Solutions for the questions

Theories of Light and Interference

Q.No	Ans	Q.No	Ans	Q.No	Ans	Q.No	Ans
1	2	11	3	21	4	31	2
2	4	12	3	22	1	32	4
3	2	13	1	23	2	33	2
4	1	14	2	24	2	34	1
5	1	15	2	25	3	35	2
6	3	16	1	26	4	36	4
7	1	17	1	27	2	37	1
8	4	18	3	28	3	38	3
9	4	19	1	29	2	39	4
10	3	20	3	30	1	40	2

Diffraction and Polarisation

1) D
2) C
3) D because wavelength of radio waves is more than the wavelengths of other waves given
4) C
5) C
6) C
7) C width of central band = $\frac{2\lambda D}{d} = \frac{2\times 5000\times 10^{-10}\times 2}{0.1\times 10^{-3}}$

   = 20mm
8) A If $\lambda_1 = \lambda$ D_1= D and D_1 = d

   then $\lambda_2 = 1.2\lambda$, D_2 = 0.9D and D_2 = 0.6d

   Therefore $\beta_2 = \frac{2\lambda_2 D_2}{d_2} = \frac{2\times 1.2\lambda\times 0.9D}{0.6d}$

   $1.8\left(\frac{2\lambda D}{d}\right) = 1.8\beta$

9) B We have $\beta = \frac{2\lambda D}{d} \Rightarrow \beta \; \alpha \; \lambda$

In water the wavelength of light will be

$\lambda_2 = \frac{\lambda_1}{n_w}$

$\frac{\beta_2}{\beta_1} = \frac{\lambda_2}{\lambda_1} = \frac{\lambda_1}{n_w \lambda_1} = \frac{1}{n_w} = \frac{3}{4}$ => $1 - \frac{\beta_2}{\beta_1} = 1 - \frac{3}{4}$ *or* $\frac{\beta_1 - \beta_2}{\beta_1}$ = 0.25

The percentage of change = 25%

10) C

11) D For n[th] secondary maximum $\sin \theta_n = \frac{(2n+1)\lambda}{2d}$

$\therefore \sin\theta_1 = \frac{3\lambda}{2d}$ *or* $\lambda = \frac{2 \times 0.012 \times 10^{-3} \times 0.0906}{3}$

= 7248 x 10^{-10} m

12) C For n[th] secondary minimum $\sin\theta_n = \frac{n\lambda}{2d}$

$\therefore \sin\theta_2 = \frac{2 \times 6000 \times 10^{-10}}{24 \times 10^{-5} \times 10^{-2}} = \frac{1}{2}$

$\theta_2 = 30^0$

13) A for n[th] minimum, $x_n = \frac{nD\lambda}{d}$

$\lambda = \frac{5 \times 10^{-3} \times 0.3 \times 10^{-3}}{3}$

= 5 x 10^{-7} = 5000Å

14) D for n[th] minimum $d\sin\theta = n\lambda$ but $d\sin\theta$ = path difference

Therefore 3λ = 18 x 10^{-7} or λ = 6 x 10^{-7} m

15) B for maxima (a + b) sin θ = nλ in grating

where n= 0, 1, 2, ...

16) D because R P = $\frac{2n\sin\theta}{\lambda} \Rightarrow RP \;\; \alpha \;\; \frac{1}{\lambda}$

17) A limit of resolution, dx = $\frac{\lambda}{2n\sin\theta}$

n = 1 $\therefore \sin\theta = \frac{4243 \times 10^{-10}}{2 \times 3 \times 10^{-7}}$

= 707.1 x 10^{-3} = 0.7071

$\theta = 45^0$

18) D

19) B

20) B $d\theta = \frac{1.22\lambda}{D} = \frac{1.22 \times 6 \times 10^{-7}}{0.6}$

= 1.22 x 10^{-6} rad

21) B

22) A

23) C

24) C i - r = 20^0 & i + r = 90^0 on subtracting 2r = 70^0 or r = 35^0

25) D $\tan i = n = \frac{C}{C_m}$ or $C_m = \frac{C}{\tan i}$ = C cot i

26) D $\tan\theta = n = \frac{\lambda_a}{\lambda_m}$

$$\lambda_m = \frac{\lambda_a}{\tan\theta} = \lambda_a \cot\theta$$

27) C

28) D

29) B for calcite which is a negative crystal $V_O < V_e$ hence $n_O > n_e$

30) B for o - ray velocity is same in all directions and hence wavefront is sphere
for e - ray, the wavefront is sphereoid as the velocity is different in different directions

31) C

32) D

33) C Leave rotatory substance turns the plane of vibration in anticlockwise direction

34) B θ = st
t = 1.52/380 = 0.004 m

35) C θ = slc

$$S = \frac{18 \times \frac{\pi}{180}}{0.2 \times 50} = 0.0314$$

36) B $\theta \ \alpha \ C \ \alpha \ \frac{m}{v}$

Since m is constant $\frac{\theta_2}{\theta_1} = \frac{V_1}{V_2} = \frac{70}{180}$ or $\theta_2 = 3.5^0$

37) D $\theta_{solution} = 2\ \theta_{quartz}$
s l c = 2 s^1t

$$t = \frac{0.01 \times 0.19 \times 200}{2 \times 380} = 0.5 \times 10^{-3} m$$

38) C

39) B $\tan\theta_p = n = \frac{1}{\sin\theta_C}$

or $\sin\theta_C = \frac{1}{\tan\theta_C} = \cot\theta_p$

40 D