

Question 30 (Answer: **A**)

- The largest possible diffraction angle is 90° , where $\sin \theta = 1$.
- So $n_{\max} = d/\lambda = (2.5 \times 10^{-6})/(550 \times 10^{-9}) = 4.5$.
- The order has to be a whole number, so the highest one produced is the 4th.

Question 29 (Answer: **A**)

- In $n\lambda = d \sin \theta$, d is the spacing between adjacent slits of the grating.
- The distance from the grating to the screen does not appear in the equation at all.
- The other three symbols are described correctly.

Question 30 (Answer: **B**)

- $d = 1/400 \text{ mm} = 2.5 \times 10^{-6} \text{ m}$, so $n_{\max} = d/\lambda = 3.57$ – the third order.
- Maxima appear on *both* sides at orders 1, 2 and 3, plus the straight-through zero order.
- Total = $2 \times 3 + 1 = 7$.

Question 30 (Answer: **D**)

- $d = 1/450 \text{ mm} = 2.22 \times 10^{-6} \text{ m}$.
- $\sin \theta = n\lambda/d = 2(680 \times 10^{-9})/(2.22 \times 10^{-6}) = 0.612$.
- $\theta = 37.7^\circ$, which rounds to 38° .

Question 29 (Answer: **C**)

- Rearranging $n\lambda = d \sin \theta$ gives $n = (d/\lambda) \sin \theta$.
- So a graph of n against $\sin \theta$ has gradient $G = d/\lambda$, and $\lambda = d/G$.
- With 300 lines per mm, $d = 3.33 \times 10^{-6} \text{ m}$, so $\lambda = 3.33 \times 10^{-6}/G$.

Question 28 (Answer: **B**)

- $d = 1/5000 \text{ cm} = 2.0 \times 10^{-6} \text{ m}$.
- $n\lambda = d \sin \theta$, so $2\lambda = (2.0 \times 10^{-6})(0.5) = 1.0 \times 10^{-6}$.
- $\lambda = 5.0 \times 10^{-7} \text{ m}$; A forgets to divide by the order.

6(a)	wave passes (through) an aperture and spreads or wave passes (by / through / around) an edge and spreads
6(b)(i)	$v = f\lambda$ $f = 3.00 \times 10^8 / 720 \times 10^{-9}$ $= 4.2 \times 10^{14} \text{ Hz}$
6(b)(ii)	$d = n\lambda / \sin \theta$ $d = (2 \times 720 \times 10^{-9}) / \sin 26$ $(= 3.3 \times 10^{-6} \text{ m})$ number of lines per m $= 1 / (3.3 \times 10^{-6})$ $= 3.0 \times 10^5 \text{ m}^{-1}$
6(b)(iii)	$\lambda \times 3 = 720 \times 2 \text{ or } \frac{1}{3.0 \times 10^5} \sin 26 = 3\lambda$ $\lambda = 480 \text{ nm}$

Question 29 (Answer: **C**)

- $d = 1/400 \text{ mm} = 2.50 \times 10^{-6} \text{ m}$.
- $\sin \theta_2 = 2\lambda/d = 0.4536$ gives $\theta_2 = 27.0^\circ$; $\sin \theta_3 = 0.6804$ gives $\theta_3 = 42.9^\circ$.
- The angle *between* them is $42.9 - 27.0 = 15.9^\circ$; D is simply θ_2 itself.