TWELFTH PHYSICS **GRAND TEST-BOOK 2**

CONDUCTED ON 9TH FEBRUARY 2020

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TIME ALLOWED: 3 Hrs **MAXIMUM PARKS: 70**

GENERAL INSTRUCTIONS:

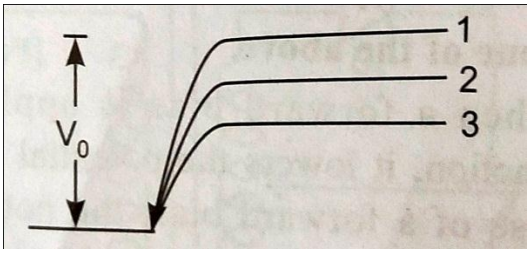
- **There are 37 questions in all. All questions are compulsory.**
- **This question paper has four sections: Section A, Section B, Section C and Section D.**
- **Section A contains twenty questions of 1 mark each, section B contains seven questions of 2 marks each, Section C contains seven questions of 3 marks each and section D contains three questions of 5 marks each.**

SECTION A

1. **A proton and an alpha particle are accelerated through same potential. The ratio of their de Broglie wavelengths λ_p/λ_α is**
   - **(a) $\sqrt{8}$**
   - **(b) $1/\sqrt{8}$**
   - **(c) 1**
   - **(d) 2**
2. **Energy of an electron in the second orbit of hydrogen atom is E and the energy of electron in 3rd orbit of He will be**
   - **(a) 16E/3**
   - **(b) 4E/9**
   - **(c) 16E/9**
   - **(d) 4E/3**
3. **A radioactive element has half life period 1600 years. After 6400 years what amount will remain?**
   - **(a) 1/8**
   - **(b) ¼**
   - **(c) ½**
   - **(d) 1/16**
4. **A metal coin is at bottom of a beaker filled with a liquid of refractive index 4/3 to a height of 6 cm. to an observer looking from above the surface of liquid, coin will appear at a depth**
   - **(a) 1.5 cm**
   - **(b) 4.5 cm**

(c) 7.5 cm
(d) 6.75 cm

5. Resolving power of a telescope can be increased by increasing
   (a) The diameter of the objective
   (b) The diameter of eyepiece
   (c) The wavelength
   (d) The focal length of eyepiece
6. Resolving power of microscope depends upon
   (a) Aperture of eye piece
   (b) Focal length of objective
   (c) Wavelength of light used(directly proportional)
   (d) Wavelength of light used(inversely proportional)
7. In the given figure Vo is the potential barrier across a p-n junction, when no battery is connected across the junction.



   (a) 1 corresponds to forward bias and 3 corresponds to reverse bias
   (b) 2 and 3 both correspond to reverse bias of junction
   (c) 2 and 3 both correspond to forward bias of junction
   (d) 3 corresponds to forward bias and 1 corresponds to reverse bias
8. The conductivity of semiconductor increases with increase in temperature because
   (a) Both number density of carriers and relaxation time increases
   (b) Number density of carriers increases, relaxation time decrease but effect of decrease in relaxation time is much less than increase in number density.
   (c) Number density of free carriers increases.
   (d) Relaxation time decreases
9. Ratio of intensities of two waves is 9:1. If these waves are superimposed, what is the ratio of maximum and minimum intensities?
   a. 3:1
   b. 4:1
   c. 9:1
   d. 5:3
10. A diver at a depth 12 m inside water (μ=4/3) sees the sky in a cone of semivertical ang;e
   a. $\tan^{-1} 4/3$

b. $\sin^{-1}\frac{3}{4}$

c. $\sin^{-1}4/3$

d. 90^{o}

11. Number of possible spectral lines emitted on dexcitation of electrons from energy level n to ground state is equal to……..

12. Minimum angle of incidence in the denser medium for which angle of refraction becomes 90^{o} is called……..

13. In full wave rectification, the output frequency is…… if the input frequency is 50 Hz?

14. A continuous locus of particle of medium vibrating in the same phase at any instant is known as…….

15. ……is the perpendicular distance of the velocity vector of the alpha particle from the centre of nucleus.

16. In an experiment on photoelectric effect, the slope of the cut-off voltage versus frequency of incident light is found to be 4.12×10^{-15} V s. Calculate the value of Planck's constant.

17. The radius of the innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. What is the radii of the n = 2 orbit?

18. Why are the elemental dopants mainly taken from 13^{th} and 15^{th} group, for doping Silicon or Germanium?

19. State the reason, why GaAs is most commonly used in making of a solar cell?

20. Why is a typical solar cell characteristics drawn in fourth quadrant

SECTION B

21. Consider the D–T reaction (deuterium–tritium fusion)

$$^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + n$$

Calculate the energy released in MeV in this reaction from the data:

m($^{2}_{1}H$)=2.014102 u

m($^{3}_{1}H$) =3.016049 u,

Mass of $_{2}He^{4}$ = 4.002604 amu,

Mass of $_{0}n^{1}$ = 1.008665 amu

22. In a single slit experiment the slit width is made double that of the original width. What would happen to the size and intensity of central diffraction band? Give reason for your answer.

23. A compound microscope with an objective of 1.25 cm focal length and an eye piece of 5 cm. a small object is kept at 2.5 cm from the objective. If the final image is formed at infinity, find the distance between objective and eye piece.

24. Draw circuit diagram to study forward and reverse bias characteristics of P-N junction diode. Also draw V-I characteristic.

25. What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations:

(a) the screen is moved away from the plane of the slits;

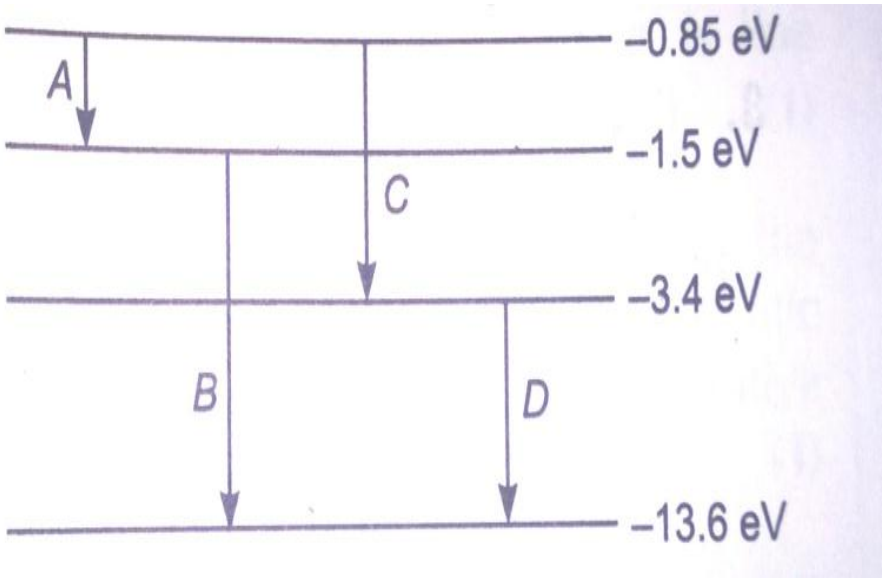
(b) the (monochromatic) source is replaced by another (monochromatic) source of shorter wavelength;

(c) the separation between the two slits is increased;

(d) the source slit is moved closer to the double-slit plane.

26. What should be the width of each slit to obtain 20 maxima of the double slit pattern within the central maxima of the slingle slit pattern for light of wavelength 500 nm, if the separation between two slits is 1 mm?

27. The energy level diagram of an element are given below.



Identify, using necessary calculation, the transmission which corresponds to the spectral line of wavelength 482nm.

SECTION C

28. In the study of Geiger-Marsdon experiment on scattering of α particles by a thin foil of gold, draw the trajectory of α-particles in the coulomb field of target nucleus. Explain briefly how one gets the information on the size of the nucleus from this study. From the relation $R = R_0 A^{1/3}$, where R_0 is constant and A is the mass number of the nucleus, show that nuclear matter density is independent of A.

29.

(A) Describe the working of LEDs.

(B) Which semiconductors are preferred to make LEDs and why?

(C) Give two advantages of using LEDs over conventional incandescent lamps.

30.

(a) Why is a photodiode operated in the reverse bias mode?

(b) For what purpose is a photodiode used?

(c) Draw its V-I characteristics for different intensities of illumination.

31. In many experimental setups the source and screen are fixed at a distance say D and the lens is movable. Show that there are two positions for the lens for which an image is formed on the screen. Find the distance between these points. Also, derive an expression to show how focal length of a convex lens can be calculated using this method(known as displacement method).

32. Write Einstein's photoelectric equation and mention which important features in photoelectric effect can be explained with the help of this equation.

The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Derive the expression for the threshold wavelength λ_0 and work function for the metal surface.

33. State Bohr's postulate of quantisation of angular momentum of the orbiting electron in hydrogen atom.

In hydrogen atom, an electron undergoes transition from 2^{nd} excited state to the first excited state and then to the ground state. Identify the spectral series to which these transitions belong. Find out the ratio of the wavelengths of the emitted radiations in the two cases.

34. A radioactive isotope has a half-life of T years. How long will it take the activity to reduce to a) 3.125%, b) 1% of its original value?

SECTION D

35. Draw a ray diagram to showing the image formation by a compound microscope. Define the magnifying power of a compound microscope when the final image is formed at near point. Hence obtain expression for total magnification when the image is formed at near point. Why must both the objective and eye piece of a compound microscope has short focal lengths?

OR

(a) Define a wavefront. Using Huyghen's principle, verify the laws of reflection at a plane surface.

(b) How is linearly polarized light obtained by the process of scattering of light?

(c) Find the Brewster's angle for air-glass interface, when the refractive index of glass is 1.5.

36.

(a) Discuss the formation of depletion region in a p-n junction. Mention the two important processes involved during the formation.

(b) With the help of circuit diagram, show how full wave rectifier rectifies the input AC signal. show input and output waveforms.

OR

(a) Using Bohr's postulates derive an expression for

(i) Radius of nth orbit

(ii) Speed and kinetic energy of electron in nth orbit

(iii) Potential energy and total energy of electron in nth orbit

(iv) Time period of an electron orbiting in nth orbit

(b) How does de Broglie's hypothesis explain the stability of these orbits?

37.

(a) Why is zener diode considered to be a special purpose diode?

(b) Why reverse current suddenly increases at reverse breakdown voltage?

(c) How zener diode is used as a voltage regulator? Explain with the help of a circuit diagram.

OR

(a) What are coherent sources of light?

(b) What are the conditions for sustained interference to take place?

(c) A beam of light consisting of two wavelengths 600nm and 800nm, is used to obtain interference of fringes in a young's double slit experiment.

(i) Find the distance of the third bright fringe on the screen from the central maximum for wavelength 800 nm?

(ii) Find the least distance from the central maximum where the bright fringes due to both wavelengths coincide.

The distance between the two slits is 0.28mm and the screen is at a distance of 1.4m from the slits.

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