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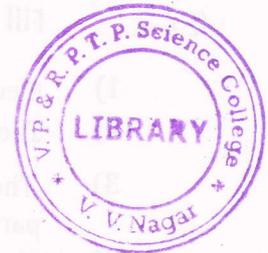
SARDAR PATEL UNIVERSITY

6th Semester B. Sc. (Under CBCS) Examination 2021Saturday, 17th July 2021

Time: 10:00 am to 12:00 pm

Subject: PHYSICS [US06CPHY23]

[Solid State Physics & Nuclear Physics]



Total Marks: 70.

- N.B: (i) All the symbols have their usual meanings.
 (ii) Figures at the right side of questions indicate full marks.

Q.1 Answer the following Multiple Choice Questions. (10)

- The intensity of scattered electron _____ as 2θ increases.
 (a) increases (b) decreases (c) remains constant (d) becomes zero
- In rotation method, _____ X-rays fall on the specimen.
 (a) polychromatic (b) monochromatic
 (c) dichromatic (d) all of these
- For constructive interference, the Bragg's condition is $n\lambda =$ _____.
 (a) $d \sin \theta$ (b) $2d \sin \theta$ (c) $d^2 \sin \theta$ (d) $(d/2) \sin \theta$
- The ratio of thermal conductivity to electrical conductivity is _____ to the temperature for a large number of metals.
 (a) equal (b) inversely proportional (c) proportional (d) not equal
- According to Lorentz model, the hall co-efficient of metal is given by $R_H =$ _____.
 (a) $\left(-\frac{3\pi}{8}\right) \times \frac{1}{n_e}$ (b) $\left(\frac{8}{3\pi}\right) \times \frac{1}{n_e}$
 (c) $\left(\frac{3\pi}{8}\right) \times \frac{1}{n_e}$ (d) $\frac{1}{n_e}$
- Nuclei having odd mass number and having half integral spin obey _____ statistics.
 (a) B-E (b) F-D (c) M-B (d) D-E
- The deviation of a nucleus from a spherically symmetric shape is expressed by _____.
 (a) electric dipole moment (b) electric quadrupole moment
 (c) nuclear magnetic moment (d) nuclear angular momentum
- _____ is a two stage accelerator.
 (a) Van de Graff accelerator (b) Linear accelerator
 (c) Tandem accelerator (d) Cyclotron
- The betatron condition is _____.
 (a) $B_0 = \frac{1}{2}B'$ (b) $B' = \frac{1}{2}B_0$ (c) $B_0 = 2B'$ (d) $B' = 2B_0$
- For a gas filled detectors, the region III in graph of variation of logarithmic pulse height versus applied voltage is known as _____.
 (a) ionization region (b) proportional region
 (c) Geiger-Muller region (d) region of limited proportionality

(P.T.O.)

Q-2

Fill in the blanks and True - False

- 1) Electrons are ____ penetrating than X-rays.
- 2) The average velocity gained during drift motion is called ____.
- 3) The powder method is used to determine the value of lattice parameters accurately. [True or False]
- 4) Electrical resistivity ρ is defined as the reciprocal of resistivity. [True or False]
- 5) $^{13}_6\text{C}$ and $^{13}_7\text{N}$ is a pair of mirror nuclei. [True or False]
- 6) A compound nucleus has life time of ____ second.
- 7) The dead time of GM counter is generally of the order of ____ μs .
- 8) Cloud chamber is one of the detectors which provides visual trajectory of a charged particle. [True or False]

Q.3. Answer the following questions in short: (Attempt Any Ten)

- 1) What is K-space?
- 2) Enlist the properties of X-ray.
- 3) What is X-ray crystallography?
- 4) Give the basis points of Lorentz modification of the Drude model.
- 5) Write any two importance of Hall effect.
- 6) State the Weidmann-Franz law.
- 7) Define (i) isotopes (ii) isobars
- 8) Write a short note on method of mesonic X-rays to estimate nuclear radius.
- 9) With any one argument explain non-existence of electron in the nucleus.
- 10) State principle of cyclotron ..
- 11) Suppose electrons with energy **70 KeV** are introduced in the Doughnut of a betatron. The speed of the electrons is **2×10^{10} cm/s**. The radius of the orbit is **50 cm** & if the electromagnet is powered by an ac frequency of **60 Hz**. & magnetic field at the orbit is **1 T**. Calculate total distance travelled by electrons in $\frac{T}{4}$ s.
- 12) Define dead time and recovery time of a GM counter.

Q.4.

Answer **any four** of the following questions. [8 marks each]

(32)

- 1 Write a detailed note on X-ray diffraction rotating crystal method.
- 2 Explain the Ewald sphere construction.
- 3 Explain free electron gas in three dimensions.
- 4 Explain electrical conductivity and Ohm's law.
- 5 What is binding energy? Derive its expression. Draw the graph of binding energy/nucleon \rightarrow mass number and explain its salient features.
- 6 Derive Q-value equation for two body in two dimensions.
- 7 State principle, construction and working of Van de Graff accelerator.
- 8 State principle, construction, working and advantages of bubble chamber.
