

SEAT No. _____

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SARDAR PATEL UNIVERSITY

M.Sc. Physics IInd Semester Examination

Day: Tuesday, Date: 17/04/2018, Time: 02:00 p.m. to 05:00 p.m.

Subject: PHYSICS, Paper: PS02EPHY21

Title: Elements of Experimental Physics

Instruction:

Figures to the right indicate marks.

Total Marks: 70

Q.1 Write answer of all questions by showing your choice against the question number. [8]

(i) Equation used to calculate unknown pressure using linear scale method:

(a) $P_1 = (V_1/V_2)h$ (b) $P_1 = -(V_1/V_2)h$ (c) $P_1 = -(V_2/V_1)h$ (d) $P_1 = (V_2/V_1)h$

(ii) The operating range of Penning gauge is _____ torr.

(a) atm. pressure to 10^{-1} (b) 10^{-1} to 10^{-3} (c) 10^{-4} to 10^{-7} (d) 10^{-8} to 10^{-13}

(iii) When X-ray tube voltage is raised, the position of maximum shift to _____ wavelength.

(a) shorter (b) longer (c) middle (d) fixed

(iv) X-ray diffraction intensities depend upon:

(a) The electrons of innermost shell of the atom

(b) The electrons of outermost shell of the atom

(c) The scattering from nuclei

(d) Any electron shell of the atom

(v) In Bragg's law, $n\lambda = 2d\sin\theta$ where 'd' is distance between _____.

(a) two unit cell (b) two planes (c) two parallel planes (d) two lattice points

(vi) The relationship between fluorescent power and higher concentration is:

(a) linear (b) non linear (c) exponential (d) None of the above

(vii) The time during which the electric field in the counter is too small to produce secondary ionization is called:

(a) dead time (b) resolving time (c) recovery time (d) relaxation time

(viii) The inner side of the upper end of PMT is coated with _____ material.

(a) NaKSb (Cs) (b) $\text{Na}_2\text{K}_2\text{Sb}$ (Cs) (c) $\text{Na}_2\text{K}_2\text{Sb}_2$ (Cs) (d) Na_2KSb (Cs)

Q.2 Attempt any Seven of the followings:

[14]

(i) Draw the schematic diagram of diffusion pump and write its principle.

(ii) Mention the advantages of sputter ion pump.

(iii) Explain X-ray absorbers in brief.

(iv) Describe slow neutron scattering in solid.

(P.T.O.)

- (v) Explain in brief sources of X-rays.
- (vi) What is TGA? Write down any two applications of TGA.
- (vii) It is necessary to use light guide in photomultiplier tube? Why?
- (viii) Why plateau is important for the selection of G.M. Counter?
- (ix) Explain the method to prepare plastic scintillator.

Q.3(a) Give a classification of vacuum pumps on the basis of their working principle and pressure range of operation. [6]

Q.3(b) Draw the structure of oil sealed rotary pump. Explain the construction and working of this pump. [6]

OR

Q.3(b) Why Penning gauge is also known as the cold cathode ionization gauge? Draw the arrangement of the electrodes and indicate the directions of the electric and magnetic fields. Discuss the process involved in the measurement of vacuum using Penning gauge. [6]

Q.4(a) Mention the basic principle electron diffraction. Give the sketch of the experimental set up and working for recording electron diffraction from a polycrystalline specimen. [6]

Q.4(b) Differentiate between continuous X-rays and characteristic X-rays. Describe an experimental set up to produce X-rays in laboratory. [6]

OR

Q.4(b) Explain Thomson's equations of X-ray scattering by an electron. Mention the merit and demerit of X-ray and Neutron diffractions? [6]

Q.5(a) Explain Principle, applications and limitations of X-ray fluorescence spectroscopy using necessary diagram. [6]

Q.5(b) Write a short note on UV- visible spectroscopy. [6]

OR

Q.5(b) With help of necessary diagram, describe in detail X-ray photoelectron spectroscopy. [6]

Q.6(a) Differentiate between organic and inorganic scintillator. Why thallium activator is used in NaI crystal to prepare scintillator? Explain construction and working of NaI(Tl) used as a scintillator using necessary diagram. [6]

Q.6(b) Describe the working of ionization chamber and the proportional counter in detail with help of schematic diagram. [6]

OR

Q.6(b) Explain in detail highly pure germanium and lithium doped germanium used as a detector with the help of suitable diagram. [6]