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Science → attempt to understand natural phenomenon., predict, modify and control the phenomenon.

Exploration	}	observation, reasoning, mathematical modelling
Experimentation		
Prediction		
Modification		
Control		

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SCIENCE is dynamic  
Theories can be refined and made more accurate.  
eg. Theory of planetary motion  
1500's → Copernicus came up with  
the theory of planetary motion.



eg. Theory of planetary motion  
1500's → Copernicus came up with  
the theory of planetary motion.  
SUN → centre  
planets → travelled around in circular  
orbits.  
late 1500's → Tycho Brahe made some observ-  
-ations. He studied planetary motion  
and collected data.

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Kepler (1600's) examined data and refined Copernicus model and stated that planets moved around the sun in elliptic orbits.

Classical mechanics  $\rightarrow$  Newton's Laws extended by Euler for rigid bodies

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Classical mechanics  $\rightarrow$  Newton's Laws  
extended by Euler for  
rigid bodies

Could not explain atomic motion  $\rightarrow$

QUANTUM MECHANICS

PHYSICS  $\rightarrow$  study of physical world  
Basic laws of nature





The screenshot shows a digital note-taking application window titled "Note1 - Windows Journal". The interface includes a menu bar with "File", "Edit", "View", "Insert", "Actions", "Tools", and "Help". Below the menu is a toolbar with various drawing tools like pens, highlighters, eraser, and selection tools, along with a color palette. The main area contains handwritten text in black ink:

Classical Physics — macroscopic (nuclear)

1) Mechanics — motion of particles, rigid or deformable bodies

2) Electrodynamics  
electric and magnetic phenomenon.  
charges and magnetic fields  
Coulomb, Oersted, Ampere, Faraday,  
Maxwell

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charges area  
Coulomb, Oersted, Ampere, Faraday,  
Maxwell

- motion of current carrying conductor in a magnetic field
- response of a circuit to an ~~ac~~ ac voltage
- ⇒ Working of antenna.

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Working of antenna.

3 Optics → phenomenon involving light

4 Thermodynamics systems in macroscopic equilibrium

changes in internal energy, temperature of a system through work and transfer of heat

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mass } scales range of  
time } wide scales  
length }

length scales — smallest length  $10^{-15}$  m  
nuclear scales

large scale → astronomical scales  
universe  $10^{26}$  m



time scales  $10^{-22}$  sec to  $10^{10}$  sec

mass  $10^{-30}$  kg (electron) to  $10^{55}$  kg (Universe)

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4 fundamental forces

- 1 Gravitational force: mutual attraction between 2 bodies by virtue of their masses.



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2. Electromagnetic force: force between charged particles: If charges are at rest  $\rightarrow$  Coulomb's Law  
Can be attractive or repulsive  
Charges in motion produce magnetic fields



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2. Electromagnetic force: force between charged particles: If charges are at rest  $\rightarrow$  Coulomb's Law  
Can be attractive or repulsive  
Charges in motion produce magnetic fields and vice versa a magnetic field gives rise to force on a moving charge.  
act at a distance  
Electromagnetic forces dominate phenomenon at atomic and molecular scales

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3 Strong Nuclear Forces  
bind protons and neutrons in a nucleus.  
Without strong nuclear forces, the nucleus  
which consists of +ve charged protons and neutral  
neutrons would disintegrate.  
Range of operation of nuclear forces is very  
small  $\sim 10^{-16}$  m.

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4. Weak nuclear forces  
appear in certain nuclear processes  
 $\beta$  decay of nucleus.  $\rightarrow$  Nucleus emits an  
electron and an uncharged particle neutrino.

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stronger than gravitational forces but much  
weaker than strong nuclear forces.

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weaker than strong nuclear forces.

Relative strengths

<u>Strongest:</u>	Strong Nuclear force	$10^{-2}$
	Electromagnetic forces	$10^{-13}$
	Weak Nuclear forces	$10^{-39}$
	Gravitational	$10^{-39}$



The screenshot shows a Notepad window titled "Notepad - Windows Journal". The text is handwritten in black ink on a white background. The title of the notes is "UNIFICATION OF FORCES", which is underlined. Below the title, there are two points:

- a) - Newton: celestial and terrestrial mechanics governed by same force
- b) Maxwell: Unified Electricity, Magnetism and Optics.

c) Salam, Glashow & Weinberg : Unification of weak nuclear forces are seen as same aspect of a single electro-weak force.

### Conservation Laws

- Mass
- Energy
- Linear Momentum
- Angular Momentum