Page No. Q1) Derive Schrodinger's time independent mane For a particle of mass m moving in a potential V(H), Schrodinger's time dependent $\frac{i\hbar}{\partial \psi(x,t)} = -\frac{\hbar^2}{2m} \nabla^2 \psi(x,t) + V(x)\psi(x,t) - (i)$ where $\Psi(H,t)$ is the more function, which depends the is reduced plank constant

\[
\forall^2\) is the faplacian operator

V(r) is the potential energy function

The mane function $\Psi(x, t)$ is the product of space function $\Psi(x)$ and time function $\Psi(t)$

 $\frac{\cdot \cdot \forall (x, t) = \forall (x) \forall (t) - (ii)}{}$

on position & and time t

Equation is given by

Assignment - 2

equation

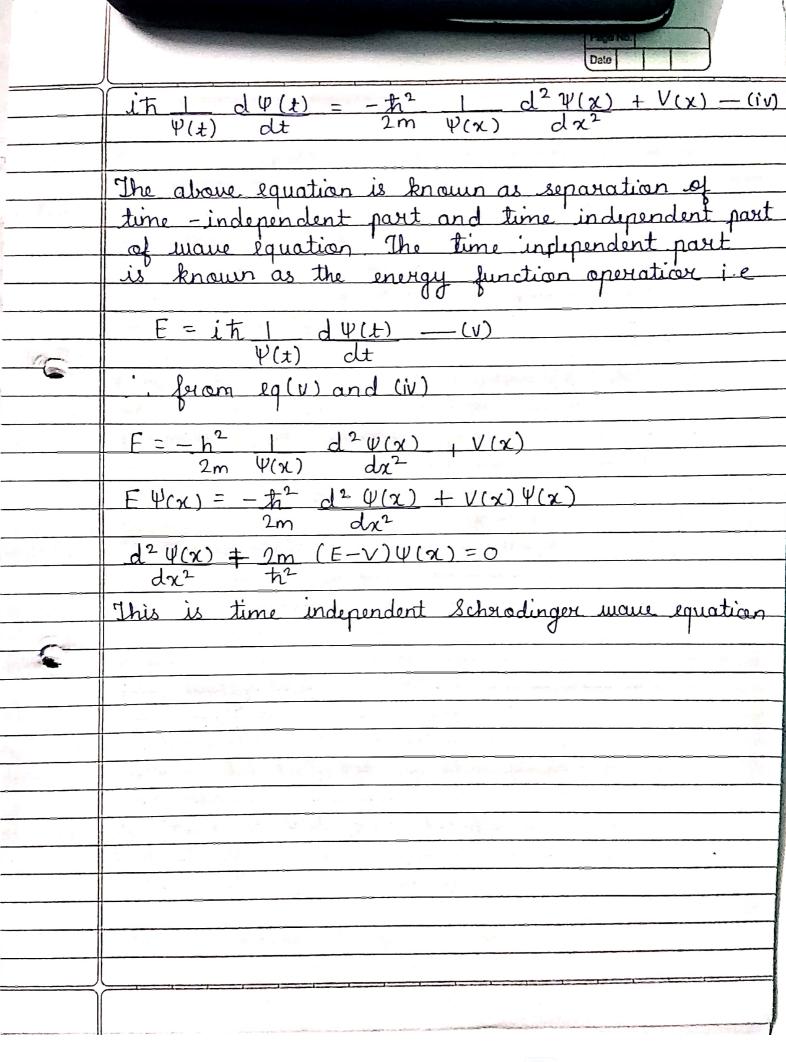
Ans

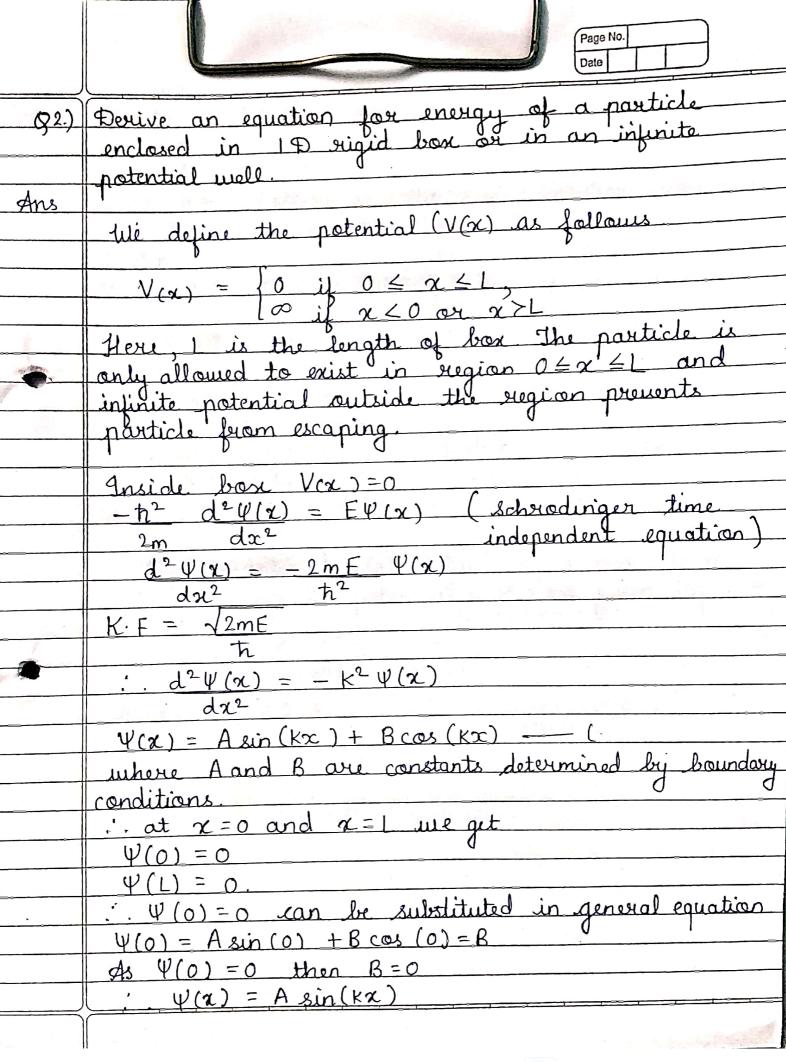
Now apply the mane function from equation (ii) to time dependent Schrodinger mane equation (i)

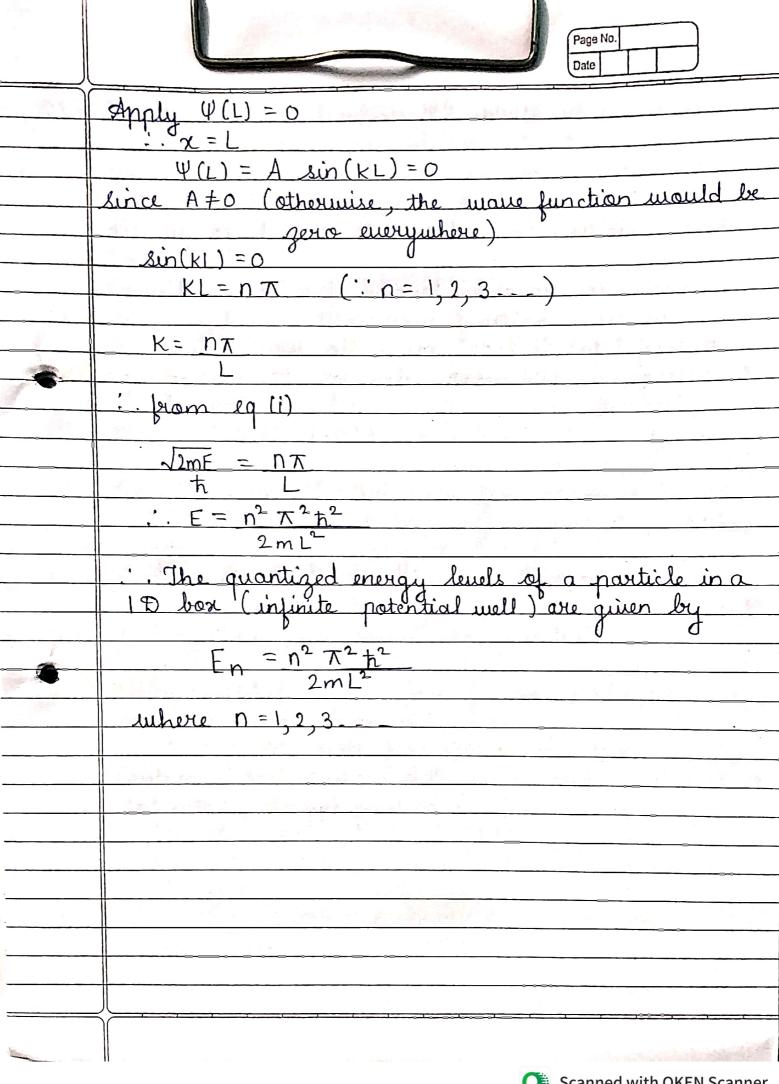
 $\frac{i\hbar \Psi(x) d\Psi(t) = -\hbar^2 \Psi(t) d^2 \Psi(x) + V(x)\Psi(x)\Psi(t)}{dt} = -\hbar^2 \Psi(t) d^2 \Psi(x) + V(x)\Psi(x)\Psi(t)$

In above equation ordinary derivatives are used instead of partial derivatives because each function $\Psi(x)$ and $\Psi(t)$ depends on one variable

Now divide equation (iii) by 4(x) 4(t) so

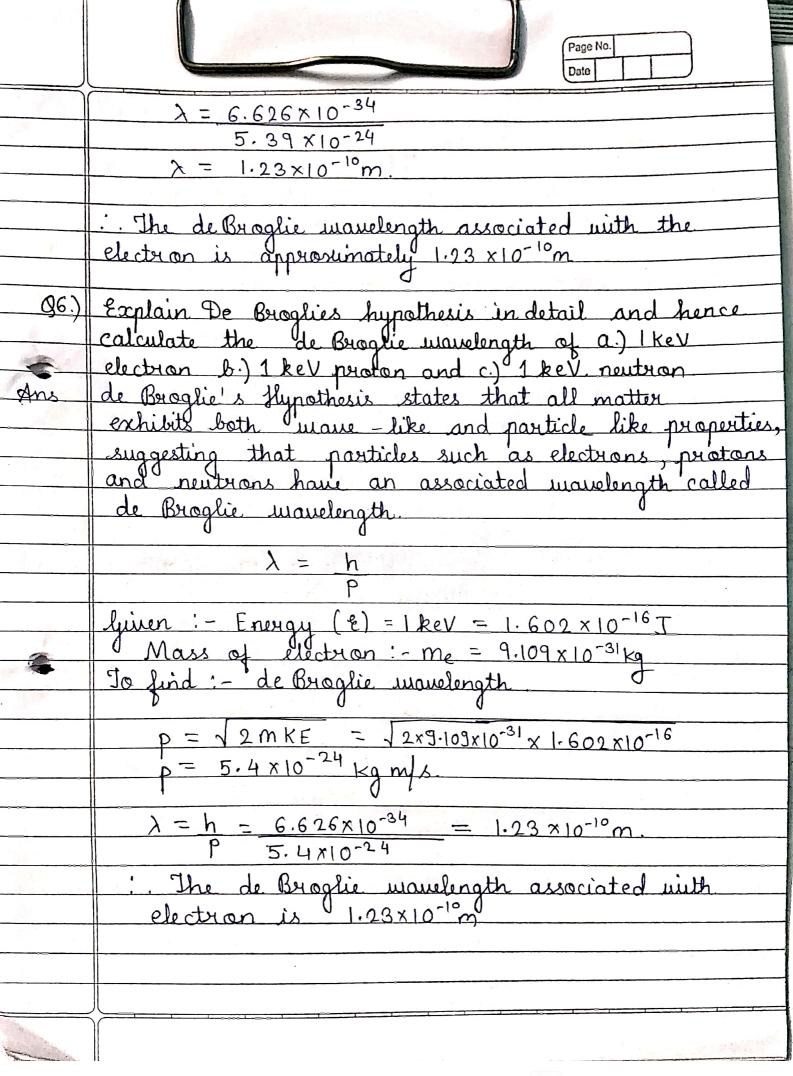






	Page No.
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(93.)	That is mare function 4? Write mathematical
191	conditions of well behaved wave function
Ans.	The mane function V represents the quantum state
	of a particle where $ \Psi'(x,t) ^2$ gives the probability
	density of finding the particle of postion & and time t.
	Conditions for well behaved mane are as follows:
	Normalization: - The mane function must be square
- 4	integrable over all space, so that total probability
	of finding the particle somewhere in space is I
	100
•	$\int_{-\infty} \Psi(x_3 \pm) ^2 dx = 1$
<u> </u>	Single Valuedness: - The mane function must be
	single valued at each point in space. I (x, t) is
	single valued for any x.
]'ii ·)	Continuity: - The mane function P(x, t) must be
	continous and smooth (differentiable) everywhere, except
-	possibly at points where the potential (V(x) is infinite. Finite amplitude: - The wave function , V(x, t) must
	Tinto anditude - The many lunction , V(x +) much
	I D. T. T. ALIAN INC. III CANAL
	14(x t) / 20 for all values of x.
\/\	Continous derivative: - dy is continous, except at infinite potential points dx
	inlinite notential noints dx
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94.) Ans.	Discuss any two applications of Junneling effect. The tunneling effect is a quantum phenomenon where particles can pass through a potential barrier that they classically shouldn't be able to
14 1	Scanning Turneling Microscope (STM):- STM Uses electron tunneling between a sharp tip and a surface to map atomic structure with high
	Nuclear Fusion in Stars: - Tunneling allows protons to overcome repulsion barriers, enabling fusion reactions in stars like the sun and releasing energy.
<u> </u>	of 10 kV What is De Broglie associated with this electron.
Ans.	Juien: - potential différence (V) = 10KV = 10000V Jo find: - De Broglie manelength (X) Solution: -
	$K \cdot F = eV$ ($K \cdot E = Kunetic Energy$) $K \cdot F = 1.602 \times 10^{-19} \times 10000$ $= 1.602 \times 10^{-15} T$.
	$KF = P^2$ $2m$
	$\frac{1.5 - \sqrt{2m \text{ Ki} \text{ E}}}{1.5 - \sqrt{2 \times 9.109 \times 10^{-31} \times 1.602 \times 10^{-15}}}$ $\frac{1.5 - \sqrt{2 \times 9.109 \times 10^{-31} \times 1.602 \times 10^{-15}}}{1.5 - \sqrt{2 \times 9.109 \times 10^{-24} \text{ kg m/s}}}$
	:. λ = h (de Broglie hypothesis)



	Page No. Date
	IkeV proton
	Given: - Provogy massof proton (mp) = 1.673×10 kg
	$p = \sqrt{2mE} = \sqrt{2 \times 1.673 \times 10^{-27} \times 1.602 \times 10^{-16}} = 7.31 \times 10^{-22} \text{ kgm/s}$ $\lambda = h = 6.626 \times 10^{-34} \approx 9.06 \times 10^{-13} \text{ m}$ $1 \times 10^{-2} \times 10^{-2} \times 10^{-2} \times 10^{-13} \times 10^$
	liven: - mass of neutron (mn) = 1.675 x 10-27kg
	$p = \sqrt{2mE} = \sqrt{2\times 1-675\times 10^{-27}\times 1.602\times 10^{-16}} = 7.31\times 10^{-22} \text{ m/s}$
	$1. \lambda = h = 6.626 \times 10^{-34} \text{ Js} \approx 9.06 \times 10^{-13} \text{ m}$ $1. \lambda = h = 6.626 \times 10^{-34} \text{ Js} \approx 9.06 \times 10^{-13} \text{ m}$
	i. The de broglie associated with proton and neutron is 9.06 × 10-13 m.
	neutron is 09.06 ×10-13 m.
Q 7.)	An electron is bound by a potential which closely
·	calculate the lowest two permissible energies (in
	electron volts) the electron can have.
Ans	Juien: - midth of square well (1) = 1 A°
	To find :- Lowest two permissible energies the
	electrion can have.
	Solution: $= n^2 h^2$
· · · · · · · · · · · · · · · · · · ·	$\frac{E_n = n^2 h^2}{8m L^2}$
	$\frac{1}{8} \times (9409 \times 10^{-34})^{2}$
	$\approx 1 \times 4.39 \times 10^{-68} \approx 6.02 \times 10^{-19} \text{ J}.$
	7.2872×10-50
	i E to eV
	E = 6.02 × 10-19 J = 3.76 eV. (i)
	1.602 ×10-19

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2.3	$E_{2} = (2)^{2} (6.626 \times 10^{-34})^{2}$ $8 \times (9.109 \times 10^{-31}) (1 \times 10^{-10})^{2}$ $E_{2} = 4 E_{1} $
	Thus, the lowest permisible energies for the electron are $E_1 \approx 3.76 \text{ eV}$, $E_2 \approx 15.04 \text{ eV}$.
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