



Lesson 2: All About Sunscreens

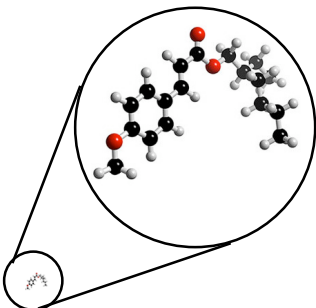

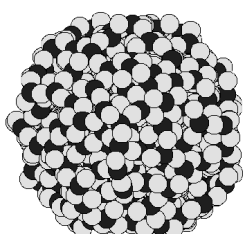
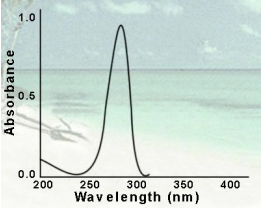
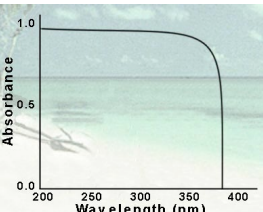
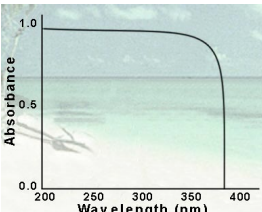
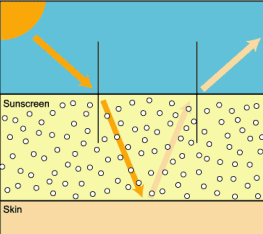
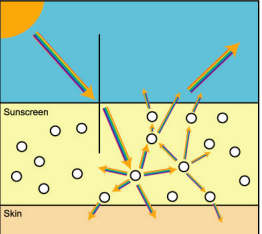
Student Materials

Contents

- Overview of Sunscreen Ingredients: Student Handout
- Light Reflection by Three Sunscreens: Student Worksheet
- Sunscreen Ingredients Activity: Student Instructions & Worksheet
- Summary of FDA Approved Sunscreen Ingredients: Student Handout
- Reflecting on the Guiding Questions: Student Worksheet



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



Name _____ Date _____ Period _____

Light Reflection by Three Sunscreens: Student Worksheet

Introduction

Three sunscreens were tested for reflection (back-scattering) with different wavelengths of light:

- One contains nanosized inorganic ingredients
- One contains traditional inorganic ingredients
- One contains organic ingredients

A graph was created to show the percent of light reflected by each sunscreen at different wavelengths and is included in this packet.

Instructions

Use the graph to answer the following questions for each sunscreen in the chart on the next page:

1. Will it appear white or clear on your skin? How do you know?
2. What size (approximately) are the molecules / clusters?
3. Can we tell how good a UV blocker it is from this graph? Why/ why not?
4. Which one of the sunscreens is it? How do you know?

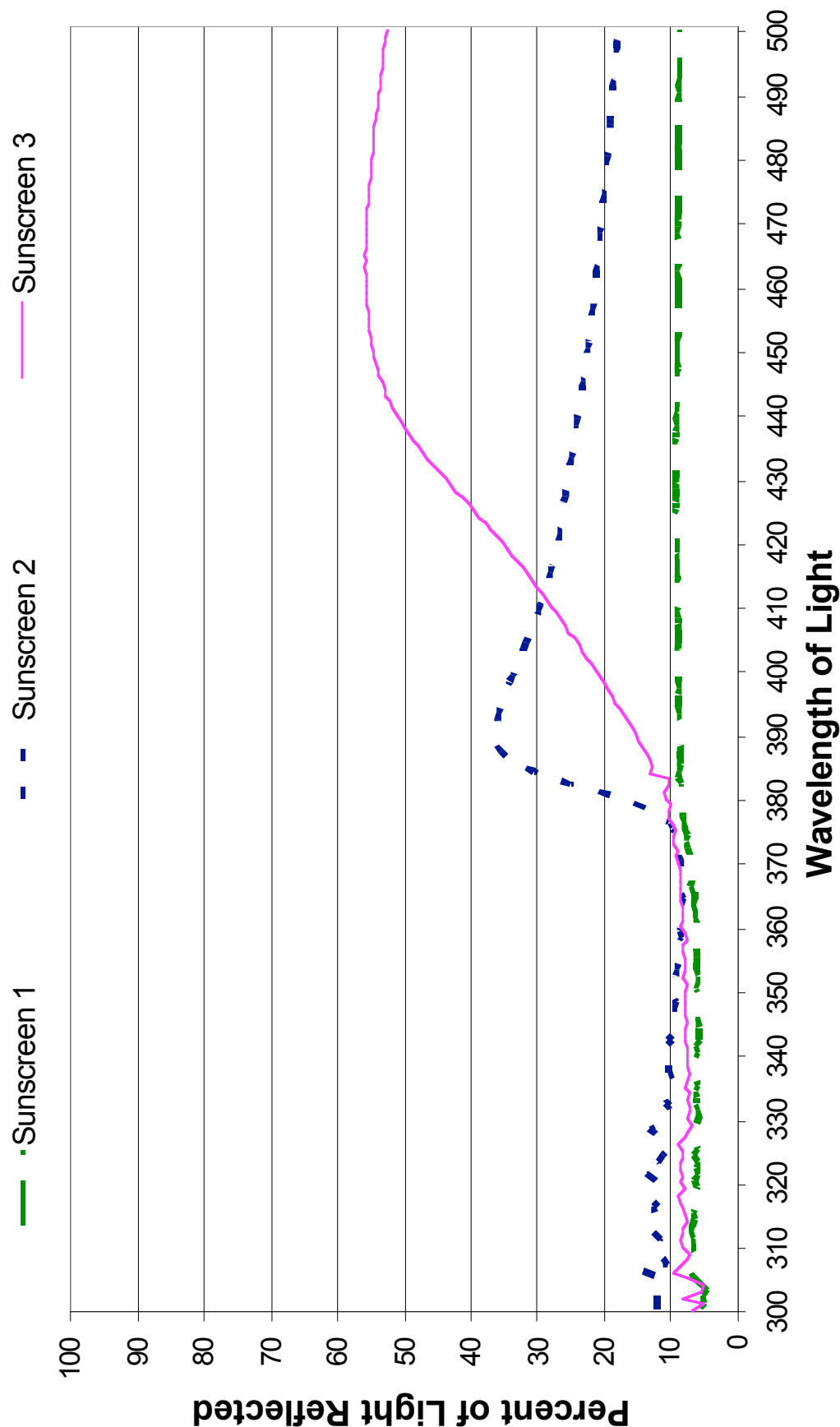


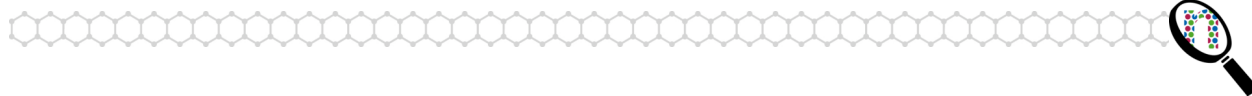
Light Reflection by Three Sunscreens Chart

	Appearance	Size	UV Blocking	Identity (w/ reason)
# 1				
# 2				
# 3				



Light Reflected by Three Screens





Sunscreen Ingredients Activity: Student Instructions & Worksheet

Most of us (hopefully) apply sunscreen to protect us from the sun when we are going to be outside for a long time. But how many of us have ever stopped to read the bottle to see what we are putting on our bodies? What kinds of chemicals are used to block the sun rays? Do different sunscreens use different ingredients to block the sun? How might the different ingredients used affect us? In this activity you'll take a look at several sunscreens to see what we are putting on our bodies when we use these products.

Materials

- Five different bottles of sunscreen.

To get a diverse group of sunscreens try to use more than one brand. Also see if you can find the following:

- One sunscreen with a high SPF (30-50).
- One sunscreen with a low SPF (5-15).
- One sunscreen designed for skiers or surfers.
- One sunscreen for sensitive skin or babies.
- One sunscreen that has zinc oxide (ZnO) or titanium dioxide (TiO₂) as an ingredient. *Note: the proper scientific name for TiO₂ is "titanium (IV) oxide", but the older name "titanium dioxide" is more commonly used.*

Instructions

Look at the back of one of the bottles. You should see a list of the "active ingredients" in the sunscreen. These are the ingredients that prevent sunlight from reaching your skin ("inactive ingredients" are added to influence the appearance, scent, texture and chemical stability of the sunscreen.) Also look to see what kind of protection the sunscreen claims to provide. Does it provide UVB protection? UVA protection? Does it claim to have "broad spectrum" protection? What is its SPF number? Does it make any other claims about its protection? Record your observations for each sunscreen in the data chart and then answer the questions that follow.

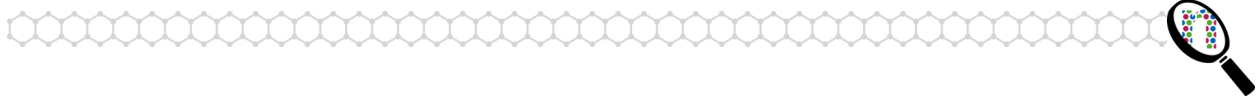


Data Chart

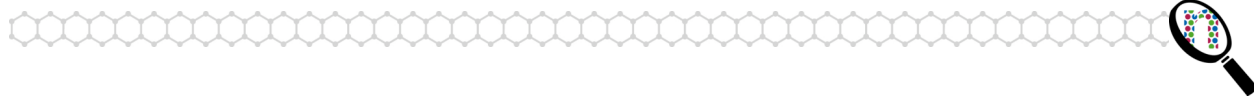
	Brand	Active Ingredients	SPF	UVB?	UVA?	Broad Spectrum?	Price
#1							
#2							
#3							
#4							
#5							

Questions

1. How many different active ingredients did most of the sunscreens have?
2. What were the most common active sunscreen ingredients you saw? Are these organic or inorganic ingredients?



3. Did any of the sunscreens you looked at have active ingredients that were very different from the rest? If so, what were they?
4. Were you able to find a sunscreen with inorganic ingredients in it? If so, which one(s) contained them?
5. How many of your sunscreens claimed to have UVA protection? UVB protection? Broadband protection?
6. Why do you think that many sunscreens have more than one active ingredient? Why can't they just put in more of the "best" one?



7. You have just looked at a sample of the different chemicals you are putting on your skin when you use sunscreen. Does this raise any health concerns for you? If so, what are some of the things you might be concerned about and why?

8. Where could you go to find out more information about possible health concerns?



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	-



Name _____ Date _____ Period _____

Reflecting on the Guiding Questions: Student Worksheet

Think about the activities you just completed. What did you learn that will help you answer the guiding questions? Jot down your notes in the spaces below.

1. What are the most important factors to consider in choosing a sunscreen?

What I learned in this activity:

What I still want to know:

2. How do you know if a sunscreen has “nano” ingredients?

What I learned in this activity:

What I still want to know:

3. How do “nano” sunscreen ingredients differ from most other ingredients currently used in sunscreens?

What I learned in this activity:

What I still want to know: