## **Model Question Paper**

Nuclear physics - Part IV

## 12th Standard

Reg.No.

Physics I.Answer all the questions. II.Use blue pen only. Time : 01:00:00 Hrs Total Marks : 85 Part-A  $5 \times 1 = 5$ 1) The safety amount of radiation exposure on the human body (a) 250 mR/day (b) 250 mR/week (c) 600R/year (d) 100R 2) The number of pair of ions produced in 1 mg of air by a radiation of about 1 mR (a)  $1.6 \times 10^6$  (b)  $1.2 \times 10^6$  (c)  $0.8 \times 10^9$  (d)  $1.2 \times 10^{12}$ 3) In fast breeder reactors, the neutron reflectors used are (a)  $Pu^{239}$  (b)  $Th^{232}$  (c)  $U^{235}$  (d)  $U^{233}$ The time taken to decay 93.75% of a radioactive element is 96 second. Find its half-life period. 4) (a) 48 s (b) 72 s (c) 24 s (d) 12 s 5) The half life period of radio carbon is. (a) 5570 years (b) 1300 years (c) 1600 years (d) 5600 years Part-B 1 x 3 = 3 6) Tritium has a half years life of 12.5 years. What a fraction of the sample of will be left over after 25 years? Part-C 3 x 5 = 15 7) Calculate the energy released when 1 kg of  $_{92}U^{235}$  undergoes nuclear fission. Assume, energy per fission is 200 MeV. Avagadro number =  $6.023 \times 10^{23}$ . Express your answer in kilowatt hour also. Thorium ( $_{90}Th^{228}$ ) emits an  $\alpha$ - particle to reduce to  $_{88}Ra^{224}$ . Calculate the kinetic energy of the  $\alpha$ -particle emitted in the following decay.  $_{90}Th^{228} \rightarrow_{88}Ra^{228} + \alpha$ 8)  $_{88}Ra^{224} \rightarrow_{88}Ra^{224} + \gamma(217 KeV)$  mass of  $_{90}$ Th<sup>228</sup>=228.028726 amu; mass of  $_{88}$ Ra<sup>224</sup> = 224.020196 amu mass of  $_{2}$ He<sup>4</sup> = 4.002604 amu 9) A piece of bone from an archaeological site is found to give a count rate of 15 counts per minute. A similar sample of fresh bone gives a count rate of 19 counts per minute. Calculated the age of the specimen. Given  $T_{\frac{1}{2}} = 5570$  years. Part-C  $2 \times 5 = 10$ 10) Show that the mass of radium ( $_{88}$ Ra<sup>226</sup>) with an activity of curie is almost a gram. Given T<sub>1/2</sub> = 1600 years. (1 curie =  $3.7 \times 10^{10}$  disintegration per second). 11) Singly ionized magnesium atoms enter into the velocity selector of Bainbridge mass spectrograph having electric and magnetic fields 30 kV/m and 0.1 tesla respectively. Calculate the radii of the path followed by the two isotopes of mass number 24 and 25 when the deflecting magnetic field is 0.5 tesla. Mass of nucleon  $1.67 imes 10^{-27}$  charge of the ion e =  $1.7 imes 10^{-19} C$  . Part-D  $4 \times 10 = 40$ 12) Derive the relation  $N=N_{o}e^{-\lambda t}$  . Derive an expression for half - life

13) Describe the discovery of neutrons and state the properties of neutrons.

14) What is the nuclear reactor? Draw the schematic diagram. Mention the name of components. List out the use and an example for each component.

15) What is a nuclear reactor? Explain the components (i) moderator and (ii) control rods.

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