



e-Edge Education Centre

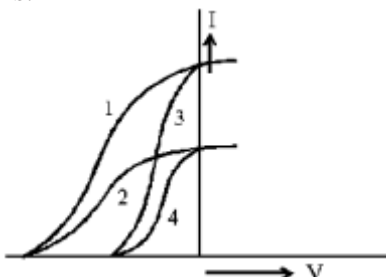
Time-1;30 H

Physics XII A & M

M.M-40

(wave optics , optical instrument, Dual nature, Atoms , nucleus)

1. The de Broglie wavelengths, associated with a proton and a neutron, are found to be equal. Which of the two has a higher value for kinetic energy? . [1]
2. A partially plane polarised beam of light is passed through a polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the polaroid. [3]
3. The given graphs show the variation of photo electric current (I) with the applied voltage (V) for two different materials and for two different intensities of the incident radiations. Identify the pairs of curves that correspond to different materials but same intensity of incident radiations. [3]



4. Four nuclei of an element fuse together to form a heavier nucleus. If the process is accompanied by release of energy, which of the two - the parent or the daughter nucleus would have a higher binding energy/nucleon? [3]
5. A radioactive material is reduced to of its original amount in 4 days. How much material should one begin with so that 4×10^{-3} kg of the material is left after 6 days. [3]
6. In a double slit interference experiment, the two coherent beams have slightly different intensities I and $I + \delta I$ ($\delta I \ll I$). Show that the resultant intensity at the maxima is

$$\frac{(\delta I)^2}{4I}$$

nearly $4I$ while that at the minima is nearly $4I$ [3]

7. Which two main considerations are kept in mind while designing the ‘objective’ of an astronomical telescope? Obtain an expression for the angular magnifying power and the length of the tube of an astronomical telescope in its ‘normal adjustment’ position. [3]
8. Calculate the de-Broglie wavelength of (i) an electron (in the hydrogen atom) moving with a speed of $\frac{1}{100}$ of the speed of light in vacuum and (ii) a ball of radius 5mm and mass 3×10^{-2} kg. moving with a speed of 100ms^{-1} . Hence show that the wave nature of matter is important at the atomic level but is not really relevant at the macroscopic level. [3].
9. The spectrum of a star in the visible and the ultraviolet region was observed and the wavelength of some of the lines that could be identified were found to be :

$$824 \text{ \AA}, 970 \text{ \AA}, 1120 \text{ \AA}, 2504 \text{ \AA}, 5173 \text{ \AA}, 6100 \text{ \AA}$$

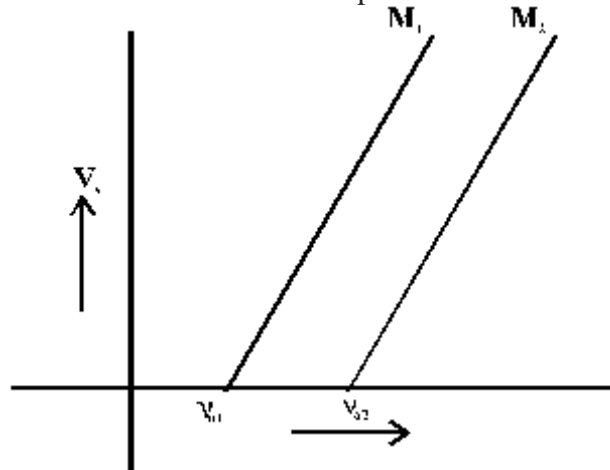
Which of these lines cannot belong to hydrogen atom spectrum? (Given Rydberg constant

$$R = 1.03 \times 10^7 \text{m}^{-1} \text{ and } \frac{1}{R} = 970 \text{ \AA}$$

. Support your answer with suitable calculations. [3]



10. Give reasons for the following : [3]
- (a) Astronomers prefer to use telescopes with large objective diameters to observe astronomical objects.
 - (b) Two identical but independent monochromatic sources of light cannot be coherent.
 - (c) The value of the Brewster angle for a transparent medium is different for lights of different colours.
- 11.. The given graphs show the variation of the stopping potential V_s with the frequency (ν) of the incident radiations for two different photosensitive materials M_1 and M_2 .



- (i) What are the values of work functions for M_1 and M_2 ?
- (ii) The values of the stopping potential for M_1 and M_2 for a frequency of the incident radiations are V_1 and V_2 respectively. Show that the slope of the lines equals

$$\frac{V_1 - V_2}{\nu_{02} - \nu_{01}} \quad [3]$$

12. Define the term 'Activity' of a radioactive substance. State its SI unit.
Two different radioactive elements with half lives T_1 and T_2 have N_1 and N_2 (undecayed) atoms respectively present at a given instant. Determine the ratio of their activities at this instant. [3]
13. (a) With the help of a labelled ray diagram, show the image formation by a compound microscope. Derive an expression for its magnifying power.
(b) How does the resolving power of a compound microscope get affected on
- (i) decreasing the diameter of its objective?
 - (ii) increasing the focal length of its objective? [3]
14. Derive fringe width in young double slits experiment. How fringe width change when whole arrangement is immersed in liquid of R.I μ [3]