[212] SEAT No._____

SARDAR PATEL UNIVERSITY
M.Sc. Physics IInd Semester Examination (CBCS)
Tuesday, Date: 26/03/2019, Time: 02:00 p.m. to 05:00 p.m.
Subject: PHYSICS, Title: Elements of Experimental Physics
Subject Code:PS02EPHY21(NEW)

Instructions:
  (a) Figures to the right indicate marks.
  (b) Answer of all the questions (including MCQs) should be written in the provided answer book only.

Total Marks: 70

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

(1) Gas molecules can be driven momentum in a desired direction by repeated collisions with a rapidly moving solid surface is the principle of ____ pump.
   (a) rotary   (b) diffusion   (c) getter ion   (d) molecular drag

(2) The operating range of Pirani gauge is from _____ Torr.
   (a) atm. pressure to 10^{-1} (b) 1 to 10^{-4} (c) 10^{-4} to 10^{-7} (d) 10^{-8} to 10^{-13}

(3) The change in the weight of the substance is recorded as a function of time or temperature in _____ .
   (a) TGA   (b) DTA   (c) DSC   (d) TGA and DTA

(4) Total scattering cross section for single nucleus-neutron scattering is given by _____ , where b is scattering length.
   (a) $4\pi b$ (b) $4\pi b^2$ (c) $4\pi/b$ (d) $4\pi/b^2$

(5) In electron diffraction, lattice spacing is calculated using equation _____ .
   (a) $r \times \lambda = d_{hkl} \times L$ (b) $d_{hkl} \times \lambda = r \times L$ (c) $r \times d_{hkl} = \lambda \times L$ (d) $2d_{hkl} = n \times \lambda$

(6) Atomic scattering factor decreases as the quantity _____ increases.
   (a) $Sin\theta/\lambda$ (b) $\lambda^2/Sin\theta$ (c) $\lambda/Sin\theta$ (d) $Sin\theta/\lambda^2$

(7) _____ is used to prepare anode in ionization chamber.
   (a) Tantalum   (b) Titanium   (c) tungsten   (d) tin

(8) If slope of the plateau region is more than _____ % per 100 anode voltage, then G.M. Counter will not give satisfactory results.
   (a) 4   (b) 6   (c) 8   (d) 10

Q.2 Attempt any Seven of the following questions: **[14]**
(1) What is pumping speed? Calculate the pumping speed (S) using constant volume method, The initial and final pressures are 1 torr & 10^{-6} torr respectively. Consider pump down time is 4 hrs and the volume of the chamber is 100 liters.

①

(P.T.O)

(2)   Sketch the diagram of rotary pump and write its principle and operating range.

(3)   Define atomic scattering factor and structure factor.

(4)   Explain Compton effect.

(5)   Define scattering cross section and differential scattering cross section for neutron scattering.

(6)   Describe differential thermal analysis (DTA).

(7)   Describe gas multiplication factor in proportional counter.

(8)   How to prepare liquid scintillator?

(9)   Explain spark chamber in brief.

Q.3(a)   Draw schematic diagram of McLeod gauge and describe its principle, construction and working. Also discuss disadvantages of this gauge.   [6]

Q.3(b)   What is sputtering? Using necessary diagram explain construction and working of sputter ion pump in detail. Also write its advantages.   [6]

OR

Q.3(b)   With the help of suitable diagram, describe principle, construction and working of a thermocouple gauge.   [6]

Q.4(a)   Derive Thomson equation for the scattering of an X-ray beam by a single electron with necessary diagram. Show that the scattering intensity depends on the scattering angle.   [6]

Q.4(b)   Explain electron diffraction in detail. Write down differences between electron diffraction and X- ray diffraction.   [6]

OR

Q.4(b)   Derive structure factor for all Bravais lattice of cubic crystal structure and generalize the rules for presence and absence of reflections for all four cubic Bravais lattice.   [6]

Q.5(a)   Write a detail note on X-ray Photoelectron spectroscopy.   [6]

Q.5(b)   Explain construction and working of differential scanning calorimetry (DSC) technique for both the type of calorimeter : (i) Heat flux DSC (ii) Power compensated DSC.   [6]

OR

Q.5(b)   Describe Atomic absorption spectroscopy in detail.   [6]

Q.6(a)   Write a short note on G.M.Counter.   [6]

Q.6(b)   With the help of necessary diagram of photomultiplier tube, describe its working in detail.   [6]

OR

Q.6(b)   Explain diode detector and surface barrier detector in detail.   [6]

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