Skin Color Lab: NYSSLS Alignment

Teacher guide for the student worksheet at mrsajdak.com/skin-color (two pages, 21 questions: Day 1 on the front, Day 2 on the back; a low-write version has the same numbers). Anatomy & Physiology, Hole's Essentials Section 6.2: skin color. The answer key is kept off the website; write to rsajdak@buffaloschools.org for it. © 2026 Ryan Sajdak. Free to use, share and change under CC BY-NC-SA 4.0 (creativecommons.org/licenses/by-nc-sa/4.0): give credit, do not sell it, share your version the same way.

The model

Five tabs in one page, no login. Every run gives the same numbers, so the key is exact. **What is real:** people of every skin color have about the same number of melanocytes (about 1 in 10 cells of the stratum basale); darker skin makes more melanin, in larger granules that last longer on the way up; melanin gathers in a cap over each nucleus and absorbs UV. Burn times use rounded real sunburn doses and the rule that a UV index of 1 delivers about 1.5 J/m² of sunburning UV a minute. **What is made up to show a pattern:** the granule counts (4, 10, 24), the tan curve, and the folate and vitamin D percents. The folate and vitamin D idea is Nina Jablonski and George Chaplin's explanation for why skin color follows the strength of UV; it is the leading hypothesis, not a settled fact. The note at the foot of the lab page and the worksheet footer say which numbers are made up.

Teach skin color here as biology. The lab says light, medium and dark skin and never uses racial categories. Two points worth saying out loud: no amount of melanin makes skin immune to sun damage or skin cancer, and sunscreen numbers assume a thick coat put on again every two hours.

Objectives

The same four statements are printed on the worksheet, two at the top of each day, with a box to tick. They match the lesson objective AP.3.6.6: explain how melanin production determines skin color and protects against UV damage.

Day	I can	Questions
1	explain what makes one person's skin darker than another's, using melanocytes and melanin.	1 to 6
1	name the three pigments of skin and tell which one changed in a case.	7 to 11
2	plan a fair test and use its numbers to explain how melanin and sunscreen protect skin from UV light.	12 to 16
2	explain why a tan is a sign of damage, and why skin needs some UV but not too much.	17 to 21

Performance expectations: building toward

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **HS-LS1-3** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Worksheet link: students use a model of the epidermis to tie a cell (the melanocyte) and its product to a job of the whole organ (Q1 to Q6, HS-LS1-2). They plan a fair test and read how the skin answers UV over time, then weigh two needs that pull in opposite directions (Q12 to Q20, a step toward HS-LS1-3). This is practice toward both, not a full assessment of either. **DCI LS1.A:** Structure and Function.

Part by part

Part	SEP	CCC	What students do
1. Inside the epidermis Tab 1, Q1 to 6	SEP 2 Developing and using models SEP 4 Analyzing and interpreting data	Patterns Structure and Function	Count melanocytes and melanin granules in light, medium and dark skin. The finding that corrects the usual misconception: 3 melanocytes in every strip, but 4, 10 and 24 granules in a cell.

2. Three pigments Tab 2, Q7 to 11	SEP 2 Developing and using models SEP 6 Constructing explanations and designing solutions	Cause and Effect	Mix melanin, carotene and blood, then solve six cases. Names that come out: cyanosis, pallor, jaundice. Q11 is the clinical point that blood color is harder to see through more melanin, which is why lips and nail beds are checked.
3. Time in the sun Tab 3, Q12 to 16	SEP 3 Planning and carrying out investigations SEP 4, SEP 5 Using mathematics and computational thinking	Cause and Effect	Plan a fair test, then run it: burn times of 20, 40 and 80 minutes at UV 8, against 300 minutes with SPF 15. Halving and doubling with the UV index.
4. Grow a tan Tab 4, Q17 to 18	SEP 4 Analyzing and interpreting data	Stability and Change	Two weeks of sun, then six without. The melanin rises late, peaks after the sun stops, and fades in about a month. The best tan is worth less than SPF 3.
5. The balance Tab 5, Q19 to 20	SEP 2 Developing and using models SEP 6 Constructing explanations and designing solutions	Cause and Effect Stability and Change	Find the melanin level that keeps folate and vitamin D both safe at three latitudes, then say what helps a person who has moved.
Wrap it up Q21	SEP 6, SEP 7 Engaging in argument from evidence	Structure and Function	Claim, evidence and reasoning: melanin is a real sunscreen, a weak one, and it comes with a trade-off.

Running it

Two class periods, one device per student or pair. Day 1 is the front (Tabs 1 and 2), Day 2 is the back (Tabs 3 to 5). Each day stands alone. Tab 4 works well run once on the board. A link can open a tab directly: mrsajdak.com/skin-color/#sun (also #cells, #mix, #tan, #bal).

Explore, then explain, then apply. Each part starts with data questions (Q1 to 4, Q7 and 8, Q17, Q19). A READ FIRST line on the sheet then sends students to the **Learn It** box under the drawing in the lab, which opens only once they have the data, before the questions that use the ideas: Q5 and 6 (melanocytes pass melanin granules up to skin cells, granules wear out on the way up, UV breaks DNA in the nucleus, and the table decides between more melanocytes and more melanin), Q9 to 11 (the pigments stacked in layers, melanin as a filter over the blood, pallor and cyanosis from the amount and oxygen of blood, carotene against bilirubin and jaundice), Q18 (a tan as a response to DNA damage, the tan read as an SPF, burns as damage that adds up, why a tan fades) and Q20 and 21 (folate, vitamin D and food sources, melanin as a dial, trade-off, and the Jablonski and Chaplin explanation). Part 3 (Q12 to 16) has no Learn It: it is a fair test and its numbers. The slideshow has a matching Learn It slide at each of the four points for whole-class teaching.

Where students get stuck: Q3 (divide the cells by the melanocytes, 30 by 3); Q14 (the SPF 15 run changes sunscreen, so it is compared with light skin at no sunscreen, not with dark skin); Q19 (the 30° row has two right answers); and the base-tan question, where the strongest answers use both the small protection and the burn days it cost. Preview Tab 2's case 6 if a student in the room has liver disease in the family.