1.2

a*λ*= 1300 nm

*n* = 1.447 and *Ng* = 1.462

*v* = *c/n* = (3×108 m s-1) / 1.447 = 2.073×108 m s-1

*vg* = c/*Ng* = (3×108 m s-1) / 1.462 = 2.052×108 m s-1

b Θp=arctan(*n*2/*n*1) =arctan(1/ 1.447) =34. 65

Θc=arcsin(*n*2/*n*1) =arcsin(1/ 1.447) = 43.72

c r =r∥= n1-n2/n1+n2=1.447-1/1.447+1=0.183

R =r2= (0.183)2 = 0.0335

d r =r∥= n1-n2/n1+n2=1-1.447/1+1.447=-0.183

R =r2= (-0.183)2 = 0.0335

1.4

SiO2 d=λ/4n2=900×10-9m /4(1.5)= 0.15μm

TiO2 d=λ/4n2=900×10-9m /4(2.3)= 0.10μm

1.6

a *p* = arctan(*n*2/*n*1) = arctan(1.33/ 1) = 53.1

b *c* = arcsin(*n*2/*n*1) = arcsin(1/ 1.33) = 48.75

1.13

a

b

c **Θ*c*12= arcsin(*n*2/*n*1) = arcsin(1/2) = 38.8,

Θ*c*13 = arcsin(*n*3/*n*1) = arcsin(1.6/2) = 53.1

d

1.16

SinΘ＝1.22λ/D

Θ＝SinΘ＝1.22λ/D＝1.22 590×10-9/2×10-2＝3.6×10-5 rad

Θ＝r/f

＝(40×10-2 m)( 3.6×10-5 rad) ＝1.44×10-5 m or 14.4μm.