TEST

JEE Mains PYQs Wave optics (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 30 Questions

Section 1 : Section A - 30 Questions

SECTION INSTRUCTIONS

This section contains 30 MCQs. +4 for every correct answer, -1 for every incorrect answer

1 Two light waves from two coherent sources have same intensity $I_1 = I_2 = I_0$. In interference pattern the intensity of light at minima is zero. What will be the intensity of light at maxima?

- I_0
- $2\ I_0$
- $5\ I_0$
- $4\ I_0$

Correct: +4 · Incorrect: -1

2 A galaxy is moving away from the earth at a speed of 286 kms^{-1}. The shift in the wavelength of a redline at 630nm is $x \times 10^{-10}$m. The value of x, to nearest integer is____(take the value of speed of light c, as $3\times10^8\ ms^{-1}$).

- 2
- 4
- 6
- 8

Correct: +4 · Incorrect: -1

3 In a interference experiment the ratio of amplitude of coherent waves is $\frac{a_1}{a_2}=\frac{1}{3}$. The ratio of maximum and minimum intensities of fringes will be

- 2
- 18
- 4
- 9

Correct: +4 · Incorrect: -1

4 On a hot summer night, the refractive index of air is smallest near the ground and increases with height from the ground. When a light beam is directed horizontally the Huygens' principle leads us to conclude that it travels, the light beam:

- bends downwards
- bends upwards
- becomes narrower
- goes horizontally without any deflection

Correct: +4 · Incorrect: -1

5 n identical waves each of intensity I_0 interfere with each other. The ratio of maximum intensities if the interference is (i) coherent and (ii) incoherent is

- n^2
- 1/n
- $1/n^2$
- n

Correct: +4 · Incorrect: -1

6 Two coherent plane light waves of equal amplitude makes a small angel α (<<1) with each other. They fall almost normally on a screen. If λ is the wavelength of light waves, the fringe width Δx of interference patterns of the two sets of waves on the screen is

- $\frac{2\lambda}{\alpha}$
- $\frac{\lambda}{\alpha}$

○ $\frac{\lambda}{(2\alpha)}$

○ $\frac{\lambda}{\sqrt{\alpha}}$

Correct: +4 · Incorrect: -1

7 The question has a paragraph followed by two statements, Statements 1 and statemetn2. Of the given four alternatives after the statements, choose the one that describes the statements.
A thin air klm is formed by putting the convex surface of a plane convex lens over a plane glass plate. With monochromatic light, this klm gives an interference pattern due to light reflected from the top (convex_ surface and the bottom (glass plate) surface of the klm.
Statement 1: When light reflects from the air glass plate interface, the reflected wave suffers a phase change of it.
Statement 2: The centre of interference pattern is dark.

○ Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 2

○ Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 2

○ Statement 1 is false, Statement 2 is true

○ Statement 1 is true, Statement 2 is false

Correct: +4 · Incorrect: -1

8 The width of one of the two slits in a Young's double slit experiment is three times the other slit. IF the amplitude of the light coming from a slit is proportional to the slit width, the ratio of minimum to maximum intensity in the interference pattern is x: 4 where x is ___

○ 1

○ 2

○ 3

○ 4

Correct: +4 · Incorrect: -1

9 In a Young's double slit experiment two slits are separated by 2mm and the scenn is placed one meter away. When a light of wavelength 500nm is used, the fringe separation will be

○ 0.25 mm

○ 0.75 mm

○ 0.50 mm

○ 1 mm

Correct: +4 · Incorrect: -1

10 In a Young's double slit experiment, light of 500 nm is used to produce an interference pattern. When the distance between the slits is 0.05 mm, the angular width ?(in degree) of the fringes formed on the distance screen is close to

- 0.17°
- 0.57°
- 1.7°
- 0.07°

Correct: +4 · Incorrect: -1

11 In a Young's double slit experiment with slit separation 0.1 mm, one observes bright fringe at angle 1/40 rad by using light of wavelength λ_1. When the light of wavelength λ_2 is used a bright fringe is seen at the same angle in the same set up. Given that l_1 and l_2 are in visible range (380 nm to 740 nm) their values are

- 625 nm, 500 nm
- 380 nm, 525 nm
- 380 nm, 500 nm
- 400 nm, 500 nm

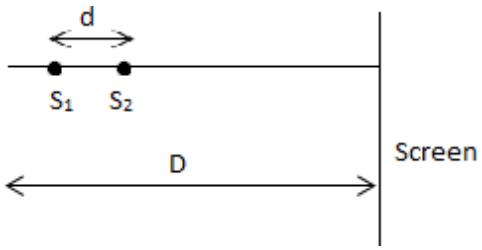
Correct: +4 · Incorrect: -1

12 In a Yong's double slit experiment, the distance between the two identical slits is 6.1 times larger than the slit width. Then the number of intensity maxima observed within the central maximum of the angle slit diffraction pattern is

- 3
- 6
- 12
- 24

Correct: +4 · Incorrect: -1

13 Two coherent point sources S_1 and S_2 are separated by a small distance 'd' as shown. The fringes obtained on the screen will be



- ○ points
- ○ straight lines
- ○ semicircles
- ○ concentric circles

Correct: +4 · Incorrect: -1

14 The maximum number of possible interference maxima for slit separation equal to 1.8l, where λ is the wavelength of light used, in a Young's double slit experiment, is

- ○ zero
- ○ 3
- ○ inknite
- ○ 5

Correct: +4 · Incorrect: -1

15 In a Young's double slit experiment with light of wavelength λ, the fringe pattern on the screen has fringe width β. When two thin transparent glass (refractive index μ) plates of thickness t_1 and t_2 ($t_1 > t_2$) are placed in the path of the two beams respectively, the fringe partern will shift by a distance

- ○ $\frac{\beta(\mu-1)}{\lambda}\left(\frac{t_1}{t_2}\right)$
- ○ $\frac{\mu\beta}{\lambda}\frac{t_1}{t_2}$
- ○ $\frac{\beta(\mu-1)}{\lambda}(t_1-t_2)$
- ○ $(\mu-1)\frac{\lambda}{\beta}(t_1+t_2)$

Correct: +4 · Incorrect: -1

16 In a Young's double slit experiment, the two slits act as coherent sources of wave of equal amplitude A and wavelength λ. In another experiment with the same arrangement the two slits are made to act as incoherent sources of waves of same amplitude and wavelength. If the intensity at the middle point of the screen in the krst case is I_1 and in the second case is I_2, then the ratio I_1/I_2 is

- ○ 2

- ○ 1
- ○ 0.5
- ○ 4

Correct: +4 · Incorrect: -1

17 With what speed should the galaxy move outward with respect to earth so that the sodium D line at wavelength 5890 $\mathring{A}$ is observed at 5896 $\mathring{A}$?

- ○ 306 km/sec
- ○ 322 km/sec
- ○ 296 km/sec
- ○ 336 km/sec

Correct: +4 · Incorrect: -1

18 Consider the diffraction pattern obtained from the sunlight incident on a pinhole of diameter 0.1 μm. IF the diameter of the pinhole is slightly increased, it will affect the diffraction pattern is such that

- ○ its size decreases, and intensity decreases
- ○ its size increases, and intensity increases
- ○ its size increases, and intensity decreases
- ○ its size decreases, and intensity increases

Correct: +4 · Incorrect: -1

19 The value of numerical aperture of the objective lens of a microscope is 1.25. If light of wavelength 5000 $\mathring{A}$ is used, the minimum separation between two points, to be seen as distinct will be

- ○ 0.24 μm
- ○ 0.38 μm
- ○ 0.12 μm
- ○ 0.48 μm

Correct: +4 · Incorrect: -1

20 Diameter of the objective lens of a telescope is 250cm. For light fo wavelength 600nm. Coming from a distance object, the limit of resolution of the telescope is close to

- ○ 1.5×10^{-7} rad
- ○ 2.0×10^{-7} rad
- ○ 3.0×10^{-7} rad
- ○ 4.5×10^{-7} rad

Correct: +4 · Incorrect: -1

21 In a double slit experiment green light (5.303 $\mathring{A}$) falls on a double slit having a separation of 19.44 μm and width of 4.05 μm. The number of bright fringes between the krst and the second diffraction minima is

- ○ 10
- ○ 05
- ○ 04
- ○ 09

Correct: +4 · Incorrect: -1

22 The angular width of the central maximum in a single slit diffraction pattern is 60°. The width of the slit is 1 μm. The slit is illuminated by monochromatic plane waves. IF another slit of same width is made near it, Young's fringes can be observed on a screen placed at a distance 50cm from the slits. If the observed fringe width is 1cm, what is slit separation distance? (i.e distance between the centers of each slit)

- ○ 25 μm
- ○ 50 μm
- ○ 75 μm
- ○ 100 μm

Correct: +4 · Incorrect: -1

23 Unpolarized light of intensity I is incident on a system of two polarizers. A followed by B. The intensity of emergent light is I/2. If a third polarizer is C is placed between A and B, the intensity of emergent light is reduced to I/3. The angle between the polarizers A and C is θ. Then

- ○ $cos\theta=\left(\frac{2}{3}\right)^{1/4}$

○ $cos\theta = \left(\frac{1}{3}\right)^{1/4}$

○ $cos\theta = \left(\frac{1}{3}\right)^{1/2}$

○ $cos\theta = \left(\frac{2}{3}\right)^{1/2}$

Correct: +4 · Incorrect: -1

24 A single slit of width 0.1mm is illuminated by a parallel beam of light of wavelength 6000 $\AA$ and diffraction bands are observed on a screen 0.5 m from the slit. The distance of the third dark band from the central bright band is

○ 3mm

○ 9mm

○ 4.5mm

○ 1.5mm

Correct: +4 · Incorrect: -1

25 Two stars are 10 light years away from the earth. They are seen through a telescope of objective diameter 30cm. The wavelength of light is 600nm. To see the stars just revolved by the telescope, the minimum distance between them should be (1 light year = 9.46×10^{15}m) of the order of

○ 10^8 km

○ 10^{10} km

○ 10^{11} km

○ 10^6 km

Correct: +4 · Incorrect: -1

26 Unpolarized light of intensity I_0 is incident on surface of a block of glass at Brewster's angle. In that case, which one of the following statements is true?

○ reflected light is completely polarized with intensity less than $I_0/2$.

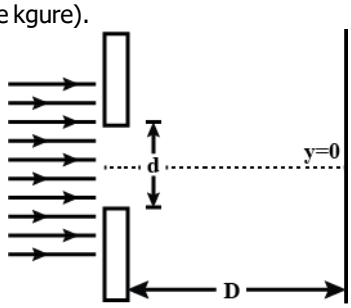
○ transmitted light is completely polarized with intensity less than $I_0/2$.

○ transmitted light is partially polarized with intensity less than $I_0/2$.

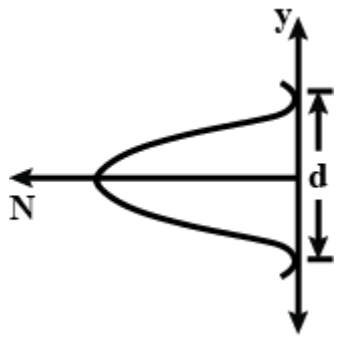
○ reflected light is partially polarized with intensity less than $I_0/2$.

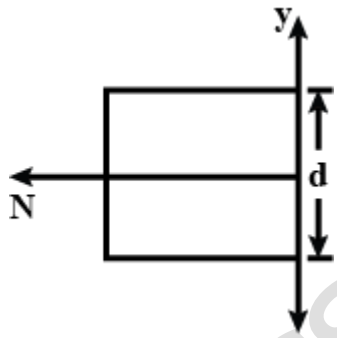
Correct: +4 · Incorrect: -1

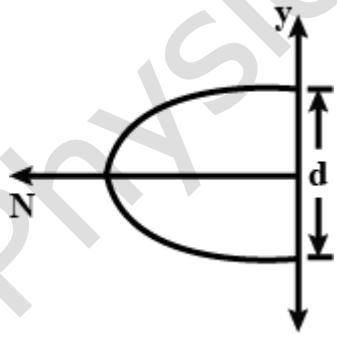
27 In an experiment, electrons are made to pass through a narrow slit of width 'd' comparable to their de-Broglie wavelength. They are detected on a screen at a distance 'D' from the slit (see kgure).



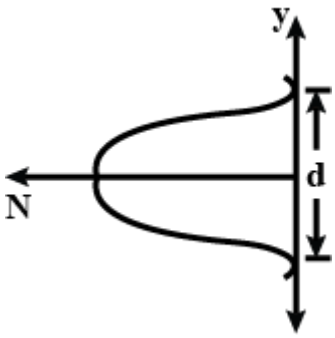
Which of the following graphs can be expected to represent the number fo electrons 'N' detected as a function of the detector 'y' (y = 0 corresponds to the middle of the slit)

○ 

○ 

○ 

○



Correct: +4 · Incorrect: -1

28 If I_0 is the intensity of the principle maximum in the single slit diffraction pattern, then what will be its intensity when the slit width is doubled?

- ○ $4\ I_0$
- ○ $2\ I_0$
- ○ $I_0/2$
- ○ I_0

Correct: +4 · Incorrect: -1

29 The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refractive index n) is

- ○ $\tan^{-1}(1/n)$
- ○ $\sin^{-1}(1/n)$
- ○ $\sin^{-1}(n)$
- ○ $\tan^{-1}(n)$

Correct: +4 · Incorrect: -1

30 Wavelength of light used in an optical instrument are $\lambda_1 = 4000$ Å and $l_2 = 5000$ Å, then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is

- ○ 16:25
- ○ 9:1
- ○ 4:5

○ 5:4

Correct: +4 · Incorrect: -1

TEST

JEE Mains PYQs Wave optics (Physics Master Academy)

ANSWERS

SECTIONS

1. Section A - 30 Questions

Section 1 : Section A - 30 Questions

1 $4 I_0$

2 6

3 4

4 bends upwards

5 n

6 $\frac{\lambda}{(2\alpha)}$

7 Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 2

8 1

9 0.25 mm

10 0.57°

11 625 nm, 500 nm

12 12

13 concentric circles

14 zero

15 $\frac{\beta(\mu-1)}{\lambda}(t_1-t_2)$

16 2

17 296 km/sec

18 its size decreases, and intensity increases

19 0.24 μm

20 3.0×10^{-7} rad

21 05

22 25 μm

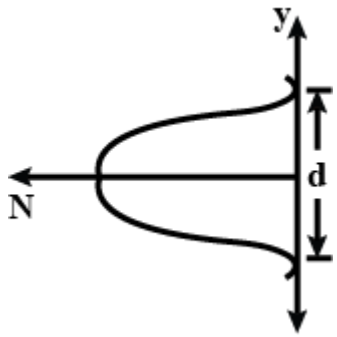
23 $cos\theta=\left(\frac{2}{3}\right)^{1/4}$

24 9mm

25 10^8 km

26 reflected light is completely polarized with intensity less than $I_0/2$.

27



28 $4\,I_0$

29 $\tan^{-1}(n)$

30 5:4

30