

Model Question Paper

Atomic physics - Part V

12th Standard

Physics

Reg.No. :

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I. Answer all the questions.

II. Use blue pen only.

Time : 01:00:00 Hrs

Total Marks : 85

5 x 1 = 5

Part-A

- 1) The equation for the minimum wavelength of x-rays continuous spectrum is given by
(a) $\lambda_{min} = \frac{12400m}{V}$ (b) $\lambda_{min} = \frac{12400 \text{ \AA}}{V}$ (c) $\lambda_{min} = \frac{eV}{hc}$ (d) $\lambda_{min} = \frac{hc}{eV}$
- 2) When the electrons are jumping from N shell to M shell then the observed X-ray line spectrum is
(a) M_{α} line (b) K_{α} line (c) M_{β} line (d) K_{β} line
- 3) According to Moseley's law, the relation between the frequency of characteristic X-ray line and the atomic number of the element which emits it is
(a) $\sqrt{\nu} = a(Z - b)$ (b) $\sqrt{\nu} \propto Z^2$ (c) $\sqrt{\nu} = (Z - a)$ (d) $\nu^2 \propto \sqrt{Z}$
- 4) In Ruby laser the wavelength of light used for optical pumping is
(a) 6563 \AA (b) 6940 \AA (c) 5500 \AA (d) 6943 \AA
- 5) The ratio of Ne and He gases used in He-Ne laser is
(a) 4:1 (b) $10^6:1$ (c) 1:4 (d) $1:10^6$

Part-B

5 x 3 = 15

- 6) Calculate the longest wavelength that can be analysed by a rock salt crystal of spacing $d = 2.82 \text{ \AA}$ in the first order.
- 7) An X-ray diffraction of a crystal gave the closest line at an angle of $6^{\circ} 27'$ if the wavelength of X-ray is 0.58 \AA , find the distance between the two cleavage planes.
- 8) How much should be the voltage of an X-ray tube so that the electrons emitted from the cathode may give an X-ray of wavelength 1 \AA after striking the target?
- 9) Find the minimum wavelength of X-rays produced by an X-ray tube at 1000kV
- 10) The minimum wavelength of X-rays produced from a Coolidge tube is 0.05 nm. Find the operating voltage of the Coolidge tube.

Part-C

5 x 5 = 25

- 11) How did Sommerfeld explain the fine spectral of spectral lines of hydrogen atom?
- 12) Derive an expression for the frequency of spectral line and also for Rydberg's constant.
- 13) What are the drawbacks of Sommerfeld's atom model.
- 14) Obtain the expression for the radius of the nth of an electron based on Bohr's theory.
- 15) Explain the spectral series of hydrogen atom. (diagram not necessary).

Part-D

4 x 10 = 40

- 16) Derive Bragg's law. Explain how a Bragg's spectrometer can be used to determine the wavelength of the X-rays.
- 17) State Bohr's postulates. Obtain an expression for the radius of nth orbit of the hydrogen atom.
- 18) a) Explain with principle, Millikan's oil drop method in determining the charge of an electron.

(OR)

- b) Derive an expression for the radius of the n^{th} orbit. Hence prove that the energy of an electron in that orbit is $E_n = \frac{-me^4}{8E_0^2 n^2 h^2}$
