(5) 5

Wave Phenom # 5 p885 Problems 21, 23, 49
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p885 - Problems (5)

21) soap bubble $n_f = 1.40$ blue green when 1 ↳ red cancels

$\lambda_{red} = 670\,nm$

a) Light change phase from outside?

• Yes

b) Light change phase from inside?

(1) • No

c) λ_{red} in bubble

1 hard
1 soft

$$\lambda_f = \frac{\lambda_{air}}{n} = \frac{670\,nm}{1.40} = 479\,nm$$

constructive "2 hard, 2 soft, 2 same"
destructive opposite

d) t for destructive of red

$$2t = \lambda \qquad t = \frac{\lambda}{2} = \frac{479\,nm}{2}$$

$$= 240\,nm$$

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23) $t_f = 120\,nm$ film on glass sheet

$n_f = 1.25$

$n_{glass} = 1.50$

a) longest λ interfere destructive

$n = 1.00$ — hard

$n = 1.25$ — hard

$n = 1.50$

$4t = \lambda_{film}$ $\quad \lambda_f = \frac{\lambda_{air}}{n}$

$4t = \frac{\lambda_{air}}{n}$ $\quad \lambda_{air} = 4tn$

$4(120\,nm)(1.25) = 600\,nm$

constructive 2 hard 2 soft 2t

destructive opposite

(1)

b) longest λ interfere constructive

$2t = \lambda_{film}$ $\quad 2t = \frac{\lambda_{air}}{n}$ $\quad \lambda_{air} = 2tn$

$2(120\,nm)(1.25) = 300\,nm$

49) $\lambda = 690\,nm$ constructive 2 possible thickness

$n_f = 1.33$

$m = 1, 3, 5$

a) $m = 1$

1.00 — hard

1.33 — soft

1.00

$4t = \lambda_{film}$ $\quad \lambda_f = \frac{\lambda_{air}}{n}$

(1)

$t = \frac{\lambda_{air}}{4n} = \frac{690\,nm}{4(1.33)}$

$t = 130\,nm$

b) $m = 3$ $\quad t = \frac{3\lambda_{air}}{4n} = \frac{3(690\,nm)}{4(1.33)} = 390\,nm$

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- Reading

76) Which of the following are benefits of thin-film coatings on windows?

- They keep infrared radiation out of the house in the summer.
- They keep infrared radiation in the house in the winter

(1)

77) A 1.25 index film on 1.50 index glass reflect infrared radiation of λ 1000nm find the net reflective phase change of infrared radiation reflected off front surface to radiation from back surface

(1)

- a whole λ

1.00 ——— hard $\frac{1}{2}\lambda$
1.25 ——— hard $\frac{1}{2}\lambda$
1.50