

Track separation on a reflective grating is
 $2 \mu\text{m}$ ($2 \text{ E-}6 \text{ m}$).
Is it possible to separate visible light
($\lambda=400\text{-}700 \text{ nm}$, $1 \text{ nm} = 1\text{E-}9 \text{ m}$) with it?

- A) Yes, of course !
- B) Yes, I guess.
- C) No, of course not !
- D) No, I guess.
- E) I do not know how to answer this question.

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Intensity of scattering $\sim 1/\lambda^4$

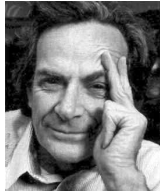
If white light hits the earth's atmosphere,
which color scatters MORE?

- A) Red light
- B) Blue light

What is science?

Science is a way of trying not to **fool** yourself.

- Richard **Feynman** (1918-1988)



The Philosophy of Science:

The final test of the validity of any idea about the physical world is
EXPERIMENT.

Corollaries:

Anecdotal evidence is not evidence. Only controlled experiments that can be reproduced by anyone count.

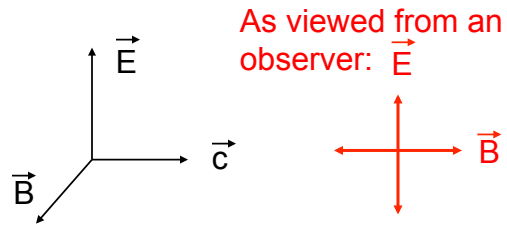
New theories do not overthrow old theories. They *extend* old theories. (Old theories, if firmly based on experiment, can't be wrong, but they can be incomplete.)

Any one human can be fooled.

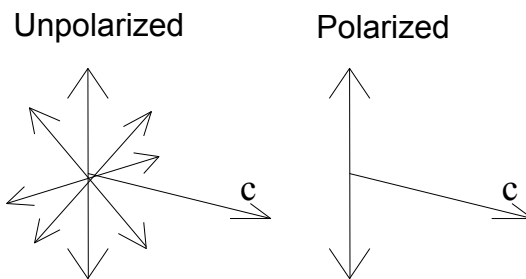
Scientists are human: ambitious, egotistical, eager for fame and recognition, eager to disprove the claims of their peers. This makes "establishment conspiracies" impossible.

Polarization of Light

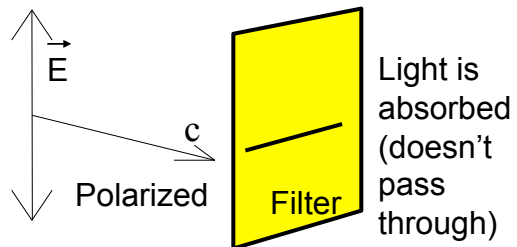
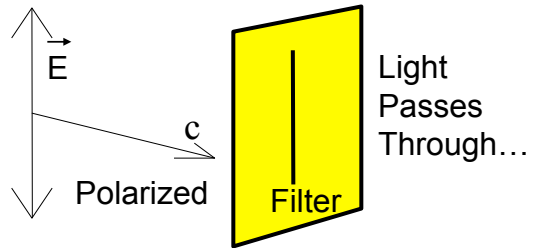
EM waves have a direction of the Electric field vector.

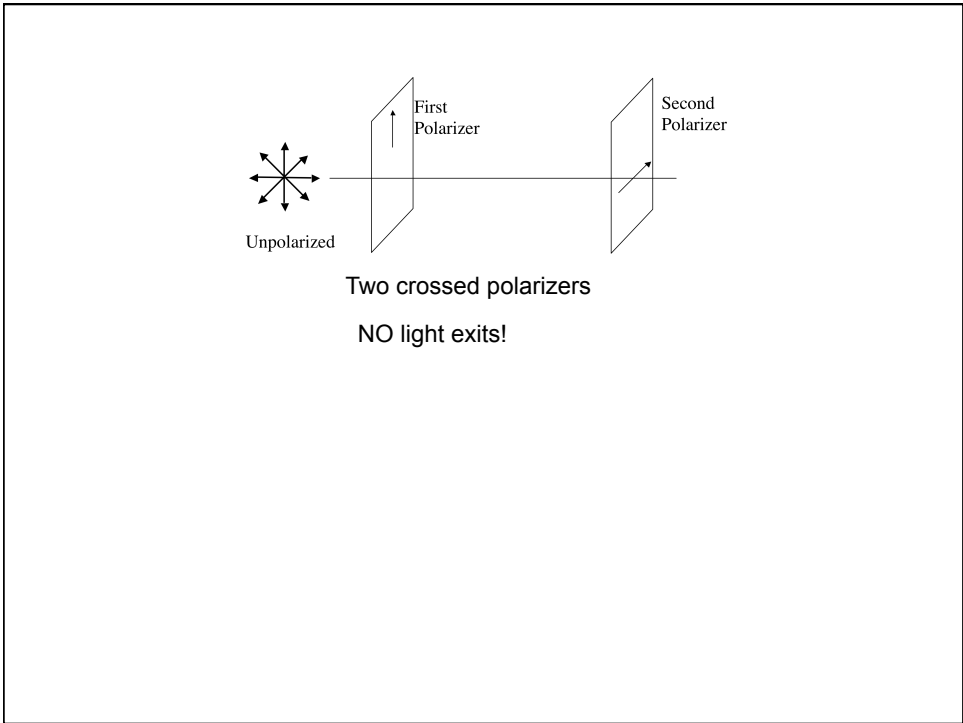
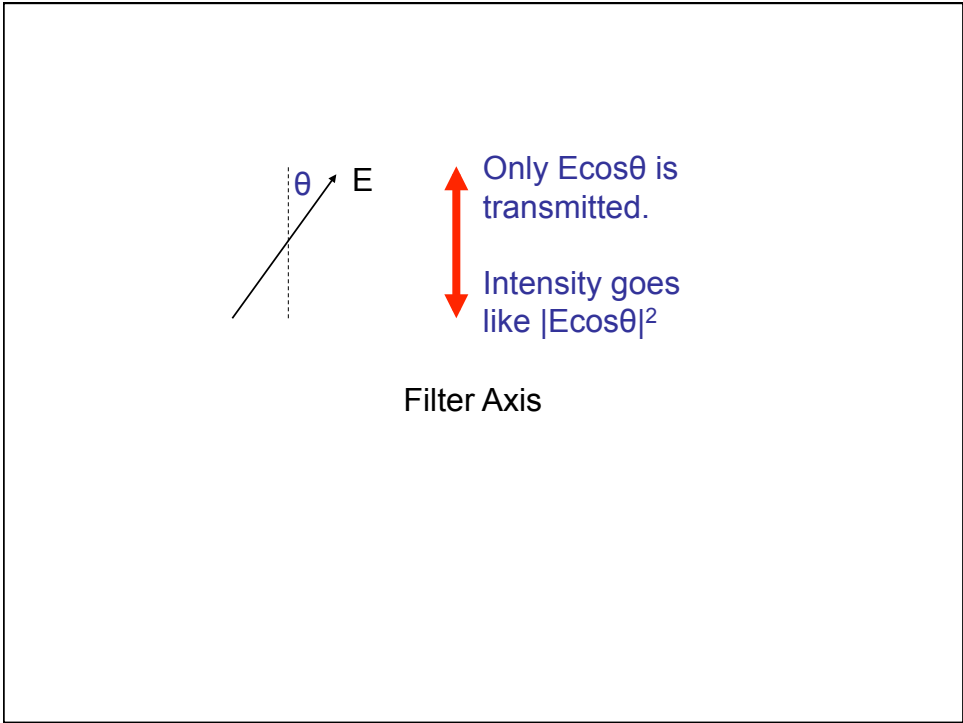


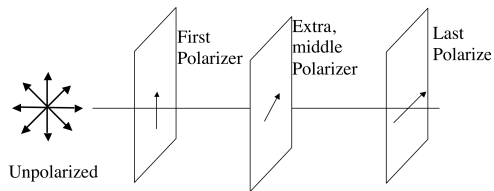
Ordinary Light is unpolarized



Polarizer = Polaroid filter
passes light with E-field along the
“pass axis” of the filter only.





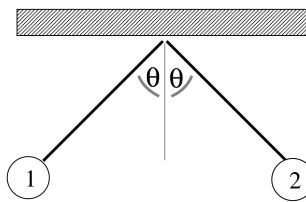


How about now?

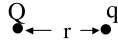
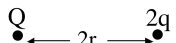
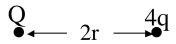
- A) Still no light! (I'm confident of this)
- B) Still no light (I'm not positive)
- C) Some light makes it through (I'm confident)
- D) Some light makes it through (??)

Two equal mass pith balls are charged and hang as shown. What can you say about Q_1 and Q_2 ?

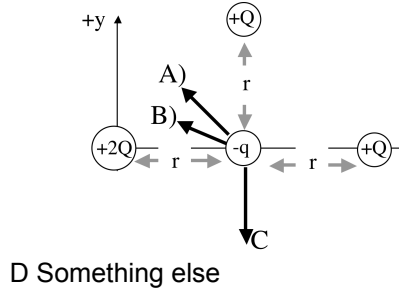
- A) $Q_1=Q_2$
- B) $Q_1=-Q_2$
- C) You can't conclude EITHER of the above from this figure



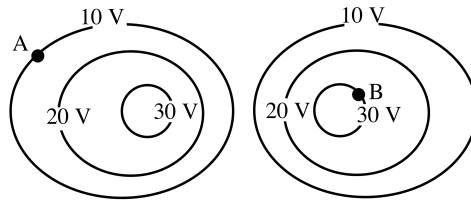
Rank the magnitude of the force on Q

- A) $F_A > F_B > F_C$ A: 
- B) $F_A > F_B = F_C$ B: 
- C) $F_A = F_C > F_B$ C: 
- D) $F_C > F_B > F_A$
- E) Something else

What is the direction of the net force on the test charge $-q$?



How much external work is required to move an electron from A to B?



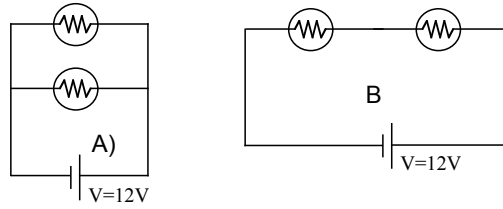
- A) +20 eV B) -20 eV C) +30 eV D) -30 eV
E) None of these!

At which point is $|E|$ greatest,
At which point is V highest?

$|E|, V$

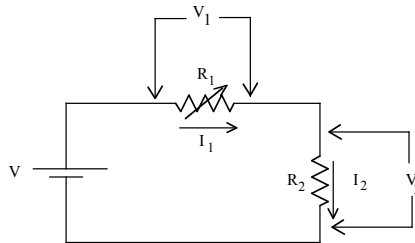
A) A, A
B) A, B
C) B, A
D) B, B
E) Other!!

Which circuit puts out more total light?



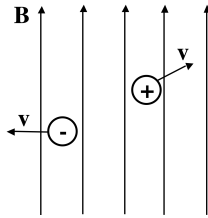
C) Both are the same

If variable resistor R_1 is decreased, what happens to voltage V_2 ?



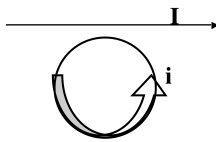
A) increases B) decreases C) constant

The direction of the forces on these
- and + charges are:



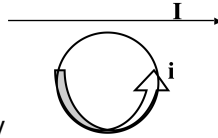
- A) in, zero B) out, zero C) in, in
D) out, in E) other!

The direction of the force on the loop is:



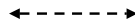
- A) up B) right C) into page
D) down E) other!

How could we have induced this current i in the small loop?



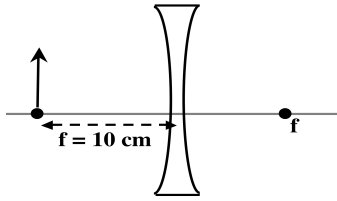
- A) increased I steadily
- B) decreased I steadily
- C) steady I to right
- D) steady I to left
- E) None of these would do it!

Describe the image seen from the right?



- A) Virtual, left of lens
- B) Virtual, right of lens
- C) Real, left of lens
- D) Real, right of lens
- E) No image forms if object is at f

$d_i = ?$



- A) +5 cm
- B) -5 cm
- C) +10 cm
- D) -10 cm
- E) Something else!