DF-2987
B. Sc. (Sem. III) Examination
March / April - 2016
Physics : Paper - IV
(Modern Physics And Optics)

Time : Hours] [Total Marks :

सूचना / Instructions :

(1) Fill up strictly the details of ★ signs on your answer book.

Name of the Examination : B. Sc. (SEM. 3)

Name of the Subject : Physics : Paper - 4 (Modern Physics And Optics)

Subject Code No. : 2987 Section No. (1, 2,....) : Nil

(2) All questions are compulsory.

(3) There are 28 questions in this question paper, all are compulsory.

(4) Symbols used in the paper have their usual meaning.

(5) Non-programmable scientific calculator can be used.

(6) For each wrong answer 0.25 per mark will be deducted.

(7) Important instructions to fill up O.M.R. Sheet are given on back side of the provided O.M.R. Sheet.
1 Which of the following terms show de-Broglie phase velocity?

(A) $\frac{k}{\omega}$

(B) $\frac{v}{c^2}$

(C) $\frac{\hbar}{v}$

(D) $c^2 / \nu$

2 Exclusion energy value for a particle confined in a box is

(A) 1J

(B) 0

(C) $6 \times 10^{-12}$ J

(D) None of these

3 Wave function at the walls of box is always _________

(A) 0

(B) 1

(C) -1

(D) अनंत / Infinite

4 In Davisson-Germer experiment target block is made up of _________

(A) Tungsten

(B) Aluminium

(C) Silver

(D) Nickel
5 Which is false with reference to Planck's constant:

(A) \[ h = 6.63 \times 10^{-34} \text{ m}^2 \text{ kg/s} \]

(B) \[ h = 4.13 \times 10^{-15} \text{ eV.s} \]

(C) (D) \[ \sigma = \frac{h}{E} \]

6 More general form of Uncertainty principle is also

(A) \[ \Delta E \Delta t \geq h \]

(B) \[ \Delta E \Delta t \leq h \]

(C) \[ \Delta E \Delta v \geq h \]

(D) None of these

7 Polarization of light establishes that light is essentially

(A) Corpuscular in nature

(B) Longitudinal wave

(C) Transverse wave

(D) Both wave and corpuscular in nature

8 Glucose solution shows

(A) dextro rotation

(B) laevo rotation

(C) Inactivity

(D) None of these
9. Rotation of plane of polarization is __________ concentration of the solution.
   (A) One half of
   (B) Inversely proportional to
   (C) Directly proportional to
   (D) None of these

10. Which of the following statements is correct?
    (A) The opaque width is known as grating element.
    (B) Width of the slit is known as grating element.
    (C) Sum of the width of the slit and opaque part is known as grating element.
    (D) Width of glass plate is known as grating element.

11. In case of minimum deviation position of grating, the equation for the mth order principal maximum is
    (A) \( d (\sin \theta - \sin i) = m \lambda \)
    (B) \( d (\sin \theta + \sin i) = \left( m + \frac{1}{2} \right) \lambda \)
    (C) \( d \sin \delta = m \lambda \)
    (D) \( 2d \sin 0.5\delta = m \lambda \)

12. How many Nicol prisms are used in Laurentz's half shade polarimeter?
    (A) 1
    (B) 3
    (C) 4
    (D) 2
13. An electron is confined in a box of 0.1 nm width. What minimum energy electron can possess?
   (A) 0
   (B) 1 J
   (C) $6.0 \times 10^{-18} \text{ J}$
   (D) $6.62 \times 10^{-27} \text{ J}$

14. Equation of the kinetic energy of a particle is.
   (A) $\frac{1}{2}mv$
   (B) $\frac{P^2}{2m}$
   (C) $\frac{1}{2}m^2v$
   (D) $\frac{P}{2m}$

15. A 50 g golf ball is moving with velocity of 30 m/s, its de Broglie wavelength is.
   (A) $4.4 \times 10^{-15} \text{ m}$
   (B) $4.42 \times 10^{-34} \text{ m}$
   (C) $5.8 \times 10^{-20} \text{ m}$
   (D) $8.52 \times 10^{-27} \text{ m}$

16. An electron is moving with a velocity of $10^7 \text{ m/s}$, its de Broglie wavelength is.
   (A) $7.28 \times 10^{-11} \text{ m}$
   (B) $6.62 \times 10^{-27} \text{ m}$
   (C) $4.8 \times 10^{-34} \text{ m}$
   (D) $8.52 \times 10^{-27} \text{ m}$

17. The de Broglie wavelength of neutron of kinetic energy 28.8 eV is.
   (A) $7.28 \times 10^{-11} \text{ cm}$
   (B) $1.735 \times 10^{-9} \text{ cm}$
   (C) $6.63 \times 10^{-12} \text{ cm}$
   (D) $6.62 \times 10^{-27} \text{ cm}$
18. What is the longest wavelength that can be observed through a plane transmission grating having $5 \times 10^3$ lines per cm?
   (A) $7 \times 10^{-4}$ cm.
   (B) $6 \times 10^{-8}$ cm.
   (C) $5.83 \times 10^{-7}$ cm.
   (D) $2 \times 10^{-4}$ cm.

19. A plane transmission grating has $5 \times 10^3$ lines per cm. For wavelength of $6 \times 10^{-5}$ cm, what is the highest order of spectrum which can be observed?
   (A) 5
   (B) 2
   (C) 3
   (D) 4

20. If the plane of vibration of the incident beam makes an angle of 45 degree with the optic axis, the ratio of the intensities of extraordinary and ordinary light is ________.
   (A) 4
   (B) 2
   (C) 3
   (D) 1

21. A liquid has refractive index of 1.5 and diamond has refractive index of 2.42 when ray passes through diamond to liquid its polarizing angle ________
   (A) 31.79°
   (B) 35.85°
   (C) 66.75°
   (D) 52.29°

22. A 15 cm long tube filled with sugar solution having specific rotation of $66^\circ$, shows rotation of plane of polarization of $7^\circ$, then strength of the solution is ________
   (A) 0.85 gm./cc.
   (B) 0.07 gm./cc.
   (C) 2.6 gm./cc.
   (D) 1.8 gm./cc.
23 An electron has energy of 803 keV. Find its group velocity and phase velocity. (Rest energy of electron is 511 keV)
(A) 0.2c, 1.5c
(B) 0.8c, 2.3c
(C) 0.771c, 1.30c
(D) 0.5c, 1.7c

24 \(10^5\) eV, 0.2\(\times\) proton energy. What is the de Broglie wavelength of a proton of \(10^5\) eV energy. \(m_p = 1.66 \times 10^{-24}\ gm\)
(A) \(6.4 \times 10^{10}\ cm/s, 2.1 \times 10^{-10}\ cm\).
(B) \(4.4 \times 10^{8}\ cm/s, 9.1 \times 10^{-12}\ cm\).
(C) \(7.9 \times 10^{11}\ cm/s, 5.1 \times 10^{-15}\ cm\).
(D) \(9.6 \times 10^{-5}\ cm/s, 5.1 \times 10^{-10}\ cm\).

25 An electron has energy of 5.3 \(\times\) 10^{-11} m. A hydrogen atom is 5.3 \(\times\) 10^{-11} m in radius. Use uncertainty principle to estimate the minimum energy an electron can have in this atom.
(A) 5.4 \(\times\) 10^{-19} J
(B) 9.54 \(\times\) 10^{-15} J
(C) 8.6 \(\times\) 10^{-11} J
(D) 25.45 \(\times\) 10^{-9} J
Unpolarized light is incident on a group of 4 polarizers, each polarizer rotates the plane of polarization by 30° to its previous one. What part of light will be transmitted at the end?

(A) 4.74
(B) 0.0211
(C) 0.211
(D) 0.474

A solution of camphor in alcohol filled in a tube of 20 cm long is found to rotate the plane of vibration of light by 27°. If specific rotation of camphor is +54° then mass of the camphor in unit volume of the solution?

(A) 0.25 gm.
(B) 2.5 gm.
(C) 5 gm.
(D) 10 gm.

A 5400 Å light normally incident on a plane diffraction grating, shows 3rd order spectral line at 30°, how many lines are there per centimetre in the grating?

(A) 15000 lines / cm.
(B) 1580 lines / cm.
(C) 2545 lines / cm.
(D) 3086 lines / cm.