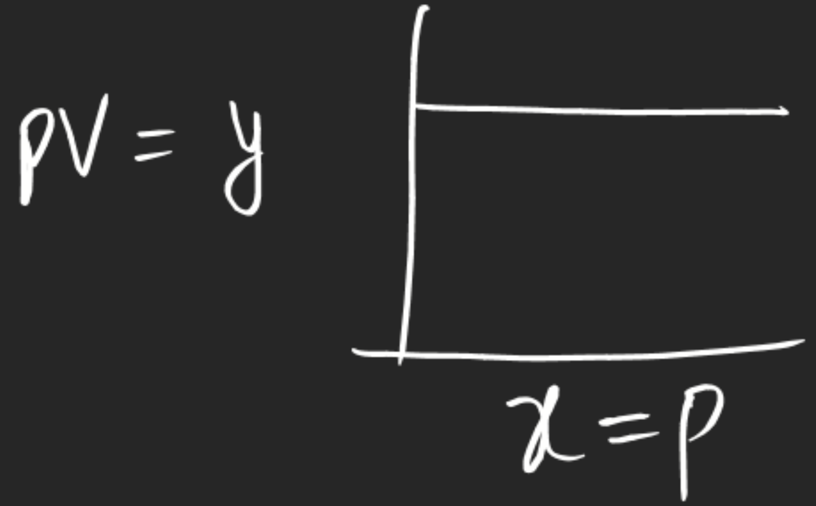
$PV = y$ $P = x$

$$V = y/x$$

$$PV = nRT$$

$$\cancel{x}\frac{y}{\cancel{x}} = nRT$$

$$y = nRT = \text{Const}$$



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6 PT vs T

$PT = y \qquad T = x$

$P = y/x$

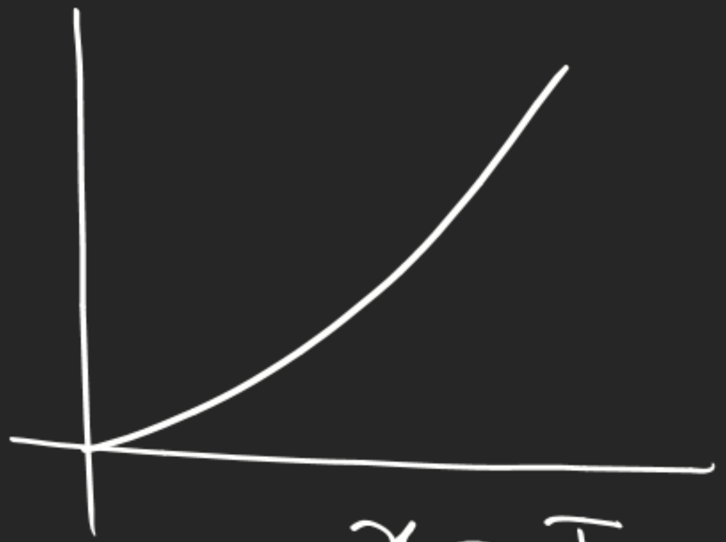
$\Rightarrow \quad PV = nRT$

$$\frac{y}{x} = \left(\frac{nR}{V}\right) x$$

$$y = \left(\frac{nR}{V}\right) x^2$$

$$y = cx^2$$

$PT = y$



$x = T$

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(7) PT vs T^2

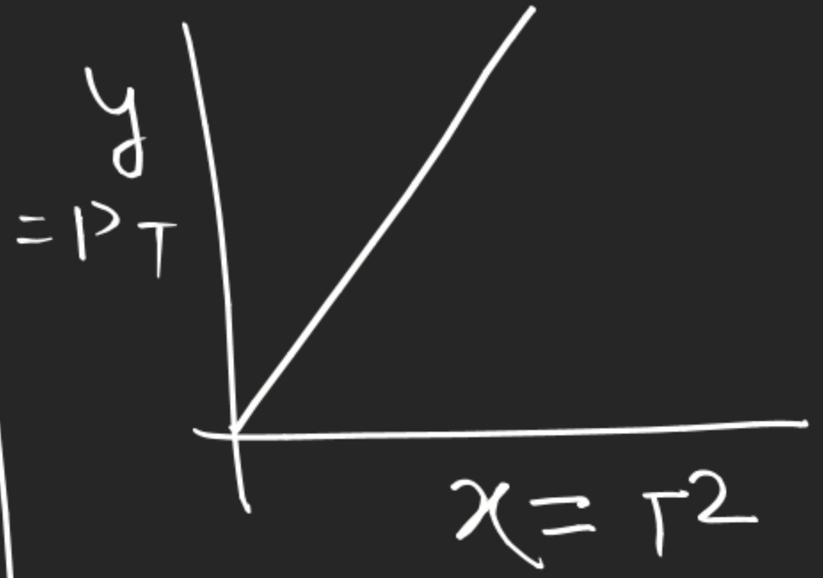
$PT = y \qquad T^2 = x$

$P = y/\sqrt{x} \qquad T = \sqrt{x}$

$\Rightarrow P = \frac{nR}{V} T$

$\frac{y}{\sqrt{x}} = \frac{nR}{V} \sqrt{x}$

$$\boxed{y = \frac{nR}{V} x}$$



$PT = \frac{nR}{V} T^2$

$y = \frac{nR}{V} x$

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8

$\log P$ vs $\log V$

$\log(xy) = \log x + \log y$

$\log \frac{1}{x} = -\log x$

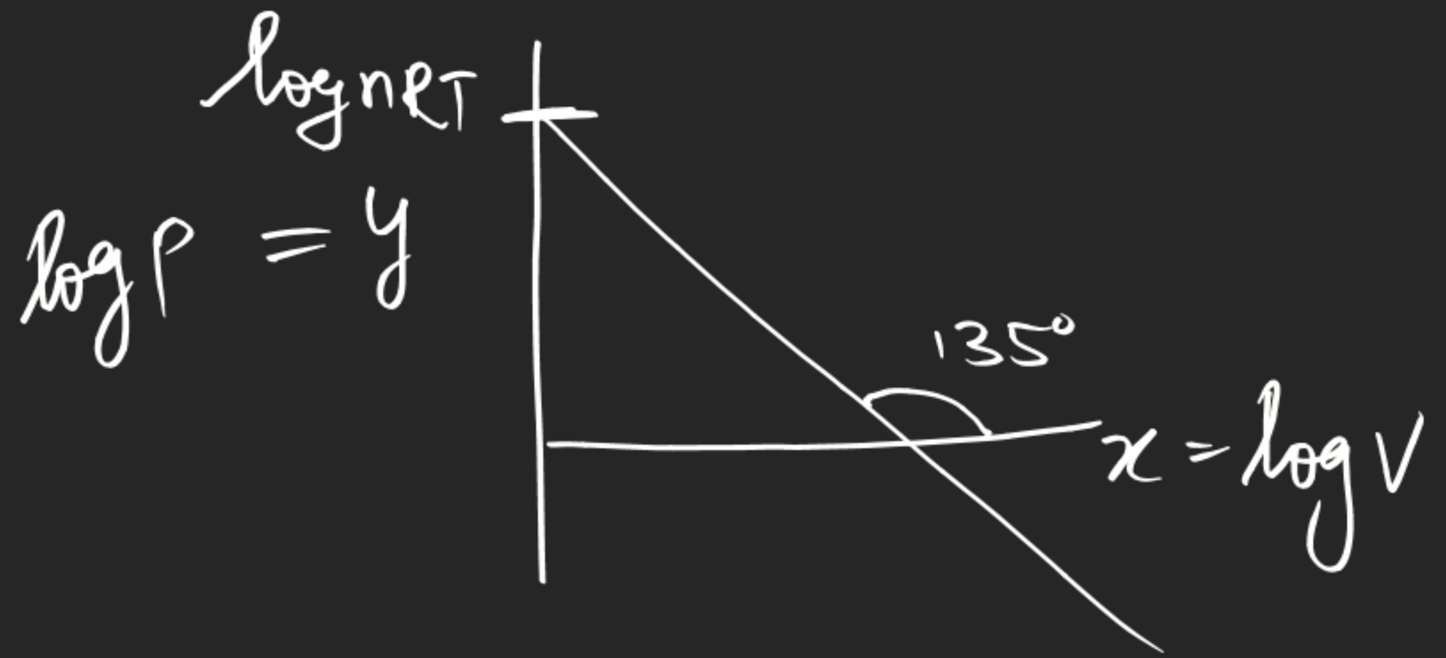
$PV = nRT$

$\underbrace{\log P}_{} + \underbrace{\log V}_{} = \log(nRT)$

$y + x = \log(nRT)$

$y = -x + \log(nRT)$

slope $= -1$ intercept $= \log(nRT)$



$\tan 45° = 1$

$\tan 135° = -1$

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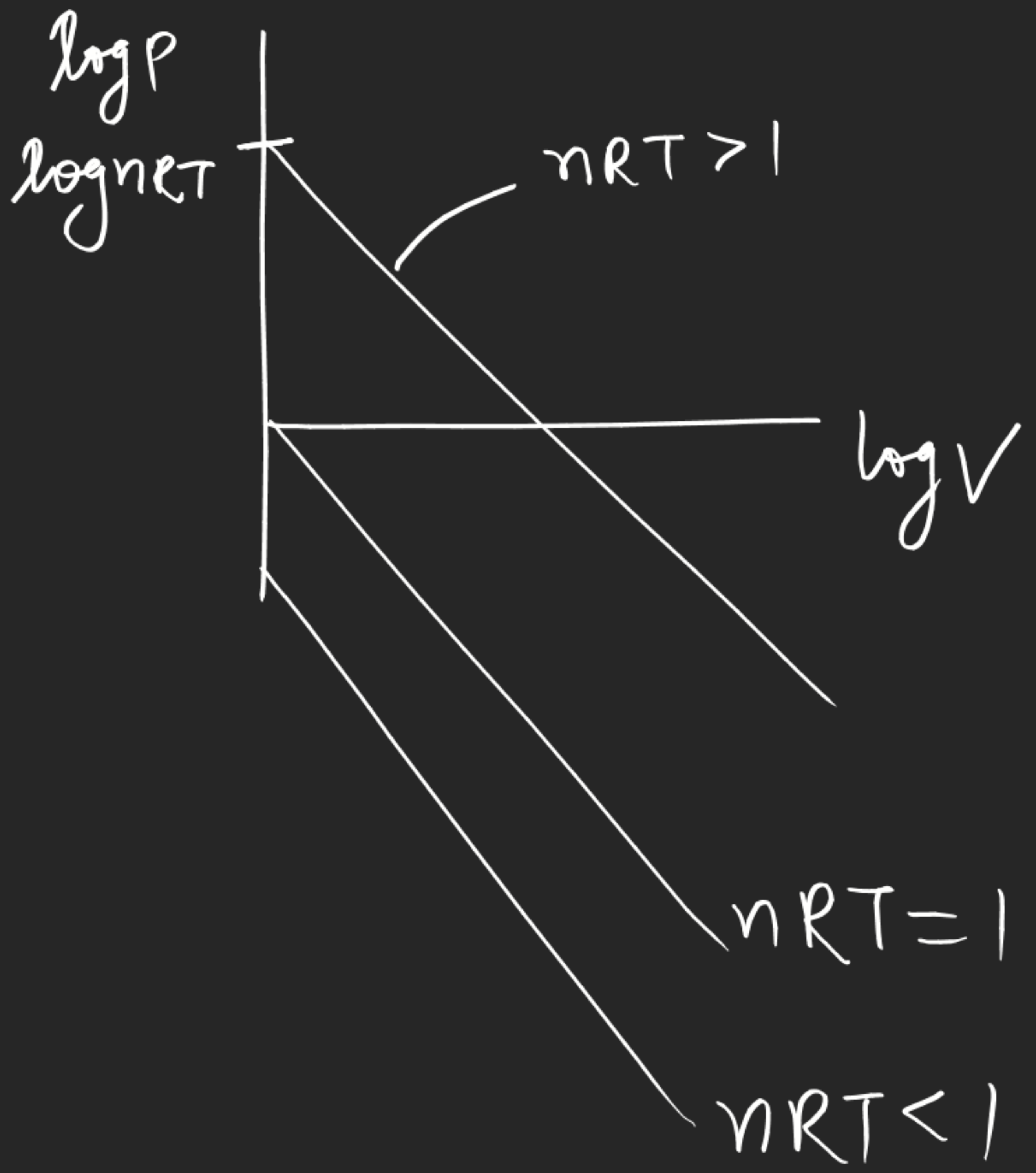
$nRT = 1 \Rightarrow \log nRT = 0$

$nRT > 1 \Rightarrow \log nRT > 0$

$\underline{0 < nRT < 1} \Rightarrow \log nRT < 0$



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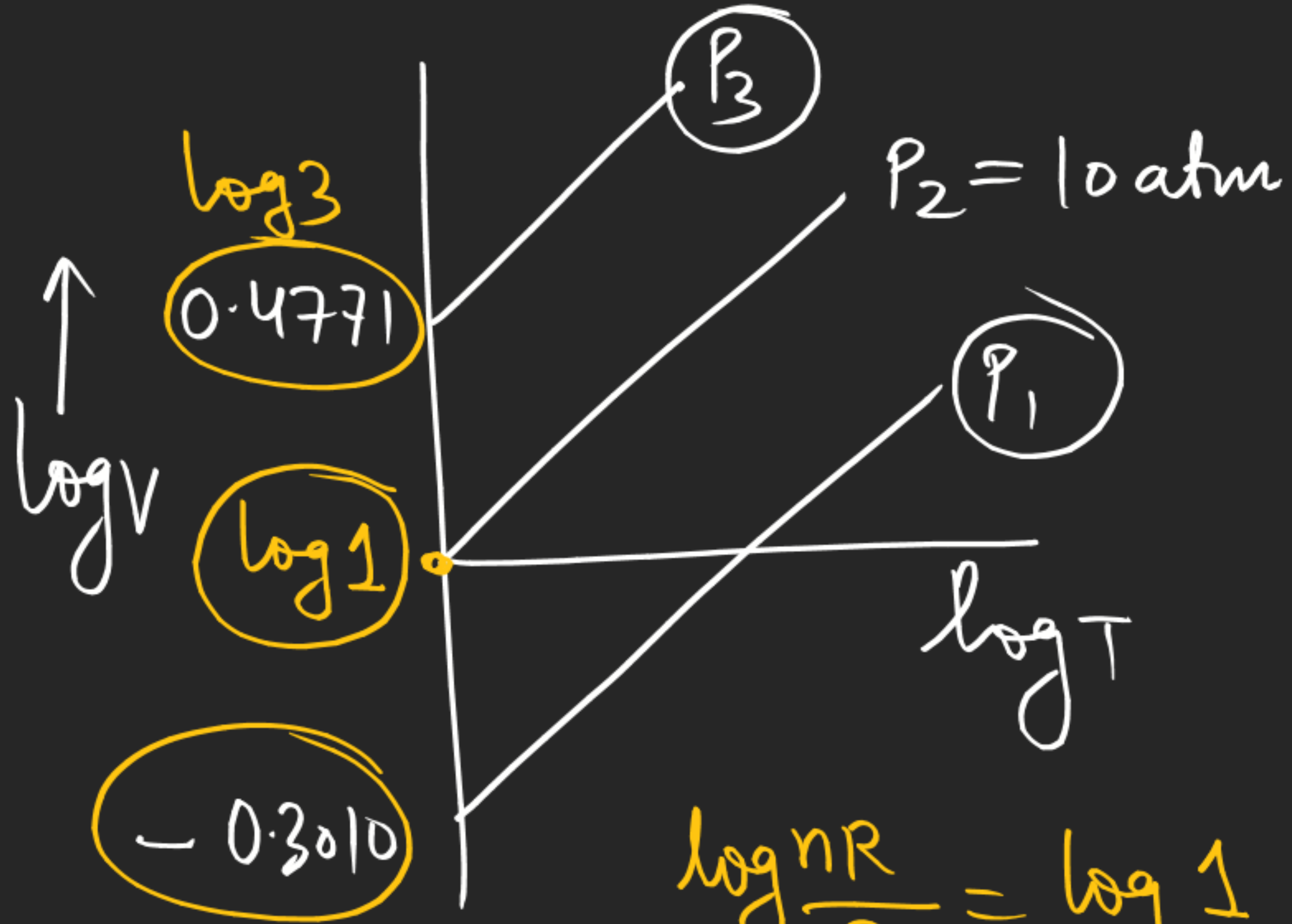
Q for 1 mol gas calculate P_1 & P_3 $\left[\begin{array}{l}\log 2 = 0.3010 \\ \log 3 = 0.4771\end{array}\right]$

$\log \frac{1}{2} = -0.3010$



log ½

$V = \frac{nR}{P} T$

$\log V = \log \frac{nR}{P} + \log T$

$\log \frac{nR}{P_2} = \log 1$

$\log \frac{nR}{P_3} = \log 3$

$\log \frac{nR}{P_1} = \log \frac{1}{2}$

$\frac{nR}{P_2} = 1$ $\quad \boxed{P_2 = nR} = 10$

$\frac{nR}{P_1} = \frac{1}{2}$ $\quad P_1 = 2 \times 10 = \underline{20 \text{ atm}}$

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O-I 1—8, 11, 12, 13

S-I 1—7

Ideal gas

Conc terms

S-II

1—5