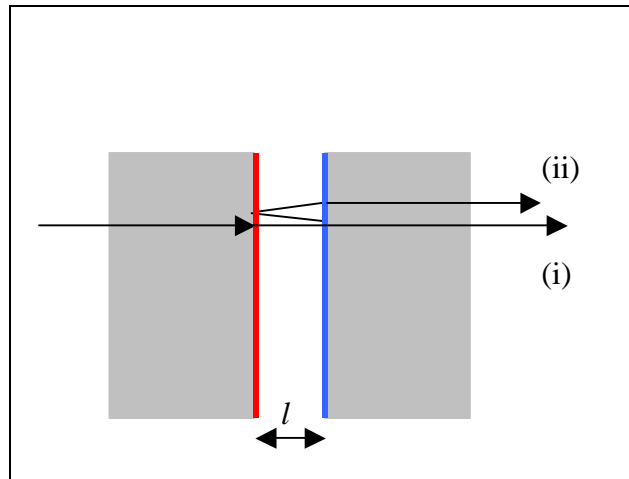


Year: 1980

Question Number: 19,20,21,22

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1980MC (19)



Ray (i) Light transmitted through the two interfaces: no  $\pi$  change

Ray (ii) Light - transmitted through the red interface (no  $\pi$  change), then  
 - reflected at the blue interface ( $\pi$  change), then  
 - reflected at the red interface ( $\pi$  change), then  
 - transmitted through the blue interface (no  $\pi$  change).

Overall: no  $\pi$  change

Ray (i) and ray (ii) produces destructive interference when

$$2l = (n + \frac{1}{2})\lambda \quad \text{or}$$

$$l = (2n + 1)\lambda/4$$

[\* emerging .... of very low intensity  $\rightarrow$  destructive interference]

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1980MC (20)

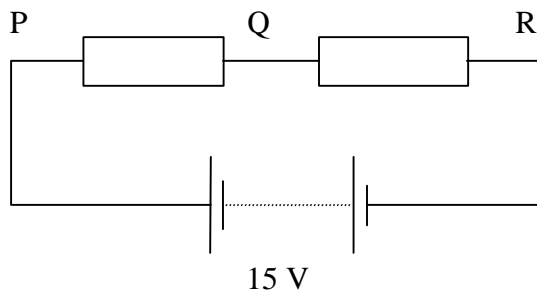
Approaching  $f' = \frac{c}{c-v} f$  or  $\frac{f'}{f} = \frac{1}{1-v/c}$

Solving,  $\frac{v}{c} = 1 - \frac{f}{f'} = 1 - \frac{99}{110} = 0.1$

Leaving  $f'' = \frac{c}{c+v} f = \frac{1}{1+v/c} f = \frac{99}{1+0.1} = 90 \text{ Hz}$  (the lowest frequency)

1980MC (21)

2



The voltmeter reads 3 V when it is connected across QR, so the p.d. across PQ is  $15 - 3 = 12 \text{ V}$ . The current in the circuit is  $12/3000 = 0.004 \text{ A}$ .

The p.d. across QR is 3 V, the current passing through the  $1 \text{ k}\Omega$  resistor is  $3/1000 = 0.003 \text{ A}$ .

The current passing through the voltmeter is  $0.004 - 0.003 = 0.001 \text{ A}$ .

The p.d. across the voltmeter is also 3 V, so its internal resistance =  $3/0.001 = 3 \text{ k}\Omega$ .

1980MC (22)

Each bulb is fully lit when the voltage is 3 V and the current is  $1.5\text{W}/3\text{V} = 0.5 \text{ A}$ .

The total p.d. is 6V (two identical circuits in series, each takes 3 V) and the total current is 2 A (four in parallel, each takes 0.5 A). Therefore, eight bulbs are used

