

Thread NSTA Light Misconception question - color of a shadow region

On Feb 16, 2011, at 10:12 PM, nishchal wrote:

Dear all

Here is a question designed by a colleague of mine for 14-15 year olds (grade 8- 9).

A shadow is a region which reflects less light than its surroundings because less light is incident on it due to obstruction by another object.

An opaque blue object casts a shadow on a red piece of paper in an open ground on a normal sunny day. What is the colour of the shadow region as your eyes see?

- A. Blue, as a blue object causes the shadow.***
- B. Black, as no light reaches within the shadow region.***
- C. A mix of blue and red, as blue light hits the red paper.***
- D. Red, as our eyes will receive red light from the shadow region.***

The reason to put this on the forum is to check –

- if this probes an age-independent misconception that "all shadows are BLACK"
- and if children understand if the colour of a surface as seen is the colour of reflected light; if so at what age
- and if they understand that colour and its intensity are different concepts (one is about frequency and the other is about amplitude) at what age.

Regards,
Nishchal Shukla
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From: William Robertson [mailto:wrobert9@ix.netcom.com]
Sent: Thursday, February 17, 2011 11:23 AM
To: nishchal
Cc: physicalscience@list.nsta.org; physics@list.nsta.org
Subject: Re: A question - colour of a shadow region

I have to ask the purpose of this item. Have the students actually investigated shadows outside on a sunny day? Have they investigated shadows inside in a dark room? If they haven't done these things, what is the point of the item? I don't see the point of asking students of this age what they might think without any direct experience with the phenomenon. Now, if there were evidence that student preconceptions about such things interfered with their understanding of light and

shadows, then I could see the point. Not seeing it right now. Maybe a bit of background on why the colleague is asking the question, beyond what you have provided.

Bill

Thanks Bill. The question is for 14-15 year olds who are expected to have observed a similar situation in their daily life. For eg. If you see someone wearing a red dress in sunlight, does the red dress become any other colour when the person gets under the shade of a tree or a bus stop?" Clearly she is in a 'shadow' under the tree or bus stop. They are expected to relate this observation to the given situation (an abstract format) and reason out the correct answer.

Regards,
Nishchal Shukla

From: William Robertson [mailto:wrobert9@ix.netcom.com]
Sent: Thursday, February 17, 2011 12:00 PM
To: nishchal
Cc: physicalscience@list.nsta.org; physics@list.nsta.org
Subject: Re: A question - colour of a shadow region

I think this question would work well as a "pre-instruction" item, determining what the students think prior to controlled investigation. Although students have probably observed such instances, they likely weren't focused on the colors involved. It's great in instruction to start with what students predict, and then devise investigations (either their own or provided by the instructor) that help them see if their predictions are correct. For that use, the item is fine. If it's intended as something to be graded as right or wrong, I wouldn't recommend that. Hope that makes sense.

Bill

That helps. Thank Bill.

Regards,
Nishchal Shukla

From: Matt Bobrowsky [mailto:matt@authentic-learning.com]
Sent: Thursday, February 17, 2011 4:55 PM
To: nishchal
Cc: physicalscience@list.nsta.org; physics@list.nsta.org
Subject: Re: A question - colour of a shadow region

Let's see... Even though the object is blocking DIRECT sunlight, there will still be lots of light reflecting off the surroundings that will strike the paper. So it will still appear red, and the correct answer is D. Is that the answer you intended?

Matt

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Dr. Matthew Bobrowsky
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=====

Yes Matt. That is the answer. Students should be able to reason out the way you have mentioned.

Regards,
Nishchal Shukla

Let's see... Even though the object is blocking DIRECT sunlight, there will still be lots of light reflecting off the surroundings that will strike the paper. So it will still appear red, and the correct answer is D. Is that the answer you intended?

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There has been an ongoing question about the role of mathematics in physics on the bio and chem lists. As I think about this question, I have to wonder how hs or college students, who have had a year of intro physics of the conventional sort, would answer this question?

It is a nice question because it does not fall on the narrow path of ideas that students negotiate in many intro physics courses.

joe

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