

MBT-403D
Paper Third
Nanobiotechnology (Max. marks: 100)

Unit I: Introduction to Nanobiotechnology; Concepts, historical perspective; Different formats of nanomaterials and applications with example for specific cases; Cellular Nanostructures; Nanopores; Biomolecular motors; Bio-inspired Nanostructures, Synthesis and characterization of different nanomaterials. Thin films; Colloidal nanostructures; Self Assembly, Nanovesicles; Nanospheres; Nanocapsules and their characterisation.

Unit II: Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for suitability of administration through various routes of delivery, advantages, strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers.

Nanoparticles for diagnostics and imaging (theranostics); concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development.

Unit III: Nanomaterials for catalysis, development and characterization of nanobiocatalysts, application of nanoscaffolds in synthesis, applications of nanobiocatalysis in the production of drugs and drug intermediates.

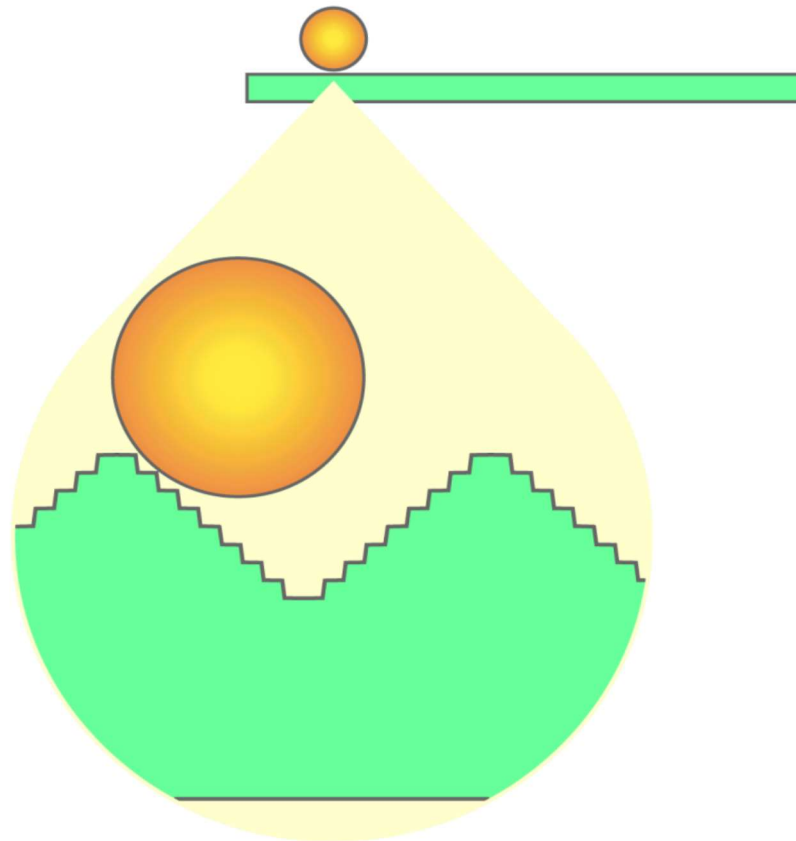
Unit IV: Introduction to Safety of nanomaterials, Basics of nanotoxicity, Models and assays for Nanotoxicity assessment; Fate of nanomaterials in different stratas of environment; Ecotoxicity models and assays; Life Cycle Assessment, containment.

Textbooks and References:

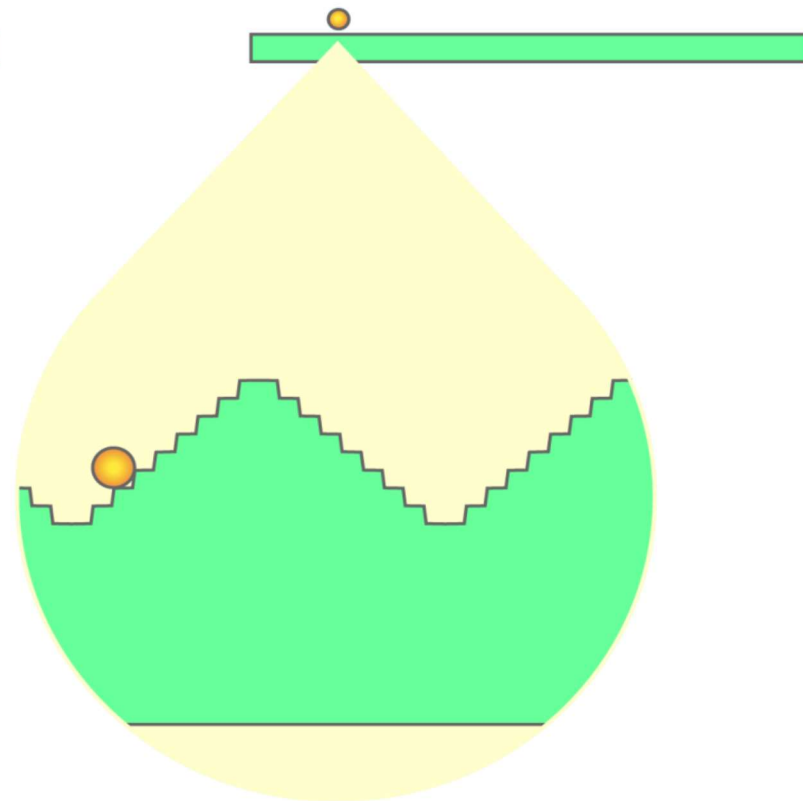
1. GeroDecher, Joseph B. Schlenoff, (2003); Multilayer Thin Films: Sequential Assembly of Nanocomposite Materials, Wiley-VCH Verlag GmbH & Co. KGaA
2. David S. Goodsell, (2004); Bionanotechnology: Lessons from Nature; Wiley-Liss
3. Neelina H. Malsch (2005), Biomedical Nanotechnology, CRC Press
4. Greg T. Hermanson, (2013); Bioconjugate Techniques, (3rd Edition); Elsevier
5. Recent review papers in the area of Nanomedicine.

Nanotechnology Plays by Different Rules

Normal scale



Nanoscale



Brief History, Continued

Dr. Richard P. Feynman

- *“Why cannot we write the entire 24 volumes of the Encyclopedia Britannica on the head of a pin?”*

Dr. Richard Feynman, one of America’s most notable physicists, 1918-1988.

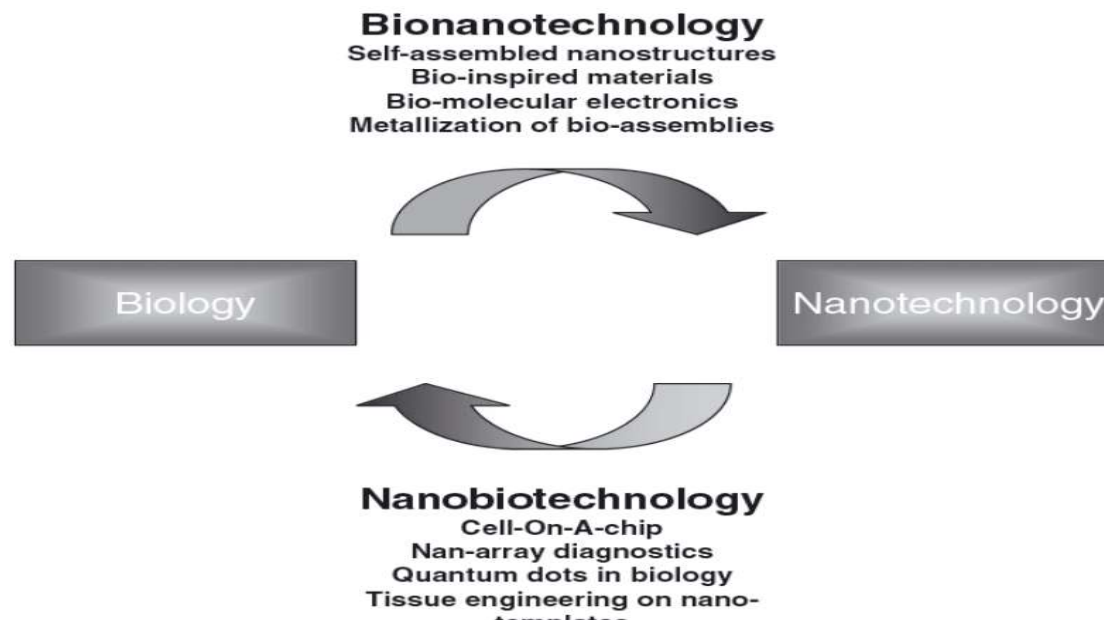


Figure 1.11: Richard Feynman.

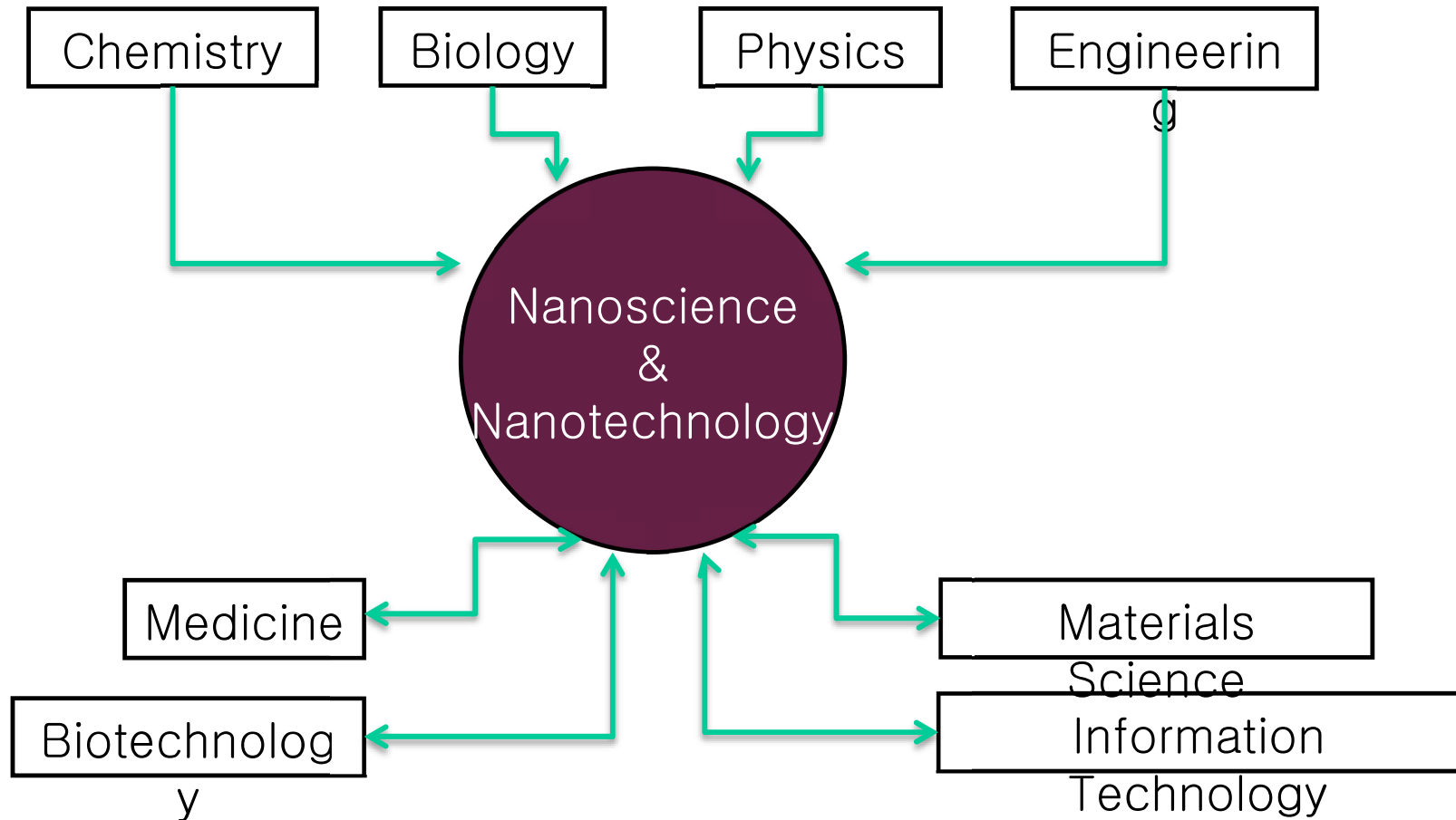
Nanotechnology

Nanotechnology: The art and science of manipulating and rearranging individual atoms and molecules to create useful materials, devices, and systems

Nanotechnology, in simple terms, means the study and exploitation of tiny objects, whose dimensions are just a few molecules and atoms. In strict scientific terms, nanotechnology concerns physical dimensions ranging from 1–100 nm (1 nm = 10^{-9} m = 10 atoms wide) down to 1 nm.



An Interdisciplinary Endeavor

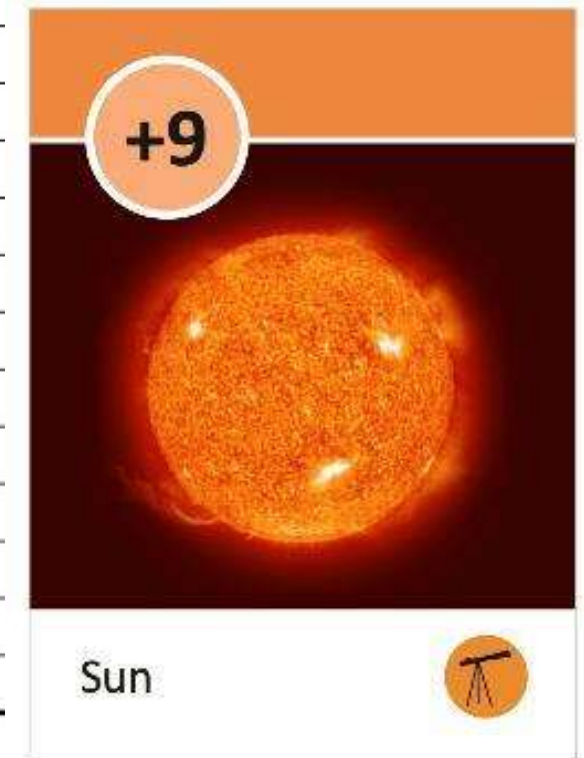


What is Nano?

Prefixes for SI Units			
Prefix	Symbol	Meaning	Notation
exa-	E	1,000,000,000,000,000,000.	1.E+18
peta-	P	1,000,000,000,000,000.	1.E+15
tera-	T	1,000,000,000,000.	1.E+12
giga-	G	1,000,000,000.	1.E+09
mega-	M	1,000,000.	1.E+06
kilo-	k	1,000.	1.E+03
hecto-	h	100.	1.E+02
deka-	da	10.	1.E+01
		1.	1.E+00
deci-	d	.1	1.E-01
centi-	c	.01	1.E-02
milli-	m	.001	1.E-03
micro-	μ	.000001	1.E-06
nano-	n	.000000001	1.E-09
pico-	p	.000000000001	1.E-12
femto-	f	.0000000000000001	1.E-15
atto-	a	.0000000000000000001	1.E-18

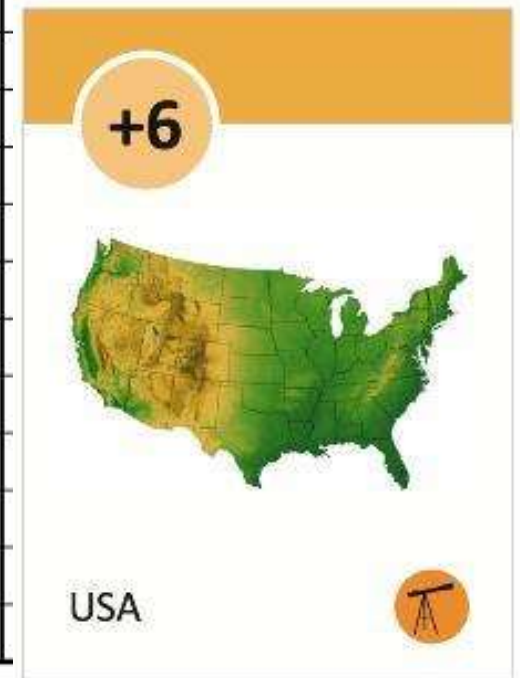
How Big is a Nanometer?

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Prefix	Symbol	Meaning	Notation
exa-	E	1,000,000,000,000,000,000.	1.E+18
peta-	P	1,000,000,000,000,000.	1.E+15
tera-	T	1,000,000,000,000.	1.E+12
giga-	G	1,000,000,000.	1.E+09
mega-	M	1,000,000.	
kilo-	k	1,000.	
hecto-	h	100.	
deka-	da	10.	
		1.	
deci-	d	.1	
centi-	c	.01	
milli-	m	.001	
micro-	μ	.000001	
nano-	n	.000000001	
pico-	p	.000000000001	
femto-	f	.0000000000000001	
atto-	a	.0000000000000000001	



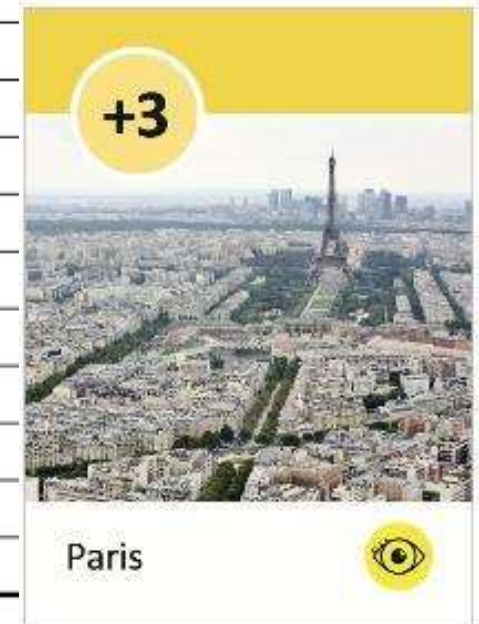
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deci-	d	.1	
centi-	c	.01	
milli-	m	.001	
micro-	μ	.000001	
nano-	n	.000000001	
pico-	p	.000000000001	
femto-	f	.0000000000000001	
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milli-	m	.001	1.E-03
micro-	μ	.000001	1.E-06
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atto-	a	.0000000000000000001	1.E-18

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Bicycle

