



One-Day Version of Clear Sunscreen

Student Materials

Contents

- Summary of Radiation Emitted by the Sun: Student Handout
- Summary of FDA Approved Sunscreen Ingredients: Student Handout
- Overview of Sunscreen Ingredients: Student Handout



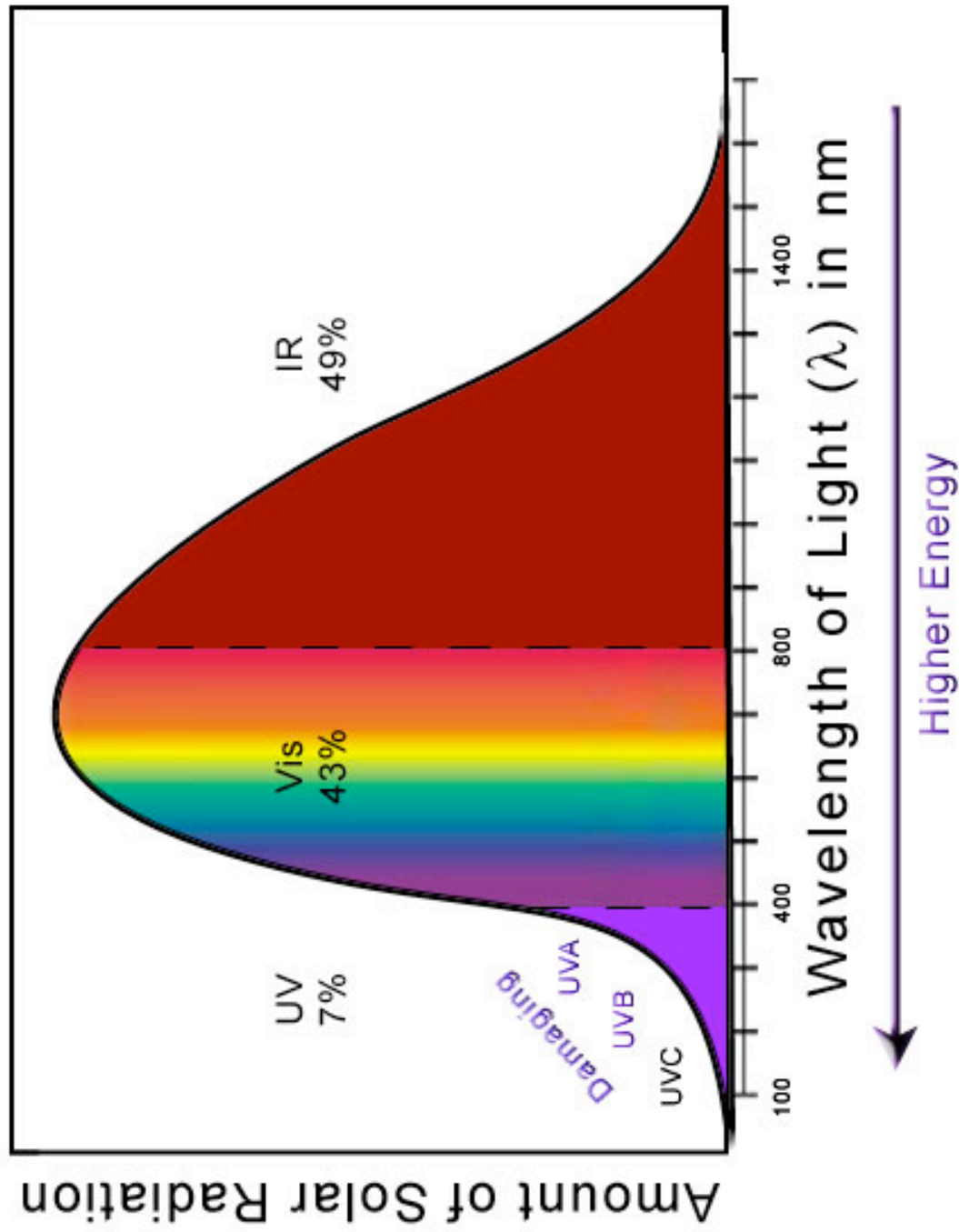
Summary of Radiation Emitted by the Sun: Student Handout

Chart of Different Kinds of Solar Radiation

Radiation Type	Characteristic Wavelength (λ)	Energy per Photon	% of Total Radiation Emitted by Sun	Effects on Human Skin	Visible to Human Eye?
UVC	~200-290 nm (Short-wave UV)	High Energy	~0% (<1% of all UV)	DNA Damage	No
UVB	~290-320 nm (Mid-range UV)	Medium Energy	~35% (5% of all UV)	Sunburn DNA Damage Skin Cancer	No
UVA	~320-400 nm (Long-wave UV)	Low Energy	~6.5% (95 % of all UV)	Tanning Skin Aging DNA Damage Skin Cancer	No
Visible	~400-800 nm	Lower Energy	~43 %	None Currently Known	Yes
IR	~800-120,000 nm	Lowest Energy	~49%	Heat Sensation (high λ IR)	No



Graph of Radiation Emitted by the Sun by Wavelength



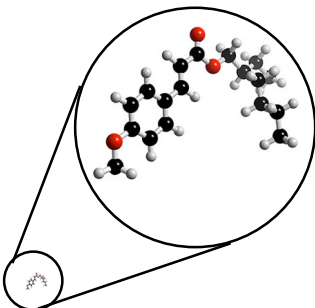
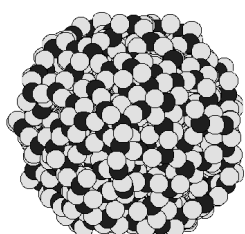
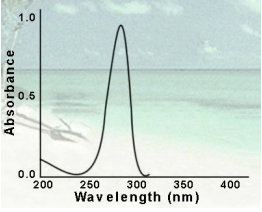
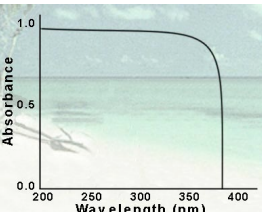
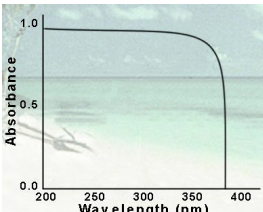
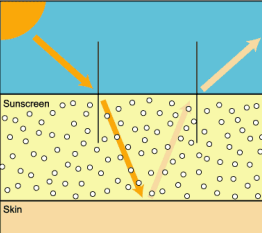
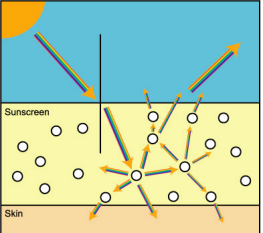


Summary of FDA Approved Sunscreen Ingredients: Student Handout

	λ range (nm)	Protection Against		Possible Allergies	Other Issues
		UVB 280-320 nm	UVA 320-400 nm		
Organic Ingredients					
PABA derivatives					
Padimate O (Octyl dimethyl PABA)	295-340	Good	Little	Yes	-
PABA (p-aminobenzoic acid)	200-320	Good	Little	Yes	Greasy, Stains
Cinnamates					
Octinoxate (Octyl methoxycinnamate) (OMC) (Parasol MCX)	295-350	Good	Little	Yes	-
Cinoxate	280-310	Good	Little	Yes	-
Salicylates					
Homosalate	295-340	Good	Little	Yes	-
Octisalate (Octyl salicylate)	295-330	Good	Little	Yes	-
Trolamin salicylate	260-355	Good	Little	Yes	-
Benzophenones					
Oxybenzone (Benzophenone-3)	295-375	Good	Some	Yes	-
Sulisobenzene (Benzophenone-4)	260-375	Good	Some	Yes	Hard to solubilize
Dioxybenzone (Benzophenone-8)	250-390	Good	Some	Yes	Hard to solubilize
Other Organics					
Ensulizole	290-340	Good	Little	Yes	-
Octocrylene	295-375	Good	Little	Yes	-
Menthyl anthranilate (Meradimate)	295-380	Good	Some	Yes	-
Avobezone (Parsol 1789) (Butyl methoxydibenzoyl methane)	295-395	Good	Good	Yes	If not well formulated, loses potency
NEW Ecamsule (Mexoryl SX)	310-370	Some	Good	Yes	Water-soluble
Inorganic Ingredients					
Titanium Dioxide	upto 365	Good	Good	No	-
Zinc Oxide	upto 380	Good	Good	No	-



Overview of Sunscreen Ingredients: Student Handout

	Organic Ingredients	Inorganic Ingredients (Nano)	Inorganic Ingredients (Large)
Atoms Involved	Carbon, Hydrogen, Oxygen, Nitrogen	Zinc, Titanium, Oxygen	Zinc, Titanium, Oxygen
Structure (not drawn to scale)	Individual molecule 	Cluster ~100 nm in diameter 	Cluster > 200 nm in diameter 
Interaction with UV light	Absorb specific λ 	Absorb all UV < critical λ 	Absorb all UV < critical λ 
Absorption Range	Parts of UVA or UVB spectrum	Broad spectrum UVA and UVB	Broad spectrum UVA and UVB
Interaction with Visible light	None	Minimal Scattering 	Much Scattering 
Appearance	Clear	Clear	White