No of Bimolecular Collision

Course on States of Matter for Class XI

akhilesh • Lesson 14 • Aug 2, 2021

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$$\frac{313}{293}$$

$$2BCl_3 + 3H_2 \longrightarrow 2B + 6HCl.$$

$$\frac{P_{O_2}}{P_{Total}} = X_{O_2}$$

Maxwell distribution of speed of Molecules

Speed of a molecules changes continuously due to collision but total KE remains constant therefore it can be concluded that no. of particles in given speed range remain constant with time at a given temp.

$$\frac{1}{du}\frac{dN}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{3/2} u^2 e^{-\frac{Mu^2}{2RT}} \cancel{du}$$

dN = no. of particle having speed betn u to u+du

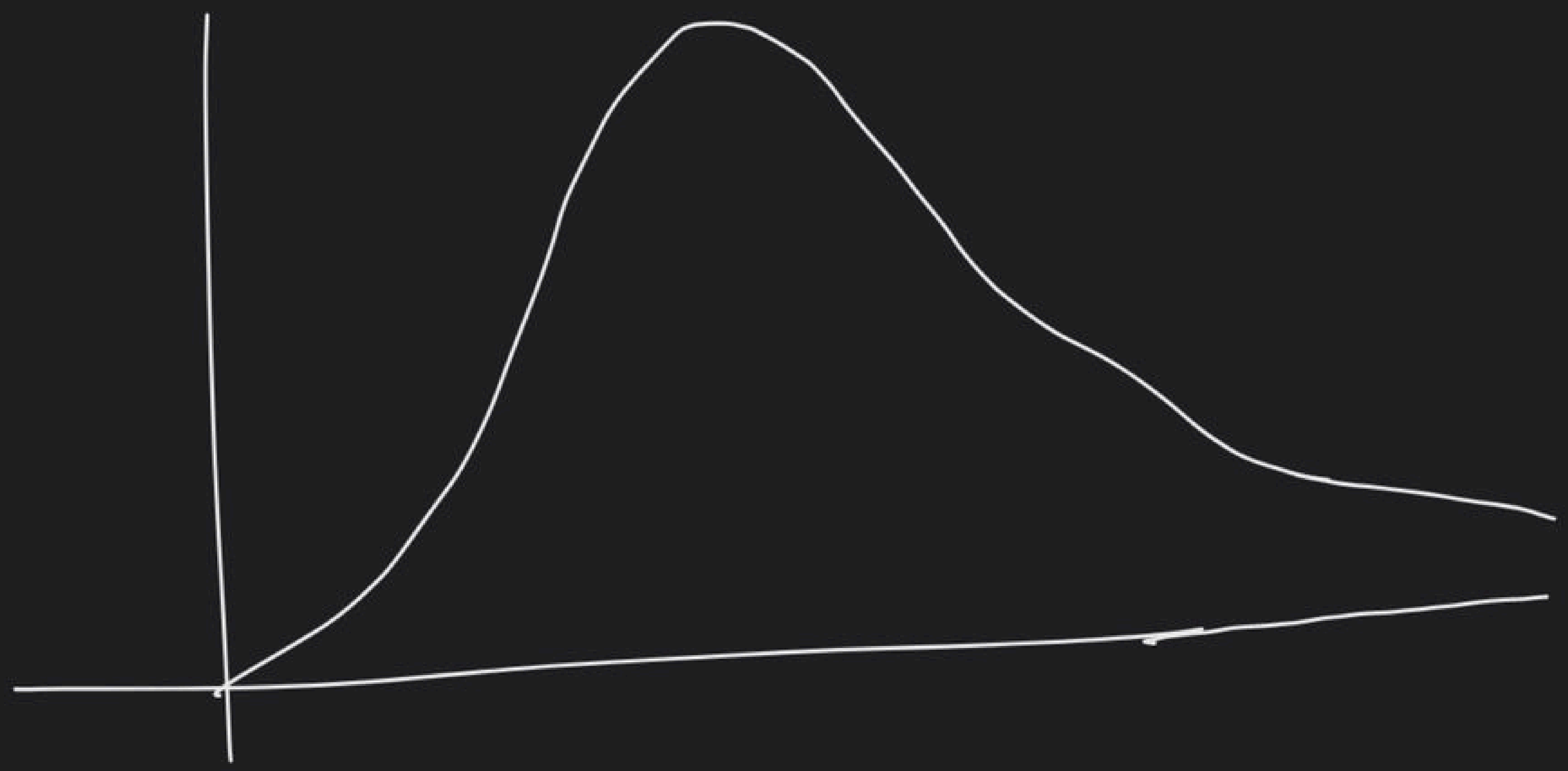
N = total no of particle

M = Mol. mass

T = temp

$$\frac{dN}{N}$$

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



$dN_1 \quad u_1$

$dN_2 \quad u_2$

$dN_3 \quad u_3$

$$U_{avg} = \frac{dN_1 \times u_1 + dN_2 \times u_2 \dots\dots}{dN_1 + dN_2 \dots\dots}$$

$$U_{avg} = \frac{\int dN \times u}{N} = \sqrt{\frac{8RT}{\pi M}}$$

$$U_{rms} = \left(\frac{dN_1 \times u_1^2 + dN_2 \times u_2^2 - - - .}{dN_1 + dN_2} \right)^{1/2}$$

$$= \left(\frac{\int dN \times u^2}{N} \right)^{1/2}$$

$$\boxed{U_{rms} = \sqrt{\frac{3RT}{M}}}$$

find V_{rms} speed of $H_2(g)$ at 300 K.

$$= \sqrt{\frac{3 \times \frac{25}{3} \times 300}{2 \times 10^{-3}}}$$

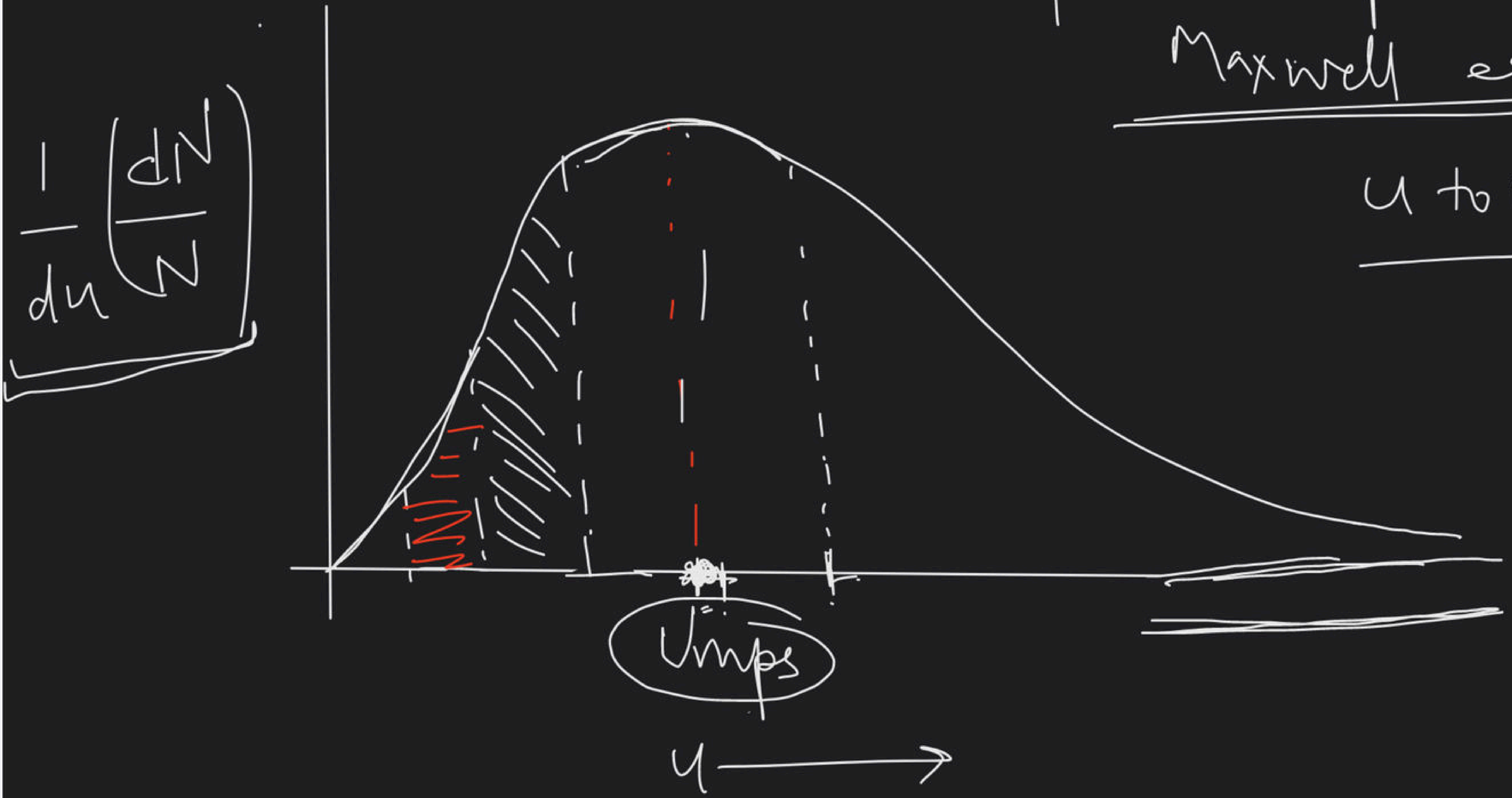
$$= 1930 \ m/sec.$$

$$= 1930 \times 18/5 \ km/hr$$

Graphical representation of

Maxwell eqn

u to u+1



1) Area $= \int \frac{1}{\cancel{du}} \cdot \frac{dN}{N} \cdot \cancel{du} = \int \frac{dN}{N}$

= fraction of particles

2) Total area = $\underline{1}$

3 V_{mps} (most probable speed)

$$\frac{1}{du}\frac{dN}{N} = y = \underbrace{4\pi\left(\frac{M}{2\pi RT}\right)^{3/2}} u^2 e^{-Mu^2/2RT}$$

$$y = c\,u^2 e^{-Mu^2/2RT}$$

$$\boxed{U_{rms} = \sqrt{\frac{2RT}{M}}}$$

Question

from Shubhro

$$y = \frac{1}{du}\frac{dN}{N} = 4\pi\left(\frac{m}{2\pi RT}\right)^{3/2} u$$

$$= C\, u^2 e^{-C_0 u}$$

$$\frac{dy}{du} = 0$$

$$\Rightarrow -C_0 u^2 \cdot 2u\, e^{-C_0 u^2} + 2cu\, e^{-C_0 u^2} = 0$$

$$\Rightarrow 2u^3 = \frac{2u}{C_0}$$

$$\Rightarrow u^2 = \frac{1}{C_0}$$

$$\Rightarrow u = \sqrt{\frac{2RT}{M}}$$

J-M

J- AdV

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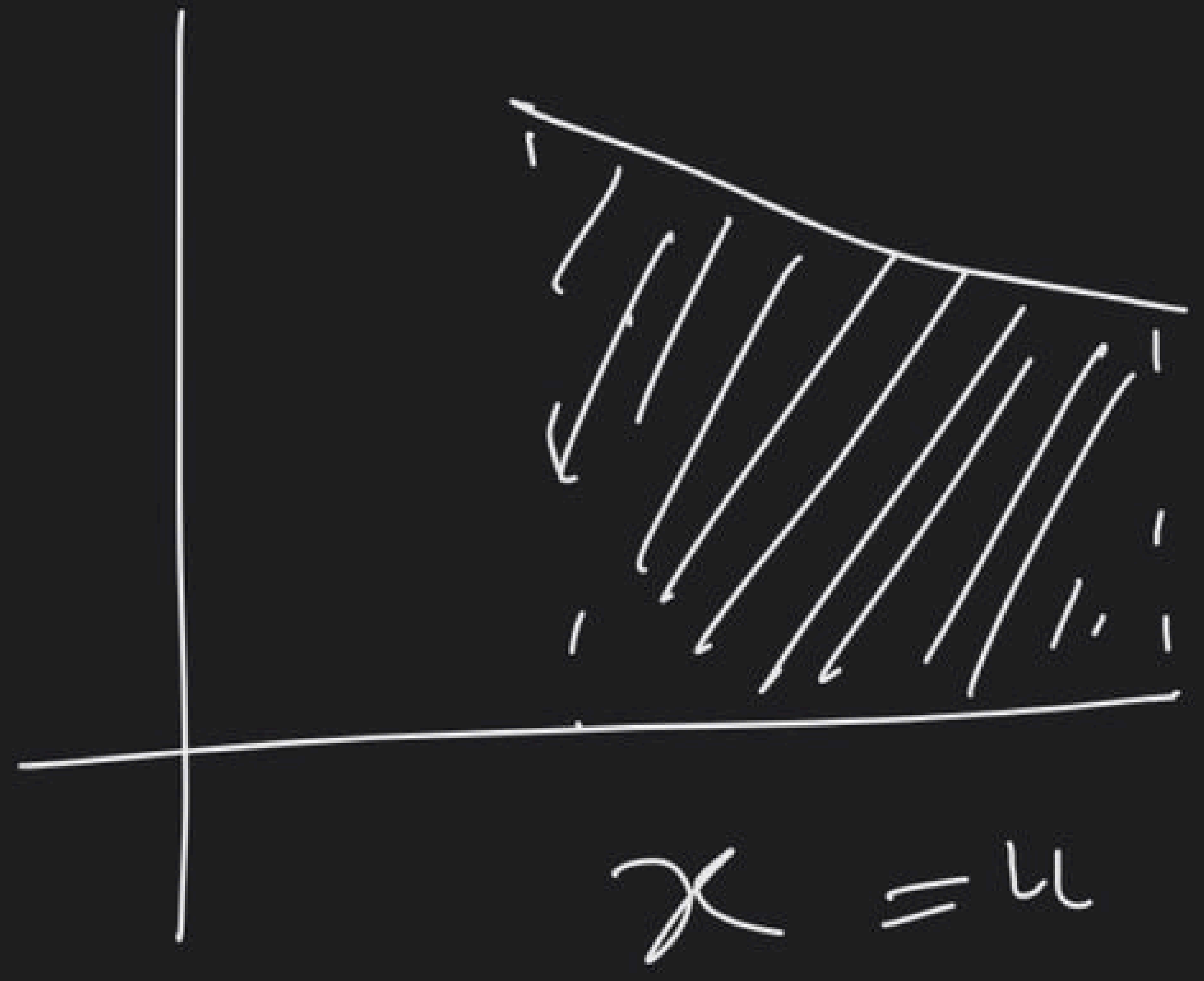
$$\frac{1}{du}\frac{dN}{N} = y$$



Area = $\int y\,dx$

Area = $\int \frac{1}{d\cancel{u}} \frac{dN}{N} \times \cancel{du}$

$$= \int_{1}^{2} \frac{dN}{N}$$

$$y = x\,\underline{e^{-x^2}}$$

$$\frac{dy}{dx} = \underline{e^{-x^2} + x\,e^{-x^2}(-2x)}$$