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# CANDIDATE ANSWER BOOKLET JEE

## CANDIDATE DETAILS

**NAME OF STUDENT** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

**DATE OF EXAMINATION** ☐☐ / ☐☐ / ☐☐☐☐

**CLASS** ☐☐

**BOARD** ☐☐☐☐

**TIME DURATION** ☐☐ : ☐☐ To ☐☐ : ☐☐

### Read The Instructions Carefully

- Please read these instructions carefully. A candidate who breaches any of the Examination Regulations will be liable to disciplinary action
- Examinations will be conducted during the allocated times shown in the examination timetable.
- Do NOT turn over the question paper until instructed at the time of commencement of the examination.
- Any unauthorised materials or devices found in your possession after the start of the examination will be confiscated, and you will be liable to disciplinary action.
- Handphones brought into the examination hall must be switched off at ALL times. If your handphone is found to be switched on in the examination hall, the handphone will be confiscated and retained for investigation of possible violation of regulations.
- Please check that you have the correct question paper and read the instructions printed on your examination question paper carefully.
- You are not allowed to communicate by word of mouth or otherwise with other candidates (this includes the time when answer scripts are being collected).
- Please raise your hand if you wish to communicate with an invigilator.
- Unless granted permission by an invigilator, you are not allowed to leave your seat.
- Once you have entered the examination hall, you will not be allowed to leave the hall until one hour after the examination has commenced.

### Question Paper Format

- Each question carries 4 marks.
- For correct answer, +4 marks. For wrong answer, -1 marks. For no attempt, 0 marks.
- All questions are compulsory.
- The question paper contains 25 objective type questions.
- Total time duration of the examination is 60 minutes.

### Score Card

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| +4 | |
| 0 | |
| -1 | |

**Total Score**

**Pass Score**

**Result**

Pass/Fail

**CHAPTER: RAY OPTICS & OPTICAL INSTRUMENTS**

**1.** The power (in diopters) of an equi convex lens with radii of curvature of 10 cm & refractive index 1.6 is:

(A) + 12 (B) – 12 (C) + 1.2 (D) – 1.2

**2.** A convexo - concave diverging lens is made of glass of refractive index 1.5 and focal length 24 cm. Radius of curvature for one surface is double that of the other. Then radii of curvature for the two surfaces are (in cm):

(A) 6, 12 (B) 12, 24 (C) 3, 6 (D) 18, 36

**3.** Two symmetric double convex lenses A and B have same focal length, but the radii of curvature differ so that $R_A = 0.9\ R_B$. If $n_A = 1.63$, find $n_B$.

(A) 1.7 (B) 1.6 (C) 1.5 (D) 4/3

**4.** When a lens of power P (in air) made of material of refractive index $\mu$ is immersed in liquid of refractive index $\mu_0$. Then the power of lens is:

(A) $\frac{\mu - 1}{\mu - \mu_0}$ P (B) $\frac{\mu - \mu_0}{\mu - 1}$ P (C) $\frac{\mu - \mu_0}{\mu - 1} \cdot \frac{P}{\mu_0}$ (D) none of these

**5.** A lens behaves as a converging lens in air and a diverging lens in water. The refractive index of the material is (refractive index of water = 1.33)

(A) equal to unity (B) equal to 1.33

(C) between unity and 1.33 (D) greater than 1.33

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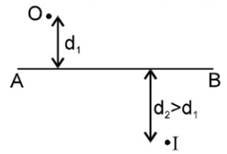
6. A ray of monochromatic light is incident on one refracting face of a prism of angle $75^0$. It passes through the prism and is incident on the other face at the critical angle. If the refractive index of the material of the prism is $\sqrt{2}$, the angle of incidence on the first face of the prism is
(A) $30^0$ (B) $45^0$ (C) $60^0$ (D) $0^0$

7. A prism having refractive index $\sqrt{2}$ and refracting angle 30º, has one of the refracting surfaces polished. A beam of light incident on the other refracting surface will retrace its path if the angle of incidence is:
(A) 0º (B) 30º (C) 45º (D) 60º

8. The distance between an object and its doubly magnified image by a concave mirror is:
[ Assume f = focal length ]
(A) 3 f/2 (B) 2 f/3 (C) 3 f
(D) depends on whether the image is real or virtual.

9. In the figure shown, the image of a real object is formed at point I. AB is the principal axis of the mirror. The mirror must be:
(A) concave & placed towards right of I
(B) concave & placed towards left of I
(C) convex & placed towards right of I
(D) convex & placed towards left of I.




10. An object is kept on the principal axis of a convex mirror of focal length 10 cm at a distance of 10 cm from the pole. The object starts moving at a velocity 20 mm/sec towards the mirror at angle 30º with the principal axis. What will be the speed of its image & direction with the principal axis at that instant.

(A) speed = $5\frac{\sqrt{7}}{4}$ mm/sec (B) speed = $5\sqrt{7}$ mm/sec

(C) $\tan^{-1}\frac{2}{\sqrt{3}}$ with the principal axis (D) none of these

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## CHAPTER: MODERN PHYSICS

31. In a photo-emissive cell, with exciting wavelength λ, the fastest electron has a speed *v*. If the exciting wavelength is changed to 3λ/4, the speed of the fastest emitted electron will be :
(A) $v\sqrt{\frac{3}{4}}$ (B) $v\sqrt{\frac{4}{3}}$ (C) less than $v\sqrt{\frac{4}{3}}$ (D) more than $v\sqrt{\frac{4}{3}}$

32. A point source of light is used in a photoelectric effect. If the source is removed farther from the emitting metal, the stopping potential
(A) will increase (B) will decrease
(C) will remain constant (D) will either increase or decrease

33. The wavelength λ of de Broglie waves associated with an electron (mass *m*, charge *e*) accelerated through a potential difference of *V* is given by (*h* is Planck's constant) :
(A) $\lambda = h/mV$ (B) $\lambda = h/2\,meV$ (C) $\lambda = h/\sqrt{meV}$ (D) $\lambda = h/\sqrt{2meV}$

34. Two particles of masses *m* and 2*m* have equal kinetic energies. Their de Broglie wavelengths are in the ratio of:
(A) 1 : 1 (B) 1 : 2 (C) 1 : $\sqrt{2}$ (D) $\sqrt{2}$ : 1

35. Two particles of masses *m* and 2*m* have equal kinetic energies. Their de Broglie wavelengths are in the ratio of:
(A) 1 : 1 (B) 1 : 2 (C) 1 : $\sqrt{2}$ (D) $\sqrt{2}$ : 1

## INTEGER TYPE QUESTIONS:

1. The bob of a simple pendulum has a mass of 40 g and a positive charge of $4.0 \times 10^{-6}$ C. It makes 20 oscillations in 45 s. A vertical electric field pointing upward and of magnitude $2.5 \times 10^4$ N/C is switched on. How much time will it now take to complete 20 oscillations ?

Answer: ☐

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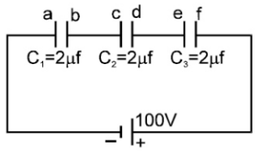
## CHAPTER: CAPACITORS

**26.** Work done in placing a charge of $8 \times 10^{-18}$ C on a condenser of capacity 100 microfarad is-
(A) $16 \times 10^{-32}$ J (B) $3.1 \times 10^{-26}$ J (C) $4 \times 10^{-10}$ J (D) $32 \times 10^{-32}$ J

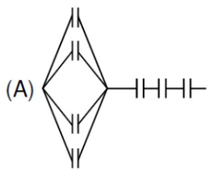
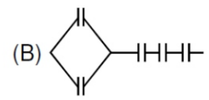
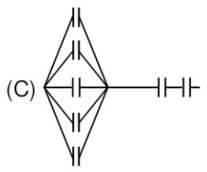
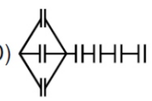
**27.** Three condensers $C_1$, $C_2$ and $C_3$ are connected to a 100 Volt D.C. source as shown in the figure. If the charges stored on the plates of $C_1$, $C_2$. and $C_3$ are $q_a$, $q_b$ and $q_c$, $q_d$ and $q_e$, $q_f$ respectively, then

(A) $q_b + q_d + q_f = \frac{100}{9}$ Coulomb
(B) $q_b + q_d + q_f = 0$
(C) $q_b = q_d = q_f$
(D) $q_a + q_c + q_e = 50$ Coulomb




**28.** The minimum number of condensers each of capacitance of 2μF, in order to obtain resultant capacitance of 5μF will be-
(A) 4 (B) 5 (C) 6 (D) 10

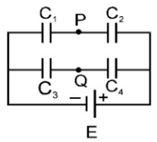
**29.** How the seven condensers, each of capacity 2μF, should be connected in order to obtain a resultant capacity of $\frac{10}{11}$ μF?

(A) 
(B) 
(C) 
(D) 

**30.** The potential difference between the points P and Q in the adjoining circuit will be-

(A) $\frac{(C_1C_4 - C_2C_3)E}{(C_1 + C_3)(C_2 + C_4)}$ (B) $\frac{C_2C_3\,E}{C_1C_2(C_3 + C_4)}$

(C) $\frac{(C_2C_3 - C_1C_4)E}{(C_1 + C_2)(C_3 + C_4)}$ (D) $\frac{(C_2C_3 - C_1C_4)E}{(C_1 + C_2 + C_3 + C_4)}$

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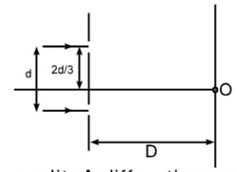
## CHAPTER: WAVE OPTICS

**11.** In the figure shown if a parallel beam of white light is incident on the plane of the slits then the distance of the nearest white spot on the screen from O is: [ assume d << D, λ << d ]
(A) 0 (B) d/2
(C) d/3 (D) d/6




**12.** A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is:
(A) 0 (B) π/2 (C) π (D) 2π

In a Young's double slit arrangement, a source of wavelength 6000 Å is used. The screen is placed 1 m from the slits. Fringes formed on the screen, are observed by a student sitting close to the slits. The student's eye can distinguish two neighbouring fringes if they subtend an angle more than 1 minute of arc.

**13.** The maximum distance between the slits so that the fringes are clearly visible will be :
(A) $\frac{3}{\pi}$ mm (B) $\frac{6}{\pi}$ mm (C) $\frac{4.5}{\pi}$ mm (D) $\frac{6.48}{\pi}$ mm

**14.** The position of the 3rd bright fringe from the centre of the screen will be :
(A) $\frac{\pi}{0.036}$ mm (B) $\frac{\pi}{36}$ mm (C) $\frac{\pi}{3.6}$ mm (D) $\frac{\pi}{0.06}$ mm

**15.** The position of the 5th dark fringe from the centre of the screen will be :
(A) $\frac{\pi}{24}$ mm (B) $\frac{\pi}{0.024}$ mm (C) $\frac{\pi}{2.4}$ mm (D) $\frac{\pi}{0.06}$ mm

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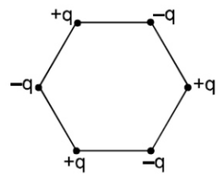
## CHAPTER: ELECTROSTATICS

**16.** A uniform electric field having a magnitude $E_0$ and direction along positive X-axis exists. If the electric potential V is zero at x = 0, then its value at x = +x will be :
(A) $V_x = xE_0$ (B) $V_x = -xE_0$ (C) $V_x = x^2E_0$ (D) $V_x = -x^2E_0$

**17.** Six charges of magnitude + q and –q are fixed at the corners of a regular hexagon of edge length a as shown in the figure. The electrostatic interaction energy of the charged particles is :

(A) $\frac{q^2}{\pi\epsilon_0 a}\left[\frac{\sqrt{3}}{8}-\frac{15}{4}\right]$ (B) $\frac{q^2}{\pi\epsilon_0 a}\left[\frac{\sqrt{3}}{2}-\frac{9}{4}\right]$

(C) $\frac{q^2}{\pi\epsilon_0 a}\left[\frac{\sqrt{3}}{4}-\frac{15}{2}\right]$ (D) $\frac{q^2}{\pi\epsilon_0 a}\left[\frac{\sqrt{3}}{2}-\frac{15}{8}\right]$

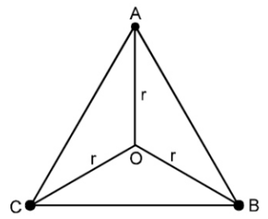



**18.** A hollow uniformly charged sphere has radius r. If the potential difference between its surface and a point at distance 3r from the centre is V, then the electric field intensity at a distance 3r from the centre is:
(A) V/6r (B) V/4r (C) V/3r (D) V/2r

**19.** Three equal point charges +Q are present at the points A, B, C of a triangle having equal sides. The intensity of electric field at O will be:

(A) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ (B) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$

(C) Zero (D) $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{r^2}$




**20.** The maximum electric field intensity on the axis of a uniformly charged ring of charge q and radius R will be :
(A) $\frac{1}{4\pi\varepsilon_0}\frac{q}{3\sqrt{3}R^2}$ (B) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{3R^2}$ (C) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{3\sqrt{3}R^2}$ (D) $\frac{1}{4\pi\varepsilon_0}\frac{3q}{2\sqrt{3}R^2}$

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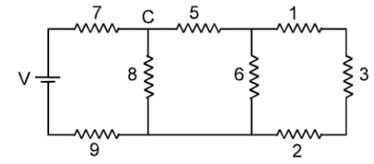
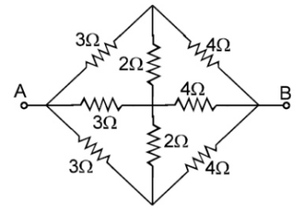
## CHAPTER: CURRENT ELECTRICITY

**21.** In the ladder network shown, current through the resistor 3 Ω is 0.25 A. The input voltage 'V' is equal to

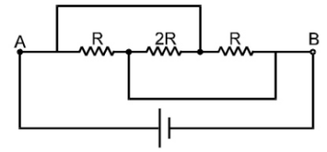
(A) 10 V
(B) 20 V
(C) 5 V
(D) 7.5 V




**22.** The equivalent resistance between A and B will be (in Ω)
(A) 2/7 (B) 8
(C) 4/3 (D) 7/3

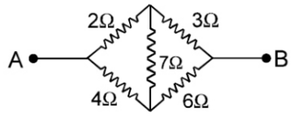



**23.** In the figure shown the current flowing through 2 R is :
(A) from left to right (B) from right to left
(C) no current (D) None of these




**24.** An electric heating element consumes 500 W when connected to a 100 V line. If the line voltage becomes 150 V, the power consumed will be :
(A) 500 W (B) 750 W (C) 1000 W (D) 1125 W

**25.** Five resistance are connected as shown in fig. The effective resistance between the points A and B is -




(A) 10/3 Ω (B) 20/3 Ω (C) 15 Ω (D) 6 Ω

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